# Sumatra Merang Peatland Project (SMPP)

# MONITORING REPORT



FOREST CARBON

SUMATRA MERANG PEATLAND PROJECT

GLOBAL ALAM LESTARI

Document Written by Forest Carbon

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| **Project title** | Sumatra Merang Peatland Project (SMPP) |
| **Project ID** | 1899 |
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| **Monitoring period** | 1st January 2022 - 31st December 2023 |
| **(CCB) GHG accounting period** | 1st January 2016 - 31st December 2062; 47-year |
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| **History of CCB status** | Date of Validation: 26 November 2019<br>Date of 1st Verification: 26 November 2019<br>Date of 2nd Verification: 30 October 2020<br>Date of 3rd Verification: 21 December 2021<br>Date of 4th Verification: 22 January 2024 |
| **Gold Level Criteria** | The SMPP aims to generate exceptional benefits for climate and biodiversity, under both the Verified Carbon Standard (VCS) and Climate, Community, and Biodiversity (CCB) standards (Third Edition).<br><br>**Exceptional Biodiversity Benefits**<br><br>The SMPP is protecting critical habitat for 7 Critically Endangered species (3 animal species and 4 tree species), 14 Endangered species (11 animal species and 3 tree species), and 20 Vulnerable species (13 animal species and 7 plant species). The species protected within the SMPP project area include the endemic Sumatran tiger (*Panthera tigris sumatrae*), the southern mitered langur (*Presbytis melalophos*), and the Malay crestless fireback (*Lophura erythrophthalma*), as well as other threatened species such as the sun bear (*Helarctos malayanus*), the agile gibbon (*Hylobates agilis*), and the rhinoceros hornbill (*Buceros rhinoceros*). The SMPP protects the area from further degradation and facilitates natural regeneration. The forest cover increased during this monitoring period. This regeneration strengthens wildlife corridors to neighboring national parks to ensure a more ecologically intact habitat that these species can depend on. Detailed information about the SMPP's biodiversity benefits can be found throughout Section 5 (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.<br><br>**Climate Change Adaptation Benefits**<br><br>The SMPP will prevent the emission of an average of 1,338,569 tonnes of $CO_2$-e annually by protecting and restoring a degraded peatland area. This will be achieved by restoring the project area's hydrology by constructing dams to block canals that have drained the project area. Detailed information about the SMPP's climate benefits generated through project activities can be found throughout Section 3.3.1 (with project activities described in Project Description (PD) Section 2.1.1). |
| **Prepared by** | Forest Carbon |

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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 |
| AOI | Area of Interest |
| APD | Avoiding Planned Deforestation |
| APDD | Avoided Planned Deforestation and Degradation |
| ARR | Afforestation, Reforestation, and Revegetation |
| ARR | Afforestation, Reforestation, and Revegetation |
| CCB | Climate, Community & Biodiversity |
| CDM | Clean Development Mechanism |
| CEO | Chief Executive Officer |
| $CH_4$ | Methane |
| CIFOR | Center for International Forestry Research |
| CIRAD | *Centre de coopération internationale en recherche agronomique pour le développement* / French Agricultural Research Centre for International Development |
| CIW | Conservation of Intact Wetlands |
| $CO_2$ | Carbon Dioxide |
| CR | Critically Endangered |
| CUPP | Conservation of Undrained and Partially Drained Peatland |
| DOC | Dissolved Organic Carbon |
| DTM | Digital Terrain Model |
| EN | Endangered |
| EWS | Early Warning System |
| FPIC | Free, Prior, and Informed Consent |
| GHG | Greenhouse Gas |
| GIS | Geospatial Information System |
| GMO | Genetically Modified Organism |
| HCV | High Conservation Value |
| HCVRN | High Conservation Value Resource Network |
| HTI | *Hutan Tanaman Industri* / 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 | *Izin Usaha Pemanfaatan Penyerapan Karbon dan/atau Penyimpanan Karbon* / Carbon storage and sequestration license |

| Abbreviation | Meaning |
|---|---|
| KBA | Key Biodiversity Area |
| LLM | Master of Law |
| MF | Methodology Framework |
| MODIS | Moderate Resolution Imaging Spectroradiometer |
| MR | Monitoring Report |
| $N_2O$ | Nitrous Oxide |
| NDC | Nationally Determined Contribution |
| NDVI | Normalized Difference Vegetation Index |
| NICFI | Norwegian International Climate and Forest Initiative |
| PBPH | *Perizinan Berusaha Pemanfaatan Hutan* / Business License for Forest Exploitation |
| PD | Project Description |
| PDT | Peat Depletion Time |
| PERADI | Indonesian Bar Association |
| PRA | Participatory Rural Appraisal |
| PT | *Perseroan Terbatas* / Limited Liability Corporation |
| RAI | Relative Abundance Index |
| RDP | Rewetting of Drained Peatland |
| REDD | Reducing Emissions from Deforestation and Forest Degradation |
| RWE | Restoration of Wetland Ecosystems |
| SAR | Synthetic Aperture Radar |
| SDG | Sustainable Development Goals |
| SMPP | Sumatra Merang Peatland Project |
| SOP | Standard Operating Procedure |
| SRN PPI | *Sistem Registrasi Nasional Pengendalian Perubahan Iklim* / National Registration System for Climate Change Control |
| VCS | Verified Carbon Standard |
| VIIRS | Visible Infrared Imaging Radiometer Suite |
| VM0007 | REDD+ Methodology Framework |
| VU | Vulnerable |
| WRC | Wetland Restoration and Conservation |
| WTL | Water Table Level |

# 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 the project's conceptual model. Section 1.2 (Standardized Benefit Metrics) 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.

**Table 1. Unique project benefits.**

| Outcome or impact | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|
| Hydrological function restoration | In the current monitoring period the project successfully completed the construction of an additional 31 dams, bringing the total to 234 peat compaction dams across the concession. Consequently, water table levels throughout the monitoring period maintained. | Section 3.3.1 | 234 peat compaction dams were installed across the project area.<br><br>87 temporary boxed dams installed.<br><br>Continuous monitoring of the water table level using dip well and smart sensors. |
| Fire prevention and fire threat reduction | In the current monitoring period, the project detected zero fire hotspots in the SMPP Project Area (using a Satellite-based early warning system). The occurrence of hotspots in the Project Zone increased from 11 in the previous monitoring period to 51 in this monitoring period.<br><br>The project held a four-day firefighting training in 2022 with Manggala Agni-fire brigade under the Indonesian Ministry of Environment and | Sections 3.2.2.2, 2.3.15, 4.3.1, and 3.3.1 | The project has maintained zero fire hotspots in the SMPP area since 2020.<br><br>Reduction in human activity within the SMPP area which has led to reduced fire risk.<br><br>Satellite-based early warning system (EWS) to detect and mitigate fires as early as possible.<br><br>Forest patrols focused on detecting and identifying hotspot fire threats, and continuously monitoring for fire in the SMPP and |

| Outcome or impact | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|
| | Forestry (MoEF). The project also supported the Village Fire Prevention Community (KMPA) from Muara Merang & Kepayang villages to attend the training.<br><br>The project supported fire safety training for each SMPP field staff member upon their induction into the project.<br><br>Reduction in human activity within the SMPP area has led to reduced fire risk. | | wider area.<br><br>Firefighting training for SMPP staff working inside the project area was held with Manggala Agni - fire brigade under MoEF.<br><br>The project facilitated KMPA from Muara Merang & Kepayang villages to attend the firefighting training with Manggala Agni.<br><br>Fire response training for nearby concessions and SMPP stakeholders.<br><br>Continued engagement with neighboring concessions on fire safety coordination and joint training.<br><br>Continued minimizing the impact of fires within the project area and maximizing fire resilience in the SMPP and surrounding landscape.<br><br>Ensure natural forest ecosystems/habitats recover that support key species.<br><br>Limit the negative impacts to health and livelihoods from smoke haze and air pollution. |

## 1.2 Standardized Benefit Metrics

**Table 2. Standardized benefit metrics.**

| Category | Metric | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| GHG emission reductions or removals | Net estimated emission removals in the project area, measured against the without-project scenario | (74,120) | Section 3.2.4.2 | 30,738 |
| | Net estimated emission reductions in the project area, measured against the without-project scenario | 1,358,500 | Section 3.2.4.2 | 7,231,880 |
| Forest cover* | For REDD† projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario | N/A | N/A | NA |
| | For ARR‡ projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario | 48.35 | Section 3.2.2.1.1.5 | 70.99 |
| Improved land management | Number of hectares of existing production forest land in which IFM practices have occurred as a result of the project's activities, measured | N/A | N/A | N/A |

* 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).

† 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).

‡ 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).

| Category | Metric | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| | against the without-project scenario | | | |
| | Number of hectares of non-forest land in which improved land management has occurred as a result of the project's activities, measured against the without-project scenario | N/A | N/A | N/A |
| Training | Total number of community members who have improved skills and/or knowledge resulting from training provided as part of project activities | 70 individuals received training on the usage and maintenance of rainwater catchment systems. 164 participants (employees and other stakeholders) received trainings including Asian waterbird census, fire prevention, human-wildlife conflict mitigation, drone operating, and EarthRanger training. 41 pregnant women and/or new mothers received training on identifying the dangers of stunting and mitigation measures. | Section 2.3.15; Section 4.3.1 | 15 health workers and cadres completed training on anti-stunting, health administration, and breastfeeding and postnatal infant care. 173 pregnant women and/or new mothers received training on identifying the dangers of stunting and mitigation measures. 164 participants (employees and other stakeholders) received trainings including Asian waterbird census, fire prevention, human-wildlife conflict mitigation, drone operating, and earth ranger training. Seven individuals were trained to assemble and install rainwater catchment systems. 145 individuals received training on the usage and |

| Category | Metric | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| | | | | maintenance of rainwater catchment systems, as well as one elementary school and one health center operator. |
| | Number of female community members who have improved skills and/or knowledge resulting from training provided as part of project activities of project activities | 21 women as employees and other stakeholders participated in trainings including Asian waterbird census, fire prevention, human-wildlife conflict mitigation, drone operating, and earth ranger training. | Section 4.2.2; Section 4.3.1 | 15 health workers and cadres completed training on anti-stunting, health administration, and breastfeeding and postnatal infant care. 173 pregnant women and/or new mothers received training on identifying the dangers of stunting and mitigation measures. 21 women as employees and other stakeholders participated in trainings including Asian waterbird census, fire prevention, human-wildlife conflict mitigation, drone operating, and earth ranger training. |
| Employment | Total number of people employed in project activities,* expressed as number of full time employees† | 14 new employees, with a total number of 48 employees. | Section 4.2.2; Section 4.3.1 | 133 employees. |

* 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.

† 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]).

| Category | Metric | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| | Number of women employed in project activities, expressed as number of full time employees | Two new female employees, with a total number of six active. | Section 4.2.2; Section 4.3.1 | 22 women employees. |
| Livelihoods | Total number of people with improved livelihoods* or income generated as a result of project activities | 17 fishermen have access to and gain their livelihood within their project area and one farmer. 15 local people are employed. 10 individuals are supported by the project (two health workers, six teachers and two librarians). 50% of the project food budget goes to 13 local shops. | Section 4.1.1; Section 4.2.2; Section 4.3.1 | 31 fishermen have access to and gain their livelihood within their project area and two farmers. 51 local people are employed. 12 individuals are supported by the project (two health workers, eight teachers and two librarians). 50% of the project food budget goes to 13 local shops. |
| | Number of women with improved livelihoods or income generated as a result of project activities | Ten individuals are supported by the project (two health workers, six teachers, and two librarians). | Section 4.2.2; Section 4.3.1 | 12 individuals are supported by the project (two health workers, eight teachers, and two librarians). 8 local female employees. |
| Health | Total number of people for whom health services were improved as a result of project activities, measured against the without-project scenario | Three health facilities were supported. 572 received COVID-19 vaccinations. 159 children received immunization shots. 20 people received health care under Indonesia's Health Insurance Scheme (BPJS). The project has also provided medical equipment | Section 4.2.2; Section 4.3.1 | Three health facilities supported. 1415 individuals received COVID-19 vaccinations. 159 students received immunization shots. 55 people received health care under BPJS. The project has also provided medical equipment and regularly delivers medicines |

* 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 | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| | | and regularly delivers medicines that will benefit approximately 8,000 residents of both villages. | | that will benefit approximately 8,000 residents of both villages. |
| | Number of women for whom health services were improved as a result of project activities, measured against the without-project scenario | Approximately 50% or ~4,000 female residents in Muara Merang and Kepayang. | Section 4.2.2; Section 4.3.1 | Approximately 50% or ~4,000 female residents in Muara Merang and Kepayang. |
| 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 | 282 students. 15 students received scholarships to Universitas Terbuka. 170 Sekolah Dasar (SD) students attend after school programs. 128 students received scholarships to attend adult continuing education programs (59 new students). | Section 4.2.2; Section 4.3.1 | 445 students. 20 students received scholarships to Universitas Terbuka and who will likely become future teachers in both villages. 244 SD students attend after school programs. 29 teachers and volunteers received library training. 136 students received scholarships to attend adult continuing education programs. |
| | 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 | 144 female students. 13 female students received scholarships to Universitas Terbuka. 87 female SD students attending after school programs. 40 female students receiving scholarships to attend adult | Section 4.2.2; Section 4.3.1 | 231 female students. 14 female students received scholarships to Universitas Terbuka and who will become future teachers in both villages. 141 (> 50%) of 260 SD students attending after school programs. 22 |

| Category | Metric | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| | | continuing education programs. | | female teachers and volunteers received library training. 43 female students received scholarships to attend adult continuing education programs. |
| Water | Total number of people who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario | 70 rainwater catchment systems were installed in houses. ~265-346 individuals with improved household water resources. 10 new rainwater catchment systems in public facilities. | Section 4.2.2; Section 4.3.1 | 147 rainwater catchment systems were installed in houses. ~665-846 individuals with improved household water resources. 10 new rainwater catchment systems in public facilities. |
| | 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 | ~130-173 (50% of household members) have improved household water resources. | Section 4.2.2; Section 4.3.1 | ~330-423 (50% of household members) have improved household water resources. |
| Well-being | Total number of community members whose well-being* was improved as a result of project activities | 17 fishermen have access to and gain their livelihood within their project area and one farmer. 15 local people are employed. 10 individuals are supported by the project (two health workers, six teachers and two | Section 4.1.1; Section 4.2.2; Section 4.3.1 | 31 fishermen have access to and gain their livelihood within their project area and two farmers. 52 local people are employed. 12 individuals are supported by the project (two health workers, eight teachers, and two |

* 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 | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| | | librarians). 50% of the project food budget goes to 13 local shops. 282 students received improved access and quality of education. | | librarians). 50% of the project food budget goes to 13 local shops. 445 students received improved access and quality of education. |
| | Number of women whose well-being was improved as a result of project activities | Three new female employees, with a total number of five female employees active. Six individuals are supported by the project (two health workers, six teachers, and two librarians). 144 female students. | Section 4.1.1; Section 4.2.2; Section 4.3.1 | 26 women employees. 12 individuals are supported by the project (two health workers, eight teachers, and two librarians). 231 total female students. |
| Biodiversity conservation | Change in the number of hectares significantly better managed by the project for biodiversity conservation,* measured against the without-project scenario | 22,922 ha | Section 2.1.7; Section 5.4.1 | 22,922 ha |
| | Number of globally Critically Endangered or Endangered species† benefiting from reduced threats as a result of project activities,‡ | 21 Critically Endangered (7) or Endangered (14) species; and 20 Vulnerable species occurring in the project area.§ | Section 5.4.1 | 21 Critically Endangered (7) or Endangered (14) species; and 20 Vulnerable species occurring in the project area.§ |

* 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.

† Per IUCN's Red List of Threatened Species.

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

§ The figures above include species recorded outside of standardized annual biodiversity monitoring surveys.

| Category | Metric | Achievements during the monitoring period | Section reference | Achievements during the project lifetime |
|---|---|---|---|---|
| | measured against the without-project scenario | | | |

# 2 PROJECT DETAILS

## 2.1 Summary Description of the Implementation Status of the Project (VCS, 2.1, 3.6; CCB, G1.2)

### 2.1.1 Summary Description of the Project (VCS, 2.1, 3.6; CCB, G1.2)

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 in a regenerating but degraded state due to the historical impact of logging, canal construction, and fires. 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. The project focus on ecosystem restoration involves 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 and multiple community development sub-activities have delivered positive net benefits in terms of participation and expansion.

This report covers the monitoring period from January 1st, 2022, to December 31st, 2023. Throughout this period, the project has supported a daily forest patrol system and daily weather monitoring. The project continued to implement community development activities and other programs achieving positive impacts for stakeholders. During the monitoring period an additional 31 dams were successfully constructed, bringing the total to 234 permanent canal blocking dams. The installation of these dams occurred on existing drainage canals and was designed to restore natural water table levels without restricting access to waterways used by fishermen.

Water table level was monitored in dip wells along 22 transects up to 1 km outside of the project boundary. Data was collected at the main canal outflows and was included in hydrological modeling. The transects and dip wells were designed to detect potential hydrological connectivity beyond the project boundary. The project also installed 30 camera traps in 2022 and 25 camera traps in 2023, of which only 21 were operational for the full deployment due to technical issues, maintaining the scope for monitoring positive biodiversity impacts.

Section 3.2.3.1 describes estimation of emissions from activity shifting for avoiding planned deforestation and planned degradation (LK-ASP), by comparing estimated parameters set as the baseline in PD versus actual parameters based on annual government statistics of licensed areas, as well as comparing deforested areas estimated through an annual global tree cover loss dataset versus estimates in the PD, and leakage calculations in HTI concessions. Section 3.2.3.2 describes why change in estimation of emissions from displacement of pre-project agricultural activities (LK-ARR) was zero. Section 3.2.3.3 describes estimation of emissions from ecological leakage (LK-ECO) by monitoring water table levels affected by rewetting activities.

In this monitoring report the non-permanence analysis was updated using the most updated Non-Permanence Risk Tool (v4.2), as detailed in project's supporting documents. The Internal Risk has been monitored through tracking project's financial and management models, The External Risk was monitored by tracking updates in the World Bank Governance Indicators of Indonesia, policy, or regulatory changes, as well as changes in community and land tenure. The Natural Risk was

monitored through tracking incidents of hazard occurrences. The total Internal Risk score was 13.25, The External Risk score was 0, and the Natural Risk score was 2.24, totaling the overall risk rating to 16. Therefore, the combined non-permanence risk buffer for the project was determined as 18% and was applied to both WRC and ARR net emission reductions.

Overall, from the beginning of this fifth monitoring period in January 2022 through the end of the monitoring period in December 2023, the SMPP estimates that 2,504,956 metric tons (t) $CO_2$-e (carbon dioxide equivalents) in emission reductions or removals were achieved.

### 2.1.2 Audit History (VCS, 4.1)

**Table 3. Audit history.**

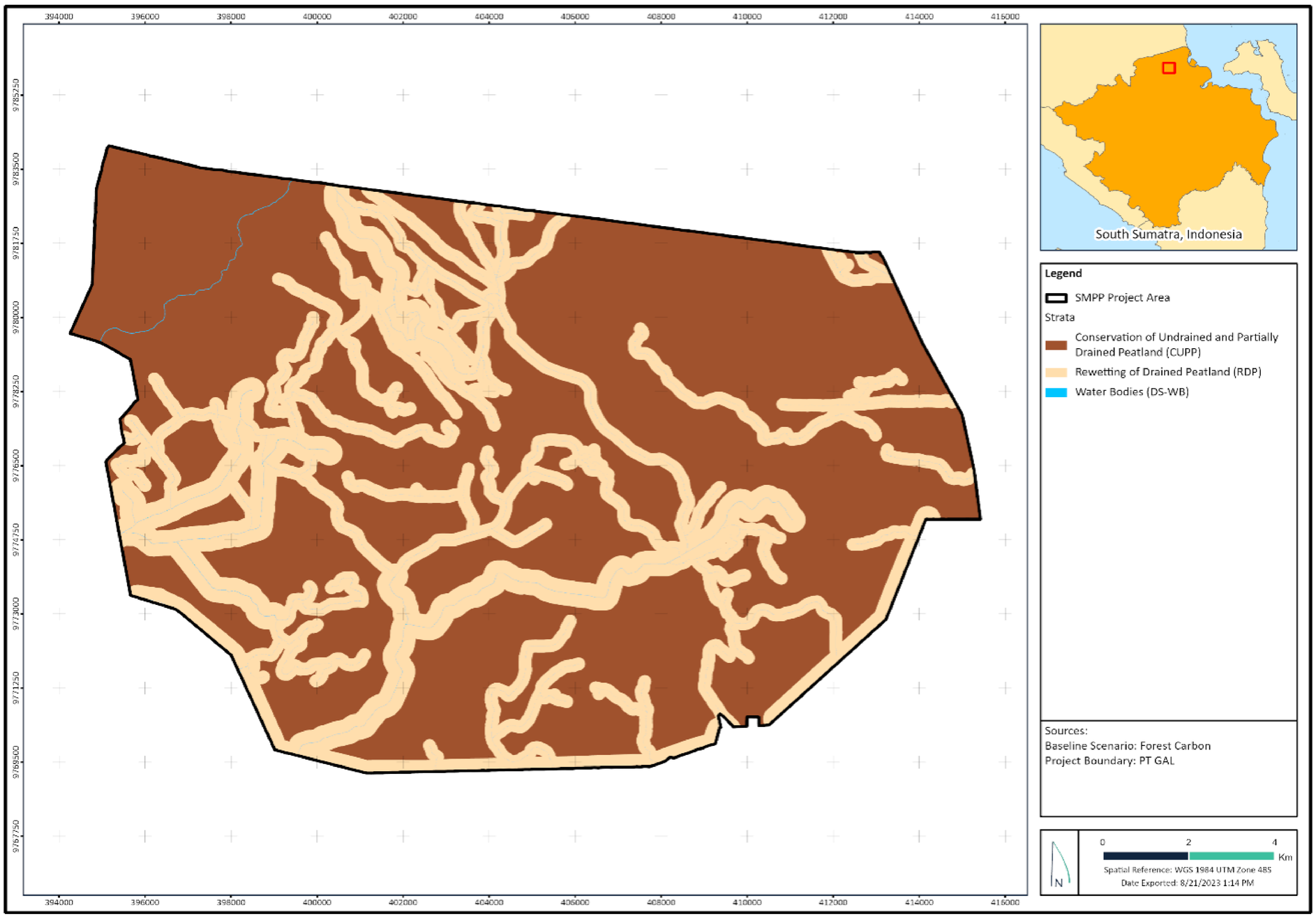
| Audit type | Period | Program | VVB name | Number of years |
|---|---|---|---|---|
| Validation/ Verification | 01/01/2016 - 31/12/2018 | VCS&CCB | Aster Global Environmental Solutions Inc. | Three years |
| Verification | 01/01/2019 - 31/12/2019 | VCS&CCB | AENOR International S.A.U. | One year |
| Verification | 01/01/2020 - 31/12/2020 | VCS&CCB | AENOR International S.A.U. | One year |
| Verification | 01/01/2021 - 31/12/2021 | VCS&CCB | AENOR International S.A.U. | One year |
| Verification | 01/01/2021 - 31/12/2021 | VCS&CCB | AENOR International S.A.U. | One year |
| Verification | 01/01/2022 - 31/12/2023 | VCS&CCB | AENOR International S.A.U. | Two years |

### 2.1.3 Sectoral Scope and Project Type (VCS, 3.2)

- 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 the sub-categories Conservation of Undrained and Partially Drained Peatland (CUPP) under Conservation of Intact Wetlands (CIW) and Rewetting of Drained Peatland (RDP) under Restoration of Wetland Ecosystems (RWE). The SMPP is not a grouped project.

**Table 4. Sectoral scope and project type.**

| | |
|---|---|
| Sectoral scope | 14: Agriculture, forestry, and other land use |
| AFOLU project category | Afforestation, Reforestation and Revegetation (ARR) and Wetlands Restoration and Conservation (WRC) |
| Project activity type | Restoration of peatlands and revegetation (ARR+RWE)<br>Avoided drainage of peatlands and revegetation (ARR+CIW) |




**Map 1. Stratification of the project area based on WRC sub-categories.**

### 2.1.4 Project Proponent (VCS, 3.7; CCB, G1.1)

The project proponents are listed below.

| | |
|---|---|
| Organization name | PT Global Alam Lestari |
| Contact person | Reagen Pangestu |
| Title | President Director |
| Address | Grand Ville Bayung Indah Blok A No. 9, Bayung Lencir, Musi Banyuasin, South Sumatra 30756 |
| Telephone | +62 878 83632218 |
| Email | reagen.pangestu@globalalamlestari.com |

| | |
|---|---|
| Organization name | Forest Carbon Pte Ltd |
| Contact person | Jeffrey Chatellier |
| Title | CEO |
| Address | 152 Beach Road #28-00 Gateway East, Singapore (189721) |
| Telephone | +62 21 5740817 |
| Email | j.chatellier@forestcarbon.com |

### 2.1.5 Other Entities Involved in the Project

There is no key implementing and technical partner.

### 2.1.6 Project Start Date (VCS, 3.8)

In accordance to the Verified Carbon Standard (VCS) definition, the project start date is January 1st, 2016, marking the date activities contributing toward greenhouse gas (GHG) emission reductions and removals were initiated. Further justification are listed in Table 15 below.

**Table 5. Project start date.**

| | |
|---|---|
| Project start date | 01 January 2016 |
| Justification | 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. |

### 2.1.7 Benefits Assessment and Project Crediting Period (VCS, 3.9; CCB, G1.9)

**Table 6. Benefits Assessment and Project Crediting Period.**

| | |
|---|---|
| Crediting period | 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.<br><br>The project holds a PAN/RAP carbon storage and sequestration license held by PT Global Alam Lestari, issued in 2013, which is extendable for up to 50 years |
| Start date of first or fixed crediting period | 01 January 2016 - 31 December 2062 |
| Total number of years of crediting period | 47 |
| CCB benefits assessment period | 47 |

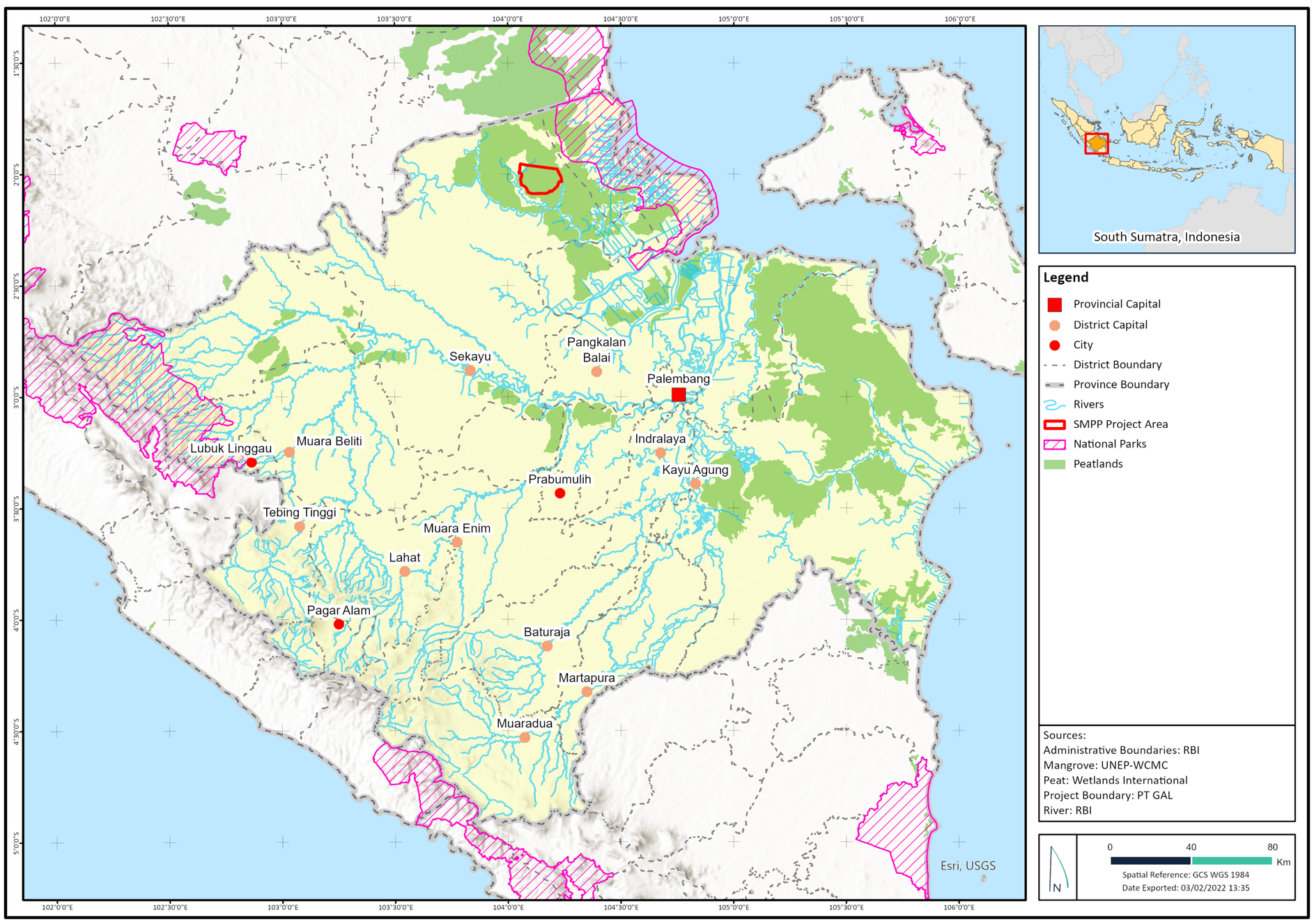
As per the updated VCS Standard v4.7, the baseline reassessment period is every six years for avoided planned deforestation and degradation (APDD) projects, where the deforestation agent is unknown. For projects that are registered on or before 19 January 2022, this update is effective at the subsequent baseline reassessment period. Therefore, for the SMPP project the first baseline reassessment will be ten years after the start date, and then subsequently every six years.

### 2.1.8 Project Location (VCS, 3.11; CCB, G1.3)

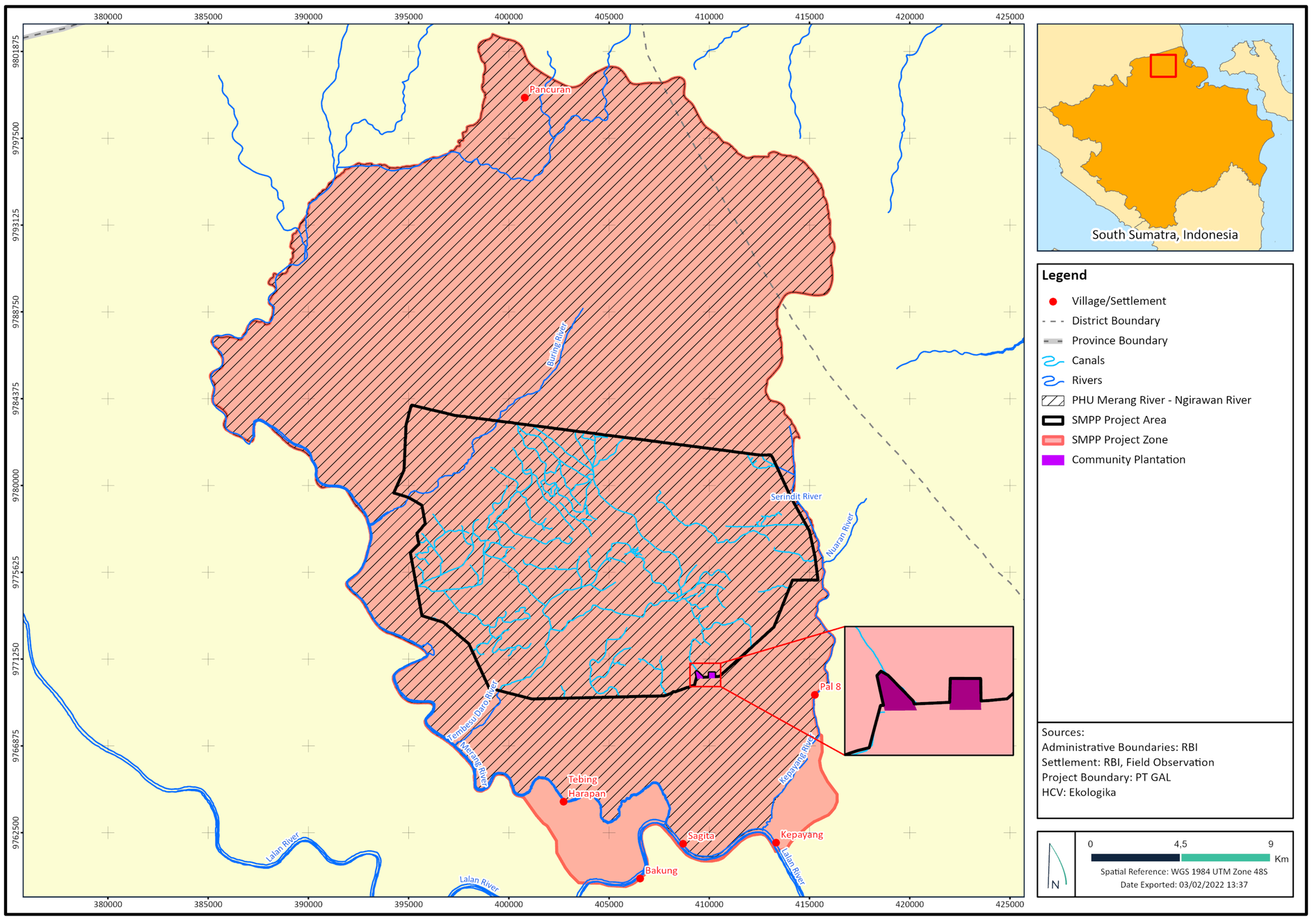
The SMPP is located within the Bayung Lencir sub-district, Musi Banyuasin district, South Sumatra province, Sumatra, Republic of Indonesia (see Map 1). The Musi Banyuasin regency is in the

northern part of South Sumatra province and is between 103-104° 45' East (E) and 1.3° - 4° South (S), it covers a total area of 14,266 square kilometers (km²). The SMPP area lies between the following geographic coordinates: 2º 1' 9.01" S and 104º 8' 43.10" E (see Map 2).

☒ KML file has been provided




**Map 2. Location of the project area.**




**Map 3. Location of the SMPP Project Area and Project Zone.**

The SMPP project zone consists of the formal project area and the government delineated peatland hydrology unit (PHU). It has also been extended to include the village areas where community development activities 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 (Map 2).

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 covers 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 150,000 ha.[1] A number of critical climate and biodiversity assets are linked to the wider peat swamp forest area that surrounds the SMPP, including the Sembilang-Berbak National Park to the northeast and the Muaro Jambi peat swamp to the north.

### 2.1.9 Title and Reference of Methodology (VCS, 3.1)

The SMPP applies version 1.5 of VCS Methodology VM0007, as per VCS Standard (v4.5, section 3.22.2).

**Table 7. Title and reference of methodology.**

| Type | Reference ID | Title | Version |
|---|---|---|---|
| Methodology | VM0007 | VM0007 REDD+ Methodology Framework (REDD+MF) | 1.5 |
| Module | VMD0006 | VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation and planned degradation (BL-PL) | 1.3 |
| Module | VMD0013 | VMD0013 Estimation of greenhouse gas emissions from biomass and peat burning (E–BPB) | 1.2 |
| Module | VMD0015 | VMD0015 Methods for monitoring of greenhouse gas emissions and removals (M-REDD) | 2.2 |
| Module | VMD0016 | VMD0016 Methods for stratification of the project area (X-STR) | 1.2 |
| Module | VMD0017 | VMD0017 Estimation of uncertainty for REDD project activities (X-UNC) | 2.2 |
| Module | VMD0041 | VMD0041 Estimation of baseline carbon stock changes and greenhouse gas emissions in ARR project activities (BL-ARR) | 1.1 |
| Module | VMD0042 | VMD0042 Estimation of baseline soil carbon stock changes and greenhouse gas emissions in peatland rewetting and conservation project activities (BL-PEAT) | 1.1 |
| Module | VMD0044 | VMD0044 Estimation of emissions from ecological leakage (LK-ECO) | 1.1 |
| Module | VMD0045 | VMD0045 Methods for monitoring greenhouse gas emissions and removals in ARR project activities (M-ARR) | 1.1 |
| Module | VMD0046 | VMD0046 Methods for monitoring of soil carbon stock changes and greenhouse gas emissions and removals in peatland rewetting and conservation project activities (M-PEAT) | 1.1 |
| Methodology | AR-ACM0003 | AR-ACM0003: Afforestation and reforestation of lands except wetlands | 2.0 |
| Tool | tool 04 | CDM Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (T-ADD) | 3.0 |
| Tool | tool 02 | CDM Tool for testing significance of GHG emissions in A/R CDM project activities (TSIG) | 1.0 |

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 8. Summary of applicability conditions.**

| No | Module | Applicability condition | Comment |
|---|---|---|---|
| 1 | REDD-MF, 4.3 ARR (Version 1.5) | The project area is non-forest land or land with degraded forest. | Condition met.<br>See SMPP PD Section 2.1.5. |
| 2 | REDD-MF, 4.3 ARR (Version 1.5) | The project scenario does not involve the harvesting of trees. Therefore, procedures for | Condition met.<br>See SMPP PD Section 2.1.11. |

| No | Module | Applicability condition | Comment |
|---|---|---|---|
| | | the estimation of long-term average carbon stocks are not provided. | |
| 3 | REDD-MF, 4.3 ARR (Version 1.5) | ARR activities are not eligible if the project scenario does not involve the application of nitrogen fertilizers. | Condition met.<br>The project does not involve the application of any fertilizers. See SMPP PD Section 2.1.11. |
| 4 | REDD-MF, 4.3 ARR (Version 1.5) | 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.<br>The project applies modules BL-PEAT and M-PEAT alongside all modules related to ARR. |
| 5 | REDD-MF, 4.4 WRC (Version 1.5) | 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.<br>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.<br>The project therefore falls in the category of RDP and CUPP.<br>The project meets the definition of domed peatlands (see SMPP PD Section 2.1.5) and is in the tropical climate zone (see Section 2.1.5 (see SMPP PD Section 2.1.5). |
| 6 | REDD-MF, 4.4 WRC (Version 1.5) | Fire reduction projects on peatland that exclude rewetting as part of the project activity are not eligible. | Condition met.<br>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 (Version 1.5) | 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.<br>The project does not include any REDD components. |
| 8 | REDD-MF, 4.4 WRC (Version 1.5) | Rewetting of drained peatland may be implemented as a separate activity or in combination with ARR project activities.<br>ARR activities must not enhance peat oxidation and therefore this activity requires at least some degree of rewetting. | Condition met.<br>The project includes extensive rewetting across the entire project area (see SMPP PD Section 2.1.11) in conjunction with WRC and ARR activities. |
| 9 | X-STR ( Version 1.2) | 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.<br>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.<br>The project does not include any REDD components. |

| No | Module | Applicability condition | Comment |
|---|---|---|---|
| 10 | X-STR (Version 1.2) | 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.<br>See application of X-STR in SMPP PD Section 3.1.3. |
| 11 | X-STR (Version 1.2) | 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.<br>The project is taking significant steps to maintain the 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 are which could be under threat of disturbance in ordered to minimize potential impacts in terms of drainage. See SMPP PD Section 3.2.3. |
| 12 | BL-ARR (Version 1.0) | The applicability conditions set out in AR-ACM0003 Afforestation and reforestation of lands except wetlands must be met. | Condition met.<br>See #25 & 17 below. |
| 13 | BL-ARR (Version 1.1) | 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 (Version 1.1) | 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.<br>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 (Version 1.1) | 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.<br>See #2 above. |
| 16 | ACM0003 (Version 2.0) | This methodology is applicable under the following conditions:<br><br>(a) The land subject to the project activity does not fall in wetland category. | Per #13 above, condition (a) can be neglected, as the project applies relevant wetland procedures.<br><br>Condition (b) is not relevant, as the project |

| No | Module | Applicability condition | Comment |
|---|---|---|---|
| | | (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:<br><br>(i) Land containing organic soils;<br><br>(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. | does not cause soil disturbance. |
| 17 | ACM0003 (Version 2.0) | 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.<br>This table lists all relevant applicability conditions and describes how they are fulfilled. |
| 18 | BL-PEAT (Version 1.1) | 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.<br>See #5 above. |
| 19 | BL-PEAT (Version 1.1) | 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 $N_2O$ emissions in the project scenario are not significant, or it must be demonstrated that $N_2O$ emissions will not increase in the project scenario compared to the baseline scenario, and therefore $N_2O$ emissions need not be accounted for. | Condition met.<br>The project does not cause an increase in $N_2O$ emissions. |
| 20 | BL-PEAT (Version 1.1) | In the baseline scenario the peatland must be (partially) drained. At project start the peatland may still be undrained. | Condition met.<br>Peatland will be drained in the baseline (see SMPP PD Section 3.2.1). |
| 21 | BL-PL (Version 1.3) | 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.<br>The project does not include any REDD components. |
| 22 | BL-PL (Version 1.3) | 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.<br>Unsustainable fuelwood collection not occurring within the project boundaries. |
| 23 | LK-ECO (Version 1.1) | This module is applicable under the following condition: | Condition met.<br>Project does not cause ecological leakage. |

| No | Module | Applicability condition | Comment |
|---|---|---|---|
| | | • Leakage caused by hydrological connectivity is avoided by project design and site selection, as outlined in Chapter 5 (Procedures). | See application of LK-ECO in SMPP PD Section 3.2.3. |
| 24 | T-ADD<br>(Version 3.0) | The tool is applicable under the following conditions:<br><br>• 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.<br><br>• This tool is not applicable to small - scale afforestation and reforestation project activities. | Condition met.<br>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<br>(Version 1.0) | The tool shall be used in the application of an A/R CDM approved methodology to an A/R CDM project activity:<br><br>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.<br><br>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.<br>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<br>(Version 1.2) | 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.<br>Project includes WRC activities. |
| 27 | M-ARR<br>(Version 1.1) | This module is applicable under the following conditions:<br><br>• The applicability conditions provided in A/R CDM consolidated methodology AR-ACM0003 (Afforestation and reforestation of lands except wetlands) and associated tools.<br><br>• Where exclusion of project activities on wetlands exists in the applicability conditions of methodologies and tools, these can be neglected for the purpose of their use in this | Condition met.<br>See #13 & #14 above |

| No | Module | Applicability condition | Comment |
|---|---|---|---|
| | | module, as accounting procedures for the peat soil are provided in nodule M-PEAT. | |
| 28 | M-PEAT (Version 1.1) | 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.<br>See #5 above. |
| 29 | M-PEAT (Version1.1) | Furthermore, the following applicability conditions apply:<br><br>• It must be demonstrated using tool T-SIG that $N_2O$ emissions in the project scenario are not significant, or it must be demonstrated that $N_2O$ emissions will not increase in the project scenario compared to the baseline scenario, and therefore $N_2O$ emissions need not be accounted for.<br><br>• In the baseline scenario the peatland must be drained or partially drained.<br><br>• At project start the peatland may still be undrained.<br><br>• It must be demonstrated using Module LK-ECO that ecological leakage must not occur. | Condition met.<br>See #19 regarding $N_2O$ emissions. The baseline scenario includes the draining of peatland. The project is partially drained at the project start. Per SMPP PD Section 3.2.3 ecological leakage does not occur. |
| 30 | M-REDD (Version 2.2) | Strata as defined in the relevant baseline modules are fixed and may not be changed without baseline revision. | Condition met.<br>See SMPP PD Section 3.1.3. |
| 31 | M-REDD (Version 2.2) | The module is always mandatory. Without application of this module the methodology shall not be used. | Condition met.<br>The module is applied as per the requirement. |
| 32 | M-REDD (Version 2.2) | Where selective logging is taking place in the project case:<br><br>• Emissions from logging may be omitted if it can be demonstrated the emissions are *de minimis* using T-SIG.<br><br>• 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.<br><br>• Logging operations may only conduct | Condition met.<br>Project does not include selective logging. |

| No | Module | Applicability condition | Comment |
|---|---|---|---|
| | | selective logging that maintains a land cover that meets the definition of forest within the project boundary.<br><br>• All trees cut for timber extraction during logging operations must have a DBH greater than 30 cm.<br><br>• 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.<br><br>• The logging practices cannot include the piling and/or burning of logging slash • Volume of timber harvested must be measured and monitored. | |
| 33 | X-UNC<br>(Version 1.2) | The module is mandatory when using VCS methodology VM0007. It is applicable for estimating the uncertainty of estimates of emissions and removals of $CO_2$-e generated from REDD and WRC project activities. The module focuses on the following sources of uncertainty:<br><br>• Determination of rates of deforestation and degradation.<br><br>• Uncertainty associated with estimation of stocks in carbon pools and changes in carbon stocks.<br><br>• Uncertainty associated with estimation of peat emissions.<br><br>• Uncertainty in assessment of project emissions. | Condition met.<br>X-UNC has been used throughout to estimate uncertainties associated with this project. See SMPP PD Section 3.2.4. |
| 34 | X-UNC<br>(Version 1.2) | Where an uncertainty value is not known or cannot be simply calculated, then a project must justify that it is using an indisputably conservative number and an uncertainty of 0% may be used for this component. | Condition met.<br>The uncertainty value is known, see SMPP PD Section 3.2.4. |

## 2.1.10 Double Counting and Participation under Other GHG Programs (VCS, 3.23; CCB, G5.9)

### 2.1.10.1 NO DOUBLE ISSUANCE

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program, or any other form of community, social, or biodiversity unit or credit?

☐ Yes ☒ No

#### 2.1.10.2 REGISTRATION IN OTHER GHG PROGRAMS

Is the project registered or seeking registration under any other GHG programs?

☐ Yes ☒ No

#### 2.1.10.3 PROJECTS REJECTED BY OTHER GHG PROGRAMS

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

### 2.1.11 Double Claiming, Other Forms of Credit, and Scope 3 Emissions (VCS, 3.24)

#### 2.1.11.1 NO DOUBLE CLAIMING WITH EMISSIONS TRADING PROGRAMS OR BINDING EMISSION LIMITS

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the VCS Program Definitions for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

#### 2.1.11.2 NO DOUBLE CLAIMING WITH OTHER FORMS OF ENVIRONMENTAL CREDIT

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the VCS Program Definitions for definition of GHG-related environmental credit system.

☐ Yes ☒ No

#### 2.1.11.3 SUPPLY CHAIN (SCOPE 3) EMISSIONS

Do the project activities affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

Is the project proponent(s) or authorized representative a buyer or seller of the product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

Has the project proponent(s) or authorized representative posted a public statement on their website saying, “Carbon credits may be issued through Verified Carbon Standard project [project ID] for the greenhouse gas emission reductions or removals associated with [project proponent or authorized representative organization name(s)] [name of product(s) whose emissions footprint is changed by the project activities].”?

☐ Yes ☐ No ☒ N/A

### 2.1.12 Sustainable Development Contributions (VCS, 3.17)

The project contributes to 10 out of 17 Sustainable Development Goals (SDGs), covering 16 indicators (Table 29).

Highlights include vaccinating over 700 people (SDG 3*), improving access to education for over 300 students through scholarships and learning support programs (SDG 4† ), avoiding and removing almost 1,300,000 t $CO_2$-e from the atmosphere (SDG 13‡ ), and providing habitat to 40 IUCN Red List species (SDG 15§).

In terms of nationally stated sustainable development priorities, the project supports one high priority goal, six medium, and three low priority goals, of which SDG 13 is off track, while others are under review.

* SDG 3; Medium-Term National Development Objective IV.19.3.18

† SDG 4; Medium-Term National Development Objective IV.21.6.1

‡ SDG 13; Medium-Term National Development Objective VII.26.3

§ SDG 15; Medium-Term National Development Objective VII.25.1.3

**Table 9. Sustainable development contributions.**

| Row number | SDG target | SDG indicator | Net impact on SDG indicator | Current project contributions | Contributions over project lifetime |
|---|---|---|---|---|---|
| 1) | 1.3 | Number of people covered by social protection floors/systems | Implemented activities to increase. | The project registered 20 new employees into the national social protection scheme. | The project registered 55 employees into the national social protection scheme over project lifetime. |
| | | ~~the project~~ | | 1 | |
| 2) | 1.4 | Number of people with improved access to drinking water | Implemented activities to increase. | 70 rainwater catchment systems installed in households in Muara Merang and Kepayang, benefiting approximately 265-346 individuals. | 147 rainwater catchment systems installed in households in Muara Merang and Kepayang villages, benefiting approximately 665-846 individuals. |
| 3) | 1.4 | Number of people with improved access to health services | Implemented activities to increase. | Three health facilities supported; 572 individuals received COVID-19 vaccinations; 159 students received immunization shots | Three health facilities supported; 1,415 individuals received COVID-19 vaccinations; 159 students received immunization shots |
| 4) | 1.4 | Number of people with improved access to education | Implemented activities to increase. | 282 students benefited from improved access to education, including 15 students receiving scholarships to Universitas Terbuka and 170 elementary students participating in after-school programs. | 445 students benefited from improved access to education, including 20 students receiving scholarships to Universitas Terbuka and 244 elementary students participating in after-school programs. |
| 5) | 3.8 | 3.8.1 Coverage of essential health services | Implemented activities to increase. | The project provided regular support to local health clinics in Muara Merang and Pancuran through provisions of medicine and medical equipment that benefits approximately 8,000 residents of both villages. The project also helped provide covid vaccinations to 572 people in 2022. Further, the project | The project provided regular support to local health clinics in Muara Merang and Pancuran through provisions of medicine and medical equipment that benefits approximately 8,000 residents of both villages. The project helped provide covid vaccinations to 1,415 people over project lifetime. The project |

| Row number | SDG target | SDG indicator | Net impact on SDG indicator | Current project contributions | Contributions over project lifetime |
|---|---|---|---|---|---|
| | | | | supported the School Child Immunization Month (BIAS) in 2023 where 159 students received immunization shots. | supported the School Child Immunization Month (BIAS) in 2023 where 159 students received immunization shots. |
| 6) | 4.3 | The number of youth and adults in formal and non-formal education and training in the previous 12 months, by sex | Implemented activities to increase. | The project provides scholarship to teachers and other community members to pursue higher education. During the monitoring period, a total of 15 students are enrolled in Universitas Terbuka as part of the program. | 15 students received and are still receiving scholarships during project lifetime. |
| 7) | 4.3 | Access to formal and informal education | Implemented activities to increase. | The project hold an after-school program for children in two elementary schools. A total of 170 students were active in the program during the monitoring period | The project hold an after-school program for children in two elementary schools. A total of 244 students participated in the program over project lifetime. |
| 8) | 5 | Number of women with improved livelihood and capacity due to the project's support | Implemented activities to increase. | 13 women received scholarship to pursue higher education. 10 women in various capacity (two health workers, tww librarians, six teachers) are supported by the project. | 14 women received scholarship to pursue higher education. 12 women in various capacity (two health workers, two librarians, eight teachers) are supported by the project. |
| 9) | 6.1 | 6.1.1 Proportion of population using safely managed drinking water services | Implemented activities to increase. | 70 units of rainwater catchment systems were installed in houses in Muara Merang and Kepayang. | 147 units of rainwater catchment systems were installed in houses in Muara Merang and Kepayang villages over project lifetime. |
| 10) | 7.b | Increased renewable energy-generating capacity | Implemented activities to increase. | Photovoltaic solar panel systems were installedand power in a newly constricted guard port . | Photovoltaic solar panel systems were installed and power six guard posts and buildings in the SMPP project site headquarters. |
| 11) | 8.5 | Number of people employed by the project | Implemented activities | | |

| Row number | SDG target | SDG indicator | Net impact on SDG indicator | Current project contributions | Contributions over project lifetime |
|---|---|---|---|---|---|
| | | | to increase. | 14 new employees, with a total number of 48 employees. 15 workers out of 48 active employee are local. | 133 employees were employed since project inception, 51 of which are local. |
| 12) | 8.6 | Number of youth in employment, education, and training | Implemented activities to increase. | The project employs 15 youth and provides scholarship to seven to pursue higher education. | The project employs 43 youth and provides scholarship to 12 to pursue higher education. |
| 13) | 10 | Increased access to income generation activities | Implemented activities to increase. | 17 fishermen and one farmer have access to and gain their livelihood within their project area. 15 local people are employed directly by the project. 10 individuals are supported by the project (two health workers, six teachers and two librarians). 50% of the project food budget goes to 13 local shops. | 31 fishermen and two farmers have access to and gain their livelihood within their project area. 51 local people are employed directly by the project since project inception. 12 individuals are supported by the project (two health workers, eight teachers and two librarians). 50% of the project food budget goes to 13 local shops. |
| 14) | 13 | Tonnes of greenhouse gas emissions avoided or removed | Implemented activities to increase. | 1,284,380 tons of $CO_2$-e were avoided or removed during the monitoring period. | 7,231,880 tons of $CO_2$-e were avoided or removed during the project lifetime. |
| 15) | 15.2 | Hectares of forest cover increased | Implemented activities to increase. | 48 ha of forest cover increased in the project area during monitoring period, measured against the without-project scenario. | 71 ha of forest cover increased in the project area during monitoring period, measured against the without-project scenario. |
| 16) | 15.2 | Hectares of land restored | Implemented activities to increase. | 22,922 ha of land restored and protected under management. | 22,922 ha of land restored and protected under management. |
| 17) | 15.5.1 | Red List Index | Implemented activities to increase. | 20 Critically Endangered (7) or Endangered (13) species; and 20 Vulnerable species occurring in the project area. benefit from reduced threats as a result of | 20 Critically Endangered (7) or Endangered (13) species; and 20 Vulnerable species occurring in the project area. benefit from reduced threats as a result of |

| Row number | SDG target | SDG indicator | Net impact on SDG indicator | Current project contributions | Contributions over project lifetime |
|---|---|---|---|---|---|
| | | | | project activities, including joint forest patrol. | project activities, including joint forest patrol. |

## 2.2 Project Implementation Status

### 2.2.1 Implementation Schedule (VCS, 3.2; CCB, G1.9)

The current monitoring period is for the years 2022 and 2023. Provided below are the key milestones and activities that took place since the project start date up to the end of the monitoring period.

**Table 10. Key milestones in the project's development and implementation.**

| Date | Milestone(s) in the project's development and implementation |
|---|---|
| January 1, 2016 | Project Start Date: January 1st, 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 protection posts along the perimeter of the project boundary. |
| 2016 - Present | Forest Protection: The project hired full time staff that reside 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 and built new living quarters, which included renovating and increasing the size of the protection 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. |
| July 2018 | The project completed its formal boundary demarcation (tata batas) 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 protection posts and installed solar panels on all the protection 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 protection 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. |
| January 2020 | 91 peat compaction dams constructed, totaling to 188 units. |
| February 2020 | 252 dip wells installed and monitored along with other weather parameters through an online project dashboard. |

| Date | Milestone(s) in the project's development and implementation |
|---|---|
| April 2020 | Amid the wide-spread COVID-19 pandemic, community development programs continue under new health and safety guidelines. In addition, the project distributed medical supplies and equipment to four public health centers around the project area, which included PPE, face masks, sanitizers, and immune-building multivitamins. |
| July 2020 | Anti-stunting program launched in collaboration with 1000 Days Fund, an NGO with a mission to end stunting by 2030. |
| August 2020 | A comprehensive camera trap implementation guideline was completed and installed. A total of 12 additional camera traps were installed to complement the first batch installed in 2019. Photos from the camera trap have been regularly recorded by Biodiversity staff which include sightings of a Sumatran Tiger. |
| October 2020 | 66 additional automated dip well sensors deployed utilizing IoT network technology to measure water table level in near real-time. The measurement data are easily observed through the online monitoring dashboard. |
| October 30, 2020 | Second VCU issuance for monitoring period Jan 1st – Dec 31st, 2019. |
| November 2020 | A total of 52 rainwater catchment systems successfully installed in both Muara Merang and Kepayang village. The project also continues regular monitoring and training of the anti-stunting program. A new initiative to develop programs to increase students' engagement with libraries and reading interests in general also started. |
| December 2020 | The third verification work launched, and the project appointed Aenor Internacional, S.A.U. as the VVB. |
| January 2021 | The project has successfully launched a new program in collaboration with Taman Bacaan Pelangi, a non-profit organization working to establish children's libraries in remote areas, to increase students' engagement with libraries and reading interests in general. The program comprises multiple stages of activities such as teacher training, library renovation, supplying children's books, and parents engagement workshop. |
| February 2021 | The project completed the installation of additional 15 dams, bringing the total number of permanent canal blocking constructed since 2019 to 203 unit. |
| February 2021 | The project recorded the presence of the Sunda Pangolin in SMPP, which is a critically endangered species and one of the most highly trafficked species. |
| February 2021 | The project has successfully installed two SmokeD smoke detection cameras at the main camp, which are working very well. This strengthens the fire monitoring system of the SMPP project tremendously and helps to detect fires within minutes day and night. |
| February 2021 | A total of almost 20 kWp photovoltaic solar panel system installation has been completed to practically avoid the use of fossil fuel for the main camp and forest protection posts electricity needs. |
| April 2021 | The project held a four-day fire prevention training with Manggala Agni - fire brigade under the MoEF. The training was also attended by the Village Fire Prevention Community from both Muara Merang & Kepayang villages by the project's invitation. |
| September 2021 | The project completed a trial for gibbon survey using AudioMoth sensors installed in five locations in the dense forest. The gibbon song data will then be analyzed in the accompanying software to estimate the number of groups/individuals of the Gibbon. |
| September 2021 | The 2020 MR verification audit has been successfully completed and the verification report has been published and uploaded to the Verra registry. |
| December 21, 2021 | Third verification issued for monitoring period Jan 1st – Dec 31st, 2020. |
| January 2022 | The forth verification work launched, and the project appointed Aenor Internacional, S.A.U. as the VVB. |
| March 2022 | Additional 9 dams were installed, brining the total number of canal blocks to 212 units. |

| Date | Milestone(s) in the project's development and implementation |
|---|---|
| May 2022 | Endangered Flat-headed Cat recorded. |
| June 2022 | Critically Endangered Sumatran Tiger and Vulnarable Sunda Clouded Leopard recorded. First records of the Sunda Clouded Leopard and the Flat-headed Cat show that the project area is now providing refuge and habitat for at least five of the six wild cat species present in Sumatra. |
| July 2022 | Critically Endangered Sumatran Tiger recorded. |
| November 2022 | The project constructed a new guard post, named "Pulai", at the southern border of the project area to increase presense in the area. |
| Decemeber 2022 | Critically Endangered Sumatran Tiger recorded. |
| January 2023 | Critically Endangered Sumatran Tiger and Vulnarable Sunda Clouded Leopard recorded. |
| February 2023 | Following up on the success of the establishment of two libraries in two schools in Muara Merang and Kepayang, the project also initiated and established reading corners at another elementary school, SDN Pancuran. This also included training for teachers. |
| February 2023 | Critically Endangered Sumatran Tiger recorded. |
| March 17, 2023 | The project successfully held a health day event with the aim to make healthcare more accessible to community members. The event consisted of a dental hygiene workshop and dental check for elementary and preschool students, and medical check up for general community members. |
| March - June 2023 | Additional 22 dams were installed, brining the total number of canal blocks to 234 units. |
| August 2023 | The first graduate of the project's higher education scholarship program occurred in 2023. The graduate is a teacher who will apply her knowledge locally. Three students are expected to graduate in 2024. |
| November 2023 | Critically Endangered Sumatran Tiger and Endangered Flat-headed Cat recorded. |
| December 2023 | Construction of a second nursery at the Main Camp. |
| January 22, 2024 | Forth verification issued for monitoring period Jan 1st – Dec 31st, 2021. |
| September/ October 2024 | This project was open for public comment on the monitoring report for 2022–2023 from Sep 10th - Oct 10th, 2024. No comments were received. |

### 2.2.2 Baseline Reassessment (VCS, 3.2.6, 3.2.7)

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes ☒ No

### 2.2.3 Methodology Deviations (VCS, 3.20)

No new deviation occurred during monitoring report period.

The deviation in methodology concerning the baseline conversion or plantation establishment rate, as validated in the PD and applied since then, remains in effect until the baseline is reassessed. This deviation was used because 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.

The minor deviation from the methodology for the CDM tool 'AR-AM-Tool-14,' concerning the monitoring and measurement of carbon stock changes in the project scenario, was verified in the 2021 monitoring report and continued to be applied during this period. This adjustment for “carbon stock estimates in trees at a point of time” now combines inventory and remote sensing methods to complement the approach outlined in the methodology. This adjustment has resulted in increased accuracy by decreasing uncertainty to below 5%.

The approach for the project scenario is adjusted slightly from section 8.1 “*Estimating carbon stock in trees at a point of time*”, as tree biomass at the plot level was used to extrapolate biomass and subsequent carbon stock at the stratum level following VCS tool VT0005. The inventory data was also used to develop a project specific wall-to-wall map of AGB (for 2021), assess carbon stock changes between 2016-2021, as described above. This does not impact the baseline scenario, project additionality, or the applicability of methodology.

The only adjustment was the change to equation 13 of “*AR-AM-TOOL-14*” which is replaced with equation 2.1 below, where $B_{TREE}$ is replaced with $\sum_{i=1} B_{TREE}$, which is required for deriving the AGB estimates of each pixel for wall-to-wall biomass maps.

$$\mathrm{C_{TREE}} = \frac{44}{12} \times \mathrm{CF_{TREE}} \times \sum_{i=1}^{n} \mathrm{B_{TREE}} \quad (1)$$

Where:

| | |
|---|---|
| $\mathrm{C_{TREE}}$ | Change in carbon stock in trees in the project area $(\mathrm{t\ CO_2e})$ |
| $\frac{44}{12}$ | Molecular ration of $CO_2$ to C $(\mathrm{unitless})$ |
| $\mathrm{CF_{TREE}}$ | Carbon fraction of tree biomass; t C $(\mathrm{t\ Dry\ Matter\ DM^{-1}})$ |
| $\mathrm{B_{TREE}}$ | Tree biomass in the tree biomass estimation pixel *i* $(\mathrm{t\ DM})$ |
| $i$ | 1,2,3, ... *n* pixel of the wall-to-wall map $(\mathrm{unitless})$ |

The tool VT0005 prescribes estimating aboveground live vegetation biomass by using remote sensing samples (e.g., airborne Light Detection and Ranging (LiDAR)) combined with *in-situ* inventory plots to extrapolate to the strata level (such as land use land cover classes) or project area of interest (AOI). This tool is being used as intended in terms of the sampling approach and can be used for wall-to-wall mapping if remote sensing data covers the entire AOI and therefore the deviation is justified.

The applicability conditions of VT005 are met because the project activity ARR requires the estimation of aboveground tree biomass. Remote sensing data were collected for the periods 2016 and 2021. The predictive model relates remote sensing metrics to aboveground tree biomass parametrically (see MR Annex section 6.2.2, equation A 6.). The tool was not used to determine change in biomass density over time, but rather used two distinctive points in time to determine the difference between biomass between these points in time.

In line with the tool, the SMPP has utilized inventory plots (for year 2021) and airborne LiDAR samples (for year 2016) and complemented the LiDAR readings from a space-borne database,

modeled a relationship with wall-to-wall radar and optical satellite images, created a per-pixel vegetation height estimate map, then applied the model relating vegetation height to aboveground biomass (AGB), to produce the wall-to-wall per-pixel estimates of AGB (see Annex 6 for details).

This approach decreases uncertainty around the carbon stock estimation by calculating the total uncertainty as the relative error of combined uncertainties from modeled tree height and plot-based AGB, resulting in an uncertainty below 5% for this monitoring period (see Annex 6 for details).

The project will monitor and model carbon stock changes in AGB in the project scenario through carbon stock mapping and analysis. The analysis will compare maps between monitoring periods. The calibrated model produces accurate wall-to-wall AGB maps with low uncertainty levels, when integrated with new remote sensing datasets. Uncertainties will be monitored and reported for each monitoring period to ensure that the highest uncertainty will not exceed the 10% threshold.

### 2.2.4 Minor Changes to Project Description (CCB Program Rules, 3.5.6)

During previous monitoring periods, changes were made to the biodiversity monitoring plan, enhancing detail and standardization without deviating from the project description. Starting in the second verification period, the biodiversity monitoring plan was updated to improve monitoring and data analysis, following adaptive management principles.

The original bird surveys, camera trap surveys, and vegetation surveys were refined, but targeted gibbon and hornbill listening surveys were deemed unnecessary and infeasible. Listening post surveys were costly and posed safety risks in tiger habitats. Hornbills are now monitored via bird point transect surveys, and gibbon populations are tracked using indirect indicators such as forest loss, fire hotspots, and hunting incidents.

SMART software for monitoring patrols and illegal activities, as described in the project plan, is not yet implemented. Manual monitoring continues, and training in SMART and EarthRanger (a web-based alternative) has occurred, with plans for future integration into the monitoring plan to improve patrol efficiency.

These changes align with the CCB Standards, improving biodiversity monitoring by refining methodologies, enhancing data analysis, and providing clearer insights into biodiversity changes and population trends in the project zone.

The project has made a number of minor changes during this reporting period to community-related aspects that do not require a project description deviation.

In Section 4.1.1 the impact previously defined as “improved water quality within the project area will benefit fish stocks long term” on fishermen was revised to “maintained and restored peatland hydrology in the project area”, as this broader terminology enables the project to identify both the positive and negative impacts of this project activity.

The project has included potential negative impacts in .... These impacts include potential human-wildlife conflict with fishermen and farmers and the predicted indirect cost of maintaining and restoring peatland hydrology in the project area. Previously these impacts were only mentioned in Section 4.1.2.

In Section 4.1.1 the project has expanded on the change in well-being in accordance with the requirements. The format of Section 4.1.2 was revised slightly to align with Section 4.1.1 and ensure consistency.

The project also made a minor change to the project description with regard to section 2.1.5. The other entities Althelia Climate Fund/ Mirova Natural Capital and Ecosphere+ are no longer part of the project because the Athelia Climate Fund was an investment fund with a 10-year term that has reached the end of its term and no longer exists.

In Section 1.2, the parameters for measuring the number of individuals, including female workers, employed were adjusted to align with requirements. The number of employees now considers only those individuals who are directly involved in project activities and working at the project site. Previously, individuals not directly involved in project activities, such as project proponent staff, were included. Due to this adjustment, there may be minor inconsistencies with the total achievements reported during the project's lifetime; however, the revised monitoring process will ensure more accurate information overall.

### 2.2.5 Project Description Deviations (VCS, 3.21; CCB Program Rules 3.5.7 - 3.5.10)

The project description deviations concerning statistics on the total area of licensed Industrial Plantation Forest, as well as data collection for the leakage analysis were verified in the 2016 - 2018 monitoring report and continued to be applied during this period.

For the monitoring periods of 2016–2018, 2019, and 2020, the MoEF did not provide statistics on the total area (in hectares) of licensed Industrial Plantation Forests (*Hutan Tanaman Industri* or HTI) in the country. To complete the initial non-spatial assessment comparing government data to the PD estimates, the project relied on the more conservative values from the most recent available year corresponding to each monitoring 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, the applicability of the 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 following deviations to the project description were introduced and applied for the first time during the current monitoring period.

The project corrected the inaccurate spelling of the village name 'Muara Muang' in PD sections 2.1.6.1, 2.1.9, 4.1.1.1, and 4.3, as well as in previous MR sections 4.1.1 and 4.2, to the correct form, 'Muara Merang'.

The project has made a change to the definition of stakeholder groups during this reporting period in in accordance with the CCB Standards definitions of ‘communities’,‘community groups’, and ‘other stakeholders’ that require a project description deviation.

In PD Section 2.1.6.1, two ‘communities’ were identified, a ‘fishing community’ and a ‘farmer community’, and residents of Muara Merang village, Kepayang village, and other unofficial settlements along the nearby river, were identified as ‘other stakeholders’. Section 4.1.2 of the PD incorrectly states that there are no ‘community groups’, but several other sections, including PD Section 4.2.1, make reference to two ‘community groups’, i.e., ‘fishermen and families’ and ‘small-scale farmers and families’.

To better align with CCB Standards definitions and utilize consistent terminology throughout relevant sections, the project proponents now define ‘fishermen’ and‘ farmer’ as both ‘communities’ and ‘community groups’. The ‘farmer community’ is now one active farmer belonging to this stakeholder group as the other has abandoned his land. The ‘fishing community’ is now composed of a small

number of fishermen who use the project area. The families of the fishermen and the farmer do not derive income and livelihoods from the project area, but can potentially affect or be affected by the project activities, are now defined as 'other stakeholders'.

The project has also removed four project impacts on the fishermen community group and two impacts on the farmer community group that were relevant to the families of these community groups, improved access to clean water, improved access to education, improved access to waste management, and improved access to employment opportunities, and assigned as impacts relevant to other stakeholders.

This deviation does not impact the applicability of the methodology, the project additionality, or the appropriateness of the baseline scenario. The change does enable more appropriate and accurate tracking of impacts on stakeholder groups due to consistent terminology in line with the requirements.

Since the PD validation, the "biodiversity changes" components described in section 5.1.1 have undergone multiple refinements as the project's biodiversity monitoring program evolved through learning, continuous improvement, resource considerations, and field conditions. Initially, the project description anticipated, and the 2016–2018 monitoring report recorded, the following biodiversity changes:

a. Increased aquatic species abundance and diversity
b. Increased mammal diversity and abundance
c. Increased apex predator populations
d. Increased invertebrate diversity and abundance

While these changes are still expected, direct measurement proved impractical, leading to a shift toward more feasible indicator groups for monitoring.

**Monitoring Period 2019:**
The following biodiversity components were added and reported:

e. Increased number of floral and faunal species in the SMPP project area
f. Maintenance of secondary forest, closed canopy, and open canopy land cover

The original four components were not reported during this period.

**Monitoring Period 2020:**
All six biodiversity components (a–f) were reported.

**Monitoring Period 2021:**
The biodiversity change components (a–f) were revised as:

a. Aquatic species diversity
b. Mammal diversity
c. Apex predator population trends
d. Invertebrate diversity
e. Cumulative number of floral and faunal species in the SMPP project area
f. Maintenance of secondary forest and enhancement of closed canopy land cover

Additionally, two new components were added:

g. Bird species diversity

h. Plant species diversity

**Monitoring Period 2022–2023:**
Components a. (Aquatic species diversity) and d. (Invertebrate diversity) were excluded due to impracticality for monitoring, further refining the focus of biodiversity change components, resulting in the following list:

b. Mammal diversity
c. Apex predator population trends
e. Cumulative number of floral and faunal species in the SMPP project area
f. Maintenance of secondary forest and enhancement of closed canopy land cover
g. Bird species diversity
h. Plant species diversity

If these biodiversity change components were included in the original project description, the project activities would have been projected to maintain or enhance these components. The methodologies used to monitor them are outlined in the current version of the biodiversity monitoring plan available in Annex 21. These changes still meet the CCB requirements of using appropriate methodologies to estimate changes in biodiversity based on defined and defendable assumptions, including assessment of predicted and actual, positive and negative, direct and indirect impacts, resulting from project activities under the with-project scenario in the project zone and over the project lifetime. They are simply a different, more holistic, and more actionable way to measure biodiversity changes.

### 2.2.6 Grouped Projects (VCS, 3.6; CCB, G1.13-G1.15, G4.1)

This is not a grouped project.

### 2.2.7 Risks to the Project (CCB, G1.10 )

The possible natural and human-induced risks that could impact the SMPP's climate, community, and biodiversity benefits are outlined in detail in Annex 1. 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 (May 3th, 2024, v4.2), shown in Annex 2. A summary of this risk analysis is outlined in Table 25 below and indicates that in the SMPP Internal Risks have the highest score, followed by Natural Risks, and with External Risks receiving a score of zero.

**Table 11. Summary of non-permanence risk analysis for the project.**

| VCS AFOLU non-permanence risk category | Score |
|---|---|
| a) Internal Risk | 16 |
| b) External Risk | 0 |
| c) Natural Risk | 1.96 |
| Overall Risk Rating (a + b + c) | 18 |

The only natural and human induced risks that are likely to occur are Fire and Geological Risk. Natural fires rarely occur on undisturbed peatlands due to naturally high-water table levels. Lightning strikes tend to be the main cause of natural fires in the tropics. However, lightning is consistently accompanied by heavy rain and for this reason presents a low risk.

To mitigate natural fire risk such as in the event of a lightning strike, the hydrological interventions from canal blocking and active forest monitoring from patrol staff are the primary strategies.

Anthropogenic causes of fire such as discarded cigarettes, flying embers from cooking fires, or fires used for cleaning agricultural fields are real sources of fire risk and are mitigated by limiting access to the site through active patrolling, early warning fire detection system, signages and stakeholder engagement. Project staff are also highly trained on fire safety management, including proper disposal of cigarettes, protected cooking techniques and proper waste disposal.

The primary geological risk are earthquakes. All staff are trained in emergency response, evacuation and first aid measures in the event of a significant geological event or other natural disaster (Table 24).

**Table 12. Natural and human-induced risks to the expected climate, community, and biodiversity benefits during this monitoring period**

| Identified risk | Potential impact of risk on climate, community and/or biodiversity benefits | Actions needed and designed to mitigate the risk |
|---|---|---|
| Fire | The only natural and human induced risks that are likely to occur are Fire and Geological Risk. Natural fires rarely occur on undisturbed peatlands due to naturally high-water table levels. Lightning strikes tend to be the main cause of natural fires in the tropics. However, if a lightning strikes, peatlands burn mostly underground and can smolder for a significant amount of time, thus emitting huge amounts of GHGs. | To mitigate natural fire risk such as in the event of a lightning strike, the hydrological interventions from canal blocking and active forest monitoring from patrol staff are the primary strategies. Anthropogenic causes of fire such as discarded cigarettes, flying embers from cooking fires, or fires used for cleaning agricultural fields are real sources of fire risk and are mitigated by limiting access to the site through active patrolling, early warning fire detection system, signages and stakeholder engagement. Project staff are also highly trained on fire safety management, including proper disposal of cigarettes, protected cooking techniques and proper waste disposal. |
| Geological Risk | The primary geological risk are earthquakes. | All staff are trained in emergency response, evacuation and first aid measures in the event of a significant geological event or other natural disaster. |

During the current monitoring period, the project continued to implement significant natural and human induced risk mitigation activities such as hydrology management through the construction of compacted peat dams, frequent forest patrols, operation, and improvement of an early warning fire detection system and fire mitigation and prevention training. Hydrology management through monitoring water table levels using dip wells throughout the project area, and rainfall measurements through several weather stations, further reduced natural and human caused risks to the project area.

### 2.2.8 Benefit Permanence (CCB, 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 to build local stewardship for the landscape. Youth are being engaged, 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 degraded peatland areas through the construction of permanent canal blocks. This is a recognized approach to restore the hydrology of degraded areas and will reduce the risk of fire in the landscape allowing the natural vegetation to be restored over the life of the project, which significantly improves the habitat. This activity is explained in more detail in Section 2.1.11 of the PD.

## 2.3 Stakeholder Engagement & Safeguards

### 2.3.1 Stakeholder Identification (VCS, 3.18, 3.19; CCB, G1.5)

Prior to project description validation, the project identified 21 fishermen in a fishermen community group, and two small-scale farmers in farmer community group. These individuals were identified through a range of methods and strategies including an assessment of previous socio-economic assessments of the project region, direct engagement with a wide variety of stakeholders in the project zone and the implementation of social surveys. Key individual interviews, formal meetings, participatory mapping, observations throughout the site over time, and focus group discussions (FGDs) were conducted as part of the social surveys. In addition, the project defined other stakeholders as those individuals who reside in communities within the project zone, such as Muara Merang and Kepayang.

Since the validation, one small-scale farmer is no longer active in the project area due to the remoteness of the farm. Project staff, through patrols, informal, and formal engagements identified this change and reported it to management according to stakeholder engagement reporting practices.

The total number of fishermen identified since validation has increased from a total of 21 to 31. This increase is due to the periodic and the seasonal nature of the fishermen, making it difficult to identify and engage with them. During this monitoring period, only 17 active fishermen were reported including two newly identified fishermen. Several of the fishermen identified before and after project validation are known to no longer be active due to livelihood changes, relocation, and death.

Project staff employ various methods to ensure continuous engagement with fishermen and the identification of new fishermen. The identification of new stakeholders, mainly fishermen, is conducted through forest patrols and engagements with current fishermen. If a fishermen, a potential rights holder, is identified, this is communicated to project community development staff, and a consultation process is implemented. If the identified potential rights holder does hold customary access and use rights, the FPIC process is implemented.

### 2.3.2 Stakeholder Access to Project Documents (VCS, 3.18, 3.19; CCB, 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) documents in English for public viewing. The executive summary of each of these documents is translated into Bahasa

Indonesia and 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.

### 2.3.3 Dissemination of Summary Project Documents (VCS, 3.18, 3.19; CCB, 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 publicly posting documents, the SMPP community development representative serves as a focal point for community inquiries and questions on the project, along with the many other staff members that are actively employed in the project. The project 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 third verification were posted in communities throughout the project area.

Monitoring results were discussed throughout the duration of project monitoring in 2022 and 2023, 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.

### 2.3.4 Informational Meetings with Stakeholders (VCS, 3.18, 3.19; CCB, G3.1)

The project continued to conduct follow-up meetings with key stakeholders that were identified at the beginning of the project throughout 2022 and 2023. The purpose of these meetings was to continue building trust and fostering relationships with project stakeholders, and to engage in further efforts towards understanding 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 project implementation scales up.

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

### 2.3.5 Risks from the Project and No Net Harm (VCS, 3.18, 3.19)

Table 26 identifies and describes actions needed and implemented to mitigate likely natural and human-induced risks to the expected climate, community, and biodiversity benefits during this monitoring period.

**Table 13. Risks to stakeholders and the environment resulting from project activities during this monitoring period, and mitigation/preventative measures.**

| Risk Category | Potential risk(s) | Potential impact of risk on stakeholders, ecosystem health, and biodiversity | Mitigation or preventative measure(s) taken |
|---|---|---|---|
| 1. Natural and human-induced risks to stakeholders' well-being expected during the project lifetime as a result of project activities | a) Increased risk of human-wildlife conflict as wildlife populations recover<br><br>b) Risk of loss of access to canal fishing grounds following project activities that maintain or restore peatland hydrology in the project area (i.e., canal blocking) | a) It is possible that as biodiversity returns to the project area and landscape connectivity improves, community groups such as fishermen or the farmer, and other stakeholders such as Kepayang village residents that venture outside the village may be impacted by large wildlife such as sun bears or tigers. Both tigers and sun bears cause several deaths and injuries every year in Sumatra.<br><br>b) No impact during this monitoring period. Maintained and restored peatland hydrology through restoration and canal blocking may have a negative impact on fishermen. During the current monitoring period, canal blocking activities were implemented as part of the project's ongoing hydrological restoration program. This included the installation of additional permanent canal blocking dams on existing drainage canals. | a) The project has developed a Human-Wildlife Conflict SOP and a Wildlife Encounter Safety SOP and training for project workers. Learnings from this training is shared by local project workers both formally and informally with local settlements. The project runs an annual Global Tiger Day event for residents in Kepayang village, which serves as both a celebration and educational opportunity on the benefits and risks of living near tigers. In addition, the project held training on human-wildlife conflict risk mitigation during this period which seven fishermen attended.<br><br>b) The project continues to maintain communications with fishers to ensure there are no negative impacts and if so, mitigation measures will be developed collaboratively. |

| Risk Category | Potential risk(s) | Potential impact of risk on stakeholders, ecosystem health, and biodiversity | Mitigation or preventative measure(s) taken |
|---|---|---|---|
| | | The project assessed whether the installation of additional canal blocking dams affected stakeholder access to fishing grounds and found no evidence that these activities restricted access or resulted in negative impacts on fishermen during the monitoring period.<br><br>In addition, there were no negative impacts of previous canal blocking activities reported by fishermen during the eight engagements with them throughout this reporting period. Note that canal fishing is a recent practice not routed in customary and legal practices. | |
| 2. Risks for stakeholders to participate in the project, including in project design and consultation | Risk of perceived favour, unfair inclusion, or unequal benefit sharing. | There is a low level of risk that is might lead to stigmatization, anger, or violence toward certain stakeholder groups or individuals. | Endeavor to deliver a fair and equitable benefit sharing mechanism to affected rights holders, and endeavor to deliver new or continued community-wide benefits beyond individual benefits. |
| 3. Risks related to working conditions | a) Injury or death from occupational safety incidents, e.g., strenuous work activities in wet, humid, and hot conditions, forest fires, transportation accidents, interactions with people conducting illegal natural resource extraction/destruction, encounters with dangerous wildlife, and | a) See Section 2.3.17 (Occupation Safety Assessment) for an overview of potential occupational safety risks for project workers. | a) See Section 2.3.17 (Occupation Safety Assessment) for risk mitigation measures related to project worker occupational safety risks. The project also ensures the safety of project workers through the training and implementation of standard operating procedures related to |

| Risk Category | Potential risk(s) | Potential impact of risk on stakeholders, ecosystem health, and biodiversity | Mitigation or preventative measure(s) taken |
|---|---|---|---|
| | exposure to mosquito borne sicknesses.<br><br>b) Failure meet all legislated worker's rights, e.g., minimum wage, working hours, leave, termination of employment, health and safety, etc. | b) Due to high levels of awareness on worker's rights legislation among management, human resources, and project staff, there is a low risk of failing to meet worker's legal rights. | health and safety as mentioned in Section 2.3.15.<br><br>b) Follow all laws and regulations related to worker's rights and maintaining a good human resources management system. See Section 2.5.2 (Relevant Laws and Regulation Related to Worker's Rights) for more details. |
| 4. Risks related to the safety of women and girls in the local community | Risk of harrassment and discrimination could be caused by the presence of staff and partners. | Any activity involving or women or girls, whether it be carried out by the project proponents or their partners, carries some degree of risk and has potential for negative impacts, including discrimination, harm, and abuse. This risk increases with increased interactions between staff and partners engagement due to project activities. | During staff onboarding and review of policies, staff must read through anti-discrimination policies. In addition, all community members, staff, and partners are aware of the grievance redress mechanism. The project has developed a Social Safeguarding Policy that will be implemented with all project staff and partners to ensure that safety of women and girls in the local community is built into project design and operations. |
| 5. Risks to children, minority, and marginalized groups in the local community | The project has assessed that there is a risk to the safety of children, and minority, and marginalized groups in the local community due to project activities | Any activity involving or affecting children, minorities, or marginalized groups, whether it be carries out by the project proponents or their partners, carried some degree of risk and has potential for negative impacts, including discrimination, harm, and abuse. This risk increases with increased | The project has developed a Social Safeguarding Policy that will be implemented with all project staff and partners to ensure that safety of children, and minority and marginalized groups in the local community is built into project design and operations. |

| Risk Category | Potential risk(s) | Potential impact of risk on stakeholders, ecosystem health, and biodiversity | Mitigation or preventative measure(s) taken |
|---|---|---|---|
| | | interactions between staff and partners engagement due to project activities. | |
| 6. Risk related to pollutant emissions to air, discharges to water, noise and vibration, the generation of waste, and the release of hazardous materials and chemical pesticides and fertilizers | a) Increased waste generated in project camps and guard posts, potentially impacting the ecological condition of soils and waterways in and around a few locations of the project area.<br><br>b) Increased pollutant discharges to water, potentially impacting the ecological condition of soils and waterways in and around a few locations of the project area.<br><br>c) Adverse effects on the environment and/or local communities from fertilizers, pesticides, herbicides, and other inputs. | a) Low impact. The project has infrastructure in place for waste management at the project site. Systems for separation of organic and non-organic waste are in place. Organic or food waste is disposed of by using it to feed the animals living at the main camp (e.g. dogs, cats, and chickens). As much food as possible is grown or sourced locally, e.g., fish and eggs from chickens and ducks, reducing packaging waste. Currently the non-organic waste generated at the project site is being stored in a self-contained landfill. Toilet facilities for staff use basic latrine-based systems. | a) Uphold current waste management procedures, source more food with lower packaging waste impacts, and investigate potential recycling opportunities.<br><br>b) More electric vehicle options will continue to be assessed. Vehicle maintenance procedures will be upheld and improved where necessary.<br><br>c) N/A |

| Risk Category | Potential risk(s) | Potential impact of risk on stakeholders, ecosystem health, and biodiversity | Mitigation or preventative measure(s) taken |
|---|---|---|---|
| | | b) Negligible impact. Project field staff row boats on canals. To get to the project area, project staff usually book a seat in existing boat 'taxis' that typically don't lead to an increase in boat traffic. Some electric boats have been purchased by the project to further reduce environmental impacts. Pickup trucks and motorbikes used to get around the project area must use fossil fuels, but their use is kept to a minimum and they are well maintained to prevent fuel or oil leakage.<br><br>c) No impact. The project does not use any agricultural inputs, including fertilizers, chemical pesticides, or biological control agents. | |

The project is committed to continuous improvement of risk assessment, risk mitigation, and adaptive management measures. The risk assessment and mitigation measures for this monitoring period are summarized below.

1. Natural and Human-Induced Risks

The project recognizes the potential for increased human-wildlife conflict as wildlife populations recover. This includes the risk of encounters with animals such as tigers and sun bears, which can pose a threat to human safety. To mitigate this, the project has developed a Human-Wildlife Conflict SOP and a Wildlife Encounter Safety SOP, along with training for project workers. These learnings are shared with local communities to increase awareness and preparedness.

Additionally, the project acknowledges the potential impact of canal blocking activities on fishermen who may lose access to fishing grounds. Although no negative impacts were observed during the reporting period, the project emphasizes continued communication with fishermen to ensure any future impacts are addressed collaboratively.

2. Stakeholder Participation Risks

The project is mindful of the risk of perceived favoritism or unequal benefit-sharing among stakeholders. To address this, the project endeavors to deliver a fair and equitable benefit-sharing mechanism and ensure community-wide benefits beyond individual gains.

3. Risks Related to Working Conditions
The project prioritizes the safety of its workers, particularly in strenuous working conditions that may involve exposure to various hazards. It ensures adherence to all legislated worker's rights, including minimum wage, working hours, and health and safety regulations.

4. Safety of Women and Girls
Recognizing the potential risk of harassment and discrimination, the project has implemented a Social Safeguarding Policy. This policy, along with anti-discrimination measures and a grievance redress mechanism, aims to ensure that safety of women and girls in the local community is built into project design and operations.

5. Risks to Children, Minority, and Marginalized Groups
The project recognizes that any activity involving or affecting children, minorities, or marginalized groups carries some degree of negative impact risk to these groups. The project's Social Safeguarding Policy, along with anti-discrimination measures and a grievance redress mechanism, aims to ensure that safety of children, and minority and marginalized groups in the local community is built into project design and operations.

6. Risks Related to Pollutant Emissions
The project acknowledges potential environmental impact risk relating to waste management, pollutant emissions to water bodies from boats, and the use of agricultural inputs. With a waste management plan in place, the use of electric boats and existing boat taxis, and no use of agricultural inputs, the project is assessed to have a low risk to the environment. Nonetheless, the project remains vigilant to uphold and improve existing mitigation measures.

### 2.3.6 Community Costs, Risks, and Benefits (CCB, G3.2)

The project has conducted a combination of formal stakeholder consultations and informational meetings with the communities dating back to 2016 as part of the stakeholder engagement and FPIC process, as mentioned in the PD Section 2.3.7. At this time, the project employed participatory methods to share information about project activities and identify costs, risks, and benefits of the project to community groups and other stakeholders. Other stakeholders were provided with ample time, based on their direction, to agree to participate in the project. Rights holders that could potentially have their rights affected by project activities, mainly fishermen and farmers, participated in this FPIC process, and continue to be engaged where possible.

During this monitoring period, new fishermen have been identified, and they are participating in the FPIC process. Due to seasonal and intermittent use by fishermen, project staff used various means to engage with them including one on one discussions and formal meetings. During these engagements, the costs, risks, and benefits of the project are identified and discussed. Fishermen are provided with time to reflect on the information. Following these engagements, agreements are drafted and discussed with the fishermen. For more information on the project FPIC activities, see Section 2.5.7.

Project staff utilize a variety of consultation methods and forums to obtain feedback from community groups and other stakeholders and to ensure concerns related to negative impacts of project activities can be communicated and addressed as described in Section 2.3.9. In addition, the grievance redress mechanism provides channels for community groups and other stakeholders to share concerns as detailed in Section 2.3.14.

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.

### 2.3.7 Information to Stakeholder on Verification Process (VCS, 3.18.6, 3.19; CCB, 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, project staff 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 announcing the public comment period and audit were posted in communities throughout the project zone. These notices included helpful instructions on how to submit a public comment on the CCB version.

### 2.3.8 Site Visit Information and Opportunities to Communicate with Auditor (VCS, 3.18.6, 3.19; CCB, G3.3)

The SMPP staff frequently met with the project communities and residents of nearby villages and settlements. To prepare for the audit, project staff informed relevant stakeholders in advance about the details of the audit process and prepared local groups with ample time for a potential remote meeting or in person consultation. This ensured stakeholders could share their feedback with the auditor regardless of logistical or travel limitations. The project arranged in-person meetings wherever possible with all relevant stakeholders.

### 2.3.9 Stakeholder Consultation (VCS, 3.18; CCB, G3.4)

**Table 14. Summary of stakeholder consultations, including one-on-one interviews, group interviews, meetings, and focus group discussions.**

| | |
|---|---|
| Ongoing consultation | The project has conducted a combination of informal and formal measures to communicate and consult with stakeholders during this monitoring period given the expanse of the project zone. The validated plan for ongoing consultation proposed quarterly meetings with community groups to discuss project activities and potential impacts on them. Similarly, quarterly meetings would be held with other stakeholders. Direct lines of communication with community groups and other stakeholders would be maintained throughout the project lifetime as part of the project's adaptive management plan.<br><br>During this reporting period, the project conducted engagements with community groups and consultations with other stakeholders. These engagements utilized different forums including one on one interviews, group interviews, meetings and FGDs to ensure inclusivity, cultural appropriateness, and to respect the availability of community groups and stakeholders.<br><br>During this period 12 engagements were held with community |

| | |
|---|---|
| | groups and 187 engagements were conducted with other stakeholders. |
| Date(s) of stakeholder consultation | See Annex 3 for a detailed list of consultation dates. |
| Communication of monitored results | Throughout the monitoring period, information was continually disseminated to individuals, particularly other stakeholders (residents of Muara Merang and Kepayang), fishermen, and the farmer, who were encouraged to further share project information throughout their wider community. 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.<br><br>The project team informed communities and stakeholders about the verification process by an independent validation/verification body through a combination of in-person and public methods. Key individuals received physical copies of the MR summary in Bahasa Indonesia, while printed summaries were publicly displayed in various locations, including Posyandu centers. In addition, SMPP Field Office maintains a full, printed version of the PMR and associated annexes in English for public viewing. The full MR and its executive summary are also available in English and Bahasa Indonesia on the VCS project database. |
| Consultation records | Engagements with community groups and other stakeholders were documented through SMPP activity reports and minutes of meetings. Community staff as well as other project staff captured key discussion points, areas for follow up action, and input from community groups and other stakeholders. In addition, if community groups expressed negative impacts of project activities on their livelihoods, this would be communicated with management. |
| Stakeholder input | SMPP activity reports are reviewed by senior project staff, including the director. Key discussion points and input from stakeholders is reviewed and discussed internally to determine the significance and impact of the proposed action and/or inaction. If additional information is required, a follow up meeting is held with the individual or group. The project staff then determines actions to take if the input is deemed significant and if no action is taken, there would be a negative impact on stakeholders.<br><br>During this monitoring period, there were no updates to the project design but minor adjustments to bolster the community development program and the fire patrol efforts. There were no significant updates to the project design as the project staff developed the project design through participatory processes ensuring the applicability of activities and mitigating negative impacts. |

### 2.3.10 Continued Consultation and Adaptive Management (VCS, 3.18; CCB, G3.4)

Throughout the lifetime of the project, staff 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 fishermen and the farmer as well as other stakeholders through in-person meetings. Community engagement staff actively listen to recommendations made by community members, or other stakeholder groups, and adapt and improve methods/programs as necessary.

The project implements measures to facilitate growth as the project matures and to refine existing practices through monitoring and evaluation. All plans, methods, goals, and objectives are reviewed to incorporate lessons learned, technological advancements, and scientific knowledge. These strategies are in accordance with the project's SOPs and its monitoring plans (see PD Sections 3.3.3, 4.4.1, 5.4.1).

During this monitoring period, the project consistently engaged with project communities and other stakeholders about project activities. There was no significant feedback provided that affected the project design; however, there were two inputs related to the community development program (Table 28). All of this feedback was taken on board and plans were adapted accordingly.

**Table 15. Summary of all comments received as part of the stakeholder consultation during the current monitoring period.**

| Summary of comments received | Actions taken |
|---|---|
| As part of the community development program, the village leader suggested that basic food provisions are to be adjusted so that more people can benefit and the provisions are adjusted according to their needs. | The project staff accepted the village leader's suggestion and increased the beneficiaries from 90 families to 180 families and provided rice rather than a parcel of mixed provisions. |
| The Kepayang village leader suggested that multiple community development activities should be held in a central location and on the same date, when possible, to increase participation and decrease the travel needs of community members. | The project adjusted the location and implementation schedule of various health events to facilitate participation and decrease time and travel constraints by community members. This did not affect the project design. |

### 2.3.11 Stakeholder Consultation Channels (CCB, G3.5)

All stakeholder engagements, including consultations and participatory processes, have been conducted via face-to-face conversations with individual stakeholders from the nearby villages and settlements. This is the most effective method in an area where phone and internet connectivity are limited. Project staff has conducted participatory surveys with the PRA method throughout the community development process. This includes focus group discussions, interviews with men and women living in nearby settlements and villages, observation, and ground checks of residents including participatory visits to a variety of important areas. Project staff shared 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.

### 2.3.12 Stakeholder Participation in Decision-Making and Implementation (VCS, 3.18, 3.19; CCB, G3.6)

The project engages consistently with project communities and other stakeholders on project implementation and design. This allows for the incorporation of local knowledge and aspirations into the project design. Consistent engagement also facilitates the mitigation of negative impacts on project activities on the livelihoods and well-being of community groups and other stakeholders.

The project staff's understanding of the gender dynamics in the communities enables them to design and implement gender sensitive consultations. The project employs different formats such as one on one engagements, gender disaggregated FGDs, and informal engagements. In addition, applying various formats creates inclusive spaces for participation where individuals can feel comfortable.

Project staff employs culturally appropriate methods when consulting with community members. Materials and formats are designed based on language and cultural context. The scheduling of engagements is mindful of cultural and religious occasions. Lastly, engagements are held at various times and places to ensure accessibility to a wide variety of needs and based on local needs to avoid loss of income and/or to enable effective participation.

Throughout the reporting period, project staff implemented routine monitoring and feedback with community groups and other stakeholders to obtain feedback related to project activities and ensure concerns can be raised if there are negative impacts associated with project activities (Section 2.3.9). Project staff routinely engaged with fishermen who were involved in the ongoing FPIC process throughout the monitoring period to discuss the project activities, risks, costs, and benefits, and to work together to establish agreements (Section 2.5.5). The grievance redress mechanism provides additional channels for project staff, community groups, and other stakeholders, to communicate concerns and feedback (Section 2.3.14).

### 2.3.13 Anti-Discrimination Assurance (VCS, 3.19; CCB, G3.7)

The project team holds every individual involved in project design and implementation to a high standard of integrity which ensures no one is involved, or complicit in, any form of discrimination or sexual harassment with respect to the project and its communities. This includes discrimination based on gender, race, religion, ethnicity, social class, or other aspects of human individuality. Throughout the project duration, the project will abide by all relevant Indonesian labor laws and regulations on anti-discrimination. Furthermore, the project has an equal opportunity policy that aims to facilitate a more even ratio of male to female employees. To ensure compliance, the project has a grievance system in place that provides all project employees, community members, and other stakeholders with a quick-response system if any discriminatory actions or sexual harassment does occur. This ensures any grievances can be addressed quickly and appropriately.

### 2.3.14 Grievances (VCS, 3.18.4; CCB, G3.8)

**Table 16. Summary of grievances that were raised during the current monitoring period and grievance resolutions.**

| Grievances received | Resolution and outcome |
|---|---|
| N/A | The GRM aims to resolve problems in a fair, transparent, timely, and effective manner in an amiable environment to maintain good relationships with stakeholders. The utilization of this GRM by stakeholders provides a means to channel feedback and discontent so that it can be managed, and aid in the identification and adjustment of the root causes of problems.<br><br>Stakeholders can submit grievances through a variety of channels as outlined in the "Sumatra Merang Peatland Project Grievance Redress Mechanism". The grievance procedure has been translated to Bahasa Indonesia and shared with project community members during engagements. It is also accessible at the project office and village offices in the project zone. |

### 2.3.15 Worker Training (VCS, 3.19; CCB, G3.9)

The project has a target to employ 80% of its field staff with residents of villages within the project zone. Workers will receive training and capacity building related to their positions as well as health and safety training. All skills development will be focused on increasing and bolstering local participation in the project and contributing to the sustainable development of the community. Key areas of training identified include biodiversity and biophysical monitoring, fire patrols and firefighting, forest protection and regeneration, community development, and administration and business management. Capacity building will expand employee knowledge, increasing prospects of future employment and contributing to human assets within communities. Gaps in the capacity or interests of staff will be constantly monitored and addressed through appropriate measures. In addition, all staff will be provided with an orientation program focused on Standard Operating Procedures (SOPs) and policies with specific attention to health and safety policies. During this monitoring period, individuals participated in training to increase skills, knowledge, and to ensure the implementation of health and safety practices. The training is institutionalized through SOPs and multiple staff members will be trained on each SOP to prevent local capacity being lost through staff turnover.

Trainings completed during this monitoring period included: Training for Asian Waterbird Census 2022, fire prevention training with Manggala Agni, social service dental health education and tooth brushing training, EarthRanger patrol monitoring software training, vegetation plot survey training, reforestation data collection and entry training, and drone training.

### 2.3.16 Community Employment Opportunities (VCS, 3.19.13; CCB, G3.10)

The project is an equal opportunity employer and is committed to ensuring local employment by providing job opportunities to identified communities and community groups including marginalized or vulnerable people. To achieve this, the project has a policy to hire 80% of its staff from communities in the project zone to increase local participation in the project and contribute further to the sustainable development of the community. Furthermore, the project has a target to have 25% of its work force comprising women to ensure greater gender balance in a field traditionally male dominated.

The project has a range of work opportunities available requiring a variety of skills and abilities. Should candidates not have the skills required for the job but demonstrate other qualities, necessary upskilling and training will be provided. 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.

The recruitment and hiring process is conducted by a panel of trained project staff and conducted in a setting that respects local culture and language. Lastly, interested candidates are assisted by project staff during the application process, should they not have the capacity or resources to apply. This will ensure vulnerable and/or marginalized groups are able to apply. 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.

### 2.3.17 Occupational Safety Assessment (VCS, 3.19; CCB, 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 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 several risks including strenuous activities in wet, humid, and hot conditions, forest fires, transportation accidents, interactions with illegal loggers, encounters with dangerous wildlife, and exposure to mosquito borne sicknesses. Project health and safety training addresses these risks and trains staff on the proper handling of equipment and other materials (see Table 20). In addition, project proponents maintain a public liability insurance of 9,000,000 EUR in case major accidents do occur.

**Table 17. Actions to mitigate potential occupational risks.**

| Potential occupational risks | Risk mitigation action |
|---|---|
| Strenuous activity in wet, humid, and hot conditions | Proper attire for work conditions and ample access to drinking water for hydration are provided. |
| Forest fires | Staff are trained in firefighting activities and are provided with proper safety equipment. |
| Transportation accidents | Staff are trained in driving and are required to always wear seatbelts and wear helmets when driving motorbikes. |
| Interactions with people conducting illegal natural resource extraction/destruction in the project area (e.g., loggers or poachers) | All project field staff (particularly patrol staff) are trained according to the project patrol SOP. This SOP gives guidance on how patrol staff should act during encounters with different types of actors that may enter the project area, including people engaged in illegal natural resource extraction/destruction.<br><br>Because project patrol teams are unarmed, they are trained to distinguish between armed and unarmed actors and to assess the risk of engaging them. If the patrol teams are faced with armed actors or outnumbered by these actors, patrol teams are trained to move away to a safe distance and coordinate with management staff in the field to document and report these incidents to local authorities. |
| Encounters with dangerous wildlife | All project field staff are trained in line with Dangerous Wildlife Encounter Safety Guidelines made specifically for this project. These guidelines assess the risk posed by the most dangerous species present in the project area, improve field staff's understanding of these species' behavior and ecology, and give species-specific guidance on how to avoid encounters, react to encounters, and react to attacks. |
| Exposure to mosquito borne sicknesses | All staff are provided adequate clothing, mosquito nets, and access to bug repellent. |

## 2.4 Management Capacity

### 2.4.1 Required Technical Skills (VCS, 3.19; CCB, G4.2 )

The project requires a range of technical and managerial skills to implement the project activities listed in Section 2.1.11 of the PD. Table 34 outlines the skills required per project activity.

**Table 18. 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. |
| 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, carbon measurement and monitoring skills throughout the monitoring period. The skillsets and experience of the core technical team is listed in Section 2.4.2. Although some positions have evolved and roles expanded, all key technical skill have been maintained or enhanced (Table 32).

**Table 19. Key technical staff in the current monitoring period.**

| 2022 | | | 2023 | | |
|---|---|---|---|---|---|
| Role | Name | Title | Role | Name | Title |
| SMPP Project Lead | Mr. Jeffrey Chatellier | Director | SMPP Project Lead | Mr. Jeffrey Chatellier | Director |
| Member of Project Management Board | Reagen Pangestu | President Director | Member of Project Management Board | Reagen Pangestu | President Director |

| 2022 | | | 2023 | | |
|---|---|---|---|---|---|
| Role | Name | Title | Role | Name | Title |
| SMPP Carbon Credit Sales and Marketing | Devan Wardwell | Director of Carbon Credit Sales and Marketing | SMPP Carbon Credit Sales and Marketing | Devan Wardwell | Director of Carbon Credit Sales and Marketing |
| SMPP MRV | Dr. Ophelia Wang | Director of Project Design and Development | SMPP MRV | Sebastian Persch | Emissions Science and Technology Lead |
| SMPP MRV | Sebastian Persch | Emissions Science and Technology Lead | SMPP Field Site Manager | Abdul Haris Marzuki | Field Site Manager |
| SMPP Field Site Manager | Abdul Haris Marzuki | Field Site Manager | SMPP Community Engagement Lead | Ahmad Susilo | Community Engagement Manager |
| SMPP Community Engagement Lead | Ahmad Susilo | Community Engagement Manager | Legal Compliance for SMPP and Community Development Advisor | Mary Osmond | Legal Advisor |
| Legal Compliance for SMPP and Community Development Advisor | Mary Osmond | Legal Advisor | SMPP MRV | Prasetya Mahardhitama | Remote Sensing Lead |
| SMPP MRV | Prasetya Mahardhitama | Remote Sensing Lead | Forest Planting | Agus Afijanto | General Operations |
| Forest Planting | Agus Afijanto | General Operations | SMPP Biodiversity lead | Catur Prasetyo | Biodiversity Manager |
| SMPP Biodiversity lead | Catur Prasetyo | Biodiversity Manager | SMPP Technical Manager | Zainuddin | Carbon Credit Production Manager |
| SMPP Technical Manager | Zainuddin | Carbon Credit Production Manager | VCS/CCB Certification and Project Management | Angga Pratama | Monitoring and Investor Reporting Lead |
| VCS/CCB Certification and Project Management | Angga Pratama | Monitoring and Investor Reporting Lead | - | - | - |

### 2.4.2 Management Team Experience (VCS, 3.19; CCB, G4.2 )

The SMPP is implemented by two project proponents: Forest Carbon and PT Global Alam Lestari (PT GAL). The joint development of the project is managed via a project management board that is composed of representatives of PT GAL and Forest Carbon.

At the implementation level, each proponent focuses on different areas of implementation. PT GAL specializes in on the ground operations for forest restoration. 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 field operations in line with the project design.

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 also leads project management, project design, field data collection and analysis, VCS/CCB certification monitoring and compliance, and technical advisory services.

**Project Management Leads**

*Mr. Jeffrey Chatellier – CEO – Forest Carbon – SMPP Project Lead*
Mr. Chatellier is Forest Carbon's CEO. He is an environmental scientist who has worked on environmental conservation, forestry, and sustainability for the past 12 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.

*Reagen Pangestu – President Director – Global Alam Lestari – Member of Project Management Board*
Mr. Pangestu is the President Director of PT Global Alam Letari and leads the ISO certification team, where he oversees the implementation and the certification of the company's Environmental Management System under the ISO 14001 standard. He is also a member of the Project Management Board.

**Project Design, Monitoring, and Implementation**

*Dr. Ophelia Wang – Director of Project Design and Development - Forest Carbon – SMPP MRV*
Dr. Wang is Forest Carbon's Director of Project Design and Development. A specialist in conservation entrepreneurship, Dr. Wang brings more than 20 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 – Climate Scientist and MRV 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 Gottingen 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 Gottingen. 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 and identified possible canal blocking locations in conjunction with Forest Carbon GIS and Remote Sensing teams.

*Agus Afijanto – General Operations – Global Alam Lestari – Forest Planting*
Mr. Afijanto oversees general operations in SMPP including forest planting. He has worked in the forestry sector for over 20 years and has a degree in forestry from Universitas Gajah Mada, Indonesia.

*Abdul Haris Marzuki – Field Site Manager – Global Alam Lestari – SMPP Field Site Manager*
Mr. Marzuki oversees all field operations in the SMPP project area. He has over 25 years' experience working in the forestry sector in Indonesia. His experience includes overseeing field staff and ensuring a safe and healthy work environment.

*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.

*Catur Prasetyo – Biodiversity Manager – Global Alam Lestari – SMPP Biodiversity Lead*
Mr. Catur is a trained biologist with extensive biodiversity conservation experience in Indonesia. Prior to joining SMPP as a Biodiversity program manager, he oversaw a team of forest patrol officers and was responsible for biodiversity monitoring at an Orangutan habitat protection project in West Kalimantan.

*Zainuddin – Carbon Credit Production Manager*
Mr. Zainuddin leads the field management and implementation of conservation plans. He has extensive working experience in the conservation sector. Prior to SMPP, he worked for KKI Warsi and WWF Indonesia. He holds a master's degree in environmental science of Jambi University.

*Mary Osmond – Legal Advisor – Forest Carbon – Legal Compliance for SMPP and Community Development Advisor*
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 also obtained a certificate from Yale University as part of the Environmental Leadership and Training Initiative Program on Tropical Forest Landscapes, Conservation, Restoration and Sustainable Land Use. 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 and the implementation of its community development program.

*Prasetya Mahardhitama – Remote Sensing Lead – 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 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.

*Angga Pratama – Monitoring and Investor Reporting Lead – Forest Carbon – VCS/CCB Certification and Project Management*
Mr. Pratama is a project manager who oversees the SMPP validation and verification process. He leads the multi-facet project monitoring by engaging with all the relevant stakeholders and liaise with the operation teams at the field. He is a Certified Sustainability Reporting Specialist under the Global Reporting Initiative (GRI) Standards.

### 2.4.3 Project Management Partnerships/Team Development (VCS, 3.19; CCB, G4.2)

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

### 2.4.4 Financial Health of Implementing Organization(s) (CCB, 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 were fully supported by an investment from Mirova Natural Capital (previously 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 (VCS, 3.19; CCB, 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 (VCS, 3.5.2-3.5.4; CCB Program Rules, 3.5.13 – 3.5.14)

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.
- Financial statements

Specific information is available privately to project validators upon request.

## 2.5 Legal Status and Property Rights

### 2.5.1 National and Local Laws (VCS, 3.1, 3.6. 3.7, 3.14, 3.18, 3.19; CCB, 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.

**New Laws and Regulations**

Indonesia issued Law No.11 of 2020 on Job Creation, known as the Omnibus Law, in August of 2020. This law creates several changes to the licensing process in the forestry sector. While relevant to project developers, the new law does not affect the SMPP project. Specific, ministry-level guidelines and procedures are still being developed in relation to the wide-ranging changes in law.

Prior to the enactment of the Omnibus Law, the right to sequester and store carbon was granted under a Business License for Carbon Sequestration and Carbon Storage (*Izin Usaha Pemanfaatan Penyerapan dan Penyimpanan Karbon*, RAP-PAN Karbon).

The Omnibus Law has created a universal license for multiple land use businesses, such as pulp/paper, selective logging and carbon sequestration and storage. This new license type, known as Forest Utilization Business License or *Perizinan Berusaha Pemanfaatan Hutan*, PBPH) now permits multiple types of forestry businesses to be conducted in a single concession area regarding to MoEF Regulation No. 8 of 2021 on Procedures and Preparation of Forestry Management Plan, as well as Utilization of Forest in Protected and Productive Forest Area (MoEF Reg. 8/2021). This MoEF Regulation No. 8/2021 aims to reform and restructure forest concession licensing.

These wide-ranging changes apply to the licensing process for new projects and are not retroactive, therefore the existing forestry license for SMPP (i.e., IUP RAP-PAN Karbon license granted in 2013) is still valid.

Furthermore, Indonesia issued Presidential Regulation No. 98 of 2021 regarding Carbon Economic Value (Perpres 98/21).[2] This regulation aims to set guidelines across all sectors of the Indonesian economy to support the Paris Agreement and to eventually require the conducting of greenhouse emission inventories in all major sectors. The Perpres 98/21 requires that voluntary carbon market projects be registered under the National Registry System for Climate Change Control (*Sistem Registrasi Nasional Pengendalian Perubahan Iklim* or SRN PPI). The SMPP has now received a project identification number under the SRN PPI (005-I-2020-1686) and is fully compliant with the requirements of the registration process.

Following the above, the MoEF released a new regulation as a follow up implementing regulation to the Perpres 98/21; MoEF Regulation No. 21 of 2022 on Procedure for Implementation of Carbon Economic Value (MoEF Regulation No. 21/2022) which provides guidance on implementing the Perpres 98/2021. Under MoEF Regulation No. 21/2022, overseas trading of carbon credits is permitted as long as such credits registered in the SRNPPI, are not counted towards another country's NDC are not counted toward Indonesia's Nationally Determined Contribution, and do not otherwise negatively impact Indonesia's NDC targets (Article 18(3)). Further, the MoEF has issued a regulation on procedures of carbon trading in the forestry sector; MoEF Regulation No. 7 of 2023 on the Procedures of Carbon Trading (MoEF Regulation No. 7/2023). MoEF Regulation No. 7/2023 highlighted that carbon trading may be conducted by holding a forestry utilization business license (i.e., PBPH and IUP RAP-PAN Karbon), further establishing that SMPP has the right to conduct

carbon trading through its IUP RAP-PAN license. Once credits are issued by Verra for this monitoring period the project will register the emission reductions with the SRN PPI as it has done for all previous monitoring periods.
VCUs generated by the project are intended for international trade on the voluntary carbon market and are not intended to contribute to Indonesia's Nationally Determined Contribution. No host country authorization for corresponding adjustments has been granted to the project to date and, accordingly, no corresponding adjustments have been applied. Any future authorization for international transfer with corresponding adjustments would be subject to applicable host country regulations and VCS requirements and would require an update to project documentation and reassessment by the VVB. On this basis, the project is in compliance with applicable regulations governing international voluntary carbon trading.

**Compliance with Existing Laws and Regulations**

The following laws and regulations apply to forestry concessions in general.

***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 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.

The primary activity of SMPP forest patrols is fire prevention and mitigation. These teams run a landscape monitoring program which uses patrol activities, remote sensing, and infrared cameras. By preventing fires in the project area and mitigating fires in the wider project zone, the project is following these laws.

***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.

Forest Carbon measures water table levels daily, has an active hydrology restoration program using canal blocks to restore natural water table levels and has conducted a full peat depth inventory and drainage model for the project site, which follow peatland management regulations from the Ministry of Environment and Forestry.

***Community Development:***

Forest Carbon conducts the community development around its concession areas, which is line with the following regulations:

- Law of the Republic of Indonesia No. 11/2020 on Job Creation, revoked and replaced by Law No 6/2023 on the Enactment of Government Regulation in Lieu of Law No. 2 of 2022 On Job Creation into Law jo 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 SMPP conducts community development around its concession areas, which is line with regulations that companies conduct CSR activities within their area of operations.

Forest Conservation Activities Business License:
The SMPP holds a PAN/RAP license that allows for carbon sequestration and carbon stock related activities. The laws and regulations specific to the PAN/RAP license are outlined in Table 1 below, including how the project complies with each requirement.

**Table 20. Laws and regulations specific to the PAN/RAP license and the compliance activities.**

| Relevant regulation or law | Compliance activity |
|---|---|
| • **MoEF Regulation No.71/MENLHK/Sekjen/KUM.1/12/2017** on Implementation of National Registration System for Climate Change.<br>• **President Regulation No.98/2021** on the Carbon Economic Value | **SRN PPI Registration:** SMPP completed the application process for Indonesia's SRN PPI in 2019. The Indonesian government is still establishing the system to manage carbon accounting at the project, jurisdictional, and national levels. The SRN PPI does not issue any form of credits or certificates.<br><br>The Project has received a project identification number (005-I-2020-1686). |
| • **MoEF Decree No: SK.949/Menhut-II/2013** on PAN/RAP Carbon License of PT Global Alam Lestari (PT. GAL).<br>• **MoEF Regulation No. 8 of 2021** on Procedures and Preparation of Forestry Management Plan, as well as Utilization of Forest in Protected and Productive Forest Area. | **Management Plan:** SMPP must develop a 10-year management plan (RKU) for the concession area. The updated 10-year plan was submitted on April 14 2020, and the project most recently summarized the plan in a presentation to the MoEF on May 4 2021, at the ministry offices. After this meeting, the MoEF gave comments on the draft and the project submitted a new revision of RKU draft based on the suggestion of MoEF on May 10 2021. |
| • **MoEF Regulation No. 8 of 2021** on Procedures and Preparation of Forestry Management Plan, as well as Utilization of Forest in Protected and Productive Forest Area.<br>• **MoEF Decree No: SK.949/Menhut-II/2013** on PAN/RAP Carbon License of PT GAL. | **Demarcation Approval:** The MoEF conducted the boundary demarcation in our project area in May 2018. All required information has been submitted to MoEF related to Regulation No. 8. and Decree No. SK.949/Menhut-II/2013. |

| Relevant regulation or law | Compliance activity |
|---|---|
| • **Government Regulation P.12/2014** on Types and Tariffs of Non-Tax State Revenue (*Penerimaan Negara Bukan Pajak*, PNBP). | **Taxation and Levy:** SMPP pays a 10% levy on all carbon transactions, and the local license holder PT GAL pays the Land and Building Tax every year. |
| • **MoEF Decree No: SK.949/Menhut-II/2013** on PAN/RAP Carbon License of PT GAL.<br>• **Law No. 40 of 2007** regarding the Limited Liability Company (Company Law).<br>• **Government Regulation No. 47 of 2012** on the Social and Environmental Responsibilities of the Limited Liability Company. | **Community Development:** SMPP implements several community development programs and collaborates with local leaders to ensure SMPP delivers lasting co-benefits for forest-dependent and other surrounding communities. Our community development programs focus on health, sanitation, education, and maternal and child health as well as efforts to improve local livelihoods.<br><br>Currently, SMPP supports the Local Government in COVID-19 prevention by supporting vaccination events and providing PPE and rapid test kits. This program builds on the project's existing support for local health centers and training for local health workers. |
| • **MoEF Decree No: SK.949/Menhut-II/2013** on PAN/RAP Carbon License of PT GAL.<br>• **MoEF Regulation No. 8 of 2021** on Procedures and Preparation of Forestry Management Plan, as well as Utilization of Forest in Protected and Productive Forest Area. | **Reports to MoEF:** As a license holder, SMPP submits periodic reports to MoEF annually and monthly. |

### 2.5.2 Relevant Laws and Regulations Related to Worker's Rights (VCS, 3.18, 3.19; CCB, G3.11)

The SMPP operations fully attend to workers' rights and seek to ensure that the rights of all employees are upheld so that all individuals are aware of their rights. The project has its own human resource policies containing the details of our employment practices. These policies are explained to all staff during their orientation program and are available for review in the project's field office. SMPP has principles to treat all persons in the project with dignity and respect.

The SMPP complies with all laws and regulations related to worker's rights as follows:

- Law of the Republic of Indonesia No. 13/2003 on Manpower (as amended by Law of the Republic of Indonesia No. 11/2020 on Job Creation, revoked and replaced by Law No 6/2023 on the Enactment of Government Regulation in Lieu of Act No. 2 of 2022 On Job Creation into Law) - the main law governing labor in Indonesia; and

- Decree of the Ministry of Employment and Transmigration No. KEP-233/MEN/2003 of 2003 dated October 31, 2003. This specific regulation sets out the working hours for SMPP field workers, ensuring a balanced and fair work environment.

### 2.5.3 Human Rights (VCS, 3.19)

The project continues to recognize, respect, and promote the rights of local communities (LCs) and customary rights holders in line with international human rights laws through policy development and implementation as well as methods to ensure inclusive participation.

SMPP is an equal opportunity employer and is committed to provide equal opportunities for employment to LCs as described in the project's equal opportunity policy (Section 2.3.16). In addition, well designed recruitment strategies and capacity building programs such as adult education programs contribute to equal opportunities for employment. Furthermore, the project consistently engages with community groups and other stakeholders in a manner that is inclusive and participatory (Section 2.3.9 and Section 2.3.11).

The project respects the rights and promotes the protection of workers rights by ensuring no forced or child labor, and the provision of equal pay through compliance with all national and provincial laws as well as project policies. These laws and policies are inline with international standards including the International Labour Organization's Declaration on Fundamental Principles and Rights at Work (Section 2.5.2). The project employs an Anti-Discrimination policy to ensure no one is involved, or complicit in, any form of discrimination or sexual harassment with respect to the project and its communities (Section 2.3.13).

SMPP continues to respect and protect the rights of LCs and customary rights holders through the implementation of the FPIC process. The project maintains routine communication with identified rights holders and is committed to identifying potential rights holders through forest patrols (Section 2.5.5 and Section 2.5.7).

### 2.5.4 Indigenous Peoples and Cultural Heritage (VCS, 3.18, 3.19)

The project design process and project implementation ensures the protection of cultural heritage from impacts of project activities. The project implemented a wide-ranging social assessment in 2018 to identify sites of cultural heritage including natural environment features that represent cultural values within the project area and no sites were identified. In addition, the project did not identify areas of cultural significance (HCV 6) through the HCV assessment completed in the project zone during the project design process. Lastly, the project does not use the cultural heritage of LCs for commercial purposes. An internal audit of environmental and social issues is completed each year. If there is a variance from the project-specific environmental and social management plans, which include cultural heritage, a plan to take corrective action is developed. Project stakeholders can also utilize the grievance process should they feel their cultural heritage is affected by project activities (Section 2.3.14).

### 2.5.5 Recognition of Property Rights (VCS, 3.7, 3.18, 3.19; CCB, G5.1)

**Table 21. Recognition of property rights.**

| | |
|---|---|
| Dispute over rights to territories and resources | N/A |
| Respect for property rights | The project implements routine measures to protect and preserve the property rights of LCs, mainly fishermen, who utilize the area for livelihoods. The project has implemented the FPIC process and has obtained consent from fishermen. In addition, during this monitoring period the project has continued to implement the FPIC process with both newly identified and seasonal fishermen despite the remoteness of the project area.<br><br>The project maintains routine communications with identified rights holders to ensure individuals can raise concerns about project activities and/or if there are any |

| | |
|---|---|
| | impacts as a result of project activity implementation. Communication channels are conducted through patrol staff, the grievance redressal mechanism, and planned engagements with stakeholders.<br><br>The project is also committed to identifying potential rights holders through forest patrols. If a potential rights holder is identified, a FPIC process is implemented to ensure property rights are secured and respected. |

### 2.5.6 Benefit Sharing Mechanism (VCS, 3.18, 3.19)

**Table 22. Benefit sharing mechanism.**

| | |
|---|---|
| Summary of the benefit sharing plan | Up to and including this monitoring period, this project has not designed, agreed, or implemented a structured benefit-sharing mechanism. This is primarily because the small number of individuals whose property rights were and/or are affected by the project did not meet the criteria for CCB Gold-Level for Exceptional Community Benefits, i.e., they did not "own or have management rights, statutory or customary, individually or collectively, to land in the project area", they did not live in a "low human development country", and more than 50% of them were above the national poverty line.<br><br>Nonetheless, the project has obtained FPIC for project activities from these affected stakeholders, and affected stakeholders have received multiple project benefits, such as maintained access rights to fishing grounds, personal and environmental protection for ongoing threat of peat fires, and employment and development opportunities for them and their families.<br><br>With recent changes to the VCS standards (effective for all project requests submitted on or after 1 March 2024), beginning with the release of VCS v4.5 on 29 August 2023, benefit-sharing with stakeholder groups whose "property rights, usage, or resources" have been impacted by project activities is mandatory. The project proponents will do everything in their power to re-engage affected stakeholders to design and implement a fair and equitable benefit-sharing agreement and benefit-sharing mechanism with affected stakeholders during the next monitoring period. |
| Benefit sharing during the monitoring period | N/A |

### 2.5.7 Free, Prior and Informed Consent (VCS, 3.18, 3.19; CCB, G5.2)

**Table 23. Free, prior, and informed consent.**

| | |
|---|---|
| Consent | The SMPP project site is remote and located multiple hours away from any settlements. |

As a result, the project is visited by only a small number of individuals, and an even smaller group whose use and access rights could potentially be impacted by project activities. These community groups are artisanal, mostly seasonal, fishermen, who fish in the project area and small-scale farmers. These individuals have been engaged in FPIC processes since they were identified as potential rights holders, starting in 2016, as recorded in the data logs, consultation documents, and agreements supplied to auditors.

The start of the SMPP project was January 2016 when the project proponents responded to a formal written request from the government of Indonesia to prevent any further damage from catastrophic fires that destroyed 99% of the forest in the project area. At that time, there were no communities or people known to be operating in what was an ecological wasteland (see PD Sections 2.1.1, 2.1.5.5, 3.1.3.1.7, and 5.2.1 for more information on fires in the project area and the resulting land cover). The project began conservation activities through forest fire patrols with staff on site as outlined in the PD. As the area began to recover from the severe fire event and staff were present at the site, consultations and engagements with the fishermen started towards the end of 2016 as they began to fish at the site.

Following these engagements and to ensure precautionary principles were followed, the project conducted an additional wide-ranging social assessment in June and July 2018 to ensure no potential rights holders were overlooked, this study indicated that only a handful of fishermen and farmers were likely to be impacted by project activities and confirmed that the project was taking the correct approach in working with potential rights holders that were periodically encountered in the project area (the social scoping study has been provided to auditors).

Following a participatory process, project costs, benefits, and risks were identified and discussed with rights holders. The farmer provided consent in 2018 and fishermen were prepared to give consent in late April 2019. The fishermen gave affirmative consent—in the form of signed agreements— for the construction of permanent canal blocks which started in December the same year (agreements have been made available to auditors). Obtaining consent from these impacted stakeholders prior to the construction of permanent canal blocks was a key project milestone for ensuring the SMPP could deliver on its climate benefits through rewetting activities.

Since then, project staff have continued to patrol the area to ensure any new potential rights holders are identified. In 2021, four additional seasonal fishermen who may be affected by project activities were encountered in the project area and were engaged in the FPIC process. Due to the remoteness of the location and intermittent fishing activities, the other two identified fishermen could not be reached and there were no indications of their fishing in 2023. Should they be located again, SMPP will resume the FPIC process to ensure access rights are maintained.

Two of these fishermen continued the process during this monitoring period in addition to two newly identified fishermen and others. The process entailed identifying and discussing the benefits, costs, and risks of the project activities with project staff through one on one engagements and meetings. The fishermen were prepared to give consent after reaching a mutual agreement and affirmative consent was provided in early 2024.

SMPP staff are committed to routine patrols and identification of current fishermen and new to ensure FPIC processes are implemented should they be required.

| | |
|---|---|
| Outcome of FPIC | Due to the remoteness of the project area and the seasonal nature of fishermen, these identified rights holders were mainly engaged individually. They were provided with information about the project activities, impacts and risks of the project activities. This was also outlined in a draft consent agreement that was presented to the rights holders. Once the agreement was reached, individual rights-holders signed the consent agreement according to a timeline they decided upon.<br><br>During this monitoring period there were a total of 17 active fishermen. Five of these fishermen provided consent in 2019. Despite challenges in tracking down individual fishermen due to the remoteness of the project area and the seasonal nature of fishing activities, the project team implemented the FPIC process during this monitoring period with eight fishermen, including newly identified individuals, and affirmative consent was reached in early 2024.<br><br>There are six individuals still participating in the FPIC process because the project field team was unable to reach them during the current monitoring period despite repeated outreach attempts. These individuals have not withheld consent. The project will continue engagement efforts with these individuals and aims to complete the FPIC process no later than the next verification, or to document continued reasonable efforts where direct engagement remains unfeasible.<br><br>The FPIC agreements acknowledge the individuals' knowledge of the project activities, describe the project activities fishermen support including use and access regulations, and state that there will be annual monitoring of the agreement and project activities. The agreements also confirm that a grievance mechanism is in place to address concerns or complaints.<br><br>The project has not encroached on land, relocated people without consent, or forced displacement, as there are a limited number of individuals entering the area. The project has surveyed, and continues to survey, the area to identify potential rights holders. If potential rights holders are identified, the project will implement a transparent and appropriate process to determine whether the individual holds rights and may be impacted by project activities.<br><br>In 2020, one fisherman was potentially affected by canal blocking. This was discussed with the individual, a mutual agreement was reached, and the individual was compensated for temporary economic displacement during construction. The fisherman was also permitted to use more accessible fishing grounds within the project area. |

### 2.5.8 Property Right Protection (VCS, 3.18, 3.19; CCB, G5.3)

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

### 2.5.9 Identification of Illegal Activity (VCS, 3.19, CCB, G5.4)

The threat of illegal activities is expected to increase as the ecological integrity of the project area improves. Some of the preventative measures taken by the project to reduce these threats include daily patrols, regular coordination with local authorities and adjacent land owners/managers, and outreach and community development with rights holders and the closest settlements to the project area.

During this monitoring period, the only illegal activities recorded inside the project area were two accidental encroachments by adjacent concession workers, resulting in vegetation loss of 11.27 ha (or 0.05% of the total project area). Field staff identified the encroachment during regular patrolling, informed the project management team swiftly, and the encroachment was immediately stopped. Of the encroached areas only 17% (or 0.01% of the total project area) were stocked with native vegetation before encroachment, and all 11.27 ha affected areas were replanted with native tree species.

The project proponent strictly prohibits the use of forced labor, child labor, and victims of human trafficking, and protects staff and contracted workers employed by third parties in project design and implementation. All project workers are adults who applied to work for the project, and are employed and paid in line with national and local legislation on worker's rights (see Section 2.5.2 for more information).

### 2.5.10 Ongoing Disputes (VCS, 3.18, 3.19; CCB, G5.5)

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

# 3 CLIMATE

## 3.1 Monitoring GHG Emission Reductions and Removals

### 3.1.1 Data and Parameters Available at Validation (VCS, 3.16)

**Table 24. Data and Parameters available at validation.**

| | |
|---|---|
| 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)^11 |
| Value applied | 0.17 m, 0.1 m, 0.06 m, and 0.02 m, for 1st, 2nd, 3rd, 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 |

| | |
|---|---|
| Data / parameter | Forest Cover Benchmark |
| Data unit | N/A |
| Description | Map showing the location of forest land within the project area at the beginning of each monitoring period. If within the Project Area some forest land is cleared, the benchmark map must show the deforested areas at each monitoring event |
| Equations | Equation 3, 7 (Module M-MON) |
| Source of data | Remote sensing in combination with GPS data collected during ground truthing |
| Value applied | N/A |
| Justification of choice of data or description of measurement methods and procedures applied | See Module M-MON |
| Purpose of data | Calculation of baseline emissions |
| Comments | N/A |

### 3.1.2 Data and Parameters Monitored (VCS, 3.16)

**Table 25. Data and Parameters monitored.**

| | |
|---|---|
| Data / parameter | $\Delta C_{WPS\text{-}ARR}$ |
| 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 | 90,074 |

| | |
|---|---|
| QA/QC procedures to be applied | See Module M-ARR |
| Purpose of data | Calculation of project emissions |
| Calculation Method | See Module M-ARR |
| Comments | N/A |

| | |
|---|---|
| Data / parameter | $\Delta C_{LK\text{-}ARR}$ |
| 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 | 0 |
| QA/QC procedures to be applied | See Module LK-ARR |
| Purpose of data | Calculation of leakage |
| Calculation Method | See Module LK-ARR |
| Comments | N/A |

| | |
|---|---|
| Data / parameter | $GHG_{WPS\text{-}WRC}$ |
| 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 | 32,201 |
| 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 | $GHG_{LK\text{-}ECO}$ |
| Data unit | t $CO_2$-e |
| Description | Net GHG emissions due to ecological leakage from the WRC project activity up to year t |
| 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 | $E_{peatburn\text{-}WPS,i,t}$ |
| Data unit | $t\ CO_2\text{-}e\ yr^{-1}$ |
| Description | GHG emissions from burning of peat within the project boundary in the project scenario in stratum i in year t |
| 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 | 0 |
| 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 | $E_{proxy\text{-}CO_2,i,t}$ |
| Data unit | $t\ CO_2\text{-}e\ yr^{-1}$ |
| Description | Soil emission of $CO_2$ as land-use proxy in stratum i at year t |
| Equations | PD Section 3.2.2.4 Equation 27 |
| Source of data | IPCC default factors (see Annex 11, Table 34) |
| Description of measurements methods and procedures to be applied | See Module M-PEAT |
| Frequency of monitoring/recording | At each monitoring period |
| Value monitored | 24,336 |
| 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 | $E_{proxy\text{-}CH_4,i,t}$ |
| Data unit | $t\ CO_2\text{-}e\ yr^{-1}$ |
| Description | Soil emission of $CH_4$ as land-use proxy in stratum i at year t |
| Equations | PD Section 3.2.2.4 Equation 28 |

| | |
|---|---|
| Source of data | IPCC default factors (see Annex 11, Table 34) |
| Description of measurements methods and procedures to be applied | See Module M-PEAT |
| Frequency of monitoring/recording | At each monitoring period |
| Value monitored | 7,220 |
| 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 |
| 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 28 |
| 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 | $E_{peatditch\text{-}CO_2,i,t}$ |
| Data unit | $t\ CO_2\text{-}e\ yr^{-1}$ |
| Description | Emission of $CO_2$ from ditches and open water stratum i at year t in the project scenario |
| Equations | PD Section 3.2.2.5.1 Equation 29 |
| Source of data | IPCC default factors (see Annex 11, Table 34) |
| Description of measurements methods and procedures to be applied | See Module M-PEAT |
| Frequency of monitoring/recording | At each monitoring period |
| Value monitored | 645 |
| 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 | $A_{ditch\text{-}WPS,i,t}$ |
| Data unit | $ha$ |

| | |
|---|---|
| Description | Total area of ditch and other open water stratum i in year t 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 | 101 |
| 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 | $A_{DefPA,i,u,t}$ |
| 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-REDD) |
| Source of data | Remote sensing imagery |
| Description of measurements methods and procedures to be applied | See Module M-REDD |
| Frequency of monitoring/recording | See Module M-REDD |
| Value monitored | N/A |
| QA/QC procedures to be applied | See Module M-REDD |
| Purpose of data | Calculation of project emissions |
| Calculation Method | See Module M-REDD |
| Comments | See Module M-REDD |

| | |
|---|---|
| Data / parameter | $C_{BSL,i}$ |
| Data unit | $t\ CO_2\text{-}e\ yr^{-1}$ |
| Description | Carbon stock in all pools in the baseline in stratum i |
| Equations | Equations 5, 24 (Module M-REDD) |
| Source of data | Module M-REDD |
| Description of measurements methods and procedures to be applied | See Module M-REDD |
| Frequency of monitoring/recording | See Module M-REDD |
| Value monitored | N/A |
| QA/QC procedures to be applied | See Module M-REDD |
| Purpose of data | Calculation of project emissions |
| Calculation Method | See Module M-REDD |
| Comments | See Module M-REDD |

| | |
|---|---|
| Data / parameter | $A_{RRL,forest,t}$ |
| Data unit | $ha$ |
| Description | Remaining area of forest in RRL at time t |
| Equations | N/A |
| Source of data | Module M-REDD |
| Description of measurements methods and procedures to be applied | See Module M-REDD |
| Frequency of monitoring/recording | See Module M-REDD |
| Value monitored | 325 |
| QA/QC procedures to be applied | See Module M-REDD |
| Purpose of data | Calculation of project emissions |
| Calculation Method | See Module M-REDD |
| Comments | See Module M-REDD |

### 3.1.3 Monitoring Plan (VCS, 3.16, 3.20)

#### 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. Figure 2 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 4 and Annex 5.

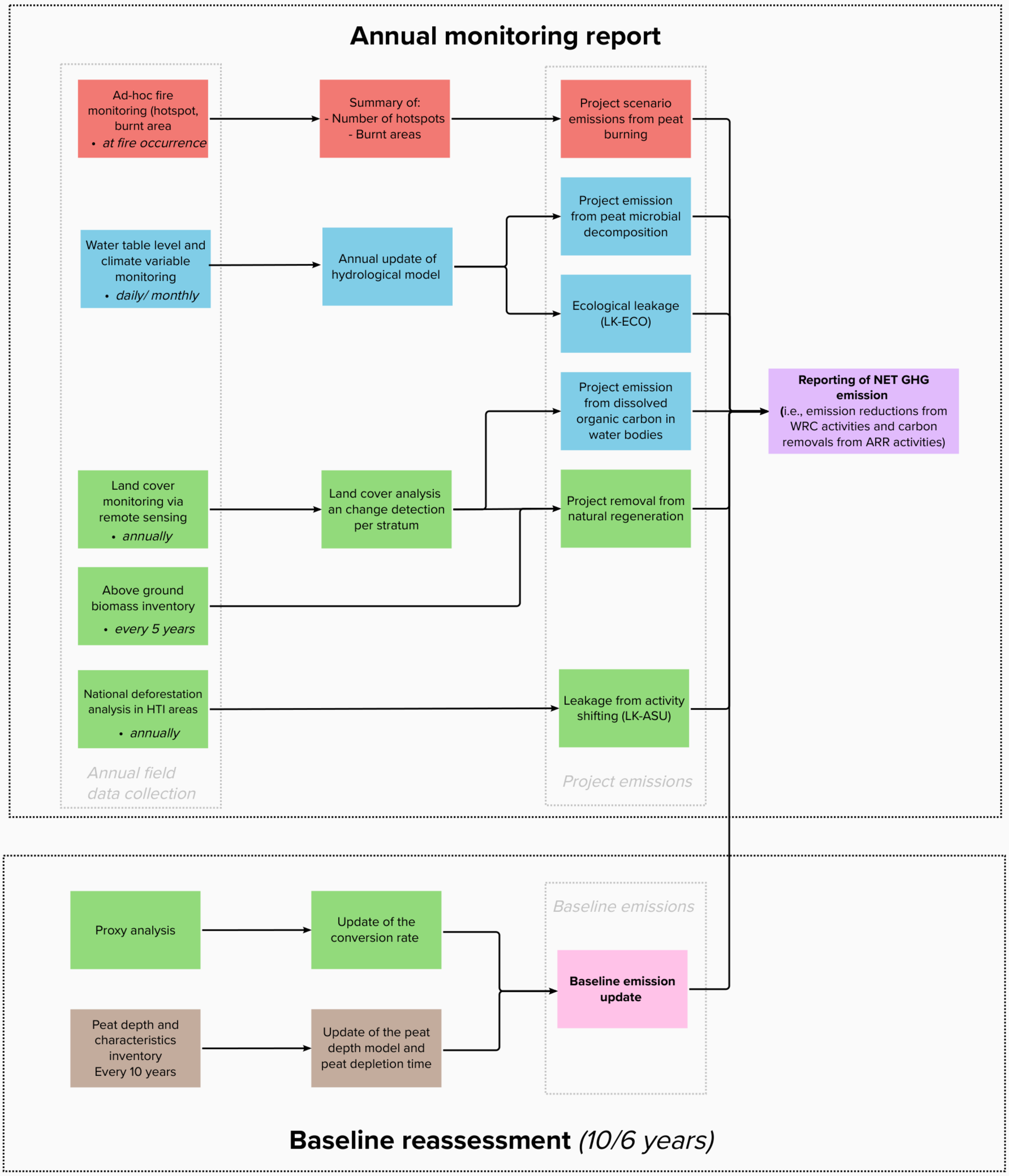



**Figure 1. Schematic workflow of the GHG data collection, data management, and annual reporting.**

Project staff standardize data through standard operating procedures (SOPs) and perform multiple quality assurance and quality control (QA/QC) assessments. All data collected, recorded, stored on online drives, 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. If internal non-conformities arise, meaning the data fail to meet QA/QC standards, the data are revised until all non-conformities are resolved. 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 1). Brief, regular monitoring reports are generated to assess the quality of data received from the field and investigations into any potential outliers.

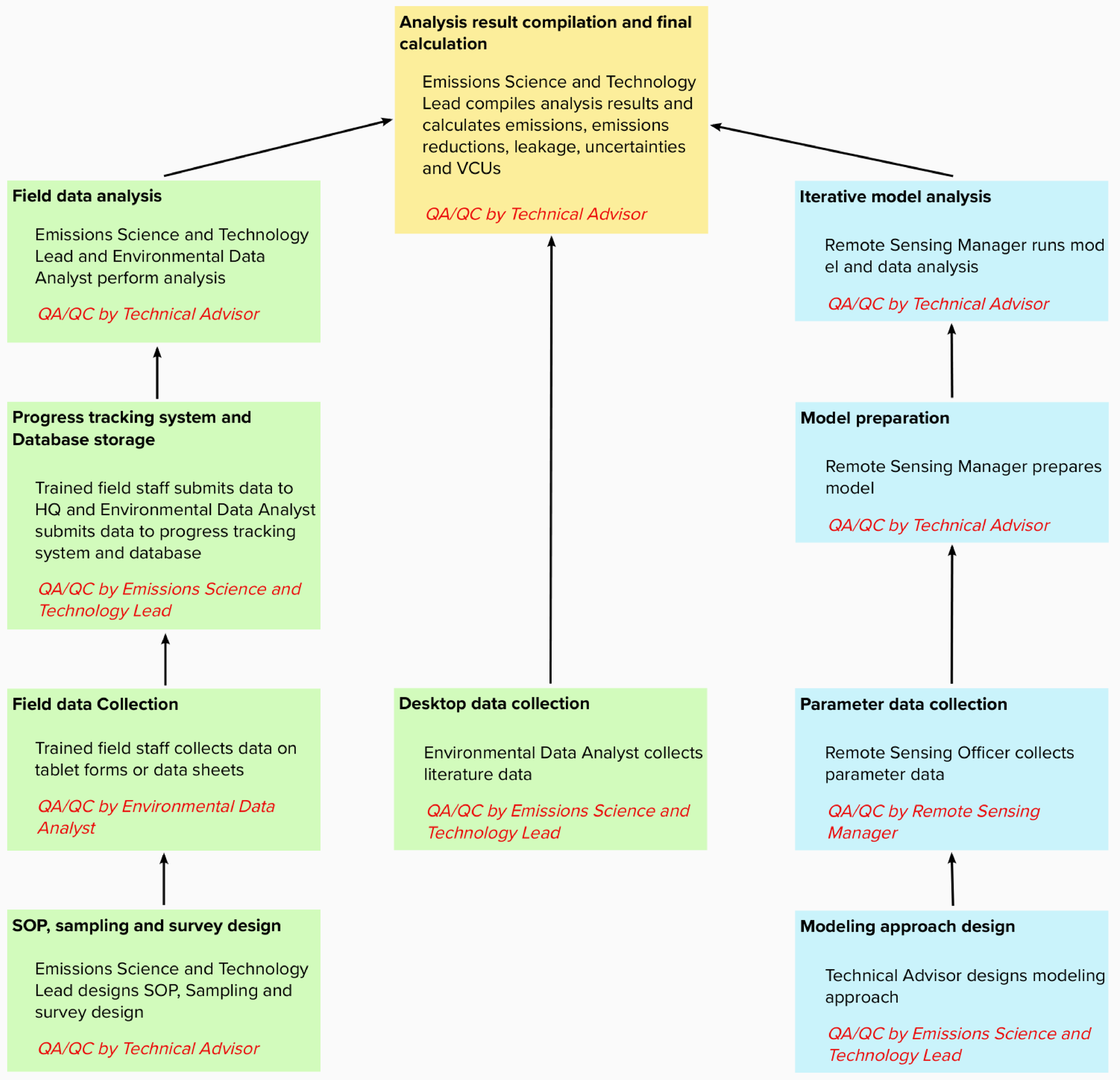



**Figure 2. Data collection, QA/QC, and processing workflow.**

The roles and responsibilities of each monitoring team member are listed below in Table 38.

**Table 26. Roles and responsibilities of the monitoring team members.**

| Position | Roles | Name | Short resume |
|---|---|---|---|
| Director of Project Design and Development | Modelling approach design, QA/QC of SOP, sampling and survey design, QA/QC of | Dr. Ophelia Wang | Dr. Wang holds a PhD and MSc degrees in spatial planning for conservation |

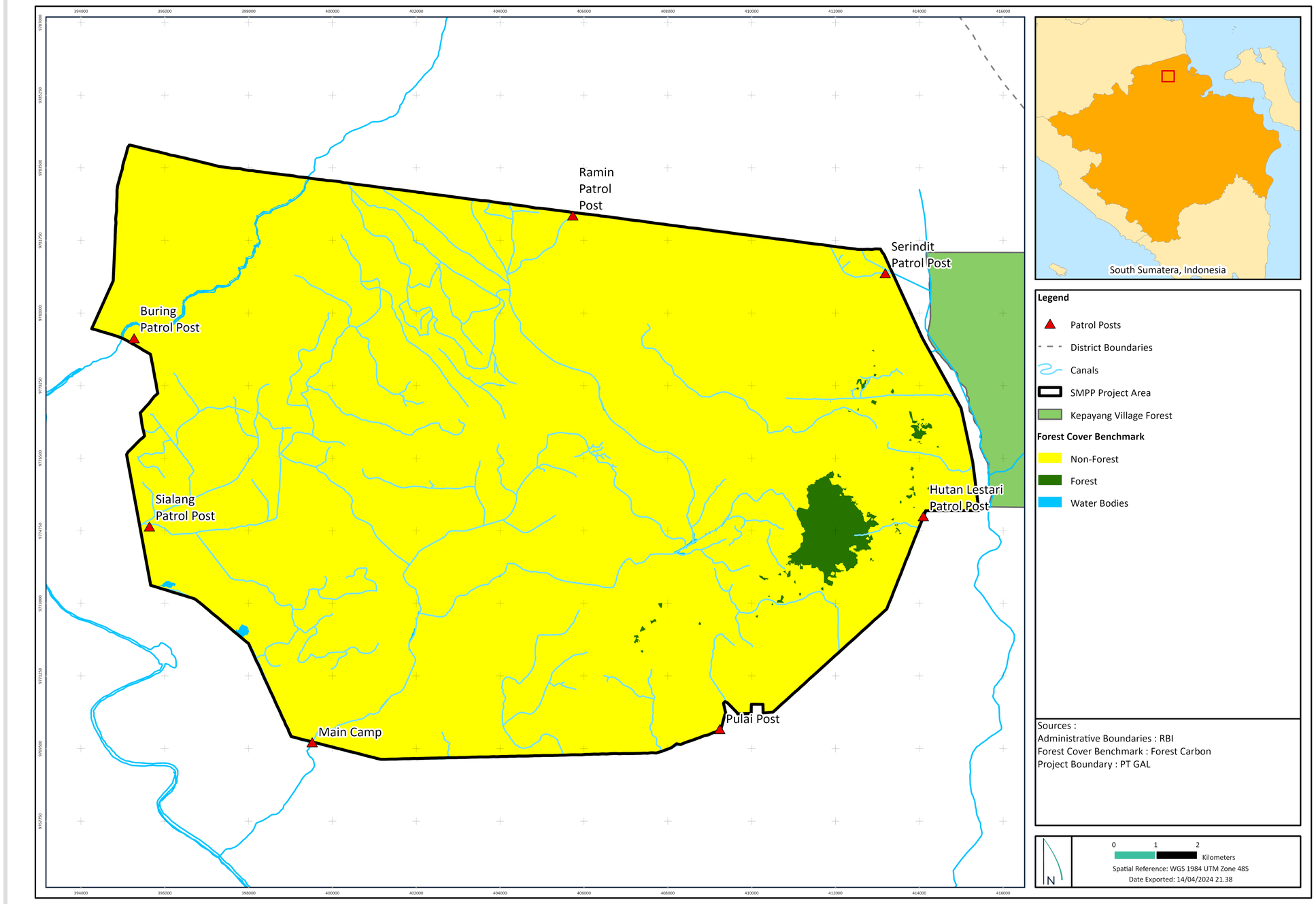
| Position | Roles | Name | Short resume |
|---|---|---|---|
| | field data analysis, QA/QC of model preparation, QA/QC of iterative model analysis, and QA/QC of result compilation and final calculation | | and brings more than 20 years of experience in technical forestry and program management. Dr. Wang's expertise is in data analysis and spatial modelling, specifically in constructing complex models that integrate spatially explicit biophysical data within peatland hydrology and fire risk analysis to provide comprehensive ecosystem service models. |
| Climate Science and MRV 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 13 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 Team Lead | Model preparation, Iterative model analysis, QA/QC of Parameter data collection | Prasetya Mahardhitama | Mr. Mahardhitama is an expert in GIS and remote sensing with more than 13 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. |
| Monitoring and Investor Reporting Lead | 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, |

| Position | Roles | Name | Short resume |
|---|---|---|---|
| | | | Indonesia. He has 16 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, and 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. |
| GIS and Remote Sensing Specialist | Parameter data collection | Rizaldy Yudhista N | Mr. Yudhista N is a GIS and Remote Sensing Specialist in Forest Carbon with 10 years of experience conducting forest landscape analysis, producing spatial analysis for design and assessment of peatland and tropical forest restoration projects. |
| Field Data Collection Lead | Field Data collection, Field data submission to HQ | Adi Jaya Prana | Mr. Adi JP carries out field monitoring and protection of peat swamp forest in the SMPP. His extensive experience has enabled him to routinely monitor the area utilizing drones, through roads and waterways to patrol for human activity and fire risk, as well as monitoring water levels in the SMPP area. Prior to SMPP he worked on a GIZ forest protection project and has a degree from University of Sriwijaya. |
| Field Staff | Field Data collection, Field data submission to HQ | Various | - |

#### 3.1.3.1.1 REMOTE SENSING

Project technical staff obtained and analyzed satellite imagery to detect land cover change over time, such as natural regeneration of vegetation. The project land cover map is updated at each monitoring period as needed.

An initial benchmark of forest/non-forest areas was created for the 2016 project start and updated annually to the current monitoring period. Map 6 below shows the map of forest/non-forest areas for this monitoring period. The emissions from deforestation will be calculated by multiplying areas of deforestation by the actual forest C stock per hectare estimated for each monitoring period. The area of remaining forest will be based on subtracting non-forest area and will be recorded in a forest benchmark map, which will be updated for each monitoring period.




**Map 4. Forest cover in current monitoring period.**

In addition to the above, Moderate Resolution Imaging Spectroradiometer (MODIS) and Visible Infrared Imaging Radiometer Suite (VIIRS) hotspot data were used to provide near real-time updates on potential fire activity in the project area and alert the ground fire control and prevention team to examine the field conditions.

#### 3.1.3.1.2 FIELD MEASUREMENT

##### 3.1.3.1.2.1 Monitoring C Stock

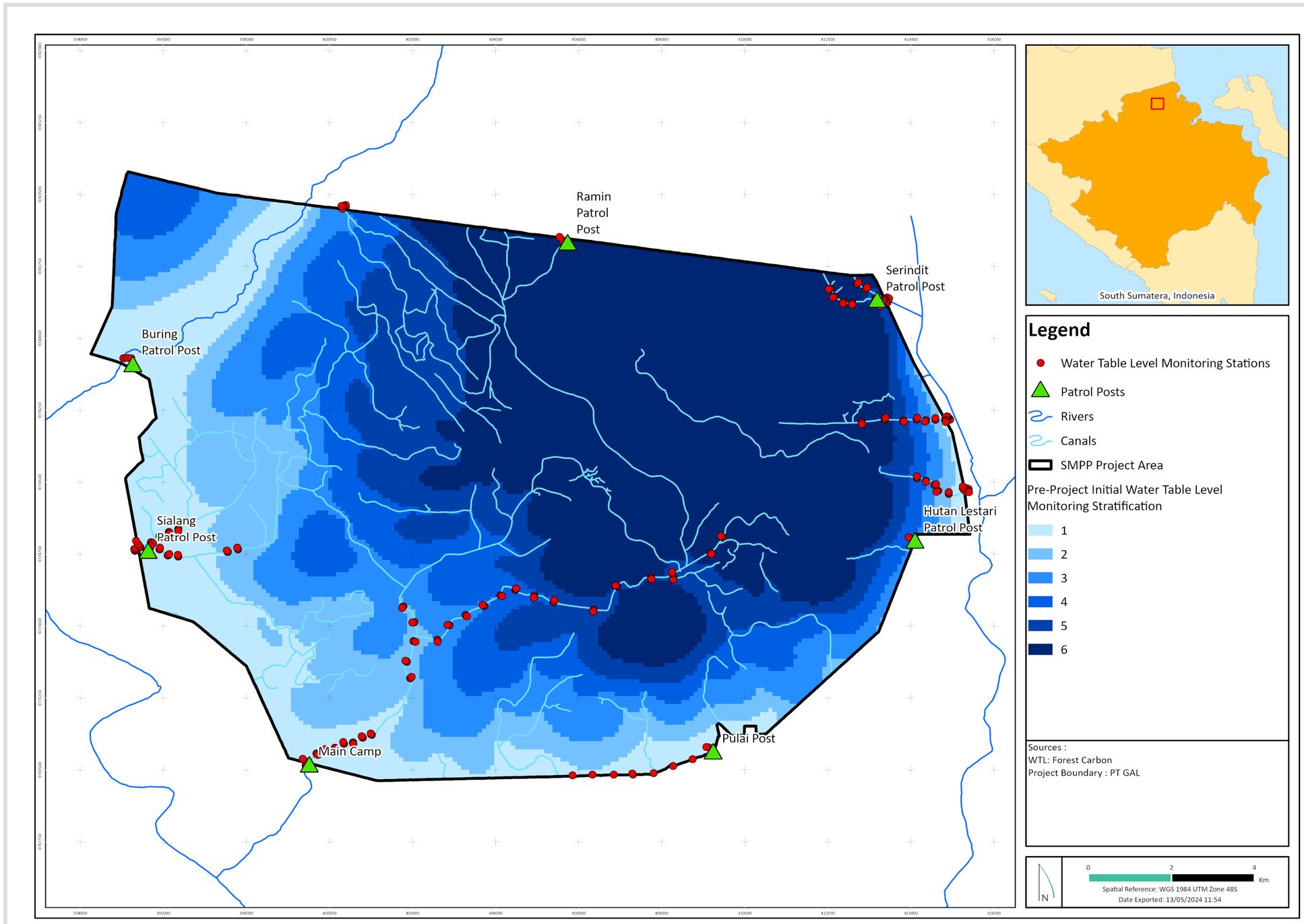
In 2020 the SMPP staff began monitoring change in tree biomass through field measurements using a point sampling method and allometric equations.[3] Per the CDM A/R Methodological Tool "Calculation of the number of sample plots for measurements within A/R CDM project activities,"[4] the project established monitoring plots for areas representing ARR activities in 2020, with plots monitored thereafter every five years. For the current monitoring period the project continued to use tree biomass and height data in conjunction with spaceborne LiDAR to model a continuous C stock

map of the project area at a resolution of 25 m using advanced machine learning algorithms (Annex 6).

#### 3.1.3.1.2.2 Monitoring GHG Emissions from Microbial Decomposition of Peat

In 2021 GHG emissions from microbial decomposition of peat were monitored by directly measuring proxy variables for GHG flux across all peat strata. By monitoring water table levels across peat strata and classifying landcover, the drainage status for a given area was modeled.

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), project staff monitored forest and non-forest cover and water table levels to update annual strata cover conditions and drainage status. Remote sensing methods in Section 3.2.2.1.1 informed 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 265 dip wells in total within six water table level strata (Map 5). A hydrological model was developed to extrapolate dip well measurements into a continuous water table level map.




**Map 5. Location of the dip wells in the project area.**

The project examined changes in vegetation cover and water table levels to determine status change strata, and the efficacy of compacted peat dams for canal blocking. Annual GHG emissions from microbial decomposition of peat were summarized by using IPCC default emission factor and

follow procedures in the VCS methodology VM0007 Module M-PEAT.

#### 3.1.3.1.2.3 Monitoring GHG Emissions from Water Bodies

Values for dissolved organic carbon (DOC) were taken from the Wetlands Supplement of the IPCC (2013).[5] The values were 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).

#### 3.1.3.1.2.4 Monitoring GHG Emissions from Peat Burning

In addition to the hotspot remote sensing data listed in Section Section 3.2.2.2, GHG emissions from peat and biomass burning were monitored in conjunction with regular forest patrols. For future monitoring events, fire monitoring will include the integration of smoke detection cameras, soil moisture monitoring with remote sensing products and soil moisture sensors on the ground to assess fire risk. In the event of a fire, suspected fires are confirmed through a combination of ground checks and visual assessment from remote sensing imagery. GHG emissions from burning are summarized annually following Module E-BPB.

#### 3.1.3.1.2.5 Peat Characteristics

As per the VCS Standard v4.2 (2022), the baseline reassessment period is every six years for avoided planned deforestation and degradation (APDD) projects where the deforestation agent is unknown. For projects that are registered on or before 19 January 2022, this update is effective at their subsequent baseline reassessment period. Therefore, for the SMPP project, the first baseline reassessment will be ten years after the start date, and then subsequently every six 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 (VCS, 3.18; CCB, CL4.2)

The project climate monitoring plan is 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 protection post in the project area. The project also publicized a variety of informational materials in both Bahasa Indonesia and English using 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 (VCS, 3.15)

In this section baseline emissions are 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

An analysis of the most likely baseline scenario was used 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 the assumptions described here were conservative and therefore resulted in lower baseline emissions to maintain validity of calculations and estimates of a baseline scenario.

It was assumed that no rewetting would occur in the baseline scenario. Examples of natural rewetting events that we excluded in the analysis were canal collapses, progressive subsidence that could lead to changes in relative water table depths, or reduced $CO_2$ emission rates with increasingly thinner aerobic soil layers. It was also assumed that regular canal maintenance activities typically carried out for drainage and transportation would continue.

As information regarding the impact, extent and frequency of canal dredging was unavailable (e.g., if dredging activities caused the peat exposure to aerobic decomposition), these emissions were omitted. This is a conservative omission as water body emissions were lower than those resulting from microbial decomposition in peat, and therefore resulted in lower emission estimates in the water body stratum than strata at the same location in the project scenario.

In the baseline scenario, the annual emissions for $CO_2$ and methane ($CH_4$) were estimated, as these emissions were impacted directly by changes in land cover and drainage status over time. However, nitrous oxide ($N_2O$) and GHG emissions derived from biomass burning were conservatively omitted.

#### 3.2.1.2 PROXY AREA ANALYSIS

Module BL-ARR and Methodology extension AR-ACM0003, do not include specific requirements to determine 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, technical staff followed Module BL-PL. As there is not a verifiable conversion plan for the project area, six (the minimum) proxy areas were selected to determine the baseline rate of conversion as per BL-PL requirements. These were further used to demonstrate the risk of abandonment.

This section describes the analytical processes to determine the conservative baseline rate of plantation establishment as per Module BL-PL which was also used subsequently in LK-ASP.

##### 3.2.1.2.1 DATA COLLECTION AND COMPILATION

Suitable proxy areas were selected as reference regions through an iterative process of data collection, compilation, review, and processing of national-level datasets. A description of the nationally available datasets used for performing the analyses to select appropriate proxy areas, as well as details on the methodology, is available in Annex 7.

##### 3.2.1.2.2 SIMILARITY ANALYSIS TO SELECT PROXY AREAS

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 ten years prior to the baseline period.

Further, it is required that the following three 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 (± 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 (± 20%). The ratio of slope classes “gentle” (slope < 15%) to “steep” (slope ≥ 15%) in the reference regions shall be (± 20%) the same of the ratio in the project area, and
3. Elevation classes (500-m classes) in the reference region shall be in the same proportion as in the project area (± 20%).

The reason for a slight deviation from Module BL-PL has been described in in PD Section 3.1.6. The reference regions had to meet the following requirements in Table 37.

**Table 27. Reference region selection criteria.**

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

The selection of reference areas followed a stepwise 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 MoEF 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 MoEF data. Ten of the 28 shortlisted concessions had their license start in 2007. Since the MoEF data did not cover this year, 2006 MoEF forest cover was used as a proxy for 2007, based on two assumptions. First, it was 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, uncertainty resulting from mixing

datasets across different time periods was avoided, which were derived using different methods by the source provider.

The first assumption was verified 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 normalized difference vegetation index (NDVI) for 2006-2007. INCAS and MoEF datasets had a mean 78% agreement between forest/non-forest areas.[6] Because the INCAS dataset used the same satellite platform (Landsat) as the MoEF and the data development involved standards, inputs and staff from the MoEF,[7] using INCAS data as a verification reference was viable.

The INCAS data of 2006-2007 was first compared with the MoEF 2006 percentage forest cover and one site was eliminated that showed a very high difference between the two data sources (MoEF: 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. Confirmation was carried out by using the INCAS dataset to examine if there was any major forest cover difference between 2006 and 2007. Another site was eliminated that presented a 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 candidate reference areas all had > 1% of forest cover difference in INCAS 2006-2007, and for these sites a change detection analysis was performed 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.[8] A dNDVI map was produced in the cloud-free areas of each 2006-2007 pair, smoothed with a majority filter algorithm, and used to categorize 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). Categories were 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.

Where the visual interpretation showed possibly different conclusions on forest cover or land-use change among dNDVI, Landsat-8 surface band composite, INCAS and MoEF datasets, maps were compared with two more global satellite-derived datasets in 2007: 1) vegetation loss (Terra-i); or 2) tree cover loss (University of Maryland). One additional site was eliminated that showed almost 100% forest cover in the INCAS and MoEF 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 7. From this iterative process it was confirmed that the remaining seven sites did not show major planned deforestation/conversion activities from 2006-2007 and therefore that the MoEF 2006 forest cover data would serve as a good proxy to represent 2007 cover.

#### 3.2.1.2.3 CONVERSION/DEFORESTATION RATE CALCULATION

After the final elimination step using the MoEF 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 a visual inspection by examining Landsat medium-resolution imagery in the licensed year and in 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 have resulted from industrial concession operations, but could be a result of smallholder practices, forest disturbance from hazards, or natural disasters. The area was eliminated, as the land conversion practices, and post-deforestation land-use did 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, these six remaining sites were selected as the proxy area for calculating the conversion/deforestation rate.

The summary comparison of sites analyzed in the visual inspection process can be found in Annex 7. The six final reference regions are summarized below in Table 39 and Map 7.

**Table 28. Summary of suitable reference regions.**

| Province | Concession name | Area (ha) | License year | Peat (%) | Forest area twelve years prior to project start year (ha) | Forest area three years prior to project start year (ha) | Total forest loss (%) | Average annual conversion/ deforestation rate (%) |
|---|---|---|---|---|---|---|---|---|
| Riau | PT Balai Kayang Mandiri | 21,165 | 2007 | 95.97 | 14,780 | 9,953 | 32.66 | 4.08 |
| Riau | PT Bina Daya Bentala | 20,008 | 2006 | 88.66 | 8,485 | 0 | 100 | 11.11 |
| Riau | PT Bina Duta Laksana | 29,153 | 2006 | 100 | 17,837 | 7,084 | 60.28 | 6.7 |
| Riau | PT Mitra Kembang Selaras | 14,718 | 2007 | 100 | 10,032 | 2,740 | 72.69 | 9.09 |
| Riau | PT Ruas Utama Jaya | 44,795 | 2007 | 99.94 | 20,935 | 4,675 | 77.67 | 9.71 |
| Riau | PT Satria Perkasa Agung (SK 102) | 11,864 | 2006 | 100 | 5,272 | 2,235 | 57.6 | 6.4 |

**Map 6. 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 as:

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

Where:

| | |
|---|---|
| $\mathrm{D\%_{planned,i,t}}$ | Projected annual proportion of land that will be deforested in stratum i during year *t*. $(\%)$ |
| $\mathrm{pn}$ | 1, 2, 3, ...n* land parcels examined in proxy area |
| $\mathrm{n}$ | Total number of land parcels examined |
| $\mathrm{D\%_{pn}}$ | Percent of deforestation in land parcel *pn* etc of a proxy area as a result of planned deforestation as defined in this module $(\%)$ |
| $\mathrm{Yrs_{pn}}$ | Number of years over which deforestation occurred in land parcel *pn* in proxy area $(\mathrm{Year})$ |
| $i$ | 1, 2, 3, … *M* strata |

The average annual conversion/deforestation rate was estimated to be 7.85% for the six proxy areas. A 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%. By taking 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, it was assumed the likelihood of deforestation (*L-Di*) was 100%.

The risk of abandonment was assessed using the six proxy areas selected above for calculating the average annual conversion/deforestation rate. After confirming the criteria in the proxy area analysis, Landsat satellite images were assessed and visually inspected to determine if any of them experienced abandonment or 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 was calculated using the equation below.

$$AA_{\mathrm{planned,i,t}} = (A_{\mathrm{planned,i}} \cdot \mathrm{D\%_{planned,i,t}}) \cdot L - D_{\mathrm{i}} \quad (3)$$

Where:

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

#### 3.2.1.3 PROJECTION OF CONVERSION UNDER BASELINE SCENARIO

Project staff spatially allocated planting blocks to the project area to produce a map based on the total annual area converted in the baseline ($AA_{Planned,i,t}$), shown in the baseline scenario in Map 4. The project area was then stratified into five strata (Table 40), 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 MoEF,[9,10]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 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)[11], 600 m (size class of primary canals),[12] up to 1,300 m.[12–14]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 prorate 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 MoEF regulations.[15]

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 immediately planted after conversion each 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 stratification of emission characteristics is shown in the baseline scenario designation map (Map 4) by incorporating (1) spatial coverage of land-use and drainage status; and (2) year of land-use and drainage status change.

**Map 7. 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 ARR ACTIVITIES UNDER THE BASELINE SCENARIO

The baseline above ground carbon stock accumulation and subsequent loss related to *Acacia* planting and harvesting is accounted for under the ARR component. As detailed in PD Sub-subsection 3.2.1.3, a total of 19,916 ha of the project area would be converted to *Acacia* plantation with a rotation cycle of four years (Table 36).

**Table 29. Land use strata change in the baseline scenario for ARR.**

| Strata | Land use | Area (Ha) | Planting start year |
|---|---|---|---|
| DS-AC | Acacia | 19,916 | 2016 |

#### 3.2.1.4.2 EMISSION CHARACTERISTICS STRATIFICATION FOR WRC ACTIVITIES UNDER THE BASELINE SCENARIO

Table 40 and Map 8 present the baseline stratification summary based on emission characteristics. A summary of dynamics of these strata is shown in Annex 8.

**Table 30. 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 cover is 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 with river buffers surrounding natural water bodies (Buring river), and deforested areas surrounding the dense forest. | 1,652 | 7.21 |
| DS-CAD | Conservation Area on Drained Peatland | Peatlands where forest cover is 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 with areas surrounding the forest having been deforested. | 643 | 2.81 |
| DS-WB | Water Body | This stratum represents rivers and drainage canals. Rivers remain 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 | 708 | 3.09 |

| Strata | Type | Description | Area (ha) | Percentage of project area (%) |
|---|---|---|---|---|
| | | 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. | | |
| 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 | 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. | 19,916 | 86.88 |
| Total | | | 22,922 | 100 |

**Map 8. Baseline stratification of the project area based on emission characteristics.**

### 3.2.1.5 BASELINE NET REMOVALS 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. Project staff accounted for the growth of *Acacia* as baseline ARR activities. The conversion to industrial timber plantation and the planting of *Acacia* would be carried out sequentially during the first 13 years of the project, resulting in a total planted area of 19,916 ha. Project staff assumed a rotation cycle of 4 years. The annual area changes under the baseline scenario are detailed in PD Annex 3 and summarized for the current monitoring period in Table 41 below.

**Table 31. Baseline planting and harvesting areas for ARR activities accounted for in the monitoring period.**

| Year | Planting (ha) | Harvesting (ha) |
|---|---|---|
| 2022 | 4,697 | 3,092 |
| 2023 | 4,608 | 3,029 |

Net GHG emissions and removals in the baseline ARR scenario were estimated using the procedure provided in AR-ACM0003 Afforestation and reforestation lands except wetlands and associated pool,[16] as outlined in Module BL-ARR, using the equation below.

$$\Delta C_{BSL\text{-}ARR} = \sum_{t=1}^{t^*} \Delta C_{BSL,t\ ACM0003} \quad (4)$$

Where:

| | |
|---|---|
| $\Delta C_{BSL\text{-}ARR}$ | Net GHG removals under the ARR baseline scenario up to time *t** $(t\ CO_2\text{-}e)$ |
| $\Delta C_{BSL,t\ ACM0003}$ | Baseline net GHG removals by sinks in year *t* (from AR-ACM0003) $(t\ CO_2\text{-}e)$ |
| $t$ | 1,2,3 … *t** time since project start $(years)$ |

Net GHG removals from Acacia growth in the ARR baseline scenario during the monitoring period amounted to 216,537 t $CO_2$-e. Net GHG baseline removals for 2021 are presented in Table 22 below. Details on calculations are provided in Annex 9.

**Table 32. Baseline net GHG removals for ARR activities accounted for in the monitoring period.**

| Year | NET GHG removal from ARR (t $CO_2$-e $yr^{-1}$) |
|---|---|
| 2022 | 95,190 |
| 2023 | 121,347 |

### 3.2.1.6 BASELINE EMISSIONS FROM MICROBIAL DECOMPOSITION OF PEAT, PEAT BURNING, AND WATER BODIES

#### 3.2.1.6.1 SPATIAL AND TEMPORAL VARIATIONS

GHG emissions resulting from microbial decomposition of peat, peat burning, and water bodies were quantified across spatial and temporal scales. Each baseline stratum included small units of land parcels with a combination of variables as described in Table 45. We calculated annual changes within strata, assessed the variability of GHG emission factors, and accounted for any restrictions on emissions while considering spatial and temporal scales.

**Table 33. Variables used for quantifying baseline GHG emissions from microbial decomposition of peat, peat burnings and dissolved organic carbon from water bodies.**

| Type | 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 (86% of the project area includes peat with depth ≥ 50 cm). |
| | (A2) Initial peat thickness available for microbial decomposition and burnings | Derived from DTM, DEL and Peat Thickness maps as described in Subsection 3.1.3.1.4. 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 8) 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 | Used to identify whether the corresponding parcel was marked |

| Type | Variables | Description |
|---|---|---|
| | | 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 sets all the drainage related parameters/variables accordingly, such as initial consolidations, bulk density changes, etc. This does not take effect if the initial stratum of the parcel 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 from peat in that stratum are set to zero. |
| | (B4) Year tag for burning | Determines whether the corresponding parcel was marked to burn for the corresponding year and counts the number of burn scars (and any repetitions) since year one. 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) and B3 (Remaining peat thickness available for microbial decomposition and burning). |

#### 3.2.1.6.2 EMISSIONS CALCULATIONS

The net carbon dioxide equivalent ($CO_2$-e) emissions from the peat (microbial decomposition and burning) and water body were calculated as per VCS Module BL-PEAT.

$$GHG_{\text{BSL-PEAT}} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} (A_{\text{peatsoil-BSL,i,t}} \cdot GHG_{\text{peatsoil-BSL,i,t}} + A_{\text{ditch-BSL,i,t}} \cdot GHG_{\text{peatditch-BSL,i,t}} + A_{\text{peatburn-BSL,i,t}} \cdot GHG_{\text{peatburn-BSL,i,t}}) \quad (5)$$

Where:

| | |
|---|---|
| $GHG_{\text{BSL-PEAT}}$ | Net GHG emissions in the WRC baseline scenario on peatland up to year *t** $(\text{t CO}_2\text{e})$ |
| $A_{\text{peatsoil-BSL,i,t}}$ | Area of peatland (not open water, not burnt) in stratum *i* in year *t* in the project scenario $(\text{ha})$ |
| $GHG_{\text{peatsoil-BSL,i,t}}$ | GHG emissions from the peat soil within the project boundary in the baseline scenario in stratum *i* at year *t* $(\text{t CO}_2\ \text{ha}^{-1}\ \text{yr}^{-1})$ |
| $A_{\text{ditch-BSL,i,t}}$ | Total area of canals and other open water stratum *i* at year *t* in the baseline scenario $(\text{ha})$ |
| $GHG_{\text{peatditch-BSL,i,t}}$ | GHG emissions from water bodies at year *t* $(\text{t CO}_2\ \text{ha}^{-1}\ \text{yr}^{-1})$ |
| $A_{\text{peatburn-BSL,i,t}}$ | Area of peat burnt in stratum *i* in year *t* in the project scenario $(\text{ha})$ |
| $GHG_{\text{peatburn-BSL,i,t}}$ | GHG emissions from burning of peat in the base line scenario in stratum *i* at year *t* $(\text{t CO}_2\ \text{ha}^{-1}\ \text{yr}^{-1})$ |
| $i$ | 1, 2, 3 …*M* strata in the baseline scenario $(\text{unitless})$ |
| $t$ | 1, 2, 3, … *t** times elapsed since the project start $(\text{yr})$ |

For all strata i where the project duration exceeds the peat depletion time (PDT or *tPDT*), for *t* > *tPDT-BSL,i* the following equations apply.

$$GHG_{\text{peatsoil-BSL,i,t}} = 0 \quad (6)$$

$$GHG_{\text{peatditch-BSL,i,t}} = 0 \quad (7)$$

$$GHG_{\text{peatburn-BSL,i,t}} = 0 \quad (8)$$

Where:

| | |
|---|---|
| $t_{\text{PDT-BSL,i}}$ | Peat Depletion Time in the baseline scenario in stratum *i* in years elapsed since the project start $(\text{yr})$ |
| $GHG_{\text{peatsoil-BSL,i,t}}$ | GHG emissions from the peat soil within the project boundary in the baseline scenario in stratum *i* at year *t* $(\text{t CO}_2\ \text{ha}^{-1}\ \text{yr}^{-1})$ |
| $i$ | 1, 2, 3 …$M_{BSL}$ strata in the baseline scenario $(\text{unitless})$ |
| $t$ | 1, 2, 3, … *t** times elapsed since the project start $(\text{yr})$ |
| $GHG_{\text{peatditch-BSL,i,t}}$ | GHG emissions from water bodies at year *t* $(\text{t CO}_2\ \text{ha}^{-1}\ \text{yr}^{-1})$ |
| $GHG_{\text{peatburn-BSL,i,t}}$ | GHG emissions from burning of peat in the base line scenario in stratum *i* at year *t* $(\text{t CO}_2\ \text{ha}^{-1}\ \text{yr}^{-1})$ |

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 49.

**Table 34. 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 monitoring period.**

| 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 $yr^{-1}$) |
|---|---|---|---|---|---|---|
| 2022 | 822,665 | 5,983 | 409,758 | 39,205 | 1,747 | 1,279,357 |
| 2023 | 936,656 | 5,308 | 402,032 | 38,466 | 1,747 | 1,384,209 |

### 3.2.1.6.3 SUBSIDENCE RELATED TO INITIAL COMPRESSION, MICROBIAL DECOMPOSITION, AND PEAT BURNING

It was assumed that the initial peat thickness in the baseline scenario is equal to the initial peat thickness as mapped at the project starting date (PD Section 3.1.3.1.4).

Peat loss due to initial compression and microbial decomposition was calculated by using the stratification of the project area on initial drainage levels, the year of conversion, and specific subsidence rates that considered the compaction after initial drainage (Annex 8). For peat loss due to burning, the number of times the individual pixels in the fire simulation were burned in the 10-year period before project start date was first assessed and subsequently an associated burn scar depth was applied (Annex 10). Technical staff 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 (3.5):

$$\mathrm{Rate}_{\mathrm{peatloss\text{-}BSL,i,t}} = \mathrm{D}_{\mathrm{peatburn\text{-}BSL,i,t}} + \mathrm{Sub}_{\mathrm{i,t}} \quad (9)$$

Where:

| | |
|---|---|
| $\mathrm{Rate}_{\mathrm{peatloss\text{-}BSL,i,t}}$ | Rate of peat loss due to microbial decomposition and burning in baseline scenario of stratum *i* at year *t* $\left(\mathrm{m\ yr^{-1}}\right)$ |
| $\mathrm{D}_{\mathrm{peatburn\text{-}BSL,i,t}}$ | Burn scar depth under baseline scenario in stratum *i* at year *t* $(m)$ |
| $\mathrm{Sub}_{\mathrm{i,t}}$ | Subsidence rate in stratum *i* in year *t* $(m)$ |
| $i$ | 1, 2, 3 …$M_{BSL}$ strata in the baseline scenario |
| $t$ | 1, 2, 3 … *t** years elapsed since the start of the project activity |

Project staff 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 (3.6):

$$\mathrm{Depth}_{peat-BSL,i,t'} = \mathrm{Depth}_{\mathrm{peat\text{-}BSL,i,t0}} - \sum_{t=1}^{t=t'} \mathrm{Rate}_{\mathrm{peatloss\text{-}BSL,i,t}} \quad (10)$$

Where:

| | |
|---|---|
| $\mathrm{Depth}_{peat-BSL,i,t^*}$ | Remaining peat thickness in the baseline scenario in stratum *i* at year $t^*$ $(\mathrm{m})$ |
| $\mathrm{Depth}_{\text{peat-BSL,i,t0}}$ | Peat thickness at the baseline scenario in stratum *i* at year $t_0$ = project start date (initial peat thickness) $(m)$ |
| $\mathrm{Rate}_{\text{peatloss-BSL,i,t}}$ | Rate of peat loss due to microbial decomposition and burning in baseline scenario of stratum *i* at year *t* $(\mathrm{m\ yr^{-1}})$ |
| $i$ | 1, 2, 3 …$M_{BSL}$ strata in the baseline scenario |
| $t$ | 1, 2, 3 … $t^*$ years elapsed since the start of the project activity |

By tracking annual peat thickness in the baseline scenario, project staff 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.

### 3.2.1.6.4 EMISSIONS FROM MICROBIAL DECOMPOSITION

It was assumed that the annual rate of conversion of undrained to drained peatland in the baseline scenario was based on the conversion rate of derived from the proxy area analysis as described in Section 3.2.1.2 and Annex 7 (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 43 below provides details on the WRC-related baseline stratification per stratum.

**Table 35. 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 in the baseline scenario.**

| Strata | Description | Area (ha) | IPCC default factor for $CO_2$ | IPCC default factor for $CH_4$ | IPCC default factor for ΔDOC |
|---|---|---|---|---|---|
| | | | t $CO_2$-e $ha^{-1}$ $yr^{-1}$ | | |
| **Initial** | | | | | |
| IN-UPSF | Undrained Dense Peatland Forest | 305 | 0 | 1.02 | |
| IN-UDP | Undrained Deforested Peatland | 14,930 | 5.5 | 0.66 | |
| IN-DPSF | Drained Dense Peatland Forest | 20 | 19.43 | 0.12 | |
| IN-DDP | Drained Deforested Peatland | 7,562 | 19.43 | 0.12 | |
| IN-WB | Water bodies (river and canals) present at project start | 105 | | | 2.09 |
| **After conversion** | | | | | |
| DS-AC | Acacia on drained peatland | 4 | 73.33 | 0.07 | |
| DS-CAU | Conservation area on undrained peatland | - | 0 | 1.02 | |

| Strata | Description | Area (ha) | IPCC default factor for $CO_2$ | IPCC default factor for $CH_4$ | IPCC default factor for ΔDOC |
|---|---|---|---|---|---|
| | | | t $CO_2$-e $ha^{-1}$ $yr^{-1}$ | | |
| DS-CAD | Conservation area on drained peatland | 1,652 | 19.43 | 0.12 | |
| DS-GF | Ground facilities on drained peatland | 708 | 19.43 | 0.12 | |
| DS-WB | Water bodies (river and canals) | 643 | | | 3.01 |

*Note: Annex 11 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.*

Project staff 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.

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

Where:

| | |
|---|---|
| $\mathrm{E_{peatsoil\text{-}BSL,i,t}}$ | GHG emissions from the peat soil within the project boundary in the baseline scenario in stratum *i* at year *t* $\left(\mathrm{t\ CO_2\text{-}e\ yr^{-1}}\right)$ |
| $\mathrm{E_{CO2\text{-}BSL,i,t}}$ | $CO_2$ emissions from the peat soil within the project boundary in the baseline scenario in stratum *i* at year *t* $\left(\mathrm{t\ CO_2\text{-}e\ yr^{-1}}\right)$ |
| $\mathrm{E_{CH4\text{-}BSL,i,t}}$ | $CH_4$ emissions from the peat soil within the project boundary in the baseline scenario in stratum *i* at year *t* $\left(\mathrm{t\ CO_2\text{-}e\ yr^{-1}}\right)$ |
| $i$ | 1, 2, 3 …$M_{BSL}$ strata in the baseline scenario $(\mathrm{unitless})$ |
| $t$ | 1, 2, 3, … *t** times elapsed since the project start $(\mathrm{yr})$ |

Project staff calculated the $CO_2$ emissions from microbial decomposition for each stratum of the peat within the SMPP using the equation below.

$$\mathrm{E_{peatsoil\text{-}BSL,CO2,i,t}} = \mathrm{A_{i,t}} \times \mathrm{EF_{CO2,i,t}} \quad (12)$$

Where:

| | |
|---|---|
| $E_{peatsoil\text{-}BSL,CO2,i,t}$ | $CO_2$ emissions from the peat soil within the project boundary in the baseline scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $A_{i,t}$ | Area of stratum *i* at time *t* $(ha)$ |
| $EF_{CO2,i,t}$ | Emission factor for $CO_2$ emissions corresponds to each stratum *i*, as provided by IPCC $(t\ CO_2\text{-}e\ ha^{-1} yr^{-1})$ |
| $i$ | 1, 2, 3 …$M_{BSL}$ strata in the baseline scenario $(unitless)$ |
| $t$ | 1, 2, 3, … *t** times elapsed since the project start $(yr)$ |

The $CH_4$ emissions from the peat soil for each stratum of the peat within the SMPP was calculated using the equation below.

$$E_{peatsoil\text{-}BSL,CH4,i,t} = A_{i,t} \times GWP_{CH4} \times EF_{CH4,i,t} \quad (13)$$

Where:

| | |
|---|---|
| $E_{peatsoil\text{-}BSL,CH4,i,t}$ | $CH_4$ emissions from the peat soil within the project boundary in the baseline scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $A_{i,t}$ | Area of stratum *i* at time *t* $(ha)$ |
| $GWP_{CH4}$ | Global Warming Potential for $CH_4$ |
| $EF_{CH4,i,t}$ | Emission factor for $CH_4$ emissions corresponds to each stratum *i*, as provided by IPCC $(t\ CO_2\text{-}e\ ha^{-1} yr^{-1})$ |
| $i$ | 1, 2, 3 …$M_{BSL}$ strata in the baseline scenario $(unitless)$ |
| $t$ | 1, 2, 3, … *t** times elapsed since the project start $(yr)$ |

The annual GHG emissions from microbial decomposition in the baseline scenario are shown below in Table 48.

**Table 36. GHG emissions from microbial decomposition of peat in the baseline scenario in the monitoring period.**

| Year | $CO_2$ from peat microbial decomposition (t CO2-e yr-1) | | $CH_4$ from peat microbial decomposition (t CO2-e yr-1) | | Total (t CO2-e yr-1) |
|---|---|---|---|---|---|
| | CUPP | RDP | CUPP | RDP | |
| 2022 | 482,071 | 340,594 | 5,530 | 453 | 828,647 |
| 2023 | 574,127 | 362,529 | 4,835 | 473 | 941,963 |

### 3.2.1.6.5 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.

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

To quantify GHG emissions from uncontrolled peat burnings, project staff followed procedures from the VCS methodology VM0007 Module E-BPB with the following equation.

$$E_{biomassburn,i,t} = \sum_{g=1}^{G} (A_{burn,i,t} \times B_{i,t} \times COMF_i \times G_{g,i}) \times 10^{-3}) \times GWP_g) \quad (14)$$

Where:

| | |
|---|---|
| $E_{biomassburn,i,t}$ | Greenhouse gas emissions due to biomass burning in stratum *i* in year *t* of each GHG ($CO_2$, $CH_4$, $N_2O$) $(t\ CO_2\text{-}e)$ |
| $A_{burn,i,t}$ | Area burnt for stratum *i* in year *t* $(ha)$ |
| $B_{i,t}$ | Average aboveground biomass stock before burning stratum *i*, year *t* $(t\ DM\ ha^{-1})$ |
| $COMF_i$ | Combustion factor for stratum *i* |
| $G_{g,i}$ | Emission factor for stratum *i* for gas *g* $(kg\ t^{-1} DM\ burnt)$ |
| $GWP_g$ | Global warming potential for gas *g* $(t\ CO_2/t\ gas\ g)$ |
| $g$ | 1, 2, 3, … *G* greenhouse gases including carbon dioxide, methane, and nitrous oxide |
| $i$ | 1, 2, 3, … *M* strata |
| $t$ | 1, 2, 3 … *t** years elapsed since the start of the project activity $(years)$ |

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 11. The average mass of peat burnt for a particular stratum was calculated using the equation.

$$P_{BSL,i,t} = D_{peatburn\text{-}BSL,i,t} \times BD_{upper,i} \times 10^4 \quad (15)$$

Where:

| | |
|---|---|
| $P_{BSL,i,t}$ | Average mass of peat burnt (DM) under baseline scenario in stratum *i*, year *t* $(t\ DM\ ha^{-1})$ |
| $D_{peatburn\text{-}BSL,i,t}$ | 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** years 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 11 for the default values used for the calculations of baseline carbon losses and emissions from burning).

For fire emissions, it was 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, project staff 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. Human population density, 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 the SMPP study, to align periods of fire risk probability modeling and burn scar area calculation (for estimating average burn area per year), remote sensing data from a 10-year span prior to project start (2006-2015) was used.

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 MoEF for 2006-2015. Land cover type, precipitation and seasonality, population, and distance to roads were the most important contributing variables to the final model.

The detailed fire risk probability data, model input preparation, iterative modeling process, model evaluation and final model result are available in Annex 12.

**Map 9. Fire occurrence suitability that predicted risk probability.**

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

It was 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, project staff 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. Parcels that had higher fire risk probability had greater chance of random selection in the simulation model.

Hotspot history based on MODIS and VIIRS data from year 2006-2015 was examined to document the number of times when a selected parcel was burnt. The 100-year fire simulation of burn

frequency was 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 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 burn area and 100-year fire simulations can be found in Annex 10.

The peat burning baseline will be re-assessed in 2026 and then every 6 years thereafter 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 44 below, and annual emissions and total emission per stratum are shown in Table 47.

**Table 37. Total GHG emissions from uncontrolled peat burning in the baseline scenario per stratum in the current monitoring period.**

| Strata | Description | Total Area burnt (ha) | | GHG Emissions from peat burning (t $CO_2$-e) | |
|---|---|---|---|---|---|
| | | 2022 | 2023 | 2022 | 2023 |
| IN-UPSF/ DS-CAU | Dense Forest (undrained) | 115 | 144 | 33,577 | 42,144 |
| IN-UDP | Deforested peatland (undrained) | 421 | 258 | 143,707 | 54,239 |
| IN-DPSF | Dense Forest (drained) | 27 | 41 | 4,141 | 18,590 |
| IN-DDP | Deforested peatland (drained) | 307 | 1 | 85,846 | 88,476 |
| DS-AC | Acacia (drained peatland) | 465 | 662 | 172,959 | 227,621 |
| DS-GF | Ground facilities (drained peatland) | - | - | - | 178 |
| WB | Water bodies (river and canals) | 25 | 26 | 8,733 | 9,251 |
| Total | | 1,360 | 1,133 | 448,963 | 440,499 |

*Note: Emissions in this table represent unintentional or uncontrolled peat burning only. Controlled or planned peat burning is illegal and excluded from the baseline scenario (see Section 3.2.1.6.5).*

**Table 38. Annual GHG emissions from peat burning in the baseline scenario in the current monitoring period.**

| Year | $CO_2$ from peat burning (t $CO_2$-e $yr^{-1}$) | $CH_4$ from peat burning (t $CO_2$-e $yr^{-1}$) | Total (t $CO_2$-e $yr^{-1}$) |
|---|---|---|---|
| 2022 | 409,758 | 39,205 | 448,963 |
| 2023 | 402,032 | 38,466 | 440,499 |

### 3.2.1.6.6 EMISSIONS FROM WATER BODIES IN PEATLAND

The only type of open water bodies present in the baseline scenario are river and drainage canals, as it was 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. The IPCC does not provide default emission factors for $CO_2$ and $CH_4$ emissions from water bodies, therefore default values for dissolved organic carbon ($\Delta$DOC) were used (for detail see Annex 11).

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 value for drained peatland (0.82 t C $ha^{-1}$ $yr^{-1}$) was applied.

The approach as set out in the VCS methodology VM0007 Module BL-PEAT was used (see equation below), and replaced $E_{peatditch-CO2,i,t}$ + $E_{peatditch-CH4,i,t}$ with IPCC DOC emission default factors converted into $CO_2$-equivalents.

$$\mathrm{E}_{\text{peatditch-BSL,i,t}} = A_{\text{ditch-BSL,i,t}} \times \mathrm{EF}_{\text{DOC-BSL,i}} \quad (16)$$

Where:

| | |
|---|---|
| $\mathrm{E}_{\text{peatditch-BSL,i,t}}$ | GHG emissions from canals and other open water in the baseline scenario in stratum *i* at year *t* $\left(\mathrm{t\ CO_2\text{-}e\ ha^{-1} yr^{-1}}\right)$ |
| $A_{\text{ditch-BSL,i,t}}$ | Total area of canals and other open water stratum *i* at year *t* in the baseline scenario $(\mathrm{ha})$ |
| $\mathrm{EF}_{\text{DOC-BSL,i}}$ | IPCC emission factor for Dissolved Organic Carbon from canal and open water in the baseline scenario in stratum *i* $\left(\mathrm{t\ CO_2\text{-}e\ ha^{-1} yr^{-1}}\right)$ |
| $i$ | 1, 2, 3 …*M* strata in the baseline scenario $(\mathrm{unitless})$ |
| $t$ | 1, 2, 3, … *t** times elapsed since the project start $(\mathrm{yr})$ |

Annual GHG emissions from DOC in water bodies in baseline scenario are shown in Table 46.

**Table 39. GHG emissions from Dissolved Organic Carbon in water bodies in the baseline scenario in the current monitoring period.**

| Year | $CO_2$ from DOC (t $CO_2$-e $yr^{-1}$) |
|---|---|
| 2022 | 1,747 |
| 2023 | 1,801 |

### 3.2.1.7 SIGNIFICANT SOURCES OF BASELINE EMISSIONS

It was determined that all sources of carbon not included in the baseline or project scenarios could be conservatively excluded. Significance tests were not necessary, as all the required carbon pools and other GHG emissions within the SMPP are included in the calculations.

### 3.2.2 Project Emissions (VCS, 3.15)

To determine project scenario emissions and changes in carbon stocks within the SMPP, analysis was based on a combination of field data, proxy analyses, and the application of default emissions factors from the IPCC.[17]

Emissions accounted for in the project scenario included:

1. Peat microbial decomposition;
2. Peat burning;
3. Dissolved organic carbon from bodies of water; and
4. AGB stock changes due to ARR activities.

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

The project has operated consistent fire patrols since the start of the SMPP and has an online satellite-based early warning system (EWS) in place to detect possible fires as quickly as possible. Project activities also include active patrolling, border protection and training. The existence of the project has generally caused a reduction in human activities in the project area. If any uncontrolled burning occurs in the SMPP, an extensive fire monitoring plan is in place to ensure emissions from fire are accounted for and deducted from emissions reductions estimates. Compacted peat dams were also constructed over existing canals throughout the project area starting in late 2019 (Map 10).

**Map 10. Completed canal blocks between 2019 and 2023.**

#### 3.2.2.1 EMISSION CHARACTERISTICS STRATIFICATION MONITORING

##### 3.2.2.1.1 LAND COVER CLASSIFICATION

In PD Section 3.1.3.1 the project area was stratified into land cover classes based on the vegetation classes used to derive aboveground carbon stocks. The classification informed the emission characterization and emission factors. This land cover classification updates the existing land cover for 2023. Annex 12 provides details on the employed methodology and results.

###### 3.2.2.1.1.1 Data Acquisition

A land cover classification for the project area in 2023 was performed based on cloud-free satellite data mosaics using optical data from Sentinel-2, and Synthetic Aperture Radar (SAR) from Sentinel-1 and ALOS-2/PALSAR-2.

Sentinel-1 and 2 are Copernicus Program satellite constellations, operated by the European Space Agency and launched in 2014 and 2015, respectively. Sentinel-1 satellite constellation carries a C-band synthetic aperture radar (SAR) instrument which provides all-weather, day and night data collection capabilities with a spatial resolution up to 5 m and a swath up to 400 km. Sentinel-2 satellite constellation carries an optical sensor that captures a wide spectrum of wavelengths up to 10 m spatial resolution.[18] The PALSAR-2 is an L-Band microwave SAR instrument launched the

ALOS-2 satellite in 2014, operated by EORC/JAXA and is less affected by clouds and rain.[19]

Sentinel-2 Level-2A Bottom of Atmospheric consists of corrected and normalized surface reflectance for thirteen spectral bands (ultra-blue, blue, green, red, five visible and near-infrared (VNIR) bands, and four shortwave infrared (SWIR) bands), as well as additional NDVI band.

#### 3.2.2.1.1.2 Classification Training Sample Development

To collect model training samples, small polygons were created within each homogeneous landcover type through expert analysis by visualizing high-resolution optical satellite data (3-m pixel size or finer, including Planet, Worldview and SPOT images). The high-resolution optical satellite data used for training were collected within the current monitoring period. In cases where the high-resolution data predated the current monitoring period, a separate assessment was undertaken using data from the current monitoring period to ensure that no landcover change had occurred between dates. The training data polygons were taken from in and around the SMPP, with areas outside used where necessary to ensure sufficient samples for each landcover type.

These covered six classes: open canopy tree/shrub mix, closed canopy tree/shrub mix, dense forest, water bodies, plantation forest, and bare ground. Plantation forest and bare ground appeared because of incidental encroachment by the project boundary (see details in Annex 14). These classes were chosen as being discernible by eye based on the high-resolution optical satellite data available, and separately seen in the coarser resolution images used for the classification.

#### 3.2.2.1.1.3 Classification Modeling

A combination of bands and derived indices from Sentinel-2 (optical) and Sentinel-1 (Synthetic Aperture Radar; SAR) from 2021 were used to create the classification model, based on different satellite datasets for assessing tropical forest landscapes. The datasets were combined using an established commercial classifier, HabitatMapper™ technical stack[20–22] (owned by Space Intelligence). This technical stack included Space Intelligence's internal machine learning classifier, developed to maximize accuracy, and produce robust, consistent, and accurate land cover classifications, while minimizing model overfitting. The classifier is largely insensitive to bands that do not contain useful spectral information and is ideally suited to classification involving multiple types of satellite data (e.g., combining the strengths of optical and SAR data) without producing artefacts or displaying noises.

#### 3.2.2.1.1.4 Accuracy Assessment

During model training a 5-fold cross validation was performed, wherein 20% of the training data was held back (the exact proportion varied slightly per class) to reach a target standard deviation on overall accuracy of 1.5%. A stratified random sample of units by land cover class were created and interpreted by two different analysts, with a third analyst finalizing agreed/disagreed observations. The units were interpreted using Planet Norwegian International Climate and Forest Initiative (NICFI) data and Sentinel-2 10-m RGB images with very high-resolution drone data available in some regions. Analysts were also instructed to include time-series information to collect more robust reference data.

During the model training, slightly lower accuracies were obtained when classifying water, largely due to the narrowness of the water channels, which are difficult to detect at the output resolution. Similarly, lower accuracies were observed between bare and plantation areas, which may occur due to the presence of bare tracks within plantations, leading to potential confusion. The closed canopy mix was mostly confused with open canopy mix and dense forest, as expected being the middle of the canopy cover continuum. Figure 3 shows the normalized confusion matrix over the training sa

mple set.

**Figure 3. Validation normalized confusion matrix with user's accuracy as the diagonal cells.**

#### 3.2.2.1.1.5 Accuracy Assessment Results

Table 50 shows that the classification model performed well outside the training samples and was able to predict the target classes accurately.

The overall accuracy for the land cover map was 90.5 ± 3.1%. The user's accuracy, a measure of how likely a pixel of a particular class in the map is the actual class, ranged from 71% for bare ground, to 96% for open canopy mix. Producer's accuracy, a measure of how well the reference data are classified, was close to 90% for all classes except bare ground (62%) and water (70%). Another class worth noting is water, where most features were considerably smaller than the minimum mapping unit (25 m). This also means that many canals were difficult to detect, since they contributed little to the pixel values compared to the surrounding areas.

**Table 40. Summary of classification accuracy in the error matrix.**

| Land cover class | User's accuracy | Producer's accuracy |
|---|---|---|
| Open Canopy Tree/Shrub/Herb Mix | 96 | 97 |
| Closed Canopy Tree/Shrub/Herb Mix | 84 | 87 |
| Secondary Forest | 86 | 87 |
| Water Bodies | 84 | 70 |
| Plantation Forest | 92 | 92 |
| Bare Ground | 71 | 62 |

The known canals and rivers that did not appear in the image due to the image resolution were added to the final map by overlaying a GIS canal/river network layer with a buffer distance derived from field and remote sensing observations (updated in 2023). A comparison analysis was performed against the previous monitoring period land cover classification and some polygons were further reclassified as Open/Closed Canopy Transition Mix to capture the seasonality of leaf on/leaf off, water level dynamics, and vegetation growth in the open and closed canopy vegetation classes. The resulting final land cover classes are shown below (Table 51 and Map 11).

**Table 41. Land cover classes during the current monitoring period.**

| Class | Area (Ha) | Area (%) |
|---|---|---|
| Open canopy tree/shrub/herb mix | 15,575 | 67.95 |
| Closed canopy tree/shrub/herb mix | 5,964 | 26.02 |
| Open/closed canopy transition mix | 904 | 3.94 |
| Secondary forest | 335 | 1.46 |
| Non-vegetation land cover | 138 | > 1 |
| Plantation forest | 7 | > 1 |
| Total | 22,922 | 100 |

**Map 11. Land Cover Classification.**

### 3.2.2.2 HOTSPOT AND FIRE OCCURRENCE SCREENING

The project continued to monitor fire occurrences by using both remote sensing data and forest patrols to monitor for fire risk on the ground. MODIS Collection 6 (MCD14DL) at 1-km resolution (hotspots with confidence ≥ 80%) and VIIRS at 375-m resolution (hotspots with confidence = High) (VNP14IMGTDL_NRT, available starting in 2012), a joint NASA/NOAA Suomi National Polar-orbiting Partnership data (Suomi NPP; available starting in 2020) and NOAA-20 satellites at 375 m resolution (VJ114IMGTDL_NRT) were used to determine the presence of potential fires.[23] No hotspots were detected in this monitoring period for all confidence levels in any fire hotspot datasets (Table 52 and Table 54).

**Table 42. MODIS hotspots (high confidence, i.e., ≥ 80%) with records detection in the project area showing no detected hotspots.**

| Year/month of MODIS hotspots detected | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2023 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Table 43. VIIRS hotspots (high confidence, i.e., ≥ 80%) with records detection in the project area showing no detected hotspots.**

| Year/month of VIIRS hotspots detected | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2023 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total | - | - | - | - | - | - | - | - | - | - | - | - | - |

### 3.2.2.3 PROJECT EMISSIONS FROM ARR ACTIVITIES

#### 3.2.2.3.1 EMISSION CHARACTERISTICS STRATIFICATION FOR ARR ACTIVITIES IN THE PROJECT SCENARIO

Although project activities include active reforestation (nursery development and replanting, see PD Section 2.1.11), technical analysis only accounted for natural regeneration of vegetation when delineating ARR emissions characteristics. The eligible area for ARR crediting is all the non-forest areas where the project would carry out activities to facilitate natural regeneration, including rewetting, fire avoidance, etc. Based on spatial analysis, the total area eligible for crediting from ARR activities is 20,601 ha, as shown in PD Section 3.1.3.1.7.

#### 3.2.2.3.2 EMISSION CALCULATIONS

All ex-ante GHG emissions and removals followed Module M-ARR in the AR-ACM0003 procedures for afforestation and reforestation lands. In AR-ACM0003, Net GHG removals under the ARR project scenario up to time *t**; t $CO_2$-e ($\Delta C_{WPS\text{-}ARR}$) equal the summation from *t* = 1 to *t** of the baseline net GHG removals by sinks in year *t* ($\Delta C$). It was assumed that non-$CO_2$ 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 project scenario WRC activities in ARR area ($GHG_{WPS\text{-}WRC}$) are presented separately in Section 3.2.2.4. Net GHG removals in the ARR project scenario are calculated using the equation below.

$$\Delta C_{\text{WPS-ARR}} = \sum_{t=1}^{t^*} \Delta C_{\text{ACTUAL,i,ACM0003}} = \sum_{t=1}^{t^*} \Delta C_{\text{TREE,PROJ,t}} \quad (17)$$

Where:

| | |
|---|---|
| $\Delta C_{\text{WPS-ARR}}$ | Net GHG removals under the ARR project scenario up to year *t** $(\text{t CO}_2\text{e})$ |
| $\Delta C_{\text{ACTUAL,i,ACM0003}}$ | Actual net GHG removals by sinks, in year *t* (from AR-ACM0003) $(\text{t CO}_2\text{e})$ |
| $\Delta C_{\text{TREE,PROJ,t}}$ | Change in carbon stock in tree biomass in project, in year *t* $(\text{t CO}_2\text{e})$ |
| $i$ | 1, 2, 3 …*M* strata |
| $t$ | 1, 2, 3, … *t** times elapsed since project start $(years)$ |

The calculations of the actual (ex-post) Net GHG removals in the project scenario are detailed in Annex 9, where the $\Delta C_{ACTUAL,t\ ACM0003}$ was calculated using a combined remote sensing/ field inventory approach following in principle the VCS tool VT0005 to estimate the AGB in 2023.

#### 3.2.2.3.2.1 GHG removals

The change in carbon stocks, i.e. GHG removals from natural regeneration of the vegetation, in the ARR areas in 2022 were 42,847 t $CO_2$-e and in 2023 47,227 t $CO_2$-e. Table 53 shows the project scenario net GHG removals accounted for in current monitoring period.

**Table 44. Project scenario net GHG removals by ARR activity accounted for in this monitoring period.**

| Year | Change in carbon stocks in the ARR area (t $CO_2$-e) |
|---|---|
| 2022 | 42,847 |
| 2023 | 47,227 |

### 3.2.2.4 PROJECT EMISSIONS FROM WRC ACTIVITIES

#### 3.2.2.4.1 EMISSION CHARACTERISTICS STRATIFICATION FOR WRC ACTIVITIES UNDER THE PROJECT SCENARIO

For the project scenario, the project area was stratified 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. Table 55 and Map 12 below show the stratification of the project area based on the types and origins of source emissions. 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 current 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. 300-m and 150-m buffers were created around both sides of the secondary and tertiary canals, respectively, to account for peatland drained during this monitoring period. The distinction between drained and undrained areas was considered when calculating project emissions.
3. Delineation of forested area:
    a. Delineation of dense forest during this monitoring period was based on the land cover classification summarized in Section 3.2.2.1.1 and detailed in Annex 8.

**Table 45. Stratification of project area based on the emission characteristics of peat and water bodies.**

| Strata | Type | Description | Area (ha) | Percentage of project area (%) |
|---|---|---|---|---|
| PS-UPSF | Undrained Dense Forest | Intact dense peatland forest on undrained peatland | 305 | 1 |
| PS-UDP | Undrained Deforested Peatland | Open canopy tree/shrub/herb mix, closed canopy tree/shrub/herb mix, plantation forest, and bare ground on drained peatland | 14,930 | 65 |
| PS-DPSF | Drained Dense Forest | Intact dense peatland forest on drained peatland | 20 | - |
| PS-DDP | Drained Deforested Peatland | Open canopy tree/shrub/herb mix, closed canopy tree/shrub/herb mix, plantation forest, and bare ground on drained peatland | 7,562 | 33 |
| PS-WB | Water Bodies | Rivers and secondary or tertiary canals that existed before project start date | 105 | - |
| Total | | | 22,922 | 100 |

**Map 12. Stratification based on emission characteristics for WRC in the current monitoring period.**

Site-specific hydrological monitoring data was regularly collected to predict spatially explicit estimates of water table level for each monitoring period. Direct measurements from the field will continue to serve as a proxy to calculate GHG emissions. The hydrological monitoring plan is detailed in Annex 4. 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 areas, if any changes occur.

#### 3.2.2.4.2 EMISSIONS FROM PEAT AND WATER BODIES

The land cover classification (detailed in Annex 13) served as a basis for developing strata for WRC activities (see Table 55).

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.

GHG emissions from microbial decomposition of peat and DOC loss through water bodies in peatlands were then quantified.

#### 3.2.2.4.3 EMISSION CALCULATIONS

The net $CO_2$-equivalent emissions from the peat microbial decomposition and water bodies for each parcel was spatially explicit estimated as detailed in Table 55. Using the procedures provided in Module BL-PEAT and Module M-PEAT, the following equation was established.

$$\mathrm{GHG}_{\mathrm{WPS\text{-}WRC}} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(\mathrm{E}_{\mathrm{peatsoil\text{-}WPS,i,t}} + \mathrm{E}_{\mathrm{peatditch\text{-}WPS,i,t}} + \mathrm{E}_{\mathrm{peatburn\text{-}WPS,i,t}}\right) \quad (18)$$

Where:

| | |
|---|---|
| $\mathrm{GHG}_{\mathrm{WPS\text{-}WRC}}$ | Net $CO_2$ equivalent peat GHG emissions in the project scenario up to year $t^*$ $(\mathrm{t\ CO_2\text{-}e})$ |
| $\mathrm{E}_{\mathrm{peatsoil\text{-}WPS,i,t}}$ | GHG emissions from microbial decomposition of the the peat soil within the project boundary in the project scenario in stratum $i$ at year $t$ $(\mathrm{t\ CO_2\text{-}e\ yr^{-1}})$ |
| $\mathrm{E}_{\mathrm{peatditch\text{-}WPS,i,t}}$ | GHG emissions from canals and other open water within the project boundary in the project scenario in stratum $i$ at year $t$ $(\mathrm{t\ CO_2\text{-}e\ yr^{-1}})$ |
| $\mathrm{E}_{\mathrm{peatburn\text{-}WPS,i,t}}$ | GHG emissions from burning of the peat within the project boundary in the project scenario in stratum $i$ at year $t$ $(\mathrm{t\ CO_2\text{-}e\ yr^{-1}})$ |
| $i$ | 1, 2, 3 …$M_{WPS}$ strata in the project scenario $(\mathrm{unitless})$ |
| $t$ | 1, 2, 3, … $t^*$ times elapsed since project start $(\mathrm{years})$ |

Procedures for quantifying the dynamics of carbon stock and peat losses are similar to those applied in the baseline scenario (see Section 3.2.1.6.1). The only differences were in the stratification.

GHG emissions from peat soils and water bodies are elaborated in detail in Section 3.2.2.4.3.1 and Section 3.2.2.4.3.2. 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 56.

**Table 46. A summary of the annual GHG emissions from peat microbial decomposition, peat burning, and water bodies under the project scenario in the current monitoring period.**

| Year | $CO_2$ emissions from peat microbial decomposition | $CH_4$ emissions from peat microbial decomposition | $CO_2$ and $CH_4$ emissions from uncontrolled burning | $CO_2$ emissions from DOC | Total emissions |
|---|---|---|---|---|---|
| | t $CO_2$-e $ha^{-1}$ $yr^{-1}$ | | | | |
| 2022 | 3,589 | 2,525 | - | 323 | 6,437 |
| 2023 | 20,747 | 4,694 | - | 323 | 25,764 |

#### 3.2.2.4.3.1 Emissions from Microbial Decomposition of Peat

The project's GHG emissions for different emission strata were calculated using the conservative and scientifically robust (TIER 1) IPCC default emission factors for each stratum *i* (Annex 7 on Emission Factors), following the equations defined by the VCS methodology VM0007 Module M-PEAT.

$$E_{peatsoil\text{-}WPS,i,t} = E_{CO2\text{-}WPS,i,t} + E_{CH4\text{-}WPS,i,t} \quad (19)$$

Where:

| | |
|---|---|
| $E_{peatsoil\text{-}WPS,i,t}$ | GHG emissions from microbial decomposition of the the peat soil within the project boundary in the project scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $E_{CO2\text{-}WPS,i,t}$ | $CO_2$ emissions from the peat soil within the project boundary in the project scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $E_{CH4\text{-}WPS,i,t}$ | $CH_4$ emissions from the peat soil within the project boundary in the project scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $i$ | 1, 2, 3 …$M_{WPS}$ strata in the project scenario $(unitless)$ |
| $t$ | 1, 2, 3, … *t** times elapsed since project start $(years)$ |

For each stratum, the $CO_2$ emissions from microbial decomposition of the peat within the project boundary are calculated by using the following equation.

$$E_{peatsoil\text{-}WPS,CO2,i,t} = A_{i,t} \times EF_{CO2,i,t} \quad (20)$$

Where:

| | |
|---|---|
| $E_{peatsoil\text{-}WPS,CO2,i,t}$ | $CO_2$ emissions from the peat soil within the project boundary in the project scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $A_{i,t}$ | Area of stratum *i* at time *t* $(ha)$ |
| $EF_{CO2,i,t}$ | Emission factor for $CO_2$ emissions corresponds to each stratum *i*, as provided by IPCC $(t\ CO_2\text{-}e\ ha^{-1}yr^{-1})$ |
| $i$ | 1, 2, 3 …$M_{WPS}$ strata in the project scenario $(unitless)$ |
| $t$ | 1, 2, 3, … *t** times elapsed since project start $(years)$ |

For each stratum, the $CH_4$ emission from the peat soil within the project boundary are calculated by using the following equation.

$$E_{peatsoil\text{-}WPS,CH4,i,t} = A_{i,t} \times GWP_{CH4} \times EF_{CH4,i,t} \quad (21)$$

Where:

| | |
|---|---|
| $E_{peatsoil\text{-}WPS,CH4,i,t}$ | $CH_4$ emissions from the peat soil within the project boundary in the project scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $A_{i,t}$ | Area of stratum *i* at time *t* $(ha)$ |
| $GWP_{CH4}$ | Global Warming Potential for $CH_4$ |
| $EF_{CH4,i,t}$ | Emission factor for $CH_4$ emissions corresponds to each stratum *i*, as provided by IPCC $(t\ CO_2\text{-}e\ ha^{-1} yr^{-1})$ |
| $i$ | 1, 2, 3 …$M_{WPS}$ strata in the project scenario $(unitless)$ |
| $t$ | 1, 2, 3, … *t** times elapsed since project start $(years)$ |

Table 62 below provides details on the WRC related project emission factors and stratification.

**Table 47. 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 in the project scenario.**

| Strata | Description | Area (ha) | IPCC default factor for $CO_2$ | IPCC default factor for $CH_4$ | IPCC default factor for ΔDOC |
|---|---|---|---|---|---|
| | | | t $CO_2$-e $ha^{-1}$ $yr^{-1}$ | | |
| PS-UPSF | Intact dense forest on undrained peatland | 305 | 0 | 1.02 | |
| PS-DPSF | Intact dense forest on drained peatland | 20 | 19.43 | 0.12 | |
| PS-DDP | Mostly open canopy tree/shrub/herb mix and closed canopy tree/shrub/herb mix on drained peatland | 14,930 | 19.43 | 0.12 | |
| PS-UDP | Mostly open canopy tree/shrub/herb mix and closed canopy tree/shrub/herb mix on undrained peatland | 7,562 | 5.5 | 0.66 | |
| PS-WB | River and secondary or tertiary canals that existed before project start date. | 105 | | | 2.09 |

#### 3.2.2.4.3.1.1 Current projections for project emissions at the start of the project

With sufficient long-term, field measurements of peat-related emissions available for estimating the overall emissions in the current monitoring period, a combination of GHG emission factors provided in Annex 11 and efficacy factors derived from the hydrological models were used as a conservative approach. Detailed explanations on the hydrological models and their results can be found in Annex 15. The effect of rewetting was considered by multiplying the emission factor for each stratum by an efficacy factor. The efficacy was derived from the annual water table changes predicted by the hydrological models that compared the pre-project WTL by stratum with the WTL in undrained peat forests (for details see Annex 16). Projected annual GHG emissions from microbial decomposition of peat are shown in Table 60.

**Table 48. GHG emissions from microbial decomposition of peat in the project scenario in the monitoring period.**

| Year | $CO_2$ from peat microbial decomposition | | $CH_4$ from peat microbial decomposition | | Total |
|---|---|---|---|---|---|
| | t $CO_2$-e $ha^{-1}$ $yr^{-1}$ | | | | |
| | **CUPP** | **RDP** | **CUPP** | **RDP** | **All strata** |
| 2022 | 2,657 | 932 | 2,086 | 439 | 6,114 |
| 2023 | 1,545 | 19,202 | 2,785 | 1,909 | 25,441 |

### 3.2.2.4.3.1.2 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).[17] Throughout project implementation, the project will take 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.

Project staff will develop site-specific TIER 3 emission factors and apply these to estimate project emissions. These methods work together to thoroughly reduce uncertainty (see Annex 17).[17]

Project staff began initial, preliminary water table level monitoring in the project area in 2018 and expanded the 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 six water table level strata in 2019 following canal blocking implementation (see Annex 4). Monitoring of all variables will be continued throughout 47-year project duration.

### 3.2.2.4.3.2 Emissions from Water Bodies in Peatlands

#### 3.2.2.4.3.2.1 Current projections for project emissions at the start of the project

The water bodies present in the project scenario are rivers and pre-existing drainage canals. The project emissions form DOC are shown in Table 65. 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 below.

$$\mathrm{E}_{\mathrm{peatditch\text{-}WPS,i,t}} = A_{\mathrm{ditch\text{-}WPS,i,t}} \times \mathrm{EF}_{\mathrm{DOC\text{-}WPS,i}} \quad (22)$$

Where:

| | |
|---|---|
| $E_{peatditch\text{-}WPS,i,t}$ | GHG emissions from canals and other open water within the project boundary in the project scenario in stratum *i* at year *t* $(t\ CO_2\text{-}e\ yr^{-1})$ |
| $A_{ditch\text{-}WPS,i,t}$ | Total area of canals and other open water in stratum *i* in year *t* in the project scenario $(ha)$ |
| $EF_{DOC\text{-}WPS,i}$ | IPCC emission factor for Dissolved Organic Carbon from canal and open water in the project scenario in stratum *i* $(t\ CO_2\text{-}e\ ha^{-1}yr^{-1})$ |
| $i$ | 1, 2, 3 …$M_{WPS}$ strata in the project scenario $(unitless)$ |
| $t$ | 1, 2, 3, … *t** times elapsed since project start $(years)$ |

**Table 49. GHG emissions from Dissolved Organic Carbon in water bodies in the project scenario in the current monitoring period.**

| Year | $CO_2$-e from DOC (t $CO_2$-e $yr^{-1}$) |
|---|---|
| 2022 | 323 |
| 2023 | 323 |

#### 3.2.2.4.3.2.2 Future approaches for calculating project emissions

Values for DOC will be taken from Wetlands Supplement of the IPCC (2013).[17] The values will be used to calculate emissions from water bodies by re-assessing the annual area changes, i.e., channel widths and lengths derived from visual assessment with medium-high resolution remote sensing images.

### 3.2.2.4.3.3 Emissions from Uncontrolled Burning

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

The project has operated consistent fire patrols since the start of the SMPP and has an online satellite-based early warning system (EWS) in place to detect possible fires as quickly as possible. If uncontrolled burning occurs in the SMPP during the project period, staff will map the area of the fire scar and the burn scar depth soon after the burning event. In addition, the project has compiled historical tracking of hotspots and direct observation data in the project area to determine the potential for repeated burning in the SMPP. In the event of a burn event, project staff will quantify equivalent GHG emissions from uncontrolled burning and deduct these from project emission reductions.

In addition, project staff 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. GHG emissions from biomass loss from burning are determined 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 18).

In cases of repeated burning 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 used to quantify GHG emissions from uncontrolled burning are given in Annex 11.

To quantify GHG emissions from uncontrolled peat burnings, project staff followed procedures in the VCS methodology VM0007 Module E-BPB using the following equation.

$$E_{peatburn\text{-}WPS,i,t} = \sum_{g=1}^{G} \left( A_{peatburn\text{-}WPS,i,t} \times P_{WPS,i,t} \times G_{g,i} \right) \times 10^{-3} \times GWP_{g} \quad (23)$$

Where:

| | |
|---|---|
| $E_{peatburn\text{-}WPS,i,t}$ | Greenhouse gas emissions due to peat burning in the project scenario in stratum *i* in year *t* of each GHG ($CO_2$, $CH_4$) $(t\ CO_2\text{-}e)$ |
| $A_{peatburn\text{-}WPS,i,t}$ | Area peat burnt under project scenario for stratum *i* in year *t* $(ha)$ |
| $P_{WPS,i,t}$ | Average mass of peat burnt (DM) under project scenario in stratum *i*, year *t* $(t\ DM\ ha^{-1})$ |
| $G_{g,i}$ | Emission factor for stratum *i* for gas *g* $(kg\ t^{-1} DM\ burnt)$ |
| $GWP_{g}$ | Global warming potential for gas *g* $(t\ CO_2/t\ gas\ g)$ |
| $g$ | 1, 2, 3, … *G* greenhouse gases including carbon dioxide, methane, and nitrous oxide |
| $i$ | 1, 2, 3, … *M* strata |
| $t$ | 1, 2, 3 … *t** years elapsed since the start of the project activity $(years)$ |

Project staff estimated the average mass of peat burnt for a particular stratum using the equation below.

$$P_{WPS,i,t} = D_{peatburn\text{-}WPS,i,t} \times BD_{upper,i} \times 10^{4} \quad (24)$$

Where:

| | |
|---|---|
| $P_{WPS,i,t}$ | Average mass of peat burnt (DM) under project scenario in stratum *i*, year *t* $(t\ DM\ ha^{-1})$ |
| $D_{peatburn\text{-}WPS,i,t}$ | Average burn scar depth under project 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** years elapsed since the start of the project activity $(years)$ |

#### 3.2.2.4.3.3.1 Current projections for project emissions at the start of the project

No hotspots were detected in this monitoring period from all fire hotspot datasets, thus no emissions from uncontrolled peat burning had to be considered (see Section 3.2.2.2).

#### 3.2.2.4.3.3.2 Future approaches for calculating project emissions

The project will continue using fire patrols, smoke detection cameras, and the EWS in the future.

### 3.2.3 Leakage Emissions (VCS, 2.5, 3.2, 3.6, 3.15, 4.3)

Project staff 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. 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, potential sources of leakage emissions from displacement of planned deforestation activities and pre-project activities on non-forest land are possible. These potential sources and the corresponding applicable modules for quantifying total leakage emissions are listed in PD Section 3.1.2 and Table 61 below.

**Table 50. Applicability of leakage modules.**

| Scenario | GHG source |
|---|---|
| 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 VCS methodology and steps defined in the PD, “areas deforested by the baseline class of agents through the years in which planned deforestation was forecasted to occur”, ($A_{defLK,i,t}$) was monitored and compared to the baseline leakage scenario (Step 3 of the PD Section 3.2.3.1).

In the PD Section 3.2.3.1, based on a historical trend of licensed HTI concessions in Indonesia between 2006-2015, we estimated an additional 489,073 ha of land per year would be licensed for HTI concessions. However, the published data from the MoEF[24–32] showed that since the project start date in 2016 the annual issued area for HTI concessions ranged between a maximum of 335,626 ha licensed between 2016 and 2017 and a minimum of -99,165 ha between 2019 and 2020.

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 data were lower than the baseline estimates shown in the PD (Table 58 below).

**Table 51. Comparison between the estimated and the actual parameters between 2016 and the current monitoring period.**

| Year | Area licensed (ha) | $WoPR_{i,t}$ | $NewR_{i,t}$ |
|---|---|---|---|
| Estimated parameters set as the baseline in PD | | | |
| 2016 | 11,560,797 | 816,770 | 815,151 |
| 2017 | 12,049,870 | 851,323 | 849,704 |
| 2018 | 12,538,944 | 885,876 | 884,257 |
| 2019 | 13,028,017 | 920,429 | 918,810 |
| 2020 | 13,517,091 | 954,982 | 953,363 |
| 2021 | 14,006,164 | 989,536 | 987,916 |
| 2022 | 14,495,238 | 1,024,089 | 1,022,469 |
| 2023 | 14,984,311 | 1,058,642 | 1,057,022 |
| Actual parameters based on government statistics of licensed areas | | | |
| 2016 | 10,842,975 | 766,056 | 764,437 |
| 2017 | 11,178,601 | 789,768 | 788,149 |
| 2018 | 11,180,438 | 789,898 | 788,279 |
| 2019 | 11,306,191 | 798,782 | 797,163 |
| 2020 | 11,207,026 | 791,776 | 790,157 |
| 2021 | 11,223,821 | 792,963 | 791,344 |
| 2022 | 11,258,939 | 795,444 | 793,825 |
| 2023 | 11,263,692 | 795,780 | 794,161 |

The above non-spatial comparison suggested that the actual deforestation caused by the baseline class of agents in this monitoring period would be lower than the PD estimate. 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 multiple datasets updated up to 2023, including the MoEF HTI boundary dataset updated in December 2023.[31] The datasets contained 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, it was 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.

The annual area deforested throughout all HTI-wood fiber and HTI concessions during the monitoring period was quantified by using remote sensing data. Official land use land cover data from the MoEF is not yet made available for year 2023. Therefore, we used the most recent and commonly recognized annual global datasets from the Global Forest Change derived by the

University of Maryland (available for year 2023).[32,33] This dataset is a proxy as it quantifies tree cover loss and does not differentiate 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. For the global dataset, we then extracted all the HTI-wood fiber and HTI concession boundaries to quantify the annual deforested area (i.e., tree cover or natural forest cover loss detected from this dataset) throughout the monitoring period.

We determined areas of deforestation and leakage using the equation below, as per module LK-ASP. The actual area of deforestation in peatland and non-peatland areas in HTI-wood fiber and HTI concessions was based on spatial analysis using the 2008 national peatland distribution data. 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 below to calculate the differences between monitored deforestation that occurred in HTIs and the projected new area of deforestation ($NewR_{,i,t}$). The results are summarized in Table 59.

$$\mathrm{LKA_{planned,i,t}} = \mathrm{A_{defLK,i,t}} - \mathrm{NewR_{i,t}} \quad (25)$$

Where:

| | |
|---|---|
| $\mathrm{LKA_{planned,i,t}}$ | The area of activity shifting leakage in stratum *i* in year *t* $(\mathrm{ha})$ |
| $\mathrm{A_{defLK,i,t}}$ | The total area of monitored deforestation by the baseline agent of the planned deforestation in stratum *i* in year *t* $(\mathrm{ha})$ |
| $\mathrm{NewR_{i,t}}$ | New calculated forest clearance by the basseline agent of the planned deforestation in stratum *i* in year *t* where no leakage in occuring $(\mathrm{ha})$ |
| $i$ | 1, 2, 3 …*M* strata $(\mathrm{unitless})$ |
| $t$ | 1, 2, 3, … *t** times elapsed since the start of the project activity $(\mathrm{yr})$ |

**Table 52. Deforested areas and leakage calculations in HTI and HTI-wood fiber concessions based on the global tree cover loss dataset.**

| Year | HTI concessions (ha) | | HTI-wood fiber concessions (ha) | | PD estimated *NewR*$_{i,t}$ (ha) | | LKA$_{planned}$ | |
|---|---|---|---|---|---|---|---|---|
| | Peat | Non-peat | Peat | Non-peat | Peat | Non-peat | Peat | Non-peat |
| 2016 | 100,116 | 334,238 | 88,081 | 274,559 | 200,935 | 614,216 | (100,819) | (279,978) |
| 2017 | 30,018 | 196,753 | 27,667 | 169,665 | 209,452 | 640,252 | (179,434) | (443,499) |
| 2018 | 19,523 | 170,129 | 18,119 | 140,692 | 217,969 | 666,288 | (198,446) | (496,159) |
| 2019 | 24,440 | 158,461 | 21,420 | 133,275 | 226,487 | 692,323 | (202,047) | (533,862) |
| 2020 | 45,311 | 138,508 | 2,904 | 8,876 | 235,004 | 718,359 | (189,693) | (579,851) |
| 2021 | 49,561 | 151,498 | 9,871 | 30,173 | 243,521 | 744,395 | (193,960) | (592,897) |
| 2022 | 3,482 | 10,197 | 333 | 5,898 | 252,039 | 770,431 | (248,557) | (760,234) |
| 2023 | 14,219 | 52,844 | 2,088 | 28,094 | 260,556 | 796,466 | (246,337) | (743,622) |

Since this analysis confirmed there was no leakage throughout the monitoring period (shown as all values of *LKA*$_{planned,i,t}$ in Table 59 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) are to 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 implemented rewetting activities. The hydrological model results for 2022 and 2023 of the mean annual water table levels within and outside the project area within a 1 km buffer were not statistically different (paired t-test: df = 364, p = 1), and showed that the WRC project activities did not influence the water table levels in the surrounding area (Table 57). The 1 km buffer and associated monitoring network were designed to capture potential hydrological connectivity between the project area and adjacent landscapes. Therefore, the ecological leakage (LK-ECO) is zero.

**Table 53. Average annual water table level and standard error within the project area and in the 1 km buffer surrounding the project area in the current monitoring period.**

| Year | Mean annual water table level (cm) ± S.E. | | Paired t-test | |
|---|---|---|---|---|
| | Outside project area | Inside project area | df | p |
| 2022 | 8.18 ± 0.65 | 8.40 ± 0.68 | 364 | 1 |
| 2023 | (9.58) ± 0.77 | (9.80) ± 0.03 | 364 | 1 |

Project staff will continue to 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 15). Seasonal variability was accounted for through multi-year monitoring and model calibration across wet and dry periods.

## 3.2.4 GHG Emission Reductions and Carbon Dioxide Removals (VCS, 3.15, 4.1)

This section provides an overview of total net emission reductions and detailed activity-specific calculations in the subsections. Project staff calculated Net GHG emission reductions as the sum of total net GHG emission reductions from WRC and total net GHG removals from the ARR project activities (see equation below).

$$\mathrm{NER}_{\mathrm{REDD+}} = \mathrm{NGR}_{\mathrm{ARR}} + \mathrm{NER}_{\mathrm{WRC}} \quad (26)$$

Where:

| | |
|---|---|
| $\mathrm{NER}_{\mathrm{REDD+}}$ | Total net GHG emission reductions of he REDD+ project activity up to year *t** $(\mathrm{t\ CO_2e})$ |
| $\mathrm{NGR}_{\mathrm{ARR}}$ | Total net GHG removals of the ARR project activity up to year *t** $(\mathrm{t\ CO_2e})$ |
| $\mathrm{NER}_{\mathrm{WRC}}$ | Total net GHG emission reductions of the WRC project activity up to year *t** $(\mathrm{t\ CO_2e})$ |

#### 3.2.4.1 UNCERTAINTY ANALYSIS

Using Module X-UNC as a guideline, technical staff calculated WRC uncertainty of the SMPP in both the baseline and project scenarios. SMPP does not have a REDD component, so REDD uncertainty calculations were not necessary. Equation number 15 of the module X-UNC was modified to the equation below.

$$\mathrm{NER}_{\mathrm{RED+ERROR}} = \frac{\sqrt{\left(\mathrm{Uncertainty}_{\mathrm{WRC_{BSL}}\,t^*} \times \mathrm{GHG}_{\mathrm{BSL\text{-}WRC},t^*}\right)^2 + \left(\mathrm{Uncertainty}_{\mathrm{WRC_{WPS}}\,t^*} \times \mathrm{GHG}_{\mathrm{WPS\text{-}WRC},t^*}\right)^2}}{\mathrm{GHG}_{\mathrm{BSL\text{-}WRC},t^*} + \mathrm{GHG}_{\mathrm{WPS\text{-}WRC},t^*}} \quad (27)$$

Where:

| | |
|---|---|
| $\mathrm{NER}_{\mathrm{RED+ERROR}}$ | Cumulative uncertainty for the REDD+ (REDD and WRC) project activities up to year *t** $(\%)$ |
| $\mathrm{Uncertainty}_{\mathrm{WRC_{BSL}}t^*}$ | Cumulative uncertainty in the WRC baseline scenario up to year *t* $(\%)$ |
| $\mathrm{Uncertainty}_{\mathrm{WRC_{WPS}}t^*}$ | Cumulative uncertainty in the WRC project scenario up to year *t* $(\%)$ |
| $\mathrm{GHG}_{\mathrm{BSL\text{-}WRC},t^*}$ | Net GHG emissions in the WRC baseline scenario up to year *t* $(\mathrm{t\ CO_2e})$ |
| $\mathrm{GHG}_{\mathrm{WPS\text{-}WRC},t^*}$ | Net GHG emissions in the WRC project scenario up to year *t* $(\mathrm{t\ CO_2e})$ |
| $t$ | 1, 2, 3, … *t** time elapsed since the project start $(\mathrm{year})$ |

Project staff calculated $CO_2$ and $CH_4$ emission uncertainties from microbial decomposition of peat and 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 11).[17] Project staff established that $CH_4$ emission uncertainty was zero, as it was conservatively excluded from emission calculations. We also established that uncertainty from GHG emissions from peat burning was also zero in the project scenario and assumed fully effective fire prevention in the project area. Project staff calculated uncertainty from GHG emissions from peat burning in the baseline using the dry mass burnt per stratum per year and standard deviations converted to 95% confidence intervals. Emissions data from $CO_2$ and $CH_4$ burning was combined to produce an overall uncertainty in $CO_2$ equivalent, because Module X-UNC does not distinguish between these emissions.

We calculated the uncertainty for WRC baseline and project scenario in 2022 as 9.17% and 0.95%, and in 2023 as 8.28% and 0.92%, respectively. This resulted in a total error of 8.00% and 7.36% for

the monitoring years 2022 and 2023, respectively. The allowable uncertainty is +/- 15% of $NER_{REDD+ERROR}$ at the 95% confidence level (X-UNC, v2.1), thus for this monitoring period no deduction of VCUs was necessary. Further details on all calculations are provided in Annex 17.

#### 3.2.4.2 TOTAL NET GHG REMOVALS FROM ARR PROJECT ACTIVITY

Project staff calculated net GHG removals related to ARR project activities by subtracting baseline removals and emissions due to leakage from the project removals (Table 64).

**Table 54. Total net GHG emission reductions for ARR project activities accounted for in the monitoring period.**

| Year | Estimated Baseline Removals | Estimated Project Removals | Estimated Leakage Emissions | Estimated NET GHG Emissions Reduction |
|---|---|---|---|---|
| | t $CO_2$-e | | | |
| 2022 | 95,190 | 42,847 | - | (52,343) |
| 2023 | 121,347 | 47,227 | - | (74,120) |

#### 3.2.4.3 TOTAL NET GHG EMISSION REDUCTIONS OF THE WRC PROJECT ACTIVITY

Project staff calculated net GHG emission reductions related to WRC project activities by subtracting project emissions and emissions due to leakage from baseline emissions (Table 63).

**Table 55. Total net GHG emission reductions for WRC project activities accounted for in the monitoring period.**

| Year | Estimated Baseline Emissions | Estimated Project Emissions | Estimated Leakage Emissions | Estimated NET GHG Emissions Reduction |
|---|---|---|---|---|
| | t $CO_2$-e | | | |
| 2022 | 1,279,357 | 6,437 | - | 1,272,920 |
| 2023 | 1,384,263 | 25,764 | - | 1,358,500 |

#### 3.2.4.4 TOTAL NET GHG REMOVALS FROM WRC AND ARR PROJECT ACTIVITIES

Project staff calculated net GHG removals related to WRC and ARR project activities by subtracting baseline removals and emissions due to leakage from the project removals (Table 74).

**Table 56. Total net GHG emission reductions for ARR and WRC project activities accounted for in the monitoring period.**

| Year | Estimated Baseline Emissions | Estimated Project Emissions | Estimated Leakage Emissions | Estimated NET GHG Emissions Reduction |
|---|---|---|---|---|
| | t $CO_2$-e | | | |
| 2022 | 1,184,167 | (36,410) | - | 1,220,577 |
| 2023 | 1,262,916 | (21,463) | - | 1,284,379 |

#### 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 18% (Table 72). 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 (Table 66).

Direct $N_2O$ emissions and emissions from biomass burning were omitted from calculations because the project does not account for emissions from fossil fuel combustion.

**Table 57. Non-permanence risk rating expected total GHG benefits to date, and amount of t CO2-e lost from loss events and reversals.**

| | |
|---|---|
| State the non-permanence risk rating (%) | 18 |
| Has the non-permanence risk report been attached as either an appendix or a separate document? | Yes |
| For ARR and IFM projects with harvesting, state, in $tCO_2e$, the Long-term Average (LTA). | N/A (The project does not include ARR and/or IFM activities with harvesting) |
| Has the LTA been updated based on monitored data, if applicable? | N/A |
| State, in $tCO_2e$, the expected total GHG benefit to date. | 7,619,318 |
| If a loss occurred (including a loss event or reversal), state the amount of $tCO_2e$ lost: | - |

**Table 58. 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 (18%) |
|---|---|---|---|
| 2022 | 1,272,920 | (52,343) | 219,703 |
| 2023 | 1,358,500 | (74,120) | 231,188 |

### 3.2.4.6 CALCULATION OF VERIFIED CARBON UNITS

Project staff calculated VCUs by subtracting the VCS non-permanence risk buffer from the uncertainty adjusted net emission reductions for each project activity (Table 73 and Table 67).

**Table 59. Calculation of estimated verified carbon units.**

| Year | $NER_{WRC}$ | $NGR_{ARR}$ | Adjusted_$NER_{WRC}$ + $NGR_{ARR}$ | Non-permanence risk buffer | Estimated VCUs |
|---|---|---|---|---|---|
| 2022 | 1,272,920 | (52,343) | 1,220,577 | 219,703 | 1,000,874 |
| 2023 | 1,358,500 | (74,120) | 1,284,379 | 231,188 | 1,053,191 |

**Table 60. Baseline, Project emissions, and Leakage emissions, Buffer pool allocation, Reductions VCUs, and Removals VCUs for the current vintage period.**

| Vintage period | Baseline emissions | Project emissions | Leakage emissions | Buffer pool allocation | Reductions VCUs | Removals VCUs |
|---|---|---|---|---|---|---|
| | $tCO_2$-e | | | | | |
| 01-Jan-2016 to 31-Dec-2016 | 749,432 | 239,018 | - | 62,924 | *N/A* | *N/A* |
| 01-Jan-2017 to 31-Dec-2017 | 882,404 | 239,018 | - | 73,354 | *N/A* | *N/A* |

| Vintage period | Baseline emissions | Project emissions | Leakage emissions | Buffer pool allocation | Reductions VCUs | Removals VCUs |
|---|---|---|---|---|---|---|
| | $tCO_2$-e | | | | | |
| 01-Jan-2018 to 31-Dec-2018 | 987,816 | 239,018 | - | 80,146 | *N/A* | *N/A* |
| 01-Jan-2019 to 31-Dec-2019 | 806,420 | 240,337 | - | 79,251 | *N/A* | *N/A* |
| 01-Jan-2020 to 31-Dec-2020 | 1,060,503 | 34,532 | - | 143,635 | *N/A* | *N/A* |
| 01-Jan-2021 to 31-Dec-2021 | 1,089,512 | (530,198) | - | 226,759 | *N/A* | *N/A* |
| 01-Jan-2022 to 31-Dec-2022 | 1,184,167 | (36,410) | - | 219,703 | *N/A* | *N/A* |
| 01-Jan-2023 to 31-Dec-2023 | 1,262,916 | (21,463) | - | 231,188 | *N/A* | *N/A* |
| Total | 8,023,170 | 403,852 | - | 1,066,861 | *N/A* | *N/A* |

Table 69 displays the difference between ex-ante and ex-post emission reduction estimates. The ex-post estimates are 13% higher than the ex-ante estimates due to two factors:

1. Ex-post ARR project removals were lower than anticipated in the PD due to the erroneous inclusion of vegetation growth across the entire ARR crediting area in ex-ante calculations. Ex-post calculations only consider planting blocks intended for conversion in the baseline, resulting in an overestimation of 833,005 t $CO_2$-e in the ex-ante estimates for the current monitoring period of 2022-2023.
2. Ex-post WRC project emissions were lower than anticipated because the project area underwent hydrological restoration earlier than expected in the PD, resulting in reduced emissions of 445,949 t CO2-e due to higher-than-modeled water table levels.

**Table 61. Ex-ante estimated reductions/removals, Achieved reductions/removals, Percent difference, Explanation for the difference for the current vintage period.**

| Vintage period | Ex-ante estimated reductions/ removals | Achieved reductions/ removals | Percent difference | Explanation for the difference |
|---|---|---|---|---|
| 01-Jan-2022 to 31-Dec-2022 | 1,407,250 | 1,220,577 | -13% | Lower-than-anticipated ARR project removals led to lower overall ex-post emission reductions. |
| 01-Jan-2023 to 31-Dec-2023 | 1,484,762 | 1,284,379 | -13% | Lower-than-anticipated ARR |

| Vintage period | Ex-ante estimated reductions/ removals | Achieved reductions/ removals | Percent difference | Explanation for the difference |
|---|---|---|---|---|
| | | | | project removals led to lower overall ex-post emission reductions. |
| Total | 2,892,013 | 2,504,956 | -13% | Lower-than-anticipated ARR project removals led to lower overall ex-post emission reductions. |

## 3.3 Optional Criterion: Climate Change Adaptation Benefits

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

The project area and project zone are vulnerable to the potential impacts of climate change, which will negatively impact the delivery of ecosystem services and functioning, livelihoods, and health. In the project zone, interventions aim to strengthen community (human) and environmental (non-human) resilience by implementing adaptation interventions through a variety of project activities (see details in PD Section 2.1.11). A summary of activities during the current monitoring period relevant to climate change adaptation and their respective benefits have been provided in Table 68.

The hydrological restoration activities within the SMPP directly reduce fire occurrence and improve water retention and watershed health. Consequently, this strengthens ecosystem services for the fisherman and farmers identified as community members who are vulnerable to the impacts of more variable weather and rainfall patterns associated with climate change. To address the human health risks of climate change, the project has invested in a community health center with new staff and supplies in response to conditions such as respiratory illness associated with wildfire haze. To build stronger long-term livelihoods capacity, the project is investing in the long-term education of community stakeholders to foster greater career mobility for those who may have their current livelihoods adversely impacted by climate change. The project also provides an alternative livelihood for those who are employed directly by the project, injecting stable income into the households of local staff, who are also able to access continuing education resources for career mobility.

**Table 62. Climate change adaptation benefits from project activities.**

| Project activity | Components | Project achievements during the monitoring period | Adaptation benefits |
|---|---|---|---|
| Forest Patrolling | Project boundary demarcation<br><br>Project boundary demarcation<br><br>Radio communication system for reporting, | Prevention of potential fire vectors and extraction of biodiversity features.<br><br>Elimination of illegal logging, poaching, exploitative fishing, and | The activity reduces fire risk, which is heightened by longer dry seasons and hot windy conditions, to surrounding ecosystems and speeds fire response time to mitigate fires before they |

| Project activity | Components | Project achievements during the monitoring period | Adaptation benefits |
|---|---|---|---|
| | Foot, bicycle, boat, and vehicle patrolling<br><br>Data collection and analysis on threats<br><br>Drone monitoring<br><br>Local law enforcement | conversion to small-scale agriculture inside the project area. | spread by having a dedicated patrol staff.<br><br>The activity provides mechanisms for prevention, monitoring, reporting and response to minimize risks and damage caused by climate change.<br><br>The risk minimization enhances resilience to potential climate change impacts. |
| Fire Prevention and Monitoring | Patrol activities<br><br>Early Warning System for potential fires<br><br>Fire response and suppression teams | Due to patrol activities, the Early Warning System, and cooperation agreements with neighboring concessions, no fire events took place during the monitoring period. | Fire prevention is critical to maintain and improve the health of the watershed, particularly for direct community members that source fresh water for agriculture and fishing from within the SMPP.<br><br>These community members would otherwise have their livelihoods adversely impacted by climate change. The activity provides mechanisms for prevention, monitoring, and rapid response to minimize fire risks and damage exacerbated by climate change.<br><br>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 | Additional 31 dams completed. | Fire prevention is critical to maintain and improve |

| Project activity | Components | Project achievements during the monitoring period | Adaptation benefits |
|---|---|---|---|
| | Canal blocking plan<br><br>Peat dam installation<br><br>Hydrology monitoring<br><br>Collaboration with adjacent concessions | Monitoring completed to 62% with 146 out of 234 completed dams (see Annex 4). | the health of the watershed, particularly for direct community members that source fresh water for agriculture and fishing from within the SMPP. These community members would otherwise have their livelihoods adversely impacted by climate change.<br><br>The activity provides mechanisms for prevention, monitoring, and rapid response to minimize fire risks and damage exacerbated by climate change.<br><br>The risk minimization enables healthy conditions to maintain biodiversity and ecosystem functioning, hence enhances resilience to potential climate change impacts. |
| Reforestation and Assisted Natural Regeneration (ANR) | Tree nurseries<br><br>ANR trial approachesAnnual ANR and replanting<br><br>Technical support to nearby Hutan Desa | Nursery planting and operation is ongoing.<br><br>ANR trials continued in 2022 and 2023 with 10,883 seedlings planted (see Annex 19). | The activity conserves genetic diversity that could be threatened by climate change, supports assisted gene flow especially for more resilient locally adapted species, and raises awareness in the communities.<br><br>Knowledge transfer also supports community forests.<br><br>The activity also promotes habitat regeneration for important species |

| Project activity | Components | Project achievements during the monitoring period | Adaptation benefits |
|---|---|---|---|
| | | | affected negatively by forest conversion, frequent wildfires, and loss of habitat connectivity. |
| Community Development | Education opportunities<br><br>Improved livelihoods and quality of life<br><br>Youth and local employment<br><br>Co-financing rainwater catchment system<br><br>Community health center supported | Supported students to attend *Universitas Terbuka* who will become future teachers.<br><br>Expansion of training activities including literacy training for librarians and parents, antigen sampling training for health workers, anti-stunting for health workers and cadres, as well as training for community members to construct household rainwater catchment systems.<br><br>Students are attending adult continuing education programs supported by the SMPP.<br><br>Fishermen and farmers are utilizing the area for their livelihoods. The SMPP directly employs local people including females.<br><br>Construction of household rainwater catchment systems in a new location.<br><br>Three community health centers supported with medicine supplies, equipment, and infrastructure improvement (see Section 4.3.1). | The activity diversifies communities' opportunities for livelihoods and employment, and thereby generating resilience to challenges brought by climate change.<br><br>The improved sanitation and water usage also enhance the well-being and community health.<br><br>Project hydrological interventions also improve water quality and quantity for the fisherman and farmers that rely on the project area for their livelihoods, reducing the risk of watershed degradation caused by climate change.<br><br>Project investments in the community health center promote greater community resilience to climate-related health crises, such as respiratory issues linked to wildfire smoke. The activity also strengthens the community response to the global pandemic which can be linked to human pressure on ecosystems and thus some of the core drivers of climate change. |

| Project activity | Components | Project achievements during the monitoring period | Adaptation benefits |
|---|---|---|---|
| Biodiversity Management and Monitoring | Detecting, identifying, and understanding the characteristics, distribution, sensitivity, and vulnerability of HCVs<br><br>Biodiversity feature monitoring design<br><br>Biodiversity monitoring implementation | Biodiversity scoping surveys were conducted covering flora and fauna, and the identification of areas providing ecosystem services.<br><br>The surveys helped to identify and understand the characteristics, distribution, sensitivity, and vulnerability of HCVs 1, 2, 3, 4, and 5.<br><br>Biodiversity monitoring plan in place.<br><br>Monitoring continued in 2022 and the results of the third and forth systematic monitoring (see Section 5.3). | The activity establishes a data-driven, traceable system to monitor changes in biodiversity features in response to climate change.<br><br>The system provides basis for predicting climate change impact on biodiversity and for developing conservation planning adjusted to address the impacts.<br><br>The system also monitors the occurrence of key prey for the Sumatran Tiger which has been documented at the site. Hunting grounds for the Sumatran Tiger are increasingly threatened by climate-caused wildfires and the project increases the availability of food for this trigger species. |
| Cross-cutting | Adaptive management<br><br>Effective administration and human resources<br><br>Financial management<br><br>Legal compliance | 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.<br><br>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 (CCB, CM2.1)

In the project area, 15 fishermen in 2022 and 12 fishermen in 2023 were defined as project community groups through a series of engagements and methodologies to identify project communities, community groups, and other stakeholders. In addition to the fishermen, there was one active farmer in the project area during this reporting period.

During this reporting period, the project continued to conduct several activities that impacted the fishermen group and the farmer. The project implemented forest patrol and fire prevention activities, performed hydrological monitoring to observe restored peatland hydrology, and maintained access to fishing grounds for fishermen. In addition, fishermen benefitted from the sale of fish, catching an average of 160kg per week and earning 3,400,000 IDR per fisherman. Similarly, the farmer, benefitted from access to farm areas and fire reduction through forest patrol.

**Table 63. Impacts for specific community groups in the project during the monitoring period.**

| Community group | Fishermen (Kepayang, Muara Merang) |
|---|---|
| Impact(s) | 1. Reduced fires<br>2. Protection of and access to fishing grounds<br>3. Maintained and restored peatland hydrology in the project area<br>4. Human-wildlife conflict |
| Type of benefit/cost/risk | 1. Reduced fires **(Actual direct benefit)**<br>2. Protection of and access to fishing grounds **(Actual direct benefit)**<br>3. Maintained and restored peatland hydrology in the project area **(Actual indirect benefit, Predicted indirect cost)**<br>4. Human-wildlife conflict **(Predicted indirect risk)** |
| Change in well-being | 1. Reduced fires<br>Reduced fires in the project area through forest patrols and fire prevention support the maintenance and/or enhancement of fishing grounds in the project area. It has reduced the risk of habitat loss and/or degradation, fishermen have maintained access to fishing grounds, avoided loss of income, and avoided respiratory health risks associated with smoke inhalation. The project conducted 1843 patrols during this monitoring period. No fires were detected in the project area, and 51 fire hotspots were detected inside the project zone and managed where necessary. These activities contribute to the protection of biodiversity, specifically fish stocks, in the area.<br><br>2. Protection of and access to fishing grounds<br>Fishermen benefited from maintained access to fishing grounds. Routine engagements were conducted with fishermen to maintain access and discuss their activities in the area. Based on the without-project scenario, access to these fishing grounds may have been lost and/or limited. |

| | |
|---|---|
| | 3. Maintained and restored peatland hydrology in the project area<br>Fishermen benefited from improved water quality and fish habitat due to maintained and restored peatland hydrology. Areas for fish breeding were enhanced and/or maintained as extreme peatland water table levels were regulated through restoration. Well-functioning peatlands have improved filtration capabilities, which improve water quality and regulate water flow. During this period, hydrological modeling indicated that water levels were consistently higher and regulated, suggesting maintained and improved peatland hydrology. These results indicate water quality was maintained and/or improved and fish habitat was maintained and/or improved. One negative impact of restored peatlands is that canal blocking, a key restoration activity, could negatively impact access to fishing grounds or disturb fishing grounds. During the current monitoring period, canal blocking activities were implemented as part of the project's ongoing hydrological restoration program. This included the installation of additional permanent canal blocking dams on existing drainage canals and did not involve the creation of new canals or expansion of the canal network. The project assessed whether the installation of additional canal blocking dams affected stakeholder access to fishing grounds and found no evidence that these activities restricted access or resulted in negative impacts on fishermen during the monitoring period. In addition, there were no negative impacts of previous canal blocking activities reported by fishermen during the eight engagements project staff had with individuals.<br><br>4. Human-wildlife conflict<br>As biodiversity improves due to increased forest protection and restoration, large wildlife such as sun bears and tigers may return. This may pose a risk for fishermen who are utilizing the area. During the project period, the project staff maintained communication, when possible, about sightings and also provided one human-wildlife conflict reduction training to seven fishermen. |
| | |
| Community group | Farmer (Kepayang) |
| Impact(s) | 1. Reduced fires in the region reduces risk of farm destruction<br>2. 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<br>3. Human-wildlife conflict |
| Type of benefit/cost/risk | 1. Reduced fires in the region reduces risk of farm destruction **(Actual direct benefit)**<br>2. 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 **(Actual direct benefit)**<br>3. Human-wildlife conflict **(Predicted indirect risk)** |
| Change in well-being | 1. Reduced fires in the region reduces risk of farm destruction |

| | |
|---|---|
| | Increased fire protection and fire management in the project zone benefited the farmer during this monitoring period through reduced risk of loss of crops, avoided respiratory health risks associated with smoke inhalation, and access to farming areas that are not blocked due to fires. This ensured the farmer maintained an income and no crops were lost. The project conducted 1843 patrols during this monitoring period. No fires were detected in the project area, and 51 fire hotspots were detected inside the project zone and managed where necessary.<br><br>2. 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<br>The farmer benefitted from maintaining access to farmland during this period as an agreement was developed to ensure access was maintained. In the without-project scenario, the farmer may have lost access to this land.<br><br>3. Human-wildlife conflict<br>As biodiversity improves due to increased forest protection and restoration, large wildlife such as sun bears and tigers may return, posing a potential risk for the farmer utilizing the area. During the monitoring period, the project staff maintained communication about sightings when possible. |

### 4.1.2 Negative Community Impact Mitigation (VCS, 3.19; CCB, CM2.2)

**Table 64. Negative well-being impacts on community groups and associated mitigation measure(s).**

| Negative community group impact | Mitigation measure(s) |
|---|---|
| Maintained and restored peatland hydrology in the project area | Maintained and restored peatland hydrology through restoration and canal blocking may have a negative impact on fishermen. During the current monitoring period, canal blocking activities were implemented as part of the project's ongoing hydrological restoration program. This included the installation of additional permanent canal blocking dams on existing drainage canals and did not involve the creation of new canals or expansion of the canal network. The project assessed whether the installation of additional canal blocking dams affected stakeholder access to fishing grounds and found no evidence that these activities restricted access or resulted in negative impacts on fishermen during the monitoring period In addition, there were no negative impacts of previous canal blocking activities reported by fishermen during the eight engagements with them throughout this reporting period. The project continues to maintain communications with all individuals to ensure there are no negative impacts and if so, mitigation measures will be developed collaboratively |
| Human-wildlife conflict | Fishermen and the active farmer conduct livelihood activities in the project area. It is possible that as biodiversity returns to the project area, fishermen or the farmer may be impacted by large wildlife such as |

| Negative community group impact | Mitigation measure(s) |
|---|---|
| | sun bears or tigers. The project has developed a human-wildlife conflict reduction strategy and is actively engaging with community members to reduce this risk. Project staff also continue to maintain direct lines of communication to ensure any issues that arise can be addressed through the project's adaptive management plan. In addition, the project held training on human-wildlife conflict risk mitigation during this period and seven fishermen attended. |

### 4.1.3 Net Positive Community Well-Being (VCS 3.19; CCB, CM2.3, GL1.4)

The project is generating net positive impacts for community groups within the project area. Since the project start date, the project has provided community groups with increased fire protection and fire management. The project has ensured community groups are able to maintain access to their fishing grounds and gardens. In addition, fishermen have benefitted from improved water quality for fish stocks due to peatland restoration activities. Furthermore, the project purchases fish to support these individuals' livelihoods.

More specifically, during this project period, 1,843 forest patrols were completed to prevent fires, there were no fires reported, and 51 fire hotspots were detected inside the project zone and managed where necessary. These efforts to protect the project area contributed to reduced risk of fishing grounds or farms from being destroyed, avoided loss of income, and avoided risk of respiratory health issues. Hydrological monitoring during this period indicated that water levels were consistently higher and regulated, suggesting maintained and improved peatland hydrology. These results indicate water quality was maintained and/or improved and fish habitat was maintained and/or improved as functioning peatlands have improved filtration capabilities, which improves water quality and regulates water flow. Negative impacts related to human-wildlife conflict were mitigated through continuous monitoring and dialogue with community groups as well as a training session on human-wildlife conflict mitigation.

For more information on other contributions to community well-being see Section 3.2.2.4.3.1.2.

### 4.1.4 Protection of High Conservation Values (CCB, CM2.4)

During this monitoring period HCVs 4 and 5 have been maintained or enhanced.

HCV 4 areas in the SMPP encompasses a variety of ecosystem functions leading to regulatory and provisioning ecosystem services, primarily: 1) flood prevention area (peat forest and floodplains); 2) clean water sources (rivers); 3) fire prevention areas (peat forest); 4) wind protection and microclimate regulator (peat forest); 5) water catchments (peat forest); and 6) pollination services (large trees hosting bee hives in intact peat forest).

SMPP's fire prevention and management strategy as well as forest patrols contributed to the safeguarding of HCV 4. Forest cover has increased in the project area, further safeguarding the functions underpinning all of the above ecosystem services. Restoration of natural peat hydrology means flooding occurs in a more predictable seasonal cycle with the benefit of vegetative cover to enhance water retention and slow its release. Bee hives are not routinely tracked by biodiversity monitoring, but given increases in forest cover and tree species diversity (see Section 5.3.1) there is reason to believe that this HCV is safeguarded and enhanced.

HCV 5 areas in the SMPP relate to three types of regulatory and provisioning ecosystem services:1) rivers and canals providing freshwater fish for subsistence or livelihoods; 2) rivers providing daily community sanitation services; and 3) land used for smallholder agriculture.

The first, freshwater fishing, is a cross-cutting topic of great social and biodiversity importance. Our teams engage with fishermen as best possible given the constraints to regular contact. Access rights of fishermen from local settlements are recognized and maintained. Fishermen are largely seasonal and for many it is not a full-time livelihood. They may pursue other livelihoods and refrain from fishing for months or even years. In 2022, there were 15 active fishermen utilizing the project area, 10 of these fishermen continued to fish in 2023, while 5 were inactive. In addition, there were 2 additional fishermen active in 2023 that were inactive in 2022. It is challenging to track the ongoing activity, catch volume, and equipment usage of these fishermen.

The use of illegal and unsustainable stun fishing methods by one fisherman was identified as a risk to HCV 5 during this monitoring period. Other fishermen raised this as a threat to fish populations in HCV 5 areas. The project is working to address this issue by a) enhancing surveillance of fishing areas with regular patrols and monitoring technology; b) conducting intensive educational campaigns about the dangers of stun fishing; c) collaborating with local authorities to strengthen law enforcement d) exploring possible alternative livelihood programs for fishermen to avoid them utilizing such equipment.

The project proponents is also working to implement a better framework for monitoring and reporting on the status of HCV 5 in rivers and canals providing freshwater fish. Catch count and species information could be sourced from fishermen on an annual basis, depending on respondent availability. This form of participatory monitoring could provide both social and biodiversity benefits and reduce risk to HCV 5.

Regarding the second form of HCV 5, daily sanitation provision by fluvial areas, these services are in no way infringed upon by the project and stand to be enhanced by the restored hydrology of the project area. As these areas are mostly in the project zone outside of the project area, usage trends are not closely monitored but project staff will continue to stay alert for grievances related to any changes in this HCV. Notably, community sanitation needs are also being addressed by installation of rainwater collection tanks in local communities as described in Section 4.2. The goal is to reduce dependency and avoid community health problems that can arise from personal use of untreated river water.

Lastly, land used for smallholder agriculture is closely monitored to ensure there is no encroachment into the project area. In 2022, 3.89 ha within SMPP bordering this HCV 5 area was cleared by smallholders. The situation and follow up are described in Annex 14 of the current MR. The project will continue to engage smallholders to ensure there is no encroachment while the HCV 5 area outside the project area is maintained.

## 4.2 Other Stakeholder Impacts

### 4.2.1 Mitigation of Negative Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.2)

Identified other stakeholders are the residents of nearby settlements outside the project area who rarely and/or do not engage in activities in the project area. One negative impact of the project on the well-being of other stakeholders is the predicted indirect risk of human-wildlife conflict. As biodiversity improves due to increased forest protection and restoration, large wildlife such as sun bears and tigers may return to the project zone. During this reporting period, there were no incidents

of human-wildlife conflict.

The project continues to implement a human-wildlife conflict reduction strategy. In 2023, SMPP held a human-wildlife conflict training and 31 individuals representing other stakeholders attended. Project staff also continue to maintain lines of communication with other stakeholders during community engagement activities and through the grievance redressal mechanism. If other stakeholders communicate negative impacts of projects activities on their well-being, the team will discuss with the individual(s), and if necessary, actions will be taken to mitigate these impacts.

### 4.2.2 Net Impacts on Other Stakeholders (VCS, 3.18, 3.19; CCB, CM3.3)

During the monitoring period, SMPP provided positive impacts to other stakeholders who are residents of nearby settlements, Muara Merang and Kepayang. There are approximately 5,460 individuals representing 1,661 households residing in Muara Merang and 2,628 individuals from 574 households residing in Kepayang. These communities live relatively far from the project area; however, SMPP is committed to providing benefits to settlements within the project zone. During this reporting period, the project delivered several community programs aimed at maintaining and enhancing community livelihoods. These activities and mitigation strategies to avoid negative impacts have resulted in net positive impacts for other stakeholders.

SMPP's community development program generates positive impacts for other stakeholders as the activities are designed to strengthen livelihoods through local employment creation, increase the quality of and access to education, improve the quality of and access to health services, improve access to clean water, and sanitation.

The community monitoring plan in Section 4.3.1 presents the achievements of the SMPP's community development program during this monitoring period. Below, highlights of the community development program and impacts on other stakeholders during the monitoring period are presented.

- Two health care facilities received support to improve infrastructure. Muara Merang clinic received support to paint the building and to install a birthing bed. Kepayang clinic received support to install a cabinet, build a fence, and construct a bridge to improve access. SMPP supported a monthly mobile health clinic to two remote settlements in 2022. In 2023, the Kepayang and Muara Merang clinic, along with the Pancuran clinic received regular medicine supplies. Vaccination programs were supported by SMPP in 2023 for school age children. In total there were 159 children vaccinated. During the reporting period, eight individuals have been registered with the national healthcare system.
- Access to clean water was improved through the installation of 80 new water catchment systems during this reporting period. A total of 70 units were installed at the household level and 10 were installed at public venues.
- Education programs were implemented to increase access to education and improve quality of education. 15 local teachers were supported to pursue university degrees through Open University and one teacher graduated during this reporting period. An after-school program for elementary students was implemented with 116 students in 2022 and 93 students in 2023 participating. Continuing education programs for SMPP employees benefited 81 individuals in 2022 and 88 students including 47 new students in 2023. The enrichment and enhancement of two school libraries through a partnership with a non-governmental organization, Taman Bacaan Pelangi, was conducted during this reporting period and 1109 books were donated.

- Employment opportunities for local community members contributed to improved livelihoods. In total, there were 14 full time positions in 2022 and 15 in 2023 for local staff at SMPP. In addition, SMPP supported the salaries of two librarians and two health workers during this reporting period. Lastly, SMPP sourced 50% of food for staff from 13 local shops, further contributing to the local economy.

## 4.3 Community Impact Monitoring

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

The project has created a monitoring plan to track impacts on community groups and other stakeholders generated by the project. This plan considers the components necessary to conduct successful monitoring of impacts over the project lifetime. In addition, it accounts for the project requirements, logistics, and staff capacities as well as the context of the communities.

**Table 65. Detail of the project's community monitoring plan with results from the monitoring period.**

| Focal issue | Key results | Indicator/ variable | Data collection method | Targeted community | Monitored impacts | Monitoring frequency | Results during 2022 | Results during 2023 |
|---|---|---|---|---|---|---|---|---|
| Improved livelihoods | Access to primary resource for community livelihoods is maintained | # of fishermen utilizing the area | Community survey | Fishermen | Protection of and access to fishing grounds. | Every three months | 15 fishermen identified and active | 12 fishermen active in the area |
| | | # of fires in the project zone | Spatial analysis and fire reports from fire patrol team | Fishermen | Reduced fires | Weekly, Monthly, Annually | 779 patrols; 0 fires; 0 hotspots | 1064 patrols; 0 fires; 0 hotspots |
| | | Monitoring of water table levels | Monitored daily using dipwells across the project area | Fishermen | Improved water quality within the project area will benefit fish stocks long-term. | Annually | Results during 2022 indicate that the water table levels are consistently higher and regulated, suggesting maintained and improved peatland hydrology | Results during 2023 indicate that the water table levels are consistently higher and regulated, suggesting maintained and improved peatland hydrology |
| | | # of farmers utilizing the area | Community survey | Small-scale farmers | 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. | Every six months | 1 farmer | 0 farmer |

| Focal issue | Key results | Indicator/ variable | Data collection method | Targeted community | Monitored impacts | Monitoring frequency | Results during 2022 | Results during 2023 |
|---|---|---|---|---|---|---|---|---|
| | | # of fires in the project zone | Spatial analysis and fire reports from fire patrol team | Small-scale farmers | Reduced fires in the region reduces risk of farm destruction | Weekly, Monthly, Annually | 779 patrols; 0 fires; 0 hotspots | 1064 patrols; 0 fires; 0 hotspots |
| | Community income improved | Income from the sale of fish (IDR/month) per fisherman | Community survey | Fishermen | Gains achieved from the sale of fish | Every three months | 3,400,000 IDR per month | 3,400,000 IDR per month |
| | | % of SMPP food budget sourced from other stakeholders | Internal report | Other stakeholders | Community income improved | Every 12 months | 51% of food sourced from 11 local shops | 50% of food sourced from 10 local shops |
| | Local employment or livelihoods increased | # of local people employed by the SMPP | Internal data records (employment contracts) | Other stakeholders | Employment opportunities within SMPP | Every 12 months | 14 staff members from local communities | 15 staff members from local communities |
| | | # of investments and agreements with other stakeholders signed by the SMPP | Internal report and contracts | Other stakeholders | Increased livelihood opportunities | Every 12 months | 2 librarians received their monthly salaries from SMPP; 2 health workers recieved their salary from SMPP | 2 librarians received their monthly salaries from SMPP; 2 health workers recieved their salary from SMPP; 1 agreement with Wahana Lestari Makmur Sukses for a joint fire monitoring and information sharing on forest fires |
| | Gender equity | # of investments | Internal report | Other | Increased | Every 12 months | No activity | No activity |

| Focal issue | Key results | Indicator/ variable | Data collection method | Targeted community | Monitored impacts | Monitoring frequency | Results during 2022 | Results during 2023 |
|---|---|---|---|---|---|---|---|---|
| | and economic success increased | and agreements with local women's groups signed by the SMPP | and contracts | stakeholders | livelihood opportunities | | | |
| | | % of women directly employed by SMPP | Internal data records (employment contracts) | Other stakeholders | Employment opportunities within SMPP | Every 12 months | 0%. Given the remoteness of the project site and the fact that it is an unaccompanied post (not appropriate for families) target gender balance for patrol and project teams has been difficult to achieve. | 0%. Given the remoteness of the project site and the fact that it is an unaccompanied post (not appropriate for families) target gender balance for patrol and project teams has been difficult to achieve. |
| Education Support | Quality of, or access to, education increased | # schools repaired or equipped | Internal report | Other stakeholders | Improved quality of education | Every 12 months | One school, SD Muara Merang, equipped with reading corner | No activity |
| | | # of university students supported | Data records, proof of enrollment to university | Other stakeholders | Improved access to education | Every 12 months | 9 students | 6 new students, bringing the number to a total of 15 students supported. 1 student graduated in 2023 |
| | | # of students attending after | Enrollment records | Other stakeholders | Improved access to | Every 12 months | 116 active students | 93 active students |

| Focal issue | Key results | Indicator/ variable | Data collection method | Targeted community | Monitored impacts | Monitoring frequency | Results during 2022 | Results during 2023 |
|---|---|---|---|---|---|---|---|---|
| | | school programs supported by SMPP | | | education | | | |
| | | # of students continuing their education in adult programs supported by SMPP | Enrollment Records | Other stakeholders | Improved access to education | Every 12 months | 81 students active from Hidayah and Intan Learning Centers (Pusat Kegiatan Belajar Masyarakat (PKBM)) | 88 students active in 2023 (47 new) from Hidayah and Intan Learning Centers (Pusat Kegiatan Belajar Masyarakat (PKBM)) |
| | | # of books in each school library in surrounding villages | Survey | Other stakeholders | Improved quality of education | Every 12 months | 1109 total | 1109 total |
| Health | Access to clean water improved | # of individuals attending trainings in household rainwater catchment system construction and operation | Internal report | Other stakeholders | Improved access to clean water | Every 12 months | 50 individuals | 20 individuals |
| | | # of households with improved rainwater catchment systems | Survey | Other stakeholders | Improved access to clean water | Every 12 months | 50 household rainwater catchment systems installed | 20 household rainwater catchment systems installed |
| | | # of constructed and operational | Internal report | Other stakeholders | Improved access to clean | Every 12 months | No activity | 10 rainwater catchment |

| Focal issue | Key results | Indicator/ variable | Data collection method | Targeted community | Monitored impacts | Monitoring frequency | Results during 2022 | Results during 2023 |
|---|---|---|---|---|---|---|---|---|
| | | sanitation facilities | | (Kepayang and Muara Merang schools) | water | | | systems installed |
| | Medical and sanitation facilities and services improved | # of health facilities improved | Internal report | Other stakeholders | Improved quality of health care | Every 12 months | 2 community health facilities have been improved by SMPP (Poskesdes Kepayang & Poskesdes Muara Merang). The improvements in Muara Merang clinic consisted of painting the clinic and supplying a birthing bed; Kepayang received a medicine cabinet, supply of medicine, permanent bridge construction and building fence. | 1 health clinic, Pancuran, supported through provision of medical equipment in 2023 |
| | | # of people registered into Indonesia's national healthcare | Internal report | Other stakeholders | Improved access to health care | Every 12 months | 3 individuals | 5 individuals |

| Focal issue | Key results | Indicator/ variable | Data collection method | Targeted community | Monitored impacts | Monitoring frequency | Results during 2022 | Results during 2023 |
|---|---|---|---|---|---|---|---|---|
| | | system with SMPP support | | | | | | |
| | | # of children vaccinated with SMPP support | Internal report | Other stakeholders | Improved access to health care | Every 12 months | No activity | 159 students received immunization shots from two participating school, SDN Kepayang and SDN Muara Merang |
| | | # of community clean-up events held | Internal report | Other stakeholders | Improved waste management | Every 12 months | No activity | No activity |
| | Waste management improved | # of plastic recycling and trash collection programs implemented | Internal report | Other stakeholders | Improved waste management | Every 12 months | No activity | No activity |
| | | Kg of plastic waste processed as recycling | Internal report | Other stakeholders | Improved waste management | Every 12 months | No activity | No activity |
| | Fire safety improved | Frequency of fire safety or prevention trainings | Internal report | Other stakeholders | Reduced fires in the region | Every three months | 1 firefighting refreshment training with Manggala Agni with 36 fire patrol staff, 8 local community fire brigade members, and 4 neighboring concession firefighting staff. | 12 internal fire trainings with SMPP staff |

### 4.3.2 Monitoring Plan Dissemination (CCB, CM4.3)

The executive summary of the monitoring report will be translated into Bahasa Indonesia, printed, and given to relevant stakeholders including village leaders from communities in the project zone. These summaries will be available for viewing at local village offices. The summary will include details of the monitoring plan and the latest monitoring results.

The executive summary in both English and Bahasa Indonesia, as well as the full monitoring report in English and Bahasa Indonesia will be available at the SMPP Field office. Lastly, notices in Bahasa Indonesia advertising the public comment period and field verification will be posted in communities throughout the project zone. The monitoring report will be made available online through the Verra Registry (https://registry.verra.org).

## 4.4 Optional Criterion: Exceptional Community Benefits

The project is not seeking Gold Level for the Community component as the majority of the residents in local villages near the project area do not fall below the national poverty line.[34] Additionally, the project is not owned or co-managed by local communities, Despite this, the project has delivered substantial net positive impacts for the identified community groups and other stakeholders through the implementation of the project's community monitoring plan.

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

N/A

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

N/A

### 4.4.3 Net Impacts on Women (CCB, GL2.5)

N/A

### 4.4.4 Benefit Sharing Mechanisms (CCB, GL2.6)

N/A

### 4.4.5 Governance and Implementation Structures (CCB, GL2.8)

N/A

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

N/A

# 5 BIODIVERSITY

## 5.1 Net Positive Biodiversity Impacts

Through long-term project activities, the SMPP has maintained and enhanced 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.[35] The terrestrial biomes of Southeast Asia have been identified as some of the most at risk biomes on the planet,[36] and Indonesia has suffered significant forest and biodiversity loss over the last 40 years.[37]

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%.[38]

The SMPP began to reverse this trend in recent years by protecting and restoring an almost 23,000-ha area of globally significant, degraded tropical peatland and peat swamp forest, and high conservation value species. Protection and restoration efforts during this and previous monitoring periods has laid a foundation for ecological regeneration, which should lead to a long-term increase in the diversity and extent of the peat swamp forest in the project area and the species that inhabit it. Evidence is mounting for net positive biodiversity impacts for both flora and fauna in the project area and will be detailed in sections that follow.

### 5.1.1 Biodiversity Changes (VCS, 3.19; CCB, B2.1)

Assessing changes in biodiversity over time requires standardized repeatable surveys conducted over two or more comparable time periods. During the current monitoring period, the third and fourth annual, standardized, repeatable biodiversity monitoring was undertaken, allowing for the first reliable analysis of biodiversity trends over time (see Section 5.1.3 for more details).

The monitoring data suggests that the previously degraded project area has managed to maintain many high conservation value species (see Section 5.1.4 and Section 4.1.4), and project activities are likely enhancing biodiversity in the project area and the project zone. Table 75 and Table 76 outline the changes to biodiversity observed during the current monitoring period. Table 6 lists the total species observations during the current monitoring period - note that it omits species encountered during previous monitoring reports or baseline study.

**Table 66. Direct changes to biodiversity during the monitoring period.**

| | |
|---|---|
| Changes in biodiversity | Cumulative number of floral and faunal species identified in the SMPP area |
| Monitored change | This monitoring period saw an increase in the cumulative number of both floral |

| | |
|---|---|
| | and faunal species identified in the SMPP project area.<br><br>The species inventory was updated with new survey data from this monitoring period. A full list of all species recorded in the SMPP can be seen in Annex 20. A summary of the species by taxonomic group and IUCN status can be seen in Table 47. The species inventory now includes:<br><br>• 42 mammals (decrease of 2 from last monitoring period: 2 unidentified species removed)<br>• 155 birds (increase of 10 species from last monitoring period: 12 new species, 2 unidentified species removed)<br>• 23 reptiles (no increase from last monitoring period; not actively surveyed)<br>• 16 amphibians (no increase from last monitoring period; not actively surveyed)<br>• 28 fish (no increase from last monitoring period; not actively surveyed)<br>• 39 arthropods, dragonflies and damselflies (no increase from last monitoring period, not actively surveyed)<br>• 138 plants, 103 of which are trees (decrease of 4 from last monitoring period: 6 new species, 10 unidentified species consolidated/removed) |
| Justification of change | The surveys conducted in during the 2024 monitoring period saw a continuation of several standardized and repeatable biodiversity monitoring methods first launched in 2020 (see Table 68 for details).<br><br>The surveys conducted during this monitoring period recorded a number of new floral and faunal species in the project area. The rate at which new species will be detected in the SMPP will likely slow over time as species accumulation curves predict that additional sampling effort will have diminishing returns as the more common, abundant, and conspicuous species are identified at higher rates during early sampling efforts and rarer, less conspicuous, or newly arrived species are identified at a much slower rate.<br><br>Of note during this period was an effort to verify, consolidate, or remove unidentified species placeholders in our datasets. From this monitoring period onwards, only biodiversity observations identifiable to family level or lower (genus, species) will be included in standard monitoring data or the cummulative species inventory. Thus there was no actual decline in species richness during this monitoring period, merely a more accurate accounting thereof.<br><br>For mammals, this reduced the total in Table 64 by one and the overall species inventory total by two (from 44 to 42). The removal from Table 64 was "Unidentified Chiroptera species," a placeholder for any bat species that appeared in camera trap images from 2020-2023. As nocturnal image resolution does not allow us to distinguish taxonomy below the class level, this record was discarded. Likewise "Unidentified Rattus species" was used as a placeholder for all 2020-2023 camera trap sightings of *Rattus spp* due to the low resolution of nocturnal camera trap images. This produced three separate *Rattus spp* records in the species inventory. We decided that difficulty in identifying *Rattus spp* from the images did not justify inclusion of a third record: the images are likely of a known species rather than a third unknown species. We updated all "Unidentified Rattus species" records to *Rattus rattus*, thus removing "Unidentified Rattus species" from the species inventory. This produces a slight change to previous years' species diversity metrics in Table 74. Mammal trigger species reported on in section 5.4.1 were not impacted by these changes. |

| | |
|---|---|
| | Two unidentified bird individuals included in the previous monitoring report were also removed, slightly offsetting the 12 new species in 2024 for a net increase of 10 species from 2023. This produces a very slight change in previous years' species diversity metrics in Table 69. Bird trigger species reported on in section 5.4.1 were not impacted by these changes.<br><br>Vegetation is easier to identify at a later date as specimens can be revisited in the field. We cross-checked historical data, photograhed leaf samples, engaged expert botanists, and removed unverifiable records from the species inventory. This resulted in the consolidation/removal of 10 plant species records from the species inventory, offsetting the addition of 6 new species in 2024. This produces a more noticable change in previous years' species diversity metrics in Table 71. Tree trigger species reported on in section 5.4.1 were not impacted by these changes.<br><br>The dynamics of tropical peatland forest restoration - especially for rarer flora and fauna species - are not fully understood. It is possible that regenerating areas will see spikes in species diversity due to an increase in the diversity of ecological niches in the project area as it becomes more heterogeneous. It may also result in the contrary, where a few species of generalists outcompete other species in a challenging environment, leading to a decrease in species richness. It is still too early to make definitive conclusions.<br><br>The increased number of species newly identified and regularly recorded in this monitoring period is likely attributable to the positive impacts of hydrological restoration from dams constructed in 2018-2024, ongoing fire management in and around the project area, ongoing patrols in the project area, and small-scale enrichment planting have increased the habitability of the project area for both flora and fauna to the extent that some species are returning to the project area or are increasing in abundance to the extent that they are now being detected in surveys. |

| | |
|---|---|
| Changes in biodiversity | Bird species diversity |
| Monitored change | Likely enhancement of bird species diversity |
| Justification of change | The point count transect survey data, now encompassing five years of standardized annual monitoring, suggest that bird species diversity is likely being being enhanced by project interventions.<br><br>Bird species are likely benefitting from ongoing project activities, including fire management, canal blocking, enrichment planting, and patrolling activities, which enhances the quality of secondary forest and increases closed canopy cover, while likely reducing illegal activity pressures (see section 5.3.1 and section 5.4.1 for details). |

| | |
|---|---|
| Changes in biodiversity | Plant species diversity |
| Monitored change | Likely maintenance of plant species diversity |
| Justification of change | The vegetation ploy survey data, now encompassing five years of standardized |

| | |
|---|---|
| | annual monitoring, suggest that plant species diversity is being enhanced by the project.<br><br>Plant species are likely benefiting from ongoing project activities. Fire management, canal blocking, enrichment planting, and patrolling activities are resulting in maintenance of secondary forest and increases in closed canopy cover, while likely reducing illegal activity pressures (see section 5.3.1 and section 5.4.1 for details). |

| | |
|---|---|
| Changes in biodiversity | Mammal diversity |
| Monitored change | Likely enhancement of mammal diversity |
| Justification of change | The camera trap survey data, now encompassing five years of standardized annual monitoring, suggest that mammal species diversity and population trends are being maintained under the with-project scenario, with early data signals indicating that ecological generalists are faring better than ecological specialists in the project area. At least several years more data is required to ascertain what may truly be occurring naturally in this regenerating tropical peatland.<br><br>Mammal species are likely benefiting from ongoing project activities. Fire management, canal blocking, enrichment planting, and patrolling activities are resulting in maintenance of secondary forest and increases in closed canopy cover, while likely reducing illegal activity pressures (see section 5.3.1 and section 5.4.1 for details). |

| | |
|---|---|
| Changes in biodiversity | Apex predator population trends |
| Monitored change | Likely maintenance of apex predator population trends |
| Justification of change | The Critically Endangered (CR) Sumatran Tiger is an apex predator whose presence can indicate an abundance of prey species and can help increase species diversity by keeping prey species abundances relatively even. The relatively high abundance of prey species in the project area supports this hypothesis.<br><br>In 2024, no Sumatran tigers (Panthera tigris sumatrae) were recorded through standard monitoring (camera trap surveys). Given their rarity and their large home ranges of 60-100 km2, it is not unexpected that camera traps at a density of roughly one station per 10 km2 of project area may not detect tigers in a given year.<br><br>The first photographic evidence of the Sumatran tiger in the project area was collected in 2020, with two distinct individuals identified using their unique striping patterns. In 2021 only tiger spoors (footprints) were recorded, just outside the project area. In 2022, camera trap surveys recorded two new individual tigers, one male and one female. In 2023 camera trap surveys recorded the same male from 2022 and a newly identified female who was recorded on a camera trap image not included in the camera trap data analysis outlined in section 5.3.1. Protecting and regenerating the project area for these individuals to survive and thrive will play a vital role in the conservation of this species and may well play an important role maintaining balanced mammal |

| | |
|---|---|
| | diversity in the project area.<br><br>These apex predators are likely benefiting from ongoing project activities. Fire management, canal blocking, enrichment planting, and patrolling activities are resulting in maintenance of secondary forest and increases in closed canopy cover, likely enhancing prey species populations, while likely reducing illegal activity pressures (see section 5.3.1 and section 5.4.1 for details). |

**Table 67. Indirect changes to biodiversity during the monitoring period.**

| | |
|---|---|
| Changes in biodiversity | Maintenance of secondary forest cover and enhancement of closed canopy land cover. |
| Monitored change | The land cover classification for this monitoring period was performed in March 2024 to assess changes in land cover between this and previous monitoring periods. This analysis showed an emerging trend of:<br><br>• Increased secondary forest cover<br>2016 = 260 ha<br>2019 = 260 ha<br>2020 = 288 ha<br>2021 = 277 ha<br>2023 = 335 ha<br>• Increased closed canopy cover (2016 = 330 ha; 2019 = 330 ha; 2020 = 5,392 ha; 2021 = 5,872 ha; 2023 = 5,964 ha)<br>• Decreased open canopy cover from regrowth into closed canopy (2016 = 21,987 ha; 2019 = 21,987 ha; 2020 = 17,173 ha; 2021 = 15,756 ha; 2023= 15,575 ha)<br>• Slight decrease of open/closed canopy transition mix from regrowth into secondary forest (2021 = 910 ha; 2023 = 904 ha)<br><br>This suggests that natural regeneration of vegetation in SMPP is already underway, which should benefit the many floral and faunal species by improving habitat quality and further diversifying niches. |
| Justification of change | The data sources for the land cover classification in this monitoring period were cloud-free satellite data mosaics over the AOI using optical data from Sentinel-1 and 2, Synthetic Aperture Radar (SAR), and ALOS-2/PALSAR-2.<br><br>The decision to change the source datasets was due to the different implementation of machine learning algorithms used for classification. The implementation for this monitoring period yielded a more precise classification.<br><br>An accuracy assessment was done against higher resolution reference images (see Section 3.2.2.1.1). For example, both the user's and producer's accuracy for Secondary Forest were high at 86% and 87% respectively, suggesting that the classification was accurate and reflected field conditions as observed during the monitoring period.<br><br>This positive trend in natural vegetation regrowth is attributable to the extensive canal dam constructions, fire management activities, and forest patrols. In this monitoring period there was a major reduction in fire hotspots, down to zero peat fires in the project area. |

| | |
|---|---|
| | Fire incidence is currently identified using a mix of regular patrols, 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 satellites orbiting earth (see Section 3.2.2.2). A pair of high-definition cameras with night vision capability were installed in the main camp which monitors the possible occurrence of forest fire by detecting the presence of fire and smoke. The cameras have a 90° field of view and 5 km maximum detection range. The two cameras were installed to cover approximately 180° field of view East to West of the main camp.<br><br>During this monitoring period, the agreement with an adjacent concession has resulted in improved access for project fire management teams to suppress nearby fires that are not within the project boundaries, and thus prevent fires before they have a chance to spread to the project area. |
| Changes in biodiversity | Aquatic species diversity |
| Monitored change | Likely increase in aquatic species diversity. |
| Justification of change | While aquatic species in the project area were surveyed for the species inventory (see Annex 20) in previous monitoring periods, ongoing monitoring of aquatic species will be done indirectly by monitoring several factors that are likely to influence aquatic species populations. However, an additional survey conducted during the 2021 period by a local student recoded 26 additional fish species, bringing the total number of fish species recorded in the project area to 28 species.<br><br>It is assumed that decreased fire hotspots (determined by climatic variables and fire management efforts), increased protection from illegal human activities (determined by patrolling activities), more natural and stable water table depth levels (determined by climatic variables, canal blocking and maintenance activities), and maintained secondary forest and increased closed canopy cover are actively contributing to positive trends in aquatic species populations in the long-term.<br><br>This monitoring period saw an increase of secondary forest cover and in closed canopy cover, no fire hotspots in the project area, the construction of an additional 31 temporary dams (to make a total of 234 dams), and 1,843 patrols carried out with no incidents of illegal activities recorded, all of which suggest that aquatic species are likely being maintained or enhanced due to project activities.<br><br>While there is potential for canal dams to have short-term negative impacts on fish that have populated these man-made canals, these impacts are highly likely to be ecologically positive in the medium and long-term (see Sections 5.1.2 and 5.2.1 for more details). |

| | |
|---|---|
| Changes in biodiversity | Invertebrate diversity |
| Monitored change | Likely increase in invertebrate diversity |
| Justification of change | While some invertebrate species in the project area were surveyed for the species inventory (see Annex 20) in previous monitoring periods, ongoing |

monitoring of changes in invertebrate species will be done indirectly by monitoring several factors that are likely to contribute to changes in invertebrate species populations. It is assumed that decreased fire hotspots (determined by climatic variables and fire management efforts), increased protection from illegal human activities (determined by patrolling activities), more natural and stable water table depth levels (determined by climatic variables, canal blocking and maintenance activities), and maintained secondary forest cover and increased closed canopy cover will all contribute to positive trends in invertebrate species populations in the long-term.

This monitoring period saw an increase in secondary forest cover and closed canopy cover, no fire hotspots in the project area, the construction of an additional 31 temporary dams (to make a total of 234 dams), and roughly 1,843 patrols carried out with no incidents of illegal activities recorded, all of which suggest that invertebrate species are likely being maintained or enhanced due to project activities.

**Table 68. Summary of species recorded in the project area by taxonomic group and IUCN Red List status.**

| Kingdom | Class / lifeform | Total No. of species in project zone | IUCN red list category | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CR | EN | VU | Total trigger species | NT | LC | DD | NE | NA |
| Animals | Mammals | 31 | 1 | 3 | 5 | 9 | 2 | 16 | 1 | 3 | 0 |
| | Birds | 125 | 0 | 1 | 5 | 6 | 15 | 102 | 0 | 2 | 0 |
| | Reptiles | 5 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 0 | 0 |
| | Amphibians | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Fish | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Insects | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total Animals** | **161** | **1** | **5** | **10** | **16** | **17** | **122** | **1** | **5** | **0** |
| Plants | Trees | 76 | 3 | 1 | 4 | 8 | 3 | 24 | 1 | 40 | 0 |
| | Palms | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Lianas | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Shrubs | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | Ferns | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| | Sedges | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | Other herb | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 0 |
| | Total Plants | **90** | **3** | **1** | **4** | **8** | **3** | **25** | **1** | **53** | **0** |
| **Total Animals & Plants** | | **251** | **4** | **6** | **14** | **24** | **20** | **147** | **2** | **58** | **0** |

### 5.1.2 Mitigation Actions (VCS, 3.19; CCB, B2.3)

There were no negative impacts on biodiversity directly resulting from project activities recorded during this monitoring period. In several instances, discussed below, biodiversity could have been negatively impacted, but the swift actions of the field teams mitigated the impacts.

Two plantations encroached on the project area accidentally, resulting in vegetation loss of 11.27 ha (or 0.05% of the total project area). Field staff identified the encroachment during regular patrolling, informed the project management team swiftly, and the encroachment was immediately stopped. Of

the encroached areas only 17% (or 0.01% of the total project area) were stocked with native vegetation before encroachment, and all 11.27 ha affected areas were replanted with native tree species. Thus, the floral biodiversity in the project area is not negatively impacted (see Annex 14).

During the current monitoring period, one attempted hunting incident was detected at the project boundary. In July 2022, hunters from outside the project zone were observed at the border of the project. It was suspected that they were targeting deer and/or tigers given their equipment and arrival in the late evening when these animals are active. It was not clear whether they intended to enter the project area or hunt in the neighboring concession, but patrols were immediately increased in this border area both day and night. Car alarms and other noise-producing devices were used to scare away animals from the area. The hunters were not encountered again after the first instance, nor were any traces of hunting activity. Faunal biodiversity within project area was likely not impacted.

No other evidence of organized hunting was observed inside or outside the project area other than this single encounter. We consider the direct risk of hunting and the indirect risk of hunting displacement to be very low. This is primarily due to the fact that the project area was heavily degraded prior to project implementation and did not provide high value wildlife habitat, resulting in very low existing hunting pressure. While wildlife habitat has since improved, the poor accessibility of the project area means very few individuals are able to reach the area and hunting large game is logistically undesirable. Daily patrols and community engagement are therefore considered sufficient to manage hunting risk. Based on these factors, the risk of displacement of hunting or poaching activities to areas outside the project boundary is considered low.

Other potential negative impacts on biodiversity in the SMPP project area and their relevant mitigation actions are outlined in Section 5.1.3 and Section 5.2.1 of this report. The potential negative impacts on biodiversity in the SMPP area are considered low in the with-project scenario, but the project continues to monitor potential negative impacts through active patrol activities, remote sensing, and field surveys. To ensure the maintenance and enhancement of HCV attributes in the SMPP project area (see Section 5.1.4 for an overview of HVCs identified in the project area), the project will continue the activities outlined in the figure below.

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

**Figure 4. SMPP Causal model for SMPP biodiversity program**

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

In the without-project scenario, the 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. During this monitoring period, the ecological integrity of the peatland in the project area was gradually restored through activities including:

- Canal blocking with canal dams and existing canal dam monitoring.
- Enrichment planting and assisted natural regeneration .
- Ongoing fire monitoring and management.
- Ongoing project area monitoring and enforcement .

In this monitoring period, the project team:

- Constructed nine temporary box dams and 22 temporary tarpaulin dams and monitored existing dams where accessible.

- Consistently monitored potential fires, with no fires occurring within the project area during this monitoring period.
- Continued enrichment planting, with 3,930 nursery seedlings planted in 2022 and 6,450 planted in 2023 in the project area during this monitoring period.
- Conducted standardized and systematic biodiversity monitoring (see Table 4).
- Continued daily patrols of the project area from each guard post for a total of 1,843 patrol days.

The impacts of the above activities can already be seen through the increase of secondary forest cover and closed canopy cover in the project area. It is assumed that the absence of fire hotspots in the project area throughout this monitoring period was a key determining factor for the regeneration of vegetation.

While this monitoring period only encompasses the second annual period of systematic biodiversity monitoring, the data suggests that positive biodiversity trends are being maintained or enhanced in the project area (see Section 5.1.1, Section 5.3.1, and Section 5.4.1). Clear evidence of biodiversity trends in any direction resulting from project activities will likely take several years to emerge at a statistically significant scale, but early data and ground observations suggest biodiversity is benefitting from project activities.

With enrichment planting only making up a small part of project activities, the positive trends in vegetation cover are likely due to efforts to restore the natural peatland hydrology with canal dams and due to careful fire monitoring and management, with this year seeing several fire hotspots in the broader project zone but none in the project area. With extreme droughts and rising temperatures becoming increasingly common under climate change, raising the risk of fires, heat stress, and food and water resource insecurity, increasing vegetation cover, improving peatland hydrology, and practicing careful fire monitoring and management will continue to be essential in assisting the biodiversity to adapt to the probable impacts of climate change.

As noted in the Project Document, three potential negative impacts or issues concerning biodiversity were identified that could eventually arise from project activities, and mitigation measures for each of these have been implemented.

- 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 (see Section 5.2.1).
- Potential increases in illegal logging and hunting in the area as biodiversity is restored and species abundance and diversity increase. No hunting was directly observed inside the project area during this monitoring but in July 2022, suspected hunters from outside the project zone were observed at the border of the project. It was suspected that they were targeting deer and/or tigers given their equipment and time of activity. It was not clear whether they intended to enter the project area or hunt in the neighboring concession, but patrols were immediately increased in this border area both day and night. Car alarms and other noise-producing devices were used to scare away animals from the area. The hunters were not encountered again after the first instance. No illegal logging was recorded during this monitoring period.

- 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 minimal. The project has already begun to prepare for the unlikely event that communities in the project zone will experience human-wildlife conflict by conducting human-wildlife conflict training for project staff. No human-wildlife conflicts were reported within the project area during this monitoring period.

Predicted increases in species diversity across all ecosystem types within the SMPP project area driven through ongoing habitat restoration and protection means that any potential negative impacts can be deemed to be negligible. Any decreases in species diversity are more likely to be attributable to natural ecological succession dynamics.

**Table 69. Project impacts on habitats for rare, threatened, or endangered species.**

| | |
|---|---|
| Species and habitat | 43 rare and threatened species (24 during standardized annual monitoring surveys, see Table 46 for an overview and Annex 20 for details).<br><br>Secondary Peat Swamp Forest Fragments<br><br>At the start of the project, the only area identified as key habitat for rare, threatened, or endangered species was the only fragment of remaining secondary peat swamp forest in the project area at the project start date following illegal logging and devastation fires. It was subsequently identified as an HCV 3 area. Biodiversity surveys in this forest fragment show that mammal, bird, and tree species populations are being maintained or enhanced in this forest fragment (see Section 5.3 and Section 5.4 for more details). The most recent land cover data shows that this fragment is expanding thanks to project activities. |
| Ares needed for habitat connectivity | The project has tangibly enhanced connectivity by expanding closed canopy and forest area, providing refugia for flora and fauna that would likely not be present in the degraded peat scrubland that characterized the project area's initial state. The project is contributing to enhanced connectivity between three Key Biodiversity Areas (KBAs): the Merang Peat Dome of which it is a major part, as well as the Sembilang and Berbak KBAs to the east and northeast. These refugia are critical in a landscape dominated by industrial plantations of Acacia and oil palm. |

Regarding Gold Level climate change adaptation benefits, project activities are very likely to assist biodiversity to adapt to the impacts of climate change. Climate change is likely to increase the intensity and duration of droughts in the region, thereby increasing the risk and severity of forest and land fires. Our comprehensive fire prevention and management activities mean that fire is a reduced threat to both flora and fauna in the project area, as well as the project zone where we are able to deploy firefighting teams. The maintenance of high water table in the project area by canal blocking further ensures that fire is a reduced risk because undrained peat is very unlikely to combust.

### 5.1.4 High Conservation Values Protected (CCB, B2.4)

During an HCV assessment between the 22nd of May and the 1st of June 2018, four of the six HCVs, which are defined under the High Conservation Value Resource Network's (HCVRN) guidelines on

HCV identification, were identified in the SMPP project area:

- 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 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 the 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), species diversity is being maintained or enhanced in the project area (see Section 5.3.1 and Section 5.4.1 of this report for more details). The latest land cover classification revealed that vegetation cover has been improved, with secondary forest cover and closed canopy cover increasing. This suggests that the natural regeneration of vegetation in the project area is well underway. This should increase the diversity and abundance of floral species and consequently lead to increases in faunal species through several biotic interactions. There has been a marked increase in the accumulated number of species recorded in the project area over the current monitoring period, and species diversity metrics for all surveyed floral and faunal groups are being maintained or enhanced when compared to the previous monitoring period (see Section 5.1.1).

For HCV 3 (ecosystems and habitats), the remaining fragment of secondary forest within the project area has increased during this monitoring period. The entire project area lies within the 150,000-ha Merang-Kepayang peat dome, the largest peat swamp dome in South Sumatra, located 5 km west of the forests of the Sembilang-Berbak National Park. The maintenance and enhancement of the secondary forest in the project area is therefore key to maintaining or enhancing HVCs within the wider landscape. The current trend of maintenance of secondary forest and regrowth in closed canopy cover in the project area suggests that HCV 3 is not being negatively impacted by project activities during this monitoring period. There is a high probability that project activities have positively impacted HCV 3 areas, primarily through effective fire management activities.

### 5.1.5 Species Used (VCS, 3.19; CCB, B2.5, 2.6)

The species used for reforestation in the project are native. Native species do not require any justification for use and do not cause any adverse effects requiring mitigation.

**Table 70. Summary of species used in the project.**

| Species introduced | Classification | Justification for use | Adverse effects and mitigation |
|---|---|---|---|
| *Aglaia rubiginosa* | Native | NA | NA |
| *Alstonia scholaris* | Native | NA | NA |
| *Alstonia spatulata* | Native | NA | NA |
| *Aquilaria malaccensis* | Native | NA | NA |
| *Aquilaria microcarpa* | Native | NA | NA |
| *Cyrtophyllum fragrans* | Native | NA | NA |

| Species introduced | Classification | Justification for use | Adverse effects and mitigation |
|---|---|---|---|
| *Dialium platysepalum* | Native | NA | NA |
| *Dyera costulata* | Native | NA | NA |
| *Koompassia malaccensis* | Native | NA | NA |
| *Neolamarckia cadamba* | Native | NA | NA |
| *Nephelium lappaceum* | Native | NA | NA |
| *Pentaspadon motleyi* | Native | NA | NA |
| *Peronema canescens* | Native | NA | NA |
| *Shorea balangeran* | Native | NA | NA |
| *Shorea teysmanniana* | Native | NA | NA |
| *Stemonurus scorpioides* | Native | NA | NA |
| *Stemonurus secundiflorus* | Native | NA | NA |
| *Syzygium acuminatissimum* | Native | NA | NA |
| *Syzygium napiforme* | Native | NA | NA |
| *Syzygium nervosum* | Native | NA | NA |

### 5.1.6 Invasive Species (VCS, 3.19; CCB, B2.5)

The project did not introduce any invasive species to the 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 the species used in enrichment planting activities are already found naturally growing in the project area. During this monitoring period, 10,380 native tree species seedlings (3,390 in 2022 and 6,450 in 2023) were planted as part of enrichment planting activities that aim to boost the assisted natural regeneration of vegetation already occurring in the project area (see Annex 19).

### 5.1.7 GMO Exclusion (CCB, B2.7)

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

### 5.1.8 Inputs Justification (VCS, 3.19; CCB, 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 and Mitigation Actions (CCB, B3.1, 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. Potential negative impacts of project activities on biodiversity in the future, which may impact offsite biodiversity and their associated mitigation actions, are outlined in sections Section 5.1.2 and Section 5.1.3.

Potential negative impacts on biodiversity occurring offsite because of project activities that may have indirectly occurred during this monitoring period are outlined in Table 77 below.

**Table 71. Negative offsite biodiversity impacts and mitigation measures.**

| Negative offsite impact | Mitigation measure(s) |
|---|---|
| Certain populations of fish now living in man-made canals may have their lifecycles, feeding strategies, and mating strategies negatively affected, and their canal habitats fragmented by canal dam construction and maintenance. | Certain fish species use the canals in the project area for at least part of their lifecycle, but their ecology is poorly understood. Thus, taking mitigation measures against the potential negative impacts of canal dam construction on these species is difficult. The canal dams constructed in the project area have the potential to fragment the canal ecosystem during dryer months and impact both onsite and offsite fish species. The canals were man-made and not a natural ecosystem. Species often rely on flooded peatlands with high WTL for use as nurseries and ecological corridors. Hydrological restoration, i.e., raising the WTL to its natural state and the more regular long-term inundation of the peat means that the area now better resembles a natural peatland, which should improve habitat quality and quantity for native fish species. Similarly, the canal dams are 200 m to 1,000 m apart (depending on the slope of the land), which should provide ample habitat for these species to persist in the short- to medium-term. Additionally, the return of riparian vegetation to canals should gradually improve the health of the wetland ecosystem. Furthermore, the dams are constructed with natural spillways allowing fish passage between dams when water levels are high. Any potential net negative offsite impacts on the canal-living fish species will be more than offset by the benefits of blocking the canals for the wider peatland ecosystem (particularly terrestrial species), meaning that project activities should continue to result in clear net biodiversity benefits, both onsite and offsite. |

### 5.2.2 Net Offsite Biodiversity Benefits (VCS, 3.19; CCB, B3.3)

See sections Section 5.1.3 and Section 5.2.1 for an overview of the net biodiversity benefits from project activities. In the current monitoring period, these benefits are already evident within the project. As none of the potential, albeit negligible, negative biodiversity impacts require mitigation at this stage of the project, the net effect of the project on offsite biodiversity during this monitoring period is positive and should remain positive for the remainder of the project.

## 5.3 Biodiversity Impact Monitoring

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

During this monitoring period, the project continued implementing the biodiversity monitoring plan based on the causal model for maintained or enhanced biodiversity in the project area (see Figure 4). This targeted causal model for biodiversity supports implementing the biodiversity monitoring plan described in the Project Document with no deviation from the validated monitoring plan. Key

activities conducted during this monitoring period on biodiversity monitoring, include:

- Camera trap surveys to monitor mammal species
- Point transect surveys to monitor bird species
- Vegetation plot surveys conducted at multiple project locations
- Management of all data collected across all methods

Table 4 below provides a summary of the biodiversity monitoring activities carried out during this monitoring period. The results for each type of biodiversity monitoring are discussed in more detail in the following subsections.

This monitoring period used standardized, repeatable survey methods. This allowed the project to derive early estimates of species diversity and abundance for some species. The ability of longitudinal data to detect change for other species will improve with time when important long-term patterns may become detectable. It is also important to note that ecological succession patterns in tropical peatlands undergoing assisted natural regeneration are often sporadic, particularly concerning fauna.

**Table 72. Summary of biodiversity monitoring.**

| No. | Monitoring type | Observation method | Target species & HCVs | Sampling method & frequency | Sampling date(s) | Analysis type | Biodiversity variable(s) measured |
|---|---|---|---|---|---|---|---|
| 1 | Camera Trap Surveys | Direct Monitoring | Mostly medium-to-large sized mammals<br><br>(HCV 1 - Species Diversity) | 2022:<br>• 30 camera trap stations were surveyed during the wet season and 29 during the dry season (due to the loss of one camera trap unit).<br>• Camera trap stations were chosen for accessibility from project area guard posts, potential suitability as mammal walkways, and proximity to focal species spoors, e.g., sun bear/tiger tracks.<br>• Each camera station was surveyed for an average of 66 days (the target was 60 days each).<br><br>2023:<br>• 25 camera trap stations were surveyed during the | 2022: February to July, and October to December; 2023: October to December | Species richness - evenness; RAI; Species presence | Mammal species diversity metrics<br>Mammal trigger species<br>Relative Abundance Index |

| No. | Monitoring type | Observation method | Target species & HCVs | Sampling method & frequency | Sampling date(s) | Analysis type | Biodiversity variable(s) measured |
|---|---|---|---|---|---|---|---|
| | | | | wet season only (but only 21 were operational for the deployment).<br>• Camera trap stations were chosen for accessibility from project area guard posts, potential suitability as mammal walkways, and proximity to focal species spoors, e.g., sun bear/tiger tracks.<br>• Each camera station was surveyed for an average of 68 days (the target was 60 days each). | | | |
| | | | | | | | Mammal trigger species<br>Naïve Occupancy |
| 2 | Point Count Transect Surveys | Direct Monitoring | Birds<br><br>(HCV 1 - Species Diversity) | • Six 1-km-long point transects were surveyed.<br>• Each point transect had five point transect counting stations/points spaced 250 m apart (a total of 30 counting stations). | 2022: January to April, and August to October; 2023: February to March, and December | Species richness - evenness; Distance Sampling | Bird species diversity metrics |

| No. | Monitoring type | Observation method | Target species & HCVs | Sampling method & frequency | Sampling date(s) | Analysis type | Biodiversity variable(s) measured |
|---|---|---|---|---|---|---|---|
| | | | | • Two five-minute counts were performed at each transect station, once in the morning and once in the evening (a total of 60 counts).<br><br>• In 2022 all six transects were surveyed twice, once in the wet season and once in the dry season. The total of 120 five-minute counts was equally distributed across morning and evening).<br>• In February and March 2023 only two transects were surveyed due to sudden staff turnover. In December 2023 all six transects were surveyed. The total of 80 five-minute counts was equally distributed across morning and evening. | | | Bird trigger species densities |

| No. | Monitoring type | Observation method | Target species & HCVs | Sampling method & frequency | Sampling date(s) | Analysis type | Biodiversity variable(s) measured |
|---|---|---|---|---|---|---|---|
| 3 | Vegetation Plot Surveys | Direct Monitoring | Plants (especially tree flora)<br><br>(HCV 1 – Species Diversity;<br>HCV 3 - Ecosystems & Habitats) | • 24 permanent, nested vegetation plots along 6 transects (i.e., 4 nested vegetation plots on each of the 6 transects) were marked and surveyed annually<br>• The 4 nested plots are spaced at 0, 100, 400, and 700 m along each transect.<br>• Using predetermined DBH and height categories, all mature trees in the 32 m x 32 m plot, all poles in the 16 m x 16 m subplot, all saplings in the 8 m x 8 m subplot, and all seedlings in the 2 m x 2 m subplot were counted and identified to species level where possible.<br>• % fern cover and % shrub cover were estimated for each 8 m x 8 m subplot, | 2022: September to October;<br>2023: December | Species richness - evenness;<br>Nested Plot Sampling | Plant species diversity metrics |
| | | | | | | | Density of trees by tree age class |
| | | | | | | | Average fern cover & average shrub cover |
| | | | | | | | Density of tree |

| No. | Monitoring type | Observation method | Target species & HCVs | Sampling method & frequency | Sampling date(s) | Analysis type | Biodiversity variable(s) measured |
|---|---|---|---|---|---|---|---|
| | | | | and verified with an aerial photograph taken from a drone where possible.<br>• All the above was completed once in 2022 and once in 2023. | | | trigger species by tree maturity category |
| 4 | Fire Incidence | Indirect Monitoring | All species<br><br>(HCV 1 – Species Diversity;<br>HCV 3 – Ecosystems & Habitats) | Fire incidence in the project area was monitored using a mix of daily regular patrols, scanning the horizon from strategically placed 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 satellites orbiting earth. Infared "SmokeD" fire sensing cameras were installed at the main SMPP camp facing areas with the most historical hotspots. | Daily, annually | Fire hotspot maps and counts | No. and location of fire hotspots in the project area and project zone |

| No. | Monitoring type | Observation method | Target species & HCVs | Sampling method & frequency | Sampling date(s) | Analysis type | Biodiversity variable(s) measured |
|---|---|---|---|---|---|---|---|
| 5 | Hydrology | Indirect Monitoring | All species<br><br>(HCV 1 – Species Diversity; HCV 3 – Ecosystems & Habitats) | The hydrology of the project area was monitored using dipwells to measure water table depth, and rainfall gauges to measure rainfall. Canal dams were also monitored to ensure the integrity of the hydrological conditions. | Daily, monthly, annually | Hydrological monitoring and hydrological restoration interventions monitoring | No. and location of canal dams constructed (inclusion of variable pending further data collection after the effects of recent rainfall-inducing La Niña events subside)<br><br>Water-table level in the project area |
| 6 | Land Cover Analysis | Indirect Monitoring | All species<br><br>(HCV 1 – Species Diversity; HCV 3 – Ecosystems & Habitats) | Annual land cover analysis was performed on data sourced from cloud-free satellite data mosaics over the project area generated from optical data from Sentinel-1, Sentinel-2, Synthetic Aperture Radar (SAR), and ALOS-2/PALSAR-2 satellites when it becomes available for the entire previous year. The data source may change if more | Annually | Remote sensing GIS data land cover analysis | Secondary forest and closed canopy land cover in the project area |

| No. | Monitoring type | Observation method | Target species & HCVs | Sampling method & frequency | Sampling date(s) | Analysis type | Biodiversity variable(s) measured |
|---|---|---|---|---|---|---|---|
| | | | | useful or suitable data becomes available as technology and/or best practice progresses. | | | |
| 7 | Patrols | Indirect Monitoring | All species<br><br>(HCV 1 – Species Diversity; HCV 3 – Ecosystems & Habitats) | • Patrols are performed daily on foot, by car, or by boat on established patrolling routes.<br>• All incidents of illegal natural resource exploitation will be recorded and reported to local authorities as necessary.<br>• EarthRanger patrol management software and mobile applications have been introduced to standardize and ease patrol result reporting | Daily, annually | Patrol & Illegal incident counts | No. of illegal hunting incidents<br><br>No. of illegal logging incidents<br><br>No. of NTFP overexploitation incidents |

## Point Transect Surveys

Point transect surveys were designed following Sutherland (2006) and Buckland et al. (2008).[39,40] Across six-point transects (see Map 13), 2,937 individuals (1,902 in 2022 and 1,035 in 2023) were recorded during this monitoring period, with 74 species recorded in 2022 and 63 species recorded in 2023.

A total of 19 new species were recorded for the first time during this monitoring period (seven in 2022 and 12 in 2023), with five trigger species recorded in 2022 and three trigger species recorded in 2023 (see Table 5). One observation of particular note was the second record of a wrinkled hornbill (*Rhabdotorrhinus corrugatus*) in the project area, a species listed as Endangered (EN) on the IUCN RED List[41] and endemic to the Sundaland Bioregion. Several other Vulnerable (VU) species were also recorded during this monitoring period, such as the Rhinoceros Hornbill (*Buceros rhinoceros*) and the Long-Tailed Parakeet (*Belocercus longicaudus*).

If bird species recorded opportunistically outside of point transect surveys are included, a total of 145 bird species have now been recorded in the project area (see Annex 20 for the full species inventory).

**Map 13. Map of project area showing the location of point count transects during this monitoring period.**

**Table 73. Summary of biodiversity metrics assessed for bird species surveyed in point transect surveys.**

| No. | Biodiversity metric | Metric type | Year | | | |
|---|---|---|---|---|---|---|
| | | | 2020 | 2021 | 2022 | 2023 |
| 1 | Total no. of species recorded in the project area (S) | Species Richness | 71 | 84 | 74 | 63 |
| 2 | (of which were first records of a given species) | Species Richness | 71 | 27 | 7 | 12 |
| 3 | (of which were trigger species) | Species Richness | 3 | 4 | 5 | 3 |
| 4 | Total no. of individuals across all species recorded in the project area (N) | Species Abundance | 1,406 | 1,972 | 1,902 | 1,035 |
| 5 | Margalef's Species Richness Index (DMg) | Species Richness Index | 9.66 | 10.94 | 9.67 | 8.93 |
| 6 | Shannon's Equitability (or Species Evenness) (E) | Species Evenness Index | 0.72 | 0.71 | 0.74 | 0.74 |
| 7 | Simpson's Index of Diversity (1-D or Ds) | Species Richness-Evenness Index | 0.91 | 0.92 | 0.93 | 0.92 |
| 8 | Shannon-Wiener Diversity Index (H') | Species Richness-Evenness Index | 3.08 | 3.16 | 3.2 | 3.06 |
| 9 | Effective Number of Species (ENS)(converted from H') | Species Richness-Evenness Index | 21.68 | 23.53 | 24.59 | 21.41 |
| 10 | % change in ENS since previous monitoring period | % change | - | 8.54 | 4.48 | (12.9) |
| 11 | % change in ENS since first monitoring period | % change | - | 8.54 | 13.4 | (1.24) |

Before discussing the results of this monitoring period, it's important to note that there was a lower sampling effort in 2023 compared to previous years due to unexpected staff turnover. All of the diversity metrics used for bird species monitoring are sensitive to sampling effort, so the lower values recorded in the second year, 2023, of this monitoring period, are likely showing a false diversity decrease or an exaggerated decrease.

It's also important to note there is a significantly lower number of trigger species discussed in this monitoring period compared to previous monitoring periods. This is not due to any loss of trigger species in the project area, but rather due to a correction in the definition of 'trigger species.' Previously, all species that were globally threatened on the IUCN Red List and all species that were endemic to the Sundaland Bioregion were identified as trigger species. Now, only those that are globally threatened on the IUCN Red List are defined as trigger species for reporting purposes.

All the metrics included in Table 5 are metrics of biodiversity adapted from Magurran (2004).[42] Some of these metrics use species richness to measure diversity, while others use evenness, and some use both (see Annex 22 for additional details on the metrics).

Margalef's Species Richness Index ($D_{Mg}$) is a measure of species richness that aims to compensate for differences in sampling effort. It is most useful when comparing between sampling periods or sites rather than for use as a standalone metric of true diversity. When comparing this monitoring period to the previous monitoring period, there was a decrease in the total number of species recorded and a decrease in $D_{Mg}$, but these metrics were higher for 2022 than in the first monitoring period.

Shannon's Equitability (or Species Evenness) (*E*) is a measure of species evenness. The results from this monitoring period suggest moderate to high evenness is being maintained across bird species in the area despite some notably higher abundances recorded for certain species, e.g., *Collocalia linchi, Prinia flaviventris, Pycnonotus goiavier*, and *Treron vernans*. Some of these larger abundances may be explained by variations in spatial and temporal flocking behavior in birds, which can result in very large counts of the same species during brief point counts.

The Simpson's Index of Diversity (Ds) of 0.93 in 2022 and 0.92 in 2023 recorded for this monitoring period suggest low dominance, high evenness, and high diversity in the project area, despite the high relative abundances for some species mentioned above. A Shannon-Wiener Diversity Index (H') of 3.20 and an Effective Number of Species (E) of 24.59 for 2022 suggests that bird species diversity in the project area has improved since previous monitoring periods. The lower and values recorded in 2023 are likely false decreases in diversity due to lower sampling effort. The onset of an El Niño event starting in mid-2023 may also have played a role in lowering 2023 diversity values, as some species may be negatively affected by the increased heat and reduced rainfall that El Niño events bring.

In 2022 all of the five observed trigger species were recorded within 25 meters of the observer conducting the point transect surveys. In 2023, two of the five observed trigger species were recorded within 25 meters of the observer. In total, six of the eight trigger species occurring in the project area have now been recorded at least once within 25 meters of the observer during point transect surveys. Using the 'Point Count Fixed-Radius Formula',[40] the density of individuals per ha was estimated for each of these species (see Table 9).

**Table 74. Density of bird trigger species in individuals per ha.**

| No. | Bird trigger species (scientific name (common name)) | Density of individuals per ha | | | |
|---|---|---|---|---|---|
| | | 2020 | 2021 | 2022 | 2023 |
| 1 | *Acridotheres javanicus* (Javan Myna) | - | 0.51 | 0.68 | - |
| 2 | *Belocercus longicaudus* (Long-Tailed Parakeet) | 0.17 | 0.17 | 0.34 | 1.19 |
| 3 | *Buceros rhinoceros* (Rhinoceros Hornbill) | - | - | 0.34 | - |
| 4 | *Lophura erythrophthalma* (Malay Crestless Fireback) | - | - | - | - |
| 5 | *Nisaetus nanus* (Wallace's Hawk-Eagle) | - | - | - | - |
| 6 | *Rhabdotorrhinus corrugatus* (Wrinkled Hornbill) | 0.68 | 0.34 | 0.17 | - |
| 7 | *Setornis criniger* (Hook-Billed Bulbul) | - | - | 0.17 | - |
| 8 | *Treron fulvicollis* (Cinnamon-Headed Green Pigeon) | NTS | NTS | - | 0.17 |

*NTS - Non-Trigger Species*

The population trends of these trigger species and the actions taken to maintain or enhance their population status and reduce threats to them are described in more detail in Table 80 of this report.

**Vegetation Plot Surveys**

Before discussing the results of this monitoring period, it's important to note that there is a significantly lower number of trigger species discussed in this monitoring period compared to previous monitoring periods. This is not due to any loss of trigger species in the project area, but rather due to a correction in the definition of 'trigger species'. Previously, all species that were globally threatened on the IUCN Red List and all species that were endemic to the Sundaland Bioregion were identified as trigger species. Now, only those that are globally threatened on the IUCN Red List are defined as trigger species for reporting purposes.

The vegetation plot survey design was adapted from Graham et al (2014).[43] Across 24 nested vegetation plots on six transects (see Map 15), there were were 473 individual trees recorded across 57 tree species in 2022 (including three newly recorded species and six trigger species) and 600 individual trees recorded across 58 tree species in 2023 (including seven newly recorded species and seven trigger species (see Table 12). Some observations of note include *Gonystylus bancana* (Ramin) and *Shorea teysmanniana* which are listed as CR on the IUCN Red List and *Shorea uliginosa* (Meranti kelungkum) which is listed as EN on the IUCN Red List, with all species being endemic to the Sundaland Bioregion.

If tree species recorded opportunistically outside of plot surveys are included, a total of 136 tree species have now been recorded in the project area, 14 of which are trigger species (see Annex 20 for the full species inventory).

**Map 14. Map of project area showing the location of transects with nested vegetation plots during this monitoring period**

**Table 75. Summary of biodiversity metrics assessed for tree species surveyed in nested vegetation plot surveys.**

| No. | Biodiversity metric | Metric type | Year | | | |
|---|---|---|---|---|---|---|
| | | | 2020 | 2021 | 2022 | 2023 |
| 1 | Total no. of species recorded in the project area (S) | Species Richness | 48 | 54 | 57 | 58 |

| No. | Biodiversity metric | Metric type | Year | | | |
|---|---|---|---|---|---|---|
| | | | 2020 | 2021 | 2022 | 2023 |
| 2 | (of which were first records of a given species) | Species Richness | 48 | 18 | 3 | 7 |
| 3 | (of which were trigger species) | Species Richness | 7 | 9 | 9 | 7 |
| 4 | Total no. of individuals across all species recorded in the project area (N) | Species Abundance | 289 | 476 | 473 | 600 |
| 5 | Margalef's Species Richness Index (DMg) | Species Richness Index | 8.29 | 8.6 | 9.09 | 8.91 |
| 6 | Shannon's Equitability (or Species Evenness) (E) | Species Evenness Index | 0.68 | 0.68 | 0.65 | 0.64 |
| 7 | Simpson's Index of Diversity (1-D or Ds) | Species Richness-Evenness Index | 0.85 | 0.86 | 0.84 | 0.84 |
| 8 | Shannon-Wiener Diversity Index (H') | Species Richness-Evenness Index | 2.65 | 2.7 | 2.64 | 2.6 |
| 9 | Effective Number of Species (ENS)(converted from H') | Species Richness-Evenness Index | 14.13 | 14.81 | 14.03 | 13.41 |
| 10 | % change in ENS since previous monitoring period | % change | - | 4.84 | (5.29) | (4.38) |
| 11 | % change in ENS since first monitoring period | % change | - | 4.84 | (0.71) | (5.05) |

Tree species diversity (as measured by *H'*, $D_S$, and *ENS*) marginally decreased overall in this monitoring period compared to the previous monitoring period and still appears to be relatively low in the SMPP project area (see Table 12 for a range of plant species diversity metrics). However, metrics of species richness (e.g., $D_{Mg}$) generally increased during this monitoring period, so the marginal decline in species diversity seems to be driven by a marginal decline in species evenness (e.g., *E*).

Much of this lack of evenness is caused by a few tree species dominating large areas of the project area. Most tree species are only represented by a handful of individuals, with a small number of pioneer species, e.g., *Macaranga pruinosa* and *Melicope lunu-ankenda*, being notably more abundant during this and previous monitoring periods.

However, these dominant species may play a key role in shading out the ferns that so often dominate and outcompete tree seedlings in heavily degraded peatlands and facilitate the growth of more tree species in the future. Indeed, fern and shrub cover seem to have declined within the vegetation plots but is still very high (see Table 11).

There was an increase in the density of trees across all tree age classes during this monitoring period, except for saplings, which may be an indicator that some trees are struggling to make it past the seedling stage in certain areas and may need some targeted inventions such as fern clearing and/or increased direct planting from tree nurseries (such interventions are not done inside the monitoring plots themselves, ensuring future data objectivity).

Similarly to the previous monitoring period, individuals from younger tree age classes (saplings and seedlings) were present at a much higher density than those from older tree age classes (poles and trees, see Table 11), which indicates expected early ecological succession and regeneration processes. Data collected in subsequent monitoring periods may more clearly support this early

evidence of ecological succession leading to increased diversity in the project area.

**Table 76. Density of individuals per ha of each tree age class, and average fern cover (%) and average shrub cover (%).**

| No. | Year | Tree age class density / ha | | | | Avg. fern cover % | Avg. shrub cover % |
|---|---|---|---|---|---|---|---|
| | | Tree | Pole | Sapling | Seedling | | |
| 1 | 2020 | 24 | 176 | 586 | 3,333 | 75 | 24 |
| 2 | 2021 | 41 | 182 | 1,348 | 5,521 | 67 | 13 |
| 3 | 2022 | 59 | 189 | 1,224 | 2,188 | 62 | 23 |
| 4 | 2023 | 90 | 252 | 964 | 6,875 | 57 | 9 |

Table 10 shows abundance and density data for each tree age class for each of the 14 trigger species identified in the project area, seven of which were recorded in vegetation plots in 2022 and six of which were recorded in 2023. The actions taken to maintain or enhance their populations and mitigate threats are described in more detail in Table 80 and Section 5.4.1 of this report.

**Table 77. Tree trigger species abundance and density per hectare (ha) for each tree age class for all trigger species observed during vegetation plots.**

| No. | Tree trigger species | Tree age class | Abundance | | | | Density/ha | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2020 | 2021 | 2022 | 2023 | 2020 | 2021 | 2022 | 2023 |
| 1 | *Anisoptera marginata* | All | - | - | - | - | - | - | - | - |
| 2 | *Aquilaria malaccensis* | All | - | - | - | - | - | - | - | - |
| 3 | *Aquilaria microcarpa* | All | - | - | - | - | - | - | - | - |
| 4 | *Cantleya corniculata* | All | - | - | - | - | - | - | - | - |
| 5 | | Tree | 1 | 1 | 1 | 1 | 0.41 | 0.41 | 0.41 | 0.41 |
| | | Pole | - | - | - | 1 | - | - | - | 1.63 |
| | | Sapling | - | 1 | 1 | - | - | 6.51 | 6.51 | - |
| | | Seedling | - | - | - | - | - | - | - | - |
| 6 | *Dyera polyphylla* | Tree | 2 | 2 | 2 | 1 | 0.81 | 0.81 | 0.81 | 0.41 |
| | | Pole | - | - | - | - | - | - | - | - |
| | | Sapling | - | - | - | - | - | - | - | - |
| | | Seedling | - | - | - | - | - | - | - | - |
| 7 | *Gonystylus bancanus* | Tree | - | - | - | 1 | - | - | - | 0.41 |
| | | Pole | - | - | - | - | - | - | - | - |
| | | Sapling | 1 | 1 | 1 | - | 6.51 | 6.51 | 6.51 | - |
| | | Seedling | - | - | - | - | - | - | - | - |
| 8 | *Shorea balangeran* | All | - | - | - | - | - | - | - | - |
| 9 | *Shorea dasyphylla* | Tree | 1 | 1 | 1 | NTS | 0.41 | 0.41 | 0.41 | NTS |
| | | Pole | - | - | - | NTS | - | - | - | NTS |
| | | Sapling | - | - | - | NTS | - | - | - | NTS |
| | | Seedling | - | - | - | NTS | - | - | - | NTS |
| 10 | *Shorea platycarpa* | All | - | - | - | - | - | - | - | - |
| | | Tree | 2 | 2 | 2 | 2 | 0.81 | 0.81 | 0.81 | 0.81 |

| No. | Tree trigger species | Tree age class | Abundance | | | | Density/ha | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2020 | 2021 | 2022 | 2023 | 2020 | 2021 | 2022 | 2023 |
| 11 | *Shorea teysmanniana* | Pole | - | - | - | - | - | - | - | - |
| | | Sapling | - | - | - | 2 | - | - | - | 13.02 |
| | | Seedling | - | - | - | - | - | - | - | - |
| 12 | *Shorea uliginosa* | Tree | - | 1 | 1 | 1 | - | 0.41 | 0.41 | 0.41 |
| | | Pole | 1 | - | - | - | 1.63 | - | - | - |
| | | Sapling | - | - | - | - | - | - | - | - |
| | | Seedling | - | - | - | - | - | - | - | - |
| 13 | *Sindora bruggemanii* | Tree | - | - | - | 1 | - | - | - | 0.41 |
| | | Pole | - | 1 | 1 | - | - | 1.63 | 1.63 | - |
| | | Sapling | - | 4 | 4 | - | - | 26.04 | 26.04 | - |
| | | Seedling | - | - | - | 4 | - | - | - | 416.67 |
| 14 | *Tetramerista glabra* | Tree | 2 | 2 | 2 | 2 | 0.81 | 0.81 | 0.81 | 0.81 |
| | | Pole | - | - | - | 1 | - | - | - | 1.63 |
| | | Sapling | 1 | 1 | 1 | 2 | 6.51 | 6.51 | 6.51 | 13.02 |
| | | Seedling | - | - | - | - | - | - | - | - |
| 15 | *Vatica venulosa* | Tree | - | 1 | 1 | - | - | 0.41 | 0.41 | - |
| | | Pole | - | 1 | 1 | - | - | 1.63 | 1.63 | - |
| | | Sapling | - | 3 | 3 | - | - | 19.53 | 19.53 | - |
| | | Seedling | - | - | - | - | - | - | - | - |

**Camera Trap Surveys**

Before discussing the results of this monitoring period, it's important to note that there was a lower sampling effort in 2023 compared to previous years due to unexpected staff turnover. All of the diversity metrics used for mammal species monitoring are sensitive to sampling effort, so the lower values recorded in the second year of this monitoring period are likely showing a false or exaggerated decrease in diversity.

It's also important to note there is a significantly lower number of trigger species appearing in this monitoring period compared to previous monitoring periods. This is not due to any loss of trigger species in the project area, but rather due to a correction in the definition of trigger species. Previously, all species that were globally threatened on the IUCN Red List and all species that were endemic to the Sundaland Bioregion were identified as trigger species. Now, only those that are globally threatened on the IUCN Red List are defined as trigger species for reporting purposes.

Camera trap surveys were conducted to assess mammal diversity and population trends in the project area. While certain reptile and bird species can be captured on the camera traps, the camera trap surveys were designed to capture mammal species, mostly medium to large-sized mammals that are likely to use game trails. Certain mammal species are likely to go under-detected or undetected (e.g., highly arboreal species and small species).

Medium to large-sized mammals are often indicators of hunting pressures, food resource availability, and overall ecosystem functioning. The presence of mammalian apex predators such as tigers can indicate an abundance of prey species and the potential for increased species diversity as predators keep prey species abundances relatively even.

In 2022, 30 camera trap units were deployed across 59 camera trap stations (30 stations surveyed in the wet season and 29 of the same stations surveyed in the dry season; see Map 14). These camera traps recorded 905 individuals across 18 mammal species (three of which were recorded for the first time).

In 2023, 25 camera trap units were deployed across 25 camera trap stations in the wet season (see Map 14), but only 21 were operational for the full deployment due to technical issues. These camera traps recorded 431 individuals across 21 mammal species (six of which were recorded for the first time).

If mammal species recorded opportunistically outside of point transect surveys are included, a total of 44 mammal species have now been recorded in the project area (see Annex 20 for the full species inventory).

**Map 15. Map of project area showing camera traps surveyed during this monitoring period**

Despite a lower sampling effort in 2023, this monitoring period showed an increase in both the total number of species recorded and an increase in *DMg* compared to previous monitoring periods (see Table 7). While species evenness, as measured by *E*, did increase in 2022 and fell back in 2023, overall species diversity as measured by *H'*, $D_S$, and *ENS* did show a general upward trend (with a small decrease in 2023) compared to the previous monitoring period.

In a heavily disturbed, newly regenerating area such as the SMPP, low to moderate mammal species

richness is expected. Moderate to low mammal species evenness is also expected with some hardy, generalist, omnivorous mammal species, such as macaques (*Macaca fascicularis* and *Macaca nemestrina*) and Sambar deer (*Rusa unicolor*) more likely to thrive in such heavily disturbed habitats. Indeed, these species were more abundantly captured on camera traps than many of the other mammal species occurring in the project area.

Overall, the trend for mammal species diversity in the project area appears to be an increasingly clear positive trend, but more long-term data will be needed to ascertain how strong this trend is.

**Table 78. Summary of biodiversity metrics assessed for mammal species surveyed in camera trap surveys.**

| No. | Biodiversity metric | Metric type | Year | | | |
|---|---|---|---|---|---|---|
| | | | 2020 | 2021 | 2022 | 2023 |
| 1 | Total no. of species recorded in the project area (S) | Species Richness | 18 | 18 | 18 | 21 |
| 2 | (of which were first records of a given species) | Species Richness | 18 | 4 | 3 | 6 |
| 3 | (of which were trigger species) | Species Richness | 5 | 5 | 8 | 6 |
| 4 | Total no. of individuals across all species recorded in the project area (N) | Species Abundance | 323 | 1,191 | 905 | 431 |
| 5 | Margalef's Species Richness Index (DMg) | Species Richness Index | 2.94 | 2.4 | 2.5 | 3.3 |
| 6 | Shannon's Equitability (or Species Evenness) (E) | Species Evenness Index | 0.71 | 0.67 | 0.75 | 0.7 |
| 7 | Simpson's Index of Diversity (1-D or Ds) | Species Richness-Evenness Index | 0.81 | 0.8 | 0.85 | 0.81 |
| 8 | Shannon-Wiener Diversity Index (H') | Species Richness-Evenness Index | 2.04 | 1.94 | 2.16 | 2.14 |
| 9 | Effective Number of Species (ENS)(converted from H') | Species Richness-Evenness Index | 7.69 | 6.98 | 8.7 | 8.5 |
| 10 | % change in ENS since previous monitoring period | % change | - | (9.25) | 24.59 | (2.33) |
| 11 | % change in ENS since first monitoring period | % change | - | (9.25) | 13.07 | 10.43 |

Camera trap surveys are a powerful tool for assessing mammal diversity and population trends in a non-invasive way. They can cover large areas with relatively little effort and detect species that are likely to actively avoid human observers. Despite these obvious benefits, camera traps do suffer from unpredictable detection rates, and analyses that can be used to account for imperfect detection and derive accurate estimates of species abundance are somewhat limited. The two species abundance estimates presented here for mammal trigger species (see Table 8) use the Relative Abundances Index (*RAI*, equation below)[44] and Naïve Occupancy.[45] They do not account for imperfect detection or model for factors that may influence detectability but are still useful as rough estimates of species abundance trends.

The *RAI* is the number of independent images of a focal species per 100 camera trap days of sampling effort. As it is often correlated with species abundance and density, it is often used as a proxy for these population estimate metrics. It is essentially a measure of relative abundance adjusted for sampling effort, and this adjustment makes it useful for comparing abundance over

space and time where sampling efforts are often different. However, caution should be taken when using RAI to estimate species population trends as it does not account for differences in detectability arising from variations in camera trap sites, species behavior, or physical characteristics.[46]

$$RAI = \frac{n_i}{\sum \mathrm{TN}} \times 100 \quad (28)$$

Where:

| | |
|---|---|
| $RAI$ | Relative Abundance Index per 100 trap days |
| $n_i$ | Number of independent images for species i |
| $\sum \mathrm{TN}$ | Number of active camera trap days |

Occupancy is defined as the proportion of sampling units (i.e., camera trap stations) that are occupied by a particular species, on a scale of 0 to 1. It measures species presence as the probability that a randomly selected sampling unit in an area of interest is occupied by at least one individual of a particular species. This probability of presence estimate is often used as a proxy for abundance. Inference from occupancy data is most powerful when factors affecting detection probability are included in the statistical model. When detection probability factors are not included in the model, the occupancy estimate is referred to as Naïve Occupancy. Table 8 shows RAI values and the Naïve Occupancy values for each of the 12 mammal trigger species identified during this monitoring period. The population trends of these trigger species and the actions taken to maintain or enhance their population status and reduce threats to them are described in more detail in Table 80 and Section 5.4.1 of this report.

**Table 79. Relative Abundance Index (RAI) and Naïve Occupancy by year for each of the mammal trigger species recorded in the project area.**

| No. | Order | Mammal trigger species name (scientific (common)) | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | RAI | | | | Naive occupancy | | | |
| | | | 2020 | 2021 | 2022 | 2023 | 2020 | 2021 | 2022 | 2023 |
| 1 | Carnivora | *Helarctos malayanus* (Sun Bear) | 3.91 | 3.74 | 3.71 | 2.47 | 0.59 | 0.68 | 0.64 | 0.57 |
| 2 | Primata | *Hylobates agilis* (Agile Gibbon) | - | - | - | - | - | - | - | - |
| 3 | Carnivora | *Lutrogale perspicillata* (Smooth-Coated Otter) | - | - | - | - | - | - | - | - |
| 4 | Primata | *Macaca fascicularis* (Long-Tailed Macaque) | NTS | NTS | 3.37 | 2.67 | NTS | NTS | 0.4 | 0.38 |
| 5 | Primata | *Macaca nemestrina* (Southern Pig-Tailed Macaque) | 8.88 | 11.1 | 6.36 | 11.45 | 0.73 | 0.63 | 0.57 | 0.76 |
| 6 | Pholidota | *Manis javanica* (Sunda Pangolin) | - | - | - | - | - | - | - | - |
| 7 | Carnivora | *Neofelis diardi* (Sunda Clouded Leopard) | - | - | 0.03 | - | - | - | 0.02 | |
| 8 | Carnivora | *Panthera tigris sumatrae* (Sumatran Tiger) | 0.49 | | 0.05 | 0.07 | 0.23 | | 0.03 | 0.05 |

| No. | Order | Mammal trigger species name (scientific (common)) | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | RAI | | | | Naive occupancy | | | |
| | | | 2020 | 2021 | 2022 | 2023 | 2020 | 2021 | 2022 | 2023 |
| 9 | Primata | *Presbytis mitrata* (Southern Mitered Langur) | - | 0.41 | 0.29 | - | - | 0.1 | 0.09 | |
| 10 | Carnivora | *Prionailurus planiceps* (Flat-Headed Cat) | - | - | 0.03 | 0.07 | - | - | 0.02 | 0.05 |
| 11 | Chiroptera | *Pteropus vampyrus* (Large Flying Fox) | NTS | NTS | - | - | NTS | NTS | - | - |
| 12 | Artiodactyla | *Rusa unicolor* (Sambar) | 0.65 | 1.38 | 2.39 | 2.74 | 0.18 | 0.39 | 0.31 | 0.57 |
| 13 | Artiodactyla | *Sus barbatus* (Bearded Pig) | 0.49 | 0.05 | - | - | 0.23 | 0.02 | - | - |
| 14 | Primata | *Trachypithecus cristatus* (Silvery Lutung) | NTS | NTS | - | - | NTS | NTS | - | - |

*NTS - Non-Trigger Species*

### 5.3.2 Biodiversity Monitoring Plan Dissemination (CCB, B4.3)

Each monitoring report will be made available online through the Verra Registry (https://registry.verra.org).

Both English and Bahasa Indonesia versions of the Executive Summary of the Project Description were distributed to project community members, including details of the biodiversity monitoring plan.

The Executive Summary of each Monitoring Report is 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 maintain its validation at the Gold Level based on the presence of ecologically important IUCN Red Listed species in the project area.

### 5.4.1 Trigger Species Population Trends (CCB, GL3.2, GL3.3)

A trigger species is defined as a species that 'triggers' the designation of a project zone as a Key Biodiversity Area (KBA) by exhibiting some key characteristics relating to species population status, i.e., species 'vulnerability' as determined by their IUCN Red List status,[41] or species 'irreplaceability'.[47] This project uses species 'vulnerability' characteristics to designate trigger species. The CCB Standard (Version 3.1) defines a 'vulnerability' following Langhammer et al. as outlined below.[48]

- Vulnerability – i.e., the regular occurrence of a globally threatened species (according to the IUCN Red List) in the project zone as follows:
  - Critically Endangered (CR) and Endangered (EN) species - presence of at least a single individual; or
  - Vulnerable species (VU) – presence of at least 30 individuals or 10 pairs.

There is a significantly lower number of trigger species in this monitoring period compared to previous monitoring periods. This is not due to any loss of trigger species in the project area, but rather due to correction in the definition of 'trigger species'. Previously, all species that were globally threatened on the IUCN Red List and all species that were endemic to the Sundaland Bioregion were identified as trigger species. Now only those that are globally threatened on the IUCN Red List are defined as trigger species for reporting purposes.

Other changes in the number of trigger species for the animal and plant groups listed here are the result of new species records or updated species data. Most of the data relating to potential trigger species status for each species in the project area species inventory is obtained from the following databases:

- IUCN Red List of Threatened Species (https://www.iucnredlist.org/)
- Avibase (https://avibase.bsc-eoc.org/avibase.jsp?lang=EN)
- The Reptile Database (http://www.reptile-database.org)
- Ecology Asia (https://www.ecologyasia.com/)
- Global Biodiversity Information Facility (https://www.gbif.org/)
- World Flora Online (http://www.worldfloraonline.org/)
- Kew Science Plants of the World Online (https://powo.science.kew.org/)
- The Plant List (http://www.theplantlist.org/)

By the end of this monitoring period, the project had recorded a total of 43 trigger species (including 29 faunal species, and 14 floral species), 24 of which have been recorded in standardized annual biodiversity monitoring). Trigger species recorded in the project area are summarized by taxonomic class below (see Table 80 and Annex 20 for a full list of trigger and non-trigger species):

- 14 mammals (increase of 5 species from previous monitoring period)
- 8 birds (no increase from previous monitoring period)
- 6 reptiles (no increase from previous monitoring period; not actively surveyed)
- 1 fish species (no increase from previous monitoring period; not actively surveyed)
- 14 tree species (decrease of 2 from last monitoring period due to update in taxonomic identifications)

While not all species groups are actively surveyed or directly assessed as part of the biodiversity monitoring plan, data on all species is updated in the species inventory each year whether the species is actively or opportunistically detected in the project area. Newly detected species that are recorded on patrols, as bycatch during other survey methods, or additional surveys are also added to the species inventory.

The population trends of trigger species within the project area and the actions taken to maintain or enhance the population status of these species in the project zone are discussed in the species population trends tables below. How species population trends will naturally progress for each species in a regenerating tropical peatland is still poorly understood, and while there is not yet enough data to determine any clear trends, trigger species have likely experienced net positive benefits during this monitoring period from recent project activities.

**Table 80. Project area trigger species population trends**

| | |
|---|---|
| Trigger species | Mammals (14 species):<br><br>1. *Helarctos malayanus* (Sun Bear) (VU)<br>2. *Hylobates agilis* (Agile Gibbon)* (EN)<br>3. *Lutrogale perspicillata* (Smooth-Coated Otter)* (VU)<br>4. *Macaca fascicularis* (Long-Tailed Macaque) (EN)<br>5. *Macaca nemestrina* (Southern Pig-Tailed Macaque) (EN)<br>6. *Manis javanica* (Sunda Pangolin)* (CR)<br>7. *Neofelis diardi* (Sunda Clouded Leopard) (VU)<br>8. *Panthera tigris sumatrae* (Sumatran Tiger) (CR)<br>9. *Presbytis mitrata* (Southern Mitered Langur) (VU)<br>10. *Prionailurus planiceps* (Flat-headed Cat) (EN)<br>11. *Pteropus vampyrus* (Large Flying Fox)* (EN)<br>12. *Rusa unicolor* (Sambar) (VU)<br>13. *Sus barbatus* (Bearded Pig)* (VU)<br>14. *Trachypithecus cristatus* (Silvery Lutung)* (VU)<br><br>*Species observed in the project area outside of standardized annual biodiversity monitoring surveys |
| With-project scenario | As primarily forest-dependent and regenerating forest-dependent mammal species, all the mammal trigger species listed above stand to benefit from key project activities undertaken during this and previous monitoring periods. Activities include new canal blocking and existing canal dam monitoring to restore the natural peatland water table level, fire management in and around the project area (bolstered by agreements with adjacent concessions), and enrichment planting and assisted natural regeneration.<br><br>Many of these species are at risk from hunting for the illegal wildlife trade, particularly *Panthera tigris sumatrae* (Sumatran Tiger), *Manis javanica* (Sunda pangolin), *Helarctos malayanus* (Sun Bear), and *Rusa unicolor* (Sambar). The project field team conducted roughly 779 patrols in 2022 and 1,064 in 2023 and observed no evidence of illegal hunting, with active patrols acting as a deterrent to hunting activities in the area.<br><br>During this monitoring period, 8 mammal trigger species were recorded during camera trap surveys, making it possible to estimate Relative Species Abundance (RAI) and Naïve Occupancy for these species (see Table 73). See section 5.3.1.3 of this report for more details on these species' abundance proxy measures.<br><br>Some estimates of note for this monitoring period include relatively high RAI and Naïve Occupancy estimates for *Helarctos malayanus* (Sun Bear) (RAI = 2.47-3.71; Naïve Occupancy = 0.57-0.64), *Rusa unicolor* (Sambar) (RAI = 2.37-2.74; Naïve Occupancy = 0.31-0.57), *Macaca nemestrina* (Southern Pig-Tailed Macaque) (RAI = 6.36-11.45; Naïve Occupancy = 0.57-0.76), and *Macaca fascicularis* (Long-Tailed Macaque) (RAI = 2.67-3.37; Naïve Occupancy = 0.38-0.40).<br><br>Southern pig-tailed macaques are listed as Endangered (EN) on the IUCN Red List, are endemic to the Sundaland Bioregion, and are threatened by habitat loss and hunting as pests and for the illegal wildlife trade. Sun bears, the world's smallest bears, are listed as Vulnerable (VU) on the IUCN Red List, extinct across |

| | |
|---|---|
| | most of their historical range, and are threatened by habitat loss, habitat fragmentation, and hunting for the illegal wildlife trade.<br><br>Two trigger species were recorded for the first time in camera trap surveys during this monitoring period, including the Sunda clouded leopard and the Flat-headed cat, meaning that project area is providing refuge and habitat to for at least five of the six wild cat species present in Sumatra. Only the Asiatic golden cat (*Catopuma temminckii*) has not been recorded in the project area yet.<br><br>Following the absence of the Sumatran tiger (*Panthera tigris sumatrae*) in camera trap survey data in in the last monitoring period, camera trap records of the species in both 2022 and 2023 were a welcome development. By the end of this monitoring at least three different adult males and two different adult females have been recorded using the project area since standardized annual camera trap surveys began in 2020.<br><br>The Sumatran tiger is a Critically Endangered (CR) subspecies of the Endangered tiger (*Panthera tigris*). It is the world's smallest tiger species and the world's rarest tiger subspecies with an estimated 300-400 individuals left in the wild. Tigers are apex predators whose presence can indicate an abundance of prey species and can help increase species diversity by keeping prey species abundances relatively even. The relatively high abundance of wild boar (*Sus scrofa*) as well as the occurrence of other potential prey species, such as, bearded pigs (*Sus barbatus*) and Sambar deer (*Rusa unicolor*) seem to support this hypothesis.<br><br>Protecting and restoring the project area will play a vital role in the conservation of the Sumatran tiger and may well play an important role maintaining balanced mammal diversity in the project area.<br><br>The camera trap survey data suggest that mammal trigger species diversity and population trends are at least being maintained under the with-project scenario. Some trigger species have seen marginal declines in RAI and Naïve Occupancy when compared to previous monitors, but more trigger species have been recorded in the project area than in previous monitoring periods and important to note that less camera traps were deployed in 2023 than in 2021 and 2022, and camera traps were only deployed once in 2023 rather than twice in 2021 and 2022.<br><br>While it's still not possible to draw any strong conclusions from the trends in the data yet, it may be the case that generalists and more common species are faring better than specialists and rare species at this point of the project area's regeneration. Some species, like carnivores, will typically have lower populations than the species they prey on and are more likely to have larger home ranges. The long-term impacts of project activities and ecological succession on the mammal populations in the project area will become clearer with more monitoring data in the coming years. |
| | |
| Trigger species | Birds (8 species):<br><br>1. *Acridotheres javanicus* (Javan Myna) (VU)<br>2. *Belocercus longicaudus* (Long-Tailed Parakeet) (VU)<br>3. *Buceros rhinoceros* (Rhinoceros Hornbill) (VU) |

| | |
|---|---|
| | 4. *Lophura erythrophthalma* (Malay Crestless Fireback)* (CR)<br>5. *Nisaetus nanus* (Wallace's Hawk-Eagle)* (VU)<br>6. *Rhabdotorrhinus corrugatus* (Wrinkled Hornbill) (EN)<br>7. *Setornis criniger* (Hook-Billed Bulbul) (VU)<br>8. *Treron fulvicollis* (Cinnamon-Headed Green Pigeon) (VU)<br><br>*Species observed in the project area outside of standardized annual biodiversity monitoring surveys |
| With-project scenario | As forest-dependent, regenerating forest-dependent, waterbody-dependent, and riparian zone-dependent bird species, all bird trigger species listed above stand to benefit from key project activities undertaken during this and previous monitoring periods. These activities include new canal blocking and existing canal dam monitoring to restore the natural peatland water table, fire management in and around the project area (bolstered by agreements with adjacent concessions), and enrichment planting and assisted natural regeneration.<br><br>Several of these species are at risk from hunting for the illegal wildlife trade, for example, *Psittacula longicauda* (Long-Tailed Parakeet), *Lophura erythrophthalma* (Malay Crestless Fireback), *Buceros rhinoceros* (Rhinoceros Hornbill), *Rhabdotorrhinus corrugatus* (Wrinkled Hornbill), and *Nisaetus nanus* (Wallace's Hawk-Eagle). The project field team conducted roughly 779 patrols in 2022 and 1,064 in 2023 during this monitoring period and observed no evidence of illegal hunting. Conducting regular patrols is likely acting as a deterrent to hunting activities in the area.<br><br>During this monitoring period, six of these trigger species were observed during point transect surveys, with all six of these being observed within 25 meters of the observer in either 2022 or 2023, allowing for an estimate of species population density to be calculated for these species (see Table 68).<br><br>For trigger species recorded within 25 m of the observer for the first time this year, their population trends over longer periods are not yet clear. However, for species that were recorded in both the current and previous monitoring periods, it is possible to infer some potential population trends.<br><br>The Vulnerable *Treron fulvicollis* (Cinnamon-Headed Green Pigeon) was recorded for the first time in the project area in this monitoring period. Long-Tailed Parakeet population densities increased in this monitoring. *Acridotheres javanicus* (Javan Myna) increased in 2022 but was not recorded in 2023. The Wrinkled Hornbill has seen steadily decreasing densities within our survey data since the monitoring began and was not recorded at all in 2023. However, another hornbill species, the Rhinoceros Hornbill was recorded again during this monitoring (and for the first time within 25m of the observer). The Wrinkled Hornbill may be experiencing population decline, potentially caused by competition from other hornbill species, or the reduced sampling effort in 2023 may be falsely indicating its absence in 2023.<br><br>Overall, despite some mixed trends among bird trigger species, it appears that the population trends of these trigger species are being maintained or enhanced. It will take several more years to understand the ecological and population dynamics of these species in a regenerating tropical peatland and for reliable population trends to become detectable. |

| | |
|---|---|
| Trigger species | Tree Species (14 species):<br><br>1. *Anisoptera marginata* (Mersawa)* (VU)<br>2. *Aquilaria malaccensis* (Agarwood)* (CR)<br>3. *Aquilaria microcarpa* (Agarwood)* (EN)<br>4. *Cantleya corniculata** (VU)<br>5. *Ctenolophon parvifolius* (VU)<br>6. *Dyera polyphylla* (Jelutong)* (VU)<br>7. *Gonystylus bancanus* (Ramin) (CR)<br>8. *Shorea balangeran* (Red Balau) (VU)<br>9. *Shorea platycarpa* (Light Red Meranti)* (EN)<br>10. *Shorea teysmanniana* (CR)<br>11. *Shorea uliginosa* (EN)<br>12. *Sindora bruggemanii* (Tampora Antu) (VU)<br>13. *Tetramerista glabra* (Punah) (VU)<br>14. *Vatica venulosa* (CR)<br><br>*Species observed in the project area outside of standardized annual biodiversity monitoring surveys |
| With-project scenario | All tree trigger species have likely benefited from key project activities undertaken during this and previous monitoring periods. These activities include new canal blocking and existing canal dam monitoring to restore the natural peatland water table depth, fire management in and around the project area (bolstered by agreements with adjacent concessions), and enrichment planting and assisted natural regeneration.<br><br>Most of these tree species are at risk of illegal logging. The project field team conducted roughly 779 patrols in 2022 and 1,064 in 2023 during this monitoring period and observed no evidence of intentional illegal logging. However, several hectares in the western and southern boundaries of the project area were degraded by the accidental expansion of an adjacent Acacia plantation into the project area. Once discovered by the field team, the expansion was halted, and the affected area was replanted with native tree species. Conducting regular patrols is likely acting as a deterrent to illegal logging activities in the area.<br><br>During this monitoring period, nine of these trigger species were recorded in vegetation plot surveys, allowing for estimates of density of individuals per hectare to be calculated for each tree age class (see Table 55). *Shorea dasyphylla* was a trigger species in 2022 but is no longer threatened as of 2023 - a single tree appears in Table 71.<br><br>Similar to the previous monitoring period, most of these trigger species occurred at very low densities as expected because of their rare and threatened status and the heavy degradation of the project area which is still in the early stages of assisted natural regeneration. However, some trigger species were notably abundant, such as *Sindora bruggemanii* (Tampora Antu), *Tetramerista glabra* (Punah), *Shorea teysmanniana* (Meranti Merawan), and *Vatica venulosa* (Resak Seluang), particularly for younger tree age classes.<br><br>Other observations of note during this monitoring period include: one |

*Gonstylus bancanus* (Ramin, CR) sapling and one tree; two *Shorea teysmanniana* (CR) trees and two saplings; and one *Vatica venulosa* (CR) tree, one pole, and one sapling. All of these are endemic to the Sundaland Bioregion. In addition, enrichment plantings included 10,235 *Shorea balangeran* (VU) seedlings dispersed throughout the project area.

Most plant trigger species saw an increase or maintenance in density when comparing this monitoring period to the previous monitoring period.

Sufficient long-term data is not yet available to establish trigger species population trends. However, early vegetation plot survey data combined with positive land cover change detection analysis suggests that trigger species are likely being maintained and enhanced under the with-project 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.

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