

SUMATRA MERANG PEATLAND PROJECT (SMPP)

MONITORING REPORT



**FOREST
CARBON**



Document Prepared by Forest Carbon

Project Title	Sumatra Merang Peatland Project (SMPP)
Project ID	1899
Version	Version 1.2
Report ID	20200902
Date of Issue	02-Sep-2020
Project Location	South Sumatra, Indonesia
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GHG Accounting/ Crediting Period	January 1 st , 2016 – December 31 st , 2062; 47-year lifetime
Monitoring Period of this Report	January 1 st , 2019 – December 31 st , 2019; 1-year second monitoring
History of CCB Status	Date of Validation: 26 November 2019 Date of 1st Verification: 26 November 2019
Gold Level Criteria	We aim to generate exceptional benefits related to climate and biodiversity through the SMPP, under both the Verified Carbon

Standard (VCS) and Climate, Community, and Biodiversity (CCB) standards.

Climate:

The SMPP will prevent the emission of an average of 1,338,569 tonnes CO₂-e annually through the restoration of a degraded peatland area. This will be achieved through the restoration of the project area's hydrology through the construction of dams to block canals that are currently draining the project area. Detailed information about the SMPP's climate benefits generated through project activity can be found throughout Section 3 (with project activities described in Project Description (PD) Section 2.1.1).

Biodiversity: The SMPP is protecting a critical habitat for 10 endangered and critically endangered species, as well as 19 additional vulnerable species. The species protected within our project area include the endemic Sumatran tiger (*Panthera tigris* ssp. *Sumatrae*), the Sumatran Surili (*Presbytis melalophos*), and the Sambar deer (*Rusa unicolor*), as well as other important species such as the sun bear (*Helarctos malayanus*), the agile gibbon (*Hylobates agilis*), and the rhinoceros hornbill (*Buceros rhinoceros*). The SMPP will increase the protection of the project area, thereby protecting the endangered habitat that these species depend on. Detailed information about the SMPP's biodiversity benefits generated through project activity can be found throughout Section 1 (with project activities related to biodiversity described in PD Section 2.1.11.6).

A summary of these biodiversity and climate benefits is available in Section 1.

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List of Acronyms

Abbreviation	Meaning
A/R	Afforestation / Reforestation
AFOLU	Agriculture, Forestry, and Other Land-Use
AGB	Aboveground biomass
ANR	Assisted Natural Regeneration
ARR	Afforestation, Reforestation, and Revegetation
BD	Bulk Density
BRG	<i>Badan Restorasi Gambut</i> / Peat Restoration Agency
C	Carbon
CCB(A)	Climate, Community, and Biodiversity (Alliance)
CDM	Clean Development Mechanism
CE	Total Community Engagement
CH ₄	Methane
CIFOR	Center for International Forestry Research
CIRAD	<i>Centre de cooperation Internationale en recherche agronomique pour le developpement</i> / French Agricultural Research Centre for International Development
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO ₂	Carbon dioxide
CO ₂ -e	Carbon dioxide equivalents
CPUE	catch per unit effort
CR	Critically Endangered
CUPP	Conservation of Undrained and Partially Drained Peatland
DBH	Diameter at Breast Height
DEL	Drainability Elevation Limit
DM	Dry Matter
dNDVI	Differencing NDVI

Abbreviation	Meaning
DOC	Dissolved Organic Carbon
DRM	Disaster Risk Management
DTM	Digital Terrain Model
EN	Endangered
ENSO	El Niño / Southern Oscillation
ER	Emission Reduction
ESA	European Space Agency
EVI	Enhanced Vegetation Index
EWS	Early Warning System
F	Fire
FAO	Food and Agriculture Organization of the United Nations
FCPA	US Foreign Corruption Practice Act
FGD	Focus Group Discussion
FPIC	Free, Prior, and Informed Consent
FSC	Forest Stewardship Council
FV	Total Financial Viability
G	Geological Events
GFOI	Global Forest Observations Initiative
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GMO	Genetically Modified Organism
GOFC-GOLD	Global Observation for Forest Cover and Land Dynamics
HCV	High Conservation Value
HP	<i>Hutan Produksi</i> / Production Forest
HR	Human Resources

Abbreviation	Meaning
HTI	<i>Hutan Tanaman Industri</i> / Industrial Plantation Forest
INCAS	Indonesian National Carbon Accounting System
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IUP PAN/RAP	<i>Izin Usaha Pemanfaatan Penyerapan Karbon dan/atau Penyimpanan Karbon</i> / Carbon storage and sequestration license
LiDAR	Light Detection and Ranging
LT	Total Land Tenure
MNDWI	Modified Normalized Difference Water Index
MODIS	Moderate-Resolution Imaging Spectroradiometer
MoE&F	Indonesian Ministry of the Environment and Forestry
MRPP	Merang REDD Pilot Project
MRV	Monitoring, Reporting, and Verification
MSAVI	Modified Soil Adjusted Vegetation Index
N ₂ O	Nitrous oxide
NBR	Normalized Burn Ratio
NBR2	Normalized Burn Ratio 2
NDC	National Determined Contribution
NDMI	Normalized Difference Moisture Index
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
NTFP	Non-Timber Forest Products
NER	Net GHG Emission Reductions
NGR	Net GHG Emission Removals
OC	Total Opportunity Cost
OLI	Landsat 8 Operational Land Imager

Abbreviation	Meaning
ON	Other Natural Risk
PC	Total Political
PCA	principal component analysis
PD	Project Description
PD	Pest and Disease Outbreak
PDT	Peat Depletion Time
PERADI	<i>Perhimpunan Advokat Indonesia</i> / Indonesian Bar Association
PKBM	<i>Pusat Kegiatan Belajar Masyarakat</i> / Learning Centers
PL	Total Project Longevity
PM	Total Project Management
PRA	Participatory Rural Appraisal
PT GAL	PT Global Alam Lestari
PT RHM	PT Rimba Hutani Mas
PT WLMS	PT Wahana Lestari Makmur Sukses
QA/QC	Quality Assurance/Quality Control
RDP	Rewetting of Drained Peatland
REDD	Reduced Emissions from Deforestation and forest Degradation
REDD+	Reducing Emissions from Deforestation and Degradation plus carbon stock enhancement
RTE	Rare, threatened, or endangered (species or ecosystems)
SAVI	Soil Adjusted Vegetation Index
SD	<i>Sekolah Dasar</i> / Elementary School
SMA	<i>Sekolah Menengah Atas</i> / High School
SMART	Spatial Monitoring and Reporting Tool
SMP	<i>Sekolah Menengah Pertama</i> / Junior High School
SMPP	Sumatra Merang Peatland Project

Abbreviation	Meaning
SOP	Standard Operation Procedure
SRTM	Shuttle Radar Topography Mission
TIRS	Landsat 8 Thermal Infrared Sensor
tPDT	time (years) until PDT is reached, i.e. all peat soil is depleted
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USGS	U.S. Geological Survey
VCS	Verified Carbon Standard
VCU	Verified Carbon Unit
VIIRS	Visible Infrared Imaging Radiometer Suite
VU	Vulnerable
W	Extreme Weather
WRC	Wetlands Restoration and Conservation

1 SUMMARY OF PROJECT BENEFITS

This section highlights some of this project's important benefits. Section 1.1 (Unique Project Benefits) should be considered in conjunction with project's conceptual model and is specific to this project. Section 1.2 provides estimates on quantifiable benefits that will be generated over the lifetime of the project.

1.1 Unique Project Benefits

The Sumatra Merang Peatland Project (SMPP) aims to generate a variety of project benefits throughout the lifetime of the project. This section outlines unique project benefits that are not captured in Section 1.2 below.

Outcome or Impact	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
Hydrological function restoration	Dam placement and engineering plan completed to guide the placement of more than 180 peat compaction dams across the concession. By the end of December 2019, the project successfully built 97 or around 50% of the permanent canal blocking, which was then fully completed in early 2020.		97 peat compaction dams installed across the project area. 87 temporary boxed dams installed
Fire prevention and fire threat reduction	- SMPP forest patrol teams responded to more than five unique fire instances in areas surrounding the concession during an extremely dry El Nino weather phenomenon - Community development program increased engagement with local schools to invest in education programming. - In November 2019, we detected one fire hotspot occurred in the SMPP area (using our Satellite-based early warning system (EWS) to detect and mitigate fires as early as possible). The project quickly deployed the Fire Fighting Team and put	PD Section 2.1.11 and 4.3.1 on this document	- Reduction in human activity within the SMPP area (this is the greatest risk that leads to fire) to prevent fires; - Satellite-based early warning system (EWS) to detect and mitigate fires as early as possible; - Forest patrols focused on detecting and identifying hotspots of fire threats, and continuously monitoring the fire threats in the SMPP; - Fire training for SMPP staff working inside the project area; and

Outcome or Impact	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
	out the small naturally occurring fire inside the project area, likely induced by lightning as well as ongoing forest patrols focused on detecting and identifying hotspots of fire threats, and continuously monitoring the fire threats in the SMPP; - No illegal activity was detected during the monitoring period; - We have facilitated fire safety trainings for each SMPP field staff member upon their introduction to the project. - Continued engagement with neighboring concessions for fire safety coordination and joint training. We facilitated a fire prevention training conducted by Manggala Agni (MoE&F's fire brigade) for 25 SMPP staff members and 12 individuals from a neighboring session's fire brigade in March 2018. - Reduction in human activity within the SMPP area (this is the greatest risk that leads to fire) to prevent fires.		Fire training for nearby concessions and SMPP stakeholders. Through our project efforts, we aim to continue minimize the impact of fires within the project area and maximize fire resilience in the SMPP and surrounding landscape. These efforts which will allow natural forest ecosystems to recover, provide extended habitats that support key species, and limit the negative impacts to health and livelihoods from smoke haze and air pollution.

1.2 Standardized Benefit Metrics

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
GHG emission	Net estimated emission removals in the project	(117,743)	3.2.4.3	(296,093)

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
reductions or removals	area, measured against the without-project scenario			
	Net estimated emission reductions in the project area, measured against the without-project scenario	683,826	3.2.4.2	2,408,073
Forest ¹ cover	For REDD ² projects: Number of hectares of reduced forest loss in the project area measured against the without-project scenario	N/A	N/A	N/A
	For ARR ³ projects: Number of hectares of forest cover increased in the project area measured against the without-project scenario	0 Hectares (Ha)	3.1.3.1.7	0 Hectares (Ha)
Improved land management	Number of hectares of existing production forest land in which IFM ⁴ practices are expected to occur 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 practices are	N/A	N/A	N/A

¹ Land with woody vegetation that meets an internationally accepted definition (e.g., UNFCCC, FAO or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests (*VCS Program Definitions*)

² Reduced emissions from deforestation and forest degradation (REDD) - Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and/or reduce the degradation of forest land where forest biomass is lost (*VCS Program Definitions*)

³ Afforestation, reforestation and revegetation (ARR) - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation (*VCS Program Definitions*)

⁴ Improved forest management (IFM) - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood and fuelwood (*VCS Program Definitions*)

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
	expected to occur as a result of the project's activities, measured against the without-project scenario			
Training	Total number of community members who have improved skills and/or knowledge resulting from training provided as part of project activities	We have not yet conducted any trainings.	2.1.11; 4.3.1	We have not yet conducted any trainings.
	Number of female community members who have improved skills and/or knowledge resulting from training provided as part of project activities of project activities	We have not yet conducted any trainings.	2.1.11.5	We have not yet conducted any trainings.
Employment	Total number of people employed in project activities, ⁵ expressed as number of full-time employees ⁶	55 employees as of December 2019	2.1.11.5; 4.2.1; 4.4.1	55 employees as of December 2019
	Number of women employed as a result of project activities, expressed as number of full-time employees	16.4% of employees = 9 women	2.1.11.5; 4.2.1; 4.4.1	9 women as of December 2019
Livelihoods	Total number of people with improved livelihoods ⁷ or income generated as a result of project activities	21 community fishermen and 2 farmer families (maintained	2.1.11.5; 4.2.1; 4.3.1	22 community fishermen and 2 farmer families (maintained

⁵ Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.

⁶ Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102];[17.28])

⁷ Livelihoods are the capabilities, assets (including material and social resources) and activities required for a means of living (Krantz, Lasse, 2001. *The Sustainable Livelihood Approach to Poverty Reduction*. SIDA). Livelihood benefits may include benefits reported in the Employment metrics of this table.

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
		livelihoods through protection of and access to fishing grounds and access to farming land). 10 fish farmers are supported through the establishment of a fish farmer group, pond construction equipment, fish seedlings and fish food. 10 elementary school teachers and 7 afterschool teachers are also supported by the project. During this monitoring period, 9 women were directly employed by SMPP.		livelihoods through protection of and access to fishing grounds and access to farming land). 10 fish farmers are supported through the establishment of a fish farmer group, pond construction equipment, fish seedlings and fish food. 10 elementary school teachers and 7 afterschool teachers are also supported by the project. During this monitoring period, 9 women were directly employed by SMPP.
	Number of women with improved livelihoods or income generated as a result of project activities	7 women are currently supported with scholarship to continue higher education level at Open University. 6 women as afterschool program teachers are also supported by the project.	2.1.11.5; 4.2.1; 4.3.1	7 women are supported with scholarship to continue higher education level at Open University. 6 women as afterschool program teachers are also supported by the project.
Health	Total number of people for whom health services were	One Village Health Facility in	2.1.11.5; 4.3.1	One Village Health Facility in

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
	improved as a result of project activities, measured against the without-project scenario	Kepayang village has been renovated and supplied with equipment and medicine and will benefit at least 2,628 residents in the mentioned village.		Kepayang village has been renovated and supplied with equipment and medicine and will benefit at least 2,628 residents in the mentioned village.
	Number of women for whom health services were improved as a result of project activities, measured against the without-project scenario	All 1,149 female residents in Kepayang village.	2.1.11.5; 4.2.1; 4.3.1	All 1,149 female residents in Kepayang village.
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	165 total students including: 10 students received scholarships to <i>Universitas Terbuka</i> who will become future teachers in both villages; 117 <i>Sekolah Dasar</i> (SD) students attending afterschool programs; 38 students received scholarships to attend adult continuing education programs. The adult education programs were funded by the project to be conducted in the villages to allow	2.1.11.5; 4.2.1; 4.3.1; 4.4.1; 4.3.1	165 total students including: 10 students received scholarships to <i>Universitas Terbuka</i> who will become future teachers in both villages; 117 <i>Sekolah Dasar</i> (SD) students attending afterschool programs; 38 students received scholarships to attend adult continuing education programs.

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
		higher attendance and reduce cost of attendance for community members.		
	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	83 total students including: 7 students received scholarships to <i>Universitas Terbuka</i> who will become future teachers in both villages; around 50% of 117 <i>Sekolah Dasar</i> (SD) students attending afterschool programs = 59; 17 students received scholarships to attend adult continuing education programs. The adult education programs were funded by the project to be conducted in the villages to allow higher attendance and reduce cost of attendance for community members.	2.1.11.5; 4.2.1; 4.3.1; 4.4.1	83 total students including: 7 students received scholarships to <i>Universitas Terbuka</i> who will become future teachers in both villages; around 50% of 117 <i>Sekolah Dasar</i> (SD) students attending afterschool programs = 59; 17 students received scholarships to attend adult continuing education programs.
Water	Total number of people who experienced increased water quality and/or improved access to	One rainwater catchment system has been installed as pilot in	2.1.11.5; 4.3.1	One rainwater catchment system has been installed as pilot in

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
	drinking water as a result of project activities, measured against the without-project scenario	Kepayang health facility that sees an average 30-50 patients per month. In collaboration with Kelola Sendang, two rain catchment systems were installed in 2 households in Kepayang. Residents with improved household water resources = ~10 people.		Kepayang health facility that sees an average 30-50 patients per month. In collaboration with Kelola Sendang, two rain catchment systems were installed in 2 households in Kepayang. Residents with improved household water resources = ~10 people
	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	Around 50% of the positively impacted residents in the houses of the pilot installation sites = ~5 women.	2.1.11.5; 4.3.1	Around 50% of the positively impacted residents in the houses of the pilot installation sites = ~5 women.
Well-being	Total number of community members whose well-being ⁸ was improved as a result of project activities	Livelihoods of 21 community fishermen and 2 farmer families and education reaching 165 students (see Education section above)	4.2.1; 4.3.1; 4.4.1	Livelihoods of 22 community fishermen and 2 farmer families and education reaching 165 students (see Education section above)

⁸ Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g. Training, Employment, Livelihoods, Health, Education and Water), and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
	Number of women whose well-being was improved as a result of project activities	Well-being of the women in the 21 community fishermen and 2 farmer families and education reaching 83 students (see Education section above). 7 women are currently supported with scholarship to continue higher education level at Open University. 6 women as afterschool program teachers are also supported by the project. During the monitoring period, 9 women are directly employed by SMPP.	4.2.1; 4.3.1; 4.4.1	Well-being of the women in the 22 community fishermen and 2 farmer families and education reaching 83 students (see Education section above). 7 women are currently supported with scholarship to continue higher education level at Open University. 6 women as afterschool program teachers are also supported by the project.
Biodiversity conservation	Change in the number of hectares significantly better managed by the project for biodiversity conservation, ⁹ measured against the without-project scenario	No data available.	2.1.7; 5.4.1	22,922 Ha
	Number of globally Critically Endangered or Endangered species ¹⁰ benefiting from reduced	10 Critically Endangered or Endangered species and 19	5.5.1	10 Critically Endangered or Endangered species and 19

⁹ Managed for biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g. enhancing the status of endangered species

¹⁰ Per IUCN's Red List of Threatened Species

Category	Metric	Achievements during the Monitoring Period	PD Section Reference	Achievements during the Project Lifetime
	threats as a result of project activities, ¹¹ measured against the without-project scenario	Vulnerable species occurring in the project area.		Vulnerable species occurring in the project area.

¹¹ In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

2 GENERAL

2.1 Project Description

2.1.1 Implementation Description

The Sumatra Merang Peatland Project (SMPP) aims to protect and restore 22,922 ha of a peatland ecosystem located in the Musi Banyuasin district in South Sumatra province. This large peatland ecosystem is currently in a predominantly degraded state due to the historical impact of logging, canal construction, and fires. The project activities have been designed to maximize the ability of the project to restore the ecological functions of the project area, and the wider peat dome in which it exists, while building strong and supportive relationships with the broad range of stakeholders within the landscape. Our focus on ecosystem restoration involves project activities such as forest patrolling, fire prevention and monitoring, canal blocking and hydrology management, reforestation and assisted natural regeneration (ANR), community development, biodiversity management and monitoring, as well as cross-cutting activities (more details can be found in the SMPP PD section 2.1.11 and Section 2.2.1). Most of these activities are ongoing, with several community development sub-activities in the final planning stage that finalized their implementation plans during the monitoring period.

This report covers the whole monitoring period from January 1st, 2019 to December 31st, 2019. Throughout this monitoring period, the project has supported a daily forest patrol system on the ground in the project area, along with daily weather monitoring. We have continued to implement community development activities and other engagements that will positively impact the stakeholders. By the end of December 2019, we have successfully built 97 or around 50% of the permanent canal blocking, which was then fully completed in early 2020.

For calculations or analysis in this monitoring report that were done using a tool or a module, we will adjust our analysis in the upcoming monitoring plan with updated tools or modules, as appropriate. For example, we calculated our non-permanence analysis using the most recent Non-Permanence Risk Tool (v4.0). If there is any update made to the tool, we will use that updated version to re-analyze our non-permanence analysis.

Overall, from the beginning of this second monitoring period in January 2019 through the end of the monitoring period in December 2019, the SMPP estimates that 566,308 metric ton (t) CO₂-e in emission reductions or removals (i.e. estimated carbon units) were achieved during this monitoring period.

2.1.2 Project Category and Activity Type

The SMPP is an Agriculture, Forestry, and Other Land-Use (AFOLU) project. More specifically, the project activities are categorized as a combination of Afforestation, Reforestation and Revegetation (ARR) and Wetlands Restoration and Conservation (WRC). Under the WRC component, the project activities relate to both the Conservation of Undrained and Partially Drained Peatland (CUPP) and Rewetting of Drained Peatland (RDP). The SMPP is not a grouped project.

2.1.3 Project Proponent(s)

The SMPP has two project proponents, as listed below.

Organization name	PT Global Alam Lestari
Contact person	Dr. Riza Suarga
Title	President Director
Address	Komp, Mall Ska Blok E 61, Delima, Tampan, Pekanbaru, Riau, 28294
Telephone	+62 761 7891749

Email	riza.suarga@globalalamlestari.com
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Organization name	Forest Carbon (registered as Equator Group Pte Ltd)
Contact person	Jeffrey Chatellier
Title	Managing Director
Address	152 Beach Road #28-00 Gateway East, Singapore (189721)
Telephone	+62 21 5740817
Email	j.chatellier@forestcarbon.com

2.1.4 Other Entities Involved in the Project

Key implementing and technical partners are listed below.

Organization name	Althelia Climate Fund (ACF)
Role in the project	Impact Investment Partner
Contact Person	Adam Gibbon
Title	Chief Technical Officer / Investment Director
Address	LABS House, 15-19 Bloomsbury Way, London WC1A 2TH, UK
Telephone	+44 (0) 77 362 869 27
Email	adam.gibbon@althelia.com

Organization name	Ecosphere+ Ltd
Role in the project	Marketing Partner
Contact Person	Lisa Walker
Title	CEO
Address	LABS House, 15-19 Bloomsbury Way, London WC1A 2TH, UK
Telephone	+44 203876 5228
Email	lisa@ecosphere.plus

2.1.5 Project Start Date (G1.9)

The project start date is January 1st, 2016, as according to the Verified Carbon Standard (VCS) definition, this was the date activities on the ground were begun to contribute toward greenhouse gas (GHG) emission reductions and removals. In January of 2016, the project started to establish a permanent presence within the project area through the construction of the project's main camp and by starting to conduct formal patrol activities leading to effective prevention of fire and forest degradation.

2.1.6 Project Crediting Period (G1.9)

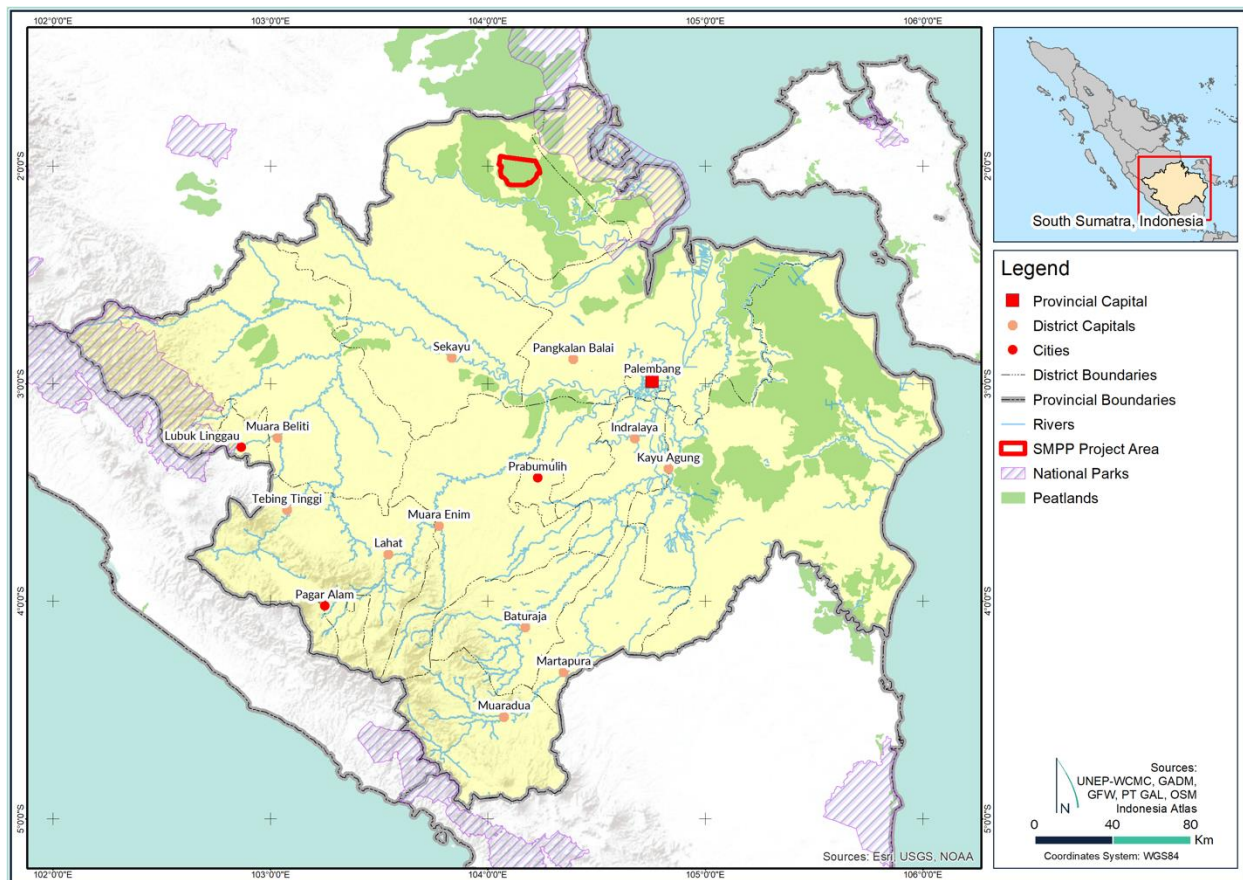
The duration of the VCS project crediting period is 47 years, with the project beginning on January 1st, 2016 and ending on December 31st, 2062. The PAN/RAP carbon storage and sequestration license held by PT Global Alam Lestari is extendable up to 50 years.

Per the VCS guidelines, a mandatory baseline re-evaluation is to be executed at a minimum of every 10 years after the project start. Therefore, there will be a mandatory baseline re-evaluation on or before January 1st, 2026 and every ten years afterwards.

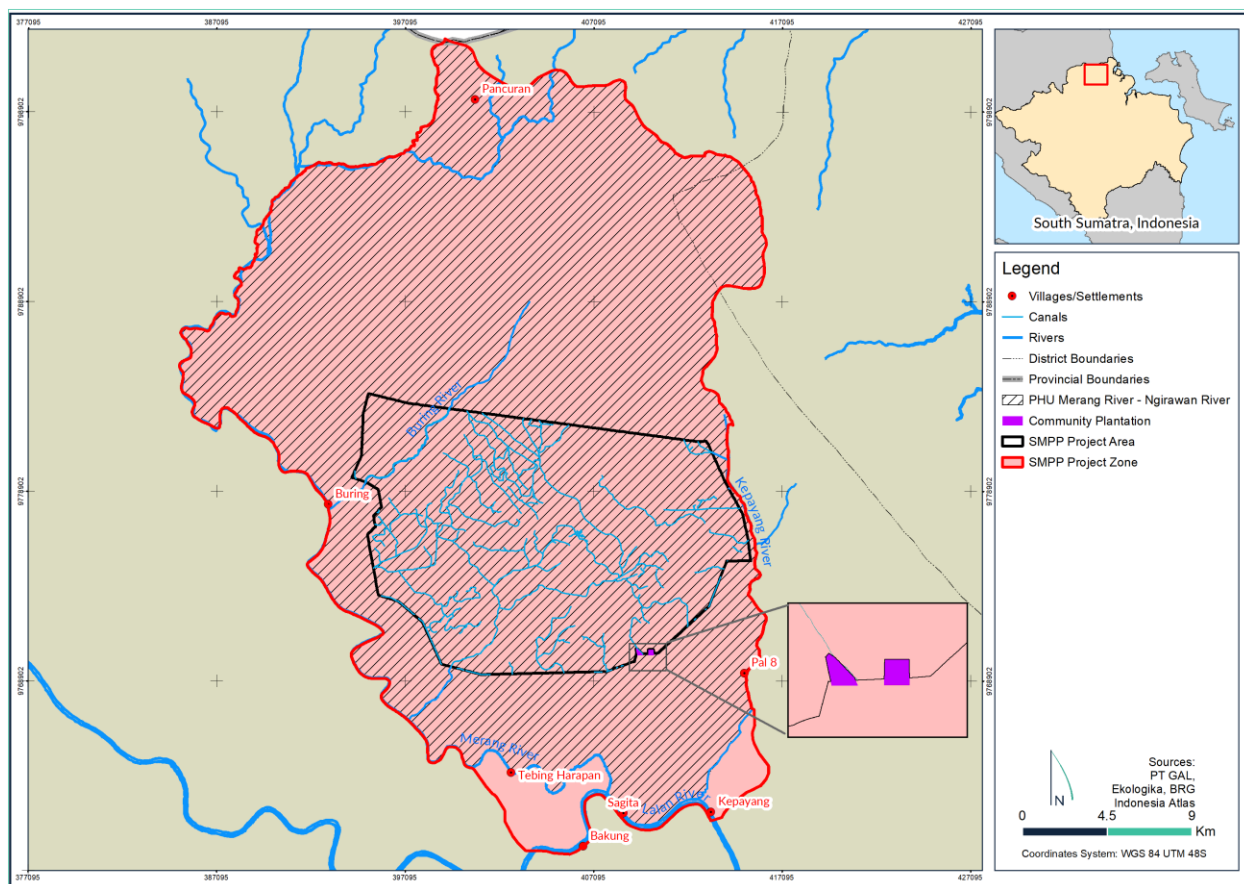
2.1.7 Project Location

The SMPP is located within Bayung Lencir sub-district, Musi Banyuasin district, South Sumatra province, Sumatra, Republic of Indonesia (see Map 1). The Musi Banyuasin regency is located in the northern part of South Sumatra province and is between 103°-104° 45' East (E) and 1.3° - 4° South (S), 14,265.96 square kilometers (km²). The SMPP area lies between the following geographic coordinates: 2° 1' 9.01" S and 104° 8' 43.10" E (see Map 2).

Map 1. Location of the SMPP area in Sumatra, Indonesia.



Map 2. Location of the SMPP area and zone.



The SMPP project zone consists of the formal project area, the government delineated peatland hydrology unit (PHU), and has been extended to include the village areas where community development operations are taking place. The project zone includes active fishing grounds inside and near the boundaries of the SMPP, in addition to the two small farms located on the southeast border of the SMPP. The project zone covers all settlement areas associated with the villages of Kepayang and Muara Merang as these villages are beneficiaries of community development activities. From an ecological perspective, the PHU represents peatland areas that will benefit from improved functionality from SMPP hydrological interventions. Within the PHU, there are commercial forest plantations, palm oil plantations, and to a limited degree, smallholder farms. The project zone is a total of 85,182 hectares.

The SMPP project area is defined by the PAN/RAP license and covers a total area of 22,934 ha minus 12 ha of land that have been excised for the farms of the two families that continue to conduct small-scale palm oil production on the southeast border.

The SMPP sits within the Merang-Kepayang peat dome, the largest peat swamp dome in South Sumatra, which covers more than 150,000 ha.^{1,2} A number of critical climate and biodiversity assets are linked to the wider peat swamp forest zone that surrounds the SMPP, including the Sembilang-Berbak National Park to the northeast and the Muaro Jambi peat swamp to the north.

2.1.8 Title and Reference of Methodology

The SMPP applies the latest version of VCS Methodology VM0007 (version 1.5). Applicable modules are available in the table below. The table below indicates how the project meets all applicability conditions of VM0007 (version 1.5) and its associated modules.

Table 1. Summary of applicability conditions.

No	Module	Applicability Condition	Comment
1	REDD-MF, 4.3 ARR	The project area is non-forest land or land with degraded forest.	Condition met. See SMPP PD Section 2.1.5.
2	REDD-MF, 4.3 ARR	The project scenario does not involve the harvesting of trees. Therefore, procedures for the estimation of long-term average carbon stocks are not provided.	Condition met. See SMPP PD Section 2.1.11
3	REDD-MF, 4.3 ARR	ARR activities are not eligible if the project scenario does not involve the application of nitrogen fertilizers.	Condition met. The project does not involve the application of any fertilizers. See SMPP PD Section 2.1.11.
4	REDD-MF, 4.3 ARR	Where project activities on wetlands are excluded by the applicability conditions of applied modules or tools, these can be disregarded for the purpose of their use within this methodology, as quantification procedures for the peat soil are provided in modules BL-PEAT and M-PEAT.	Condition met. The project applies modules BL-PEAT and M-PEAT alongside all modules related to ARR.
5	REDD-MF, 4.4 WRC	This methodology is applicable to rewetting drained peatland (RDP) and conservation of undrained and partially drained peatland (CUPP) activities on project areas that meet the VCS definition for peatland. The scope of this methodology is limited to domed peatlands in the tropical climate zone.	Condition met. The project area contains peatland (see SMPP PD Section 2.1.5) which would be drained in the baseline and which will be conserved and restored in the project scenario. The project therefore falls in the category of RDP and CUPP. The project meets the definition of domed peatlands (see SMPP PD Section 2.1.5) and is located in the tropical climate zone (see Section 2.1.5 (see SMPP PD Section 2.1.5)).
6	REDD-MF, 4.4 WRC	Fire reduction projects on peatland that exclude rewetting as part of the project activity are not eligible.	Condition met. The project includes extensive rewetting across the entire project area (see SMPP PD Section 2.1.11) in conjunction with WRC and ARR activities.
7	REDD-MF, 4.4 WRC	Rewetting of drained peatland and conservation of undrained or partially drained peatland may be implemented in combination with REDD project activities. REDD project activities on peatland must not increase drainage.	N/A. The project does not include any REDD components.
8	REDD-MF, 4.4 WRC	Rewetting of drained peatland may be implemented as a separate activity or in combination with ARR project activities. ARR activities must not enhance peat oxidation and therefore this activity requires at least some degree of rewetting.	Condition met. The project includes extensive rewetting across the entire project area (see SMPP PD Section 2.1.11) in conjunction with WRC and ARR activities.

No	Module	Applicability Condition	Comment
9	X-STR	In case of REDD, aboveground biomass stratification is only used for pre-deforestation forest classes, and strata are the same in the baseline and the project scenario. Post-deforestation land-uses are not stratified. Instead, average post-deforestation stock values (e.g., simple or historical area-weighted approaches are used, as per Module BL-UP).	N/A. The project does not include any REDD components.
10	X-STR	For peatland rewetting and conservation project activities this module must be used to delineate non-peat versus peat and to stratify the peat according to peat depth and soil emission characteristics, unless it can be demonstrated that the expected emissions from the soil organic carbon pool or change in the soil organic carbon pool in the project scenario is de minimis.	Condition met. See application of X-STR in SMPP PD Section 3.1.3.
11	X-STR	In the case of peatland rewetting and conservation project activities, the project boundary must be designed such that the negative effect of drainage activities that occur outside the project area on the project GHG benefits are minimized.	Condition met. The project is taking significant steps to maintain the intactness of hydrology in the project area and to restore hydrology in areas which have been disturbed by existing drainage. The project is monitoring areas outside the project area which could be under threat of disturbance in order to minimize potential impacts in terms of drainage. See SMPP PD Section 3.2.3.
12	BL-ARR	The applicability conditions set out in AR-ACM0003 Afforestation and reforestation of lands except wetlands must be met.	See #25 & 17 below.
13	BL-ARR	Applicability conditions included in AR-ACM0003 Afforestation and reforestation of lands except wetlands and corresponding tools that exclude project activities on wetlands can be disregarded for the purpose of their use in this module, as accounting procedures for the peat soil are provided in module BL-PEAT.	Condition met. See #2 above.
14	BL-ARR	Where the ARR project activity is implemented on peatland, the peatland must be degraded in the baseline scenario as identified by the presence of drainage infrastructure (ditches, canals) and associated lowered water tables below the surface. In the case of forested peatland, degradation may be identified by the removal or degradation of the tree cover before the project start date.	Condition met. ARR project activities are only implemented on already degraded land which would be further degraded in the baseline as demonstrated in SMPP PD Sections 3.1.3 and 3.2.1.
15	BL-ARR	The project scenario does not involve the harvesting of trees. Therefore, procedures for the estimation of long-term average carbon stocks are not provided.	Condition met. See #2 above.

No	Module	Applicability Condition	Comment
16	ACM0003	This methodology is applicable under the following conditions: (a) The land subject to the project activity does not fall in wetland category; (b) Soil disturbance attributable to the project activity does not cover more than 10 per cent of area in each of the following types of land, when these lands are included within the project boundary: (i) Land containing organic soils; (ii) Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in appendices 1 and 2 to this methodology.	Per #13 above, condition (a) can be neglected, as the project applies relevant wetland procedures. Condition (b) is not relevant, as the project does not cause soil disturbance.
17	ACM0003	A project activity applying this methodology shall also comply with the applicability conditions of the tools contained within the methodology and applied by the project activity.	Condition met. This table lists all relevant applicability conditions and describes how they are fulfilled.
18	BL-PEAT	This module is applicable to RDP and CUPP activities on project areas that meet the VCS definition for peatland. The scope of this module is limited to domed peatlands in the tropical climate zone	Condition met. See #5 above.
19	BL-PEAT	It must be demonstrated by using the latest version of the CDM A/R methodological tool: "Tool for testing significance of GHG emissions in A/R CDM project activities" (T- SIG) that N ₂ O emissions in the project scenario are not significant, or it must be demonstrated that N ₂ O emissions will not increase in the project scenario compared to the baseline scenario, and therefore N ₂ O emissions need not be accounted for	Condition met. The project does not cause an increase in N ₂ O emissions.
20	BL-PEAT	In the baseline scenario the peatland must be (partially) drained. At project start the peatland may still be undrained.	Condition met. Peatland will be drained in the baseline (see SMPP PD Section 3.2.1).
21	BL-PL	The module is applicable for estimating the baseline emissions on forest lands (usually privately or government owned) that are legally authorized and documented to be converted to non-forest land.	N/A. The project does not include any REDD components.
22	BL-PL	Where, pre-project, unsustainable fuelwood collection is occurring within the project boundaries modules BL-DFW and LK-DFW shall be used to determine potential leakage	N/A. Unsustainable fuelwood collection not occurring within the project boundaries.
23	LK-ECO	This module is applicable under the following condition: • Leakage caused by hydrological connectivity is avoided by project design and site selection, as outlined in Chapter 5 (Procedures).	Condition met. Project does not cause ecological leakage. See application of LK-ECO in SMPP PD Section 3.2.3.

No	Module	Applicability Condition	Comment
24	T-ADD	The tool is applicable under the following conditions: • Forestation of the land within the proposed project boundary performed with or without being registered as the A/R CDM project activity shall not lead to violation of any applicable law even if the law is not enforced. • This tool is not applicable to small - scale afforestation and reforestation project activities.	Condition met. Reforestation activities do not violate any applicable laws. indeed, they are required under the project scenario. The reforestation activities are not classified as small scale.
25	T-SIG	The tool shall be used in the application of an A/R CDM approved methodology to an A/R CDM project activity: a) To determine which decreases in carbon pool and increases in emissions of the greenhouse gases measured in CO ₂ equivalents that results from the implementation of the A/R project activity, are insignificant and can be neglected b) To ensure that it is valid to neglect decreases in carbon pools and increases GHG emission by source stated as being insignificant in the applicability conditions of an A/R CDM methodology	Condition met. T-SIG was used, however no significance calculations needed to be performed as carbon pools and sources of GHG emissions were only neglected where it was demonstrably conservative.
26	E-BPB	This module is applicable to avoiding unplanned deforestation or degradation (AUDD), avoiding planned deforestation (APD) and avoiding degradation project activities, whether or not situated on peatland.	Condition met. Project includes WRC activities.
27	M-ARR	This module is applicable under the following conditions: • The applicability conditions provided in A/R CDM consolidated methodology AR- ACM0003 (Afforestation and reforestation of lands except wetlands) and associated tools. • Where exclusion of project activities on wetlands exist in the applicability conditions of methodologies and tools, these can be neglected for the purpose of their use in this module, as accounting procedures for the peat soil are provided in module M-PEAT.	Condition met. See #13 & #14 above
28	M-PEAT	This module is applicable to RDP and CUPP activities as defined in VCS AFOLU Requirements. The project area must meet the VCS definition for peatland. This module is limited to domed peatlands in the tropical climate zone.	Condition met. See #5 above.
29	M-PEAT	Furthermore, the following applicability conditions apply: It must be demonstrated using tool T-SIG that N ₂ O emissions in the project scenario are not significant, or it must be demonstrated that N ₂ O emissions will not increase in the project scenario	Condition met. See #19 regarding N ₂ O emissions. Baseline scenario includes draining of peatland. Project is partially drained at project start.

No	Module	Applicability Condition	Comment
		compared to the baseline scenario, and therefore N₂O emissions need not be accounted for. In the baseline scenario the peatland must be drained or partially drained. At project start the peatland may still be undrained. It must be demonstrated using Module LK-ECO that ecological leakage must not occur.	Per SMPP PD Section 3.2.3 ecological leakage does not occur.
30	M-MON	Strata as defined in the relevant baseline modules are fixed and may not be changed without baseline revision.	Condition met. See SMPP PD Section 3.1.3.
31	M-MON	The module is always mandatory. Without application of this module the methodology shall not be used	Condition met. The module is applied as per the requirement.
32	M-MON	Where selective logging is taking place in the project case: - Emissions from logging may be omitted if it can be demonstrated the emissions are de minimis using T-SIG. - If emissions from logging are not omitted as de minimis, logging may only take place within forest management areas that possess and maintain a Forest Stewardship Council (FSC) certificate for the years when the selective logging occurs. - Logging operations may only conduct selective logging that maintains a land cover that meets the definition of forest within the project boundary. - All trees cut for timber extraction during logging operations must have a DBH greater than 30 cm. - During logging operations, only the bole/log of the felled tree may be removed. The top/crown of the tree must remain within the forested area. - The logging practices cannot include the piling and/or burning of logging slash - Volume of timber harvested must be measured and monitored.	Condition met. Project does not include selective logging.
33	X-UNC	The module is mandatory when using VCS methodology VM0007. It is applicable for estimating the uncertainty of estimates of emissions and removals of CO₂-e generated from REDD and WRC project activities. The module focuses on the following sources of uncertainty: - Determination of rates of deforestation and degradation - Uncertainty associated with estimation of stocks in carbon pools and changes in carbon stocks - Uncertainty associated with estimation of peat emissions - Uncertainty in assessment of project emissions	Condition met. X-UNC has been used throughout to estimate uncertainties associated with this project. See SMPP PS Section 3.2.4.
34	X-UNC	Where an uncertainty value is not known or cannot be simply calculated, then a project must justify that it is using an indisputably conservative	Condition met.

No	Module	Applicability Condition	Comment
		number and an uncertainty of 0% may be used for this component.	The uncertainty value is known, see SMPP PD Section 3.2.4.

2.1.9 Other Programs (G5.9)

The SMPP's activities and GHG emission reductions do not fall under any other emissions trading program or other binding limit in relation to GHG emissions. The SMPP only seeks to generate VCUs under VCS and has never received another form of GHG-related environmental credit. The SMPP does not participate under any other GHG program.

2.1.10 Sustainable Development

The SMPP is aligned with a number of sustainable development and environmental protection targets designated by the Indonesian government. The following key policy components align directly with our project objectives, including emphasizing climate action, supporting communities, and protecting biodiversity.

Indonesia's Medium-Term Development Plan covers nine priorities, called *Nawacita*, which include references to sustainable development in the forestry sector. Specifically, the Environment and Forestry Development Strategic Priorities Plan for the period between 2015-2019³ aims to protect the quality of the environment to maintain ecosystem services function and to improve water security and community health; utilize forest and environmental resources in sustainable manner to improve the economy and prosperity of local people; and preserve the balance of ecosystems and biodiversity as a way to support sustainable development. These targets for reporting and monitoring are listed below.

2.1.10.1 Economic Growth and Development

The government seeks to improve the economic development of Indonesia with a target to increase the per capita income from \$3,918 USD in 2015 to \$6,0181 USD by the end of 2019.⁴

The SMPP contributes to economic growth by providing project stakeholders with employment opportunities and a variety of livelihood enhancement activities. The project actively employs local stakeholders for forest protection and facility management and provide access to education for all project staff in addition to surrounding communities.

2.1.10.2 Poverty and Inequality

Indonesia's National Medium-Term Development Plan for 2015-2019 targets a decrease in poverty rates of 7.0-8.0% and a decrease in the unemployment rate of 4.0-5.0% by the end of 2019. In order to achieve these goals, the Indonesian government plans to improve access to job opportunities by increasing the productivity of industries that can create jobs, increasing workers' living standards and changing low-skilled industries to skills-based industries. The government is highly focused on lowering poverty levels in rural areas, to develop Indonesia from the periphery by strengthening regions and villages.⁴

The SMPP is supporting rural poverty reduction by generating employment for groups with low education levels which increases household income. The SMPP has a target to hire 80% of its field staff from communities in proximity to the project area. In 2019 we employed 24 local staffs out of total 35 field staffs or around 68.5%. In addition, the SMPP is working to ensure gender balance and aims to employ 25% women as project staff, along with a community development component targeting a number of women's groups in nearby villages and settlements. During this monitoring period, the project directly employed 16.4% or nine women as project staff. The project aims to reach the target in the next monitoring period and has already increased these numbers as of early 2020.

2.1.10.3 Education

The Ministry of Education and Culture has a target to increase the capacity and quality of 14,000 educators throughout the country. The government also aims to improve infrastructure for education by building 210 new schools and 2,500 classrooms; rehabilitating 41,000 classrooms and renovating 294 schools as well as building 2,140 laboratories and 1,332 libraries.⁵

The SMPP's educational program is clearly in line with these development targets as it provides a university scholarship program for teachers, supports school infrastructure initiatives and funds additional adult education programs for community members to progress beyond middle school education levels and obtain high school diplomas.

2.1.10.4 Sustainable Forest and Land-use

The Indonesian Peat Restoration Agency (*Badan Restorasi Gambut* or BRG) has a target to restore two million ha of peatlands in the country. The project area is located in one of the agency's priority areas and is the center for hydrological interventions in the PHU that surrounds SMPP.⁶

2.1.10.5 Climate Change

Indonesia ratified the Paris Agreement as part of its commitment to address climate change and submitted its National Determined Contribution (NDC) which is also in line with *Nawacita* priorities that are integrated across the Medium-Term Development Plan. The SMPP aims to contribute to Indonesia's overall CO₂ emission reduction target by 2020 in conjunction with the appropriate monitoring and reporting.

2.2 Project Implementation Status

2.2.1 Implementation Schedule (G1.9)

The current monitoring period is for the year 2019. Provided below are the key milestones and activities that took place during the monitoring period.

Table 2. Key milestones in the SMPP's development and implementation.

Date	Milestone(s) in the project's development and implementation
January 1, 2016	Project Start Date: January 1 st , 2016.
2016	The project constructed with a permanent field camp in the project area which is now the main camp of the project. The project also constructed three patrol posts along the perimeter of the project boundary.
2016 - Present	Forest Protection: The project hired full time staff that resided in project facilities within the project boundary. This marked the beginning of routine patrolling of the project area that continued through the entire monitoring period.
2016 - Present	Community Engagement: The project-initiated community engagement meetings and activities in nearby villages in 2016.
2016	The project began its first phase of canal blocking construction and completed five temporary box dams in the eastern part of the project area.
2017	In 2017, the project began a more extensive canal blocking program and built an additional 75 temporary box dams throughout the project area. The project also greatly expanded its facilities by increasing the size of its office, building new living quarters, which included renovating and increasing the size of the patrol posts. The project hired a full-time community development manager and additional technical staff to focus on biodiversity and forest restoration. The project also secured a long-term investment to scale up project activities in October of 2017. The project also began supporting educational programs in Muara Merang and Kepayang villages.

Date	Milestone(s) in the project's development and implementation
July 2018	The project completed its formal boundary demarcation (<i>tata batas</i>) with the government and received approval from the government.
September 2018	The project established a tree nursery at its main camp. It also increased the size of its patrol posts and installed solar panels on all the patrol posts.
December 2018	The project completed a peat depth survey and developed a detailed hydrology restoration plan. It also finalized the development of VCS/CCB project document. The project built a large patrol post in the eastern part of the project area to protect and monitor the project's remaining secondary forest. The project continued to expand its support of education programs in the nearby villages.
May 2019	PD (Project Documentation) completed for VCS and CCB.
July 2019	Aster Global began field visit audit for joint Validation and Verification.
November 2019	Audit completed.
November 2019	Water table level monitoring system installed.
December 2019	97 peat compaction dams constructed.
December 2019	First VCU issuance.

2.2.2 Methodology Deviations

No new deviation since the last monitoring report occurred during the monitoring report period. The methodology deviation related to the baseline conversion/plantation establishment rate that was used in the PD is still in effect until the baseline will get reassessed. In short, Module BL-ARR and Methodology extension AR-ACM0003 do not include specific requirements for the justification of the plantation establishment rate. We therefore followed Module BL-PL to justify our conservative baseline conversion/plantation establishment rate (which is not deforestation) and to calculate leakage with a baseline deforestation rate, we followed Module BL-PL. The conservative approaches of BL-PL provided an analytical basis for the plantation establishment rate. Although this analysis was not needed for our baseline rate of conversion, we employed this approach to give our baseline rate more validity. A slight deviation from the requirements of BL-PL took place when justifying deforestation rate used for the subsequent LK-ASP. Further details can be found in the PD.

2.2.3 Minor Changes to Project Description (RULES 3.5.6)

There have been minor changes to the biodiversity monitoring plan during this monitoring period, such as the addition of detailed SOPs on data collection and more detail on camera trap surveying and the use of SMART software. The minor changes are in conformance with the requirements of the Climate, Community & Biodiversity Standards criteria and indicators. Further details are outlined in section 5.3.1.

2.2.4 Project Description Deviations (RULES 3.5.7 – 3.5.10)

No new deviation since the last monitoring report occurred during the monitoring report period. The deviation related to data collection for the leakage analysis, as previously used, did not negatively impact the conservativeness of the quantification of GHG emission reductions or removals, or the applicability methodology, additionality or the appropriateness of the baseline scenario. This deviation was a minor change in the procedures for measurement and monitoring, which VCS lists as an acceptable example of deviation that can be included in a Monitoring Report.

The Ministry of Environment and Forestry (MoE&F) statistics of total area (ha) of licensed Industrial Plantation Forests (*Hutan Tanaman Industri* or HTI) in the country is not yet available for 2018. In order to complete the initial non-spatial assessment of the government data compared to the PD estimates, we used the more conservative value from 2017.

2.2.5 Grouped Projects

This is not a grouped project.

2.2.6 Risks to the Project (G1.10)

The possible natural and human-induced risks that could impact the SMPP's climate, community, and biodiversity benefits are outlined in great detail in Annex 2: VCS AFOLU Non-Permanence risk analysis. Additional mitigation strategies will be developed if new risks emerge during project implementation. These risks should be considered in conjunction with the non-permanence risk assessment carried out in accordance with the most recent AFOLU Non-Permanence Risk Tool v4 (September 19th, 2019 version). A summary of this risk analysis is outlined in Table 3 below, indicates that in the SMPP Internal Risks have the highest score, followed by Natural Risks, with External Risks receiving a score of zero.

During the 2019 monitoring period, the project implemented significant natural and human induced risk mitigation activities such as hydrology management through the construction of compacted peat dams, frequent forest patrols, implementation of an early warning fire detection system, and through monitoring of water table level using dipwells throughout the project area, and rain fall measurements through a number of weather stations.

Table 3. Summary of non-permanence risk analysis for the SMPP.

VCS AFOLU non-permanence risk category	Score
a) Internal Risk	
Total Project Management (PM) Risk Value	-4.0
Total Financial Viability (FV) Risk Value	0.0
Total Opportunity Cost (OC) Risk Value	0.0
Total Project Longevity (PL) Risk Value	15
Total Internal Risk (PM + FV + OC + PL)	11
b) External Risk	
Total Land Tenure (LT) Risk Value	2.0
Total Community Engagement (CE) Risk Value	-5.0
Total Political (PC) Risk Value	0.0
Total External Risk (LT + CE + PC)	0.0
c) Natural Risk	
Fire (F) Risk Value	1.0
Pest and Disease Outbreak (PD) Risk Value	0.0
Extreme Weather (W) Risk Value	0.0
Geological Events (G) Risk Value	2.0
Other Natural Risk (ON) Value	0.0
Total Natural Risk (F + PD + W + G + ON)	3.0
Total Overall Risk Rating (a + b + c)	14

2.2.7 Benefit Permanence (G1.11)

There are no potential negative environmental impacts resulting from the project in either the project area or the surrounding region. The project also does not anticipate any negative socio-economic impacts. While the SMPP has a 25-year IUP PAN/RAP carbon storage and sequestration license that is extendable up to 50 years, the project's activities are designed to enhance the CCB benefits beyond the project's lifetime. Community development activities are designed to increase family incomes by creating opportunities for education and employment. The project is also making investments into small businesses and supporting an increase in education levels among residents in nearby settlements. By investing in the human capital of the region, SMPP can create more possibilities for formal employment with more reliable and higher wages. The project will also promote the importance of conservation and hydrology management to nearby villages as a way build local stewardship for the landscape. Youth will be targeted to promote a shift away from exploitative land-use practices to activities in the formal economy. These community development activities are outlined in more detail in Section 2.1.11 of the PD.

From a biodiversity permanence perspective, the SMPP is rewetting the peatlands through the construction of permanent canal blocks which is a recognized approach to restore the hydrology of this degraded area, which will reduce the risk of fire in the landscape allowing the natural vegetation to be restored over the life of the project. This activity is explained in more detail in Section 2.1.11 of the PD.

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

To provide stakeholders with access to project documents, the SMPP Field Office maintains a full, printed version of the project description (PD) and monitoring report (MR) document in English for public viewing. The executive summary was translated into Bahasa Indonesia and was given to community leaders to make available in public places in the surrounding villages, and the full PD and MR with their executive summaries were posted in English and in Bahasa Indonesia on the VCS project database, which is now known as the Verra Registry.

2.3.2 Dissemination of Summary Project Documents (G3.1)

To disseminate project documents to communities, other stakeholders, and the public, the SMPP Field Office maintains a full, printed version of the PD and MR and associated annexes in English for public viewing. The executive summary was translated into Bahasa Indonesia and was given to community leaders to make available in public places in the surrounding villages, and the full PD and MR with their executive summaries were posted in English and in Bahasa Indonesia on the VCS project database, which is now known as the Verra Registry. In addition to the executive summary, the SMPP community development representative serves as a focal point for community inquiries and questions on the project, along with the many other staff that are actively employed in the project. We provided a brochure in Bahasa Indonesia advertising the project, and an email address was posted in local villages and given to SMPP communities and other stakeholders as a point of contact. Finally, notices in Bahasa Indonesia advertising the public comment period for the project's first combined validation and verification were posted in communities throughout the project area. It included details on how to make a comment on the CCB version as well.

Monitoring results were discussed throughout the duration of project monitoring, and information was continually disseminated to the communities through consultation with actively involved individuals, particularly SMPP residents, fishermen, and village leaders, who were encouraged to further share project information throughout their wider community.

2.3.3 Informational Meetings with Stakeholders (G3.1)

The project continued to conduct follow-up meetings with key stakeholders that were identified at the beginning of the project throughout 2019. The purpose of these meetings was to continue to build trust and forge relationships with project stakeholders and engage in further efforts to understand local history, livelihoods potential and any community concerns. Identification of other social, religious, and economic

factors that could potentially influence how the community responds to the project were also recorded, to ensure effective engagement with surrounding communities and other stakeholders as implementation scales up.

The project publicized a variety of informational materials in both Bahasa Indonesia and English through the use of a combination of promotional materials such as letters, signs, banners, and announcements at community meetings and workshops.

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

The project has implemented a variety of social consultations, described further in Section 2.3.7, where information was provided on the potential costs, risks and benefits to the identified communities. The SMPP aims to work collaboratively with the identified communities of fishermen and farmers that traverse the project borders to ensure their engagement throughout the duration of the project (see PD Sections 2.1.6 and 2.1.9 for more details). These identified project communities are familiar with the project and its intentions as a result of continued consultative meetings and participation in development programming. The primary communication method with the communities is through in-person meetings, as many do not have mobile phones and are often located at their remote fishing areas or farms.

In May through July 2019, the SMPP Community Development manager has conducted a follow up consultation meeting with the communities as defined by CCB, namely the fisherman inside the concession and the farming operations south of the project area. The meetings identified needs to improve their working capacity and consequently their overall incomes, which SMPP is addressing through its community development plan. These interactions were also used to further inform and educate these stakeholders about the importance of canal blocking to restore and protect the site from further fires.

CCB-Defined “Other stakeholders” were also included in the consultative process and are a larger beneficiary group which includes residents of Muara Merang, Kepayang villages, along with other nearby settlements. In 2019, follow-up meetings have taken place with other stakeholders in these villages through one-on-one discussions, small group meetings, and through participation in formal village meetings where village officials invited project representatives. These meetings with other stakeholders included discussions on project costs, risks and benefits to the relevant stakeholders. More details on the consultations including the dates, locations and number of attendants, are provided in Section 2.3.7.

The SMPP field office, which has been open since 2016, now serves as an information hub that is open to community members and other stakeholders who wish to gain information about the project and/or submit comments or grievances.

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

To provide information to communities and other stakeholders on the validation and verification process, the SMPP Field Office maintains a full, printed version of the PD and MR and associated annexes in English for public viewing. The executive summary was translated into Bahasa Indonesia and was given to community leaders to make available in public places in surrounding villages, and the full PD and MR and its executive summary was posted in English and Bahasa Indonesia on the VCS project database. In addition to the executive summary, we provided a brochure in Bahasa Indonesia advertising the project, and an email address was posted in local villages and given to SMPP communities and other stakeholders as a point of contact. Finally, notices in Bahasa Indonesia advertising the public comment period and field validation were posted in communities throughout the project area. It included details on how to make a comment on the CCB version.

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

The SMPP staff frequently meet with the identified project communities and residents of nearby villages and settlements on a frequent basis. Due to recent situation with the spread of COVID-19 and Government imposed lockdowns in many areas throughout Indonesia, the project proponent will coordinate closely with the auditor and finalize an audit plan to arrange for online video interviews or through video recordings. In order to prepare for the audit, project staff will inform relevant stakeholders in advance about the details of

the audit process and prepare local groups with ample time for the remote audit so that they can communicate with the auditor. The project will arrange for online meetings with all relevant stakeholders during the audit process to enable the auditor to ask questions of all relevant stakeholders.

2.3.7 Stakeholder Consultation (G3.4)

The project has conducted a combination of formal stakeholder consultations and informational meetings with the communities dating back to 2016 (see SMPP PD Section 2.3.3). We will continue to facilitate these meetings throughout the duration of the project. We recognize the feedback and advice provided by these parties is critical to the long-term success of this project, and therefore consider all information gathered in these meetings. Additionally, this feedback is a valuable opportunity for the project to enhance and adapt all aspects of project design and implementation according to guidance from relevant identified stakeholders.

Participatory Rural Appraisal (PRA), a method used to conduct social surveys in rural settings in a quick and efficient manner, which is described further in PD Section 2.1.8. Our community development team have carried out extensive direct engagement with the communities and other stakeholders in the SMPP and surrounding villages and settlements. Overall, since our project start date is 2016, this effort has consisted of a variety of meetings and discussions. This engagement has been broad and in addition to formalized discussions, many meetings were informal conversations without specific written agendas.

Throughout the duration of the 2019 monitoring period, we have consulted with the local communities and stakeholders to ensure mutual understanding regarding all project activities and potential impacts. During the 2019 monitoring period, we have documented at least 9 engagements with community fishermen, 10 engagements with a community farmer, 30 engagements with school groups or other education facilitators, 24 engagements with village officials, 4 engagements with managers from nearby concessions, 6 engagements with local women's groups, and 21 engagements with village residents in the Muara Merang and Kepayang villages and other nearby settlements. A summary of these meetings is outlined in Table 4 below. These stakeholder consultations and engagements consisted of one-on-one interviews, group interviews, formal meetings, and focus group discussions (FGDs).

Table 4. Summary of stakeholder consultations

Note: (One-on-one interviews, group interviews, meetings, and focus group discussions)

SMPP group	Stakeholder Groups	Number of times engaged (in the first monitoring period: 2016-2018)	Current engagement (In 2019 monitoring period)
Community	Fishermen	22	9
	Farmers	1	10
	Total formal community consultations:	23	19
Other stakeholders	School groups and education facilitators	50	30
	Officials from nearby villages	11	24
	Managers from nearby concessions	9	4
	Residents from nearby villages and settlements	45	21
	Women's groups from nearby villages and settlements	3	6
	Total formal other stakeholder consultations:	118	85
Type of engagement	One-on-one interview	71	92
	Group interview	15	6

SMPP group	Stakeholder Groups	Number of times engaged (in the first monitoring period: 2016-2018)	Current engagement (In 2019 monitoring period)
	Meeting	53	5
	Focus Group Discussion (FGD)	2	1
	Total number of consultations:	141	104

We have specifically implemented increased engagement with consistent notetaking with direct observation and monitoring of the fishermen and farmer communities that derive their livelihoods from within the SMPP area. Our team has met with fishermen groups and other stakeholders from nearby villages and settlements as part of our effort to disseminate project information to communities in the surrounding area. Engagement meetings focused on project activities, including peat ecosystem preservation, canal blocking, and fishing. The project carried out these stakeholder consultations with community fishermen from Kepayang, Tebing Harapan, Buring, Pal 8, and Bakung.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

Throughout the lifetime of the project, we will maintain a direct line of communication with community members and relevant stakeholders. This establishes a commitment to communication and consultation, which keeps stakeholders informed of project activities including restoration, maintenance, monitoring and the CCB validation and verification process. SMPP staff in the field maintain communications with the fishermen and farming community groups and other stakeholders through in-person meetings. We actively listen to recommendations made by any identified community members, or other stakeholder groups, and adapt and improve our methods as necessary.

The project has an adaptive management plan to effectively grow as the project matures and systematically refines existing practices through monitoring and evaluation. We periodically review our plans, methods, goals and objectives, to incorporate new lessons learned, available technology, and scientific knowledge. These strategies are in accordance with the project's Standard Operating Procedures (SOPs) and its monitoring plans (see PD sections 3.3.3, 4.4.1, 5.4.1).

During the 2019 monitoring period, the project had consistent meetings and engagement with project communities and other stakeholders on community development plans to listen and document what these stakeholders would like. The information collected from these meetings showed that these stakeholders wanted the the project to expand its health and education programs. As a result the project has continued to finance and build these programs. We will continue to engage and listen to project stakeholders. Inputs from stakeholders will be a major influence on the design and implementation of the community development program.

2.3.9 Stakeholder Consultation Channels (G3.5)

We have conducted all stakeholder engagement, including consultations and participatory processes via face-to-face conversations with individual stakeholders from the nearby villages and settlements, which is the most effective method in an area where phone and internet connectivity are limited. Our project staff have conducted participatory surveys with the Participatory Rural Appraisal (PRA) method during the community development process. This included focused group discussions, interviews with men and women living in nearby settlements and villages, and observation and ground checks with local residents including participatory visits to a variety of important areas. Our project strives to share information consistently and openly with all stakeholders and community members. See PD Section 2.3.3 to learn more about informational meetings with stakeholders and PD Section 2.3.2 for more information on project information dissemination.

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

The SMPP engages in consistent consultations with project communities and other stakeholders on project implementation and design as a way to incorporate local knowledge into the project and account for unforeseen impacts. Consultations ensure inclusive engagement with both men, women and marginalized stakeholder groups, ensuring their participation in culturally appropriate ways to ensure that the project can accommodate a wide range of perspectives. Project consultations and methods are described in more detail in Section 2.3.7.

2.3.11 Anti-Discrimination Assurance (G3.7)

The project team holds every individual involved in project design and implementation to a high standard of integrity, to ensure no one is involved in, or complicit in, any form of discrimination or sexual harassment with respect to the project. This includes discrimination based on gender, race, religion, ethnicity, social class, or other aspects of human individuality. Throughout the project duration, the SMPP will abide by all relevant Indonesian labor laws and regulations on anti-discrimination. Further, the project has an equal opportunity policy that ensures that the project will not engage in or be complicit in any form of discrimination or sexual harassment. To ensure compliance, the project has a grievance system in place that will provide all project employees, identified community members, and other stakeholders with a quick-response system in the event that any discriminatory actions or sexual harassment does occur, to ensure grievances can be addressed quickly and appropriately.

2.3.12 Grievances (G3.8)

We recognize the importance of a grievance redress mechanism within the SMPP to keep the project running smoothly and free of conflict. If conflicts or grievances arise, the project relies on the feedback and grievance redress mechanism, which has been outlined and shared as a formal policy. This process is designed to be an efficient, fair and accessible mechanism for resolving complaints and conflicts in a transparent and comprehensive manner. The mechanism can also address issues or conflict between the community and the project, or issues use related to employee rights, work practices, and employee safety raised by project staff or contractors.

If any grievances occur and are reported from surrounding communities or other relevant stakeholders, we will quickly respond to them by following the formal mechanism process. Grievances will be assessed to identify and verify the cause, actors and scale of grievances, and the project's senior management will recommend resolution options based on feedback from relevant stakeholders. If 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 can 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.

This grievance policy is outlined in the document "Sumatra Merang Peatland Project Grievance Redress Mechanism" and has been described at community meetings and shared at key locations in the project area. The grievance policy has been translated to Bahasa and shared with project community members and stored in central communal locations where project community members and other stakeholders live. To ensure transparency, the project will maintain a record book of all grievances received and their resolutions, which can be viewed upon request by project stakeholders or auditors. There were no grievances reported during the 2019 monitoring period.

2.3.13 Worker Training (G3.9)

The SMPP has a target to employ 80% of its field staff with residents of nearby villages and settlements and has achieved 68.5% employment of locals during 2019. As part of the on-boarding process, the project provides all staff with an orientation program where it provides overviews of the project's Standard Operating Procedures (SOPs) and policies with specific attention to health and safety policies. The employees also receive training in the use of technology such as GPS units, computers, solar energy, IoT sensors and firefighting equipment which will expand employee knowledge increasing their prospects of future employment. Local capacity is constantly being supported through training programs and recruitment

drives for full-time and part time employment opportunities to ensure strong local capacity despite staff turnover.

2.3.14 Community Employment Opportunities (G3.10)

The SMPP is an equal opportunity employer and is committed to engage with the identified community groups and local stakeholders on employment opportunities. To achieve this, the project has a policy to hire 80% of its staff from local areas as a way to increase community and stakeholder benefits. Further, the project has a target to have 25% of its work force be women to ensure greater gender balance in fields traditionally dominated by men. During this monitoring period, the project directly employed 16.4% or nine women as project staff. The project aims to reach the target in the next monitoring period and has already increased these numbers as of early 2020. To create opportunities for marginal groups, the project also has positions available for staff who have not obtained high school diplomas to ensure these vulnerable groups have access to meaningful employment opportunities. The project also makes the project-sponsored adult education program available for all staff to enable them to raise their education levels.

Job opportunities are publicly advertised in similar channels where other project news is publicized, such as community sign boards and announcements via community leaders. Meetings are convened within project stakeholder villages and settlements as part of the recruitment process in order to spread the word and attract candidates. The project has also communicated that it is always actively recruiting for forest patrol officers and that interested parties can apply directly at the project office.

Job applicants are selected for interviews based on their skills, experience and demonstration of potential required for the advertised positions. Successful candidates are then selected in accordance with the project's equal opportunity policy. Applicants who live in the local villages and settlements are given preference in the case where two applicants show the same capacity for a given position whereas one is from the local area and the other is not.

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

The SMPP core principals require that all persons in the project are treated with dignity and respect. The SMPP complies with all national and provincial laws related to worker's rights, including: Law No. 13/2003 regarding Manpower. This is an umbrella law on labor relationship in Indonesia, which stipulates the working conditions and rights and obligations of the employees and the Company. The SMPP operations fully comply with operations in regard to the rights of workers, and the project seeks to ensure that the rights of all employees are upheld in a manner where all individuals are aware of their rights. The project has its own human resource policies containing the details of employment practices that are followed. These policies are explained to all staff during their orientation program and are available for review in the project's field office and posted at all forest patrol offices.

2.3.16 Occupational Safety Assessment (G3.12)

The project is committed to ensuring occupational safety for all project staff and follows all relevant Indonesian worker's rights laws and regulations, particularly those pertaining to health and safety. The project has created a comprehensive Health and Safety Plan and informs all staff on the workplace risks through a risk register and outlines safe practices to mitigate those risks during employee orientation and through ongoing training. A hard copy of the relevant project regulations is kept at the project office for reference by project staff. Project staff are exposed to a number of risks that include strenuous activity in wet, humid, and hot conditions, forest fires, transportation accidents, interactions with illegal loggers, encounters with dangerous wildlife, and exposure to mosquito borne sicknesses. The health and safety training for the project addresses these risks and also trains staff on the proper handling of equipment and other materials. In addition, project proponents maintain a public liability insurance of 9,000,000 EUR in case major accidents do occur.

Table 5. Actions to mitigate potential occupational risks

Potential Occupational Risks	Risk Mitigation Action
Strenuous activity in wet, humid, and hot conditions	Proper attire for work condition and ample access to drinking water for hydration are provided.
Forest fires	Staff are trained in fire-fighting activities and are provided proper safety equipment.
Transportation accidents	Staff are trained in driving and are required to wear seatbelts at all times and wear helmets when driving motorbikes.
Interactions with illegal loggers	The project has a policy not to engage illegal loggers to avoid any physical conflict.
Encounters with dangerous wildlife	The project has a policy on when to conduct forest patrol and also carry noise-makers to avoid encounters with dangerous wildlife.
Exposure to mosquito borne sicknesses	All staff are provided with mosquito nets and access to bug repellent.

2.4 Management Capacity

2.4.1 Required Technical Skills (G4.2)

The project requires a range of technical and managerial skills in order to implement the project activities listed in Section 2.1.11 of the PD. Table 6 outlines the skills required per project activity.

Table 6. Key skills required to implement the project activities.

Project Activity	Sub-project Activity	Key Skills Required
Carbon stock measurements	Aboveground and belowground biomass measurement	Peatland science, forestry, GIS/ remote sensing, forest and peatland inventories, statistics, and carbon monitoring, reporting, and verification (MRV).
FPIC and community engagement and development	Stakeholder consultation, livelihood development, and education program.	Community organizing, conflict resolution, business management, adult education, and livelihoods.
Biodiversity assessment and monitoring	Habitat conservation and management and biodiversity monitoring.	HCV mapping, forest conservation, conservation biology, and biodiversity monitoring
Monitoring skills	Land cover mapping, water level monitoring, subsidence monitoring, climate monitoring, biodiversity monitoring, community monitoring, and fire monitoring.	GIS/remote sensing, hydrology, peatland science, conservation biology and monitoring, social science surveys, and peatland forest fire management
Forest protection and enforcement	Enforcement and patrolling and forest fire prevention and control.	Forestry, peatland forest fire management, and community engagement.

Project Activity	Sub-project Activity	Key Skills Required
Forest and peatland conservation and restoration	Hydrological management, reforestation, enrichment planting, and habitat conservation.	Hydrology, peatland science, silviculture, forestry, and biodiversity conservation, engineering.
Project management and administration	Logistics, finance and accounting, human resources (HR), administration, and government reporting.	Finance and accounting, HR, business management, legal compliance, and administration.

The project has successfully maintained a team of experts on community engagement, biodiversity assessment and carbon measurement and monitoring skills throughout the monitoring period. The skillsets experience of the core technical team are listed in section 2.4.2.

2.4.2 Management Team Experience (G4.2)

The SMPP is implemented by two project proponents: PT Global Alam Lestari (PT GAL) and Forest Carbon. The joint development of the project is managed via a project management board that is composed of representatives of PT GAL and Forest Carbon with an observer from the investment partner, Althelia Climate Fund (ACF).

At the implementation level, each proponent focuses on different areas of implementation. PT GAL, a subsidiary of an established Indonesian forestry company, specializes on the ground operations for forest restoration in the project area. Its staff have significant experience in overseeing the implementation of large-scale land management projects in Indonesia. As the holder of the PAN/RAP license, its role in the project is to implement all field activities in line with the project design, manage and oversee community and stakeholder relations, and ensure compliance with all government regulations.

Forest Carbon is a leading forest conservation and restoration company that has been working in Indonesia since 2007. Forest Carbon has staff experienced in project management, VCS/CCB project design, Geographic Information Systems (GIS) and remote sensing, forest and biomass inventories, biodiversity mapping and monitoring, and community engagement. Forest Carbon's also leads project management, project design, field data collection and analysis, VCS/CCB certification monitoring and compliance, and technical advisory services.

2.4.2.1 Project Management Leads

Dr. Riza Suarga – President Director – Global Alam Lestari – SMPP Project Lead

Dr. Suarga is PT GAL's President Director and is a seasoned corporate executive with over 30 years of experience running large-scale businesses in Indonesia's forestry sector. His academic credentials are extensive, with a BA from Ohio University in engineering, a master's in human resource management from Triskakti University, and a Ph.D. in natural resource management from the University of Indonesia. His management experience and wide-ranging academic background make him well-suited to lead teams within the sustainable forestry and conservation sectors. As a member of the Indonesian Chamber of commerce for over eight years, he is currently the chamber's liaison at the Ministry of Environment and Forestry since 2014 where he serves as the chairman of the Ecolabel desk focusing on certification standards for products from the forestry sector. He has also been a member of the Indonesian Forest Concessionaires Association (*Asosiasi Pengusaha Hutan Indonesia* or APHI) since 1998 and served as Vice Chairman of its Carbon Team as well as the Chairman of its Law & Regulations Board. He has written numerous academic articles covering topics such as sustainable forest management and ways to combat illegal logging in Indonesia. He is fluent in English, Bahasa Indonesia, and conversant in Japanese.

Mr. Jeffrey Chatellier – Managing Director - Forest Carbon – SMPP Project Lead

Mr. Chatellier is Forest Carbon's Managing Director. He is an environmental scientist who has worked on environmental conservation, forestry, and sustainability for the past 10 years. With a combined background in economics and environmental science, Mr. Chatellier has advised major corporations and international

environmental organizations on forest conservation, environmental risk mitigation, and sustainability. He has worked closely on the development of multiple REDD+ projects in Southeast Asia, which has given him in depth knowledge of various carbon standards and the technical and political challenges to conservation projects in the developing world. He has reviewed existing scientific carbon accounting methodologies and worked with companies on developing the necessary project documents to obtain carbon credits, including the Rimba Raya peatland project in Central Kalimantan, Indonesia, and the REDD+ project to protect the Keo Seima Wildlife Sanctuary in Cambodia.

In addition to these two managers, the project team is highly skilled in forest management, peatland science, Indonesian and legal and policy compliance, GIS and remote sensing and community engagement that will support project management and implementation.

2.4.2.2 Project Design, Monitoring, and Implementation

Dr. Ophelia Wang – Technical Advisor - Forest Carbon – SMPP MRV:

Dr. Wang is Forest Carbon's Technical Adviser. A specialist in conservation entrepreneurship, Dr. Wang brings more than 17 years of experience in technical forestry and program management, backed by Ph.D. and M.Sc. studies in tropical conservation spatial planning in regions as diverse as Latin America and Southeast Asia. Dr. Wang brings deep technical expertise in program management system design and strategic planning for conservation projects, in addition to multiple years of experience in Latin America, U.S. and Southeast Asia using GIS and remote sensing techniques to improve landscape-scale spatial planning, information system management, and conservation implementation. Dr. Wang's strengths lie in data analysis, specifically in integrating habitat and species data with peatland hydrology and fire risk analysis to provide comprehensive ecosystem service models.

Sebastian Persch – Emissions Science and Technology Lead – Forest Carbon – SMPP MRV

Mr. Persch is a tropical peat hydrology expert who has worked on various topics related to forestry, conservation, and climate change since 2011. He specializes in tropical peat ecology, including advanced data analysis and statistical programming using open source software and has conducted research on peatlands in Sumatra on carbon stock and carbon dynamics estimation. Sebastian holds B.Sc. and M.Sc. in Tropical Forestry Ecology, all from the Georg-August Universität Göttingen in Germany. He conducted research at the Center for International Forestry Research (CIFOR), which focused on root dynamics within land-use change from forest to oil palm plantation in the tropical peat swamps of Berbak National Park and the *Taman Hutan Raya* in Jambi, Indonesia. He has held previous positions and consultancies with the Centre de cooperation *Internationale en recherche agronomique pour le developpement* (CIRAD), the James Hutton Institute, and the University of Göttingen. With Forest Carbon he has completed assignments modeling baseline and expected emissions from peat drainage in Berbak National Park and in the degraded peat lands of the Ex-Mega Rice project area in Central Kalimantan. For those assignments Sebastian modeled emissions from drainage, established proxies with calibrated GHG emission profiles in Strata I and identified possible canal blocking locations in conjunction with Forest Carbon GIS and Remote Sensing teams.

Abdul Haris Marzuki – Field Site Manager – Global Alam Lestari – SMPP Head of Field Operations

Mr. Marzuki oversees all field operations in the SMPP project area. He has 25 years' experience working in the forestry sector in Indonesia. His experience includes overseeing field staff and ensuring a safe and healthy work environment.

Mr. Ahmad Susilo– Community Engagement Manager – Global Alam Lestari – SMPP Community Engagement lead

Mr. Susilo has extensive experience in engaging with local communities and government officials. He leads all community engagement activities and implementation of the community development program for the SMPP.

Mary Osmond – Legal Advisor – Forest Carbon – Legal Compliance for SMPP

Ms. Osmond is a trained lawyer with a background in business and environmental law in Indonesia. She holds a law degree from Atmajaya University and an LLM from the University of Groningen in the

Netherlands and is a member of the Indonesian Bar Association (PERADI). She is an expert on conservation law in Indonesia and acts as the primary legal compliance officer for the Sumatra Merang Peatland Project. As the Indonesian Presidential Office's UKP4 Representative in Jambi, she worked with relevant entities to implement a transparent licensing system for the mining and plantation sectors, resulting in a provincial regulation mandating the system. She has also advised multiple NGOs on land tenure and licensing strategy and international investors on establishing business operations in Indonesia. She is supporting SMPP on legal compliance and monitoring.

Prasetya Mahardhitama – Remote Sensing Manager – Forest Carbon – MRV

Mr. Mahardhitama is an expert in GIS and remote sensing. His background in information technology systems enables him to build custom applications that leverage GIS & Remote Sensing data, including high-resolution satellite imagery from Light Detection and Ranging (LiDAR), Satellite and Unmanned Aerial Systems. He has developed custom web and mobile GIS applications for conservation projects and has supported forest landscape analysis and mapping across Southeast Asia and is also a certified drone pilot.

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

All relevant project management experience is present in the current SMPP partners.

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

Both project proponents, PT GAL and Forest Carbon, are financially stable companies, capable of implementing and maintaining a project of the scale of the SMPP. Additionally, the initial project activities are fully supported by an investment from Althelia Climate Fund. See PD Section 2.1.20 for information on the financial sustainability of the project's funding. Project validators may request to see more specific financial statements to verify financial health.

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

The project is fully compliant with the US Foreign Corruption Practice Act (FCPA). As a collaborative effort, the SMPP team is committed to upholding a high level of integrity and professionalism throughout all aspects of project design and implementation. The project has a zero-tolerance attitude towards corruption and unethical behavior, and is not involved in, or complicit in, any form of corruption such as bribery, embezzlement, fraud, extortion, and collusion.

2.4.6 Commercially Sensitive Information (RULES 3.5.13 – 3.5.14)

Our project's commercially sensitive information that is not publicly available includes:

- Agreements and contracts between project proponents, other project entities, and stakeholder groups – regarding implementation of project activities.

Specific information is available privately to project validators upon request.

2.5 Legal Status and Property Rights

2.5.1 Recognition of Property Rights (G5.1)

The project is committed to recognizing, respecting, and supporting all property rights of communities and other stakeholders. An assessment of the project area showed that there are no groups living in the project area full time and that there were two small farms that overlap with the project license area, along with a small number of fishermen that fish inside or near the project area. However, the project was specifically designed, following the identification of these customary rights holders, to ensure that no impingement upon these land rights holders or their livelihoods will occur.

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

As outlined previously, the project does not impinge on any rights holder's access or use of the project area. As per CCB requirements, FPIC is required only when these rights are negatively impacted. If it is ever determined that the project impacts these rights holders, either inadvertently or through the implementation of project activities, then an FPIC process will be initiated. The project continues to adopt a highly consultative engagement process, including the Participatory Rapid Assessment of local communities and ongoing consultations with all stakeholders which ensures that all stakeholders and communities have the opportunity to share their feedback in an informative and meaningful way.

2.5.3 Property Right Protection (G5.3)

Project activities do not lead to involuntary removal or relocation of property rights holders from their lands or territories and does not force rights holders to relocate activities important to their culture or livelihood. If in the future any relocation activities need to be undertaken, it will take place with a written agreement that demonstrates that the agreement was made with the free, prior, and informed consent of those concerned and includes provisions for just and fair compensation.

2.5.4 Identification of Illegal Activity (G5.4)

Small-scale illegal activities, such as illegal logging or hunting, were historically practiced in parts of the project area and could negatively impact the rehabilitation of the forest and reduce the returning levels of biodiversity. The project has constructed and staffed several forest patrol posts along the boundary of the project area to ensure an equal distribution of forest patrol coverage across the project area. The SMPP is also reducing the risk of these illegal activities and negative impacts with the implementation of its forest protection plan and a community development plan that provides sustainable livelihoods options. With stronger economic alternatives, the project expects that the need to participate in illegal activities will be further reduced.

2.5.5 Ongoing Disputes (G5.5)

There are no ongoing disputes or any previously unresolved conflicts inside the project area.

2.5.6 National and Local Laws (G5.6)

The SMPP is designed to be in full compliance with national, regional, and local laws of the Republic of Indonesia, especially laws regulating forest conservation projects. Relevant laws and regulations include:

Fire Prevention:

- Law No. 32/ 2009 regarding Environmental Protection and Management.
- Government Regulation No. 45/2004 regarding Forest Protection.
- Government Regulation No. 71/2014 regarding Protection and Management of Peatland Ecosystem.
- Government Regulation No. 57/2016 regarding the Change of the Government Regulation No. 71/2014 regarding Protection and Management of Peatland Ecosystem.
- Ministry of Environment and Forestry (MoE&F) Regulation No. 32/2016 regarding Controlling the Forest and Land Fire.
- South Sumatra Provincial Regulation No.1/2018 regarding the Peatland Ecosystem Protection and Management ("Peraturan Daerah No.1/2018"). This regulation stipulates the peatland management and protection including the obligations to prevent fire and avoid the damages of peatland.

Canal Blocking:

- Ministry of Environment and Forestry Regulation Np. P.14 / MENLHK / SETJEN / KUM.1 / 2/2017 regarding the Procedures for Inventory and Determination of the Function of Peat Ecosystems;

- Ministry of Environment and Forestry Regulation No. P.15/MENLHK/SETJEN/KUM.1/2/2017 regarding the Procedures of Water Table Measurement in the Peat Ecosystem's Monitoring Point.
- Ministry of Environment and Forestry Regulation No.P.16/MENLHK/SETJEN/KUM.1/2/2017 regarding the Technical Guidelines for Restoring the Function of Peat Ecosystems.
- Ministry of Environment and Forestry Regulation No. P10/MENLHK/SEKJEN/KUM.1/3/2019 regarding the Enactment and Management of Peat Dome Based on the Peatland Hydrology Unit.

Community Development: GAL conducts the community development around its concession areas, which is line with the following regulations:

- Law No. 40 of 2007 regarding the Limited Liability Company ("Company Law").
- Government Regulation No. 47 of 2012 on the Social and Environmental Responsibilities of the Limited Liability Company.
- The Ministry of Environment and Forestry No.P.39/MENHUT-II/2013 on the Local Community Development through Forestry Partnership. This regulation is required the forestry license holders to conduct community development activities.

Forest Conservation Activities Business License: GAL holds a PAN/RAP license that allows to conduct the carbon sequestration and stock activities. The relevant regulations on licensing process are the following:

- Ministry of Environment and Forestry Regulation No. P.36/Menhut-II/2009 regarding Procedures for Licensing of Commercial Utilization of Carbon Sequestration and/or Storage in Production and Protected Forests. This regulation establishes the PAN/RAP License type and sets out the allowable activities of this license type.
- The Ministry of Environment and Forestry Regulation No. 11 of 2013 regarding the Amendment of MoE&F Regulation 36/09 on the Procedure of License of Utilization of Carbon Sequestration and/or Stock in the Production Forest and the Protected Forest.
- The Ministry of Environment and Forestry Regulation No.8 of 2015 regarding the Second Amendment of MoEF F Regulation 36/09 on the Procedure of License of Utilization of Carbon Sequestration and/or Stock in the Production Forest and the Protected Forest.
- Ministry of Environment and Forestry Regulation No. 7/2015 regarding Technical Guidelines Rendering License and Non-License in Environment and Forestry Sector in Implementation of One Stop Service.
- Ministry of Environment and Forestry Regulation No. P.22/MENLHK/SETJEN/KUM.1/2018 regarding Norms, Standards, Procedures and Criteria of One Stop Integrated Services through Electronically in Environment and Forestry Sector.

PAN/RAP Management Activities:

- Government Regulation No. 6/2007 regarding Forest Governance and Preparation of Forest Management Plan that was amended by Government Regulation No. 3/2008.
- Ministry of Environment and Forestry Regulation 43/2013 regarding Boundary Arrangement.
- Ministry of Environment and Forestry Regulation No.P.73/MENHUT-II/2014 regarding the Work Plan of PAN/RAP in Production Forest.
- Ministry of Environment and Forestry No.P.74/Menhut-II/2014 regarding the Implementation of Silviculture Technics in Utilization of Carbon Sequestration and/or Carbon Stock Business in Production Forest.
- Ministry of Environment and Forestry Regulation No.P.71/MENLHK/SETJEN/KUM.1/12 2017 regarding the Climate Change National Registration System. This regulation creates the National Registration System which all project related to reduce carbon emission shall be registered in this system in order to avoid double counting of carbon.

Trading & Taxation:

- The Government Regulation No. 46 of 2017 regarding the Green Environmental Instrument. This regulation specifically relates to for environmental services trading.
- Ministry of Environment and Forestry No.P.12/Menhut-II/2014 regarding Types and Tariffs of Non-Tax State Revenue Applicable to the Ministry of Forestry. This specifically relates to taxes on carbon credit transactions.
- The Ministry of Environment and Forestry No. 50 of 2014 regarding the Sale of Indonesia Certified Emission Reduction. This regulation sets out the guidelines and rules for the license and management rights holders, including PAN/RAP license holder to both sell and trade ICER/SPEKHI unit.

Labor:

- Law No. 13/2003 regarding Manpower.
- The Manpower and Transmigration Regulation No.233/2003 regarding the Type of Works can be conducted in continuously. This regulation stipulates the exemption of work hours for certain sector, including conservation.
- The Manpower and Transmigration Decree No. Kep.100/MEN/VI/2004 regarding the Implementation of Definite-Term Employment Agreement.

3 CLIMATE

3.1 Monitoring

3.1.1 Data and Parameters Available at Validation

The data and parameters for the SMPP that will be available at validation according to the VCS methodology VM0007 MF are provided in the tables below.

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^*
Equations	PD Section 3.1.3.1.6 Equation 5
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 Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$GHG_{BSL-WRC}$
Data unit	t CO ₂ -e
Description	Net GHG removals in the WRC baseline scenario up to year t^*
Equations	PD Section 3.1.3.1.6 Equation 6
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 Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$D_{peatburn,i,t}$
Data unit	m yr ⁻¹
Description	Fire scar depth per year
Equations	PD Section 3.2.1.5.3 Equation 14, PD Section 3.2.1.5.5 Equation 20, PD Section 3.2.2.6 Equation 31
Source of data	Konecny et al. (2016)

Value applied	0.17 m, 0.1 m, 0.06 m, and 0.02 m, for 1 st , 2 nd , 3 rd , and subsequent burning, respectively.
Justification of choice of data or description of measurement methods and procedures applied	Literature
Purpose of Data	Calculation of baseline and project emissions
Comments	N/A

Data / Parameter	CC
Data unit	%
Description	Carbon concentration of the peat
Equations	N/A
Source of data	Own measurement
Value applied	0.53
Justification of choice of data or description of measurement methods and procedures applied	Sampling using standard field and laboratory techniques
Purpose of Data	Calculation of baseline and project emissions
Comments	N/A

3.1.2 Data and Parameters Monitored

The data and parameters for the SMPP that were monitored according to the VCS methodology VM0007 MF are provided in the tables below. A detailed list of all relevant data and parameters are further elaborated in our future Climate MRV System.

Data / Parameter	$\Delta C_{WPS-ARR}$
Data unit	t CO ₂ -e
Description	Net GHG removals in the ARR project scenario up to year t^*
Equations	PD Section 3.1.3.1.6 Equation 5
Source of data	Module M-ARR
Description of measurements methods and procedures to be applied	See Module M-ARR
Frequency of monitoring/recording	See Module M-ARR
Value monitored	N/A
QA/QC procedures to be applied	See Module M-ARR
Purpose of data	Calculation of project emissions
Calculation Method	See Module M-ARR
Comments	

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^*
Equations	PD Section 3.1.3.1.6 Equation 5
Source of data	Module LK-ARR
Description of measurements methods and procedures to be applied	See Module LK-ARR
Frequency of monitoring/recording	See Module LK-ARR
Value monitored	N/A
QA/QC procedures to be applied	See Module LK-ARR
Purpose of data	Calculation of leakage
Calculation Method	See Module LK-ARR
Comments	

Data / Parameter	$GHG_{WPS-WRC}$
Data unit	t CO ₂ -e
Description	Net GHG emissions in the WRC project scenario up to year t^*
Equations	PD Section 3.1.3.1.6 Equation 6
Source of data	Module M-PEAT
Description of measurements methods and procedures to be applied	See Module M-PEAT
Frequency of monitoring/recording	See Module M-PEAT
Value monitored	240,337
QA/QC procedures to be applied	See Module M-PEAT
Purpose of data	Calculation of project emissions
Calculation Method	See Module M-PEAT
Comments	See Module M-PEAT

Data / Parameter	GHG_{LK-ECO}
Data unit	t CO ₂ -e
Description	Net GHG emissions due to ecological leakage from the WRC project activity up to year t

Equations	PD Section 3.1.3.1.6 Equation 6
Source of data	Module LK-ECO
Description of measurements methods and procedures to be applied	See Module LK-ECO
Frequency of monitoring/recording	See Module LK-ECO
Value monitored	0
QA/QC procedures to be applied	See Module LK-ECO
Purpose of data	Calculation of leakage emissions
Calculation Method	See Module LK-ECO
Comments	See Module LK-ECO

Data / Parameter	$E_{peatburn-WPS,i,t}$
Data unit	t CO ₂ -e yr ⁻¹
Description	GHG emissions from burning of peat within the project boundary in the project scenario in stratum <i>i</i> in year <i>t</i>
Equations	PD Section 3.2.2.6 Equation 30
Source of data	Literature values
Description of measurements methods and procedures to be applied	See Module E-BPB
Frequency of monitoring/recording	At each monitoring period
Value monitored	1,319
QA/QC procedures to be applied	See Module E-BPB
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	$E_{proxy-CO2,i,t}$
Data unit	t CO ₂ -e yr ⁻¹
Description	Soil emission of CO ₂ as land-use proxy in stratum <i>i</i> at year <i>t</i>
Equations	PD Section 3.2.2.4 Equation 27
Source of data	IPCC default factors
Description of measurements methods and procedures to be applied	See Module M-PEAT

Frequency of monitoring/recording	At each monitoring period
Value monitored	227,767
QA/QC procedures to be applied	See Module M-PEAT
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	$E_{proxy-CH_4,i,t}$
Data unit	t CO ₂ -e yr ⁻¹
Description	Soil emission of CH ₄ as land-use proxy in stratum <i>i</i> at year <i>t</i>
Equations	PD Section 3.2.2.4 Equation 28
Source of data	IPCC default factors
Description of measurements methods and procedures to be applied	See Module M-PEAT
Frequency of monitoring/recording	At each monitoring period
Value monitored	11,106
QA/QC procedures to be applied	See Module M-PEAT
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	A_i
Data unit	ha
Description	Total area of stratum <i>i</i>
Equations	PD Section 3.2.2.4 Equation 27 & 28
Source of data	Module X-STR
Description of measurements methods and procedures to be applied	See module X-STR
Frequency of monitoring/recording	See module X-STR
Value monitored	See Table 23

QA/QC procedures to be applied	See module X-STR
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	$E_{peatditch-CO2,i,t}$
Data unit	t CO ₂ -e yr ⁻¹
Description	Emission of CO ₂ from ditches and open water stratum <i>i</i> at year <i>t</i> in the project scenario
Equations	PD Section 3.2.2.5.1 Equation 29
Source of data	Literature values
Description of measurements methods and procedures to be applied	IPCC default factor for naturally drained organic soils
Frequency of monitoring/recording	At each monitoring period
Value monitored	145
QA/QC procedures to be applied	See Module M-PEAT
Purpose of data	Calculation of project emissions
Calculation Method	N/A
Comments	N/A

Data / Parameter	$A_{ditch-WPS,i,t}$
Data unit	ha
Description	Total area of ditch and other open water stratum <i>i</i> in year <i>t</i> in the project scenario
Equations	PD Section 3.2.2.5.1 Equation 29
Source of data	Module X-STR
Description of measurements methods and procedures to be applied	See Module X-STR
Frequency of monitoring/recording	See Module X-STR
Value monitored	69.30
QA/QC procedures to be applied	See Module X-STR
Purpose of data	Calculation of project emissions
Calculation Method	N/A

Comments	N/A
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Data / Parameter	$A_{DefPA,i,u,t}$
Data unit	Ha
Description	Area of recorded deforestation in the project area in stratum i converted to land use u at time t
Equations	Equation 3 (Module M-MON)
Source of data	Remote sensing imagery
Description of measurements methods and procedures to be applied	See Module M-MON
Frequency of monitoring/recording	See Module M-MON
Value monitored	N/A
QA/QC procedures to be applied	See Module M-MON
Purpose of data	Calculation of project emissions
Calculation Method	See Module M-MON
Comments	See Module M-MON

Data / Parameter	$C_{BSL,i}$
Data unit	t CO ₂ -e ha ⁻¹
Description	Carbon stock in all pools in the baseline in stratum i
Equations	Equations 5, 24 (Module M-MON)
Source of data	Module M-MON
Description of measurements methods and procedures to be applied	See Module M-MON
Frequency of monitoring/recording	See Module M-MON
Value monitored	N/A
QA/QC procedures to be applied	See Module M-MON
Purpose of data	Calculation of project emissions
Calculation Method	See Module M-MON
Comments	See Module M-MON

Data / Parameter	$A_{RRL,forest,t}$
Data unit	Ha

Description	Remaining area of forest in <i>RRL</i> at time <i>t</i>
Equations	
Source of data	Module M-MON
Description of measurements methods and procedures to be applied	See Module M-MON
Frequency of monitoring/recording	See Module M-MON
Value monitored	254.39 Ha
QA/QC procedures to be applied	See Module M-MON
Purpose of data	Calculation of project emissions
Calculation Method	See Module M-MON
Comments	See Module M-MON

3.1.3 Monitoring Plan

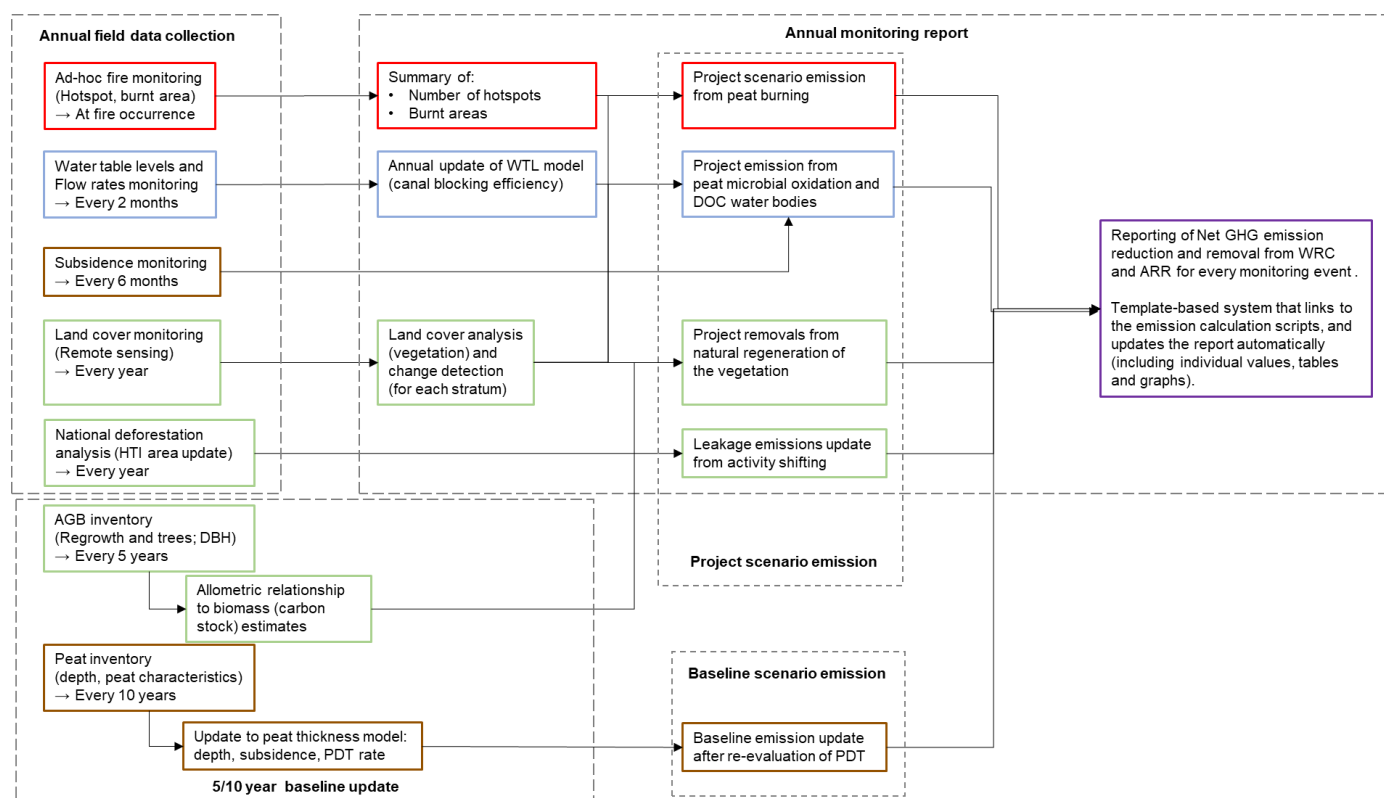
3.1.3.1 Approaches for Climate Impact Monitoring

Climate impact monitoring includes monitoring changes in land cover, peat thickness and water table level, as per the VCS VM0007 methodological requirements. A summary of the main monitoring methods is given below.

3.1.3.2 Implementation of Data Collection and Management

Figure 1 below illustrates a workflow of field data collection activities, activity frequencies, data analysis or modeling associated with the activities, quantification of GHG emissions, and preparation for annual reporting. Details for sampling approaches and procedures are available in Annex 7 and Annex 14.

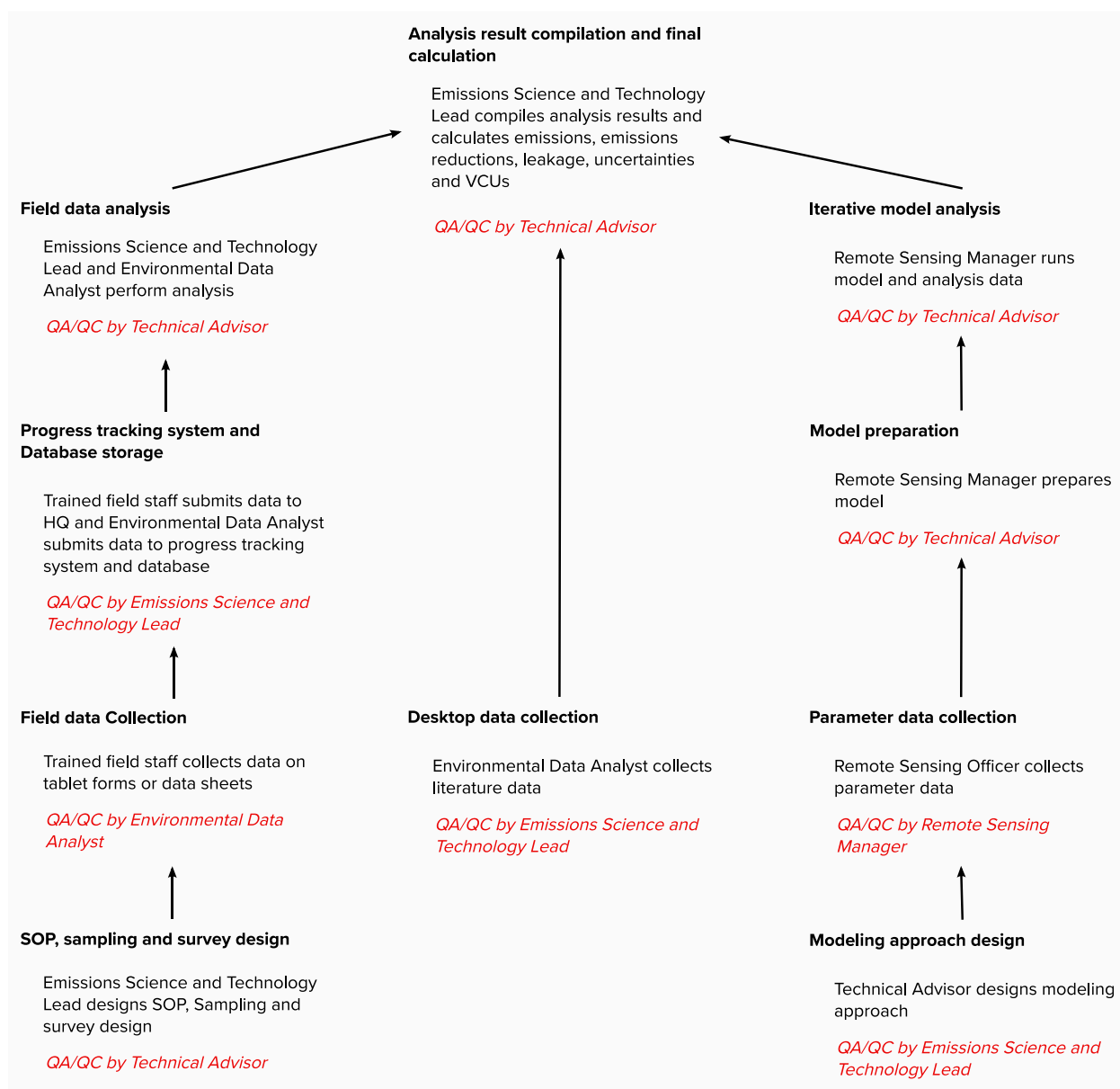
Figure 1. Schematic workflow of the GHG data collection, data management, and annual reporting



We standardize data through standard operation procedures (SOPs) and perform multiple quality assurance and quality control (QA/QC) assessments. All data collected, recorded, stored, and reported are subject to review and approval by data analysts, data managers, the technical project lead, and the project team leader with reference to each level of data management. In order to ensure the security and traceability of data entry and QA/QC, all data in raw, intermediate, and final stages have access levels pre-defined for different types of users (Figure 2).

Brief, regular monitoring reports will be generated to assess the quality of data being received from the field and investigations into any potential outliers. Any possible monitoring equipment failures will be carried out to ensure the data passes QA/QC.

Figure 2. Data collection, QA/QC, and processing workflow.



The roles and responsibilities of each monitoring team member are listed below in Table 7 .

Table 7. Roles and responsibilities of the monitoring team members.

Position	Roles	Name	Short Resume
Technical Advisor	Modelling approach design, QA/QC of SOP, sampling and survey design, QA/QC of field data analysis, QA/QC of model preparation, QA/QC of iterative model analysis, and	Dr. Ophelia Wang	Dr. Wang holds a PhD and MSc degrees in spatial planning for conservation and brings more than 17 years of experience in technical forestry and program management. Dr. Wang's expertise are in data analysis and spatial modelling, specifically in constructing complex models that integrate spatially explicit biophysical data within peatland hydrology and

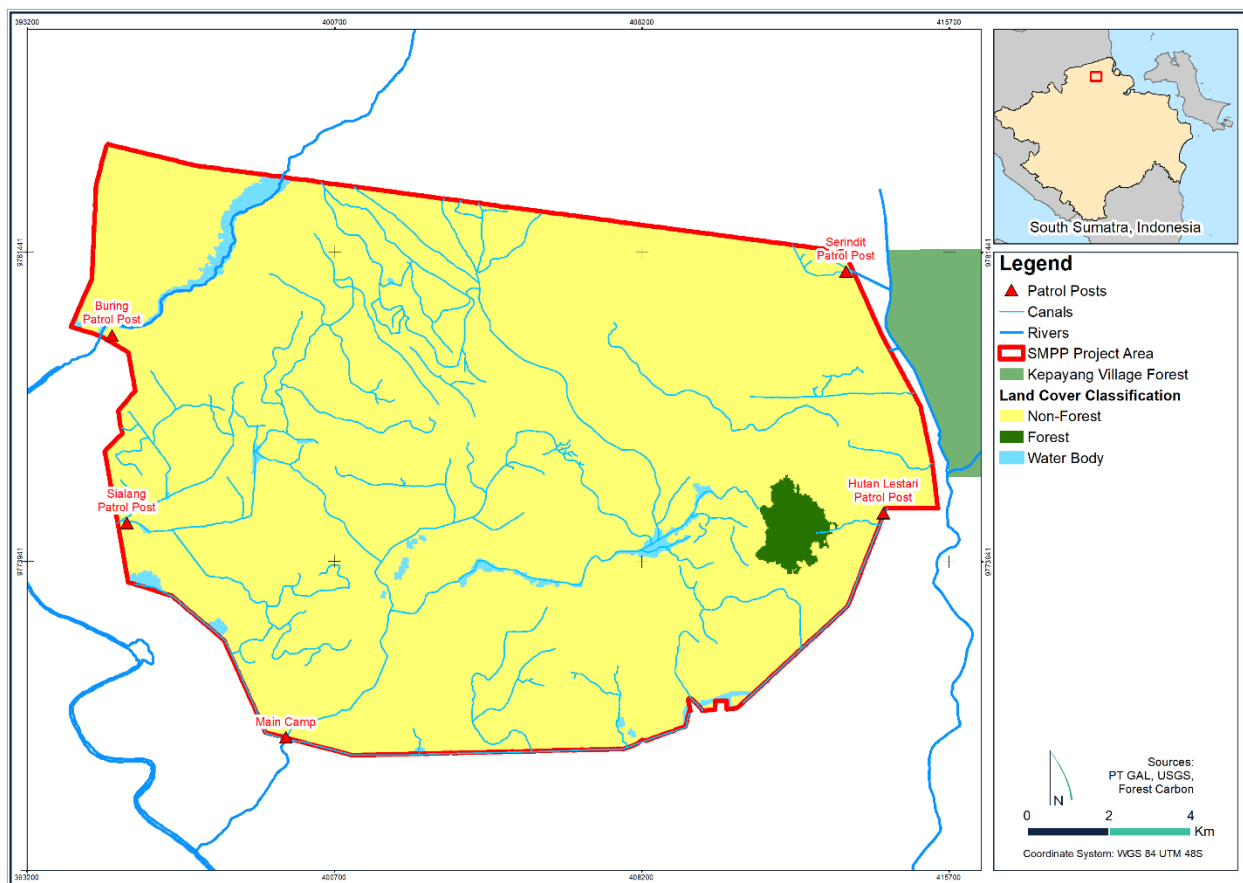
Position	Roles	Name	Short Resume
	QA/QC of result compilation and final calculation		fire risk analysis to provide comprehensive ecosystem service models.
Emission Science and Technology Lead	SOP, sampling and survey design, Field data analysis, Analysis result compilation and final calculation, QA/QC of progress tracking and database storage, QA/QC of Desktop data collection, QA/QC of Modelling approach design	Sebastian Persch	Mr. Persch has 9 years of experience as a tropical peat hydrology expert. He specializes in tropical peat ecology, including advanced data analysis and statistical programming using open source software. He has completed assignments modelling baseline and expected emissions from peat drainage, and established proxies which calibrated GHG emission. He leads the emission science team.
Remote Sensing Manager	Model preparation, Iterative model analysis, QA/QC of Parameter data collection	Prasetya Mahardhitama	Mr. Mahardhitama is an expert in GIS and remote sensing with 10 years of experience. His background in information technology systems enables him to conduct advanced GIS modelling activities that leverage GIS & Remote Sensing data, including high-resolution satellite imagery from Light Detection and Ranging (LiDAR) and Satellite and Unmanned Aerial Systems. He leads the remote sensing team.
Environmental Data Analyst	Progress tracking and database storage, Desktop data collection	Angga Pratama	Mr. Pratama is an engineer with a degree in Engineering Physics from the Institute of Technology Bandung, Indonesia He has 12 years of experience and his work background in IT includes development and maintenance of a climate change mitigation and forest carbon sequestration web portal. This took data from across the Asia region it has enabled him to develop custom web GIS and land usage licensing applications. He is also a Certified Sustainability Reporting Specialist under the Global Reporting Initiative (GRI) Standards.
Remote Sensing Officer	Parameter data collection	Rizaldy Yudhista N	Mr Yudhista N is a GIS and Remote Sensing Specialist in Forest Carbon with 6 years of experience conducting forest landscape analysis, producing spatial analysis for design and assessment of peatland and tropical forest restoration projects.
Field Staff	Field Data collection, Field data submission to HQ	Various	-

3.1.3.2.1 Remote Sensing

We obtained and analyzed satellite imagery to detect land cover change, such as natural regeneration of vegetation, or (if any) vegetation loss was caused by fire or encroachment. For future monitoring events in cases where forest changes take place, we will follow the procedures outlined in VCS methodology VM0007 Module M-MON to quantify the relevant parameters. We will update the land cover map at each monitoring period as needed and carry out the update annually.

An initial benchmark of forest/non-forest areas has been created for the 2019 monitoring period. For future monitoring periods, we will quantify the area of recorded deforestation by subtracting change areas of forest cover. We will then calculate the emissions from deforestation by multiplying areas of deforestation by the average forest carbon stock per hectare. The area of remaining forest will be based on subtracting non-forest area and we will record it in a forest benchmark map, which will be updated for each monitoring period. Map 3 below shows the initial benchmark map of forest/non-forest area distribution.

Map 3. Forest cover benchmark



In addition to the above, we used MODIS and VIIRS hotspot data to provide nearly real-time updates on potential fire activity in the project area and alert ground fire controlling/prevention team to examine the field conditions.

3.1.3.2.2 Field Measurement

3.1.3.2.2.1 Monitoring C Stock

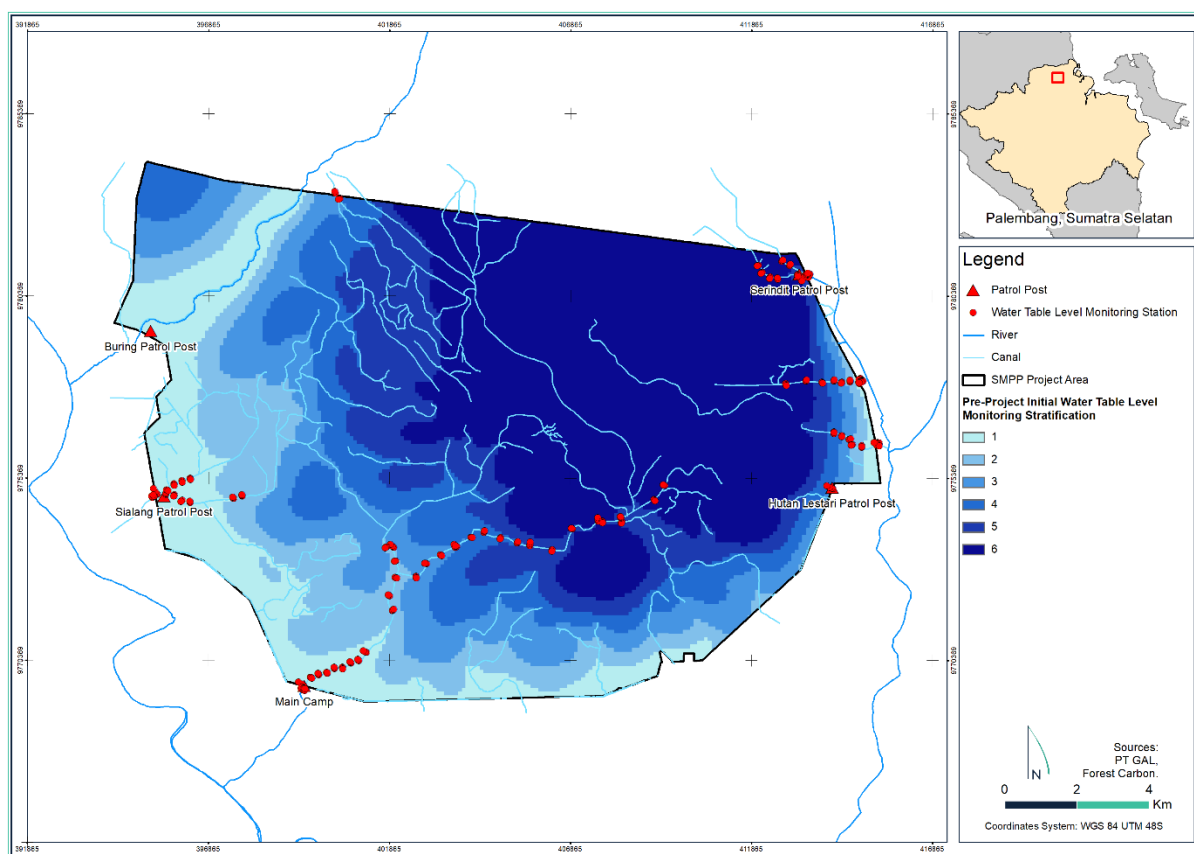
In 2020 we will begin monitoring change in carbon stocks of tree biomass through field measurements using a point sampling method with an allometric equation on tree diameter (diameter at breast height or DBH).⁷ Per the CDM A/R Methodological Tool "Calculation of the number of sample plots for measurements within A/R CDM project activities,"⁸ the project will establish monitoring plots for areas representing ARR

activities starting in 2020, with plots monitored thereafter every five years. Allometric equations based on DBH will be the main parameter.

3.1.3.2.2.2 Monitoring GHG Emissions from Microbial Decomposition of Peat

In 2020 we will begin monitoring GHG emissions from microbial decomposition of peat by directly monitoring proxy variables for GHG flux that are used when calculating GHG emissions. For strata with less dynamic water table levels (e.g. undrained forested peatland) as well as strata where water table levels are more dynamic or without forest cover (e.g. initially drained deforested peatland), we will monitor forest and non-forest cover as well as water table levels to update annual strata cover conditions and drainage status. Remote sensing methods in Section 3.1.3.2.1. will inform changes in vegetation cover. To monitor drainage status, the project implemented point-based monitoring using dip wells installed and distributed along transects comprising each water table level stratum, which included 264 dip wells in total within 6 water table level strata (Map 4). A hydrological model is being developed to extrapolate dip well measurements into a continuous water table level map.

Map 4. Location of the dip wells in the project area



Since 52% of the planned permanent peat compaction dams were completed in 2019, the project will examine changes in vegetation cover and water table levels to determine status change strata (if any), and efficacy of compacted peat dams for canal blocking. Annual GHG emissions from microbial decomposition of peat will be summarized by using IPCC default emission factor and following procedures in the VSC methodology VM0007 Module M-PEAT.

3.1.3.2.2.3 Monitoring GHG Emissions from Water Bodies

We will determine the amount of time necessary to develop and monitor site-specific dissolved organic carbon (DOC) value(s). The value(s) will be used to calculate emissions from water bodies by considering changes in area (i.e. channel widths and lengths derived from visual assessment with medium-high resolution remote sensing images).

3.1.3.2.2.4 Monitoring GHG Emissions from Peat Burning

In addition to the hotspot remote sensing data listed in Section 3.1.3.2.1, we also monitored GHG emissions from peat and biomass burning in conjunction with regular forest patrols. On the 14th of November 2019, there was a small naturally occurring fire inside the project area, likely induced by lightning, which was incorporated into the project emission calculations (see 3.2.2.9). For future monitoring events, we will continue to update the fire monitoring, including integration of soil moisture monitoring with remote sensing products and soil moisture sensors on the ground to assess fire risk areas. In all fire incidences, areas are checked through a combination of ground checking and visual assessment from remote sensing imagery. GHG emissions from burning are summarized annually following Module E-BPB.

3.1.3.2.2.5 Peat Characteristics

The baseline scenario requires updating every ten years. Future data collection will include additional peat inventory at sampling locations stratified by the project's digital terrain model (DTM). The inventory data collection will include peat depth, peat type, bulk density and carbon content. This field data will be added to the existing peat depth data to refine the interpolated peat thickness map. This model informs the baseline emission characteristics.

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

We have the climate monitoring plan available for public review at the project office. The full results of the climate monitoring included in the monitoring report are linked in the monitoring report summaries. The project provided printed summaries of the monitoring reports to project community members, other stakeholders and beneficiaries of project activities, and provided printed copies to local government officials and posted them in community center locations and at all patrol post in the project area. The project also publicized a variety of informational materials in both Bahasa Indonesia and English through the use of a combination of promotional materials such as letters, signs, banners, and announcement at community meetings and workshops.

3.2 Quantification of GHG Emission Reductions and Removals

3.2.1 Baseline Emissions

In this section we describe baseline emissions derived from the VCS methodology VM0007 (version 1.5) REDD+ MF and its modules BL-PL, BL-ARR, AR-ACM0003, BL-PEAT, and E-BPB.

3.2.1.1 General Assumptions

We used analyses of the most likely baseline scenario, to assess baseline emissions as well as the resulting changes on carbon stocks.

These emissions sources included:

1. Changes in aboveground biomass stocks (characterized by conversion to plantations);
2. Peat microbial decomposition;
3. Peat burning; and
4. Dissolved organic carbon from bodies of water.

All of the assumptions and omissions of emissions that we describe here are conservative efforts that result in lower emissions to maintain validity of our calculations and estimates of a baseline scenario.

We assumed that no other events of rewetting would occur in the baseline scenario. Examples of natural events that we excluded in our analysis may include canal collapses, progressive subsidence that could lead to changes in relative water table depths, or reduced CO₂ emission rates with increasingly thinner aerobic soil layers.

We also assumed that regular canal maintenance activities typically carried out for drainage and transportation would continue.

As information on the volume and frequency of dredging is unavailable (for example if dredging activities caused the peat to be exposed to aerobic decomposition), we omitted these emissions. This is a conservative omission as water body emissions are lower than those resulting from microbial decomposition in peat, and therefore results in lower emission estimates in the water body stratum than strata at the same location in the project scenario.

In the baseline scenario, we calculated the annual emissions for carbon dioxide (CO₂) and methane (CH₄) as these emissions are impacted directly by changes in land cover class and drainage status over time. However, we conservatively omitted nitrous oxide (N₂O) and GHG emissions derived from biomass burning.

3.2.1.2 Proxy Area Analysis

Module BL-ARR and Methodology extension AR-ACM0003, do not include specific requirements to justify the plantation establishment rate. To substantiate the conservative baseline conversion/plantation establishment rate (which is not deforestation) and to calculate leakage with a baseline deforestation rate, we followed Module BL-PL. We do not have a verifiable plan for conversation of the project area for the conversion/deforestation rate. Therefore, per BL-PL requirements, we selected the minimum six areas to determine the baseline rate of conversion/deforestation. These were further used to demonstrate the risk of abandonment.

In this section we describe the analytical processes to determine the conservative baseline rate of plantation establishment as per Module BL-PL which was used subsequently in LK-ASP.

3.2.1.2.1 Data Collection and Compilation

We selected suitable proxy areas as reference regions through an iterative process of data collection, compilation, review and processing of global or national-level datasets. Our description of the globally and nationally available datasets used for performing iterative analyses to select appropriate proxy areas, as well as details on the methodology, is available in Annex 8.

3.2.1.2.2 Similarity Analysis to select Proxy Areas

According to the methodology, all proxy areas must meet the following criteria:

1. Land conversion practices shall be the same as those used by the baseline agent or class of agent;
2. The post-deforestation land-use shall be the same in the reference regions as expected in the project area under business as usual;
3. The reference regions shall have the same management and land-use rights type as the proposed project area under business as usual;
4. 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 neighboring countries;
5. 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);
6. Deforestation in the reference region shall have occurred within the 10 years prior to the baseline period; and

The methodology also requires that the three following conditions shall be met:

1. 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 ($\pm 20\%$);
2. 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 ($\pm 20\%$). The ratio of slope classes “gentle” (slope < 15%) to “steep” (slope $\geq 15\%$) in the reference regions shall be ($\pm 20\%$) the same of the ratio in the project area; and

3. Elevation classes (500-m classes) in the reference region shall be in the same proportion as in the project area ($\pm 20\%$).

We have described and explained the reason for a slight deviation from Module BL-PL in PD Section 3.1.6. Requirements for the reference regions had to meet the following criteria in Table 8.

Table 8. Reference region selection criteria.

Project area at project starting date	Reference region requirement
59.6% forest cover as per MoE&F 2013	39.6-79.6% forest cover
100% peat	At least 80% peat
100% of area in the 0 - 500 m class	At least 80% of the area must fall in the 0-500 m class
100% of area has "gentle" (slope < 15%) slopes	At least 80% of the area must have "gentle" slopes

The selection reference areas followed a step-wise elimination approach by examining one item on the criteria list at a time. After the final step of elimination from the land-use, management practice, elevation, slope, and soil (peat) criteria, 28 shortlisted reference regions remained for the forest cover similarity analysis.

As the dataset from the Indonesian Ministry of Environment and Forestry (MoE&F) was not consistently available on an annual basis (only for 2006, 2009, 2011, 2012, 2013 and 2015) during the ten years prior to the project starting date, not all the potential proxy area license areas were covered by MoE&F data. Ten of the 28 shortlisted concessions had their license start in 2007. Since the MoE&F data did not cover this year, we chose to use the MoE&F forest cover in 2006 as a proxy of 2007, based on two assumptions. First, we assumed that large-scale, major planned conversion/deforestation would only begin after the licenses were issued. Second, by using a credible data source from a single year, we avoided uncertainty resulting from mixing datasets across different time periods, which were derived using different methods by the source provider.

We verified the first assumption by using two independent satellite-derived datasets produced by the Indonesian government and by the project technical team, namely the forest cover (Indonesian National Carbon Accounting System or INCAS) and pixel-based change detection analysis of Landsat-8 NDVI for 2006-2007. INCAS and MoE&F datasets had a mean 78% agreement between forest/non-forest areas.⁹ Because the INCAS dataset used the same satellite platform (Landsat) as the MoE&F and the data development involved standards, inputs and staff from the MoE&F,¹⁰ using INCAS data as a verification reference was viable.

We first compared the INCAS data of 2006-2007 with the MoE&F 2006 percentage forest cover and eliminated one site that showed a very high difference between the two data sources (MoE&F: 5.8%; INCAS: 78.8% in 2006 and 81.6% in 2007) as this discrepancy indicated significant difference in the definition of forest or analysis bias/errors. We also confirmed by using the INCAS dataset to examine if there was any major forest cover difference between 2006 and 2007. We eliminated another site that had moderate difference between the two years (INCAS: 90.4% in 2006 and 81.5% in 2007) because this indicated potential industrial deforestation/conversion between 2006-2007.

The remaining group of concessions for possible reference areas all had > 1% of forest cover difference in INCAS 2006-2007, and for these candidates we a change detection analysis by comparing the difference in vegetation reflectance (i.e. NDVI value) between 2006 vs. 2007 using the ENVI software version 5.3. Differencing NDVI (dNDVI) has been a well-known pre-classification change detection method to identify discernible shift in vegetation or land-use types.¹¹ We produced a dNDVI map in the cloud-free areas of each 2006-2007 pair, smoothed the output map with a majority filter algorithm, and categorized the standard deviation of dNDVI. The categorization identified multiple spatial clusters that represented several different types of vegetation change: 1) industrial deforestation/conversion; 2) crop/plantation to harvest; 3) plantation rotation cycle; 4) smallholder activities; and 5) no change (i.e. no loss or gain in dNDVI). We cross-checked between the dNDVI category map and Landsat-8 surface reflectance bands (in composite band combination of 6-5-4) to assign the spatial clusters into a dNDVI category by visually inspecting the imagery texture, color, pattern, patch size, patch shape, land features and adjacent patch types.

When the visual interpretation showed possibly different conclusion of forest cover or land-use change among dNDVI, Landsat-8 surface band composite, INCAS and MoE&F datasets, we compared them with two more global satellite-derived datasets in 2007: 1) vegetation loss (Terra-i); or 2) tree cover loss (University of Maryland). We eliminated one more site that had almost 100% forest cover in the INCAS and MoE&F datasets but showed moderate level of tree cover loss in the University of Maryland data and industrial-level deforestation/conversion in the dNDVI analysis.

The summary comparison of sites analyzed in this process can be found in Annex 8. From this iterative process we confirmed that the remaining seven sites did not show major planned deforestation/ conversion activities from 2006-2007. We concluded that their forest cover shown in the MoE&F 2006 could serve as a good proxy to represent their 2007 cover. We then proceeded with forest cover similarity analysis using these seven sites.

3.2.1.2.3 Conversion/Deforestation Rate Calculation

After the final elimination step using the MoE&F forest cover data, seven proxy areas remained. One concession only had a 1.31% average annual forest loss rate from 2009 (the licensed year) to 2015 (prior to our project start date on 01/01/2016), which is very different from the other six sites. According to our visual inspection by examining Landsat medium-resolution imagery in the licensed year and 2015, this site did not show prominent expansion of large-scale conversion/deforestation and development activities compared to the other sites. Instead, irregular, patchy and small-size deforestation/conversion indicated smallholder activities and/or natural hazards/disasters. It is likely that the 1.31% mean annual forest loss rate might not result from industrial concession operations, but could be a result of smallholder practices, forest succession from hazards, or natural disasters. Thus, the area was eliminated, as the land conversion practice and post-deforestation land-use of this site would not meet the similarity criteria when compared to the project area baseline scenario.

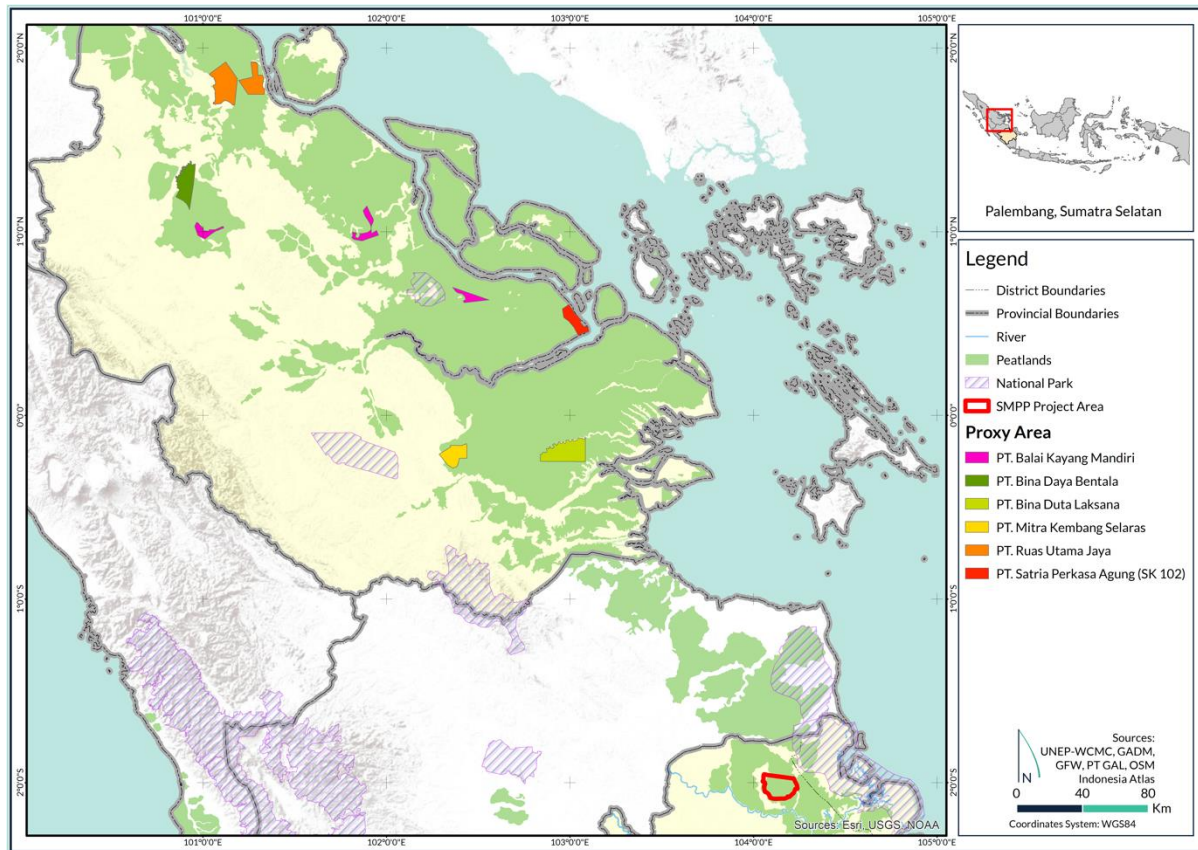
The visual inspection also confirmed that the other six sites showed signs of continuing conversion/deforestation activities consistent with industrial plantations, and thereby these areas were not subject to risk of abandonment. Considering their similarity to the project area's baseline scenario, we selected these six remaining sites as the proxy area for calculating the conversion/deforestation rate.

The summary comparison of sites analyzed in this visual inspection process can be found in Annex 8. We summarize the six final reference regions below in Table 9 and Map 5.

Table 9. Summary of suitable reference regions.

Province	Concession name	Area (ha)	License year	Peat (%)	Forest area in licensed year or 2006 (2007's proxy) (ha)	Forest area in 2015 (ha)	Total forest loss (%)	Average annual conversion/ deforestation rate (%)
Riau	PT Balai Kayang Mandiri	21,165.29	2007	95.97	14,779.51	9,952.86	32.66	4.08
Riau	PT Bina Daya Bentala	20,007.71	2006	88.66	8,484.97	0	100.00	11.11
Riau	PT Bina Duta Laksana	29,153.01	2006	100.00	17,837.11	7,084.26	60.28	6.70
Riau	PT Mitra Kembang Selaras	14,717.45	2007	100.00	10,031.47	2,740.08	72.69	9.09
Riau	PT Ruas Utama Jaya	44,794.62	2007	99.94	20,934.68	4,674.85	77.67	9.71
Riau	PT Satria Perkasa Agung (SK 102)	11,863.52	2006	100.00	5,271.74	2,235.25	57.60	6.40

Map 5. Location of the project area and the six reference regions selected for proxy areas.



3.2.1.2.4 Conversion/Deforestation Analysis

The annual conversion/deforestation was calculated (1) as:

$$D\%_{planned,i,t} = \left(\sum_{pn=1}^n \left(\frac{D\%_{pn}}{Yr_{spn}} \right) \right) / n \quad (1)$$

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 of a proxy area as a result of planned deforestation as defined in this module; %
Yr_{spn}	Number of years over which conversion/deforestation occurred in land parcel pn in proxy area; years
n	Total number of land parcels examined
pn	1, 2, 3, ... n * land parcels examined in proxy area
i	1, 2, 3, ... M strata

We estimated the average annual conversion/deforestation rate for these six proxy areas to be 7.85%. Our review of common Industrial Plantation Forest (*Hutan Tanaman Industri* or HTI) concession practices based on document research and concession manager interviews indicated a typical conversion/deforestation rate of 12-13%. Since we took conservative approaches analytically during the similarity analysis to set an estimated rate lower than known practices, the baseline rate of conversion/deforestation uncertainty was set to zero.

3.2.1.2.4.1 Likelihood of Deforestation and Risk of Abandonment

As HTI concessions are designated by zoning for deforestation and are not under any particular government control while licensed, we assumed the likelihood of deforestation ($L-D_i$) to be 100%.

We assessed the risk of abandonment using the six proxy areas selected above for calculating the average annual conversion/deforestation rate. After confirming the criteria in the proxy area analysis, we accessed and visually interpreted Landsat satellite images to determine if any of them experienced abandonment for forest regrowth. All proxy areas showed clear signs of continued conversion/deforestation and plantation activities throughout 2006-2015, therefore the BL-PL Module is applicable.

3.2.1.2.4.2 Area of Conversion/Deforestation

The annual area of conversion/deforestation in the baseline case (2) is:

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

Where:

$AA_{planned,i,t}$	Annual area of baseline planned deforestation for stratum i at time t ; ha
$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum i during year t . If actual annual proportion is known and documented (e.g. 25% per year for 4 years), set to proportion; %
$A_{planned,i}$	Total area of planned deforestation over the baseline period for stratum i ; ha
$L-D_i$	Likelihood of deforestation for stratum i ; %

3.2.1.3 Projection of conversion under baseline scenario

We spatially allocated the project area to produce a map based on the calculation of total annual area converted in the baseline ($AA_{planned,i,t}$), shown in the baseline scenario in Map 6. We then stratified the project area into five strata (Table 10), using an iterative, spatially explicit delineation process with four land-use types, two drainage statuses, and one water body class. The spatial allocation consisted of the following steps:

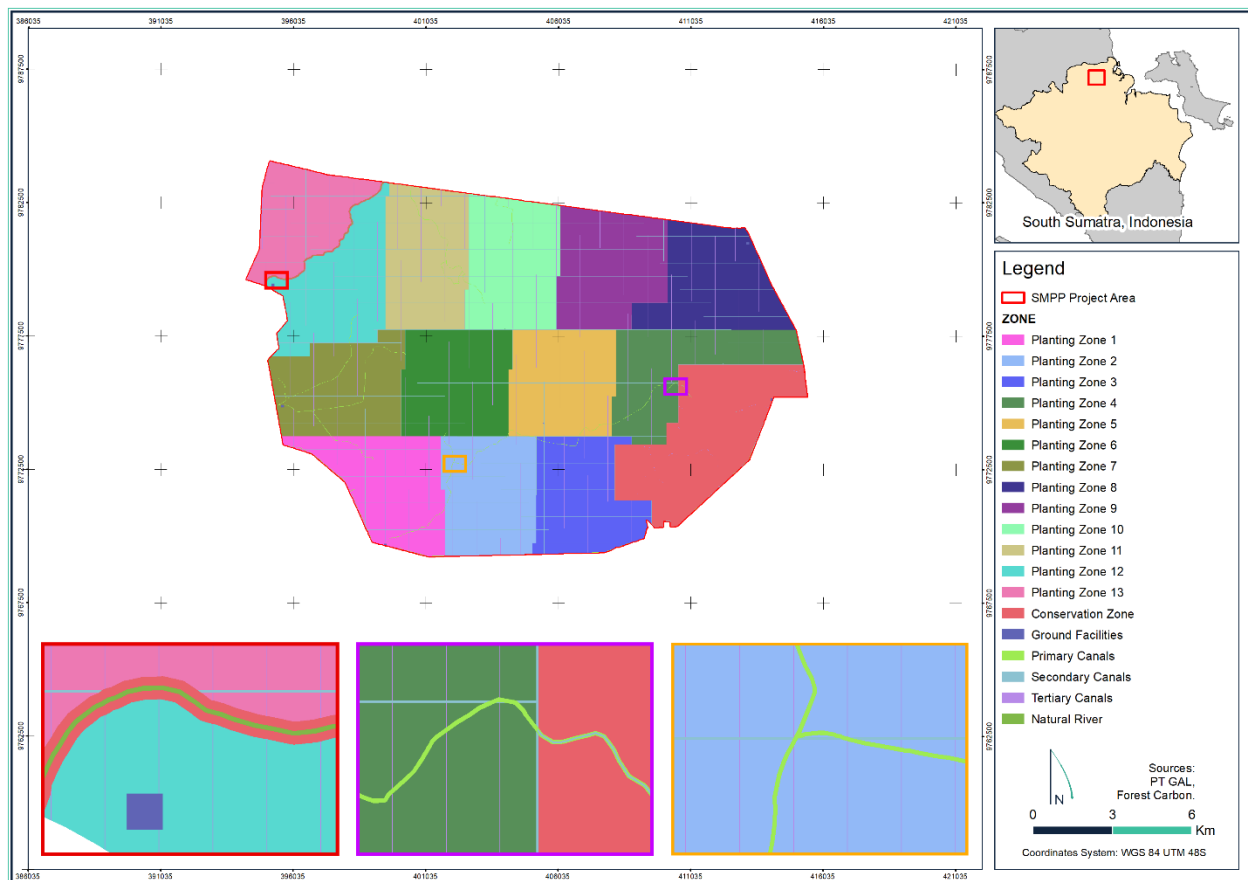
1. Define the maximum area allowed for development. According to MoE&F,^{12,13} 10% of the project area must be set aside for conservation, while the remaining 90% can be developed.
2. Define allowable infrastructure areas. Of the 90% of the project area available for development, a maximum of 5% could be designated as ground facilities and infrastructure (camps, guard posts, access roads, canals, and log collection ports), based on common practice analysis obtained through interviews and remote sensing data.
3. Delineate water bodies:
 - a. Delineation of water bodies present at the project start date (i.e. natural river such as Buring river). The natural water body stratum does not change for the entire project period.
 - b. Delineation of secondary (≤ 7 m) and tertiary (≤ 2 m) canals that existed prior to the project start date. These canals were then converted into 1) baseline primary canals, 2) secondary canals, 3) tertiary canals based on their locations in the zoning design and the conversion year, 4) Acacia planting zone. The widths of canals were based on common practice, observations from the field, and Google Earth high-resolution imagery of the project area and its surroundings.

- c. Delineation of baseline primary canals (12 m) converted in the first year of baseline scenario, widened from the initial secondary canals and aimed to serve for water surface control, log, seedling and worker transportation.
 - d. Delineation of 7-m wide baseline secondary canals that enclosed planting blocks. We divided the secondary canal development into the first four years of conversion, corresponding to review of a plantation work planning document.
 - e. Delineation of 2-m wide baseline tertiary canals that enclosed one planting block. The tertiary canals were assumed to be developed in the same year as the corresponding planting zone's conversion.
4. Delineation of drained/undrained areas:
 - a. Various academic studies show that close proximity to canals influences water table level, peat subsidence, burned area depth and probability of high frequency fire events. Observed impact of canal proximity varied across different regions, from 300 m (size class of secondary canals)¹⁴, 600 m (size class of primary canals)¹⁵, up to 1,300 m.¹⁵⁻¹⁷ Based on the literature, we employed a conservative approach to assume that areas within a 300-m distance from secondary canals and a 600-m distance from primary canals would be drained. Lacking literature that studied the distance impact of canals in the size class of tertiary canals, we took a conservative approach to prorated an assumed distance (150 m) within which drainage occurred.
 - b. We created a 600-m, 300-m, and 150-m buffer around both sides of the primary, secondary, and tertiary canals, respectively, to account for peatland drained at the project start date and in the subsequent years of baseline scenario.
 - c. The distinction between drained and undrained areas was also considered for emission characteristics and calculations.
5. Delineation of conservation area:
 - a. Delineation of intact dense forest and nearby closed or open canopy tree/shrub mix areas and the surroundings at the project start date. Summary and details of the land cover classification are available respectively in PD Section 3.1.3.1.1 and PD Annex 3.
 - b. A 25-m buffer zone on both sides of the natural water bodies was added to the conservation area according to MoE&F regulations.¹⁸
6. Delineation of ground facilities:
 - a. We created a 100-m buffer around camps and guard posts.
7. Delineation of planting zones:
 - a. Conversions to canals, ground facilities and planting zones followed the annual conversion rate of 7.85% determined in the proxy area analysis in Section 3.2.1.2. The remaining project area after deducting the conservation area, water bodies and ground facilities was available for planting zones. We delineated a total of 13 planting zones, with a several zones to accommodating conversions for ground facilities and secondary canal development.
 - b. Each planting zone consisted of multiple 150 X 500 m (75 ha) planting blocks based on common practice, as observed in the neighboring concession planting blocks using Google Earth high-resolution imagery.
8. Annual land-use change:
 - a. Ground facilities (camps, posts, log ponds) were constructed on year 1, based on common practice analysis and data from interviews with plantation managers.
 - b. Baseline primary canals were developed in year 1, expanded from the existing secondary canals prior to the project start.

- c. Baseline secondary canals were developed in four stages (year 1 to 4).
- d. Baseline tertiary canals were developed in the year of the planting zone development at which the tertiary canals were located.
- e. Existing secondary and tertiary canals that overlapped with a planting zone were converted to planting zone at the year of zone development. Canals that overlapped with baseline secondary canals were converted to secondary canals at the year of secondary canal development. Canals that overlapped with baseline tertiary canals were converted to tertiary canals at the year of corresponding zone development. Canals inside the conservation area remained unchanged for the project period.
- f. One planting zone was converted and planted immediately per year.
- g. Each planting zone was harvested and immediately replanted every four years, following the Acacia planting cycles known from common practices. For example, year 1 conversion was also set as the same year to plant and in year 5 the harvest was also set for replanting immediately.

The baseline strata of emission characteristics are shown in the baseline scenario designation map (Map 6) by incorporating (1) spatial coverage of land-use and drainage status; and (2) year of land-use and drainage status change.

Map 6. Baseline scenario map of the project area.



3.2.1.4 Emission Characteristics in the Baseline Scenario

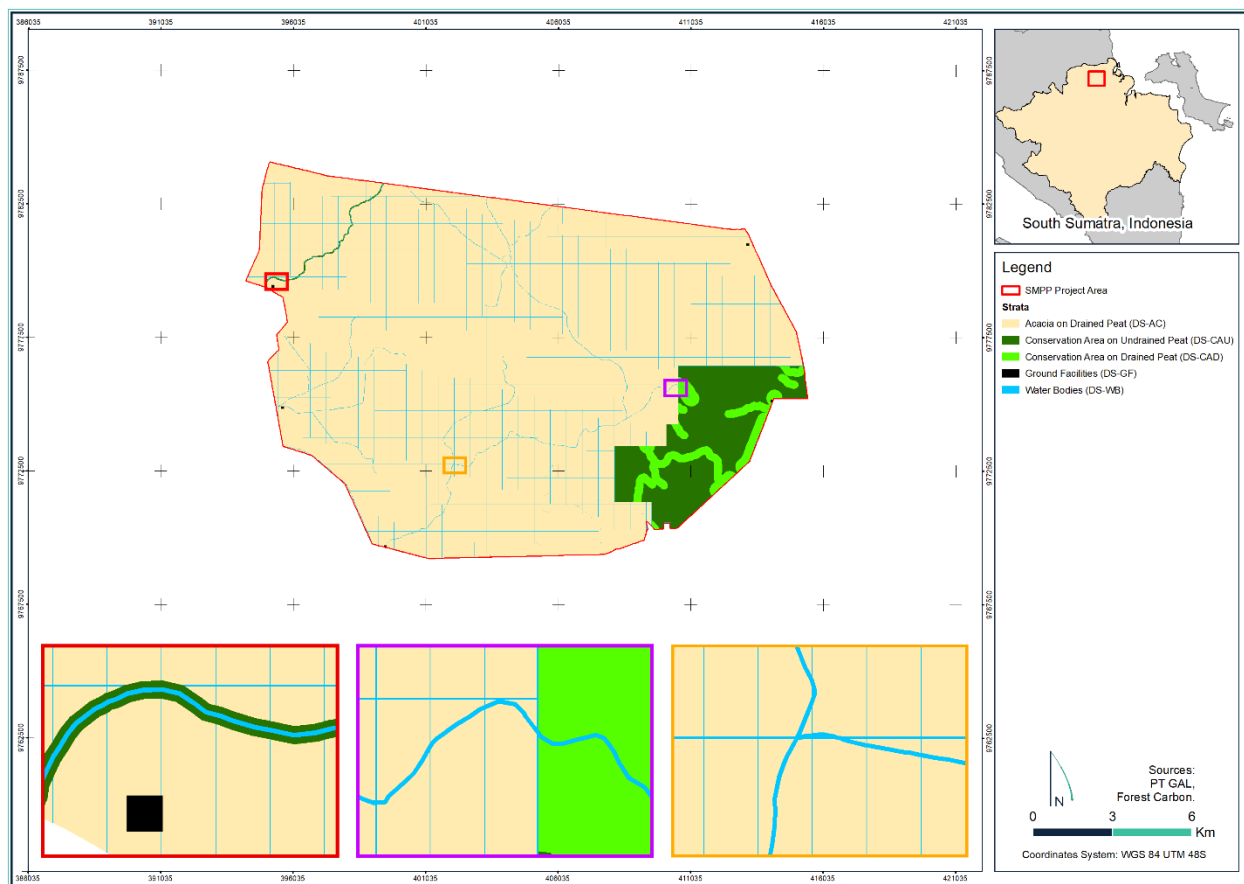
3.2.1.4.1 Emission characteristics stratification for WRC activities under the baseline scenario

Table 10 and Map 7 present the baseline stratification summary based on emission characteristics. A summary of dynamics of these strata is shown in Annex 10.

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

Strata	Type	Description	Area (ha)	Percentage of Project Area (%)
DS-CAU	Conservation Area on Undrained Peatland	Peatlands where forest covers are not removed, and drainage is absent. This stratum remains unchanged since the project start date. The locations are in areas where dense forest was present at the project start date, river buffer surrounding natural water body (Buring river), and deforested area surrounding the dense forest.	1,652.10	7.21
DS-CAD	Conservation Area on Drained Peatland	Peatlands where forest covers are not removed, and drainage is present. This stratum remains unchanged since the project start date. The locations are in areas where dense forest was present at the project start date, and deforested area surrounding the dense forest.	643.04	2.81
DS-WB	Water Body	This stratum represents river and drainage canals. River remains unchanged during the project period. Initial secondary and tertiary canals existed at the project start date. Baseline primary canals are built in year 1, expanded from initial secondary canals. Baseline secondary canals are built in year 1-4. Baseline tertiary canals are built in the year of planting zone development. Existing canals that are on baseline secondary canals are converted to secondary canals according to the secondary canals' development phase. Existing canals that are on baseline tertiary canals are converted to tertiary canals in the year of planting zone development. Existing canals that are on a planting zone are converted to planting zone according to the year of zone development.	707.51	3.09
DS-GF	Infrastructure	Infrastructure on drained peatland. This stratum represents lands used for concession operations, such as base camps, station camps, log yards, and access roads between planting blocks. The locations are as close as possible to transportation access (rivers).	4.09	0.02
DS-AC	Planting Zone	Acacia plantation on drained peatland. Acacia planting starts in the same year as conversion. The development of drainage constructions is assumed to happen just before - or in the same year as conversion/planting.	19,915.65	86.88
Total			22,922.39	100.00

Map 7. Baseline stratification of the project area based on emission characteristics.



3.2.1.4.2 Emission characteristics stratification for ARR activities under the baseline scenario

The baseline above ground carbon stock accumulation and subsequent loss related to Acacia planting and harvesting, which is accounted for under the ARR component. As detailed in PD Sub-subsection 3.2.1.3, a total of 19,915.65 ha of the project area would be converted to Acacia plantation with a rotation cycle of 4 years (Table 11). A summary of dynamics is shown in Table 11.

Table 11. Land use strata change in the baseline scenario for ARR

Strata	Land use	Area (Ha)	Planting Start year
DS-AC	Acacia	19,915.65	2016

3.2.1.5 Baseline emissions from microbial decomposition of peat, peat burning, and water bodies

3.2.1.5.1 Spatial and Temporal Variations

We quantified GHG emissions from microbial decomposition of peat, peat burning, and water bodies across spatial and temporal scales. Each baseline stratum included a small unit of land parcels with a combination of variables (described in Table 12 below).

We also calculated annual strata changes, variability of GHG emission factors, and any restrictions to GHG emissions (Table 12). We also accounted for spatial and temporal scales with GHG emission factors.

Table 12. Variables used for quantifying baseline GHG emissions from microbial decomposition of peat, peat burnings and dissolved organic carbon from water bodies.

Variables	Description
(A) Spatial Variables	
(A1) Soil Type	Distinction between peat or non-peat. This was used to exclude all non-peat parcels from GHG calculation (99.99% of the project area includes peat with depth $\geq$ 50cm).
(A2) Initial peat thickness available for microbial decomposition and burnings	Derived from DTM, drainage elevation limit (DEL), and Peat Thickness maps as described in Sub-subsection 3.1.3.1.4 of the PD. These maps were used to determine the initial condition for subsequent calculations of the remaining peat layer available for microbial decomposition and burning.
(A3) Initial stratum	Stratum of the corresponding parcel at the project start date (as derived in Annex 10) before conversion into the baseline stratum takes effect. This was used to determine the correct emission factor for the corresponding parcel for the duration before B1 and B2 (see below) take effect.
(A4) Peat burning tag	This was used to identify whether the corresponding parcel was marked as a possible area for peat burning and the frequency of total years of historical and simulated burns.
(B) Temporal Variables	
(B1) Year of drainage	Determines the onset of conversion from initial stratum to a drained stratum and set 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 was already a drained stratum. Together with B2 this was used to determine the correct emission factor for the corresponding parcel.
(B2) Year of conversion/planting of the baseline land cover	Determines the onset of conversion of initial stratum to converted/planted stratum. Together with B1 this was used to determine the correct emission factor for the corresponding parcel.
(B3) PDT	The PDT defines the period of time that it takes to deplete the remaining peat layer by microbial decomposition and burning. 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 was 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 was 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 was marked for burning in the corresponding year (as being checked in B4), this restriction further checked whether GHG emissions from burning would still be possible based on variables: B1 (Year of drainage), B2 (Year of conversion/planting)

Variables	Description
	and B3 (Remaining peat thickness available for microbial decomposition and burning).

3.2.1.5.1.1 Emission Calculations

We calculated the net carbon dioxide equivalent (CO₂-e) emissions from the peat (microbial decomposition and burning) and water body as per VCS Module BL-PEAT (3):

$$GHG_{BSL-WRC} = \sum_{t=1}^{t^*} \sum_{i=1}^M (E_{peatsoil-BSL,i,t} + E_{peatditch-BSL,i,t} + E_{peatburn-BSL,i,t}) \quad (3)$$

Where:

$GHG_{BSL-WRC}$	Net GHG emissions in the CUPP baseline scenario up to year t^* (t CO ₂ -e)
$E_{peatsoil-BSL,i,t}$	GHG emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO ₂ -e yr ⁻¹)
$E_{peatditch-BSL,i,t}$	GHG emissions from water bodies in the baseline scenario in stratum i at year t (t CO ₂ -e 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 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 (4) apply:

$$E_{peatsoil-BSL,i,t} = 0 \quad (4)$$

$$E_{peatditch-BSL,i,t} = 0$$

$$E_{peatburn-BSL,i,t} = 0$$

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 ₂ -e yr ⁻¹)
$E_{peatditch-BSL,i,t}$	GHG emissions from water bodies at year t (t CO ₂ -e 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 ₂ -e 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, water bodies and peat burning are elaborated in detail in the PD subsections 3.2.1.5.4, 3.2.1.5.5 and 3.2.1.5.6. A summary of the quantified GHG emissions from peat microbial decomposition, uncontrolled peat burning and water body under the baseline scenario is presented in Table 13.

Table 13. 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 in 2019.

Year	CO ₂ from peat microbial decomposition (t CO ₂ -e yr ⁻¹)	CH ₄ from peat microbial decomposition (t CO ₂ -e yr ⁻¹)	CO ₂ from peat burning (t CO ₂ -e yr ⁻¹)	CH ₄ from peat burning (t CO ₂ -e yr ⁻¹)	CO ₂ from DOC (t CO ₂ -e yr ⁻¹)	Total (t CO ₂ -e yr ⁻¹)
2019	495,247	6,923	383,685	36,711	1,597	924,163

3.2.1.5.1.2 Subsidence Related to Initial Compression, Microbial Decomposition, and Peat Burning

We assume that the initial peat thickness in the baseline scenario is equal to the initial peat thickness as mapped at the project starting date (PD Sub-subsection 3.1.3.1.4).

We calculated peat loss due to initial compression and microbial decomposition by using the stratification of the project area on initial drainage, the year of conversion, and specific subsidence rates that took into account the compaction after initial drainage (Annex 10). For peat loss due to burning, we first assessed the number of times the individual pixels of the fire simulation were burned in the 10-year period before project start date and subsequently applied an associated burn scar depth (Annex 10). We quantified the annual peat loss rates in the baseline scenario as the sum of the burn scar depth (in areas where peat burning was simulated) and the subsidence rate, using the equation (5):

$$Rate_{peatloss-BSL,i,t} = D_{peatburn-BSL,i,t} + Sub_{i,t} \quad (5)$$

Where:

$Rate_{peatloss-BSL,i,t}$	Rate of peat loss due to microbial decomposition and burning in baseline scenario of stratum i at year t (m yr ⁻¹)
$D_{peatburn-BSL,i,t}$	Burn scar depth under baseline scenario in stratum i at year t (m)
$Sub_{i,t}$	Subsidence rate in stratum i in year t (m)
i	1, 2, 3, ... M_L strata in the baseline scenario (unitless)
t	1, 2, 3, ... t^* time elapsed since the project start (yr)

We assessed the remaining peat depth annually for the project period based on the rate of peat loss due to microbial decomposition of and burning incidents using the equation (6):

$$Depth_{peat-BSL,i,t^*} = Depth_{peat-BSL,i,t_0} - \sum_{t=1}^{t^*} Rate_{peatloss-BSL,i,t} \quad (6)$$

Where:

$Depth_{peat-BSL,i,t^*}$	Remaining peat thickness in the baseline scenario in stratum i at year t^* (m)
$Depth_{peat-BSL,i,t_0}$	Peat thickness at the baseline scenario in stratum i at year t_0 = project start date (initial peat thickness) (m)
$Rate_{peatloss-BSL,i,t}$	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	1, 2, 3, ... M_L strata in the baseline scenario (unitless)
t	1, 2, 3, ... t^* time elapsed since the project start (yr)

By tracking annual peat thickness in the baseline scenario, we assured that no GHG emissions have been accounted for within any parcel of each stratum once the available carbon stock in peat has been depleted.

3.2.1.5.1.3 Emissions from Microbial Decomposition

We assumed that the annual rate of conversion of undrained to drained peatland in the baseline scenario was based on the rate of conversion/deforestation agents as described in Subsection 3.2.1.2 and Annex 8 (7.85% a year). The temporal variability of the emissions from peat microbial decomposition are directly related to land-use and drainage changes in the baseline scenario. Table 14 below provides details on the WRC-related baseline stratification per stratum.

Table 14. The stratification used for the calculation of GHG emissions per stratum, the area per each stratum and the CO₂ and CH₄ default factors used for the specific land-use.

Strata	Description	Area (ha)	IPCC default factor for CO ₂ (t CO ₂ -e ha ⁻¹ yr ⁻¹)	IPCC default factor for CH ₄ (t CO ₂ -e ha ⁻¹ yr ⁻¹)	IPCC default factor for ΔDOC (t CO ₂ -e ha ⁻¹ yr ⁻¹)
Initial					
IN-UPSF	Undrained Dense Peatland Forest	234.08	0	1.02	
IN-UDP	Undrained Deforested Peatland	15205.17	5.5	0.66	
IN-DPSF	Drained Dense Peatland Forest	20.26	19.43	0.12	
IN-DDP	Drained Deforested Peatland	7393.59	19.43	0.12	
IN-WB	Water bodies (river and canals) present at project start	69.30			2.09
After conversion					
DS-AC	Acacia on drained peatland	19,915.65	73.33	0.07	
DS-CAU	Conservation area on undrained peatland	1,652.10	0	1.02	
DS-CAD	Conservation area on drained peatland	643.04	19.43	0.12	
DS-GF	Ground facilities on drained peatland	4.09	19.43	0.12	
DS-WB	Water bodies (river and canals)	707.51			3.01
Note: Annex 10 on Default Factors for Quantification of GHG emissions in the baseline and project scenarios provides more details on the emission factors used and the respective references.					

We calculated baseline GHG emissions for different emission strata by using the conservative TIER 1 IPCC default emission factors for each stratum, following the equations defined by the Module BL-PEAT (7):

$$E_{peatsoil-BSL,i,t} = E_{CO_2-BSL,i,t} + E_{CH_4-BSL,i,t} \quad (7)$$

Where:

$E_{CO_2-BSL,i,t}$	CO ₂ emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO ₂ -e yr ⁻¹)
$E_{CH_4-BSL,i,t}$	CH ₄ emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO ₂ -e 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)

We calculated the CO₂ emissions from microbial decomposition for each stratum of the peat within the SMPP using the equation (8):

$$E_{peatsoil-BSL,CO_2,i,t} = A_{i,t} \times EF_{CO_2,i,t} \quad (8)$$

Where:

$E_{peatsoil-BSL,CO_2,i,t}$	CO ₂ emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO ₂ -e yr ⁻¹)
$EF_{CO_2,i,t}$	Emission factor for CO ₂ emissions corresponds to each stratum i , as provided by IPCC (t CO ₂ -e 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)

We calculated the CH₄ emissions from the peat soil for each stratum of the peat within the SMPP using the equation (9):

$$E_{peatsoil-BSL,CH_4,i,t} = A_{i,t} \times GWP_{CH_4} \times EF_{CH_4,i,t} \quad (9)$$

Where:

$E_{peatsoil-BSL,CH_4,i,t}$	CH ₄ emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO ₂ -e yr ⁻¹)
$EF_{CH_4,i,t}$	Emission factor for CH ₄ emissions corresponds to each stratum i , as provided by IPCC (t CO ₂ -e ha ⁻¹ yr ⁻¹)
$A_{i,t}$	Area of stratum i at time t (ha)
GWP_{CH_4}	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)

The annual GHG emissions from microbial decomposition in the baseline scenario are shown below in Table 15.

Table 15. GHG emissions from microbial decomposition of peat in the baseline.

Year	CO ₂ from peat microbial decomposition (t CO ₂ -e yr ⁻¹)	CH ₄ from peat microbial decomposition (t CO ₂ -e yr ⁻¹)	Total (t CO ₂ -e yr ⁻¹)
2019	495,247	6,923	502,170

3.2.1.5.1.4 Emissions from Peat Burning

According to Module E-BPB, GHG emissions from biomass burning can result from:

1. Conversion of forest land to non-forest land using fire;
2. Periodic burning of grassland or agricultural land after deforestation;
3. Controlled burning in forest land remaining forest land;
4. Uncontrolled fire in drained peat swamp forest; and
5. Uncontrolled peat burning in (abandoned) drained peat sites.

We assumed that there was no controlled peat burning during plantation activities, as burning to clear forests on Acacia plantations is illegal. Therefore, we only accounted for emissions from unintentional or uncontrolled burnings in the baseline scenario. In addition, we omitted AGB lost by combustion.

To quantify GHG emissions from uncontrolled peat burnings, we followed procedures from the VCS methodology VM0007 Module E-BPB with the following equation (10):

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

Where:

$E_{peatburn-BSL,i,t}$	Greenhouse emissions due to peat burning under baseline scenario in stratum i in year t of each GHG (CO ₂ , CH ₄) (t CO ₂ -e)
$A_{peatburn-BSL,i,t}$	Area peat burnt under baseline scenario in stratum i in year t (ha)
$P_{BSL,i,t}$	Average mass of peat burnt (dry matter or DM) under baseline scenario in stratum i , year t (t DM ha ⁻¹)
$G_{g,i}$	Emission factor in stratum i for gas g (kg t ⁻¹ DM burnt)
GWP_g	Global warming potential for gas g (t CO ₂ t ⁻¹ g ⁻¹)
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)

For repeated burns, scar depths of the 1st, 2nd, 3rd and 4th subsequent burnings are assumed as 0.17 cm, 0.1 cm, 0.06 cm, and 0.02 cm, respectively. Detailed parameters for quantifying GHG emissions from uncontrolled burning are available in Annex 10. We estimated the average mass of peat burnt for a particular stratum using the equation (11):

$$P_{BSL,i,t} = D_{peatburn-BSL,i,t} \times BD_{upper} \times 10^{-4} \quad (11)$$

Where:

$P_{BSL,i,t}$	Average mass of peat burnt under baseline scenario in stratum i , year t (t DM 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 derived from the mass of peat lost by combustion and emission factors from scientific literature (see Annex 10 for the default values used for the calculations of baseline carbon losses and emissions from burning).

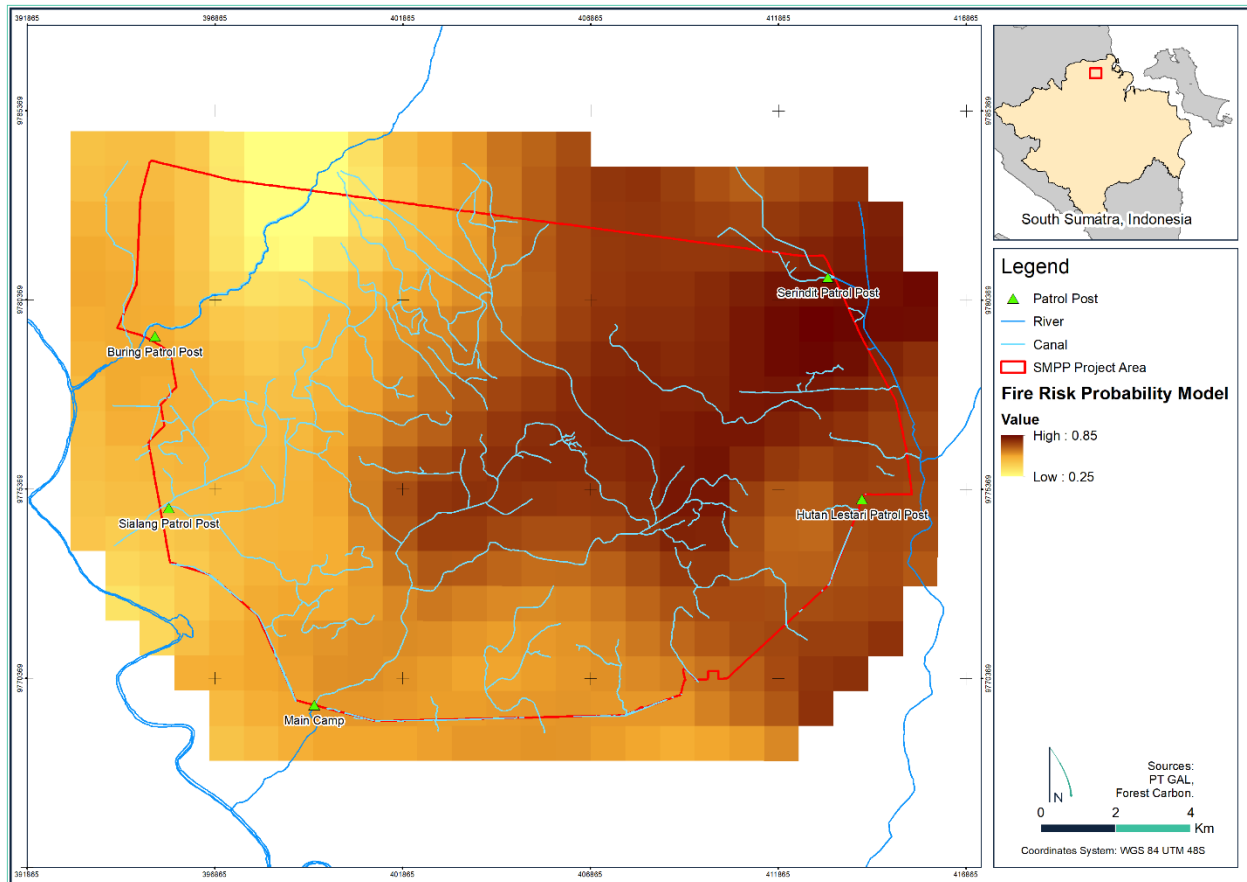
For fire emissions, we assumed that the likelihood of random, uncontrolled or repeated peatland burnings would be higher in areas with greater probability of fire risks. To identify areas of greater fire risk in the baseline of the project area, we performed spatially explicit suitability modeling to examine the distribution of fire probability.

Previous fire probability models showed that in general, higher fire likelihood is related to predictor variables of human development activities, climate, topography, vegetation and ignition. In particular, human population, distance to roads, bioclimate, annual precipitation, elevation, slope, and land cover types associated with agricultural activities had the greatest model contribution and are the strongest predictors of fire occurrence probability. Many models of fire risk use historical fire detection data derived from satellite imagery products to calibrate. For our study to align periods of fire risk probability modeling and burn scar area calculation (for estimating average burn area per year), we decided to use remote sensing data from a 10-year span prior to project start (2006-2015).

The initial input data included point locations and 31 environmental variables, including NASA MODIS and VIIRS 2006-2015 hotspots, WorldClim bioclimatic variables, NASA SRTM elevation and derived slope and aspect, LandScan population count, distance to road, distance to river, and land cover change produced by the Ministry of Environment and Forestry for 2006-2015. Land cover type, precipitation and seasonality, population, and distance to roads were the most important contributing variables to the final model.

We documented the detailed fire risk probability data, model inputs preparation, iterative modeling process, model evaluation and final model result in Annex 11.

Map 8. Fire occurrence suitability that predicted risk probability.



We then calculated annual percentage of burn rate in the study area for 2006-2015, by using historical MODIS and VIIRS hotspot data. We assumed each hotspot occurred with a conservative burn area estimate or estimate coefficient based on literature values. The calculation produced the average 6.12% of burnt area (1,402.85 ha) per year. This value was used as a parameter in estimating the annual area burnt threshold in the baseline scenario.

We assumed that uncontrolled burnings in peatlands repeat randomly in places that are 'high risk' areas. To determine where the 'high risk areas' are in the baseline of the project area, we used the fire occurrence risk probability model, as well as the average annual burnt area estimate above, to simulate the spatial position of burning for 100 years. This simulation did not show the "actual area burnt" in the baseline scenario, and instead shows possible locations where peat burning can be expected to occur randomly.

The location of possible burn areas in each year of the baseline scenario was simulated as using the probable areas of fire risk from the model as weight, by randomly selecting parcels annually over 100 years in such a way that the annual average area of the selected parcels approximately equaled (but did not exceed) the area of average annual burn area. Parcels that had higher fire risk probability had greater chance to be randomly selected in the simulation model.

We examined the hotspot history based on MODIS and VIIRS data from year 2006-2015 to document the number of times when a selected parcel was burnt. We then examined the 100-year fire simulation of burn frequency and combined with the 2006-2015 data to record the overall history/projection of burning. If a parcel had no hotspot record in 2006-2015 and was selected randomly in the first time of simulation, the parcel was marked as "catching the 1st burning". If it had a hotspot record and was randomly selected once over the 100 years, it was marked as "catching the 2nd burning", and so forth.

The detailed methodologies, justifications and calculations of annual burnt area and 100-year fire simulations can be found in Annex 12.

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.

The total GHG emission from uncontrolled peat burning in the baseline scenario per stratum are shown in Table 16 below, and annual emissions and total emission per stratum are shown in Table 17.

Table 16. Total GHG emissions from uncontrolled peat burning in the baseline scenario per stratum.

Strata	Description	Total Area burnt in 2019 (ha)	GHG Emissions from peat burning in 2019 (t CO ₂ -e)
IN-UPSF/ DS-CAU	Dense Forest (undrained)	143.07	38,261.45
IN-UDP	Deforested peatland (undrained)	331.74	106,518.10
IN-DPSF	Dense Forest (drained)	48.30	15,768.55
IN-DDP	Deforested peatland (drained)	488.10	168,473.06
DS-AC	Acacia (drained peatland)	268.05	83,257.90
DS-GF	Ground facilities (drained peatland)	-	-
WB	Water bodies (river and canals)	25.47	8,097.69
Total		1,304.73	420,376.76

Table 17. Annual GHG emissions from peat burning in the baseline scenario.

Year	CO ₂ from peat burning (t CO ₂ -e ha ⁻¹ yr ⁻¹)	CH ₄ from peat burning (t CO ₂ -e ha ⁻¹ yr ⁻¹)	Total (t CO ₂ -e ha ⁻¹ yr ⁻¹)
2019	383,685	36,711	420,396

3.2.1.5.1.5 Emissions from water body in peatland

The only type of open water bodies present in the baseline scenario are river and drainage canals, as we assumed that the baseline agent would not create ponds or lakes. The area of river and canals in the baseline scenario was determined based on common practice observed in Acacia concessions adjacent to SMPP, as well as direct measurements from high-resolution satellite imagery. The water bodies were temporally and spatially stratified for the PD. In short, primary canals were set as existing canals before baseline conversion, whereas secondary and tertiary canals were to be constructed when new canals appeared starting in Year 1 and when converting an area into a planting zone, respectively. IPCC does not provide default emission factors for CO₂ and CH₄ emissions from water bodies, thus we used the default values for dissolved organic carbon (Δ DOC) (for detail see Annex 10).

The only natural river in the project area is the Buring river, hence in the baseline this is the only WB area, on which the default value for natural water bodies is applied (0.57 t C ha⁻¹ yr⁻¹). For all other water bodies, i.e. canals, the default values for drained peatland (0.82 t C ha⁻¹ yr⁻¹) was applied.

We used the approach as set out in the VCS methodology VM0007 Module BL-PEAT (equation 12), and replaced $E_{peatditch-CO_2,i,t} + E_{peatditch-CH_4,i,t}$ with into CO₂-equivalents converted DOC emission default factors:

$$E_{peatditch-BSL,i,t} = A_{ditch-BSL,i,t} \times EF_{DOC-BSL,i} \quad (12)$$

Where:

$E_{peatditch-BSL,i,t}$	GHG emissions from canals and other open water stratum i at year t in the baseline scenario (t CO ₂ -e ha ⁻¹ yr ⁻¹)
$A_{ditch-BSL,i,t}$	Total area of canals and other open water stratum i at year t in the baseline scenario (ha)
$EF_{DOC-BSL,i}$	PCC emission factor for Dissolved Organic Carbon from canal and open in the baseline scenario in stratum i (t CO ₂ -e ha ⁻¹ yr ⁻¹)
i	1, 2, 3, ... M strata
t	1, 2, 3, ... t time elapsed since the start of the project activity (years)

Annual GHG emissions from Dissolved Organic Carbon in water bodies in baseline scenario are shown in Table 18.

Table 18. GHG emissions from Dissolved Organic Carbon in water bodies in the baseline scenario.

Year	CO ₂ from DOC (t CO ₂ -e ha ⁻¹ yr ⁻¹)
2019	1,597

3.2.1.6 Baseline emissions from ARR Activities

Under the baseline scenario, the area designated for Acacia plantation would sequester carbon in trees through growth (emission removals) and release it again after harvesting. We accounted for the growth of Acacia as baseline ARR activities. The conversion and thus planting of Acacia would be carried out sequentially during the first 13 years of the project, resulting in a total planted area of 19,915.65 ha. We assumed a rotation cycle of 4 years. The annual area changes under the baseline scenario are detailed in PD Annex 3 and summarized in Table 19 below.

Table 19. The assumed annual planting and harvesting under ARR activities within the monitoring period in the baseline scenario.

Year	Planting	Harvesting
2019	3,092.11	1,569.10

Net GHG emissions and removal in the baseline ARR scenario were estimated using the procedure provided in AR-ACM0003 Afforestation and reforestation lands except wetlands and associated pool,¹⁹ as outlined in Module BL-ARR, using the equation (13):

$$\Delta C_{BSL-ARR} = \sum_{t=1}^{t^*} (\Delta C_{BSL,t,ACM003}) \quad (13)$$

Where:

$\Delta C_{BSL-ARR}$	Net GHG removals under the ARR baseline scenario up to time t (t CO ₂ -e)
$\Delta C_{BSL,t,ACM003}$	Baseline net GHG removal by sinks in year t (from AR-ACM0003) (t CO ₂ -e)
$EF_{DOC-BSL,i}$	IPCC emission factor for Dissolved Organic Carbon from canal and open in the baseline scenario in stratum i (t CO ₂ -e ha ⁻¹ yr ⁻¹)
t	1, 2, 3, ... t^* time elapsed since the start of the project activity (years)

Net GHG removals under the ARR baseline scenario within the project period are estimated to be 978,846 t CO₂-e. Annual GHG removals under ARR within the monitoring period are shown in Table 20 below. Details on calculations are provided in Annex 5.

Table 20. Baseline net GHG removal from ARR activities in project area within monitoring period in the baseline scenario.

Year	NET GHG removal from ARR (t CO ₂ -e yr ⁻¹)
2019	117,743

3.2.1.7 Significant sources of Baseline Emissions

We have determined that all sources of carbon not included in the baseline or project scenarios can be conservatively excluded. Significance tests were not necessary as all of the required pools of carbon and other GHG emissions within the SMPP have already been included in our calculations.

3.2.2 Project Emissions

To determine project scenario emissions and changes in carbon stocks within the SMPP analysis was based on a combination of field-based data, proxy analyses, and default emissions factors from the IPCC.²⁰

We accounted emissions in the project scenario from:

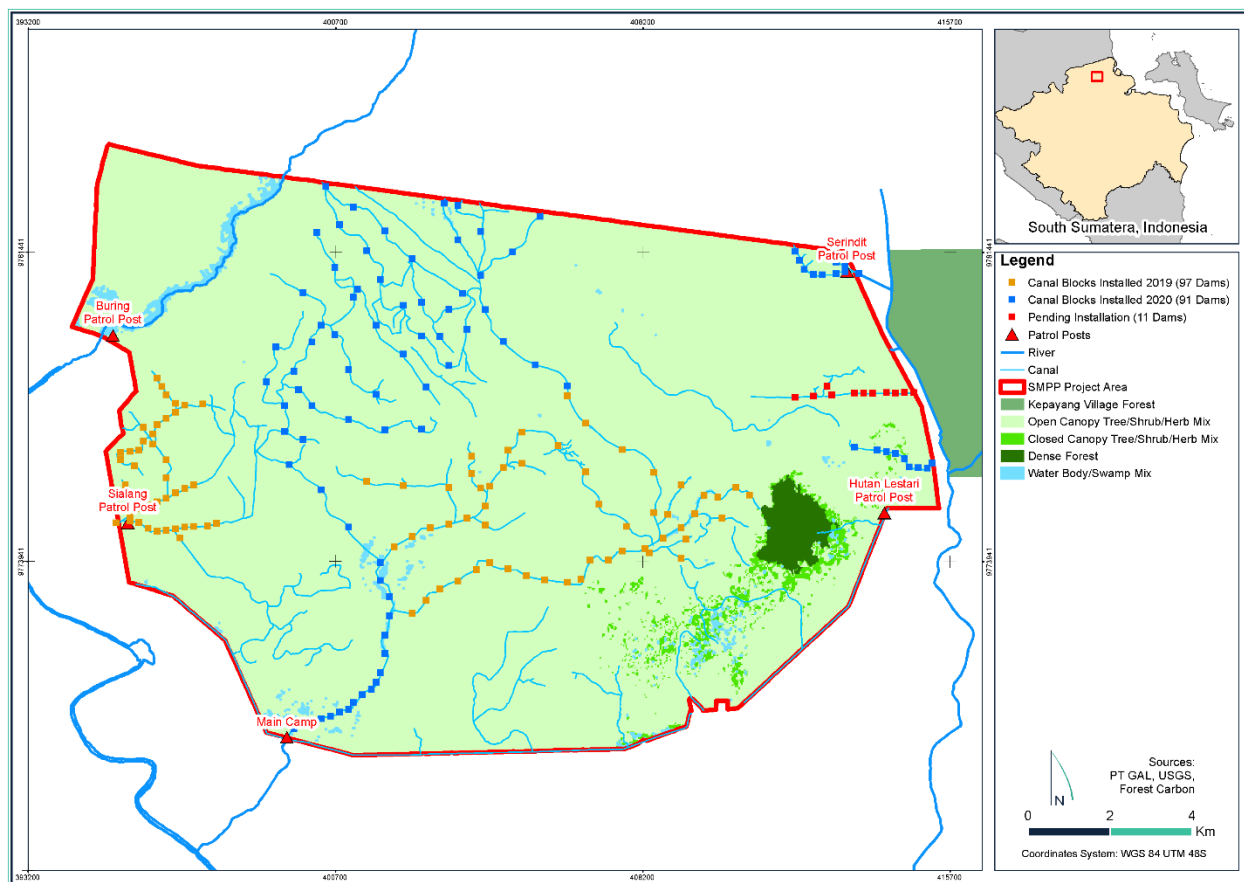
1. Above-ground biomass (AGB) stock changes due to ARR activities (from 2020 as this is the first year the project will conduct an AGB inventory);
2. Peat microbial decomposition; and
3. Water table level changes due to WRC activities.

Project activities specifically related to climate are described in the PD, in Section 2.1.11 and include rewetting drained peatland areas, conservation of existing natural peat areas, natural regeneration of vegetation, and fire control measures with a target of zero burning in the SMPP.

We have operated consistent fire patrols since the start of the SMPP, and we also have an online satellite-based early warning system (EWS) in place to detect possible fires as quickly as possible. Our project activities include active patrolling, border protection and training, and as a result of the project there is a reduction of human activity in the project area. For future monitoring events, if any uncontrolled burning does occur in the SMPP during the project period, we have extensive fire monitoring plans in place, and we will adjust our calculations to account for these emissions.

We also constructed compacted peat dams over existing canals throughout the project area in late 2019, so we assumed there will not be any non-human induced rewetting in the project scenario (Map 9).

Map 9. Planned and completed canal blocks in late 2019 through early 2020.



3.2.2.1 Emission Characteristics Stratification Monitoring

3.2.2.1.1 Land Cover Change Detection

In PD Section 3.1.3.1 we stratified the project area into land cover classes based on vegetation types that are indicative of varying aboveground carbon stocks as a result of the 2016 land cover classification. The classification informed the appropriate emission characterization and emission factors. This change detection describes differences in vegetation in 2018-2019. Annex 3 provides details on the employed methodology and results.

3.2.2.1.1.1 Data Acquisition

We performed land cover change detection by using Landsat satellite imagery products developed by the Global Land Analysis and Discovery team (GLAD) as Landsat Analysis Ready Data (ARD) for both 2018 and 2019:

1. Tile 104E_01S, and
2. Tile 104E_02S.

The U.S. Geological Survey (USGS) offers on-demand products of Landsat 8 OLI/TIRS Surface Reflectance data.²¹ The surface reflectance data correct satellite images for atmospheric effects to create Level-2 data at a 30-m spatial resolution.

Individual Landsat Level-2 surface reflectance images were further processed by the GLAD team into Landsat ARD, a time-series of 16-day normalized surface reflectance composites with minimal atmospheric contamination.²²

Each 16-day ARD composite consists of normalized surface reflectance for six spectral bands (blue, green, red, NIR, and two SWIR), normalized brightness temperature, and quality flag in separate rasters. The ARD products used for this change detection analysis included the six visible multi-spectral bands (bands 1-6). We also computed two additional spectral indices using the normalized surface reflectance bands: Normalized Difference Moisture Index (NDMI) and Normalized Difference Vegetation Index (NDVI).

We transformed the original surface reflectance bands 1-6 by conducting principal component analysis (PCA) to reduce dataset dimensionality for the 2018 and 2019 images. With PCA, the original six normalized bands that were correlated, were transformed into a simpler dataset of uncorrelated variables representing the most important variance from the original dataset.²³ We included the first PCA axis (PCA-1) of 2018 and 2019 into the change detection, which accounted for 83.6% and 75.9% variance of the original surface reflectance bands 1-6 for 2018 and 2019, respectively.

3.2.2.1.1.2 Change Detection Preparation

The 2016 imagery classification informed the extent of forest/non-forest areas used for stratifying emission characteristics. By assessing land cover in high-resolution LiDAR ortho-photos acquired in 2017 (obtained and shared by Deltares) and drone photographs acquired in 2018, as well as the peat inventory conducted in 2019, we found discernible regrowth from rapid-growing early succession vegetation and minor shifts in vegetation types defined in the 2016 land cover classification. The lack of shift in land cover classes could indicate no change in stratification for emission characteristics. To verify this, we performed a change detection analysis by comparing the downloaded and pre-processed Landsat 8 ARD images for 2018 and 2019.

We generated a difference image resulting from comparing each band of the two-year Landsat ARD images, PCA axes, and derived indices. Initial inspections showed that two bands highlighted the most discernible patterns of image differences: NDMI and PCA-1. For reference satellite imagery, we obtained Sentinel-2A Level 1C images in 2019 from the Sentinel data hub of the European Space Agency (ESA).²⁴ The multispectral visible bands of Sentinel images contained different spatial resolutions (20 m and 10 m). We first performed a pan-sharpening technique to resample the visible bands to 10-m spatial resolution to enhance visual contrast, texture, and pattern among different vegetation types.

We compared the initial output comparison, by using 2018 and 2019 Landsat 8 ARD and Sentinel 2A images with a visual inspection to examine differences in color, shape, pattern, and texture using the same visible band composite between the two dates and then to cross-check with patterns extracted in the three change detection difference images.

3.2.2.1.1.3 Results

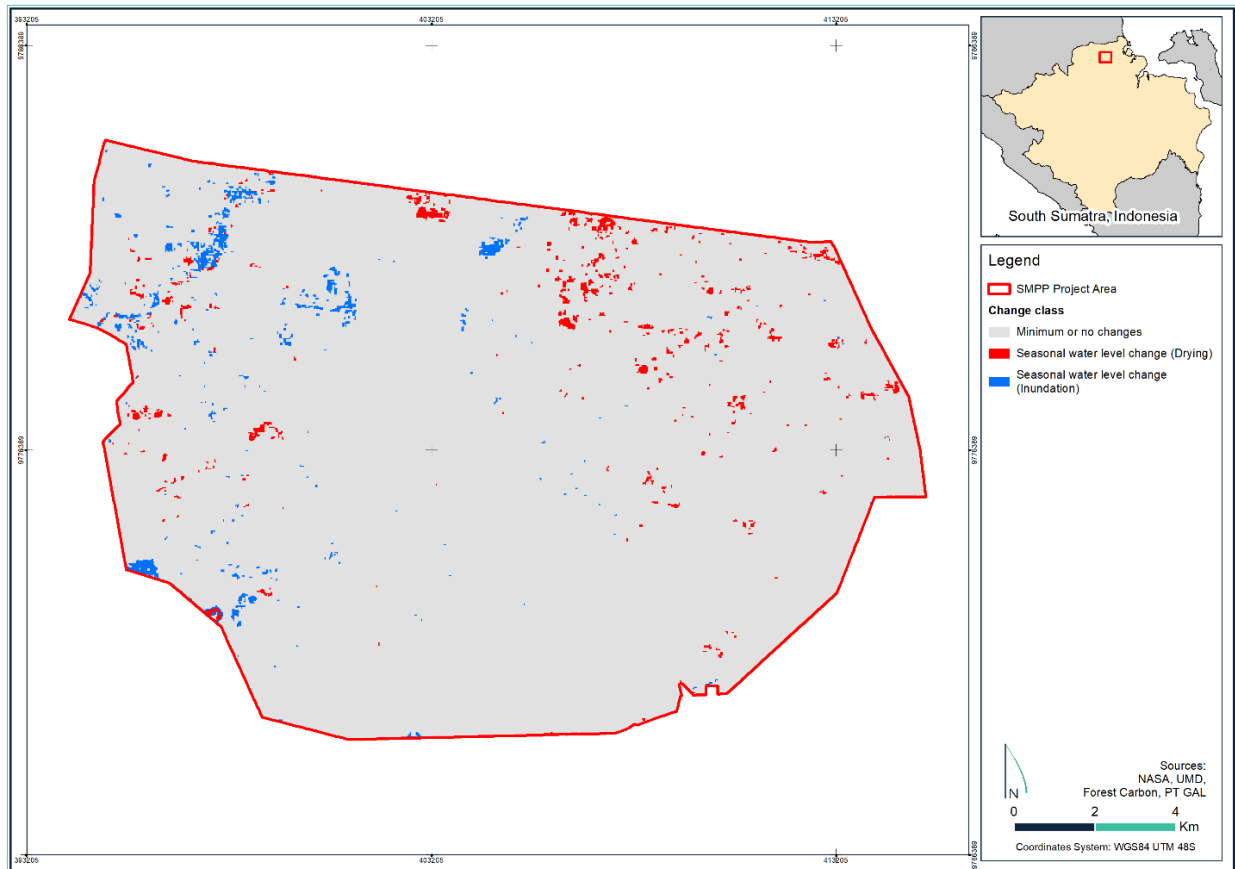
We merged change detection types extracted from the two bands difference images to create a single change detection summary image. The change detection image showed variations in water content related to seasonal changes in different months of the year. The change detection did not identify multiple spatial clusters that would represent potential vegetation shifts from one class to another. We performed visual inspections on all detected changes, cross checking with the original 2018 and 2019 Landsat ARD and Sentinel-2A images when needed to determine the nature of changes.

We identified and summarized two classes of changes:

1. None or minimum changes: a land cover classes that showed none or minimum changes in 2019 compared to 2018. Based on visual inspections of the Landsat ARD and Sentinel images, we detected change clusters that experienced minor water content change and vegetation regrowth, but no shift to other land cover classes.
2. Water content change: this change type included two subtypes, (1) seasonal drying (decrease of water level); and (2) seasonal inundation (increase of water level). These changes occurred when seasonal water level fluctuated, mostly in close proximity to canals and natural river, and in land cover areas of Open Canopy Tree/Shrub/Herb Mix.

The final change detection map merged NDMI and PCA-1 outputs as a harmonized map (Map 10).

Map 10. Final change detection classes.



Map 11 below overlays the 2019 change detection with the 2018 change detection (as detailed in the 2016-2018 monitoring period). It illustrates that changes detected in 2019 carried over the very minor within-class changes from the previous monitoring period.

Map 11: The 2018 change detection classes overlaid with 2019 change detection classes.

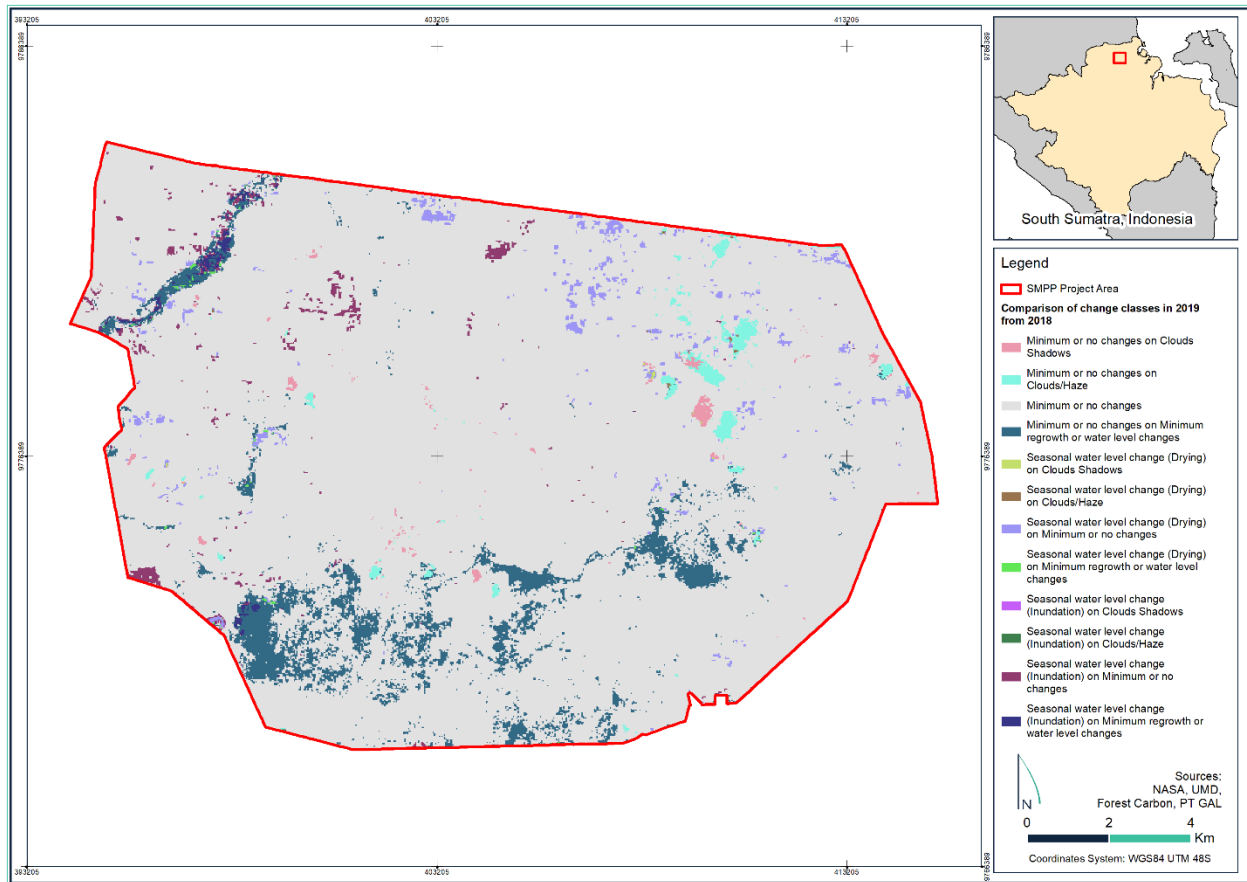


Table 21 below summarizes the percentage area of changes detected in 2019 compared to the previous monitoring period. The regrowth that took place in the land cover class in the previous monitoring period has little or seasonal water content change and has not yet caused a shift from a land cover class to another that would require new activity data to be generated for the purpose of determining emissions characteristics. This analysis verified that the land use designations and area strata used for characterizing emission characteristics in the PD are the same for this monitoring period.

Table 21. Summary of changes compared to the 2018 change detection.

Changes between 2018 to 2019 compared to changes from 2016 to 2018 (by percentage of total project area)					
Change type		2019			Grand Total
		Minimum or No Changes	Seasonal Water Level Change (Drying)	Seasonal Water Level Change (Inundation)	
2016-2018	Cloud Shadows	0.3	-	-	0.3
	Clouds/Haze	0.8	-	-	0.8
	Minimum Regrowth/Water Level Changes	5.1	0.1	0.2	5.4
	Minimum Regrowth/No Changes	91.5	1.1	0.8	93.4
	Total	97.8	1.2	1.0	100

3.2.2.2 Hotspot and Fire Occurrence Screening

We continued to monitor fire occurrences by using both remote sensing data and also ground fire patrol. As outlined in the PD Section 3.2.1.5 for the fire risk probability modeling, annual burnt area estimates, and burn scar depth post-simulation models, we used Moderate Resolution Imaging Spectroradiometer (MODIS) Collection 6 (MCD14DL) at 1-km resolution (hotspots with confidence $\geq 80\%$) and Visible Infrared Imaging Radiometer Suite (VIIRS) at 375-m resolution (hotspots with confidence = High) (VNP14IMGTDL_NRT, available starting in 2012) to determine the presence of fires.²⁵ By reviewing the hotspots in the project area during the monitoring period, we detected one MODIS (confidence $\geq 80\%$) in 2019 (Table 22). However, this was a false hotspot as the field observations reported by the project fire patrolling staff and verified that no uncontrolled or unintentional burning took place in October 2019. A low confidence hotspot detected by VIIRS sensor (Confidence level is 'Nominal') in the project area was verified to be an actual uncontrolled burning event (likely caused by lighting), thus we accounted for the GHG emissions from uncontrolled burning occurred during the monitoring period (see Section 3.2.2.9).

Table 22. Number of MODIS and VIIRS hotspot records detected in the project area in 2019.

Note: Hotspots listed have a high confidence ($\geq 80\%$).

Year/month of MODIS hotspots detected	July	August	September	October	November	Total
2019	0	0	0	1	0	1
Total	0	0	0	1	0	1

Year/month of VIIRS hotspots detected	August	September	October	November	Total
2019	0	0	0	0	0
Total	0	0	0	0	0

3.2.2.3 Emission Characteristics Stratification for WRC Activities Under the Project Scenario

For the project scenario, we stratified the project area based on two land cover classes (forest and non-forest), two drainage statuses (drained and undrained) and one water body class. through a spatially explicit delineation process. A project scenario map is provided in Map 12. The mapping process involved the following steps:

1. Delineation of water bodies:
 - a. Delineation of natural water bodies present at the project start date (i.e. natural river such as Buring river). The natural water body stratum did not change for the entire project period.
 - b. Delineation of secondary and tertiary canals that existed prior to the project start date and did not change for the entire project period. The widths of canals were based on observations from the field and Google Earth high-resolution imagery of the project area.
2. Delineation of drained/undrained areas:
 - a. Following the literature studies of canal proximity impact on peatland (as discussed in Section 3.2.1.3), we employed a conservative approach to assume that areas within a 300-m distance from secondary canals and 150-m distance from tertiary canals would be drained.
 - b. We created a 300-m and 150-m buffer around both sides of the secondary and tertiary canals, respectively, to account for peatland drained at the project start date. The distinction between drained and undrained areas at project start date was taken into account for emission characteristics and calculation.
3. Delineation of forested area:
 - a. Delineation of dense forest at the project start date was based on the land cover classification summarized in PD Section 3.1.3.1.1 and detailed in PD Annex 3.
4. Annual status change:
 - a. As described in PD Section 2.1.11 and detailed in Annex 7, the project plans to construct and implement dense compacted peat dams over canals across the project area in 2019. However, the construction of the 199 dams was only to 52% completed until the end of December, thus the change in water table level will only be used in the next monitoring report. Based on the planned canal blocking locations recommended by Deltares and other biophysical parameters, we constructed hydrological models of water table level at the project start date, and annually until the predicted water table level reached saturation (see details in Annex 6).

For areas delineated as “drained” or “undrained” at project start date (see above), we defined annual rewetting efficacy by calculating the ratio of each year’s water table level increase from the initial WTL over the maximum of total water table level increase as a proxy. This ratio served as basis to adjust emission factors starting in 2019. The hydrological models estimated that maximum water table level was reached in the fifth year since rewetting. Therefore, we predicted all “drained” areas would become “undrained” after 2024. Table 23 and Map 12 below show stratification of the project area based on emission characteristics. Table 24 lists dynamics in strata.

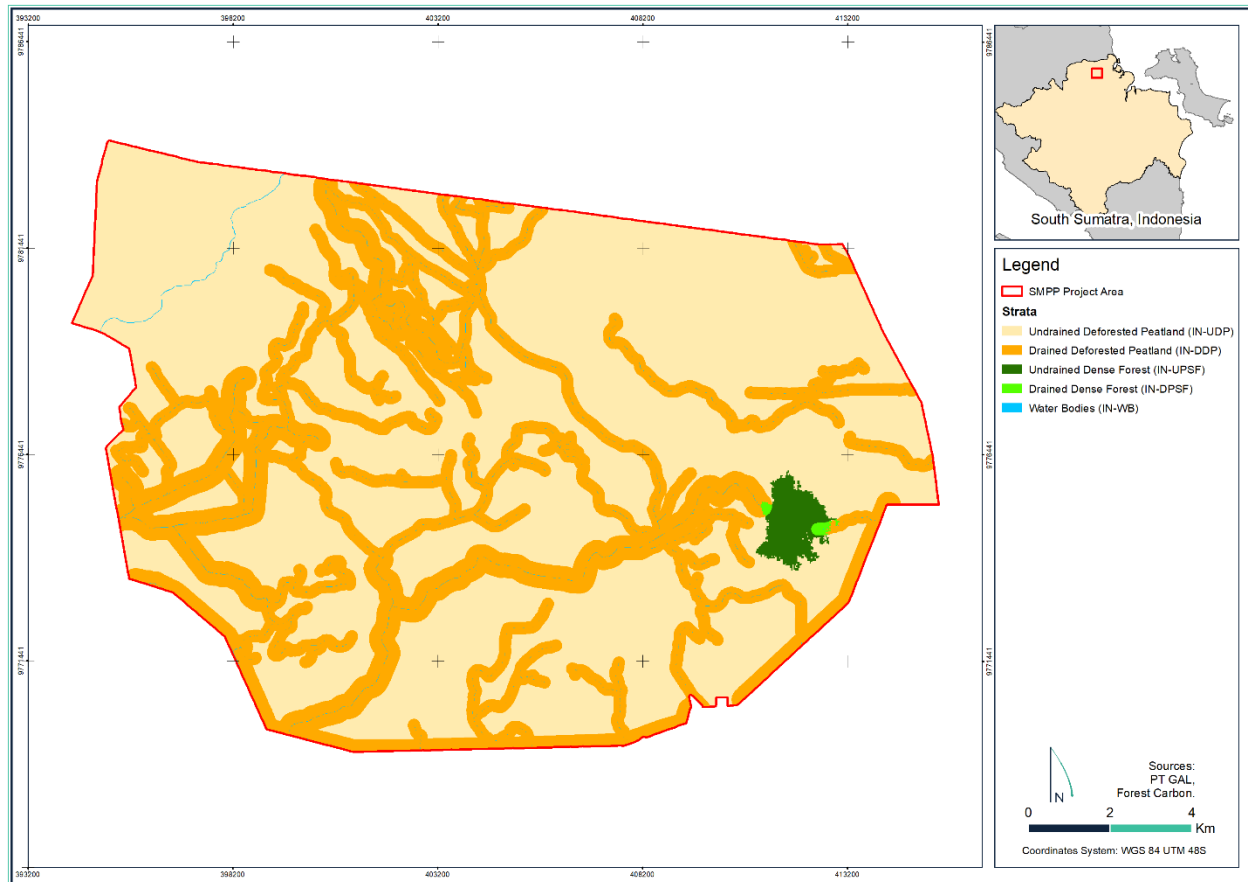
Table 23. Stratification of project area based on emission characteristics from peat and water bodies at project start date.

Strata	Type	Description	Area (ha)	Percentage of project area (%)
IN-UPSF	Undrained Dense Forest	Intact dense forest on undrained peatland	234.08	1.02
IN-DPSF	Drained Dense Forest	Intact dense forest on drained peatland	20.26	0.09
IN-DDP	Drained Deforested Peatland	Mostly open canopy tree/shrub/herb mix and closed canopy tree/shrub/herb mix on drained peatland	15,205.17	66.33
IN-UDP	Undrained Deforested Peatland	Mostly open canopy tree/shrub/herb mix and closed canopy tree/shrub/herb mix on undrained peatland	7,393.59	32.25
IN-WB	Water Bodies	River and secondary or tertiary canals that existed before project start date.	69.30	0.30
Total			22,922.39	100.00

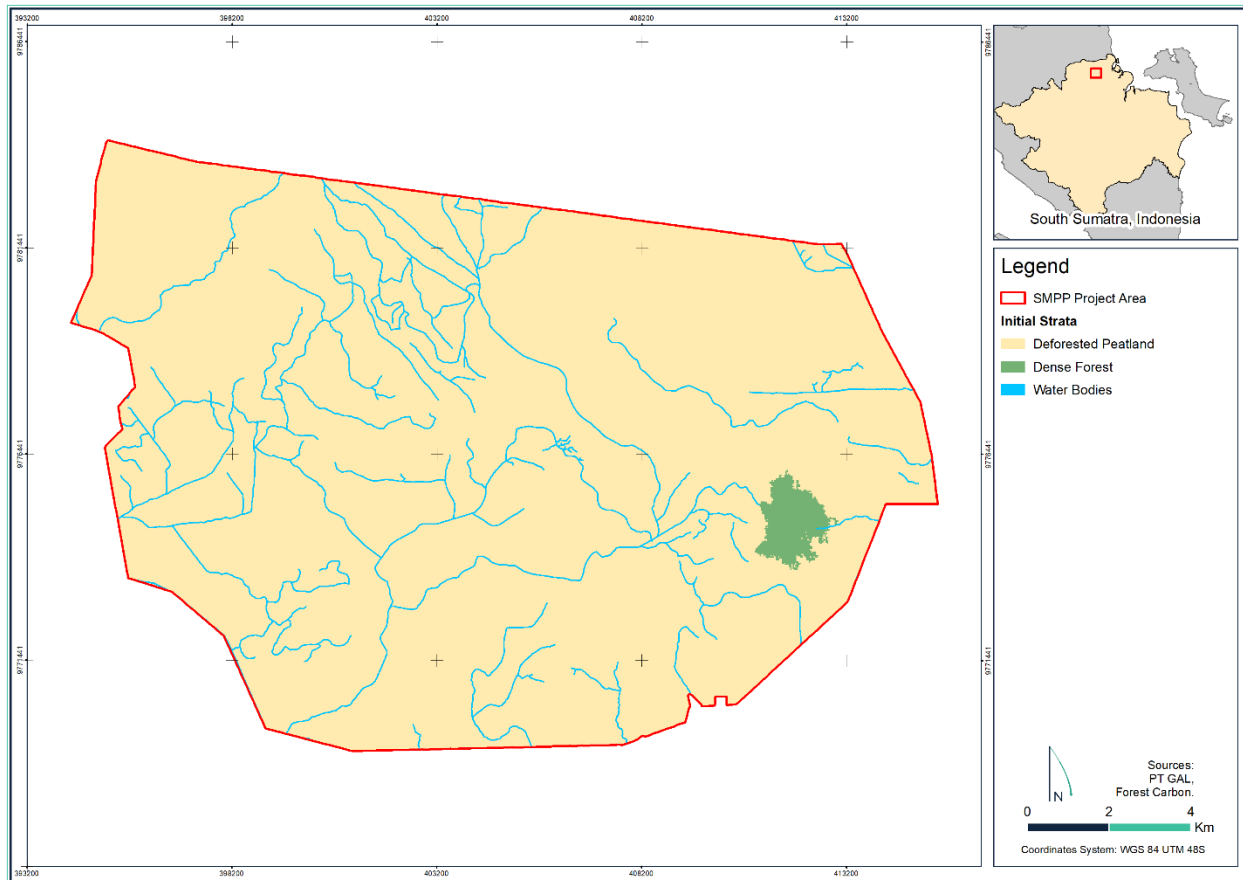
Table 24. Changes in strata based on emission characteristics from peat and water bodies in the project scenario.

Strata transition	Description	Area (ha)	Activity description
IN-DDP → PS-UDP	Deforested peatland (drained) to Deforested peatland (undrained)	7,393.59	Rewetting from canal blocking activities will be effective from 2019 onwards.
IN-DPSF → PS-UPSF	Dense Forest (drained) to Dense Forest (undrained)	20.26	
IN-UDP → PS-UDP	Deforested peatland (undrained) to Deforested peatland (undrained)	15,205.17	Various project activities will facilitate natural regeneration from non-forest vegetation to forest.
IN-UPSF → PS-UPSF	Dense Forest (undrained) to Dense Forest (undrained)	234.08	
IN-WB → PS-WB	Water bodies to water bodies	69.30	

Map 12. Initial stratification based on emission characteristics for WRC.



Map 13. Strata changes in the project scenario.



We will collect site-specific hydrological monitoring data to predict spatially and temporally explicit estimates of water table level and flow under the project scenario. Sufficient direct measurements from the field will serve as a proxy to calculate GHG emissions. Rewetting efficacy may change for the strata with the most dynamic water table levels (rewetted strata drained at project start date). The hydrological monitoring plan is detailed in Annex 7.

Together, land cover stratification based on updated land cover classification and change detection from remote sensing imagery and site-specific emission proxies will be used to re-stratify non-forest, if any changes occur. Strata with less dynamic water table levels (undrained forest stratum at project start date) will not be re-stratified (unless significant changes in emission characteristics are observed) and GHG quantification method remains unchanged.

3.2.2.4 Emission Characteristics Stratification for ARR Activities Under the Project Scenario

Although the project activities will include reforestation (nursery and replanting, see PD Section 2.1.11), for delineating ARR emission characteristics we only accounted for natural regeneration of vegetation. The eligible area for ARR crediting is all the non-forest areas where the project activities would carry out activities to facilitate natural regeneration of vegetation, including rewetting, fire avoidance, etc. Based on the spatial analysis, the area eligible for crediting from ARR activities is 20,601.37 ha, as shown in PD Section 3.1.3.1.7.

3.2.2.5 Emissions from Peat and Water Bodies (WRC)

The 2016 land cover classification (detailed in PD Annex 3) and water body data collected by PT GAL served as a basis for developing strata for WRC activities (see PD Table 38).

The strata for the project scenario analysis include:

1. Drained forested peatland;
2. Undrained forested peatland;
3. Drained non-forested peatland;
4. Undrained non-forested peatland; and
5. Water bodies.

We then quantified the GHG emissions from microbial decomposition of peat and DOC loss through water bodies in peatlands on spatial and temporal scales.

3.2.2.6 Spatial and Temporal Variability

Each stratum in the project scenario in Table 23 consisted of small units of parcels in combinations of the spatial variables described in Table 25. Temporal variability in project emissions was based on annual time steps. Table 25 outlines the variables that determined strata changes, temporal variability of GHG emission factors, and restrictions to GHG emissions. We accounted for spatial and temporal scales with our GHG emission factors.

Table 25. Variables used in the schematization of quantification of GHG emissions from microbial decomposition of peat and dissolved organic carbon from water bodies in peatlands in the project scenario.

Variables	Description
(A) Spatial Variables	
(A1) Soil Type	Distinction between peat or non-peat. This was used to exclude all non-peat parcels from GHG calculation. 99.99% of the project area has predicted peat depth ≥ 50 cm.
(A2) Initial peat thickness available for microbial decomposition and burnings	Derived from DEM, DEL and Peat Thickness maps as described in Sub-subsection 3.1.3.1.4 of the PD. These maps were used to determine the initial condition for subsequent calculations of the remaining peat layer available for microbial decomposition.
(A3) Initial stratum	Stratum of the corresponding parcel at the project start date (as derived in Annex 9) before change into rewetted stratum takes effect. This was used to determine the correct emission factor for the corresponding parcel for the duration before B1 and B2 (in this table, below) take effect.
(B) Temporal Variables	
(B1) Year of rewetting	Determines the onset of conversion from initial stratum to rewetted stratum and sets the drainage related parameter, i.e. emission factor for the corresponding parcel.
(B2) PDT	The PDT is the period of time that it takes to deplete the remaining peat layer by microbial decomposition. Once the PDT is reached in a given stratum all GHG emissions in that stratum are set to zero.

3.2.2.6.1 Emission Calculations

We estimated the net CO₂-equivalent emissions from the peat microbial decomposition and water bodies for each parcel, spatially and temporally explicitly as detailed in Table 23 and Table 24. Using the procedures provided in Module BL-PEAT and Module M-PEAT, we eliminated the term $E_{peatburn-WPS,i,t}$ and established the equation (14):

$$GHG_{WPS-WRC} = \sum_{t=1}^{t^*} \sum_{i=1}^M (E_{peatsoil-WPS,i,t} + E_{peatburn-WPS,i,t} + E_{peatditch-WPS,i,t}) \quad (14)$$

Where:

$GHG_{WPS-WRC}$	Net CO ₂ equivalent peat GHG emissions in the project scenario up to year t^* (t CO ₂ -e)
$E_{peatsoil-WPS,i,t}$	GHG emissions from microbial decomposition of the peat soil within the project boundary in the project scenario in stratum i in year t (t CO ₂ -e yr ⁻¹)
$E_{peatburn-WPS,i,t}$	GHG emissions due to peat burning under project scenario in stratum i in year t of each GHG (CO ₂ , CH ₄) (t CO ₂ -e yr ⁻¹)
$E_{peatditch-WPS,i,t}$	GHG emissions from water bodies within the project boundary in the project scenario in stratum i in year t (t CO ₂ -e yr ⁻¹)
i	1, 2, 3, ... M strata
t	1, 2, 3, ... t^* time elapsed since the start of the project activity (years)

Our procedures for quantifying the dynamics of carbon stock and peat losses are similar to those applied in the baseline scenario (see section 3.2.1.5.1). The only differences include stratification, temporal sequence of strata change, and the assumed absence of peat burning.

GHG emissions from peat soils, and water bodies are elaborated in detail in section 3.2.2.6. A summary of the quantified GHG emissions from peat microbial decomposition, uncontrolled peat burning and water bodies under the project scenario are presented in Table 26.

Table 26. A summary of the annual GHG emissions from peat and water bodies under the project scenario in 2019.

Year	CO ₂ from peat microbial decomposition (t CO ₂ -e ha ⁻¹ yr ⁻¹)	CH ₄ from peat microbial decomposition (t CO ₂ -e ha ⁻¹ yr ⁻¹)	Emissions (CO ₂ and CH ₄) from uncontrolled burning (t CO ₂ -e ha ⁻¹ yr ⁻¹)	CO ₂ -e from DOC (t CO ₂ -e yr ⁻¹)	Total (t CO ₂ -e ha ⁻¹ yr ⁻¹)
2019	227,767	11,106	1,319	145	240,337

3.2.2.6.2 Subsidence Related to Microbial Decomposition of Peat

As no drainage would take place in the project scenario, there would be no initial compaction. Similarly, we assumed no burning in the project period, and therefore there would not be any peat loss from peat fires. The annual peat loss rates in the project scenario equal the subsidence rate and are calculated using the equation (15):

$$Rate_{peatloss-WPS,i,t} = Sub_{i,t} \quad (15)$$

Where:

$Rate_{peatloss-WPS,i,t}$	Rate of peat loss due to microbial decomposition in project scenario of stratum i at year t (m yr ⁻¹)
$Sub_{i,t}$	Subsidence rate in stratum i in year t (m)

i	1, 2, 3, ... M_L strata in the project scenario (unitless)
t	1, 2, 3, ... t^* time elapsed since the project start (yr)

We assessed the remaining peat depth annually for the project period based on the rate of peat loss due to microbial decomposition using equation (16):

$$Depth_{peat-WPS,i,t^*} = Depth_{peat-WPS,i,t_0} - \sum_{t=1}^{t^*} Rate_{peatloss-WPS,i,t} \quad (16)$$

Where:

$Depth_{peat-WPS,i,t^*}$	Remaining peat thickness in the project scenario in stratum i at year t^* (m)
$Depth_{peat-WPS,i,t_0}$	Peat thickness at the project scenario in stratum i at year t_0 = project start date (initial peat thickness) (m)
$Rate_{peatloss-WPS,i,t}$	Rate of peat loss due (subsidence) due to microbial decomposition of peat in the project scenario in stratum i in year t (m yr ⁻¹)
i	1, 2, 3, ... M_L strata in the project scenario (unitless)
t	1, 2, 3, ... t^* time elapsed since the project start (yr)

By tracking annual peat thickness estimated in the project scenario, we assured that no GHG emissions would be accounted for within any parcel of each stratum, once the available carbon stock/peat has been depleted.

3.2.2.7 Emissions from Microbial Decomposition of Peat

We calculated the project GHG emissions for different emission strata using the conservative and scientifically robust (TIER 1) IPCC default emission factors for each stratum i (Annex 10 on Emission Factors), following the equations defined by the VCS methodology VM0007 Module M-PEAT (17):

$$E_{peatsoil-WPS,i,t} = E_{CO_2-WPS,i,t} + E_{CH_4-WPS,i,t} \quad (17)$$

Where:

$E_{CO_2-WPS,i,t}$	CO ₂ emissions from the peat soil within the project boundary in the project scenario in stratum i at year t (t CO ₂ -e yr ⁻¹)
$E_{CH_4-WPS,i,t}$	CH ₄ emissions from the peat soil within the project boundary in the project scenario in stratum i at year t (t CO ₂ -e 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 (yr)

For each stratum, the CO₂ emissions from microbial decomposition of the peat within the project boundary are calculated by using the equation (18):

$$E_{peatsoil-WPS,CO_2,i,t} = A_{i,t} \times EF_{CO_2,i,t} \quad (18)$$

Where:

$E_{peatsoil-WPS,CO_2,i,t}$	CO ₂ emissions from the peat soil within the project boundary in the project scenario in stratum i at year t (t CO ₂ -e yr ⁻¹)
$EF_{CO_2,i,t}$	Emission factor for CO ₂ emissions corresponds to each stratum i , as provided by IPCC (t CO ₂ -e yr ⁻¹)
$A_{i,t}$	Area of stratum i at time t (ha)
i	1, 2, 3, ... M_{WPS} strata in the project scenario (unitless)

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

For each stratum, the CH₄ emission from the peat soil within the project boundary are calculated by using the equation (19):

$$E_{peatsoil-WPS,CH_4,i,t} = A_{i,t} \times GWP_{CH_4} \times EF_{CH_4,i,t} \quad (19)$$

Where:

$E_{peatsoil-WPS,CH_4,i,t}$ CH₄ emissions from the peat soil within the project boundary in the project scenario in stratum i at year t (t CO₂-e yr⁻¹)

$EF_{CH_4,i,t}$ Emission factor for CH₄ emissions corresponds to each stratum i , as provided by IPCC (t CO₂-e ha⁻¹ yr⁻¹)

$A_{i,t}$ Area of stratum i at time t (ha)

GWP_{CH_4} Global Warming Potential for CH₄

i 1, 2, 3, ... M_{WPS} strata in the project scenario (unitless)

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

Table 27 below provides details on the WRC related project emission factors and stratification.

Table 27. The stratification used for the calculation of GHG emissions per stratum, the area per each stratum and the CO₂ and CH₄ default factors used for the specific land-use.

Strata	Type	Description	Area (ha)	Percentage of project area (%)
PS-UPSF	Undrained Dense Forest	Intact dense forest on undrained peatland	234.08	1.02
PS-DPSF	Drained Dense Forest	Intact dense forest on drained peatland	20.26	0.09
PS-DDP	Drained Deforested Peatland	Mostly open canopy tree/shrub/herb mix and closed canopy tree/shrub/herb mix on drained peatland	7,393.59	32.25
PS-UDP	Undrained Deforested Peatland	Mostly open canopy tree/shrub/herb mix and closed canopy tree/shrub/herb mix on undrained peatland	15,205.17	66.33
PS-WB	Water Bodies	River and secondary or tertiary canals that existed before project start date.	69.30	0.30
Total			22,922.39	100

3.2.2.7.1 Current projections for project emissions at the start of the project

With sufficient long-term, field-based measurements of peat-related emissions not yet available for estimating the overall emissions, GHG emission factors provided in Annex 10 were used as a conservative approach. The effect of rewetting was taken into account by multiplying the emission factor for each stratum by an efficacy factor derived from the annual water table changes predicted by the hydrological models (for details see Annex 6). As stated earlier, the model predicted that complete rewetting will be achieved in 2024, five years after the completed dam construction. We further assumed that once the carbon stock in

the vegetation is equal to the carbon stock of secondary peat swap forest,²⁶ the emission profile changes from the PS-UCP stratum to the PS-UPSF stratum.

Projected annual GHG emissions from microbial decomposition of peat is shown in Table 28.

Table 28. GHG emissions from microbial decomposition of peat in the project scenario.

Year	CO ₂ from peat microbial decomposition (t CO ₂ -e ha ⁻¹ yr ⁻¹)	CH ₄ from peat microbial decomposition (t CO ₂ -e ha ⁻¹ yr ⁻¹)	Total (t CO ₂ -e ha ⁻¹ yr ⁻¹)
2019	227,767	11,106	238,873

3.2.2.7.2 Future approaches for calculating project emissions

To determine carbon and GHG fluxes from peat microbial decomposition in the project scenario, we will take approaches with varying levels of resolution (IPCC TIER 1 – TIER 3).²⁰ Throughout project implementation, we will conduct measurements in the field (IPCC TIER 2 and TIER 3) and collect data to reduce emission uncertainties and account for spatial and temporal variation in the water tables.²⁰

We will develop site-specific TIER 3 emission factors (in 2020) and apply these to estimate project emissions. These methods work together to thoroughly reduce uncertainty (see Annex 13).

We began initial, preliminary water table level monitoring in the project area in 2018 and will expand to the whole project area in 2019 following canal blocking implementation (see Annex 7). Monitoring of all variables will be continued throughout 47-year project duration.

3.2.2.8 Emissions from water bodies in peatlands

3.2.2.8.1 Current projections for project emissions

The water bodies present in the project scenario are rivers and pre-existing drainage canals. The project emissions from DOC are shown in Table 29. As a conservative estimate both water bodies are treated the same, and the DOC IPCC default factor for natural water bodies was applied using the equation (20):

$$E_{peatditch-WPS,t} = A_{ditch-WPS,t} \times EF_{DOC-WPS} \quad (20)$$

Where:

$E_{peatditch-WPS,i,t}$	GHG emissions from canals and other open water at year t in the project scenario (t CO ₂ -e ha ⁻¹ yr ⁻¹)
$A_{ditch-WPS,i,t}$	Total area of canals and other open water at year t in the project scenario (ha)
$EF_{DOC-WPS,i}$	IPCC emission factor for Dissolved Organic Carbon from canal and open in the project scenario (t CO ₂ -e ha ⁻¹ yr ⁻¹)
t	1, 2, 3, ... t time elapsed since the start of the project activity (years)

Table 29. GHG emissions from Dissolved Organic Carbon in water bodies in the project scenario in 2019.

Year	CO ₂ -e from DOC (t CO ₂ -e y ⁻¹)
2019	145

3.2.2.8.2 Future approaches for calculating project emissions

In 2020 either CO₂ and CH₄ or DOC measurements from water bodies will be carried out and site-specific emission factors will be developed. GHG emission estimates from water bodies will be re-assessed annually during the project period. Any change in the area of open water will be taken into account if it significantly influences project GHG emissions.

3.2.2.9 Emissions from uncontrolled burning

We are implementing a variety of project activities to address burning, such as peatland rewetting and best-practice fire management, with goals of zero burning, fire control, and fire prevention (PD Section 2.1.11).

We have operated consistent fire patrols since the start of the SMPP, and we also have an online satellite-based early warning system (EWS) in place to detect possible fires as quickly as possible. If uncontrolled burning does occur in the SMPP during the project period, we map the area of the fire scar and the burn scar depth soon after the burning event. We have compiled historical tracking of hotspots and direct observation data in the project area to determine the repetition of burning in the SMPP. We will quantify equivalent GHG emissions from uncontrolled burning and deduct these from our emission reductions.

In addition, we calculate GHG emissions that result from peat burning using dry mass loss based on burn scars, depth, bulk density of peat, combustion factors, and GHG potential of GHG species. We determine GHG emissions from biomass loss from burning using land cover type, combustion factors, and GHG potential of GHG species. Bulk density of peat is assumed constant throughout the project period and was found to be relatively homogeneous throughout horizontal and vertical peat soil profiles (Annex 4).

In cases where there were repeated burns within the SMPP, scar depths of the 1st, 2nd, 3rd, 4th, and subsequent burnings are assumed as 0.17 cm, 0.1 cm, 0.06 cm, and 0.02 cm, respectively. The detailed parameters we used to quantify GHG emissions from uncontrolled burning are given in Annex 10.

To quantify GHG emissions from uncontrolled peat burnings, we followed procedures in the VCS methodology VM0007 Module E-BPB using the following equation (21):

$$E_{peatburn-WPS,i,t} = \sum_{g=1}^G \left((A_{peatburn-WPS,i,t} \times P_{WPS,i,t} \times P_{WPS,g,i}) \times 10^{-3} \right) \times GWP_g \quad (21)$$

Where:

$E_{peatburn-WPS,i,t}$	GHG emissions due to peat burning under project scenario in stratum i in year t of each GHG (CO ₂ , CH ₄) (t CO ₂ -e)
$A_{peatburn-WPS,i,t}$	Area peat burnt under project scenario in stratum i in year t (ha)
$P_{WPS,i,t}$	Average mass of peat burnt under project scenario in stratum i , year t (t DM ha ⁻¹)
$G_{g,i}$	Emission factor in stratum i for gas g (kg t ⁻¹ DM burnt)
GWP_g	Global warming potential for gas g (t CO ₂ t ⁻¹ g ⁻¹)
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)

We estimated the average mass of peat burnt for a particular stratum using the equation (22):

$$P_{WPS,i,t} = D_{peatburn-WPS,i,t} \times BD_{upper} \times 10^{-4} \quad (22)$$

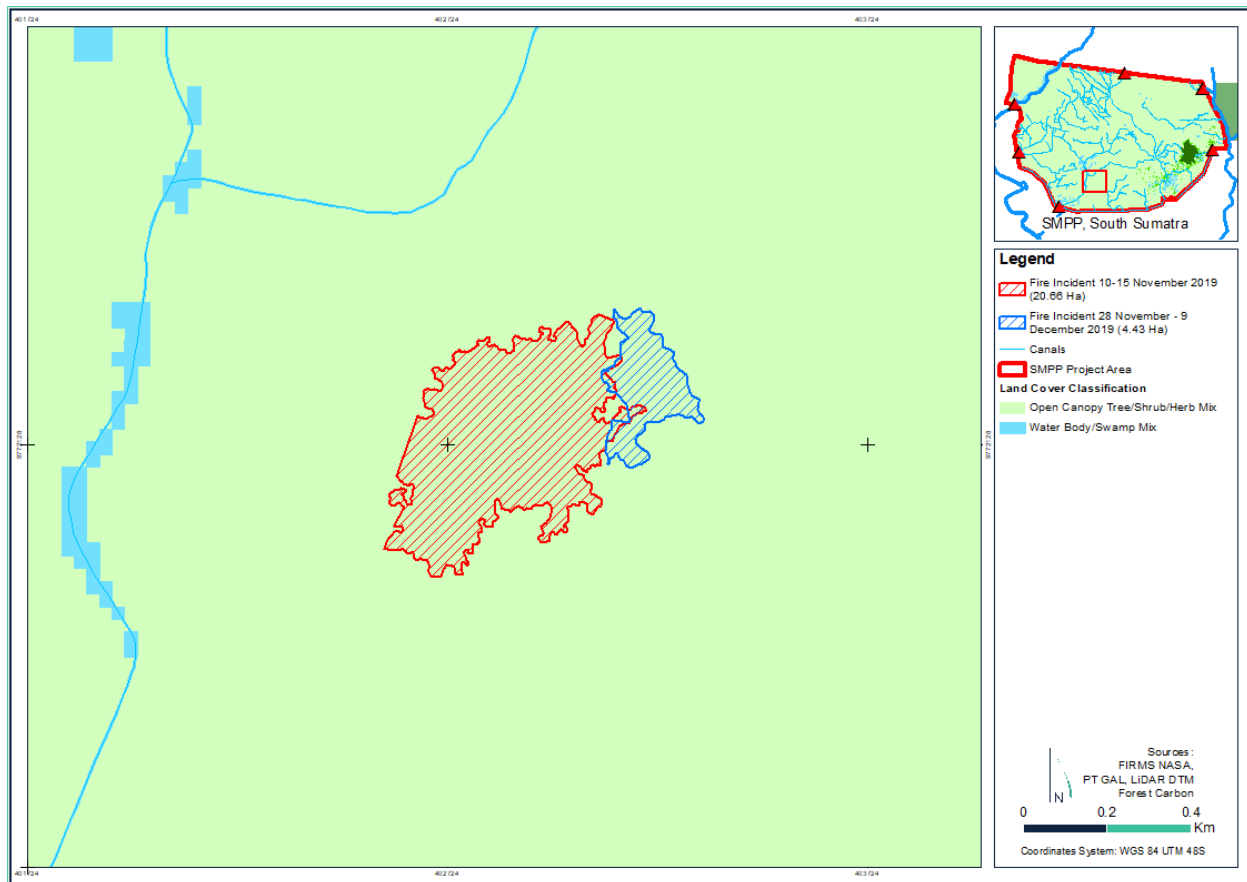
Where:

$P_{WPS,i,t}$	Average mass of peat burnt under project scenario in stratum i , year t (t DM ha ⁻¹)
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$D_{\text{peatburn-WPS},i,t}$	Average burn scar depth under project scenario in stratum i in year t (m)
$BD_{\text{upper},i}$	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)

Between the 10th – 15th and 28th of November – 9th of December 2019 fires occurred inside the project area, likely caused by lightning, because no evidence of human interaction was found in the area, and the only access to that particular project area was through the main camp which is closely monitored. There were also reports of lightning throughout the nights. The project's fires early warning system successfully identified the fires and using field observations from drones the fires were quickly identified, extinguished within one day and followed by a multiple day soil cooling period by the Fire Response and Suppression (FRS) team. The fires burnt a total of 24.93 ha of non-forest shrub vegetation (Map 14).

Map 14. Fire events inside the project area on the 10th – 15th of November and 28th of November – 9th of December 2019.



The fire resulted in 1,319 t CO₂-e or 0.08 % of the previously verified emission reductions of the project. However, no loss event occurred (as defined as the loss of > 5% of the previously verified ERs), and thus no loss report needs to be issued. We account for the fire emissions in the MR under emissions from uncontrolled burning in the project scenario (Table 30).

Table 30. GHG emissions from uncontrolled burning in the project scenario.

Parameter	Value
EF CO ₂ (4+ burning, t CO ₂ -e)	48.28
EF CH ₄ (4+ burning, t CO ₂ -e)	4.62
Area (ha)	24.93
CO ₂ Emissions (t CO ₂ -e)	1,203.52
CH ₄ Emissions (t CO ₂ -e)	115.15
Total Emissions (t CO ₂ -e)	1,318.67
Previously verified ER (2016-2018)	1,749,688
Percentage burn event of total	0.08%

3.2.2.10 Project Emissions from ARR Activities

As stated under Sub-section PD 1.1.2.3 the project activities will include reforestation (nursery and replanting, see PD Section 2.1.11), however for delineating ARR emission characteristics we only accounted for the natural regeneration of vegetation.

All ex-ante GHG emissions and removals follow Module M-ARR in the AR-ACM0003 procedures for afforestation and reforestation lands. Net GHG removals under the ARR project scenario up to time t^* ; t CO₂-e ($\Delta C_{WPS-ARR}$) equal the summation from $t = 1$ to t^* of the baseline net GHG removals by sinks in year t ; (ΔC) in AR-ACM0003. We assume that non-CO₂ GHG emissions under the project scenario are zero, and shrubs, dead wood, and litter are not significant in the C pool calculations.

Net GHG emission related to WRC activities in the project scenario in ARR area (GHGWPS-WRC) are presented separately in the peat Section 5.3.1. Net GHG removals under the ARR project scenario are calculated using the equation (23):

$$\Delta C_{WPS-ARR} = \sum_{t=1}^{t^*} (\Delta C_{ACTUAL,i,ACM0003}) = \sum_{t=1}^{t^*} (\Delta C_{TREE,PROJ,t}) \quad (23)$$

Where:

$\Delta C_{WPS-ARR}$	Net GHG removals under the ARR project scenario up to time t ; t CO ₂ -e
$\Delta C_{ACTUAL,t,ACM0003}$	Actual net GHG removal by sinks in year t (from AR-ACM0003) (t CO ₂ -e)
$C_{TREE,PROJ,t}$	Change in carbon stock in tree biomass in project, in year t : t CO ₂ -e
i	1, 2, 3, ... M strata
t	1, 2, 3, ... t^* time since project start

IPCC default factors for annual C stock increment were used in the calculation (see Annex 10). Cumulative net GHG removals related to ARR activities in the project scenario within the project period were estimated to be 6,894,688 t CO₂-e. Annual GHG removals within the monitoring period are shown in Table 31 below. Changes in carbon stock in the project scenario are not accounted for in the first four years of the project, as an AGB inventory will only be implemented in 2020. As such, this will represent the first year from which actual gains can be monitored and accounted for. The project will conduct annual inventories from 2020 onwards.

Table 31. Project scenario net GHG removals by ARR activity within the project period in 2019.

Year	Change in carbon stocks in the ARR area (tCO ₂ -e)
2019	N/A

3.2.3 Leakage

We determined leakage according to the requirements in Module LK-ASP in the VCS methodology VM0007 REDD+ MF. As expressed in Section 3.2.1, baseline scenario activity in the SMPP includes planned conversion to industrial Acacia plantations and resulting peatland drainage. Our project activities combine Avoiding Planned Deforestation (APD), Reforestation (ARR), in combination with Conservation of Undrained and Partially drained Peatland (CUPP) and Rewetting of Drained Peatland (RDP).

Accordingly, we may see potential sources of leakage emissions from displacement of planned deforestation activities and pre-project activities on non-forest land. These potential sources and the corresponding applicable modules for quantifying total leakage emissions are listed in PD Section 3.1.2 and Table 32 below.

Table 32. 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.
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 (LK-ASP)

Activity shifting leakage was monitored against the leakage baseline defined in the PD Section 3.2.3. As per the methodology, and the steps defined in the PD, “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 PD Section 3.2.3.1), using the following methods.

In our PD Section 3.2.3.1, based on a historical trend of licensed HTI concessions in the country for the period 2006-2015, we estimated an additional 489,073 ha of land per year would be licensed for HTIs. However, the published statistics from the Ministry of Environment and Forestry (MoE&F) showed that in 2016 licensed HTI concessions only increased by 142,132.44 ha (from 10,700,842.33 ha in 2015 to 10,842,974.77 ha in 2016). In 2017 licensed HTI concessions increased by 335,626.68 ha (from

10,842,974.77 ha in 2016 to 11,178,601.45 ha in 2017)²⁷. In 2018 licensed HTI concessions increased by 836.13 ha (from 11,178,601.43 ha in 2017 to 11,180,437.58 ha in 2018). In 2019 licensed HTI concessions increased by 125,753.16 ha (from 11,180,437.58 ha in 2018 to 11,306,190.74 ha in 2019). This indicated that deforestation in the absence of the project ($WoPR_{i,t}$ in PD Section 3.2.3.1) and the new area of annual deforestation ($NewR_{i,t}$ in PD Section 3.2.3.1) calculated using the government statistics data was lower than the baseline estimates set in the PD (Table 33 below).

Table 33. Comparison between the estimated and the actual parameters in 2016-2019.

Year	Area licensed (ha)	$WoPR_{i,t}$	$NewR_{i,t}$
Estimated parameters set as the baseline in PD			
2016	11,560,796.98	816,770.31	815,150.84
2017	12,049,870.47	851,323.35	849,703.88
2018	12,538,943.97	885,876.39	884,256.92
2019	13,028,017.46	920,429.43	918,809.97
Actual parameters based on government statistics of licensed areas			
2016	10,842,974.77	766,056.17	764,436.70
2017	11,178,601.45	789,768.19	788,148.72
2018	11,180,437.58	789,897.92	788,278.45
2019	11,306,190.74	798,782.38	797,162.91

The above non-spatial comparison suggested that the actual deforestation caused by baseline class of agents in this monitoring period would be lower than the PD estimates. To provide continuous and spatially explicit quantification for this monitoring period as summarized below, we obtained and compiled the most up-to-date and available datasets on licensed HTI concession boundaries (i.e. Acacia and other industrial-level HTI types, or HTI unspecified that could include Acacia) and its subset of HTI-wood fiber (i.e. pulp wood including Acacia) in Indonesia. These HTI-wood fiber and HTI concession boundaries were compiled from the 2018 datasets of the Greenpeace and SystemIQ, as the official government datasets are not available.²⁸ The datasets contain the spatial delineation of concessions, the year of granted license for each, and the company that owns it (if known). In some cases where the concession date is not available, we assumed conservatively that they were granted prior to 2015, so that any deforestation was included in the PD calculation of $NewR_{i,t}$. One of the long existing challenges in Indonesia's land use management and spatial planning has been the incomplete, inconsistent, mismatched and outdated concession boundaries, as observed in the acquired HTI-wood fiber and HTI concession boundaries. Prior to the analysis, we examined all the boundaries to remove topology errors and spatial overlap between neighboring parcels.

We quantified annual area deforested throughout all HTI-wood fiber and HTI concessions during the monitoring period by using remote sensing data. Official land use land cover data from the MoE&F only covered 2016-2017, and the draft 2018 map has not yet made available. Therefore, we used the best and most accurate global dataset available from the Global Forest Change derived by the University of Maryland.^{29,30} This dataset is a proxy as it quantifies tree cover loss, thereby not differentiating harvesting/replanting rotation cycles within a plantation. Therefore, our approach to use this dataset was conservative as a plantation's rotation cycle might have been considered deforestation. We then extracted all the HTI-wood fiber and HTI concession boundaries to quantify the annual deforested area (i.e. tree cover loss detected from this dataset) throughout the monitoring period.

We determined areas of deforestation and leakage using the equation below, as prescribed in module LK-ASP. The actual area of deforestation attributable to peatland and non-peatland areas in HTI-wood fiber and HTI concessions was based on spatial analysis using the 2008 national peatland distribution data.³¹ The allocation of projected $NewR_{i,t}$ on peatland and non-peatland followed the summary described in the PD Section 3.2.3.1, whereby we proportionally allocated 24.65% to peatland and 75.35% to non-peatland.

We used the equation 24 below for calculating the difference between deforestation occurred in HTIs and estimated as $NewR_{i,t}$, and summarized results 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. Leakage calculations as occurred in HTI concessions (ha). Values in parentheses = deforestation detected in HTI-wood fiber concessions.

	HTI concessions (ha)		PD estimated $NewR_{i,t}$ (ha)		$LKA_{planned}$	
Year	Peat	Non-peat	Peat	Non-peat	Peat	Non-peat
2016	118,975.02 (54,381.03)	272,188.58 (179,349.71)	200,934.68	614,216.16	-81,959.66	-342,027.58
2017	50,997.80 (14,944.69)	158,280.05 (105,922.39)	209,452.01	640,251.87	-158,454.21	-481,971.82
2018	28,498.48 (9,878.08)	143,829.03 (96,436.69)	217,969.33	666,287.59	-189,470.85	-522,458.56
2019	40,706.73 (26,009.30)	124,432.14 (79,505.11)	226,486.66	692,323.31	-159,770.63	-488,386.06

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

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 CDM tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” area. 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. In the areas identified for ARR activities, the SMPP project area did not have any pre-project agricultural activities taking place within the project area. As a result, no pre-project agricultural activities will be displaced by ARR project activities, and hence $Change_C_LK-ARR = 0$.

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

During this monitoring period the project did not implement rewetting activities. Therefore, the ecological leakage (LK-ECO) is zero. We will monitor the effectiveness of rewetting activities to confirm that no ecological leakage is occurring at each future monitoring event, by installing monitoring dip wells within the vicinity of canal block positions inside and bordering the project area (see details in Annex 7).

3.2.4 Net GHG Emission Reductions and Removals

This section provides an overview of total net emission reductions and details activity specific calculations in the subsections. We calculated Net GHG emission reductions as the sum of total net GHG emission reductions of the WRC project activity and total net GHG removals of the ARR project activity (25).

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

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)

3.2.4.1 Uncertainty Analysis

Using Module X-UNC as a guideline, we calculated WRC uncertainty of the SMPP in both the baseline and project scenarios. Our project does not have a REDD component, so REDD uncertainty calculations were not necessary. We modified the X-UNC equation (21) to the following equation (26):

$$NER_{REDD+ERROR} = \frac{\sqrt{(Uncertainty_{WRCBSL,t^*} \times GHG_{BSL-WRC,t^*})^2 + (Uncertainty_{WRC,WPS,t^*} \times GHG_{WPS-WRC,t^*})^2}}{(GHG_{BSL-WRC,t^*} + GHG_{WPS-WRC,t^*})} \quad (26)$$

We calculated CO₂ and CH₄ emission uncertainties from microbial decomposition of peat and dissolved organic carbon (DOC) from water bodies in the baseline and project scenarios, using the standard error data from the peat emission factors in the IPCC Wetlands Supplement 2013 (see Annex 10).²⁰ We established that CH₄ emission uncertainty was zero, as it was conservatively excluded from our emission calculations. We also established that uncertainty from GHG emissions from peat burning was also zero in the project scenario, as we assumed full fire prevention in the project area. However, we calculated uncertainty from GHG emissions from peat burning in the baseline using the dry mass burnt per stratum per year and their standard deviations converted to 95% confidence intervals. We combined emissions data from CO₂ and CH₄ burning to produce an overall uncertainty in CO₂ equivalent, because Module X-UNC does not distinguish between these emissions.

We calculated the uncertainty for WRC in 2019 as 13.98%, and 1.98%, for the baseline and project scenario, respectively. This resulted in a total error in this project activity at 11.01%. Assuming a threshold of 15% uncertainty, no deduction of VCUs was necessary. Further details on all calculations are provided in Annex 13.

3.2.4.2 Total net GHG emission reductions of the WRC project activity

We calculated net GHG emission reductions related to WRC project activities by subtracting project emissions and emissions due to leakage from baseline emissions (see Table 35).

Table 35. Total net GHG emission reductions of the WRC project activities.

Year	Estimated Baseline Emissions (t CO ₂ -e)	Estimated Project Emissions (t CO ₂ -e)	Estimated Leakage Emissions (t CO ₂ -e)	Estimated NET GHG Emission Reductions (t CO ₂ -e)
2019	924,163	240,337	-	683,826

3.2.4.3 Total net GHG removals from ARR project activity

We calculated net GHG removals related to ARR project activities by subtracting baseline removals and emissions due to leakage from the project removals (see Table 36).

Table 36. Total net GHG removals of the ARR project activities.

Year	Estimated Baseline Removals (t CO ₂ -e)	Estimated Project Removals (t CO ₂ -e)	Estimated Leakage Emissions (t CO ₂ -e)	Estimated NET GHG Emission Reductions (t CO ₂ -e)
2019	117,743	-	-	(117,743)

3.2.4.4 Total net GHG removals from WRC and ARR project activity

We calculated net GHG removals related to WRC and ARR project activities by subtracting baseline removals and emissions due to leakage from the project removals (see Table 37).

Table 37. Total net GHG emissions from WRC and ARR project activities.

Year	Estimated Baseline Emissions (t CO ₂ -e)	Estimated Project Emissions (t CO ₂ -e)	Estimated Leakage Emissions (t CO ₂ -e)	Estimated NET GHG Emission Reductions (t CO ₂ -e)
2019	806,420	240,337	-	566,083

3.2.4.5 Calculation of the VCS non-permanence risk buffer withholding

The combined non-permanence risk buffer for the project was determined as 14%. Per VCS methodology VM0007, the annual buffer withholding for all activities was determined as a percentage of the total carbon stock benefits which excludes emissions due to leakage (see Table 38). As the project does not account for emissions from fossil fuel combustion, direct N₂O emissions and emissions from biomass burning were also omitted from calculations.

Table 38. Annual non-permanence risk buffer withholding.

Year	WRC NET GHG Emission Reductions (t CO ₂ -e)	ARR NET GHG Emission Reductions (t CO ₂ -e)	Non-Permanence Risk Buffer (14%)
2019	683,826	(117,743)	79,251

3.2.4.6 Calculation of Verified Carbon Units

We calculated VCUs by subtracting the VCS non-permanence risk buffer, adjusted for the net emission reductions uncertainty for each project activity (see Table 39).

Table 39. Calculation of estimated verified carbon units.

Year	NER_{WRC}	NGR_{ARR}	$Adjusted_NER_{WRC} + NGR_{ARR}$	Non-Permanence Risk Buffer (14%)	Estimated VCUs
2019	683,826	(117,743)	566,083	79,251	486,832

3.3 Optional Criterion: Climate Change Adaptation Benefits

3.3.1 Regional climate change scenarios (GL1.1)

Precipitation in Indonesia is strongly influenced by El Niño/ Southern Oscillation (ENSO) events, which might become more frequent and intense as a result of climate change. Because Indonesia typically experiences drought during El Niño events (the warm phase of ENSO) and excessive rain during La Niña events (cool phase of ENSO), the shifting global pattern of ENSO will have substantial regional impacts.³²

Various reports show that the geographic region of the project zone is likely to exhibit various effects of climate change with greater weather anomalies by 2050, 2080, and 2100. Temperatures will increase consistently with increased duration of heat waves and dry spells.^{33,34} There will be a considerable shift in precipitation patterns, with increase in rainfall especially during the wettest months of rainy season (December to February).^{32,35} Pattern of seasonality is likely to change, with the wet season begins several weeks later than the average compared to historical periods.³⁶ This delay would result in increase in rainfall later in the crop year and decrease in rainfall later in the dry season.³⁴ There will be increased frequency and intensity of heavy rainfall events.³³

The region is vulnerable to other weather-related disasters and climate hazards such as forest and land fires, storms, and drought that damage infrastructure and degrade ecosystems, leading to loss of life, property, ecosystem services, and livelihoods.³³ Accordingly, longer dry season and a more intense rainy season will result in prolonged drought and more intense flooding.³⁶

3.3.2 Climate change impacts (GL1.2)

Changes in land-use, temperature, and precipitation have already caused widespread wildfires in the project zone, as evidenced by the catastrophic fires in 2015. Altered biophysical features, as well as vegetation composition and structure impact biodiversity and ecosystem services functioning. Climate change would exacerbate this problem.

Climate change has food security and economic growth implications. Changing precipitation patterns, evaporation, run-off, and soil moisture would all impact agricultural production levels. In addition, reduced availability of freshwater will have implications for health and economic production processes.³⁴

Specific to agriculture, heat stress will reduce production, heat and humidity increase will increase pests and diseases, heavy rainfall will increase flood damage to cultivated land, and increased inundation and drought will cause production loss or failure. For water resources, elongated dry seasons will reduce water supplies for domestic consumption and agriculture and floods will decrease water quality. For natural resources, increased frequency and extent of wildfires will cause decline in biodiversity (or extinction of endangered species) and ecosystem services and affect viability of forest-dependent livelihoods. For human health, increased floods and humidity will introduce incidence of waterborne and vector-borne diseases, whereas increased heat will bring risk of food security.³³

In the province of South Sumatra where the project zone is, climate change will impose declines in the value of agricultural output, increased exposures and costs due to impacts of dengue fever and malaria, and increased value of agricultural losses.³⁵

3.3.3 Measures Needed and Designed for Adaptation (GL1.3)

The project area and project zone are vulnerable to the potential impacts of climate change, which imposes impact on ecosystem services functioning, livelihoods and health. In the project zone, we aim to strengthen community (human) and environmental (non-human) resilience by implementing adaptation options through a variety of project activities (see details in Section PD 2.1.11). We summarize activities relevant to climate change adaptation and their respective benefits in Table 40 below.

Table 40. Climate change adaptation benefits from project activities.

Project activity	Components	Project achievements during the monitoring period	Adaptation benefits
Forest Patrolling	- Project boundary demarcation - Guard posts - Radio communication system for reporting - Foot, bicycle, boat and vehicle patrolling - Data collection and analysis on threats - Drone monitoring - Local law enforcement	- Prevention of potential fire vectors and extraction of biodiversity features. - Elimination of illegal logging, poaching, exploitative fishing, and conversion to small-scale agriculture inside the project area.	- The activity provides mechanisms for prevention, monitoring, reporting and response to minimize risks and damage caused by climate change. - The risk minimization enhances resilience to potential climate change impacts.
Fire Prevention and Monitoring	- Patrol activities - Early Warning System of potential fires - Fire Response and Suppression teams	Due to patrol activities, Early Warning System, and cooperation agreements with neighboring concessions, no fire events took place during the monitoring period.	- The activity provides mechanisms for prevention, monitoring, and rapid response to minimize fire risks and damage exacerbated by climate change. - The risk minimization enables healthy conditions to maintain biodiversity and ecosystem functioning, hence enhances resilience to potential climate change impacts.
Canal Blocking and Hydrology Management	- Technical assessment - Canal blocking plan - Peat dam installation - Hydrology monitoring - Collaboration with adjacent concessions	- Canal blocking planned for implementation. - Monitoring will begin after the peat dam installation in 2019 and be reported for the next monitoring period.	- The activity provides robust, replicable mechanisms for improving soil and water quality, hence strengthens biodiversity and ecosystem services features. - The biophysical improvement prepares the site facing climate change, hence generates resilience to potential impacts.

Project activity	Components	Project achievements during the monitoring period	Adaptation benefits
Reforestation and Assisted Natural Regeneration (ANR)	- Tree nurseries - ANR approach trials - Annual ANR and replanting - Technical support to nearby <i>Hutan Desa</i>	- Nursery construction and operation in ongoing process. - ANR trials will begin in 2020. - Monitoring will begin in 2020 and be reported for the next monitoring period.	- The activity conserves gene pools that could be threatened by climate change, supports assisted gene flow especially for more resilient species, and raises awareness in the communities. - The knowledge transfer also supports community forests.
Community Development	- Education opportunities - Improved livelihoods and quality of life - Youth and local employment - Waste clean up - Co-financing rainwater catchment system	- Improvement of sanitation and washing facilities at the elementary schools in progress. - Supported students to attend <i>Universitas Terbuka</i> who will become future teachers. - Students are attending adult continuing education programs supported by the SMPP. - Fishermen and farmers are utilizing the area. The SMPP directly employed local people including females. - Facilitation of the construction of water pump, water tank, and pipes at school.	- The activity diversifies communities' opportunities for livelihoods and employment, and thereby generating resilience to challenges brought by climate change. - The improved sanitation and water usage also enhance the well-being and community health.
Biodiversity Management and Monitoring	- Detecting, identifying and understanding the characteristics, distribution, sensitivity and vulnerability of HCVs - Biodiversity feature monitoring design - Biodiversity monitoring implementation	- Biodiversity scoping surveys were conducted covering flora and fauna, and the identification of areas providing ecosystem services. - The surveys helped to identify and understand the characteristics, distribution, sensitivity, and vulnerability of HCVs 1, 2, 3 and 4. - Biodiversity monitoring plan in place. - Monitoring started in 2019 and will be reported in the next monitoring period.	- The activity establishes a data-driven, traceable system to monitor changes in biodiversity features in response to climate change. - The system provides basis for predicting climate change impact on biodiversity and for developing conservation planning adjusted to address the impacts.

Project activity	Components	Project achievements during the monitoring period	Adaptation benefits
Cross-cutting	- Adaptive management - Effective administration and human resources - Financial management - Legal compliance	- Reorganization of the management team and senior technical leads to better project development and operations. - Recruited a new community development manager to execute activities following the project planning. - The project management board holds regular meetings to assess budget and project performance and adapt needs for large-scale activities	- The activity ensures that the decision-making process to address climate change impacts is backed by sustainable business management and operations. - Therefore, a mechanism to generate business resilience to climate change is in place.

4 COMMUNITY

4.1 Net Positive Community Impacts

4.1.1 Community Impacts (CM2.1)

The SMPP is in an isolated area with comparatively little interaction with local people. However, there are still some important groups that interact with the project landscape and activities. In the Climate, Community & Biodiversity Standards, Third Edition, a “community” refers to any group of people that derive any income, livelihood, cultural values, or other contributions to well-being from within the project area. There are no individuals living within the SMPP area and few that rely on it for their livelihood or ascribe cultural value to the zone. The SMPP interacts with a total of two community groups, according to the CCB: a group of 22 fishermen, distributed across the Kepayang river, the Buring river, and the Tembesu Daro canal, and two small-scale palm oil farmers and their families.

Following the CCB methodology, we have defined the residents of nearby settlements, including from the formally recognized Muara Muang and Kepayang villages, as well as other unofficial settlements along the rivers, as “other stakeholders” as they do not derive their livelihoods from the project area. However, these communities are an important aspect of the social development component of the project and thus the community profiles and our program objectives for them are covered in detail in section 4.3, which covers other stakeholder groups.

Fishing activities are spread across three main areas, including those used by four fishermen along the Kepayang river, four fishermen along the Buring river, and the remaining along the Tembesu Daru canal. Proximity of large industrial activities among other factors, has resulted in the Lalan river becoming too polluted to fish safely. Fishing communities therefore rely on the cleaner waters in and around the SMPP for safe and productive fishing, despite the considerable distance away from their homes. The smallholder farmers cultivate palm oil on the eastern border of the project boundary and the project team has an on-going and open dialogue with them about the impact and potential benefits of the project.

The project will provide a variety of positive impacts to these two communities, as outlined in Table 41 below. Due to the lack of individuals living near or within the SMPP, we will focus much of our community development programming on those defined by the CCB as other stakeholders, who live primarily in the Muara Merang and Kepayang villages. These activities are outlined in detail throughout Section 4.2. Given that the direct community members also live in these same surrounding areas, our work to provide benefits to other stakeholders in neighboring settlements and villages will also benefit community members beyond what has been immediately identified below.

Table 41. Impacts for specific community groups in the SMPP.

Community Group	Fishermen and their Families
Impact(s)	• Reduced fires in the region; • Protection of and access to fishing grounds; and • Improved water quality within the project area will benefit fish stocks long-term. As the project continues, there will also be: • Improved access to clean water; • Improved access to education; • Improved waste management; and • Employment opportunities within the SMPP including sale of fish to SMPP field staff.
Type of Benefit/Cost/Risk	Direct Benefits
Change in Well-being	Improvement to livelihoods and overall quality of life

Community Group	Small-Scale Farmers and their Families
Impact(s)	- Reduced fires in the region reduces risk of farm destruction; and - Long-term livelihood security as the SMPP and farmers have an agreement to ensure the farmers can maintain access to their existing plots of land that overlap with the project area. As the project continues, there will also be: - Improved access to education; - Improved waste management; and in general, enhanced ecosystem services in the project area.
Type of Benefit/Cost/Risk	Direct benefits
Change in Well-being	Improvement to livelihoods and overall quality of life

4.1.2 Negative Community Impact Mitigation (CM2.2)

The SMPP communities of fishermen and farmers do not reside within the SMPP but only enter and exit for activities related to their livelihoods. It is possible that as biodiversity returns to the SMPP area, fishermen or farmer communities may be impacted by large wildlife such as sun bears or tigers. To deal with this potential negative impact, we have a wildlife human conflict reduction strategy and will train community members on how to reduce this risk. We will also continue to maintain direct lines of communication with the project communities to address issues through our adaptive management plan to mitigate issues as they arise.

Increased water levels from canal blocking and other peat rewetting strategies could potentially impact farmer productivity, but through in-person interviews our farmer community members have expressed a sentiment that the decreased risk from fire from mitigation activities by the project outweighs any inconvenience caused by higher water levels. The biggest risk to smallholder farming assets is from wildfires, which could completely wipe out their investment, as evidenced by the 2015 fire which degraded a large portion of the area.

Throughout the 2019 monitoring period, the project has continued to directly engage with the community small-scale farmers, including on socialization for the canal blocking construction which was going to be started by the end of December 2019. From at least 10 meetings with the small-scale farmers, the project was able to capture their feedbacks and statements, including:

- They said that they like that the project prevents peat fires, and this helps them ensure their farm is a success.
- They think that fishing will be a lot better after the canals are implemented and fish have had a chance to spawn in the pools behind the dams. They are happy about this.

To help the farmers to clear the garden from weeds and make it easier to clear brush in a safe way that doesn't use fire, in September 2019 the project delivered a consumer-grade handheld grass trimmer. This can be used by the farmers to plant a new food garden to offset any loss of livelihoods from temporarily not being able to do subsistence fishing and ensure that fire isn't used for clearing the grasses. The grass trimmer is equipped with a protective blade guard to protect the user from flying objects. Appropriate safety gear was also provided. The project also delivered other goods to increase his general well-being while living and working at his seasonal farm. The project maintains consistent communication with this farmer when he is living and working on his farm which is not his primary source of income or his livelihood.

Using the same approach, direct engagement with community fishermen consistently occurred throughout the 2019 monitoring period. In September 2019, the project received feedback from a fisherman who regularly fished in the Tembesu Daro canal:

- He hasn't been able to fish due to low water levels of the El Nino dry season of 2019. Once the water levels have risen, he will resume fishing activities.
- The existing dams had not negatively impacted his fishing activities. He is still able to set nets and traps. He indicated that the dams improved fishing as fish are more concentrated behind the dams, hence increasing his livelihood.
- The fisherman has several boats he uses to enter or exit his fishing spot inside the project concession, and a boat that always stay near his fishing hut that he uses to set traps or collect the fish.
- He has some difficulty in traversing the dams with his largest boat but can traverse them using his smaller canoe.

As part of the socialization for the project's plan to construct canal dams which was scheduled to begin in December 2019, the project discussed options with him as access to fishing grounds in the Tembesu Daro canal was going to become more difficult. The project expressed its support to him and discussed other areas in the project area along the Buring river in the Northwest portion of the SMPP, or the Lalan or Kepayang rivers that are easier to access.

In January 2020 the project supported the fisherman with funds for fishing equipment and supported him to access other fishing grounds in the project zone and he has continued his fishing activities. We will continue to monitor all impacts of the canal dams on the community fishermen.

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

With the SMPP, we aim to generate significant net positive impacts for the fishing and farming communities within the SMPP. Since the project start date (Section 2.1.5), and as the project progresses, we will ensure that fishermen will be able to maintain access to their fishing grounds. In addition, the project will buy fish to support these individual's livelihoods, to provide sustenance for project staff. The project will also offer employment opportunities for this community if they are interested.

Better hydrology management is expected to improve the water quality in the project area which will create more abundant and protected fishing grounds. The project will also help reduce fires throughout the wider project landscape, by deploying a fully equipped fire-fighting team and early warning system (EWS) for fires. These efforts to protect the concession also protect vital community assets, reducing the risk of fishing grounds or farms being destroyed. The identified farmer community will have long-term livelihoods security through an agreement with the project that guarantees land tenure for their existing plots of land that overlap into the project boundaries. These stakeholders are engaged in project activities and have been trained in fire monitoring and other forest patrol practices.

Additionally, the well-being of nearby stakeholders will continue to improve as we enact our community development plan and bring community-focused activities into the SMPP and the surrounding villages and settlements. Positive impacts from the SMPP community development program targeting other stakeholders will also affect the fishermen and farmers that rely on the project area, as these communities live in the villages and settlements surrounding the SMPP area. Benefits from this community development include improved access to clean water, effective waste management, healthcare, and education (see Section 4.2). In general, ecosystem services in the project area will be significantly enhanced. When compared to the without-project scenario, the communities and other stakeholders in the region will benefit from an overall increased quality of life and improved livelihoods as a result of project activities.

4.1.4 Protection of High Conservation Values (CM2.4)

The project will ensure that no HCVs related to community well-being will be negatively affected by the SMPP. The identified communities that interact with SMPP rely heavily on the protection of the HCV 5 areas for fishing and small-scale farming. The other stakeholders in nearby villages benefit from the protection of the peat swamp forest and other areas within the SMPP for overall improved water quality. Our project's main objective is to protect and enhance these areas, and therefore there are no predicted negative impacts on these HCVs. The SMPP will utilize our community development team on the ground to continuously monitor for any potential negative impacts on these HCVs in the project area.

4.2 Other Stakeholder Impacts

The project defines “other stakeholders” as any groups other than communities that will be affected by project activities, namely proactive social development efforts and livelihoods programming. The SMPP aims to work with residents of nearby settlements and villages, including those primarily from the formally recognized Muara Muang and Kepayang villages, as well as other unofficial settlements along the rivers, all of which are defined as other stakeholders.

Approximately 5,460 people comprising 1661 households reside in Muara Muang, and 2,628 people in 574 households reside in Kepayang.³⁷ It is important to emphasize that these stakeholders are still fairly removed from the project site, at a significant distance from the SMPP. However, SMPP is committed to robust development activities in the villages and settlements that surround the project site, despite their distance. Not only are these efforts a key part of the benefit sharing strategy for the project, but the creation of strong and supportive relationships with local stakeholders will also prevent risks associated with future encroachment, in the case where the project’s restored ecological functions become an attractive target for illegal activities such as logging or poaching.

The majority of SMPP community development activities will be directly focused on the project’s other stakeholders, who we have defined as residents of nearby settlements and villages surrounding the SMPP. We do not anticipate any negative impacts to this group of other stakeholders as a result of project activities, especially as these stakeholders do not derive their livelihoods from project area and reside a considerable distance away from the SMPP. The SMPP’s community development activities will generate positive impacts for other stakeholders as the activities are designed to strengthen family livelihoods by creating local employment opportunities, making new investments into small businesses and increasing the quality of education in nearby villages.

Detailed progress on the SMPP’s community development since the start date of this monitoring period can be found in Section 4.3.1. We have continued to implement the following community development activities that will positively impact other stakeholders including:

- Education support through continued education opportunities for local teachers through Open University (*Universitas Terbuka*), after school programs for elementary school children, adult education for employees who do not hold a high school diploma, improvement of elementary and middle school sanitation facilities, and enrichment and maintenance of school libraries.
- Improved livelihoods and quality of life through local food sourcing for project employees and training for craftsmen/women, as well as investments in women’s groups in both Muara Merang and Kepayang villages and support to community health programs.
- Youth and local employment to increase the number of SMPP field staff recruited locally in addition to the creation of educational development and capacity building opportunities for employees.
- In collaboration with local youth community, SMPP has supported renovation for one village health facility and provided medicines along with medical equipment.
- Co-financing for the construction of household rainwater catchment systems to address the need of clean and pollution-free water.

Community investments are designed to be an integral part of the SMPP’s operating expenses. The project aims to deliver tangible benefits to surrounding communities through community-based business development programs and education initiatives. To support these efforts, the project will continue to allocate a significant portion of its operating budget for community development throughout its long-term operations.

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

Identified other stakeholders, principally the residents of the settlements and villages closest to the SMPP rarely engage in activities in the project area and reside a great distance away from the SMPP, which reduces the risk of negative impacts from project activities.

However, it is possible that many years in the future as biodiversity returns to the SMPP area, local stakeholders may be impacted by large wildlife such as sun bears or tigers, but we have assessed this risk as low. To deal with this potential negative impact, SMPP will be developing a wildlife human conflict reduction strategy and will train stakeholders on how to reduce this potential negative risk in due course. We will also continue to maintain direct lines of communication with local stakeholders and should any other negative impacts emerge, we will be prepared as part of our adaptive management plan to adjust operations so that potential negative impacts can be mitigated effectively.

4.2.2 Net Impacts on Other Stakeholders (CM3.3)

As described in Section 4.2.1 above, the SMPP has no current net negative impacts to other stakeholders during the 2019 monitoring period. While there could be a potential negative impact from human wildlife conflicts in the future as described in section 4.2.1, this is not currently a net negative impact on stakeholders of the project. All positive impacts to other stakeholders are discussed in Section 4.2.

4.3 Community Impact Monitoring

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

The SMPP has created a monitoring plan to track community and other stakeholder impacts delivered by the project. This monitoring plan addresses the following core issues: improved livelihoods, education support, and health (Table 42). This plan considers the components necessary to conduct successful monitoring of all stakeholders and the impacts of the SMPP throughout the duration of the project. Our community monitoring plan considers the overall requirements of the project combined with the financial, logistical, and staff capacity constraints, starting with the specific fishing and farming communities and widening to the equally important group of other stakeholders who live in nearby settlements and villages. Further information about how SMPP will address social impacts related to the HCVs 4 and 5, please refer to Section 4.1.4. The initial results of the SMPP's community development project activities are outlined below.

Table 42. Details of the SMPP's community monitoring plan with initial results from the first monitoring period and the current results for 2019.

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
Improved livelihoods	Access to primary resource for community livelihood is maintained	# of fishermen utilizing the area	Community survey	Community fishermen	Every 3 months	21 fishermen	21 fishermen identified; 1 fisherman passed away during the monitoring period.
		# of farmers utilizing the area	Community survey	Community small-scale farmers	Every 6 months	2 farmers	2 farmers
	Community income improved	Gains achieved from the sale of fish	Community survey	Community fishermen	Every 3 months	Estimated average weekly catch is ~30 kg. Fresh fish are sold at ~25,000 IDR (\$1.73 USD) per kg. Dried salted fish are sold at ~30,000 IDR (\$2.01 USD) per kg. Estimated average weekly revenue per fishermen is around 800,000 IDR (\$55.31 USD).	During 2019, estimated average weekly catch is ~30 kg. In the dry season, peak weekly catch could reach up to ~40 kg. Fresh fish are sold at ~25,000 IDR (\$1.73 USD) per kg. Dried salted fish are sold at ~30,000 IDR (\$2.01 USD) per kg.
		% of SMPP food budget sourced from SMPP	Internal report	Community fishermen, community small-scale	Every 12 months	In progress: fish eaten by SMPP staff will be completely	In 2019, monthly food supplies in basecamp and guard posts are

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
		community and other stakeholders		farmers, and other stakeholders-residents of settlements and villages near SMPP		sourced by community fishermen, but this is still being developed. In progress: chicken eaten by SMPP staff will be completely sourced by other stakeholders, but this is still being developed.	fulfilled entirely from local shops in both Muara Merang and Kepayang Village. Chicken eaten by SMPP staff is completely sourced from the village community member.
	Project employment increased	# of people directly employed by the SMPP	Internal data records (employment contracts)	Other stakeholders-residents of settlements and villages near SMPP	Every 12 months	54 employees as of May 2019	55 employees as of December 2019
	Local employment or livelihoods increased	# of local people employed by the SMPP	Internal data records (employment contracts)	Other stakeholders-residents of settlements and villages near SMPP	Every 12 months	There are 14 SMPP staff members from Kepayang village (including one woman) and 4 staff members from Muara Merang village as of May 2019.	There are 24 SMPP staff members from nearby villages and settlements (including 3 women) as of December 2019.
		# of investments and agreements	Internal report & contracts	Other stakeholders-	Every 12 months	In progress: in 2019 SMPP will	Discussion was held and initial

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
		with other stakeholders signed by the SMPP		residents of settlements and villages near SMPP		make its first investment to help establish a chicken production farm in Muara Merang.	investment for a small scale chicken coop was provided. However the chicken coop was not successful due to disease infecting the chickens. The project is evaluating the lesson learned if the project is viable in the future.
	Gender equity and economic success increased	# of investments and agreements with local women's groups signed by the SMPP	Internal report & contracts	Women's groups in Muara Merang and Kepayang villages	Every 12 months	In progress: SMPP will make an investment to further develop local women's craft-making activities.	Effort has been made to identify suitable activities and type of craft. Further activities are scheduled for the next monitoring period.
		% of women directly employed by SMPP	Internal data records (employment contracts)	Other stakeholders-female residents of settlements and villages near SMPP	Every 12 months	18.5%	16.4% - Given the remoteness of the project site and the fact that it is an accompanied post (not appropriate for families) gender balance for patrol and project

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
							teams has been difficult to achieve.
Education Support	Quality of, or access to, education increased	# schools repaired or equipped	Internal report	Kepayang and Muara Merang schools	Every 12 months	We have improved the sanitation and washing facilities at the elementary school (SD) in Kepayang, and improvements to the SD in Merang are in progress.	We are finalizing the plan to build a permanent fence at the elementary school (SD) in Kepayang to help improve the focus of the students during school hour.
		# of university students supported	Data record, proof of enrollment to university	Voluntary teachers in Kepayang and Muara Merang schools with insufficient education background	Every 12 months	We have supported 3 students who will become future teachers in Muara Merang to attend <i>Universitas Terbuka</i> .	We are now supporting 10 students to attend <i>Universitas Terbuka</i> . 7 of which are women.
		# of students attending afterschool programs supported by the SMPP	Enrollment Records	Kepayang and Muara Merang schools	Every 12 months	115 SD students (50 in Kepayang and 65 in Merang) as of May 2019	117 SD students (47 in Kepayang and 70 in Merang as of December 2019)
		# of students continuing their education in adult programs	Enrollment Records	Hidayah and Intan Learning Centers (<i>Pusat Kegiatan Belajar</i>)	Every 12 months	9 students (5 men and 4 women- Class C has 2 women from Kepayang, 2	Total of 38 students (6 women and 10 men in Class B; 11

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
		supported by the SMPP		Masyarakat or PKBM)		women from Merang, and 5 men from Merang). One of these male students is an SMPP staff member.	women and 11 men in Class C).
		# of books in each school library in surrounding villages	Survey	Kepayang and Muara Merang elementary schools	Every 12 months	In progress: our community development manager is continuing to investigate what each schools' library needs are.	In progress: We have developed a plan to construct and equip two elementary school libraries in 2020.
	Access to clean water improved	# of individuals attending trainings in household rainwater catchment systems construction	Internal report	Other stakeholders- residents of settlements and villages near SMPP	Every 12 months	In progress: in 2019 SMPP will conduct our first household rainwater catchment system training in surrounding villages and settlements.	In 2019 SMPP has installed 1 rainwater catchment system as pilot, located in the public health facility. 3 community members and 5 SMPP staffs received training to construct the system. Further training and construction are scheduled for the

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
							next monitoring period.
Health		# of households with improved rainwater catchment systems	Survey	Other stakeholders-residents of settlements and villages near SMPP	Every 12 months	In progress: currently no household rainwater catchment systems have been improved or newly constructed, but this will change after our first training takes place.	One rainwater catchment system has been installed as pilot in Kepayang health facility that sees an average 30-50 patients per month. In collaboration with Kelola Sendang, two rain catchment systems were installed in 2 households in Kepayang. Further construction is scheduled in the next monitoring period.
		# of health facilities improved	Internal report	Other stakeholders-residents of settlements and villages near SMPP	Every 12 months	In progress: currently no health facilities have been improved, but we aim to begin these improvements in 2019.	In collaboration with local youth community, SMPP has supported renovation for one village health facility and provided medicines along

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
							with medical equipment.
	Medical and sanitation facilities and services improved	# of constructed and operational sanitation facilities	Internal report	Kepayang and Muara Merang schools	Every 12 months	We have facilitated construction of a water pump, water tank, and pipes to the SD in Kepayang; and improvements to sanitation facilities at the SD in Merang are in progress.	In progress: our community development manager is continuing to investigate the requirements to improve the sanitation facilities at the SD in Merang.
		# of people registered into Indonesia's national healthcare system with SMPP support	Internal report	Other stakeholders-residents of settlements and villages near SMPP	Every 12 months	In progress: currently no individuals have been registered into Indonesia's national healthcare system with our support, but we aim to begin these registrations in 2019.	20 individuals have been registered into Indonesia's national healthcare system with SMPP support. 7 of which come from nearby village. We aim to increase the number in the next monitoring period.
		# of children vaccinated with SMPP support	Internal report	Other stakeholders-residents of settlements and	Every 12 months	In progress: currently no children have been vaccinated	Initial effort to revive a village health facility has been started. This

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
				villages near SMPP		with our support, but we aim to begin these vaccinations in 2019.	will enable vaccination to be carried out in the next monitoring period.
		# of community clean-up events held	Internal report	Other stakeholders-residents of settlements and villages near SMPP	Every 12 months	In progress: in 2019 SMPP will conduct our first community clean-up event in surrounding villages and settlements.	In collaboration with local youth community, SMPP has conducted community clean-up event in Kepayang village. We aim to expand and scale up in 2020.
	Waste management improved	# of plastic recycling and trash collection programs implemented	Internal report	Other stakeholders-residents of settlements and villages near SMPP	Every 12 months	In progress: over the next two years, the SMPP will implement recycling and trash collection programs in surrounding villages and settlements.	In progress: initial discussion and planning has been carried out. We aim to start these programs in 2020.
		Kg of plastic waste processed as recycling	Internal report	Other stakeholders-residents of settlements and villages near SMPP; and	Every 12 months	In progress: over the next two years, the SMPP will implement recycling and trash collection	In progress: initial discussion and planning has been carried out. We aim to start these programs in 2020.

Focal issue	Key results	Indicator/variable	Data collection method	Targeted community	Monitoring frequency	Previous results (during 2016-2018 monitoring period)	Current results (during 2019 monitoring period)
				SMPP field sites.		programs in surrounding villages and settlements.	
	Fire safety improved	Frequency of fire safety or prevention trainings	Internal report	SMPP staff and other stakeholders-residents of settlements and villages near SMPP	Every 3 months	We have facilitated fire safety trainings for each SMPP field staff member upon their introduction to the project. In addition, we facilitated a fire prevention training conducted by Manggala Agni (MoE&F's fire brigade) for 25 SMPP staff members and 12 individuals from a neighboring session's fire brigade in March 2018.	During 2019, there has been at least 11 forest fire incidents outside the project concession. We have been leading and/or assisting those neighboring concession in fighting fires. Periodical fire readiness training is conducted regularly.

4.3.2 Monitoring Plan Dissemination (CM4.3)

Our community monitoring plan was disseminated to project communities, other stakeholders and the public. To disseminate project documents, including information specifically related to community development and monitoring, to communities, other stakeholders, and the public, the SMPP Field Office maintains a full, printed version of the PD and MR and associated annexes in English for public viewing. The executive summary was translated into Bahasa Indonesia and was given to community leaders to make available in public places in the surrounding villages, and the full PD and MR its executive summary was posted in English and in Bahasa Indonesia on the VCS project database. In addition to the executive summary, we provided a brochure in Bahasa Indonesia advertising the project, and an email address was posted in local villages and given to SMPP communities and other stakeholders as a point of contact. Finally, notices in Bahasa Indonesia advertising the public comment period and field validation were posted in communities throughout the project area. It included details on how to make a comment on the CCB version.

4.4 Optional Criterion: Exceptional Community Benefits

The project is not seeking to be validated to the Gold Level for the Community component as the majority of the residents in local villages near the project area are not below the national poverty line.³⁸ Additionally, the project is not owned or co-managed by local communities, and as a result the project does not meet the CCB criteria to obtain this distinction. Despite this, we will seek to deliver high levels of net positive impacts for the identified project communities and other stakeholders who live in nearby villages and settlements through the implementation of the project's community development plan.

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

N/A

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

N/A

4.4.3 Net Impacts on Women (GL2.5)

N/A

4.4.4 Benefit Sharing Mechanisms (GL2.6)

N/A

4.4.5 Governance and Implementation Structures (GL2.8)

N.A

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

N/A

5 BIODIVERSITY

5.1 Net Positive Biodiversity Impacts

Through long-term project activities, the SMPP aims to protect and improve the quality of biodiversity and biodiversity-related HCVs in the project area.

Tropical biodiversity is in rapid decline globally, driven largely by habitat destruction and over exploitation as well as a range of interacting drivers including climate change, invasive species, and habitat degradation.³⁹ The terrestrial biomes of Southeast Asia have been identified as some of the most at risk biomes on the planet,³⁹ and Indonesia has suffered significant forest and biodiversity loss over the last 40 years.⁴⁰

Sumatra is the sixth largest island in the world and the second largest island in Indonesia after Borneo. The remaining forests of Sumatra still maintain a rich biodiversity with high levels of endemism. However, Sumatra globally has one of the highest deforestation rates in the world, driven largely by transmigration and expansion of commercial agricultural production in the form of pulp/paper and palm oil production. Between 1985 and 2001, Sumatra lost 12 million hectares of natural forest, or 48% in 22 years. In 2007, Sumatra only had 30% forest cover remaining or about 13 million hectares of forest. The forests in the eastern plains of Sumatra, where the project site is located, are especially vulnerable to species extinction risk, and natural forest cover in the area has already declined by 70%.⁴¹ The SMPP aims to reverse this trend by protecting a site of acknowledged international importance in an area with significant peatland ecosystems and high conservation value species. The project aims to increase the variety, integrity, and extent of the peat swamp forest and to increase the abundance, diversity, and habitat features of critically endangered and endemic wildlife in the project area.

5.1.1 Biodiversity Changes (B2.1)

It is not expected that long-term benefits related to biodiversity will be realized until the area has had enough time to fully recover. The positive impacts of reduced fire incidence, restored water table and improved forest cover are likely to already be influencing biodiversity. However, at this time, it is difficult to monitor progress specifically resulting from project activities as there is not any straightforward baseline information related to what the site looked like before the project start date. Therefore, the current monitoring period has been utilized to improve the baselines and better understand the biodiversity extant in the project area. Table 43 and Table 44 outlines the changes to biodiversity observed during the current monitoring period. Changes to biodiversity are largely due to increased sampling frequency and are an indication of an expanded baseline data collection.

Table 43. Direct changes to biodiversity during the 2019 monitoring period.

Changes in Biodiversity	Increased number of both floral and faunal species identified in the SMPP project area
Monitored Change	We completed the collection of all results for all species surveys conducted in the SMPP in 2018 and 2019. With these results, we can now confirm that SMPP contains at least all of the species in Appendix A. The species inventory now includes: • 18 mammals (increase of 1 species from previous monitoring report) • 69 birds (increase of 49 species) • 16 reptiles (increase of 9 species) • 11 amphibians (increase of 11 species) • 2 fish (increase of 2 species) • 39 arthropods (dragonflies and damselflies) (increase of 39 species)

	55 plant species (18 of which are trees) (increase of 43 species)
Justification of Change	A robust and repeatable surveying methodologies have been developed for long term monitoring of the project biodiversity baselines which are currently being implemented. Survey conducted in the current monitoring period therefore did not follow a particularly rigid survey design, as their purpose was only to expand the inventory of species at SMPP through increased sampling effort, rather than to provide a baseline for repeatable surveys that met all the required statistical assumptions. For this reason, the increased number of species identified and inventoried in this monitoring period can be attributed to increased sampling effort. See below for a full list of the surveys and their dates below. 1. Unstructured transect surveys for floral species along tracks and canals carried out by a peatland expert consultant from Euroconsult Mott MacDonald (EMM) (24-26 April, 2018) 2. Unstructured transect surveys (for flora and fauna) along tracks and canals as part of a wider HCV assessment, carried out by a team from Ekologika Consultants (22 - 26 May 2018) 3. A camera trap survey by the ZSL Kelola Sendang Program (27 - 31 May 2018) 4. Unstructured transect surveys (for fauna only) along tracks and canals by an independent, expert biodiversity consultant (11 January 2019) 5. An unstructured line transect survey for dragonflies carried out by the ZSL Kelola Sendang Program (3 - 6 May 2019) 6. An unstructured line transects survey and trap survey for herpetofauna carried out by the ZSL Kelola Sendang Program (22 – 24 July 2019) 7. An unstructured point transects survey and mist netting survey for birds carried out by the ZSL Kelola Sendang Program (25 – 30 July 2019)

Table 44. Indirect changes to biodiversity during the 2019 monitoring period.

Changes in Biodiversity	Maintenance of secondary forest land cover, closed canopy land cover, and open canopy land cover.
Monitored Change	Prior to this monitoring report, we last performed a land cover classification analysis in early 2019 (using August 2016 imagery data to reflect the start of the project). A follow up analysis using Landsat 8 Analysis Ready Data (ARD) for 2019 has revealed that secondary forest land cover has been maintained (2016 = 259.64 ha; 2019 = 259.64 ha), closed canopy land cover has been maintained (2016 = 330.2 ha; 2019 = 330.2 ha), and open canopy land cover has been maintained (2016 = 21,986.95 ha; 2019 = 21,986.95 ha). The change detection analysis revealed that some of the vegetation underwent regrowth however this does not result in the vegetation class shifting to another class. This suggests that natural regeneration of vegetation in SMPP is already underway, which should increase the faunal species who rely on this vegetation for their survival.
Justification of Change	The data source for our change detection analysis of August 2016 data and the 2019 data was Landsat 8 Level 2 Surface Reflectance satellite imagery data and Landsat Analysis Ready (ARD) data respectively.

	Given that enrichment planting and illegal logging patrols have not yet begun, and that canal blocking with the new and improved compacted-peat dams did not begin until early December 2019. The majority of the maintenance or enhancement of land cover types can be attributed to assisted natural regeneration of the vegetation in SMPP. This is likely occurring due to the monitoring and suppressing of any potential fires in or near the SMPP project area. Potential fires are currently identified using a mix of scanning the horizon from strategically placed guard posts, and daily checks on open access fire hotspot data from the VIIRS and MODIS spectroradiometer remote imaging sensors which are attached to two different satellite orbiting earth (Section 3.2.2.2). An agreement with an adjacent concession has resulted in improved access for SMPP teams to suppress nearby fires that are not within the project boundaries. This allows for effective preventative measures to be taken before any potential fire spreads and impacts the project area.
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The key activity of this monitoring period was the improvement of the biodiversity monitoring plan to ensure that future monitoring was robust and could capture the positive impact of the project on species and habitats. This plan is currently being implemented and will be utilized to its full extent in the next monitoring plan. However, during the current monitoring period there have been ongoing ecological surveys of the SMPP site. Through these field surveys and informal observations by field staff throughout the year covered in this report, previously reported species appear to have been maintained and the project area still contain many globally significant species, despite the degraded nature of the forest throughout most of the concession. Species of particular interest include:

- Sun bears (*Helarctos malayanus*), which are surprisingly abundant judging by the number of tracks, scrapes, and other signs observed.
- Agile gibbons (*Hylobates agilis*), which are present in sufficient numbers to suggest the potential for the site to ultimately hold a significant population, provided habitat regeneration occurs as planned.
- Hornbill species (Bucerotidae) and pheasants such as the Crestless Fireback (*Lophura erythrophthalma*).
- The Sumatran tiger (*Panthera tigris* ssp. *Sumatrae*) has also been documented by project staff through visual sightings, vegetation markings, and observed footprints.

Despite the degradation in the forest landscape, the SMPP site has maintained a significant level of biodiversity with a number of RTE species present (Table 45), with monitoring conducted throughout the project area since 2017 (Map 15).

Map 15. Map of monitoring survey transects, camera trap locations, and Gibbon listening posts

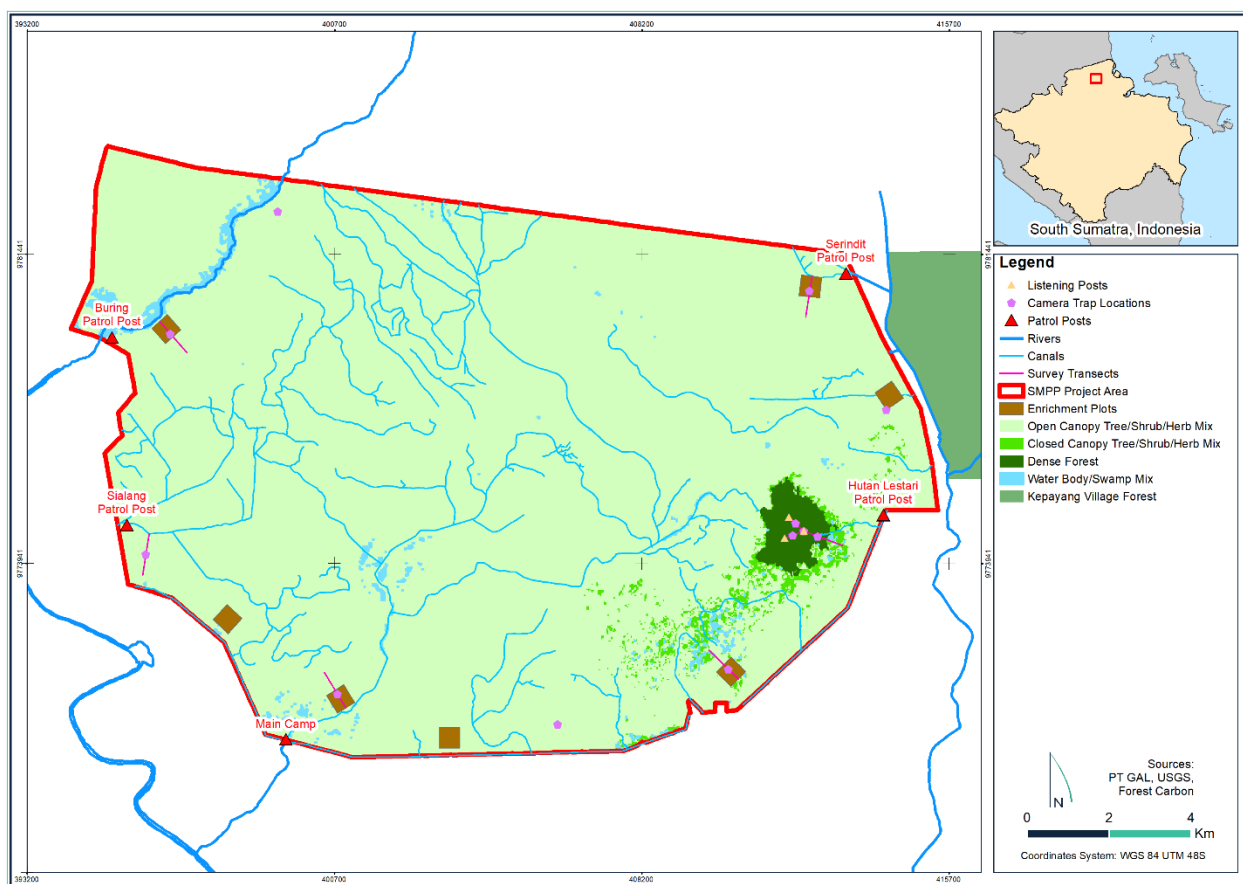


Table 45. List of fauna and flora species identified during independent rapid biodiversity assessment.

Scientific Name	Common Name	Local Name	Family	IUCN	CITES	Endemic
Mammals						
<i>Callosciurus notatus</i>	Plantain squirrel	Bajing kelapa	Sciuridae	LC	Not listed	No
<i>Helarctos malayanus</i>	Sun bear	Beruag madu	Ursidae	VU	I	No
<i>Hylobates agilis</i>	Agile gibbon	Owa	Hylobatidae	EN	II	No
<i>Hystrix brachyura</i>	Malayan porcupine	Landak	Hystriidae	LC	Not listed	No
<i>Lutrogale perspicillata</i>	Smooth-coated otter	Berang-berang	Mustelidae	VU	II	No
<i>Macaca fascicularis</i>	Nicobar crab-eating Macaque	Monyet kera/ekor panjang	Cercopithecidae	LC	II	No
<i>Macaca nemestrina</i>	Southern pig-tailed Macaque	Beruk	Cercopithecidae	VU	II	No

Scientific Name	Common Name	Local Name	Family	IUCN	CITES	Endemic
<i>Muntiacus muntjak</i>	Southern red Muntjac	Kijang	Cervidae	LC	Not listed	No
<i>Panthera tigris ssp. Sumatrae</i>	Sumatran tiger	Harimau Sumatera	Felidae	CR	I	Yes
<i>Paradoxurus hermaphroditus</i>	Common Palm Civet	Musang luwak	Viverridae	LC	III	No
<i>Presbytis melalophos</i>	Sumatran Surili	Simpai merah	Cercopithecidae	EN	I	Yes
<i>Prionailurus bengalensis</i>	Leopard cat	Kucing hutan/kuwuk	Felidae	LC	II	No
<i>Rhinosciurus laticaudatus</i>	Shrew-faced squirrel	Bajing tanah moncong runcing	Sciuridae	NT	Not listed	No
<i>Rusa unicolor</i>	Sambar deer	Rusa sambar	Cervidae	VU	Not listed	Yes
<i>Sus barbatus</i>	Bearded pig	Babi jenggot	Suidae	VU	Not listed	No
<i>Sus scrofa</i>	Wild boar	Babi hutan	Suidae	LC	Not listed	No
<i>Tragulus kanchil</i>	Lesser Oriental Chevrotain	Pelanduk kancil	Tragulidae	LC	Not listed	
Birds						
<i>Accipiter gularis</i>	Japanese Sparrowhawk	Elangalap nipon	Accipitridae	LC	II	No
<i>Amaurornis phoenicurus</i>	White-breasted waterhen	Kareo padi	Rallidae	LC	Not listed	No
<i>Buceros rhinoceros</i>	Rhinoceros hornbill	Enggang cula	Bucerotidae	VU	II	No
<i>Centropus sinensis</i>	Greater Coucal	Bubut besar	Cuculidae	LC	Not listed	No
<i>Chalcophaps indica</i>	Grey-capped emerald dove	Delimukan zamrud	Columbidae	LC	Not listed	No
<i>Elanus caeruleus</i>	Black-winged kite	Elang tikus	Accipitridae	LC	II	No
<i>Gallus gallus</i>	Red junglefowl	Ayam hutan merah	Phasianidae	LC	Not listed	No
<i>Gracula religiosa</i>	Common hill myna	Tiong emas	Sturnidae	LC	II	No
<i>Haliastur indus</i>	Brahminy kite	Elang bondol	Accipitridae	LC	II	No
<i>Ictinaetus malayensis</i>	Black eagle	Elang hitam	Accipitridae	LC	II	No
<i>Lophura erythrophthalma</i>	Malay Crestless Fireback	Sempidan merah	Phasianidae	VU	Not listed	No

Scientific Name	Common Name	Local Name	Family	IUCN	CITES	Endemic
<i>Loriculus galgulus</i>	Blue-crowned hanging-parrot	Serindit Melayu	Psittacidae	LC	II	No
<i>Microhierax fringillarius</i>	Black-thighed falconet	Alap-alap capung	Falconidae	LC	II	No
<i>Nisaetus cirrhatus</i>	Changeable hawk-eagle	Elang brontok	Accipitridae	LC	II	No
<i>Nisaetus nanus</i>	Wallace's hawk-eagle	Elang Wallace	Accipitridae	VU	II	No
<i>Otus lempiji</i>	Sunda Scops-owl	Celepuk reban	Strigidae	LC	II	No
<i>Psittacula longicauda</i>	Long-tailed parakeet	Betet ekor-panjang	Psittacidae	VU	II	No
<i>Psittinus cyanurus</i>	Blue-rumped parrot	Nuri tanau	Psittacidae	NT	II	No
<i>Rhipidura javanica</i>	Sunda pied fantail	Kipasan belang	Rhipiduridae	LC	Not listed	No
<i>Spilornis cheela</i>	Crested serpent-eagle	Elangular bido	Accipitridae	LC	II	No
Reptiles						
<i>Amyda cartilaginea</i>	Asiatic softshell turtle	Labi-labi	Trionychidae	VU	II	No
<i>Broghammerus reticulatus</i>	Reticulated python	Sawa, sanca batik	Pythonidae	LC	II	No
<i>Cuora amboinensis</i>	Amboina box turtle	Kuya batok	Geoemydidae	VU	II	No
<i>Heosemys spinosa</i>	Spiny turtle	Kura-kura duri	Geoemydidae	EN	II	No
<i>Ophiophagus hannah</i>	King cobra	Tedung, ular anang	Elapidae	VU	II	No
<i>Tomistoma schlegelii</i>	False gharial	Sinyulong	Gavialidae	EN	II	No
<i>Varanus salvator</i>	Common water monitor	Biawak, biancak	Varanidae	LC	II	No
Fish						
<i>Notopterus notopterus</i>	Bronze featherback	Putak	Notopteridae	LC	Not listed	No
<i>Scleropages formosus</i>	Asian arowana	Arwana perak	Ostoglossidae	EN	II	No
Plants						
<i>Anisoptera marginata</i>		Tenam	Dipterocarpaceae	EN	Not listed	No
<i>Aquilaria microcarpa</i>		Gaharu	Thymelaeaceae	VU	II	No
<i>Cantleya corniculata</i>		Bedaru	Stemonuraceae	VU	Not listed	No

Scientific Name	Common Name	Local Name	Family	IUCN	CITES	Endemic
<i>Combretocarpus rotundatus</i>		Perepat	Anisophylleaceae	VU	Not listed	No
<i>Cyrtostachys lakka</i>	Lipstick palm	Palem merah	Arecaceae	VU	II	No
<i>Dyera costulata</i>		Jelutung bukit	Apocynaceae	VU	Not listed	No
<i>Dyera polyphylla</i>		Jelutung rawa	Apocynaceae	VU	II	No
<i>Nepenthes</i> sp.	Pitcher plants	Kantong semar	Nepenthaceae	N/A	II	No
<i>Shorea dasyphylla</i>		Meranti payau	Dipterocarpaceae	EN	II	No
<i>Shorea platycarpa</i>	Light red Meranti	Meranti paya	Dipterocarpaceae	CR	Not listed	No
<i>Shorea teysmanniana</i>		Meranti merawan	Dipterocarpaceae	EN	Not listed	No
<i>Shorea uliginosa</i>		Meranti kelungkum	Dipterocarpaceae	VU	Not listed	No

Most of the species were identified around the edges of the project area and in the surrounding concessions, representing strong potential for wildlife return as an outcome from assisted regeneration efforts. More effective biodiversity tracking will be conducted in a systematic manner to include broader coverage of the project site through the establishment of gibbon/hornbill listening posts, additional camera-trap locations and annual bird survey transects (Map 15).

Under the project scenario, the maintenance and improvement in both the quality and extent of threatened habitats will have significant positive impacts on the range of biodiversity in the area. Reduced degradation, fragmentation and reduction in the fire disturbance frequency will ensure the ongoing survival of the documented species at the site and the expansion of important species into newly restored areas. Restoration efforts are also expected to lead to an eventual long-term increase in the carrying capacity for a range of species across the project area. As the landscape recovers and is returned to a regenerated state, colonization of species from outside the project area into newly established habitats will drive increased diversity, including species that are currently using the area only as a corridor but that may eventually become residents. Peatland rehabilitation will lead to improved ecosystem services for biodiversity, affecting an increase in important pollinating and seed dispersing species which will accelerate natural regeneration within the project area. Through implementation of the project scenario, the survival and eventual recovery of populations of many species of conservation concern is expected. These species would otherwise become severely depleted or would be eliminated entirely from the landscape under the baseline scenario.

These benefits will be achieved by reducing the threats outlined in PD Section 2.1.8. No negative effect on biodiversity in the project area is anticipated from any project activities (see Table 43 and Table 44).

The expected net benefits for biodiversity will be:

- The persistence of the full range of intact, ecologically functional habitats which are minimally degraded or undisturbed by humans.
- The restoration and regeneration of drained, burned over and degraded peatland into functional forest.
- The protection of drained, burned over and degraded peatland from fire risks.

- The persistence and recovery of populations of species of conservation concern. These populations should fulfil their full range of ecological functions and eventually grow to carrying capacity.
- The augmentation of the current extant biodiversity through provisioning of habitat through restoration activities.
- Improvement of both terrestrial and aquatic habitat quality and quantity that currently acts as a biological corridor.

There are two fundamental assumptions dictating why the above prescribed biodiversity benefits will be achieved by avoiding the baseline scenario of conversion to an industrial Acacia plantation. The assumptions relate to each of the two key current habitat types occurring in the project area. Firstly, a majority of the land cover is already degraded, drained or previously burned peatland. The current vegetation structure across much of the project area consists of open patches with scrub and early successional species (PD Figure 2). The last incidence of significant fire in the area was 2015, with a small fire in November 2019 (Section 3.2.2.9). The project will significantly reduce the risk of fires to ensure that the degraded areas can regenerate further. This natural regeneration will be augmented through active restoration and replanting with species of both genetic and ecological significance.

The second assumption is that these biodiversity benefits will also be achieved by reducing the threats outlined in PD Section 2.1.8. in the remaining area of closed canopy peat swamp forest (~400 ha). Because this area will remain undrained in the project scenario it will continue to provide important habitat for both flora and fauna as it will benefit from active threat reduction, improved hydrology, and gradual expansion in size. It will also provide additional benefits as a seed and seedling source for reforestation efforts in other parts of the project area. Seeds and seedlings that disseminate naturally from the remaining peat forest are an appropriate ecotype for local restoration efforts and will help to expedite the restoration process.

The key threats that will be addressed are habitat loss, increased fire resilience and resistance, hunting in all forms, and over-harvesting of non-timber forest products (NTFPs). Although hunting, fishing and over-harvesting of NTFPs are not currently issues in the project area, as the forest recovers, and the biodiversity improves the area may become targeted for such activities. These, and other threats listed in PD Section 2.1.8, will be addressed by the activities set out in PD Section 2.1.11. The conceptual model described in Section 2.1.11 (PD Figure 1) further illustrates each of the assumptions underlying the implementation of each of these activities.

5.1.1.1 Expected Negative Impacts

Even though the threats to biodiversity in the SMPP area are considered low, the project proponents will ensure that all possible threats are observed and monitored to ensure they do not negatively impact the project. The SMPP is focused on restoring the degraded natural peatland ecosystems and is designed to deliver positive impacts within the project area and the wider landscape in the process.

5.1.2 Mitigation Actions (B2.3)

There were no negative impacts on biodiversity recorded during this monitoring period. To ensure the maintenance and enhancement of HCV attributes in the SMPP project area, we will continue the activities outlined in Figure 3.

These activities all follow the precautionary principal in that they are rooted in sound ecological principles concerning ecological succession and tropical peatland restoration, and previous research on the threats to the species found in the project area and the habitat in which they live.

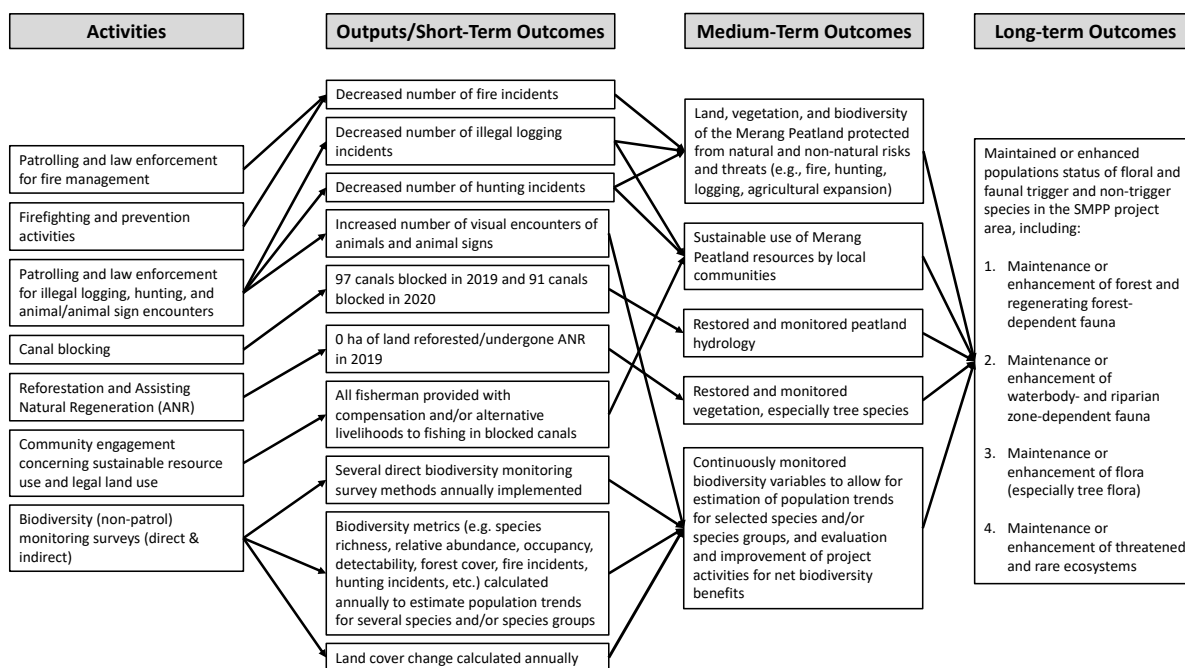


Figure 3. SMPP Causal model for SMPP biodiversity program

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

In the without-project scenario, the project area would have undergone conversion to Acacia plantation, further degrading the remaining, peatland, vegetation, and forest which would at a minimum result in:

- Further habitat degradation and homogenization
- Continued use of the canals for drainage which heavily impacts hydrology of the peatland
- Potential unchecked hunting and illegal logging practices
- Continued poor fire management practices
- Exacerbated drought and increased fire incidence in the area

All of which would have contributed to the ongoing decline of biodiversity in the project area.

In the with-project scenario, the ecological integrity of the peatland in the project area is being gradually restored through activities such as:

- Canal blocking,
- Reforestation and assisted natural regeneration
- Community engagement
- Fire management
- Increased monitoring and enforcement (see Figure 3).

The impacts of the above activities can already be seen through the changes in land cover between the satellite imagery analysis in August 2016 and March/May/September 2019, with secondary forest land cover being maintained, and closed canopy land cover increasing by 3.7%.

During the 2019 monitoring period, no enrichment planting was conducted. Illegal logging patrols, and canal blocking only began after the 2019 satellite imagery analysis of land cover was conducted. Therefore, it is assumed that our intensive fire management throughout this monitoring period to suppress fires in or around the SMPP project area, was the key determining factor for the regeneration of vegetation cover in the project area.

Three potential negative impacts or issues concerning biodiversity were identified that could eventually arise from project activities, and mitigation measures for each of these are already planned.

1. Canal dams could potentially negatively impact extant fish populations, which will be offset through the benefits for both aquatic and terrestrial species derived from canal dams and restoring peatland hydrology in the area. However no negative impacts to extant fish populations were observed.
2. Potential increases in illegal logging and hunting in the area as biodiversity is restored and species abundance and diversity increases. This will be mitigated by beginning SMART patrols and coordinating with local law enforcement authorities in 2020. No hunting was observed inside the project area.
3. Increased human-wildlife conflict with local communities. This assumes that significant increases in biodiversity in the medium- and long-term may result in more human-wildlife conflict with local communities. However, given that no communities live within the project area, and very few live within the project zone, conflict is likely to be non-existent or minimal. In the unlikely event that communities in the project zone ever experience human-wildlife conflict in the medium-or long term, tailored human-wildlife conflict mitigation strategies will be developed in a participatory process. No human wildlife conflicts were reported within the project area.

Predicted large increases in species abundance and diversity across the all ecosystem types within the SMPP project area driven through ongoing habitat restoration mean that any potential negative impacts can be deemed to be negligible.

5.1.4 High Conservation Values Protected (B2.4)

During a High Conservation Value (HCV) assessment between 22 May and 1 June 2018, four of the six High Conservation Values (HCVs)—defined under the High Conservation Value Resource Network's (HCVRN) guidelines on HCV identification—were identified in the SMPP:

- HCV 1: Species diversity, i.e. Concentrations of biological diversity including endemic, rare, endangered or threatened species that are significant at the global, regional and national levels.
- HCV 3: Ecosystems and habitats, i.e., Rare, Threatened, or Endangered ecosystems, habitats or refugia
- HCV 4: Ecosystem services, i.e. Basic ecosystem services in critical situations, including protection of water catchments and the control of fires.
- HCV 5: Community Needs, i.e. Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for livelihoods, health, nutrition, water etc.), identified through the engagement with these communities or indigenous peoples.

Updates for this monitoring period relating to latter two HCVs (HCV 4 and HCV 5) are community-related HCVs and can be found in section 4.1.4 of this monitoring report.

For HCV 1 (species diversity), it is very unlikely that species diversity has been negatively affected by the project during the 2019 monitoring period. The 2019 change detection analysis revealed that vegetation cover has been maintained, with detected regrowth or minimum regrowth within the vegetation classes. This suggests that natural regeneration of vegetation in the SMPP project is already underway. This should increase the diversity and abundance of floral species and consequently lead to increases in faunal species through a number of biotic interactions. There has been a marked increase in the number of species recorded in the SMPP project area over the current monitoring period, this is likely due mostly to an increased sampling effort rather than a sharp increase in species biodiversity over a short timescale (see

section 5.1.1). Any potential negative impacts on HCV 1 will become more apparent once patrol and survey data collected through the biodiversity monitoring plan (see section 5.3.1) in 2020 is analyzed.

For HCV 3, the remaining fragment of secondary forest within the SMPP has been maintained with no detectable change in its extent. The entire project area lies within the 150,000 ha Merang-Kepayang peat dome—the largest peat swamp dome in South Sumatra—being located 5 km west of the forests of the Sembilang National Park. The maintenance and enhancement of the project area is therefore key to maintaining or enhancing HVCs within the wider landscape. The current trend of regrowth or minimum regrowth in open and closed canopy covers and maintained secondary forest cover across the project area suggests that HCV 3 is not being negatively impacted by project activities during this monitoring period. Convexly, there is a high probability that project activities have positively impacted HCV 3 areas, primarily through effective fire management activities.

5.1.5 Invasive Species (B2.5)

The project did not introduce any invasive species to the SMPP project area during this monitoring period. As the project aims to restore the natural ecological processes in the project area, while also aiming to increase the survival rate in enrichment planting areas, all of the species that will be used in enrichment planting activities in the coming years are already found naturally growing in the project area. Though nurseries have been constructed and stocked, as fire management and completion of compacted-peat dams was the main focus during this monitoring period, no enrichment planting has yet been carried out.

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

The project did not introduce any non-native species to the SMPP project area during this monitoring period. As the project aims to restore the natural ecological processes and to increase the survival rate in enrichment planting areas. All species used in enrichment planting activities sourced from natural populations in the project area. Though nurseries have been constructed and stocked, as fire management and completion of compacted-peat dams was the main focus during this monitoring period, no enrichment planting has yet been carried out.

5.1.7 GMO Exclusion (B2.7)

The project did not introduce any GMO species to the SMPP project area during this monitoring period.

5.1.8 Inputs Justification (B2.8)

The project does not use any agricultural inputs, including fertilizers, chemical pesticides, or biological control agents.

5.2 Offsite Biodiversity Impacts

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

There are no predicted negative offsite biodiversity impacts derived from project activities. furthermore, there is no evidence that any negative offsite biodiversity impacts have occurred within this monitoring period. The small number of potentially negative impacts of project activities on biodiversity in the future—which may impact offsite biodiversity should they even come to fruition—and their associated mitigation actions, are outlined in section 5.1.3.

The only potential negative offsite biodiversity impact from our project activities that may have started to occur during this monitoring period is outlined in the table below:

Negative Offsite Impact	Mitigation Measure(s)
Certain populations of fish now living in man-made canals may have their lifecycles, feeding strategies, mating strategies negatively affected, and their canal habitats fragmented by canal dam construction.	Certain fish species use the canals in the project area for at least part of their lifecycle, but their ecology is poorly understood, so taking mitigation measures against the potential negative impacts of canal dam construction on these species is difficult. While the type of canal dam that is being constructed in the project area has the potential to fragment the canal ecosystem during dryer months and impact both on-site and offsite fish species. It is important to remember that these canals are not a natural ecosystem, that these species often rely on flooded peatland with high water-table depths for use as nurseries and ecological corridors, which will be enabled through the hydrological restorations, i.e. raising the WTL to its natural state. Similarly, the canal dams are 200 m to 1000 m apart (depending on the slope of the land), which should provide ample habitat for these species at least in the short- to medium-term. Additionally, the vegetation in canal riparian zones should also gradually regenerate and improve the health of these wetland ecosystems. Further there is flooding and spill over near peat compaction dams allows for fish to pass. Any potential net negative impact of the canal-living fish species is more than offset by the benefits of blocking the canals for the wider peatland ecosystem (particularly terrestrial species), meaning that project activities should result in clear net biodiversity benefits, both onsite and offsite.

5.2.2 Net Offsite Biodiversity Benefits (B3.3)

See section 5.1.3 and section 5.1.2 for an overview of the net biodiversity benefits from project activities, both those projected and those benefits already evident, as well the negligible potential negative biodiversity impacts of project activities. As none of the potential, albeit negligible, negative biodiversity impacts require mitigation as this stage of the project, the net effect of the project on biodiversity during this monitoring period is likely positive and should remain positive for the remainder of the project.

5.3 Biodiversity Impact Monitoring

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

During this monitoring period, the project worked to enhance and expand the biodiversity monitoring plan and decided to refine a causal model (based on the overall project causal model) that targeted biodiversity (see Figure 3). This targeted causal model allowed for the development of a revised biodiversity monitoring plan that included relevant direct and indirect indicators of the biodiversity in SMPP.

As can be seen in Figure 3, to ensure that monitoring data captures population trends for each trigger species and non-trigger species, species were grouped depending on habitat dependency. The main species groups to be monitored are:

1. Forest- and regenerating forest-dependent fauna (see Appendix A for a full list of species and their habitat dependency)
2. Waterbody- and riparian zone-dependent fauna (see Appendix A for a full list of species and their habitat dependency)
3. Flora (especially tree flora) (see Appendix A for a full list of species and their habitat dependency)

When the species are grouped in this way, variable can be selected variables that both directly measure changes in these groups (e.g., species abundance estimates, detection probabilities, etc.) and indirectly measure factors that can threaten or enhance these groups (e.g., forest cover, fire incidents, hunting incidents, etc.) (see Table 46).

Table 46. Summary of direct and indirect biodiversity indicators that will be measured, and the method for measuring them, for each species group that will be monitored in the SMPP.

No.	Species Group	Variable Measured	Variable Type	Method of Verification
1	Forest- and regenerating forest-dependent fauna	Forest Cover	Indirect	Land Cover/Land Use GIS Data Analysis
2		Floral Species Richness	Direct	Vegetation Plots
3		Floral Species Relative Abundance	Direct	Vegetation Plots
4		Tree Density	Indirect	Vegetation Plots
5		Water-table Depth	Indirect	Manual Water-table Depth Gauge
6		Illegal logging Incidents	Indirect	SMART Patrol Survey
7		Hunting Incidents	Indirect	SMART Patrol Survey
8		Fire Incidents	Indirect	SMART Patrol Survey; GIS Data Analysis (Modus Hotspot Data)
9		Fire Incidents Extinguished	Indirect	SMART Patrol Survey
10		Area of agricultural land encroachment within project area boundaries	Indirect	Land Cover/Land Use GIS Data Analysis
11		Medium- and Large-Sized Mammal Species Richness Estimate	Direct	Camera Trap Survey
12		Medium- and Large-Sized Mammal Species Detection Probability	Direct	Camera Trap Survey
13		Medium- and Large-Sized Mammal Species Occupancy Probability	Direct	Camera Trap Survey
14		Medium- and Large-Sized Mammal Species Relative Abundance Estimate	Direct	Camera Trap Survey

No.	Species Group	Variable Measured	Variable Type	Method of Verification
17		Non-Ground-Dwelling Bird Species Richness Estimate	Direct	Point Count Survey
18		Non-Ground-Dwelling Bird Species Relative Abundance	Direct	Point Count Survey
19		Non-Ground-Dwelling Bird Species Abundance	Direct	Point Transect Survey
20		Non-Ground-Dwelling Bird Species Density	Direct	Point Transect Survey
21	Waterbody- and riparian zone-dependent fauna	Forest Cover	Indirect	Land Cover/Land Use GIS Data Analysis
23		Riparian Vegetation Species Richness	Direct	Vegetation Plots
24		Riparian Vegetation Species Relative Abundance	Direct	Vegetation Plots
25		Water-table Depth	Indirect	Manual Water-table Depth Gauge; Water Table Sensors
26		Hunting Incidents	Indirect	SMART Patrol Survey
27		Fire Incidents	Indirect	SMART Patrol Survey; GIS Data Analysis (Modus Hotspot Data)
28		Fire Incidents Extinguished	Indirect	SMART Patrol Survey; GIS Data Analysis (Modus Hotspot Data)
29		No. of canal dams constructed	Indirect	Canal dam construction field reports, Diagrams, and GIS data
30	Flora (especially tree flora)	Forest Cover	Indirect	GIS data analysis
31		Floral Species Richness	Direct	Vegetation Plots
32		Floral Species Relative Abundance	Direct	Vegetation Plots
33		Tree Density	Indirect	Vegetation Plots
35		Water-table Depth	Indirect	Manual Water-table Depth Gauge; Water Table Sensors
36		Illegal logging Incidents	Indirect	SMART Patrol Survey
37		Fire Incidents	Indirect	SMART Patrol Survey; GIS Data Analysis (Modus Hotspot Data)
38		Fire Incidents Extinguished	Indirect	SMART Patrol Survey

All of the new guidelines for direct biodiversity measurements (i.e., various biodiversity survey methods) are completed, with the exception of the data handling and analysis protocol for camera trap data, which is

dependent on which software packages will be used for the duration of the project. As it stands a number of methods are currently being trialed.

At the end of 2019, SMART (Spatial Monitoring and Reporting Tool) training for five key biodiversity staff members was Scheduled. SMART is a software application that enables the collection of digital survey and patrol data in the field using android devices (i.e., most phones), and transfer of this data to targeted SMART users in almost real time.

The training took place after the current reporting period from 10-14 February 2020. At the time of submission of this report, the custom SMART data model for SMPP is being finalized. This will enable fully digital data collection for all surveys and patrols and near real-time transfer of this data to project headquarters for summary and analysis. SMART will form the foundation of the biodiversity monitoring activities, which will become apparent in the 2020 monitoring report and all subsequent reports.

At the time of submission, the cutting and marking of what will be permanently maintained tracks and transects, monitoring points, plots for biodiversity surveys and patrols is near completion (see Map 15 for the map of these new transects, points, and plots).

5.3.2 Biodiversity Monitoring Plan Dissemination (B4.3)

Each monitoring report will be made available online through the VCS Project Database (<https://www.vcsprojectdatabase.org>).

Both and English and Bahasa Indonesia versions of the Executive summary of the Project Description (which includes details of the biodiversity monitoring plan) are distributed to project community members.

The Executive Summary of each monitoring report will be translated into Bahasa Indonesia and given to all relevant stakeholders (including local community leaders in the project zone, adjacent concessions, and local authorities).

5.4 Optional Criterion: Exceptional Biodiversity Benefits

The SMPP aims to achieve exceptional biodiversity benefits and be validated to the Gold Level based on the presence of ecologically important IUCN Red Listed species in our project area.

5.4.1 Trigger Species Population Trends (GL3.3)

By the end of this monitoring period, the project had recorded a total of 39 trigger species (29 faunal species, and 10 floral species), which are summarized by taxonomic class below (see Appendix 15 for a full list of trigger and non-trigger species):

- 10 mammals
- 9 birds
- 5 reptiles
- 2 amphibians
- 1 fish
- 2 insects (dragonflies)
- 10 plant species (6 of which are tree species)

For this monitoring period, we have not documented population trends of trigger species. However, it can be said that all species groups (containing both trigger and non-trigger species) defined in section 5.3.1 are likely to have been maintained or enhanced during this monitoring period through fire management activities and the construction of compacted-peat canals dams. This is particularly evident when observing the maintenance of the secondary forest land cover and closed canopy land cover during this monitoring period, as well the early improvement of the hydrological system after dam construction in late 2019.

Trigger species in the SMPP are defined, in accordance with the CCB standards, as species that ‘trigger’ the site to meet Key Biodiversity Area qualifying conditions, which are determined based on IUCN vulnerability criteria.⁴² Twenty nine trigger species have been identified as being present in the SMPP including one apex predator, seven other mammal species, four bird species, five reptile species, one aquatic species, and eleven plant species. Further information about these trigger species is outlined in Table 47 below. Overall, the trigger species in the SMPP will be positively affected by the with-project scenario in all cases. At this time, no estimations of population numbers are available for these species within the SMPP.

Table 47. Trigger species in the SMPP.

Trigger Species	Apex Predators (1): <i>Panthera tigris</i> ssp. <i>Sumatrae</i>
Population Trend at Start of Project	The Sumatran tiger (<i>Panthera tigris</i> ssp. <i>Sumatrae</i>) is endemic to the island of Sumatra. Listed as critically endangered, IUCN indicates that this species is decreasing.
Without-project Scenario	Without the presence of the project, it is highly likely that species diversity would be negatively affected by increasing development and land-use change within the SMPP area. Although the majority of the land is significantly degraded, the land is used by mammals of significance for global biodiversity conservation such as the Sumatran tiger. Even though currently it is unlikely that the project area holds resident individuals. Rather, it is more likely that the project area is being utilized as a corridor between other land-uses in the landscape.
With-project Scenario	Under the project scenario tiger prey species such as pigs and Sambar deer are expected to increase from their current densities as the rewetting and reforestation progresses. In combination with the predicted increased forest cover, this will likely result in increased use of the SMPP area as a corridor by tigers in the area. The project area is also capable of holding resident individuals.

Trigger Species	Mammals (7): <i>Hylobates agilis</i> , <i>Presbytis melalophos</i> , <i>Helarctos malayanus</i> , <i>Lutrogale perspicillata</i> , <i>Macaca nemestrina</i> , <i>Rusa unicolor</i> , and <i>Sus barbatus</i>
Population Trend at Start of Project	The agile gibbon (<i>Hylobates agilis</i>), occupying Sumatra, Kalimantan, Peninsular Malaysia and Thailand, and the Sumatran Surili (<i>Presbytis melalophos</i>), endemic to the island of Sumatra, are both listed as endangered and IUCN indicates that the populations of these species are decreasing. The other mammals mentioned above are listed as vulnerable species. These species reside throughout Asia, and the IUCN Red List indicates that the populations of these species are in decline.
Without-project Scenario	Without the presence of the project, it is likely that species diversity would be negatively affected by increasing development and land-use change within the SMPP area.
With-project Scenario	With the SMPP in place, the ability for these areas to support biodiversity will be strengthened and these areas will be protected. Increased forest cover and the planting of tree species that are important to mammal species for some aspect of their ecology such as for food sources or nesting will likely encourage population growth of key mammal species like gibbons, sun bears, pigs, and Sambar deer.

Trigger Species	Birds (4): <i>Buceros rhinoceros</i> , <i>Lophura erythrophthalma</i> , <i>Nisaetus nanus</i> , and <i>Psittacula longicauda</i>
Population Trend at Start of Project	These species of birds occur throughout Asia, and IUCN Red List indicates that populations of all of these species are decreasing and lists them as vulnerable. Hornbills in particular are at significant and ongoing risk from illegal wildlife trade.
Without-project Scenario	Without the presence of our project, it is likely that species diversity would be negatively affected by increasing development and land-use change within the SMPP area. These species are threatened by habitat loss and disturbance.
With-project Scenario	With the project, the number and extent of bird habitats will be improved, and a higher abundance of these species will be able to thrive.

Trigger Species	Reptiles (5): <i>Heosemys spinosa</i> , <i>Tomistoma schlegelii</i> , <i>Amyda cartilaginea</i> , <i>Cuora amboinensis</i> , and <i>Ophiophagus hannah</i> ; Aquatic Species (1): <i>Scleropages formosus</i>
Population Trend at Start of Project	The spiny turtle (<i>Heosemys spinosa</i>), false gharial (<i>Tomistoma schlegelii</i>), and Asian arowana (<i>Scleropages formosus</i>) are all listed as endangered species. The Asiatic softshell turtle (<i>Amyda cartilaginea</i>), Amboina box turtle (<i>Cuora amboinensis</i>), and king cobra (<i>Ophiophagus hannah</i>) are listed as vulnerable. All of these reptiles and fish are distributed throughout Asia. Populations of false gharial, Asian arowana, and king cobra are decreasing, while the population trends of the other species listed here are unspecified by the IUCN.
Without-project Scenario	Without the presence of the project, it is likely that species diversity would be negatively affected by increasing development and land-use change within the SMPP area. These species are threatened by habitat loss and disturbance, exacerbated by the changes to natural aquatic or water-logged areas that Acacia plantation activities generate in the baseline scenario.
With-project Scenario	One of the key project activities is the rewetting of drained peat across the project area through the installation of canal blocks. These activities will significantly increase the volume and extent of ground water across the project. This, in combination with riparian replanting activities and natural regeneration will lead to increased heterogeneity of aquatic habitats. More diverse habitats will lead to increased diversity and abundance of aquatic species over time. Blocking of canals will naturally increase the extent and quality of different spawning grounds (fish and amphibians) and nesting sites (gharials and turtles) this natural diversification of the canal substrate will be further augmented by selecting species for replanting around the canal blocks that encourage the formation of root mats to bind the compacted peat material used for canal construction. These root and vegetation mats can also provide spawning and nesting grounds for the aquatic community.

Trigger Species	Plant Species (11): <i>Shorea platycarpa</i> , <i>Anisoptera marginata</i> , <i>Shorea dasyphylla</i> , <i>Shorea teysmanniana</i> , <i>Aquilaria microcarpa</i> , <i>Cantleya</i>
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	<i>corniculata</i> , <i>Combretocarpus rotundatus</i> , <i>Cyrtostachys lakka</i> , <i>Dyera costulata</i> , <i>Dyera polyphylla</i> , and <i>Shorea uliginosa</i>
Population Trend at Start of Project	<i>Shorea platycarpa</i> is listed as critically endangered, while <i>Anisoptera marginata</i> , <i>Shorea dasyphylla</i> , and <i>Shorea teysmanniana</i> are listed as endangered and the remaining species above are listed as vulnerable. There is insufficient data in the IUCN Red List concerning the population trends of these species.
Without-project Scenario	Without the presence of the project, it is likely that species diversity would be negatively affected by increasing development and land-use change within the SMPP area. These species are threatened by single species Acacia plantations and continued land conversion and degradation.
With-project Scenario	With the project, a diverse selection of plant species would have the opportunity to return to a thriving forest, without the continued pressure from Acacia plantations that threaten floral biodiversity. Disturbance in these forests would be reduced and these vulnerable species would be protected, especially in areas of intact forest that would be degraded through the impact of alteration of the hydrological conditions and subsidence by the surrounding concession in the baseline scenario.

6 ADDITIONAL PROJECT IMPLEMENTATION INFORMATION

No additional information is required to document how the project has been implemented.

7 ADDITIONAL PROJECT IMPACT INFORMATION

No additional information is required to document results of monitoring for CCB standards.

8 LIST OF ANNEXES

Annex 1 Identification of Project Risks

Annex 2 VCS AFOLU Non-Permanence Risk Analysis

Annex 3 Land Cover Change Detection from 2016 to 2019 in the Project Area

Annex 4 Peat Inventory of the Project Area

Annex 5 Justification of Eligibility of the ARR Project Area

Annex 6 Hydrological Modeling for the Project Scenario

Annex 7 Canal Blocking Plan and Hydrological Monitoring Planning Standard Operation Procedures

Annex 8 Proxy Analysis of Reference Region for Conversion/Deforestation Rate

Annex 9 Strata Changes in the Baseline Scenario

Annex 10 Default Factors for Quantification of GHG Emissions in the Baseline and Project Scenario

Annex 11 Regional Fire Probability Modeling for Predicting Fire Risk

Annex 12 Estimate of Annual Area Burnt and Simulation of 100-Year Fire Occurrence

Annex 13 Uncertainty in WRC Estimates

Annex 14 Peat Characteristics and Subsidence Monitoring SOPs

Annex 15 SMPP Species Inventory Showing Taxonomic Class, Species Name, Habitat Dependency/Species Groups, and Trigger Species Status

Annex 16 References