Forest Carbon Partnership Facility (FCPF)
Carbon Fund

ER Monitoring Report (ER-MR)

ER Program Name and Country:	**East Kalimantan - Jurisdictional Emission Reductions (EK-JER) Program, INDONESIA**
Reporting Period covered in this report:	***01-07-2019 to 31-12-2020***
Number of FCPF ERs:	***30,850,798 tonCO$_2$e***
Quantity of ERs allocated to the Uncertainty Buffer:	***0 tonCO$_2$e***
Quantity of ERs to allocated to the Reversal Buffer:	***1,713,933 tonCO$_2$e***
Quantity of ERs to allocated to the Reversal Pooled Reversal buffer:	***1,713,933 tonCO$_2$e***
Date of Submission:	***v. 31/07/2022***

WORLD BANK DISCLAIMER

The boundaries, colors, denominations, and other information shown on any map in ER-MR does not imply on the part of the World Bank any legal judgment on the legal status of the territory or the endorsement or acceptance of such boundaries.

The Facility Management Team and the REDD Country Participant shall make this document publicly available, in accordance with the World Bank Access to Information Policy and the FCPF Disclosure Guidance.

TABLE OF CONTENTS

1 IMPLEMENTATION AND OPERATION OF THE ER PROGRAM DURING THE REPORTING PERIOD

1.1 Implementation status of the ER Program and changes compared to the ER-PD

Implementation of ER (emission reduction) program under this reporting period is reported from July 2019 – December 2020.

The implementation of ER Program compared to ER-PD (Emission Reduction Program Document) is summarized per component as follows:

1) Component 1: Forest and Land Governance

1.1. Strengthening the licensing regime

- License processes related mining and forestry are improved for efficiency and effectiveness, that are integrated into one single system (OSS). The system is under management of Provincial Investment and Licensing Integrated Service (DPMPTSP). The number of permits decreased after verification (clean and clear) was conducted during the reporting period. In ERPD, total mining permits up to 2017 were 1434 units. In 2019, the total mining permits decreased to 386 permits due to verification processes. Up to December 2020, there are only 272 mining permits that passed the annual assessment.

  In forestry sector, up to 2017 the social forestry permit was only 38 units. Government accelerated the program. As a result, the number of social forestry permits increased. Up to December 2020, there are 75 social forestry permits that have been issued to communities in East Kalimantan with the total of 193k ha.

  In Estate crops sector, East Kalimantan Government issued High Conservation Value (HCV) Policy on Sustainable Estate Crops (No.7/2018[1]). The regulation emphasises restoration of high conservation value (HCV) areas. The implementation of this regulation was followed up by Berau Bupati's decree[2] no 287/2020 about designation of HCV area inside an oil palm plantation for 83,000ha. Development partners involved in supporting designation of High Conservation Value (HCV) area are *Yayasan Konservasi Alam Nusantara* (YKAN), German Sustainable and Climate-Friendly Palm Oil Production and Procurement (GIZ SCPOPP), German Low-Emissions Oil Palm Development (GIZ LEOPALD), *Dewan Daerah Perubahan Iklim* (DDPI) Kaltim, Kalimantan Forest United National Development Program (Kalfor-UNDP), *Forum Perkebunan* (Estate Crops Multi-stakeholders Forum), Mulawarman University, private companies and others government institutions. Another efficiency for license issuance is the development of spatial databases, in which the licensing process is through a web-platform system that can be previewed. This web platform can assess whether the area is overlapped or not. If the area is overlapped then the license must be postponed until the issue is solved.

[1] PERDA Prov. Kalimantan Timur No. 7 Tahun 2018 tentang Pembangunan Perkebunan Berkelanjutan [JDIH BPK RI]

[2] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Regulation/SK Bupati Berau 287 2020 ttg Peta Indikatif ANKT.pdf

1.2. Dispute Settlement

- Dispute settlement has been addressed. At national level, a national policy under National Agrarian Reform Program (TORA) on the change of forest boundary area has been issued (S.698/Menlhk/Setjen/Pla.2/9/2021 on 10 September 2021)[3]. The revision of forest boundary area in the province between private lands and social forestry areas has been conducted with the size of 119.4 ha and 142.8ha respectively. The revision is still on-going in several districts (Paser Penajam Utara, East Kutai, Berau, and Kutai Kartanegara). The partner is directly from Ministry of Environment and Forestry (MoEF). Due to Covid-19, field activities are limited. The budget allocation for field surveys were transferred to combatting Covid-19. In order to minimise conflict within stakeholders, the provincial government has developed standard operation procedure (SOP) for conflict resolution in forestry sector. The standard operational procedure (SOP) provides guidance for EK Forestry Agency staff to implement conflict resolution and to ensure the State's rights, individual or group rights, customary community rights, concession holders rights, and to protect forest and its resources. Fifteen (15) disputes have been addressed using this SOP up to July 2020. Most of disputes were about tenurial rights. The disputes have been decreased from 27 cases in 2019 to 5 cases in 2020. Parties who supported conflict resolution are as follows: the Forest Management Unit (FMU), MoEF Social Forestry and Environmental Partnership (*Balai Perhutanan Sosial dan Kemitraan Lingkungan*/BPSKL), MoEF Regional Forest Gazettement Agency (*Balai Pemantapan Kawasan Hutan*/BPKH), local government, village government, concession holders and local or customary community. The EK government has developed the grievance system called "Aspirasi Etam" through Governor Regulation No 69/2019[4]. The "Aspirasi Etam" (meaning our aspirations) is an online portal for the community to report the complaints issued in East Kalimantan (EK). For FCPF, this "Aspirasi Etam" is used by the community/public to give feedback and grievances related to FCPF activities.

1.3 Support for the recognition of adat land

- The designated areas for customary forests that cover 23,867ha have been approved by the Central Government, whereas indicative areas for customary forests that have complied with regulations cover 554,552ha. As one of efforts to support the recognition of adat land from district government, validation of Customary Forest for Muluy and Muara Ande in Paser District has been conducted (under Bupati's Paser Decree No. 4/2019)[5]. However, up to 2020, there are only two customary forests that have been acknowledged by both MoEF and District Governments, namely 1) Muluy - Swan Slutung Village, Paser District and 2) Hemaq Beniung - Kampung Juaq Village, Kutai Barat respectively. Total area for both customary forests are 7,770ha.

1.4 Strengthening village spatial planning

- In order to prevent overlapping land use, and to strengthen the village programs inside the village areas, the spatial land use plan was developed. Up to December 2020, 6 village spatial plans in peatland areas have been completed. In addition, 7 villages in Kombeng sub-district, with the support from GIZ-SCPOPP, have been finalised. So, total villages that

[3] https://drive.google.com/file/d/1FMouiE2CBYxN5vakgxkB0O4HWM7ihXCt/view?usp=sharing
[4] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Regulation/PERGUB_69_2019-aspirasi etam.pdf
[5] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Regulation/Perda Paser 4 thn 2019 MHA Paser.pdf

have been mapped are 13 out of 150 villages. After the village spatial plan was completed, the process continued at the higher scale, sub-district/*kecamatan* and finally at the kabupaten/district level. At the kabupaten level, the village spatial plan will be synchronized with other sectors' spatial plans such as forestry, fishery and plantation. The development partners involved for village spatial plan are TNC/YKAN, GIZ -SCPOPP, WWF Indonesia, Yasiwa, and Yayasan Bumi.

2) Component 2: Improving Forest Supervision and Administration

2.1 Strengthening management capacity within the State Forest Area: FMU development

- From a total of 19 Forest Management Unit (*Kesatuan Pemangkutan Hutan*/KPH) in East Kalimantan, up to December 2020 there were 10 out of 19 Long Term Forest Management Plans (RPHJPs) that have been ratified and approved by MoEF. To complete the other 9 RPHJPs, capacity building was conducted, such as strengthening KPH staff on development of KPH RPHJP (on 22-25 November 2020 in Samarinda). One of the activities is patrolling for Prevention and Suppression from Forest and Land fires in conservation and forest production areas (Kutai National Park for 53 times during the reporting period and 14 times with communities known as Community Partner Rangers/*Masyarakat Mitra Polhut*). KPH conducts forest patrolling every year. Twenty (20) cases of illegal logging were reported in East Kalimantan during the reporting period. Nine (9) Business plans of KPHs were developed with the support from development partners (GGGI, GIZ, WWF, TNC/YKAN, etc). In order to accelerate the development of business plans for other KPHs, a coaching clinic (capacity building) was conducted by Forestry Service of East Kalimantan. A baseline study on the application of environmental economic instruments and other incentive schemes was conducted as part of pre-assessment on sustainability of environmental services of Manggar Watershed in order to supply raw water for 79% of Balikpapan city residents.

2.2 Strengthening provincial and district governments to supervise and monitor the implementation of sustainable Estate Crops

- Strengthening provincial and district governments in monitoring implementation of sustainable estate crops were conducted through identification and development of HCV area maps. In early 2020 Bupati Berau signed a Decree on HCV indicative map No 287/2020[6] covering 83,000ha.

3) Component 3: Reducing deforestation and forest degradation within licensed areas

3.1. Implementation of HCV policies for Oil Palm Estates

- Private sectors have a key role in reducing deforestation and forest degradation within their licensed aeras such as implementation of HCV policies for oil palm estates. Commitments from district governments to implement HCV policies have been acknowledged. Meeting coordination within Estate Crops Services of East Kalimantan (Rakor Perkebunan) was conducted in Balikpapan on 18 October 2019. Seven (7)

[6] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Regulation/SK Bupati Berau 287 2020 ttg Peta Indikatif ANKT.pdf

Regencies in East Kalimantan proposed HCV indicative maps within plantation businesses concessions or plantations. The HCV is designated areas by district governments with total coverage of 417.505 ha. Up to December 2020, Berau district has put the committed areas of 83,876ha as HCV protection into Bupati's Decree on HCV indicative map No 287/2020[7]. Assistance to oil palm smallholders towards sustainability in order to gain Indonesia Sustainable Plam Oil (ISPO) & Rountable Sustainable Palm Oil (RSPO) Certificates was conducted. Up to 2020, there are 60 companies that have obtained ISPO, whereas 12 companies obtained RSPO certificates. The area of the ISPO-certified is 520,605 ha, and the area of RSPO-certified is 87,070 ha.

3.2 Support for smallholders and Community Based Fire Management and Monitoring Systems (CBFMMS)

- In order to prevent forest and land fires, EK Estate Crops Service with the support of private companies established the Farmer Group on Fires Management and Prevention known as Fire Prevention Farmers Group (*Kelompok Tani Peduli Api*/KTPA). The total KTPA are 81 KTPAs. The KTPAs are key players in helping district government and private companies in combating forest and land fires. In the forestry sector, the private companies also contributed to the development of Community-based Fire Management and Prevention (MPA). The contribution includes training, gears and tools for firefighters, and patrol. Sinarmas Forestry and partners (PT. Surya Hutani Jaya, PT. Sumalindo Hutani Jaya II, PT. Acacia Andalan Utama, PT. Kelawit Wana Lestari) had 43 activities (patroli, training, and providing gears and tools to MPA) across six sub-districts in East Kalimantan until December 2020.

3.3 Implementation of HCV and RIL-C policies for Forestry Concessions

- The private sector implemented HCV and RIL policies inside their forest concession areas (IUPHHK-HA). The implementation was monitored by Production Forest Management Agency (BPHP) East Kalimantan region (MoEF's branch office in East Kalimantan). Up to 2019, three (3) out of 64 IUPHHK-HA have implemented reduced impact logging for carbon (RIL-C). The RIL-C training on the field site has been done for eight (8) companies. In terms SFM certification for timber plantation, it has reached 21 out of 42 timber plantation concession (IUPHHK-HT), whereas for natural forest has reached 53 out of 64 IUPHHK-HA.

4) Component 4: Sustainable Alternatives for Communities

4.1 Sustainable livelihoods

- Capacity building on strengthening village owned entrepreneurship (BUMDes) has been conducted in 45 out of 150 villages during July 2019 – December 2020. The contents of training included financial management and village assets, innovation, etc. Partnerships between government and communities in conserving wildlife have been conducted such as restoration of orangutan habitats in East Kutai district, conservation of sea turtle in Derawan islands, Berau district, conservation of black crocodile Siam (Siamensis) in Mesangat-Kenohan Suwi, East Kutai District, conservation of Sumatran Rhino in Kelian

[7] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Regulation/SK Bupati Berau 287 2020 ttg Peta Indikatif ANKT.pdf

West Kutai district, and also conservation education that aims to increase awareness of the community on the importance of conservation in East Kalimantan.

4.2 Conservation partnerships

- BKSDA Kaltim has implemented development of partnerships with communities for conservation of 100,000 hectares of Managed Traditional Zones and Community Empowerment in 10 Villages on Management of Conservation Areas and for livelihood development.

4.3 Social forestry

- Up to December 2020, there are 75 social forestry (SF) permits that have been issued to communities in East Kalimantan with a total of 193k ha. The target area for SF is 250k ha. Most permits are issued for village forests (34 licenses - 165k ha), community-based timber plantation/HTR (15 licenses - 13k ha), community forestry/Hkm (13 licenses - 2.2k ha), forest partnerships (11 licenses - 5.4k ha), and customary forest/HA (2 licenses - 7.7k ha).

5) Component 5: Project Management and Monitoring

5.1 Project coordination and management

- Coordination meetings during July 2019 – December 2020 were hosted by different EK government services such as the EK Forestry Service for Safeguards issues, the Bureau Economy for BSM, and the EK Environmental Service for Measurement, Monitoring and Reporting (MMR) and Free, Prior and Informed Consent (FPIC). Coordination meetings were conducted with the purpose to strengthen and increase awareness of OPD (provincial government services) about their important roles in the implementation of ER Programs.
- Working Groups for Benefit Sharing, Safeguards, MMR, and Budget and Planning were established. These working groups are under Secretariat Office of Provincial Government East Kalimantan. Outputs are Draft Governor Regulation on Benefit Sharing, Draft SOP for Working Group Safeguards, MMR portal (website MMR), Technical correction on Emission Factor for FREL East Kalimantan, Data revision on Forest Cover for ER Calculation, and extrapolation of plot sample permanents (583 PSPs) under different 11 forest cover types.
- During the reporting period, the budget was mostly implemented according to the plan. However, since the Covid-19 pandemic in Indonesia started in March 2020, most of the field activities were limited. Social distancing was applied. As a result, meetings face to face were avoided. The budget plan for 2020 was revised and allocated to support combating Covid-19. For example, EK forestry Service had to revise its budget for facilitating RIL-C. The budget was reallocated to support the purchase of antigen detection rapid diagnostic test for Covid-19.

5.2 Monitoring and evaluation

- At the early stage of the reporting period most coordination between and within government agencies and partner agencies was conducted by *Sub National Prorgram Namangemetn Unit (SN-PMU) under Economic Bureau of Provincial Secretariat.,*At the end of the reporting period, the FCPF Readiness Fund was limited (the program was ended in December 2020). Most of the financial support for implementation of the ER program

in the province was taken from the EK government budget and partly from the development partners. Since working groups (safeguards, benefit sharing, MMR, and budgeting and planning) have been established, coordination of ER programs is led by the chairman of each working group. The Safeguards issue, for example, is led by EK Forestry Service, whereas MMR is led by EK Environment Service. The development partners are invited and actively participate in the issues related to the ER program.

5.3 Program communication

- The communication process is carried out by SN-PMU with the executor at the Provincial Secretariat Public Relations Bureau. Publication is carried out on the provincial website (www.kaltimprov.go.id), social media (instagram.com/pemprov_kaltim), as well as local newspapers, radio and television.

For further details of activities during the reporting period can be found in MMR Web Portal East Kalimantan (https://mrv.kaltimprov.go.id/).

1.2 Update on major drivers and lessons learned

Seven main drivers of deforestation and forest degradation in East Kalimantan were qualitatively identified through a series of consultative meetings with local stakeholders between October 2015 and March 2018. The main drivers are as follows:

1. Timber plantations
2. Estate crops
3. Mining
4. Subsistence agriculture
5. Unsustainable logging practices
6. Forest and land fires
7. Aquaculture

During the reporting period, those above drivers were then assessed through land cover changes from July 2019 – December 2020.

Land Cover changes July 2019 – December 2020

It was found that 19,310 ha of forest was lost during July 2019 – December 2020. The main drivers of deforestation for such period were caused by unlicensed land clearing (32.7%), oil palm (23.8%), Agriculture (15%), timber plantation (12.7%), unsustainable forest management (10.6%), mining (3%), and fishpond (2.2%).

Table 1. Area Deforested July 2019 - December 2020

Driver	Area deforested July 2019 – December 2020 (hectare)	Share of total deforestation (%)
Unlicensed Land clearing	6,310.37	32,7%
Estate crops - oil palm	4,597.77	23.8%
Agriculture	2,888.84	15.0%
Timber Plantation	2,450.48	12.7%

Driver	Area deforested July 2019 – December 2020 (hectare)	Share of total deforestation (%)
Unsustainable Forest Management	2,047.01	10.6%
Mining	587.85	3.0%
Fishpond	428.10	2.2%
Total Deforestation 2019-2020	**19,310.41**	**100.0%**

Comparing between the drivers from the baseline period (2006-2016) and reporting period (July 2019 – December 2020), unlicensed land clearing became the main driver of deforestation following up with the oil palm. However, the deforestation rate has sharply decreased compared to the baseline. The announcement and commitments from seven districts/regencies to provide areas for HCV protections (remaining natural forest inside concessions) contributed to the slowing down of land clearing in oil palm sector. Up to December 2020, one district, Berau, has put the committed areas of 83,876ha as HCV protection into Bupati's Decree on HCV indicative map No 287, year 2020. The other six districts will follow it in the following years. Policy or regulation on HCV management in oil palm has been formulated, and will be issued soon. Prior to commitments of the province and districts to protect HCV areas, the enforcement to manage HCV inside the oil palm concession was weak. As a result, forest conversion from natural forest to oil palm was dominant in deforestation. In the mining sector, deforestation was sharply down. During the reporting period, mining activity significantly decreased due to the low demand for coal in the international market. The mining policy (moratorium on coal mining license) issued by the Provincial Government to evaluate mining license seems effective to reduce the number of coal mining operations in the province.

1.2.1 Update on the strategy to mitigate and/or minimize potential Displacement

The progress of strategic actions to mitigate and minimize potential displacement are as follows:

1.	**Conversion of forest to estate crops (oil palm)**	
	Risk of displacement	**Medium**
	Progress of the strategy in Place	The issuance of the Provincial Regulation on Sustainable Plantations and the Governor's Regulation on the Identification of HCV areas, as well as the identification of HCVs in each district have been done and will be continued. The Plantation Office has also established a Sustainable Plantation Communication Forum (*Forum Komunikasi Perkebunan Berkelanjutan*/FKPB).
2.	**Conversion of natural forest to industrial timber plantations**	
	Risk of displacement	**Low**
	Progress of the strategy in Place	Accelerate the implementation of Sustainable Forest Management (*Pengelolaan Hutan Produksi Lestari*/PHPL) and SVLK in IUPHHK-HT, including the determination of HCV in concession areas. Cooperation between MoEF and the Forestry Agency, as well as KPHs has enhanced to supervise and monitor implementation. Up to December 2020, 21 out of 42 timber plantation concessions have been certified under PHPL certificates.

3.	**Unsustainable Forest Management**	
	Risk of displacement	**Low**
	Progress of the strategy in Place	Accelerate the implementation of PHPL and SVLK in IUPHHK-HA, including the determination of HCV and implementation of RIL in concession areas. Cooperation between MoEF and the Forestry Agency, as well as KPHs is enhanced to supervise and monitor implementation. Up to December 2020, there are 53 out of 64 natural forest concessions having PHPL certificates.
4.	**Forest clearing for subsistence agriculture**	
	Risk of displacement	**Medium**
	Progress of the strategy in Place	Social forestry program aims to reduce the pressure of natural forests from the expansion of subsistence agriculture. The program has been included into Provincial Mid Term Development Plan (*Rencana Pembangunan Jangka Menengah Daerah/RPJMD*) 2019-2023 and Provincial Strategic Development Plan (*Rencana strategis Pembangunan/Renstra*). The annual target for SF in RPJMD is 32,000ha. Up to December 2020, there are 75 SF licenses that have been issued by MoEF with the total size of SF area for 193k ha.
5.	**Forest clearing for mining**	
	Risk of displacement	**Medium**
	Progress of the strategy in Place	Mining licenses have been assessed and integrated into one single system (OSS). There is a significant decrease of licenses from 386 to 272. With the new Job Creation Act 2020, the authority of issuing licenses is now controlled under Ministry of Energy and Minerals (National Government Ministry).
6.	**Destruction of mangroves for aquaculture**	
	Risk of displacement	**Low**
	Progress of the strategy in Place	The dispute settlement in coastal area that potentially accelerate mangrove conversion to fishponds has been decreasing since the national agrarian reform program (TORA) was launched in East Kalimantan in 2021.

2 SYSTEM FOR MEASUREMENT, MONITORING AND REPORTING EMISSIONS AND REMOVALS OCCURRING WITHIN THE MONITORING PERIOD

2.1 Forest Monitoring System

The ER Program has two sets of organizational structures for measurement, monitoring and reporting of emissions estimates as presented in Figure 1.

Figure 1. Organizational Structure for measurement, monitoring and reporting of the implementation of ER Program

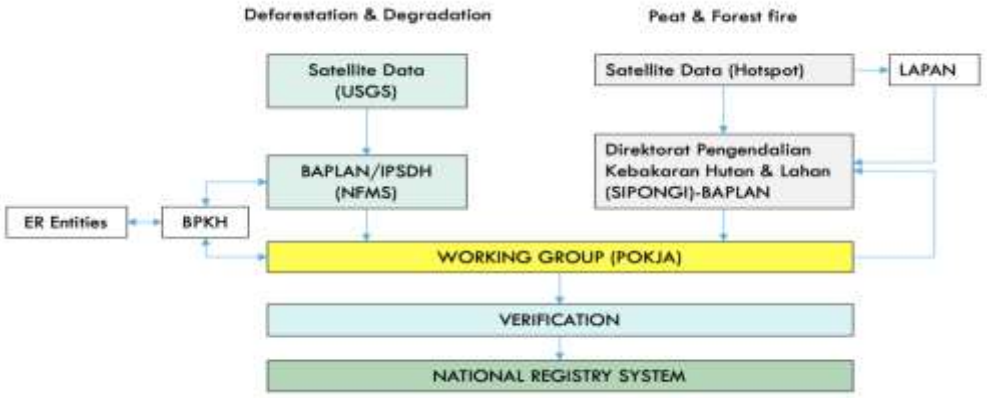


Figure 1 above shows the institutional bodies that responsible for producing annual national land cover (LC) map (scale 250.000). Indonesian national space agency (LAPAN = *Lembaga Penerbangan dan Antariksa Nasional*) provides satellite imageries from various sources and various spatial resolution to MoEF as main input for LC map production. In order to maintain the cosistency with earliest LC map year 1990, the image sources used is Landsat products. SPOT 6/7 also provides by LAPAN and often used for validation and accuracy assessment of LC map as well as accuracy assesment Land Cover Change between 2 different LC maps. LAPAN was established on 27 November 1963 and responsible for development and utilization of aerospace technology and research including remote sensing data utilization and production.

BAPLAN (*now changed to PKTL - Forestry Planning and Environmental Management)* as one of DG of MoEF, produces LC map annually since 2011. BAPLAN has several directorate and Forest Resource Inventory and Monitoring Directorate (IPSDH = *Inventarisasi dan Pemantauan Sumber Daya Hutan*) is resonsible for producing national LC assisted by 22 Regional Office for the Management of Forest Area (BPKH = *Balai Pemantapan Kawasan Hutan*) spread from Sumatera to Papua including one office in EK. Most staff of IPSDH dan BPKH have adequate GIS and Remote Sensing knowledge and skills needed for LC production. BPKH did visual interpretation of Landsat imageries and conducting ground check for accuracy assessment (Figure 2). IPSDH will conducting quality control and quality assurance (QC/QA) of BPKH LC map. During the process of LC map production, BPKH may receives input from various institution (ER entities) for ensuring the map is more accurate. Meanwhile, another directorate under BAPLAN named PKHL is responsible to produce annual burn area map based on hotspot information provides by LAPAN. LC and burn area map is used as main input for monitoring and reporting of ER program implementation in

Indonesia and EK. The EK working group of MMR has responsible to analysed LC and burn area map data to calculate various sources of emission from deforestation, forest deradation, fire, soil mangrove and peats at certain period. In EK, Enviroment Service (DLH = *Dinas Lingkungan Hidup*) was appointed as coordinator for working group of MMR. DLH is provincial government body that responsible for environmental management including waste and pollutant management, prevention and controlling environmental degradation. In ER program, EK DLH facilitates MMR working group meeting and resonsible for any administration work as well as submission of emission calculation reports. The MMR system of the ER Program is also integrated with the national forest monitoring system (NFMS) as described in Regulation of Director General of Forest Planning Number P.1/VII- IPSDH/2015[8].

Data Process at National Level

The BPKH receives satellite data from Forest Resource Inventory and Monitoring (IPSDH). The satellite data is first acquired by LAPAN, which also does pre-processing of data up to mosaicking before sending the data to the respective institutions (including IPSDH). The visual interpretation is conducted by the BPKH using a standard methodology for land cover mapping (Margono *et al*, 2014, 2016). Results of the processing and ground check by BPKHs are sent back to IPSDH for validation by IPSDH including some necessary edge-matching as appropriate, as part of the QA/QC process. Finally, the accuracy of the interpretation is assessed by comparing the land cover maps to field data from the ground check using a contingency matrix (MoFor, 2012, Margono *et al.*, 2012). There are about 300 points for ground checking in East Kalimantan (MoEF, 2017), which are determined randomly by land cover classes. All the data from the BPKH are then consolidated to generate data on forest cover change.

Data Process at sub-national level

The ER Program (through the Working Group[9] of MMR) analyses the data from the IPSDH/BPKH to calculate emissions from deforestation and degradation, peat decomposition, fire, and loss of mangrove soil from the conversion of mangrove to aquaculture using 2 LCLU maps (T_0 and T_1). Results of the estimation are then submitted to the EK Environmental Service (*Dinas Lingkungan Hidup*/DLH) for internal validation. The DLH then submits the results of the validated calculation to the national registry system.

To facilitate the work of the Working Group, the Government of East Kalimantan has developed a web portal for the Sub-national MMR System for managing all the processed data from the national and also from local governments. The system is operated by the Provincial Environmental Office (DLH) as Coordinator of the East Kalimantan MMR Working Group. The menu on the web portal (http://mrv.kaltimprov.go.id) consists of Measurement (data input pages) and Reporting section. In order to access and input data into those sections, it needs a user account that has to be registered to DLH. On the other hand, data related to Emission Factor (*Faktor Emisi*), Activity Data (*Data Aktivitas*) and Emission include Reference Emission Level (*Tingkat Emisi Rujukan*),

[8] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Guidance/PERDIRJEN Planologi Kehutanan No P.1-VII-IPSDH-2015 Tentang Pedoman Pemantauan Penutupan Lahan.pdf

[9] The Working Group of MMR is led by Provincial Environmental Service. The members are from Bureau Economy of Governor Office, Forestry Service, Estate Crop Service, Dipteropa Agency – MoEF, Forest Ecocsytem Wregion IV – MoEF, Climate Change Regional Council/Dewan Daerah Perubahan Iklim/DDPI, Mulawarman University, Bioma Foundation, Yasiwa Foundation, Planet Urgence, Conservation Foundation, GGGI, GiZ, and YKAN)

Actual Emission after reference period (Emisi *Aktual*) and Performance of Emission Reduction (*Kinerja Penurunan Emisi)* are publicly available.

The MMR web portal has been tested using national data. The infrastructure for the server has been ready and installed in Samarinda, East Kalimantan. This MMR web portal increases public participation of Government Services to village communities or indigenous people to update their ER activities and participate in monitoring the condition of forests and changes in the forest/land that occurs.

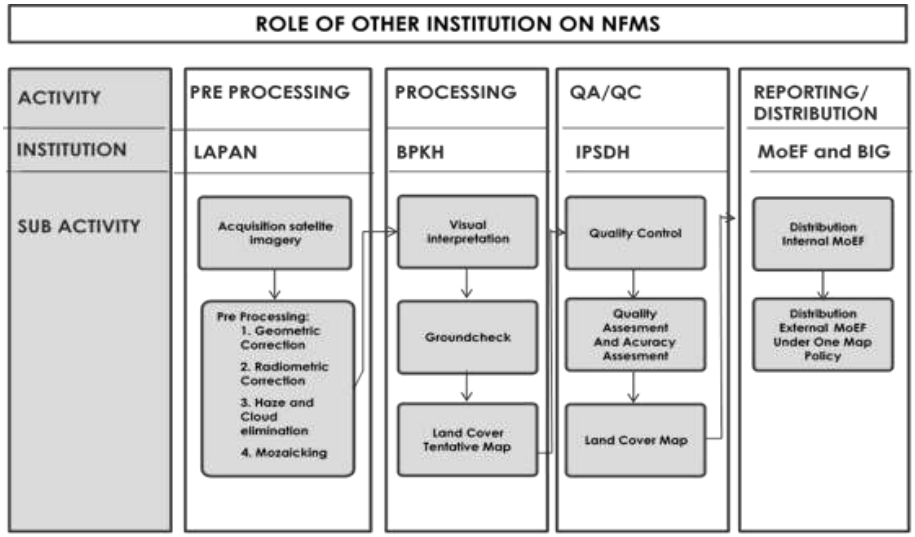


Figure 2. Related institutions on NFMS management (MoEF, 2017)

The process of the production of land cover maps will be on an annual basis as defined in the Regulation of the Director General of Forest Planology Number P.1/VII- IPSDH/2015[10]. The timeline of the process is shown in **Error! Reference source not found.**. The collection of the LANDSAT images is conducted throughout the year by LAPAN and the pre-processing of the image is conducted as the data becomes available for producing the mosaic. The mosaic will be available by June to be distributed to IPSDH and to BPKH.

Design and maintenance of the Forest Monitoring System

The design of Indonesia forest monitoring system is formally regulated using MoEF regulation No. P7/2021[11]. Indonesia forest monitoring system includes two main components which is forest inventory and land cover mapping. National forest inventory is conducted by MoEF at least once in a five year period using more than 4000 sample plots distributed systematically (20 km × 20 km) across Indonesia. The national forest inventory started for the first time in 1989 as supported by FAO and WB. The sample plots is set as rectangle shape with size 100 m × 100 m (for non mangrove forest) and 50 m × 50 m (for mangrove forest). Approximately 74% of these sample plots were used for calculating Indonesia FREL. One of the pivotal result from national forest

[10] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Guidance/PERDIRJEN Planologi Kehutanan No P.1-VII-IPSDH-2015 Tentang Pedoman Pemantauan Penutupan Lahan.pdf
[11] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Regulation/2021pmlhk007_menlhk.pdf

inventory is emission factor (biomass stock) for each land cover classes after calculated using allometric equations by Manuri *et.al* (2017)[12] and Chave (2014)[13].

Complementing to national forest inventory is land cover mapping. Land cover mapping is not limited to forest area but to all land cover that appropriate to mapping product scale 250.000. Twenty three of land cover classes (including cloud class) has been mapped since 1990 for entire Indonesia mass land. Since 2011, MoEF has successfully produced annual land cover maps of Indonesia. The LC map is used for monitoring the forest coverage that can be further analysed for deforestation and forest degradation by comparing two set of LC map data. Interpretation of satellite image is conducted by trained and skilled personel in BPKH using visual method in GIS enviroment combine with ground checking. The budget for ground checking is always prepared by BPKH since it is necessary to calculate the accuracy.

The interpretation process is often conducted in July-October, while ground check is conducted in June-September. In October-December, all the results of the interpretation by BPKH will be compiled to the national by IPSDH for QA/QC and accuracy assessment. By February Y+1, the result of the interpretation is normally finalized and reported. Table below shows the LC map production under current national forest monitoring system (NFMS).

Table 2. Timeline of land cover map production under the current NFMS

No	Activity	Year (n-1)						Year (n)											
		J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
A	**LAPAN**																		
	Collecting Landsat Satelite Image																		
	Finalization of Mozaik (M)													M					
B	**IPSDH**																		
	Techncail evaluation																		
	Supervision																		
	Quality Control																		
	Data finalization (DF)																		DF
	Reporting ®																		R
C	**IPSDH/BPKH**																		
	Data distribution (DD)																		
	Interpretation																		
	Ground Checking																		
	National Compilation of results (NC)																NC		

For Measurement, Monitoring and Reporting (MMR) of peat and forest fire, as seen in Figure 2, estimation of peat and forest burnt area is based on Director General of Climage Change (DG-CC) MoEF Regulation No. P.11/PPI/PKHL/Kum.1/12/2018[14]. The interpretation of the burned area uses remote sensing data, such as Landsat, SPOT and others, and is supported by hotspot data obtained from monitoring satellite imagery of NOAA-AVHRR, SNPP-VIIRS, ATSR, Terra/Aqua MODIS, Himawari and others. It is also supported by information based on the results of ground check reports and forest fire extinguishing locations. Such data analysis was done by the Directorate for Forest and Land Fire Prevention, of the MoEF. The ER Program (through the Working Group) gets access to and analyses the burn scar data in order to estimate burnt area

[12] https://link.springer.com/article/10.1007/s13595-017-0618-1
[13] https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.12629
[14] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Guidance/Perdirjen P. 11 Pedoman Teknis Penaksiran Luas Karhutla (2).pdf

and greenhouse gas emissions. Results of the estimation are then submitted to IPSDH for internal verification.

Indonesia forest monitoring system continue to evolve and improve the method and tools for getting trustworthy data on land cover map and biomass stock by involving uncertainty analysis started in 2020. Other than land cover map and biomass stock, Indonesia forest monitoring system is currently producing burn scare map at montly period that pivotal for calculating emission from fire.

Systems and processes that support the Forest Monitoring System, including Standard Operating Procedures and QA/QC procedures

At national level, Indonesia forest monitoring system is supported by MoEF (IPSDH) and LAPAN as shown in Figure 1 and 2. At sub-national level (East Kalimantan province), the system is supported by DLH especially for emission calculation. LAPAN provides mozaics of Landsat imageries to be further interpreted by BPKH. LAPAN has two ground stations (located in Pare-pare, South Sulawesi and Rumpin, Bogor, West Java) for receiving and processing Landsat raw data sets (in daily basis) into L1 level (image scene was corrected using ground control points dan digital elevation model). Collection of L1 level imageries send to LAPAN office in Jakarta for further processing into L2 level or Analysis Ready Data (ARD). Analysis Ready Data (ARD) are pre-packaged and pre-processed bundles of Landsat data products that make the Landsat archive more accessible and easier to analyze, and reduce the amount of time users spend on data processing for time-series analysis. Collection of Landsat ARD image in a single year are then processed into RGB mosaics by LAPAN Jakarta office before distributed to end user (e.g. IPSDH). Further information on Landsat processing procedure by LAPAN see page 20 on this link.

MoEF (IPSDH) has already provided procedure for interpreting medium resolution satellite images i.e. Landsat images from LAPAN (click to see the document). The procedure contains key interpretation of 23 land cover classes as guidance for operator GIS in BPKH during interpretation process. For calculating accuracy and uncertainty, another separate document is provided by IPSDH[15]. These 2 procedures ensure the quality and accuracy of LC data that will be used to calculate land cover change and emission from deforestation and forest degradation in ER program.

The ER Program in East Kalimantan uses the data generated by the above mentioned NFMS that consist of Forest inventory data and LC map. The system provides continuous information on activity data and emission factors that can ensure the sustainability of activity data supply needed for estimating emission reductions from the implementation of the ER Program, thus ensuring consistency. The ER Program will continue to apply these samples-based area estimation for ER purposes, and will consider whether this approach is also applicable to the NFMS for national reporting purposes.

In addition, the ER Program also includes ground checking activities, as mentioned above, to increase the number of points required for the accuracy assessment. At present, due to limited budget BPKH can only do ground checks in a small number of observation points. Through the ER Program, it is planned for ER Entities, as shown in Figure 2.

[15] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Guidance/SOP_AKURASI_ISI_EBOOK.pdf

Role of communities and non-government in the forest monitoring system
The community and non-government parties can provide input to the MoEF through Directorate Forest Resource Inventory and Monitoring (IPSDH), if they find data that is not in accordance with field conditions. Reports are accompanied by field photo documentation, as well as GPS location points. Regarding forest fire information, based on real-time hotspot data, short messages are sent from the national to the provincial level, then forwarded to the district to the village head. The village then carried out a field check, and re-informed the actual situation on the ground.

We highlight a minor alteration of Indonesia national forest monitoring system (NFMS) URL (uniform resource locator) from http://webgis.menlhk.go.id:8080/nfms_simontana/ as it is mentioned in ERPD, to the new URL as https://nfms.menlhk.go.id/

2.2 Measurement, monitoring and reporting approach

2.2.1 Line Diagram

The ER Program applies methods for monitoring activity data and for estimating emission factors that are aligned with the approach used in developing Indonesia's FREL and that comply with established standards for the measurement of satellite imagery (LANDSAT) interpretation to estimate forest cover changes (SNI 8033:2014).[16] These standards have been defined in the annex of the Regulation of the Director General of Forest Planology Number P.1/VII- IPSDH/2015[17]. Technical guidelines for field observation and ground check procedures for land cover accuracy assessment can be seen in Annex 9.1 ERPD and Annex 9.2 ERPD, respectively. In the implementation phase (June 2019-December 2024), activity data (AD) and emission factors (EF) are monitored in the Accounting Area to measure emissions from deforestation and forest degradation. Monitoring follows the procedures defined in the NFMS (national forest monitoring system) and in the East Kalimantan forest inventory. Parameters to be monitored include the same parameters used to develop the REL, specifically:

Activity Data

- Forest cover change resulting in deforestation or forest degradation for all land that was forested in 2006.
- Areas of burned forest land in stable secondary forest and peat land starting in 2006.

Emission Factors

- Emission factors for live biomass by land cover classes (forested and non-forested)
- Emission factors for peat and mangrove soils
- Emission factors for fires

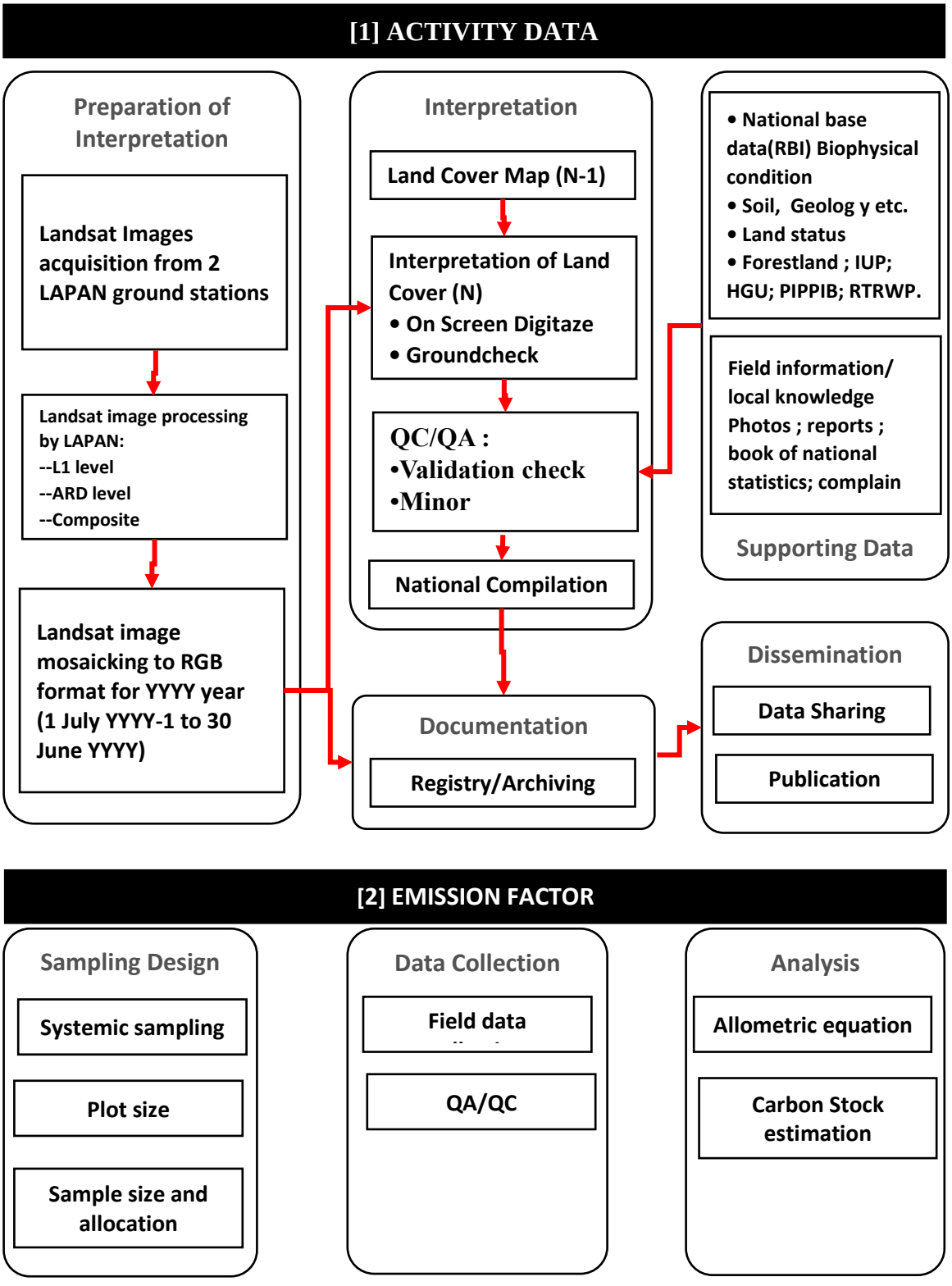
Table 3. Characterization of forest and non-forests in Indonesia used in national land cover mapping

No	Land cover type	Code	Description
	Forests		

[16] Standar Nasional Indonesia (Indonesia National Standard) No. 8033 year 2014 regarding Method for Estimation of Forest Cover Changes based on Result of Visual Interpretation of Optical Remote Sensing Imagery.
[17] Perdirjen Planologi (2015). Pedoman pemantauan penutupan lahan (guidance for monitoring land cover change). http://appgis.dephut.go.id/appgis/download/Pemantauan%20Hutan%20Nasional/Perdirjen_Plano_2015_01_Pedoman_PSDH.pdf

No	Land cover type	Code	Description
1	Primary dry land forest	2001	Natural tropical forests growing on non-wet habitat including lowland, upland, and montane forests with no signs of logging activities. The forest includes heath forest and forest on ultramafic and lime-stone, as well as coniferous, deciduous and mist or cloud forest, which shows no, or little, influence from human activities such as logging.
2	Secondary dry land forest	2002	Natural tropical forests growing on non-wet habitat including lowland, upland, and montane forests that exhibit signs of logging activities indicated by patterns and signs of logging (appearance roads and patches of logged-over area). The forest includes heath forest and forest on ultramafic and lime-stone, as well as coniferous, deciduous and mist or cloud forest.
3	Primary swamp forest	2005 biics2020test	Natural tropical forests growing on wet habitat in swamp form, including, brackish swamp, marshes, sago and peat swamp, which shows no, or little, influence from human activities such as logging.
4	Secondary swamp forest / logged forest	20051	Natural tropical forests growing on wet habitat in swamp form, including brackish swamp, marshes, sago and peat swamp that exhibit signs of logging activities indicated by patterns and signs of logging (appearance roads and logged-over patches).
5	Primary mangrove forest	2004	Wetland forests in coastal areas such as plains that are still influenced by the tides, muddy and brackish water and dominated by species of mangrove including Nipa (Nipafrutescens), which shows no, or little, influence from human activities such as logging.
6	Secondary mangrove forest / logged forest	20041	Wetland forests in coastal areas such as plains that are still influenced by the tides, muddy and brackish water and dominated by species of mangrove and Nipa (Nipa frutescens), and exhibit signs of logging activities, indicated by patterns and signs of logging activities.
7	Plantation forest	2006	The appearance of the structural composition of the forest vegetation in large areas, dominated by homogeneous trees species, and planted for specific purposes. Planted forests include areas of reforestation, industrial plantation forest and community plantation forest.
	Non-Forests		
8	Dry shrub	2007	Highly degraded logged over areas on non-wet habitat that are ongoing process of succession but not yet reach stable forest ecosystem, having natural scattered trees or shrubs.

No	Land cover type	Code	Description
9	Wet shrub	20071	Highly degraded logged over areas on wet habitat that are ongoing process of succession but not yet reach stable forest ecosystem, having natural scattered trees or shrubs.
10	Savanna and Grasses	3000	Areas with grasses and scattered natural trees and shrubs. This is typical of natural ecosystem and appearance on Sulawesi Tenggara, Nusa Tenggara Timur, and south part of Papua island. This type of cover could be on wet or non-wet habitat.
11	Pure dry agriculture	20091	All land covers associated with agriculture activities on dry/non-wet land, such as tegalan (moor), mixed garden and ladang (agriculture fields).
12	Mixed dry agriculture	20092	All land covers associated with agriculture activities on dry/non-wet land that is mixed with shrubs, thickets, and log over forest. This cover type often results of shifting cultivation and its rotation, including on karts.
13	Estate crop	2010	Estate areas that has been planted, mostly with perennials crops or other agriculture trees commodities.
14	Paddy field	20093	Agriculture areas on wet habitat, especially for paddy, that typically exhibit dyke patterns (pola pematang). This cover type includes rainfed, seasonal paddy field, and irrigated paddy fields.
15	Transmigration areas	20122	Kind of unique settlement areas that exhibit association of houses and agroforestry and/or garden at surrounding.
16	Fish pond/aquaculture	20094	Areas exhibit aquaculture activities including fish ponds, shrimp ponds or salt ponds.
17	Bare ground	2014	Bare grounds and areas with no vegetation cover yet, including open exposure areas, craters, sandbanks, sediments, and areas post fire that has not yet exhibit regrowth.
18	Mining areas	20141	Mining areas exhibit open mining activities such as open-pit mining including tailing ground.
19	Settlement areas	2012	Settlement areas including rural, urban, industrial and other settlements with typical appearance.
20	Port and harbor	20121	Sighting of port and harbor that big enough to independently delineated as independent object.
21	Open water	5001	Sighting of open water including ocean, rivers, lakes, and ponds.
22	Open swamps	50011	Sighting of open swamp with few vegetation.
23	Clouds and no-data		Sighting of clouds and clouds shadow with size more than 4 cm2 at 100.000 scales display.


[1] ACTIVITY DATA
Preparation of Interpretation
Landsat Images acquisition from 2 LAPAN ground stations
Landsat image processing by LAPAN:
--L1 level
--ARD level
--Composite
Landsat image mosaicking to RGB format for YYYY year (1 July YYYY-1 to 30 June YYYY)
Interpretation
Land Cover Map (N-1)
Interpretation of Land Cover (N)
• On Screen Digitaze
• Groundcheck
QC/QA :
•Validation check
•Minor
National Compilation
Documentation
Registry/Archiving
• National base data(RBI) Biophysical condition
• Soil, Geolog y etc.
• Land status
• Forestland ; IUP; HGU; PIPPIB; RTRWP.
Field information/ local knowledge Photos ; reports ; book of national statistics; complain
Supporting Data
Dissemination
Data Sharing
Publication
[2] EMISSION FACTOR
Sampling Design
Systemic sampling
Plot size
Sample size and allocation
Data Collection
Field data
QA/QC
Analysis
Allometric equation
Carbon Stock estimation

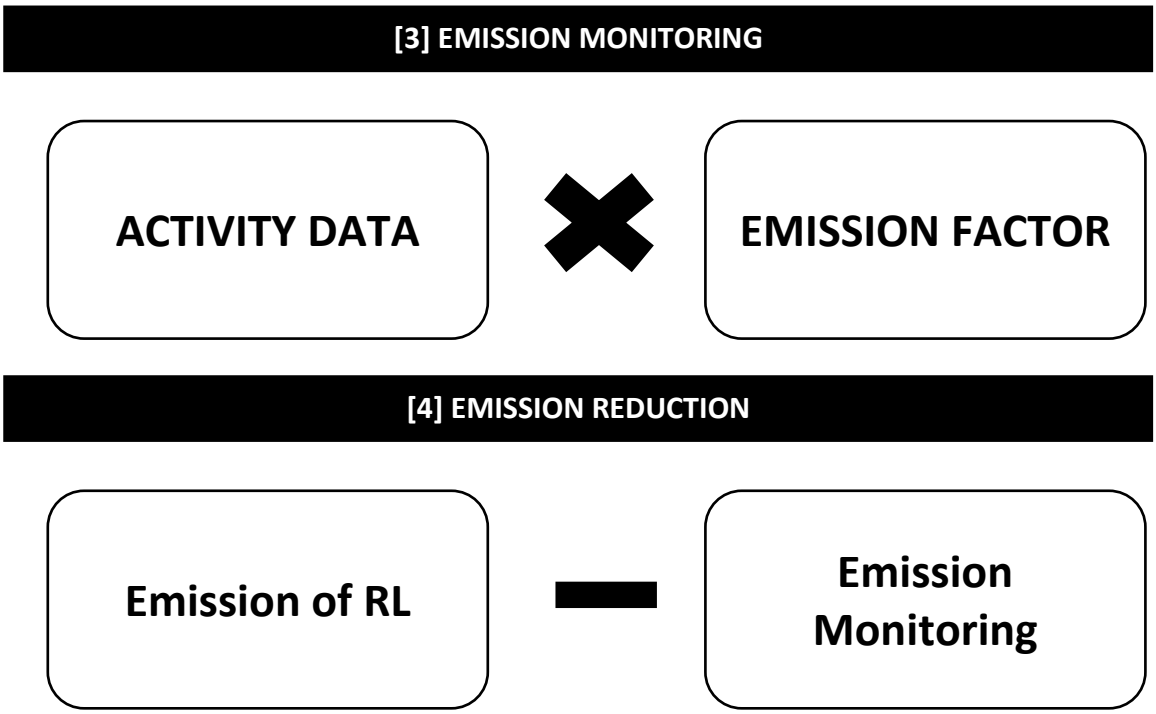


Figure 3. Flow chart for calculation of emissions from deforestation and forest degradation

2.2.2 Calculation

As described in the line diagram above, the basic equation to estimate carbon stock within a specific land cover type in one monitoring year is as follow:

$$GHG_{LC,t} = \left(A_{LC,t} \times B_{LC,t} \times CF_{BC} \times CF_{CCE}\right) \quad \textit{Equation 1a}$$

$$B_{LC,t} = \left(AGB_{LC,t} + \left(RS_{LC} \times AGB_{LC,t}\right)\right) \quad \textit{Equation 1b}$$

Where:

$GHG_{LC,t}$	=	*Gross emissions from deforestation and forest degradation at year t; $tCO_2e*year^{-1}$;*
$A_{LC,t}$	=	*Extent of the land cover type LC in year t; hectare*
$B_{LC,t}$	=	*Average Total Biomass of land cover type LC; ton*
$AGB_{LC,t}$	=	*Average Aboveground Biomass of land cover type LC; ton*
RS_{LC}	=	*Average Root:Shoot ratio of land cover type LC, unitless*
CF_{BC}	=	*Carbon Fraction; biomass to carbon conversion factor, unitless (0.47)*
CF_{CCE}	=	*CO_2eq Fraction; carbon to CO2eq conversion factor, unitless (44/12)*

Further explanation of the terms are given below.

Emission reduction calculation

$$ER_{ERP,t} = RL_t - GHG_t \quad \textit{Equation 1c}$$

Where:

ER_{ERP}	=	*Emission Reductions under the ER Program in year t; $tCO_2e*year^{-1}$.*
RL_{RP}	=	*Gross emissions of the RL from deforestation and forest degradation over the Reference Period; $tCO_2e*year^{-1}$. This is sourced from Annex 4 to the ER Monitoring Report and equations are provided below.*
GHG_t	=	*Monitored gross emissions from deforestation and forest degradation at year t; $tCO_2e*year^{-1}$;*
t	=	*Number of years during the monitoring period; dimensionless.*

Reference Level (RL_t)

Following the TAP assessment of the ERPD, Indonesia notified the FMT on the intention to apply technical corrections to the reference level for the ER-Program before the signing of the ERPA. The corrected RL estimation may be found in Annex 4, yet a description of the equations is provided below.

Gross emissions of the RL from deforestation over the Reference Period (RL_{RP}) are estimated as the sum of annual change in total biomass carbon stocks (ΔC_{B_t}) during the reference period.

Reference level calculation

$$RL_{RP} = (\sum_{RPs}^{RPe} (GHG_{DD} + GHG_{SM} + GHG_{FIRE}))/t) + GHG_{DEK} \qquad \textit{Equation 1d}$$

Where:

RL_{RP}	=	*Gross emissions of the RL from deforestation and forest degradation over the Reference Period; $tCO_2e*year^{-1}$. This is sourced from Annex 4 to the ER Monitoring Report and equations are provided below.*
GHG	=	*Gross emissions from deforestation and forest degradation at year (2005/2006 until 2015/2016); $tCO_2e*year^{-1}$;*
DD	=	*Annual emission above ground biomass – deforestation and forest degradation*
SM	=	*Annual emission soil mangrove*
FIRE	=	*Annual emission fire*
DEK	=	*Emission from decomposition on year 2017/2018*
t	=	*Number of years during the reference level period (10 years); dimensionless.*
RPs	=	*Start of reference period – 2005/2006- 2006/2007*
RPe	=	*End of reference period – 2014/2015-2015/2016*

The calculations of Emissions in the Monitoring period using the same method as the Reference Level.

The calculation of the emission over the reference period and the monitoring period are given in files, fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx. The calculation of the monitored emission (combining Activity Data and Emission Factors) is given in the same file where specific calculation for each carbon pool is given in different sheets with naming convention listed in the following table.

AD_ER_DEF_XXYY	:	Activity Data and Monte Carlo Simulation of Carbon Emission from Deforestation between year 20XX to year 20YY

AD_ER_DEG_XXYY	:	Activity Data and Monte Carlo Simulation of Carbon Emission from Forest Degradation between year 20XX to year 20YY
AD_ER_DEK_XXYY	:	Activity Data and Monte Carlo Simulation of Carbon Emission from Peat Decomposition between year 20XX to year 20YY
ER_SMangrove	:	Activity Data and Monte Carlo Simulation of Carbon Emission from Mangrove Soil for reference and monitoring periods
Peat_Def_Fire	:	Activity Data and Monte Carlo Simulation of Carbon Emission from Fire on Peatland for reference and monitoring periods
FireStableForest	:	Activity Data and Monte Carlo Simulation of Carbon Emission from Fire on Stable Forest for reference and monitoring periods

Beside these main worksheets, the following sheets are also available to help understand the calculation of carbon emission

EF_EKJERP	:	Above ground biomass, root:shoot ratio, carbon fraction, below ground biomass, emissions factors for mangrove, peat and fire used in this work
UncertaintyAD	:	Reference tables for Uncertainties for each land cover change status
ActivityData0616	:	Attribute table of the land cover change map in reference period
ActivityData1521	:	Attribute table of the land cover change map in monitoring period
Sum All	:	Summary of Carbon Emission from each Carbon Pools
Sum Def	:	Summary of Monte Carlo Simulation for Emission from Deforestation
Sum Deg	:	Summary of Monte Carlo Simulation for Emission from Degradation
Sum SMgrv	:	Summary of Monte Carlo Simulation for Emission from Mangrove Soil
Sum PeatDek	:	Summary of Monte Carlo Simulation for Emission from Peat Decomposition
Sum PeatFire	:	Summary of Monte Carlo Simulation for Emission from Fire on Peatland
Sum StableForest	:	Summary of Monte Carlo Simulation for Emission from Fire on Stable Forest
SumSensitivityAnalysis		Summary of Sensitivity Analysis for Each Carbon Pools

The following sections show the calculations of emissions for the different components discussed above.

●CARBON STOCK AND EMISSION FACTOR

The estimation of the carbon stock of the above ground biomass of the six forest-types uses local allometric models, i.e.

- Primary and Secondary Dryland forest (Manuri et al., 2017)
  $AGB = 0.167 \times DBH^{2.56} \times WD^{0.889}$ (Equation 2)

- Primary and Secondary Swamp forest (Manuri et al., 2014)
  $AGB = 0.242 \times DBH^{2.473} \times WD^{0.736}$ (Equation 3)
- Primary and Secondary Mangrove forest (Komiyama et al., 2005)
  $AGB = 0.251 \times WD \times DBH^{2.46}$ (Equation 4)

where:
AGB= Above ground biomass
DBH= Diameter at chest height
WD= Weight density

To convert AGB (t/ha) to C (t/ha) for each forest types, carbon fraction of 0.47 is used as suggested by the IPCC 2006 (C = 0.47 * AGB).

The below ground biomass (BGB) for dry forest is estimated using root-shoot ratio from the IPCC GPG LULUCF (Table 3A.1.8. page 3.168). The value of the ratio is 0.24 for dry forest. For mangrove forest the value is 0.36 based on measurement reported in Komiyama et al., 2005 for mangrove forest in Indonesia. For swamp forest is assumed to be the same as that of mangrove forest in Indonesia.

The data source for the carbon stock of non-forest lands is derived from mainly Indonesian literatures (ER-PD Annex 8.3.). The below ground biomass (BGB) of non-forest classes is also estimated using root-shoot ratio based on IPCC default values (IPCC GPG GL for LULUCF page 3.168 table 3A.1.8). The values of the ratio vary between land cover types, i.e. 0.32 for forest plantation and estate crops), 0.48 for dry and wet shrubs, mix dryland agriculture and transmigration area, and 1.58 for savanna/grassland, pure dryland agriculture, rice paddy, bare ground and settlement.

Emission factors EF_f for biomass consumed by fire can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following formula:

$L_{fire} = A * EF_f$ (Equation 5)

$EF_f = M_B * C_f * G_{ef} * 10^{-3}$ (Equation 6)

$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$ (Equation 7)

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CO2, CH_4, N_2O

A = burnt area, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Chapter 2-page 2.48).The default value of the IPCC combustion factor, C_f, is 0.36

G_{ef} = emission factor, g kg^{-1} dry matter burnt (1580 for CO2, 6.8 for CH4 and 0.20 for N2O, Table 2.5 of 2006 IPCC Guideline, Chapter 2- Page 2.47)

Emission factors EF_f for the peat fires can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following formula:

$L_{fire} = A * EF_f$ (Equation 8)

$EF_f = M_B * C_f * G_{ef} * 10^{-3}$ (Equation 9)

$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$ (Equation 9)

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CO2, CH_4, N_2O

A = burnt area, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Volume 4, Chapter 2-page 2.48)

G_{ef} = mission factor, g kg^{-1} dry matter burnt (default values in Table 2.7, Chapter 2 of 2013 Supplement to 2006, page 2.36)

The M_B for the peat is 353 tons dry matter per hectare following IPCC default (Table 2.6 of the Chapter 2 in page 2.40, 2013 Supplement to the 2006 IPCC). The M_B depends on depth of peat and bulk density of the peat. Based on measurement in Central Kalimantan, the M_B is about 505 tons dry matter per hectare with assumption that the average depth of peat burn is 0.33 m and bulk density 0.153 t/m^3 (MRI 2013). However, we adopt the IPCC default as the default considering the data was based on measurement from multiple locations that may represent better general condition. The C_f is taken from the IPCC default value (Tables 2.6 of 2006 IPCC Vol. 4 Chapter 2). The G_{EF} for CO_2 is 1,701 g/kg dry matter burnt (Table 2.7 of the Chapter 2 of the 2013 Supplement to the 2006 IPCC, page 2.36) and for CH_4 is 21 g/kg dry matter burnt.

Calculation of emission factor of mangrove soil, i.e. the difference between amount of carbon in the mangrove soil (C_M) and amount of carbon in soil on the floor of the aquaculture system (C_{AQ}). Data on the soil carbon of mangrove and abandoned pond is taken from Kauffman *et al.* (2017) based on measurement from the 20 locations in East Kalimantan. The procedure for the sampling is described in Kauffman et al. (2016). Based on measurement in 20 locations in East Kalimantan, the value of C_M is 902.91 tC/ha and the value of C_{AQ} is 487.31 tC/ha, thus the EF for conversion of mangrove soil to aquaculture system is 415.6 tC/ha (Kauffman, 2017[18]).

● EMISSIONS FROM DEFORESTATION

Emissions from deforestation include the following:

- Emissions associated with loss of living forest biomass
- Emissions associated with soil carbon

As described in the previous section, the carbon pools used to measure emissions from deforestation depend on the land type. For deforestation on mineral soils AGB and BGB are included. For deforestation on organic soils (peat forests and mangroves) soil carbon is also

[18] https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.1482

included. The methods for calculating emissions from deforestation are described below.

a. Deforestation emissions from living biomass

The method used for the calculation of average annual historical emissions follows the national method (MoEF, 2015)[19] that is consistent with the IPCC. Emissions from deforestation at a given period were calculated by aggregating CO_2 emissions resulting from newly identified deforested areas within that period.

The calculation of CO_2 emissions from deforested areas used the following equation:

$$GE_{ijk=} = A_{ijk} \times EF_{jk} \times (44/12) \qquad \text{(Equation 10)}$$

GE_{ijk} = CO_2 emissions from deforested area-i at forest change class-j to non-forest class-k, in tCO_2e

A_{ijk} = Deforested area-i in forest change class-j to non-forest class-k, in hectare (ha).

EF_j = Emission Factor which is calculated as the difference between carbon stock of forest class-j and carbon stock of non-forest class-k, in ton carbon per ha (tC ha-1). Emission factors for each forest and non-forest class are listed in sub-chapter 3.1.1 ER-PD/Annex 4 ER-MR.

(44/12) is conversion factor from tC to tCO_2e

Carbon stock of the lands after the conversion used in the calculation of the emission from the deforestation is the lifetime average carbon stock. It is assumed that land-cover types after deforestation will not change. This assumption is adopted since it is not practical to track the changes of land cover after deforestation, and it is unlikely that the natural forest that have been converted to non-forest lands will change back to natural forest. The deforestation of primary or secondary forest to non-forested was also counted only once that occur at one particular area. Identification of primary or secondary forest area in particular year is filtered using the primary or secondary forests of the previous years. Thus, the deforestation of primary and secondary forest to non-forested will be detected only in remaining primary or secondary forests of the previous years that have never been deforested before.

The emission from gross deforestation at period t (GEt), was estimated using equation below,

$$GE_t \sum_{i=1}^{N} \sum_{j=1}^{P} GE_{ijk} \qquad \text{(Equation 11)}$$

GE_t = total emission at period t from deforested area-I in forest class-j to non-forest class-k, expressed in tCO_2

N = number of deforested area units at period t (from t0 to t1), expressed without unit

P = number of forest classes which meet natural forest criterion.

[19] https://redd.unfccc.int/files/national_frel_for_redd__in_indonesia_2015.pdf

Further, average emissions from deforestation from all periods were calculated as follows:

$$\mathrm{MGE_P} = \frac{1}{\mathrm{T}}\sum_{\mathrm{t=1}}^{\mathrm{p}} \mathrm{GE_t} \qquad \text{(Equation 12)}$$

MGEP = mean or average emissions from deforestation from all period P (expressed in tCO_2yr^{-1})
t = number of years in period P

The estimation of emission from deforestation from the loss of living biomass between two years (period) used the land use transition matrix.

The emissions from the change of a land use category to other land use category from the transition matrix used the equation 2 and their corresponding emission factors as defined in sub-chapter 3.1.1.

Indonesia's National Forest Monitoring System (NFMS) categorize the whole land uses into six different forest types and 17 land cover types. Ideal carbon emission accounting shall consider every land cover types since they have different carbon content. However, combining 6 forest cover types and 17 non-forest cover types is indeed a tedious work, so the East Kalimantan Carbon Accounting Task Force decided to weight the emission factors of all non-forest cover types and ended up with only six different combinations of the carbon emissions.

b. Deforestation emissions from soil carbon
b1. Emissions from Peat decomposition in deforested areas

The procedures of calculating peat decomposition from deforestation follow three steps as shown in Annex 4 E Figure 8.5. First is defining natural forest in 2006 over peat land, and then step 2 is generating land cover change from each interval year to define a transition area matrix for the associated year of interval. The third step is calculating total annual emissions by multiplying the transition matrix of both areas and associated emission factors.

Calculation of emissions from peat decomposition used the same basis as emissions from deforestation. This is due to the fact that once deforestation occurs in peat forest, there will be emissions from removal of the ABG at the time of conversion as describe above, and plus from peat decomposition subsequently. The formula for estimating the emission from peat decomposition is the following:

$$\mathrm{PDE_{ijt}} = \mathrm{A_{ijt}} \times \mathrm{EF_j} \qquad \text{(Equation 13)}$$

PDE = CO_2 emission ($tCO_2yr\text{-}1$) from peat decomposition in peat forest area-i changed into land cover type-j within time period-t
A = area-i of peat forest changed into land cover type-j within time period-t
EF = the emission factor from peat decomposition of peat forest changed into land cover class-j (t_CO_2 ha yr-1) [20]

[20] Emission factor for an area of change is an average of the emission factors of the respective land cover before and after. This reflects the assumption that conversion of land cover on peatland between two time periods gradually affects the peat water table implying a gradual peat decomposition emission. For example, the emission factor of

Emission factor for peat decomposition of peat forest change using Paciornik and Rypdal (2006) and IPCC (2014). These emission factors are reported in 2013 Supplement Guideline to 2006 IPCC Guidelines for National GHG Inventory: Wetlands[21]. Most of the data reported in the guideline come from Indonesian experiences.

b2. Emissions from Peat Fire in deforested areas

Emission factors EF_f for the peat fires can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following formula:

$$L_{fire} = A * EF_f \quad \text{(Equation 14)}$$

$$EF_f = M_B * C_f * G_{ef} * 10^{-3} \quad \text{(Equation 15)}$$

$$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3} \quad \text{(Equation 16)}$$

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CO_2, CH_4, N_2O

A = burnt area, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Volume 4, Chapter 2-page 2.48)

G_{ef} = mission factor, g kg^{-1} dry matter burnt (default values in Table 2.7, Chapter 2 of 2013 Supplement to 2006, page 2.36)

The M_B for the peat is 353 tons dry matter per hectare following IPCC default (Table 2.6 of the Chapter 2 in page 2.40, 2013 Supplement to the 2006 IPCC). The M_B depends on depth of peat and bulk density of the peat. Based on measurement in Central Kalimantan, the M_B is about 505 tons dry matter per hectare with assumption that the average depth of peat burn is 0.33 m and bulk density 0.153 t/m^3 (MRI 2013). However, we adopt the IPCC default as the default considering the data was based on measurement from multiple locations that may represent better general condition. The C_f is taken from the IPCC default value (Tables 2.6 of 2006 IPCC Vol. 4 Chapter 2). The G_{EF} for CO_2 is 1,701 g/kg dry matter burnt (Table 2.7 of the Chapter 2 of the 2013 Supplement to the 2006 IPCC, page 2.36) and for CH_4 is 21 g/kg dry matter burnt.

Calculation of emissions from peat fire in the deforested area (L_{fire}) is calculated using the following formula (IPCC, 2014):

$$L_{fire} = A * EF_f = A * M_B * C_f * G_{ef} * 10^{-3} \quad \text{(Equation 17)}$$

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CH_4, N_2O, etc.

secondary forest is 19 tCO2 ha-1 y-1 and the emission factor of bare ground is 51 tCO2 ha-1 y-1, so that the average emission factor for an area changing from secondary forest to bare ground is 35 tCO2 ha-1 y-1.

[21] CHAPTER 1 (ipcc.ch)

A = area burnt, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Volume 4 Chapter 2-page 2.48)

G_{ef} = emission factor, g kg^{-1} dry matter burnt (default values in Table 2.5 of the 2006 IPCC Guideline, Volume 4 Chapter 2-page 2.47)

b3. Emissions from *Mangrove Soil in deforested areas*

When mangrove forests are converted to aquaculture, they normally are being cleared and the soil being removed or excavated, normally 1.5 to 2 meters deep. When the organic soils are excavated, they exposed to aerobic condition and being oxidized that emit CO_2. Considering that soil mangrove has very high organic content (Kauffman et al, 2017[22] and Murdiyarso et al, 2015[23]), conversion of mangroves will result in a significant amount of CO_2 emissions.

Calculation of emissions from mangrove soil in the ER program is considered only for conversion to aquaculture. Emissions released are calculated as potential emissions assuming that emissions from organic soil removed from the floor of the aquaculture system are emitted once at the time of the conversion. Thus, the calculation of the emissions from conversion of mangrove to aquaculture (E_{MS}) used the following formula:

$$E_{MS} = A_{MA} \times EF_{MA} \qquad \text{(Equation 18)}$$

A_{MA} is area of mangrove converted to aquaculture, EF_{MA} is emission factor, i.e. the difference between amount of carbon in the mangrove soil (C_M) and amount of carbon in soil on the floor of the aquaculture system (C_{AQ}).

Summary: Average Historical Emissions from Deforestation

Emissions from deforestation is calculated based on the emissions associated with loss of living forest biomass (AGB and BGB), and the emissions associated with soil carbon. The Emission from soil includes the emission from peat soil due to decomposition process, and fire events, and also the emission from mangroves soil due to mangrove conversion to aquaculture.

[22] https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.1482
[23] https://www.nature.com/articles/nclimate2734

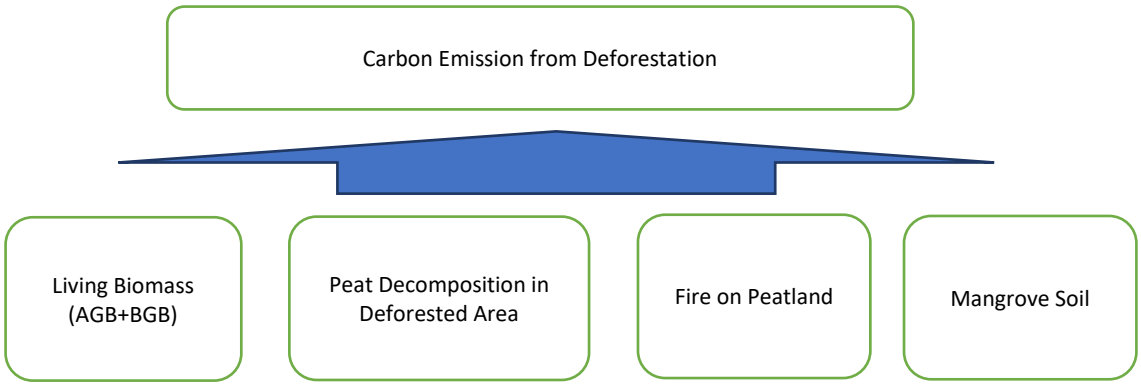


Figure 4. Emission from Deforestation

- **EMISSIONS FROM FOREST DEGRADATION**

The emission from degradation of natural forest include:

1. *Emissions due to the degradation of primary forest into secondary forest*
2. *Emissions due to further degradation of secondary forest caused by fire*
3. *Emissions from peat decomposition in secondary forests*

a. Emissions from forest degradation of primary forest to secondary forest

The assessment of changes of primary forest to secondary forest and the estimation of emissions from the removal of the living biomass (AGB and BGB) and decomposition of organic soils follows a similar procedure as that of the deforestation (Equations 2-4). The degradation of primary forest to secondary forest was also counted only once that occur at one particular area, similar to the procedure used in calculating the deforested area. Identification of secondary forest area in particular year is filtered using the primary forests of the previous years. Thus, the degradation of primary forest to secondary forest will be detected only in remaining primary forests of the previous years that have never been degraded before.

The estimation of emission from forest degradation from the loss of living biomass (change of primary to secondary forest) between two years (period) used the land use transition matrix in all forests (production and non-production forests).

The emissions from the change of primary to secondary used the equation 19. For example, the emission from 41,722.33 ha degraded area (Primary dryland forest to Secondary dryland forests; 2001-2002) occurred in the period 2006 and 2009 is calculated as follow:

$$E_{2001\text{-}2002} = A * (EF_{BC} - EF_{AC}) * 44/12 \qquad \text{(Equation 19)}$$

Where:

EF_{BC} = *Emission Factor of the specific area with previous land cover type before forest degradation occured; tC*year^{-1};*

EF_{AC} = *Emission Factor of the specific area with current land cover type after forest degradation occured; tC*year^{-1};*

$E_{2001-2002}$ = 41,722.33*(167.3-122.06)*44/12 = 6,922,432.35 ton CO_2 or about 2,307,477.45 tCO_2e per year.

b. Emissions due to further degradation of stable secondary forest caused by fire

Emission factors EF_f for biomass consumed by fire can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following equation 14,15 and 16. Gas emission factor from dry matter burnt for CO_2, CH_4 and N_2O is 1701.33 g kg^{-1}, 21 g kg^{-1} and 0.20 g kg^{-1} respectively.

Fire in secondary forest will result in further degradation and in more emissions. Estimation of the stable forest area affected by fire is by delineating burnt area of the stable forest (forests that remained as secondary forest throughout the reference period) hotspot (see Annex 4 section 8.4.3). This is to avoid double counting of emissions in which the loss of biomass due to fire in the deforested forest is not included. The implication of this is that when the secondary forests affected by fire are deforested during the future ERP reporting period, we will have to use separate emission factors in the calculation of the emission from deforestation which take into account the loss of carbon due to fire that occurred in the reference period.

For example, the area of stable secondary forests affected by fire in 2007 was 280.39 ha which is all secondary dryland forest (2002). The total fire emission reached 46,787.70 ton CO_2e (using equation 6). A similar approach was taken for all other years to estimate the emissions from fire in stable secondary forest.

c. Emissions from peat decomposition in secondary forests

The loss of carbon from the decomposition of organic soil occurs in secondary forest (IPCC, 2014). These are considered to be inherited emissions because the disturbance (which changed the forest from primary to secondary) occurred prior to 2006. The estimation of the emission from peat decomposition uses equation 5. Similar to those in deforestation, considering the inherited carbon emissions on peatland, the carbon emission from peat decomposition between year 2017-2018 is considered as total carbon emission for the whole reference period (2006-2016).

Summary: Average Historical Emissions from Forest Degradation

Emissions from forest degradation is calculated based on the emissions associated with loss of living forest biomass (AGB and BGB) due to transition of primary forest to secondary forest, and fires in stable secondary forest. In addition, the emissions associated with soil carbon on peat secondary forest is also included. The Emission calculation from peat soil on secondary forest follows the method of peat decomposition process.

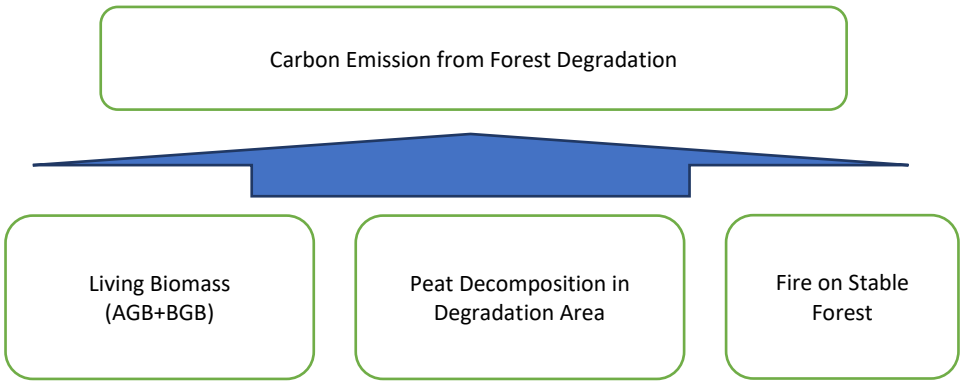


Figure 5. Emission from Forest Degradation

3 DATA AND PARAMETERS

3.1 Fixed Data and Parameters

3.1.1 Carbon Stock for Deforestation and Forest Degradation

Parameter:	Carbon stock used for the estimation of emission from deforestation and degradation
Description:	Emission Factor for deforestation and forest degradation, i.e. living biomass (AGB+BGB) of the six forest classes, primary and secondary dryland forests; primary and secondary swamp forests; primary and secondary mangrove forests; and 17 type of non-forest lands (Plantation forest; Dry shrub; Wet shrub; Savanna and Grasses; Dry agriculture; Mixed dry agriculture; Estate crop' Paddy field' Transmigration areas; Bareland; Settlement; Others (pond, mining, port, open water, open swamp, ponds)
Data unit:	ton /hectare
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	The primary data source for the carbon stock of natural forests is derived from the measurement of AGB from the Permanent Sampling Plots in of National Forest Inventory (NFI) in East Kalimantan (see sheet 'TC_AGB' on file TC_AGB lokal_Uncertainty_23Jul2022 - The estimation of AGB used local allometric equations (Manuri et al , 2017[24] for dryland forest; Manuri et al., 2014[25] for swamp forests; Komiyama et al., 2005[26] for mangrove.The valu of the root shoot ratio can be seen on sheet 'TC_Uncertainty' on file TC_AGB 34ocal_Uncertainty_23Jul2022 – The estimation of the carbon stock of the above ground biomass of the six forest-types uses local allometric models, i.e. • Dryland forest (Manuri et al., 2017) $AGB = 0.167 \times DBH^{2.56} \times WD^{0.889}$ • Swamp forest (Manuri et al., 2014) $AGB = 0.242 \times DBH^{2.473} \times WD^{0.736}$ • Mangrove forest (Komiyama et al., 2005) $AGB = 0.251 \times WD \times DBH^{2.46}$ The data source for the carbon stock of non-forest lands is derived from mainly Indonesian literatures (see sheet 'AGB_Other Studies 'on file TC_AGB 34ocal_Uncertainty_23Jul2022 –

[24] https://link.springer.com/article/10.1007/s13595-017-0618-1
[25] https://www.sciencedirect.com/science/article/abs/pii/S0378112714005209
[26] https://www.cambridge.org/core/journals/journal-of-tropical-ecology/article/abs/common-allometric-equations-for-estimating-the-tree-weight-of-mangroves/6067C26CECE5B0EF18A319B8DB89B771

The carbon stock data used are total of above ground (AGB) and below ground biomass (BGB). Calculation for BGB = AGB * Root shoot ratio. The value of the ratio is 0.24 for primary forest. For mangrove and swamp forest the value is 0.36 based on measurement from Komiyama et al., 2005 for mangrove. The values of the ratio vary between land cover types, i.e. 0.32 for forest plantation and estate crops), 0.48 for dry and wet shrubs, mix dryland agriculture and transmigration area, and 1.58 for savanna/grassland, pure dryland agriculture, rice paddy, bare ground and settlement.

Spatial level: regional (province)

Value applied:

Forest lands

Land cover	Code	AGB (t/ha)
Primary Dryland Forest	2001	287.08
Secondary dryland forest	2002	209.44
Swamp primary forest	2005	538.56
Swamp secondary forest	20051	365.30
Mangrove primary forest	2004	263.38
Mangrove secondary forest	20041	181.83

Non-forest lands

Land cover	Code	AGB (t /ha)
Plantation forest	2006	133.11
Dry shrub	2007	41.36
Wet shrub	20071	46.53
Savanna and Grasses	3000	5.96
Pure dry agriculture	20091	15.96
Mixed dry agriculture	20092	47.89
Estate crop	2010	105.75
Paddy field	20093	9.36
Transmigration areas	20122	21.28
Bare ground	2014	5.32
Settlement	2012	8.51
Port and harbor	20121	0.00
Open water	5001	0.00
Open swamps	50011	0.00
Mining areas	20141	0.00
Fish pond/aquaculture	20094	0.00

After the AGB successfully calculated, the BGB was estimated by multiplying the AGB with the Root:Shoot Ratio, then multiplying the result with the carbon fraction to estimate the carbon content (C /Ha).

<table>
<tr><td></td><td></td></tr>
<tr><td>QA/QC procedures applied</td><td>Guidelines for Quality Assurance and Control (QA/QC) of Indonesia's Greenhouse Gases Inventory (DGCC MoEF, 2018[27])</td></tr>
<tr><td>Uncertainty associated with this parameter:</td><td>Key uncertainty comes from (1) sampling error (between 13 to 31%), (2) allometric model (27%-31%), (3) biomass conversion factor to carbon (5.3% Table 4.3 of the 2006 IPCC) and (5) root: shoot ratio (based on the IPCC GPG for LULUCF. And measurement, i.e. between 9% & 32%; See Annex 12.1ERPD for details).

The uncertainty of above ground biomass (AGB) for each land cover type was determined through standard statistical measures combining the mean and the 95% confidence interval. For a complete work regarding the uncertainty of the estimates of AGB, please consult the following file TC_AGB 36ocal_Uncertainty_23Jul2022 .

For the case of Deforestation, it was too complex to perform all calculations involving all 23 land cover types with 6 forest types and 17 non-forest types. Therefore, a weighting approach was applied to estimate the AGB while error propagation approach was applied to estimate uncertainty values of those non-forest classes. In the end, there were only 6 values for AGB along with uncertainty and standard error for 6 classes of forest.

For forests
<table>
<tr><th>Land cover</th><th>Code</th><th>Uncertainty (%)</th></tr>
<tr><td>Primary Dryland Forest</td><td>2001</td><td>9.27</td></tr>
<tr><td>Secondary dryland forest</td><td>2002</td><td>5.24</td></tr>
<tr><td>Swamp primary forest</td><td>2005</td><td>22.11</td></tr>
<tr><td>Swamp secondary forest</td><td>20051</td><td>29.87</td></tr>
<tr><td>Mangrove primary forest</td><td>2004</td><td>14.61</td></tr>
<tr><td>Mangrove secondary forest</td><td>20041</td><td>18.45</td></tr>
</table>
For non-forests
<table>
<tr><th>Land cover</th><th>Code</th><th>Uncertainty (%)</th></tr>
<tr><td>Plantation forest</td><td>2006</td><td>14.57</td></tr>
<tr><td>Dry shrub</td><td>2007</td><td>31.79</td></tr>
<tr><td>Wet shrub</td><td>20071</td><td>42.19</td></tr>
<tr><td>Savanna and Grasses</td><td>3000</td><td>31.79</td></tr>
<tr><td>Pure dry agriculture</td><td>20091</td><td>14.57</td></tr>
<tr><td>Mixed dry agriculture</td><td>20092</td><td>31.79</td></tr>
<tr><td>Estate crop</td><td>2010</td><td>15.86</td></tr>
<tr><td>Paddy field</td><td>20093</td><td>14.57</td></tr>
</table>
</td></tr>
</table>

[27] http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/dokumen/Pedoman_QA_QC_FULL_ISBN.pdf

	Transmigration areas	20122	31.79
	Bare ground	2014	14.57
	Settlement	2012	14.57
	Port and harbor	20121	0.00
	Open water	5001	0.00
	Open swamps	50011	0.00
	Mining areas	20141	0.00
	Fish pond/aquaculture	20094	0.00
Any comment:			

3.1.2 Fire in Secondary Forest

Parameter:	Emission factors used for the estimation of emission from Fire in Secondary Forest
Description:	*Emission Factor for biomass fire*
Data unit:	*t CO_2e/ha*
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	*See chapter 2.2.2.* Spatial level: regional (province) with data provided nationally by MoEF.
Value applied:	

Parameter	Value	Unit
Combustion Factor	0.36	Unitless
EF CO_2	1580	(g/kg DM)
EF CH_4	6.8	(g/kg DM))
EF N_2O	0.2	(g/kg DM)
Pooled EF	756.24	(g/kg DM)

QA/QC procedures applied	*Guidelines for Quality Assurance and Control (QA/QC) of Indonesia's Greenhouse Gases Inventory (DGCC MoEF, 2018)*
Uncertainty associated with this parameter:	

Parameter	Uncertainty	Unit
Combustion Factor	16.67	%
EF CO_2	8.29	%

	EF CH_4	27.94	%
	EF N_2O	35.00	%
	Pooled EF	256.60	%
Any comment:	Key of uncertainty is error in estimating the amount of biomass available for burning, combustion factor and EFs of three gases (CO_2, CH_4 and N_2O).		

3.1.3 ***Peat Fire***

Parameter:	Emission Factor for deforested peat fire
Description:	*Emission Factor for peat fire*
Data unit:	*t CO_2e/ha*
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	*See chapter 2.2.2 .* Spatial level: regional (province)
Value applied:	756.24 t CO_2e/ha. The value is estimated from the summation of the result of the multiplication of MB, C_f, and G_{ef} for CO_2 and CH_4 (see equation 11)
QA/QC procedures applied	*Guidelines for Quality Assurance and Control (QA/QC) of Indonesia's Greenhouse Gases Inventory (DGCC MoEF, 2018)*
Uncertainty associated with this parameter:	Key of uncertainty is error in estimating the amount of biomass available for burning, combustion factor and EFs of three gases (CO_2, and CH_4). Uncertainty level is 66.5% (Pooled uncertainty based on confidence interval EF of Tables 2.6 and 2.7 of the 2013 Supplement to the 2006 IPCC Guidelines, $U_{Polled} = \sqrt{(U_{CO2}^2+U_{EF\text{-}CH4}^2)}$
Any comment:	

3.1.4 Emission Factor from Soil

b. Emission Factors from peat soils

Parameter:	Emission Factor for peat decomposition
Description:	Peat emissions happen slowly over time once land is cleared for a number of years depending on the depth of the peat soil. The emissions from peat decomposition do not continue indefinitely, as they cease when the peat has completely decomposed or reached the water table.
Data unit:	*t CO2e/ha*
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	*See chapter 2.2.2* Spatial level: national
Value applied:	

Land cover	**Code**	**EF (t CO_2/ha/yr)**
Primary dryland forest	2001	0
Primary mangrove forest	2004	0
Primary swamp forest	2005	0
Secondary dryland forest	2002	19
Secondary mangrove forest	20041	19
Secondary swap forest	20051	19
Plantation forest	2006	73
Estate crop	2010	40
Pure dry agriculture	20091	51
Mixed dry agriculture	20092	51
Dry shrub	2007	19
Wet shrub	20071	19
Savanna and Grasses	3000	35
Paddy Field	20093	35
Open swamp	50011	0
Fish pond/aquaculture	20094	0
Transmigration areas	20122	51
Settlement areas	2012	35
Port and harbor	20121	0
Mining areas	20141	51
Bare ground	2014	51
Open water	5001	0
Clouds and no-data		Nd

QA/QC procedures applied	*Guidelines for Quality Assurance and Control (QA/QC) of Indonesia's Greenhouse Gases Inventory (DGCC MoEF, 2018)*
Uncertainty associated with this parameter:	Key uncertainty comes from sampling error (number of sampling, timing of sampling, length of the time between sampling taken to processing in laboratory). The uncertainty is taken from the 2013 supplement for 2006 IPCC Guideline (IPCC, 2014)
Any comment:	

Land cover	**Code**	**Uncertainty (%)**
Primary dryland forest	2001	0.0
Primary mangrove forest	2004	0.0
Primary swamp forest	2005	0.0
Secondary dryland forest	2002	84.2
Secondary mangrove forest	20041	84.2
Secondary swap forest	20051	84.2
Plantation forest	2006	20.5
Estate crop	2010	55.0
Pure dry agriculture	20091	86.3
Mixed dry agriculture	20092	86.3
Dry shrub	2007	84.2
Wet shrub	20071	84.2
Savanna and Grasses	3000	108.6
Paddy Field	20093	108.6
Open swamp	50011	0.0
Fish pond/aquaculture	20094	0.0
Transmigration areas	20122	86.3
Settlement areas	2012	108.6
Port and harbor	20121	0.0
Mining areas	20141	86.3
Bare ground	2014	86.3
Open water	5001	0
Clouds and no-data		Nd

b. Emission Factors from mangrove soils

Parameter:	Emission Factor for mangrove soil and shrimp pond
Description:	Calculation of emissions from mangrove soil in the ER program is considered only for mangrove forest converted to aquaculture. Emissions released are calculated as potential emissions assuming that emissions

	from organic soil removed from the floor of the aquaculture system are emitted once at the time of the conversion.
Data unit:	*Ton CO_2e /hectare*
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	Data on the soil carbon of mangrove and abandoned pond is taken from Kauffman et al. (2017)[28] based on measurement from the 20 locations in East Kalimantan. The procedure for the sampling is described in Kauffman et al. (2016)[29] Data can see at sheet 'Mangrove Soils 'on file TC_AGB 41ocal_Uncertainty_23Jul2022. Spatial level: province
Value applied:	902.91 tCO_{2e}/ha (mangrove) 487.31 tCO_{2e}/ha (abandoned shrimp pond) EF = 415.6 tCO_{2e}/ha Uncertainty = 33.4%.
QA/QC procedures applied	*Guidelines for Quality Assurance and Control (QA/QC) of Indonesia's Greenhouse Gases Inventory (DGCC MoEF, 2018)*
Uncertainty associated with this parameter:	Key uncertainty comes from sampling error
Any comment:	

3.2 Monitored Data and Parameters

This section outlines all data and parameters that are monitored during the Period June 2019 – June 2020.

3.2.1. DEFORESTATION

Deforestation

a. Deforestation from forest categories to non-forest categories

Parameter:	Land cover change from forest to non-forest
Description:	Area of land cover change between July 2019 - December 2020. The land use transition matrices between these periods are generated to estimate the change of area from forest categories to non-forest categories.
Data unit:	hectare
Value monitored during this Monitoring/Reporting Period:	Area: **Land Cover Transition** | **2019-2020 (Ha)** | **2020-2021 (Ha)***

[28] https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.1482
[29] https://link.springer.com/article/10.1007/s11273-015-9453-z

	Primary Dryland Forest to Non-Forest	0.00	68.05
	Primary Mangrove Forest to Non-Forest	0.00	32.64
	Primary Swamp Forest to Non-Forest	0.00	0.00
	Secondary Dryland Forest to Non-Forest	4397.15	12142.51
	Secondary Mangrove Forest to Non-Forest	80.48	430.54
	Secondary Swamp Forest to Non-Forest	1167.22	463.67

* The land cover transition in 2020-2021 considered only half of the value since the data used for this monitoring period ranges from July 2020 to June 2021

Please note that the land cover transition area presented here is so called *adjusted area* since it was adjusted according to the level of uncertainty in land cover change classification process. Further details about adjusting the land cover change are can be found in the next chapter related to uncertainties.

Detail calculation on excel file https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx

Source of data and description of measurement/calculation methods and procedures applied:	Activity data used in the monitoring period came from Ministry of Environment and Forestry national land cover data (NFMS). The land cover map has been developed by MoEF for the period of 1990 to 2021. Principally, a mosaic of Landsat imageries were prepared to cover the whole area by the Indonesian Space Agency (LAPAN). The MoEF then perform visual interpretation to the image to develop the land cover map consists of 23 land cover types as listed in the SNI No 8033 Year 2014. The land cover map series then further analyzed by the East Kalimantan MMR Technical Team to define the carbon emission as described in this report. The analysis conducted by the East Kalimantan MMR Technical Team includes accuracy assessment of the land cover change status to define overall uncertainty for each land cover change status. This process was performed by generating stratified random samples within the area of land cover changes then analyzed to confirm whether or not the land cover changes stated in the map is correct. The analyst used Higher-resolution imageries (e.g. SPOT-6/7 with 1.5 m ground resolution or Sentinel-2 with 10 m ground resolution) to conclude the real status of the land cover changes. The result of this assessment is presented in detail in MS Excel file named: https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/AccuracyAssessmentEK_LandCover2020_2021_v02U.xlsx

	It is available online at https://nfms.menlhk.go.id/ , which is coupled with webGIS at geoportal.menlhk.go.id for display and viewing. The two websites are part of geospatial portal under the one map policy. Further details on the method for land cover mapping conducted by MoEF , including the method for remote sensing data processing and analysis including type of sensors and the details of the images used can be found here https://jurnal.ugm.ac.id/ijg/article/view/12496/9041
QA/QC procedures applied	SNI 8033-2014 - Methods for Forest Cover Change Interpretation from Optical Satellite Imageries (https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Guidance/SNI 8033 2014.pdf) and Tosiani, et.al (2020) Standard Operating Procedure (SOP): Calculation of Accuracy and Uncertainty of Land Cover Change (https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Guidance/SOP AKURASI_ISI_EBOOK.pdf).
Uncertainty for this parameter:	Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover) and that of land cover changes. The estimation of uncertainty follows a modified method presented by Olofsson et al. (2014), substituting a post stratified estimator of variance (Olofsson 2019, pers. com.). The uncertainty of the land cover change (deforestation) for the period of July 2019- June 2020 and July 2020 - June 2021 are 4,69% and 5.78%, respectively.
Any comment:	

b. Peat decomposition

Parameter:	Peat decomposition
Description:	Area of land cover changes between July 2019-June 2020 and July 2020-June 2021. The land use transition matrices between these periods are generated to estimate the change of areas from forest categories to non-forest categories that occurred in the peatland for the estimation of emissions from peat decomposition from the deforested areas. The use of July 2017 – June 2018 period, which is different than the reference period of other carbon pools (2006-2016) for peatland deforestation is part of an **agreement with CFPs** considering the Indicator 13.1 of the Methodological Framework. Indonesia is not eligible for applying an upward adjustment to its reference level, while Indonesia has peatland in which such indicator is not possible to be applied for countries that have peatland forest.. For reference level using period between July 2017-June 2018.
Data unit:	Hectare

Value monitored during this Monitoring/Reporting Period:

Land cover change	July 2019-June 2020 (Ha)	July 2020- June 2021 (Ha)*
2002-2002	69.10	69.10
2004-2004	1,359.74	1,360.63
2005-2005	6,463.37	6,463.37
2007-2007	9.62	9.62
2010-2010	1,898.13	1,935.03
2012-2012	4.26	4.26
2014-2014	130.51	145.98
2014-2010	36.07	0.00
5001-5001	2.69	45.58
20041-20041	4,423.79	4,380.18
20051-20051	43,189.86	43,189.86
20051-2014	15.31	0.00
20071-20071	646.67	1,357.91
20092-20092	32.17	32.02
20141-20141	45.07	45.07
Total	59,038.59	59,038.59

Note: The first column shows land cover change using cover class codes

* The land cover transition in July 2020 – June 2021 considered only half of the value since the data used for this monitoring period ranges from July 2020 to December 2020

Source of data and description of measurement/calculation methods and procedures applied:

Activity data uses used in the monitoring period came from MoEF Ministry of Environment and Forestry national land cover data (NFMS). The land cover map has been developed by MoEF for the period of 1990 to 2021. Principally, a mosaic of Landsat imageries were prepared to cover the whole area by the Indonesian Space Agency (LAPAN). The MoEF then perform visual interpretation to the image to develop the land cover map consists of 23 land cover types as listed in the SNI No 8033 Year 2014. The land cover map series then further analyzed by the East Kalimantan MMR Technical Team to define the carbon emission as described in this report. The analysis conducted by the East Kalimantan MMR Technical Team includes accuracy assessment of the land cover change status to define overall uncertainty for each land cover change status. This process was performed by generating stratified random samples within the area of land cover changes then analyzed to confirm whether or not the land cover changes stated in the map is correct. The analyst used Higher-resolution imageries (e.g. SPOT-6/7 with 1.5 m ground resolution or Sentinel-2 with 10 m ground resolution) to conclude the real status of the land cover changes. The result of this assessment is presented in detail in MS Excel file named:

<table>
<tr><td></td><td>https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/AccuracyAssessmentEK_LandCover2020_2021_v02U.xlsx

It is available online at https://nfms.menlhk.go.id/ , which is coupled with webGIS at geoportal.menlhk.go.id for display and viewing. The two websites are part of geospatial portal under the one map policy.
The peat area map is provided by the Ministry of Agriculture (2011), through national survey of peatland, updated by the MoEF.
The description of methods for data derived from remote sensing images including type of sensors and the details of the images used can be found here https://jurnal.ugm.ac.id/ijg/article/view/12496/9041</td></tr>
<tr><td>QA/QC procedures applied</td><td>SNI 8033-2014 - Methods for Forest Cover Change Interpretation from Optical Satellite Imageries and Tosiani, et.al (2020) Standard Operating Procedure (SOP): Calculation of Accuracy and Uncertainty of Land Cover Change.</td></tr>
<tr><td>Uncertainty for this parameter:</td><td>Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover) and that of land cover changes.

The estimation of uncertainty follows a modified method presented by Olofsson et al. (2014), substituting a post-stratified estimator of variance (Olofsson 2019, pers. com.).

July 2019-June 2020
<table>
<tr><th>Land cover change</th><th>Uncertainty (%)</th></tr>
<tr><td>20051-2014</td><td>11.05</td></tr>
<tr><td>2002-2002</td><td>10.28</td></tr>
<tr><td>2004-2004</td><td>10.28</td></tr>
<tr><td>2005-2005</td><td>10.28</td></tr>
<tr><td>20041-20041</td><td>10.28</td></tr>
<tr><td>20051-20051</td><td>10.28</td></tr>
<tr><td>2007-2007</td><td>10.45</td></tr>
<tr><td>2010-2010</td><td>10.45</td></tr>
<tr><td>2012-2012</td><td>10.45</td></tr>
<tr><td>2014-2010</td><td>10.45</td></tr>
<tr><td>2014-2014</td><td>10.45</td></tr>
<tr><td>5001-5001</td><td>10.45</td></tr>
<tr><td>20071-20071</td><td>10.45</td></tr>
<tr><td>20092-20092</td><td>10.45</td></tr>
<tr><td>20141-20141</td><td>10.45</td></tr>
</table>

July 2020 – June 2021</td></tr>
</table>

	<table><tr><th>Land cover change</th><th>Uncertainty (%)</th></tr><tr><td>2002-2002</td><td>10.52</td></tr><tr><td>2004-2004</td><td>10.52</td></tr><tr><td>2005-2005</td><td>10.52</td></tr><tr><td>2007-2007</td><td>10.38</td></tr><tr><td>2010-2010</td><td>10.38</td></tr><tr><td>2012-2012</td><td>10.38</td></tr><tr><td>5001-5001</td><td>10.38</td></tr><tr><td>20041-20041</td><td>10.52</td></tr><tr><td>20051-20051</td><td>10.52</td></tr><tr><td>20071-20071</td><td>10.38</td></tr><tr><td>20092-20092</td><td>10.38</td></tr><tr><td>2014-2014</td><td>10.38</td></tr><tr><td>20141-20141</td><td>10.38</td></tr></table>
Any comment:	Deforestation and subsequent land cover changes for peat lands. Tracking change over time is necessary to estimate the future inherited emissions because emissions are related to future land cover.

c. Deforestation: Mangrove forest to aquaculture

Parameter:	Deforestation: Mangrove forest to aquaculture
Description:	Area of land cover changes between July 2019 - June 2020 and July 2020 – June 2021. The land use transition matrices between these periods are generated to estimate the change of areas from mangrove forests to aquaculture/fishpond for the estimation of emission from the loss of soil carbon
Data unit:	Hectare
Value monitored during this Monitoring/Reporting Period:	<table><tr><th>Land use change</th><th>Area 2019-2020 (ha)</th><th>Area 2020-2021 (ha)</th></tr><tr><td>Primary mangrove forest to pond</td><td>0</td><td>28.35</td></tr><tr><td>Primary mangrove forest to pond</td><td>0</td><td>223.46</td></tr><tr><td>Total mangrove forest to Pond</td><td>0</td><td>251.81</td></tr></table>
Source of data and description of measurement/calculation methods and procedures applied:	Activity data uses used in the monitoring period came from MoEF Ministry of Environment and Forestry national land cover data (NFMS). The land cover map has been developed by MoEF for the period of 1990 to 2021. Principally, a mosaic of Landsat imageries were prepared to cover the whole area by the Indonesian Space Agency (LAPAN). The MoEF then perform visual interpretation to the image to develop the land cover map consists of 23 land cover types as listed in the SNI No 8033 Year 2014. The land cover map series then further analyzed by the East Kalimantan MMR Technical Team to define the carbon emission as described in this report. The analysis conducted by the East Kalimantan MMR Technical Team includes accuracy assessment of the land cover change status to define

<table>
<tr><td></td><td>overall uncertainty for each land cover change status. This process was performed by generating stratified random samples within the area of land cover changes then analyzed to confirm whether or not the land cover changes stated in the map is correct. The analyst used Higher-resolution imageries (e.g. SPOT-6/7 with 1.5 m ground resolution or Sentinel-2 with 10 m ground resolution) to conclude the real status of the land cover changes.

The result of this assessment is presented in detail in MS Excel file named:
Accuracy Assessment EK Land Cover 2020-2021 v02U.xlsx

It is available online at https://nfms.menlhk.go.id/, which is coupled with webGIS at geoportal.menlhk.go.id for display and viewing. The two websites are part of geospatial portal under the one map policy.
The description of methods for data derived from remote sensing images including type of sensors and the details of the images used is can be found https://jurnal.ugm.ac.id/ijg/article/view/12496/9041</td></tr>
<tr><td>QA/QC procedures applied</td><td>SNI 8033-2014 - Methods for Forest Cover Change Interpretation from Optical Satellite Imageries; and
Tosiani, et.al (2020) Standard Operating Procedure (SOP): Calculation of Accuracy and Uncertainty of Land Cover Change,</td></tr>
<tr><td>Uncertainty associated with this parameter:</td><td>Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover) and that of land cover changes.

The estimation of uncertainty follows a modified method presented by Olofsson et al. (2014), substituting a post-stratified estimator of variance (Olofsson 2019, pers. com.).
<table>
<tr><th>Land use change</th><th>Uncertainty 2019-2020 (%)</th><th>Uncertainty 2020-2021 (%)%</th></tr>
<tr><td>Mangrove forest to pond</td><td>4.69</td><td>5.78</td></tr>
</table>
</td></tr>
<tr><td>Any comment:</td><td>Deforestation and subsequent land cover changes for peat lands. Tracking change over time is necessary to estimate the future inherited emissions because emissions are related to future land cover.</td></tr>
</table>

3.2.2. FOREST DEGRADATION

a. Forest degradation – from primary forest to secondary forest

Parameter:	*Forest degradation - – from primary forest to secondary forest*

<table>
<tr><td>Description:</td><td>Area of degradation, change of primary forest into secondary forests between July 2019- June 2020 and July 2020 – June 2021, that occurred in all forested land. The land use transition matrices between these periods are generated to estimate the change of area from Primary forests to Secondary Forests</td></tr>
<tr><td>Data unit:</td><td>hectare</td></tr>
<tr><td>Value monitored during this Monitoring/Reporting Period:</td><td>
<table>
<tr><th>Land use change</th><th>Area 2019-2020 (ha)</th><th>Area 2020-2021 (ha)</th></tr>
<tr><td>Primary dryland forest to Secondary forest</td><td>0.00</td><td>2,803.26</td></tr>
<tr><td>Primary mangrove forest to secondary forest</td><td>0.00</td><td>0.00</td></tr>
<tr><td>Primary swamp forest to secondary forest</td><td>0.00</td><td>0.00</td></tr>
<tr><td>Total area</td><td>0.00</td><td>2,803.26</td></tr>
</table>
</td></tr>
<tr><td>Source of data and description of measurement/calculation methods and procedures applied:</td><td>Activity data uses used in the monitoring period came from MoEF Ministry of Environment and Forestry national land cover data (NFMS).
The land cover map has been developed by MoEF for the period of 1990 to 2021. Principally, a mosaic of Landsat imageries were prepared to cover the whole area by the Indonesian Space Agency (LAPAN). The MoEF then perform visual interpretation to the image to develop the land cover map consists of 23 land cover types as listed in the SNI No 8033 Year 2014. The land cover map series then further analyzed by the East Kalimantan MMR Technical Team to define the carbon emission as described in this report. The analysis conducted by the East Kalimantan MMR Technical Team includes accuracy assessment of the land cover change status to define overall uncertainty for each land cover change status. This process was performed by generating stratified random samples within the area of land cover changes then analyzed to confirm whether or not the land cover changes stated in the map is correct. The analyst used Higher-resolution imageries (e.g. SPOT-6/7 with 1.5 m ground resolution or Sentinel-2 with 10 m ground resolution) to conclude the real status of the land cover changes.

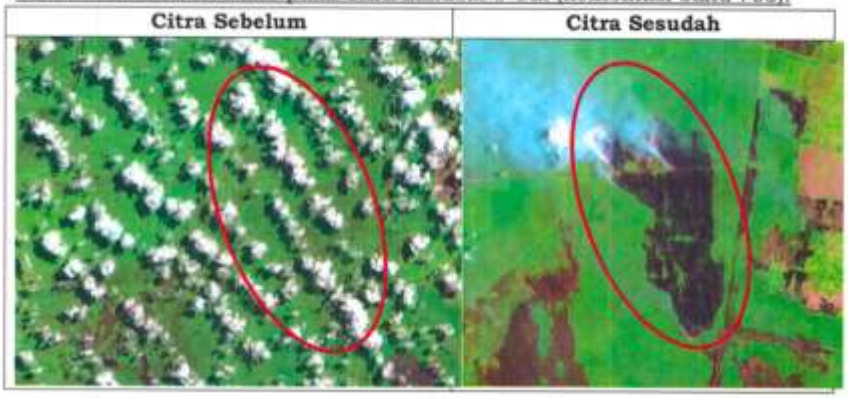
It is available online at https://nfms.menlhk.go.id/ , which coupled with webGIS at geoportal.menlhk.go.id for display and viewing. The two websites are part of the geospatial portal under the one map policy.
The description of methods for data derived from remote sensing images including type of sensors and the details of the images used is can be found https://jurnal.ugm.ac.id/ijg/article/view/12496/9041</td></tr>
</table>

<table>
<tr><td></td><td>The result of this assessment is presented in detail in MS Excel file named: Accuracy Assessment EK Land Cover 2020-2021 v02U.xlsx</td></tr>
<tr><td>QA/QC procedures applied</td><td>SNI 8033-2014 – Methods for Forest Cover Change Interpretation from Optical Satellite Imageries; and
Tosiani, et.al (2020) Standard Operating Procedure (SOP): Calculation of Accuracy and Uncertainty of Land Cover Change,</td></tr>
<tr><td>Uncertainty for this parameter</td><td>
<table>
<tr><th>Land use change</th><th>2019-2020 (U %)</th><th>2020-2021 (U %)</th></tr>
<tr><td>Primary dryland forest to Secondary forest</td><td>0.00</td><td>6.89</td></tr>
<tr><td>Primary mangrove forest to secondary forest</td><td>0.00</td><td>6.89</td></tr>
<tr><td>Primary swamp forest to secondary forest</td><td>0.00</td><td>6.89</td></tr>
</table>
</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

b. Forest degradation – secondary forest affected by fires

<table>
<tr><td>Parameter:</td><td>Forest degradation – Forest degradation – secondary forest affected by fires</td></tr>
<tr><td>Description:</td><td>Area of secondary forest affected by fires in 2019-2020, that identified using burnt scare area (NFMS – https://nfms.menlhk.go.id), which coupled with webGIS at geoportal.menlhk.go.id for display and viewing.</td></tr>
<tr><td>Data unit:</td><td>hectare</td></tr>
<tr><td>Value monitored during this Monitoring/Reporting Period:</td><td>This data is the three secondary forest classes (Dry land forest, swamp forest and mangrove forest).
<table>
<tr><th>Land Cover Change</th><th>2019-2020 Burnt scare area (ha)</th><th>2020-2021 Burnt scare area (ha)</th></tr>
<tr><td>Secondar dryland forest</td><td>0.00</td><td>0.03</td></tr>
<tr><td>Secondary mangrove forest</td><td>0.00</td><td>0.00</td></tr>
<tr><td>Secondary swamp forest</td><td>0.57</td><td>0.00</td></tr>
<tr><td>Total</td><td>0.57</td><td>0.03</td></tr>
</table>
</td></tr>
<tr><td>Source of data and description of measurement/calculation methods and procedures applied:</td><td>Activity data uses used in the monitoring period came from MoEF Ministry of Environment and Forestry national land cover data (NFMS).
The land cover map has been developed by MoEF for the period of 1990 to 2021. Principally, a mosaic of Landsat imageries were prepared to cover the whole area by the Indonesian Space Agency (LAPAN). The MoEF then perform visual interpretation to the image to develop the land cover map consists of 23 land cover types as listed in the SNI No 8033 Year 2014. The</td></tr>
</table>

	land cover map series then further analyzed by the East Kalimantan MMR Technical Team to define the carbon emission as described in this report. The analysis conducted by the East Kalimantan MMR Technical Team includes accuracy assessment of the land cover change status to define overall uncertainty for each land cover change status. This process was performed by generating stratified random samples within the area of land cover changes then analyzed to confirm whether or not the land cover changes stated in the map is correct. The analyst used Higher-resolution imageries (e.g. SPOT-6/7 with 1.5 m ground resolution or Sentinel-2 with 10 m ground resolution) to conclude the real status of the land cover changes. The result of this assessment is presented in detail In MS Excel file named: Accuracy Assessment EK Land Cover 2020-2021 v02U.xlsx It is available online at https://nfms.menlhk.go.id/ which coupled with webGIS at geoportal.menlhk.go.id for display and viewing. The two websites are part of the geospatial portal under the one map policy. The description of methods for data derived from remote sensing images including type of sensors and the details of the images used is can be found https://jurnal.ugm.ac.id/ijg/article/view/12496/9041 The geospatial data used for estimating the fire on secondary forest are produced by the DGCC especially the Forest Fire Mitigation and Control Directorate under the DGCC of MoEF. The technical procedures are given in the DGCC Regulations No P.11/PPI/PKHL/KUM/1/12/2018 (https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Guidance/Perdirjen P. 11 Pedoman Teknis Penaksiran Luas Karhutla (2).pdf) . Data Source (before and after fire events): 1. Optical medium-resolution satellite imagery data (Landsat, Sentinel) 2. Hotspot indication from NOAA-AVHRR, SNPP-VIIRS, ATSR, Terra/Aqua MODIS, Himawari and other potential satellite missions Technical Procedures: 1. Geometric and Radiometric Corrections 2. Visual Interpretation and Delineation of Fire-Affected Forest Areas 2.1. Remote Sensing Image Fusion (as necessary) 2.2. Image Sharpening 2.3. Spatial Filtering 2.4. Geometric and Metadata Format Preparation 2.5. Compiling optical data with hotspot data 2.6. Delineation of Fire Affected Forest The fire-affected forest is detected by comparing the previous and current optical satellite imageries by looking at the color of the area. Dark brownish of black dominated areas meant that those particular area were burnt.

<table>
<tr><td></td><td>Contoh ciri area terbakar pada Citra Landsat 8 OLI (kombinasi band 753):
 
</td></tr>
<tr><td>QA/QC procedures applied</td><td>SNI 8033-2014 - Methods for Forest Cover Change Interpretation from Optical Satellite Imageries, Tosiani, et.al (2020) Standard Operating Procedure (SOP): Calculation of Accuracy and Uncertainty of Land Cover Change, and DGCC regulation number P.11/PPI/PKHL/KUM.112/2018 on Technical Guidelines for the Assessment of Forest and Land Fire Areas.</td></tr>
<tr><td>Uncertainty for this parameter</td><td>Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover) and from land cover changes (uncertainty of land cover changes).
The estimation of uncertainty follows a modified method presented by Olofsson et al. (2014), substituting a post-stratified estimator of variance (Olofsson 2019).

<table>
<tr><th>Land Cover Change</th><th>Uncertainty 2019-2020 (%)</th><th>Uncertainty 2020-2021 (%)</th></tr>
<tr><td>Secondar dryland forest</td><td>2.39</td><td>3.26</td></tr>
<tr><td>Secondary mangrove forest</td><td>2.39</td><td>3.26</td></tr>
<tr><td>Secondary swamp forest</td><td>2.39</td><td>3.26</td></tr>
</table></td></tr>
<tr><td>Any comment:</td><td>Forest degradation. This is to estimate the loss of above ground biomass of the stable secondary forest due to fire.</td></tr>
</table>

4 QUANTIFICATION OF EMISSION REDUCTIONS

4.1 ER Program Reference level for the Monitoring/Reporting Period covered in this report

Under the corrected Reference Level (see Annex 4), the average annual historical emissions from deforestation reached 23.9M tCO_2e per year, whereas from forest degradation reached 3,5M tCO2e per year. 'Deforestation' includes all emissions associated with change from forest to non-forest cover, including living biomass, peat decomposition, peat fires in deforested areas, and mangrove soil in deforested areas. 'Degradation' includes all emissions associated with change from high biomass forest to lower biomass forest and includes living biomass, and peat decomposition and fires in secondary forest. Based on that, the reference level for this reporting period is 27.47M tCO_2e per year. See Annex 4 Table 8.22.

Table 4 - 1. Comparison of Reference Level between 2019 ERPD and Technical Correction

	ER Program Document		Technical Correction	
	Deforestation (ton CO_2e)	**Forest degradation (ton CO_2e)**	**Deforestation (ton CO_2e)**	**Forest degradation (ton CO_2e)**
Living biomass	49,735,619.29	14,701,507.87	23,058,668.41	2,391,882.73
Peat decomposition	109,330.85	929,875.96	55,852.41	987,517.06
Fire	33,555.69	1,804,726.13	105,267.80	141,019.29
Mangrove soil	1,091,581.22		729,648.69	
Total	**50,970,087.05**	**17,436,109.96**	**23,949,437.31**	**3,520,419.08**
	68,406,197.00		**27,469,856.40**	

Table 4-2. Reference Level from Deforestation and Degradation occurred in 2006 - 2016

Year of Monitoring/ Reporting period *t*	**Average annual historical emissions from deforestation over the Reference Period (tCO_{2-e}/yr)**	**If applicable, average annual historical emissions from forest degradation over the Reference Period (tCO_{2-e}/yr)**	**If applicable, average annual historical removals by sinks over the Reference Period (tCO_{2-e}/yr)**	**Adjustment, if applicable (tCO_{2-e}/yr)**	**Reference level (tCO_{2-e}/yr)**
2019-2020	23,949,437.31	3,520,419.08			27,469,856.40
2020-2021	23,949,437.31	3,520,419.08			27,469,856.40
Total	47,898,874.63	7,040,838.17			54,939,712.80

4.2 Estimation of emissions by sources and removals by sinks included in the ER Program's scope

Based on calculation emissions by sources from the ER program during the Monitoring period July 2019-June 2021, emissions from deforestation reached 7.8M tCO_2e whereas from forest degradation reached 1.5M tCO_2e using the same categories described above, and program during the Monitoring period July 2020-June 2021, emissions from deforestation reached 5.8M tCO2e per year whereas from forest degradation reached 1.5M tCO_2e. So, total net emissions for period July 2019-June 2020 is 2.1M tCO_2e per year and July 2020-June 2021 is 7.2M tCO_2e per year. See sheet 'Sum All' on file for emission calculation – https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx

Table 4-3. Emissions from Deforestation and Degradation **July 2019 - June 2021**

Year of Monitoring/Reporting Period	Emissions from deforestation (tCO_{2-e}/yr)	If applicable, emissions from forest degradation (tCO_{2-e}/yr)*	If applicable, removals by sinks (tCO_{2-e}/yr)	Net emissions and removals (tCO_{2-e}/yr)
2019-2020	2,108,501.18	184.72		2,108,685.90
2020-2021	5,765,850.22	1,485,166.81		7,251,017.03
Total	7,874,351.40	1,485,351.53		9,359,702.93

Since the reporting period is from **July 2019 to December 2020**, then the net emissions and removals need to be adjusted as follows:

Table 4-4. Emissions from Deforestation and Degradation **July 2019 - December 2020**

Year of Monitoring/Reporting Period	Emissions from deforestation (tCO_{2-e}/yr)	If applicable, emissions from forest degradation (tCO_{2-e}/yr)*	If applicable, removals by sinks (tCO_{2-e}/yr)	Net emissions and removals (tCO_{2-e}/yr)
2019-2020	2,108,501.18	184.72		2,108,685.90
2020-2021*	2,882,925.11	742,583.40		3,625,508.51
Total	4,991,426.29	742,768.12		5,734,194.41

* The carbon emission in 2020-2021 in this table represents **only half** of the carbon emission value between July 2020 to June 2021, since the data used for this monitoring period ranges from July 2020 to June 2021, while the reporting period lasts from July 2020 to December 2020. Please see the summary of the calculation here https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_summary_26Juli2022c.xlsx

4.3 Calculation of emission reductions

Based on reference level emissions with deduction from net emissions under the ER program during the monitoring period (July 2019- June2020 and July 2020-June 2021), the East Kalimantan has produced emission reductions of 25.77M tCO_2e. See sheet 'Sum All' on file for emission calculation – https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx

Table 4-4. Emissions Reduction Calculation

Total Reference Level emissions during the Monitoring Period (tCO_2-e)	54,939,712.80
Net emissions and removals under the ER Program during the Monitoring Period (tCO_2-e)	9,359,702.92
Emission Reductions during the Monitoring Period (tCO_2-e)	45,580,009.88
Length of the Reporting period/Length of the Monitoring Period (# days/# days)	549/730 days
Emission Reductions during the Reporting Period (tCO_2-e)	34,278,664.9 *).

*) Emission Reduction Calculation during the reporting period presented in table 4-4 covers the period of 549 days, started from 1 July 2019 to 31 December 2020. Therefore calculation of Emission Reduction in the reporting period is confined to between 1 July 2019 to 30 June 2020 and 1 July 2020 to 30 June 2021, (as defined in section 1). The Emission Reduction calculation is then done by substracting the 1.5 amount of carbon of RL (annual) with the sum of emissions for 2019-2020 + half of (RL minus emissions for 2020-2021). This makes the calculation balanced since both reference period and crediting period lasts 1.5 years (549 days).
Please see the summary of the calculation here https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_summary_26Juli2022c.xlsx

5 UNCERTAINTY OF THE ESTIMATE OF EMISSION REDUCTIONS

5.1 Identification, assessment and addressing sources of uncertainty

Identification, assessment and addressing sources of uncertainty are presented below as follows:**Sources of uncertainty**	**Analysis of contribution to overall uncertainty**	**Contribution to overall uncertainty (High / Low)**	**Addressed through QA/QC?**	**Residual uncertainty estimated?**
Activity Data				
Measurement	• There are two sources of error related to the Landsat images. First stripping problem that leads to a loss of some data from the images and the need for manipulation using different images. Second, Indonesia almost always has a lot of cloud clover. The cloud's shadows and cloud coverage will affect the quality of the images as it generates data gaps. These constraints affect the image interpretation process. • Interpretation of satellite images to produce land cover maps is done by trained interpreters who use manual or visual interpretation digitization technique. Standard Operating Procedures (SOPs) and manuals are provided to guide the interpreters to do the satellite image interpretation • Interpreters have been trained using the technical guidelines and SOPs that have been prepared.	*L (random)*	*YES*	*NO*
Representativeness	The ground truthing uses stratified random sampling. Compilation of several ground truthing results within a specific year interval was used for accuracy assessment that will provide level of accuracy of the land cover classes interpretation. The sample has been designed according to the SOP that has been prepared.	*L (bias)*	*YES*	*NO*
Sampling	The number of points to represent land cover categories will determine the level of accuracy of the assessment. Ground truthing will reflect the accuracy of the interpretation with real condition. It helps to determine the accuracy of the satellite interpretation results. Therefore, the number of points of ground check will significantly affect the level of uncertainty. The number of sampling plots will be increased in order to reduce the uncertainty rate. The sample has been designed according to the SOP that has been prepared.	*H (random / bias)*	*YES*	*YES*
Extrapolation	MoEF land cover data which has 23 classes and is reclassified into 5 (five) classes of land cover change, namely deforestation, forest degradation, forest gain (forest growth), stable forest (fixed/unchanged forest cover) and stable non-forest (non-forest	*H (bias)*	*YES*	*NO*

Identification, assessment and addressing sources of uncertainty are presented below as follows:**Sources of uncertainty**	**Analysis of contribution to overall uncertainty**	**Contribution to overall uncertainty (High / Low)**	**Addressed through QA/QC?**	**Residual uncertainty estimated?**
	cover that remains / does not change). This measurement is in accordance with the SOP.			
Approach 3	The approach is carried out by only calculating deforestation from forested areas from the beginning of the reference period until the measurement year, after which it changes to non-forested areas, while degradation is calculated in primary forested areas from the beginning of the reference period until the calculation year.	*L (bias)*	*YES*	*NO*
DBH measurement	Measurement officers in the field have gone through a training process and are provided with technical instructions for measuring, which are accompanied by a process of supervision and QA/QC. This measurement is in accordance with the technical guideline and supervise by MoEF.	*L (random)*	*YES*	*NO*
H measurement		*L (random)*	*YES*	*NO*
Plot delineation		*L(random)*	*YES*	*NO*
Wood density estimation	The calculation of wood density is carried out through a laboratory measurement approach on the species in the sample plot.	*L (random)*	*YES*	*NO*
Biomass allometric model	The sample tree data used to construct biomass allometric models is still relatively limited to trees of a certain size. Standard errors are also documented in the allometric model process.	*L(random)*	*YES*	*NO*
Sampling	Determination of the location of the sample is done based on proportional random based on forest class area. The sample has been designed according to the SOP.	*H (random)*	*YES*	*YES*
Carbon Fraction	Carbon fraction uses the values listed in Table 4.3 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4: Agriculture, Forestry and Other Land Use https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf	*H (bias / random)*	*YES*	*YES*
Rootto-shoot ratio)	Root shoot ratio using the IPCC GPG LULUCF Table 3A.1.8 - https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Anx_3A_1_Data_Tables.pdf	*H (bias / random)*	*YES*	*YES*
Representativeness	Representative sample by purposive sample in each land cover class. The sample has been designed according to the SOP that has been prepared.	*L (bias)*	*YES*	*NO*
Model	The combination of AD & EF does not necessarily need to result in additional uncertainty. QA/QC carried out by the MMR East Kalimantan team	*L (bias)*	*YES*	*NO*
Integration	This source of error is linked to the lack of comparability between the transition classes of the Activity Data and those of the Emission Factors. QA/QC carried out by the MMR East Kalimantan team	*L (bias)*	*YES*	*NO*

5.2 Uncertainty of the estimate of Emission Reductions

Parameters and assumptions used in the Monte Carlo method

The calculation for uncertainty of emissions reduction was based on Monte Carlo method. The parameters and assumptions are presented as follows:

Table 14. Parameter and assumptions used in Monte Carlo Method

Parameter included in the model	Parameter values	Error sources quantified in the model (e.g. measurement error, model error, etc.)	Probability distribution function	Assumptions
Project Area	12,734,692 ha			ER program document
Length of reference period	10 years			ER program document
Carbon Fraction	0.47	Measurement	Triangular (lower bound = 0.44, upper bound = 0.49, mode = 0.47)	IPCC 2006
Ratio of molecular weights of CO_2 and C	44/12			Default
Root shoot ratio	See sheet 'EF_EKJERP' excel file https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx			2006 IPCC GPG LULUCF Table 3A.1.8.
AGB sample	See sheet 'EF_EKJERP' excel file https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx	Sampling	Normal distribution	
Activity data	See sheet 'UncertaintyAD' excel file https://mrv.kaltimprov.go.id/storage/gue	Sampling	Non-parametric bootstrapping	

Parameter included in the model	Parameter values	Error sources quantified in the model (e.g. measurement error, model error, etc.)	Probability distribution function	Assumptions
	st/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx			

Quantification of the uncertainty of the estimate of Emission Reductions

The calculation of uncertainty from deforestation and forest degradation in the monitoring period has been done with exactly the same method to keep the consistency with those calculated during the reference period. The Monte Carlo technique has also been applied in the monitoring period. The calculation of uncertainty of Emission Reduction at the 90% confidence level is presented as follows:

Table 5. Uncertainty of aggregated Emissions Reduction

		Total Emission Reductions*
A	**Median**	35,404,709.61
B	**Upper bound 90% CI** (Percentile 0.95)	31,595,294.53
C	**Lower bound 90% CI** (Percentile 0.05)	39,343,003.80
D	**Half Width Confidence Interval at 90% (B – C/2)**	3,873,854.63
E	**Relative margin (D/A)**	11%
F	**Uncertainty discount**	0

5.3 Sensitivity analysis and identification of areas of improvement of MRV system

Sensitivity analysis is conducted by switching off each source of uncertainty at a time and assess the impact to the overall uncertainty of Emission Reductions, and generate the error estimates using Monte Carlo. The uncertainty level of these parameters shall be reduced in the next monitoring cycle/period. The results of sensitivity analysis are given in the following table.

Table 6. Sensitivity Analysis

Sensitivity Test	Median	Lower bound (5th percentile)	Upper bound (95th percentile)	Half-width confidence interval at 90%	Relative Margin	Uncertainty (%)
All on	35,404,709.61	31,595,294.53	39,343,003.80	3,873,854.63	0.10	10.94
R:S Uncertainty	35,471,602.13	35,001,607.79	35,949,894.69	474,143.45	0.01	1.34
CF Uncertainty	35,463,547.88	34,959,756.78	35,968,679.38	504,461.30	0.01	1.42
Sampling uncertainty	35,479,001.24	33,736,204.15	37,220,024.41	1,741,910.13	0.05	4.91
Emission Factor uncertainty	35,447,106.81	33,535,207.34	37,352,701.23	1,908.746.94	0.05	5.38

Activity Data	35,476,198.51	32,158,638.15	38,852,025.32	3,346,693.58	0.09	9.43

The sensitivity analysis was done using Monte Carlo approach by removing one estimation parameter at a time, i.e.:

No	Parameter Used	Approach
1	All on	Using the uncertainty for Root shoot ratio, Carbon Fraction, Sampling uncertainty AGB, and Activity Data
2	R:S Uncertainty	Using the uncertainty for Root shoot ratio, and other uncertainty parameter near zero.
3	CF Uncertainty	Using the uncertainty for carbon fraction ratio, and other uncertainty parameter near zero
4	Sampling uncertainty	Using the uncertainty for AGB biomass sampling, and other uncertainty parameter near zero
5	Emission Factor uncertainty	Using the uncertainty for Root shoot ratio, carbon fraction, and AGB biomass sampling, but uncertainty for activity data near zero
6	Activity Data	Using the uncertainty for activity data (AD), and other parameter near zero

6 TRANSFER OF TITLE TO ERS

6.1 Ability to transfer title

Based on Criterion 36, the ability of a Program Entity to transfer title to ERs needs to be demonstrate through various means, namely: reference to existing legal and regulatory frameworks; sub-arrangements with potential land and resource tenure holders (including those holding legal and customary rights as identified by the assessments conducted under Criterion 28); and benefit sharing arrangements under the Benefit Sharing Plan.

Based on the 1945 Constitution of the Republic of Indonesia, the Government through MoEF has the mandate to regulate natural resources for people, prosperity and welfare. The specific mandate to regulate forest resources, including forest carbon stock, is from Forestry Act 1999 (Article 4 Point 1) through implementation of REDD+, as part of the legal forestry activities. Based on President Regulation No.98/2021 (Article 1 Point 22), carbon right is regulated and managed by the Central Government. In this regard, the MoEF is by law considered as Program Entity as having ability to transfer the title of ERs resulting from the REDD+ program, that is conceptualized as "a national approach with sub-national implementation". The Regulation also mentioned that carbon price and its market would be regulated under Ministry Decree/Regulation. In addition, based on Law of Republic of Indonesia No. 23 of 2014 concerning Sub National Governance page 118 which clearly states that Provincial Government has the authority on "environmental services utilization with exception of carbon utilization, carbon storage and/or carbon sequestration". In other words, carbon utilization, its storage or sequestration is regulated and managed by the Central Government.

In relation to the Title of Emission Reductions (ERs), the term "Title" here is not necessarily identical to "Carbon Rights". Rather, title is intended to capture an environmental service derived from forests. As such, the volume of ERs is a measure of the performance of this service. Hence, the legal title corresponds to the performance results. Furthermore, the "transfer of Title to ERs" applies both to Contract ERs (22 million ERs) and a Call Option Volume of 20 million tons (for additional ERs). The Title to ERs as referred to the FCPF ERPA document is in the form of "Contract ER Volumes" reflecting the emissions reduction performance achieved by the GoI. Therefore, the Carbon Rights is owned and governed by the GoI in accordance with the prevailing laws and regulation.

In order to ensure the implementation of the ER program at sub-national level, a Memorandum of Understanding (MoU) between the national (through MoEF) and sub-national level was signed (No.PKS.3/SETJEN/ROKLN/KLN.0/3/2020 and No.197/2439/B.Humas-III)[30]. The sub-national level hereafter represented by Provincial Government of East Kalimantan, which also represent beneficiaries from province, district, village including indigenous people for the ER implementation in East Kalimantan. The MoU covers a) strategy and program for REDD+ activity in the province, b) working plan of REDD+, c) benefit sharing mechanism between national and sub-national level, d) safeguards implementation, e) carbon rights managed by Central Government, f) data and information exchange on forest and land cover change. It is clear in the MoU that Central Government manages and regulates the rights of carbon. The commitments to implement the ER program from village and indigenous people were also stated in the FPIC Process[31]. The FPIC is a process to get approval from the village and indigenous people to participate

[30] MoU REDD+ di Kaltim_Materai Sekjen KLHK.pdf (kaltimprov.go.id)
[31] PADIATAPA IMPLEMENTATION REPORT_ENG.pdf (kaltimprov.go.id)

the ER Program. The commitment for participation in ER Program of the village and indigenous people is then put into the village approval statement (see FPIC Report[32]).

Furthermore, we confirm our understanding that as part of the agreed provisions of ERPA Tranche B, the contract ERs/additional ERs transferred from Indonesia will be re-transferred to Indonesia as soon as possible, but no later than 30 calendar days and claimed as part of Indonesia's achievements under the Nationally Determined Contributions (NDC), as already stated in the signed ERPA.

With reference to the Criterion 38 indicator 38.1 of the Methodological Framework, the GoI has decided to use the FCPF ER Transaction Registry, after all achievements of ERs in EK-JERP in the framework of the Carbon Fund are registered first in the National Registry System (SRN) of MoEF. During the reporting period the ability to transfer Title to ERs was clear and uncontested, meaning there were no objections or complaints received by land-owners or other stakeholders.

6.2 Implementation and operation of Program and Projects Data Management System

The EK-JERP program was designed through a series of multi-stakeholder consultations from 2017-2019. Based on Criterion 37, the ER Program host country should decide whether to maintain its own comprehensive national REDD+ Program and Projects Data Management System.

Since the Government of Indonesia has appointed the Ministry of Environment and Forestry as a National Focal Point for climate change mitigation and adaptation, the national REDD+ Program and Projects Data Management System are managed by MoEF. However, data and information from the field are managed and stored at Provincial level as Portal Measurement Monitoring Report/MMR (https://mrv.kaltimprov.go.id/). All format reports for ER activities have been designed and put onto both web-based and excel-based. Trainings on how to fulfil and submit the reports have been conducted in 7 districts during the reporting period. The field ER activities done by Forest Management Unit (FMU) are reported to the Portal MMR (mrv.kaltimprov.go.id) through online system and copied to Forestry Service (see Figure 4). For FMU that has difficulty to access to the Portal MMR, needs to go to the nearest capital sub-district with the internet coverage. This Portal MMR is managed by Provincial Environmental Service. The Provincial government through The Environment Service then submits an annual report of the EK-JER program to the MoEF. The Report is automatically embedded into the MoEF website for the National Registration System known as SRN-PPI (http://srn.menlhk.go.id/). All REDD+ initiatives in East Kalimantan have to be registered into SRN-PPI. Up to now, there is no voluntary REDD+ initiatives such as VERRA Projects implemented in East Kalimantan (see the list of REDD+ project registered under VERRA[33]) and no also Plan VIVO project in East Kalimantan[34].

The **Error! Reference source not found.** shows the flow of ER data and information from fields to the MMR East Kalimantan Web Portal (mrv.kaltimprov.go.id). The ER annual report will be submitted to the SRN Portal of MoEF (srn.menlhk.go,id).

[32] PADIATAPA IMPLEMENTATION REPORT_ENG.pdf (kaltimprov.go.id)
[33] allprojects Verra in Indonesia.xlsx (live.com)
[34] All Plan Vivo Project in Indonesia.xlsx (live.com)

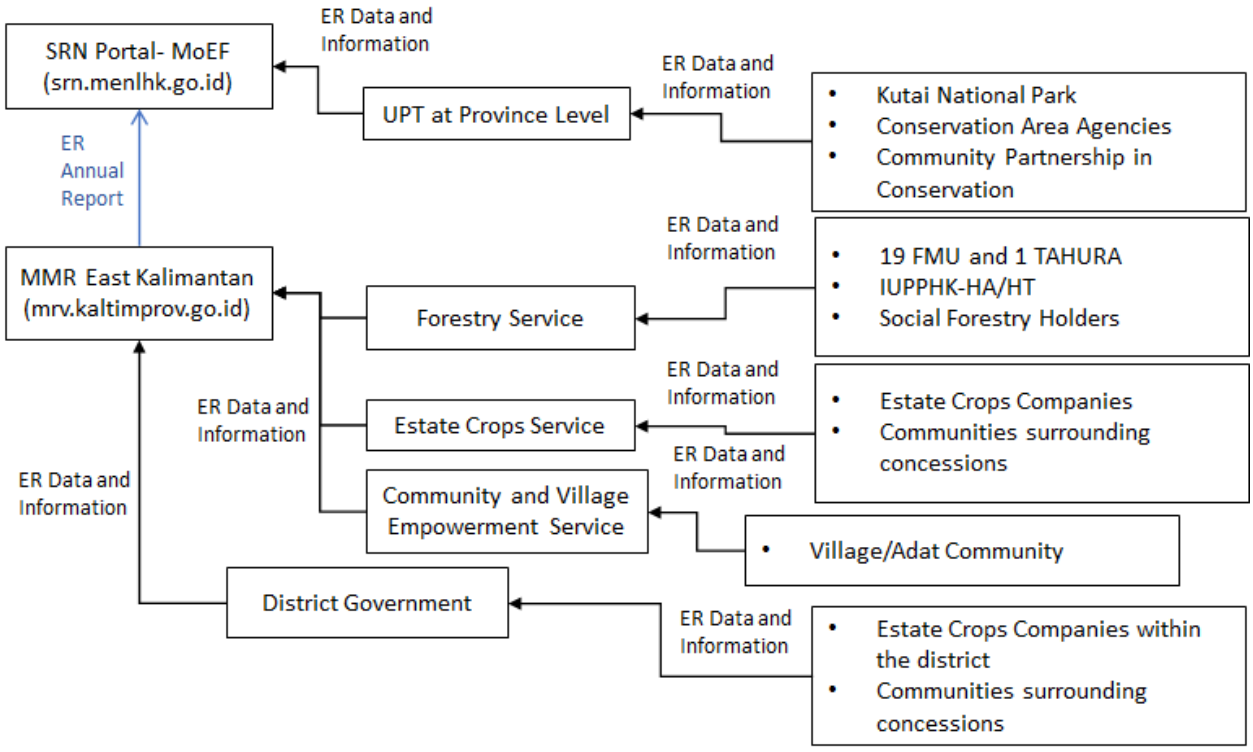


Figure 6. Project Management on ER Data and Information System

Several standard operational procedures (SOPs), such as reporting, data entry, data validation, and data and information exchange are being developed for data management.

6.3 Implementation and operation of ER transaction registry

Up to now, the ER transaction registry system for Indonesia has not been developed yet. The MoEF agreed that emission reductions from East Kalimantan Province in the framework of FCPF will be registered first in the National Registry System (SRN) under MoEF[35], prior to submission to the FCPF-CF through the World Bank CATS for the first and subsequent reporting periods, until the Indonesian transaction registry system is developed.

Based on Government Regulation No. 46/2017[36], BPDLH is appointed as fund manager and has a mandate (President Regulation No 77/2018[37]) to collect environment or climate change funds either from government, private, or international donor countries. The future role of BPDLH will be not only to disburse the funds to beneficiaries, but also as the host for domestic carbon trade. The carbon project/REDD+ initiatives in the future might need to register to BPDLH for selling their carbon in domestic market, so that the government target for Indonesia's NDC can be achieved by 2030.

[35] President Regulation No.98/2021 (Article 69, Point 1) stated that emissions reported by each entity have to be reported to national registry system. https://peraturan.bpk.go.id/Home/Details/187122/perpres-no-98-tahun-2021
[36] https://peraturan.bpk.go.id/Home/Details/64701
[37] https://peraturan.bpk.go.id/Home/Details/94707/perpres-no-77-tahun-2018

6.4 ERs transferred to other entities or other schemes

The estimated ERs produced during the first reporting period was 30.8 million(subject to validation and verification). The Program Entity proposes to offer 22 million Contract ERs to the FCPF Carbon Fund. In addition, the Project Entity will offer the Additional ERs (estimated at 8.8 million, subject to validation and verification) for purchase under the Call Option, with the price to be negotiated in accordance with the ERPA. No ERs in East Kalimantan are transferred to other entities or other schemes during the reporting period.

7 REVERSALS

7.1 Occurrence of major events or changes in ER Program circumstances that might have led to the Reversals during the Reporting Period compared to the previous Reporting Period(s)

As this first reporting period, the occurrence of major events or changes in the ER program circumstances that might have reversals during the reporting report compared to the previous reporting report is “Not Applicable”.

7.2 Quantification of Reversals during the Reporting Period

As this is the first reporting period, the quantification of reversals during the reporting period is “Not Applicable”

7.3 Reversal risk assessment

Risk Factor A: Lack of comprehensive and sustained support of the relevant stakeholders

The successful implementation and sustainability of emission reductions is dependent on active contributions from the various levels of government, from the private sector, and from local communities. It is confirmed that much of the ER Program’s sustainability depends on the continued political will of the national, provincial, and district governments to implement the policies that the ER Program is supporting. These policies include the policy on sustainable estate crops, the HCV and RIL policies, social forestry, and other key policies linked to land governance.

Current support for these policies is strong at the national and provincial levels, and many of the policies are integrated into the medium-term development plan. Up to 2020, policies to support ER implementation have been formulated and issued such as continuation of moratorium licenses on coal mining, application of one service for all licenses policy, issuance of regulation on sustainable estate crops (No.7/2018[38]), East Kalimantan Governor Regulation on Criteria of High Conservation Area (HCVA)[39], and Berau District’s decree on HCVA (No.287/2020[40]). This HCVA decree from Berau District is one of important efforts to avoid negative impacts on local development of oil palm expansion to natural forests. It is expected that other 6 (six) districts will follow to produce HCVA regulation.

There is some risk from issues related to benefit sharing. However, in order to give clear understanding the mechanism of benefit sharing for ER payments, consultations with related stakeholders including beneficiaries have been conducted since 2015. In East Kalimantan, benefit sharing working group has been formed. Inputs and feedbacks from beneficiaries through FPIC process in 2019 and 2020 were adopted to benefit sharing document. Based on these consultations, benefit sharing regulation through governor regulation is being formulated and ready to be issued this year.

[38] https://peraturan.bpk.go.id/Home/Details/185205/perda-prov-kalimantan-timur-no-7-tahun-2018
[39] https://jdih.kaltimprov.go.id/produk_hukum/detail/75185be6-ac76
[40] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Regulation/SK Bupati Berau 287 2020 ttg Peta Indikatif ANKT.pdf

To support coordination and supports from relevant stakeholders, the other working groups namely MMR working group, Safeguard working group, and Planning and Budgetary working group also have been formed. Each group has exclusively task to invite relevant development partners and government services to discuss and address certain topics of ER program.

Based on the above progress, the risk of reversal due to a lack of comprehensive and sustained support of the relevant stakeholders is categorized as **low**.

Risk Factor B: Lack of institutional capacities and/or ineffective vertical/inter-sectoral coordination
Poor coordination across sectors could hamper progress in improving land governance, which is an important part of the ER Program's sustainability strategy. Policy coordination, especially for the land-based sectors, is a challenge in Indonesia. Separate ministries are responsible for mining, agriculture, and forestry, and conflicts in the legal frameworks and overlapping mandates of each sector are a barrier to land governance. This is particularly the case for land administration which distinguishes between forest and non-forest land, each with separate regulatory frameworks and institutional arrangements.

In order to empower coordination across sectors, institutional arrangements for the ER program has been developed. At national level, there will be vertical coordination between the levels of government will be important for the program's implementation and its sustainability. As noted under Risk Factor A, the district governments play an important role in implementing reforms related to estate crops. Continued district support for policy implementation will in part depend on the coordination of districts with the province. For issues related to land registration, efforts of multiple agencies in particular of the MoEF and the national land agency (BPN) will need to be coordinated.

Lack of institutional capacities has been identified as an underlying driver of deforestation and is being addressed through the activities in Component 1. Inadequate progress in this area, would mean that policies such as the RIL-C and HCV policies, as well as support for local communities, would be less effective, especially after support for policy implementation has ended.

Based on the above assessment, the risk of reversal due to a lack of institutional capacities and/or ineffective vertical/inter-sectoral coordination is categorized as low.

Risk Factor C: Lack of long-term effectiveness in addressing the underlying causes
The expected long-term effectiveness in addressing the underlying causes of deforestation depends on the complexity of the driver and whether further support will be needed to address the driver after the program has ended. As discussed in the table, some drivers will require continued political will, while others require sustainable solutions to be in place. Based on the assessment provided in the table below, the overall risk of reversal due to a lack of long-term effectiveness in addressing the underlying causes is categorized as low.

Table 7. Underlying Causes

Underlying Driver	Long-term effectiveness in addressing driver
Poor land governance	Improvements are expected to be long-term, but may not be fully in place by the end of the ER Program.
Ineffective forest supervision and administration	Long-term effectiveness in addressing this driver depends on continued political will (see Risk Factor A), and on the ability of FMUs to generate sufficient revenue or to receive budgetary or external funding.
Weak policies for forest protection	Improvements in policies are expected to be long-term, but effectiveness depends also on enforcement (political will and forest supervision).
Lack of incentives for sustainable management practices	The Program is expected to contribute to an improved incentives framework, but direct support will stop when the program ends.
Limited alternative livelihood opportunities for local communities	Long-term effectiveness will depend partly on the level of benefits that the alternative livelihood opportunities can provide.
Lack of fire management capacity and lack of alternatives for land clearing	Long-term effectiveness will depend on continued support and the long-term attractiveness of alternative livelihood options.
Climate factors	Cannot be directly addressed. See discussion under Risk Factor D.

Risk Factor D: Exposure and vulnerability to natural phenomena

Extreme fire events in East Kalimantan are linked to prolonged periods of drought, which in turn are closely linked to El Nino Southern Oscillation events. These occur on average every 3-7 years with the last event occurring in 2016, so there is a high likelihood of an ENSO event occurring during the program period, and the accounting area will of course continue to be affected after the program ends. While the ER Program has no influence on the occurrence of ENSO events, the program includes a number of activities that should lead to a reduction in the scale of fires and their impact on forests. As noted in the table above, the long-term effectiveness of these measures will depend on continued support and on the long-term attractiveness of alternative livelihood options. The risk of future extreme fire impacting remaining forests contributes to the anticipated risk of reversal.

Based on the above assessment, the risk of reversal due to exposure and vulnerability to natural phenomena is categorized as low.

Table 18. Reversal Risk Assessment

Risk Factor	Risk indicators	Default Reversal Risk Set-Aside Percentage	Discount	Resulting reversal risk set-aside percentage
Default risk	*N/A*	**10%**	*N/A*	*10%*
Lack of broad and sustained stakeholder support	*Low* FPIC with villages and communities has been carried out, and minutes of approval from the community are available.	**10%**	*10%*	*0%*
Lack of institutional capacities and/or ineffective vertical/cross sectorial coordination	*Low* Capacity building for stakeholders (government, community, private sector, non-governmental organizations) has been carried out in program implementation, implementation of social and environmental safeguards, and management of reversals and leakage risks.	**10%**	*10%*	*0%*
Lack of long term effectiveness in addressing underlying drivers	*Low* The program has been integrated into government development plans and strategic plans of government agencies, as well as development partners.	**5%**	*5%*	*0%*
Exposure and vulnerability to natural disturbances	*Low* National, provincial and district governments already have disaster management plans, including forest and land fires, and have coordinated disaster management systems.	**5%**	*0%*	*0%*
		Total reversal risk set-aside percentage		*10%*

8 EMISSION REDUCTIONS AVAILABLE FOR TRANSFER TO THE CARBON FUND

A.	**Emission Reductions during the Reporting period (tCO_2-e)**	*from section* ***Error! Reference source not found.***	34,278,665
B.	**If applicable, number of Emission Reductions from reducing forest degradation that have been estimated using proxy-based estimation approaches (use zero if not applicable)**		0.00
C.	**Number of Emission Reductions estimated using measurement approaches (A-B)**		34,278,665
D.	**Percentage of ERs (A) for which the ability to transfer Title to ERs is clear or uncontested**	*from section 6.1*	100%
E.	**ERs sold, assigned or otherwise used by any other entity for sale, public relations, compliance or any other purpose including ERs accounted separately under other GHG accounting schemes or ERs that have been set-aside to meet Reversal management requirements under other GHG accounting schemes**	*from section 6.4*	0.00 –
F.	**Total ERs (B+C)*D-E**		34,278,665
G.	**Conservativeness Factor to reflect the level of uncertainty from non-proxy based approaches associated with the estimation of ERs during the Crediting Period**	*from section 5.2*	0
H.	**Quantity of ERs to be allocated to the Uncertainty Buffer (0.15*B/A*F)+(G*C/A*F)**		0 –
I.	**Total reversal risk set-aside percentage applied to the ER program**	*from section 7.3*	10%
J.	**Quantity of ERs to allocated to the Reversal Buffer (F-H)*(I-5%)**		1,713,933
K.	**Quantity of ERs to be allocated to the Pooled Reversal Buffer (F-H)*5%**		1,713,933
L.	**Number of FCPF ERs (F- H – J – K)**		**30,850,798**

ANNEX 1: INFORMATION ON THE IMPLEMENTATION OF THE SAFEGUARDS PLANS

I. Requirements of FCPF on Managing the Environmental and Social Aspects of ER Programs

The East Kalimantan Emission Reduction Program (EK ER Program) aims to reduce deforestation and forest degradation in an area covering 12.7 million hectares that comprise the East Kalimantan provincial jurisdiction. The ER program supports enabling conditions and promotes sustainable management practices that directly address the underlying drivers of emissions.

The implementation of safeguards within the scope of ERPD complies with World Bank (WB) safeguards policies aligned with the UNFCCC safeguards related to REDD+. Relevant environmental and social safeguard policies triggered for the program include:

1) OP 4.01 Environmental Assessment
2) OP 4.04 Natural Habitat
3) OP 4.09 Pest Management
4) OP 4.10 Indigenous Peoples
5) OP 4.12 Involuntary Resettlement
6) OP 4.36 Forests

Relevant environmental and social assessments and consultation processes to define strategic options in the ERPD are presented in the Strategic Environmental and Social Assessment (SESA) for the ER Program. The principles and key requirements of the above WB safeguards policies are translated and operationalized into the Environmental and Social Management Framework (ESMF), Indigenous People Planning Framework (IPPF), Resettlement Policy Framework (RPF), and Process Framework (PF), as well as the Feedback Grievance Redress Mechanism (FGRM).

The World Bank reviewed and cleared these instruments, which were publicly disclosed at: http://ditjenppi.menlhk.go.id/admin/berita-admin/peraturan-perubahan-iklim/3326-ditjenppi.html.
The ESMF and its associated frameworks provide guidelines for assessing the potential environmental and social impacts and preparing the environmental and social management plans and required measures to minimize adverse environmental and social impacts under the ER Program in East Kalimantan. The other important documents for the reporting period include the safeguards due diligence report (*Due Diligence Report for Retroactive Emissions Reductions for July 2019 to June 2020 period or EK Retroactive Report*) and Free Prior Inform Consent (FPIC) report.

The safeguards due diligence represents one of the key requirements for ER Program effectiveness following the ERPA signature. This annex outlines key findings of the due diligence report, including safeguards performance assessments within the reporting period and the proposed system enhancement measures. The due diligence report has been reviewed and cleared by the World Bank in November 2021. Overall, the results showed adequate institutional capacity for identifying and managing environmental and social risks, although some gaps and areas for strengthening remain. Between June 2019 and November 2020, the management of risks and impacts was consistent and/or in alignment with the provisions under the ESMF, despite the absence of such an ESMF during early activity implementation. To date, no significant adverse impacts were reported under the reporting period, based on the typology of

activities being included for retroactive financing, which include low risk and "no-regret" activities from the environmental and social perspectives, including regulatory development, technical assistance, and capacity building. Relevant environment and social mitigation measures were embedded as part of the activity implementation, including integration of community participation and sustainability under village planning, and community consultations for conflict resolution. There were a few gaps with regards to the documentation of environmental and social management, technical capacity, particularly in addressing complex ER issues such as land tenure, and overall supervision capacity for which correctional action plans have been proposed and currently being implemented.

Further operationalization of the ESMF and its associated frameworks are presented in the following action plans for the Environmental and Social Risk Management under the EK ER Program. The document can be accessed at the following link:
https://mrv.kaltimprov.go.id/storage/guest/SAFEGUARDS/fcpf_ek_Draft esmp_2020Dec23_SA_ok.docx

II. Monitoring and Reporting Requirements

1. Entities that are responsible for implementing the Safeguards Plans are adequately resourced to carry out their assigned duties and responsibilities as defined in the Safeguards Plans.

1.1 Summarize the key institutional arrangements, such as decision procedures, institutional responsibilities, budgets, and monitoring arrangements required under the Safeguards Plans.

A summary of the key institutional arrangements is provided in Table A1.1.

Table A1.1. Summary of Key Institutional Arrangements

Institutional Arrangements	Summary
Decision procedures	*The decision procedures to implement Safeguards plans are conducted through culturally appropriate and inclusive decision-making mechanisms, such as involving adat representatives, ensuring communities' participation through Musrenbangdes, organizing public consultations, and increasing women's participation.*
Institutional responsibilities	*A safeguard working group consisting of stakeholders from governmental actors, NGOs, businesses, and academia ensures the implementation of the safeguards plans in the East Kalimantan Province. The East Kalimantan Forestry Service is the coordinator of this working group.*
Budgets	*The primary funding sources for implementing the Safeguards Plans are the Regional Revenue and Expenditure Budget (Provincial APBD), regional transfer funds, the National Revenue and Expenditure Budget / APBN, grant funds, and ER Payment. Some government partners, like NGOs and CSOs, also have the budget for managing E&S risks. However, their budget is limited.*
Monitoring	*The Directorate General of Climate Change, MOEF, has established an MRV system known as the National Registry System (Sistem Registry*

	Nasional/SRN). The ER Programs will be registered in this system to enhance a robust and transparent monitoring system. The EK Environment Agency leads the monitoring system at the sub-national level. The Environment agency at the district level will assist the monitoring process by gathering the reports from the implementing agencies. The reports will be submitted to DGCC and SEKDA, who will be responsible for distributing them to the World Bank. The FGRM at the province level is supported by Aspirasi Etam, a system that enables people to submit their feedback, grievances, and complaints online. The Aspirasi Etam is developed under the Governor Regulation, No. 69, Year 2019. Community-based fire management and Monitoring Systems (CBFMMS) are developed to involve communities in the monitoring process at the village level.

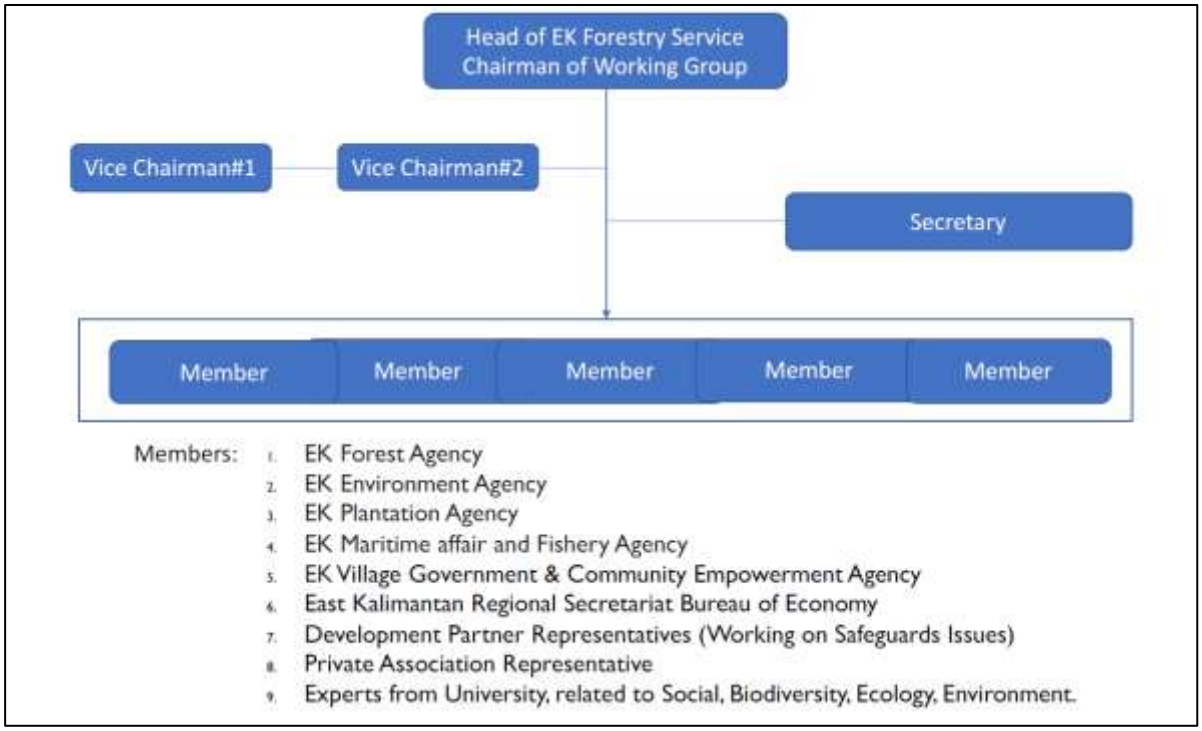
The Safeguards Working Group was established following consultations with the relevant agencies/services during the reporting period based on Safeguards Plans. The regulation for the group has been drafted. However, the regulation for their official appointment has not been issued as of the date of the report, pending the issuance of a new regulation from the Ministry of Home Affairs regarding the new nomenclature for the relevant directorates and sub-directorates under sub-national governments.

Subject to the issuance of this regulation, a Governor regulation on the Safeguards Working Group is expected to be issued in 2022. In the meantime, the Safeguards Working Group has prepared Standard Operating Procedures (SOP) to ensure safeguards plans are implemented accordingly. The preparation involved the national and provincial governments, AMAN (Indigenous Peoples Alliance of the Archipelago), universities, the private sector, and NGOs. For instance, a set of procedures for the FGRM was prepared to enable affected and interested stakeholders to raise their concerns and suggestions. In addition, the SOP also includes instructions on how such concerns and suggestions will be followed up. There are three steps for complainants to submit complaints through Aspirasi Etam. The number of complaints submitted and resolved can be monitored on the following website: https://aspirasi.kaltimprov.go.id/.

Day-to-day operating costs for the Working Group are expected to be financed by the ER payment proceeds (i.e., under the Operational Costs/Responsibility Costs). Until such payments are made, regular group coordination meetings have been occasionally supported by the regular allocated budget from APBD (through EK Forestry Service's Regular Budget). Field supervision, including monitoring and reporting, and technical assistance on implementing BSP are expected to be sourced from ER Payment proceeds.

The organizational structure for the Safeguards Working Group is in Figure A1.1.

Figure A1.1. Structure Organization for Safeguards Working Group



The Working Group is chaired by the Head of EK Forestry Agency and supported by two Vice-Chairmen, namely 1) the Head of Watershed Management and Rehabilitation Division, and 2) the Head of Forest Planning and Utilization Division. In addition, the Secretary of the Safeguard Working Group is housed by the Forest Planning and Governance in EK Forest Agency. In other words, the EK Forestry Service is responsible for the overall coordination, supervision, and reporting for the Safeguards Working Group. Based on the e-survey involving 24 institutions, the results show that those institutions have the adequate institutional capacity to function effectively in supporting the Working Group. There are six indicators: resource allocation, technical capacity, identification and management of environmental and social risks, stakeholder engagement and consultations, FGRM, and availability of supporting documentation. The results of the e-survey are provided through this link: https://1drv.ms/x/s!ApxFBBsaVYWCgsYUiaM9p7ZwB12C7A?e=HqMRHY.

The members of the working group consist of the following representatives (See Figure A1.1):

1. EK Forest Agency
2. EK Environment Agency
3. EK Plantation Agency
4. EK Maritime affair and Fishery Agency
5. EK Village Government & Community Empowerment Agency
6. EK Law Agency
7. EK Borders, Regional Planning, and Cooperation Agency
8. EK Communication and Information Agency
9. East Kalimantan Regional Secretariat Bureau of Economy
10. Development Partner Representatives (Working on Safeguards Issues)
11. Private Association Representative

12. Experts from University, related to Social, Biodiversity, Ecology, Environment

The Safeguards Working Group has developed an institutional arrangement for a decision-making procedure, institutional responsibilities, and monitoring and reporting procedures in line with the ESMF and is currently implemented under the EK ER Program. A Gubernatorial Decree is being prepared and expected to be issued in 2022 as the legal basis for the Safeguards Working Group. In addition, specific responsibilities for FGRM management are outlined in the FGRM framework which is an integral part of the ESMF.

This Working Group is currently expanding membership to include the EK Population and Women's Empowerment and Child Protection Agency, which will be responsible for gender issues, and The *Aliansi Masyarakat Adat Nusantara*/AMAN Kaltim which will be facilitating engagement with *Adat* communities, including supporting the program entities in the implementation of the Community Customary Law. To encourage the involvement of those two agencies, they will be intensively engaged and involved in relevant workshops and FGDs related to the FCPF Carbon Fund in East Kalimantan.

To ensure adequate implementation of the safeguards requirements by the relevant agencies/implementing entities, the Working Group will facilitate discussions, provide technical support, and review safeguards documents, including any applicable environmental and social management plans (ESMPs) such as the AMDAL/RKL-RPL, UKL-UPL, SPPL, Forest Management Plan, or any other equivalent plans prepared by these entities. The Working Group will assign a team of specialists with expertise in Environmental and Social Safeguards, gender, CBNRM, and FGRM to ensure effective oversight of ERP safeguards. The working group will compile all safeguards documents, including relevant site-specific ESMPs, into one provincial safeguards document on the ER program and submit it to the Secretariate National REDD+ through the Provincial Project Management Unit (PPMU). The roles and responsibilities of the Safeguards Working Group, project management unit, and implementing entities in managing safeguards for the ERP are provided in Figure A1.2.

Figure A1.2. Main Roles of implementing entities and safeguards working group in implementing, monitoring, and reporting the implementation of environmental and social aspects of the ER program

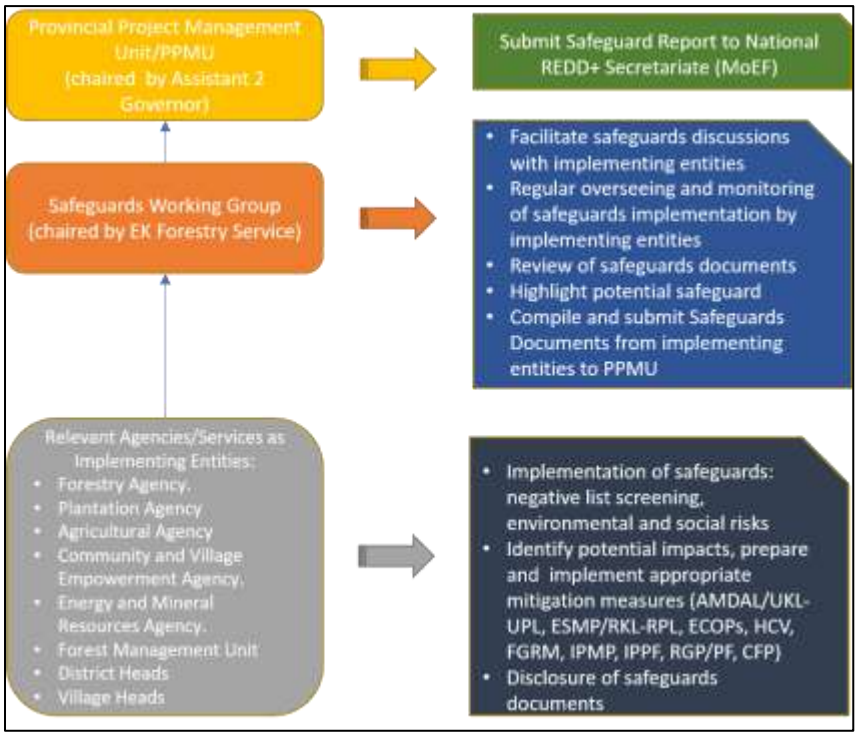


Figure A1.3. Review and Clearance Procedure

The implementation structure for the environment and social management under the EK FCPF-Carbon Fund consists of government institutions (*Perangkat Daerah*/PD), NGOs/development partner representatives, the private sector, village government, and Forest Management Unit/*Kesatuan Pemangkuan Hutan* (KPH).

Referring to Figure A1.3 above, the implementing entities, with support from the E&S specialists, conduct environmental and social risk screening, analysis of risks, and preparation of relevant management plans as applicable for their respective activities and report the result to the PMU. Most of the entities have performed environmental and social risk screening. Thirteen out of 19 entities conduct E&S risks identification and management mechanisms. They have done the screening process through reporting, reviewing, and examining the projects to identify risks, sources, impacts, and mitigation options. The detailed roles and responsibilities of relevant agencies for safeguards implementation under the ER program can be found in Table 5-2 ESMF Document.

The monitoring arrangement for the environmental and social risk and impact management under the ER Program focuses on the overall compliance of the applicable environmental and social requirements outlined in the ESMF and its associated frameworks. This includes planning and implementing social and environmental risk prevention and mitigation procedures under the reported activities.

1.2 Confirm whether the institutional arrangements summarized above have been put in place.

The institutional arrangements summarized above have met most of the relevant requirements for the Safeguards Working Group to perform accordingly. The relevant requirements are budget allocation, resources and skills, and coordination agreements.

The EK government uses the Regional Revenue and Expenditure Budget (Provincial APBD) as the main source to finance E&S risks management. Dependency on the APBD has risks that affect medium- to long-term funding sustainability. The EK government's liability to finance the E&S risks and management might change depending on the political and economic circumstances. The COVID-19 pandemic showed that the provincial government tightened the budget in response to the pandemic. While in the Provincial RPJMD, no specific/off-the-top budget allocation for E&S risk management was allocated, some budget allocation was available to finance activities related to the E&S risk management by the participating agencies. For instance, the EK Environmental Agency allocated IDR 446, 250, 000 in 2019 and IDR 2,720,000,000 in 2020 for grievance handling and conflict monitoring related to environmental and social cases. Meanwhile, in 2019 the Forest Management Units (FMUs) allocated around IDR 3,920,000,000 for grievance, conflict management, tenure, and customary forests. In addition, some development partners of EK government, including GiZ, Propeat, and Leopold, also allocated IDR 90,000,000 for conflict mediation strengthening support.

Referring to the EK Retroactive Report, the safeguards due diligence confirmed that social and environmental safeguards had been implemented quite well during the observation period of June 2019 to December 2020. The Aspirasi Etam website shows that from July 2019 to December 2020, 38 out of 45 aspirations and complaints had been solved. Feedback mostly consist of public

appreciation related to the government performance and suggestions for public development. Complaints were related to environmental pollution, public facilities, and tenurial conflicts.

Despite the above system and capacity, some gaps in implementation remain. Based on the analysis of the due-diligence findings, quality of implementation of the management of social and environmental issues varies across agencies in the framework of a jurisdiction-based emission reduction program in East Kalimantan. These include availability of human resources for managing social and environmental issues, the availability of financing, and the need to improve SOPs in risk identification, and monitoring and reporting on the implementation of the management of social and environmental issues. The EK government institutions have been concerned about improving technical capacities to conduct E&S risks management since the issuance of Law No. 23 of 2014 on regional government and the ensuing delegation of district forestry staff. Capacity building programs have included a broad range of safeguards topics such as gender and climate change, reversal and leakage, and SIS REDD+. topics such as gender and climate change, reversal and leakage, and SIS REDD+.

Coordination and agreements among the key stakeholders were achieved through the formation of the Safeguards Working Group. The EK Forestry Agency is appointed as the coordinator of the Working Group that involves multi-stakeholders, including governmental and non-governmental actors. The program implementation entities conduct the E&S risk management program on their activities and report the result to the PMU. However, several actions need to be taken by the EK government to enable the Safeguards Working Group to function effectively. First, the EK government needs to expedite the issuance of a gubernatorial decree to form the legal basis for the Safeguards Working Group. Second, not all implementing agencies have internal capacities for E&S risks identification and management mechanisms. Therefore, they depend on external E&S specialists. The EK government needs to strengthen the institutional capacities of the implementing agencies by improving the E&S management skills of internal government officials.

1.3 Confirm that the implementing entities and stakeholders understand their respective roles, have the technical capacity to execute their responsibilities, and have adequate human and financial resources.

This is confirmed. The following table describes the roles and responsibilities of relevant stakeholders regarding the ER program in implementing safeguards. The availability of financial resources currently comes from regular provincial budgets (ABPD). In other words, from the EK government services budgets. The financial resources during the reporting report were not yet sourced from ER Payments of the Carbon Fund. The ER program seeks to address the financial gaps (i.e., the vulnerability in solely relying on APBD budgets) by utilizing the first ER payments.

Table A1.2. The Roles and Responsibilities, Technical Capacity, and Resources Availability of Relevant Stakeholders[41]

Component ER Program	List of stakeholders	Roles and Responsibilities related to safeguards	Assessment of technical capacity	Availability of human resources	Availability of financial resources
Forest and land governance	• BPSKL (*Balai Perhutanan Social dan Kemitraan Lingkungan)* • EK Forestry Service • EK Social Forestry Working Group • EK Social Service • EK Environment Service • Development Partners • DDPI • EK Communication and Information Service • EK *Adat* Council	• Strengthen existing FGRM to promote accessibility, reliability, and transparency • Capacity building for government agencies and the private sector in the ESMF, and ECOP, including aspects around community engagement and sustainable NRM • Capacity building in participatory community mapping, database development/conflict inventory, and analysis of social problems • Addressing access restriction risks through alternative livelihoods/employment/skills training • Regular monitoring of the Social Forestry program to ensure capacity building and technical support to	• 15 out of 24 entities have sufficient technical capacity for E&S risks management, including capacity for reporting, monitoring, evaluating, managing grievances system, managing natural resources, forest resources, and biodiversity, conducting inclusive public consultations, promoting sustainable living, solving conflicts, and gender mainstreaming. Four stakeholders stated that they have excellent capacities and the rest stated that they have no such capacities.	Available. More than half of the stakeholders, 13 out of 24, have internal staff who have adequate capacity to conduct E&S risks management	Available. Almost all stakeholders depend on Provincial Budgets (APBD). Some of them receive alternative funding from Regency Budgets, regional transfer funds, and grants. 13 out of 24 stakeholders have the ability to finance capacity building programs. However, only four out of 24 stakeholders have the ability to finance the operational budget for FGRM.

[41] This refers to the EK Retroactive Report.

Component ER Program	List of stakeholders	Roles and Responsibilities related to safeguards	Assessment of technical capacity	Availability of human resources	Availability of financial resources
		community groups and mitigate unintended environmental impacts • Capacity building to engage with *Adat* communities and Indigenous Peoples and other vulnerable groups dependent on forest resources. A participatory Indigenous Peoples Plan (IPP) may be developed to establish a strategy for such engagement • Addressing the risk of access restrictions through alternative livelihoods/jobs/skills training • Periodic monitoring of the Social Forestry program to ensure capacity building and technical support to community groups and reduce unwanted environmental impacts • Capacity building to engage with Indigenous and Indigenous Peoples and other vulnerable groups who depend on forest resources. A participatory Indigenous Peoples Plan (IPP) can be developed to develop a strategy for such engagement			
Improving Forest Supervision and Administration	• DGCC as the Project Executing Agency, and Provincial Forestry Agency	• Capacity building for FMUs and relevant government institutions on sustainable NRM and ESMF in particular	• 15 out of 24 entities have sufficient technical capacity for E&S risks management, including capacity for reporting, monitoring, evaluating, managing grievances	Available. More than half of the stakeholders, 13 out of 24, have internal staff who	Available. Almost all stakeholders depend on Provincial Budgets (APBD. Some of them receive alternative

Component ER Program	List of stakeholders	Roles and Responsibilities related to safeguards	Assessment of technical capacity	Availability of human resources	Availability of financial resources
	as Implementing Agency • Other entities: FOERDIA, DDPI, NGOs	• Effective scheduling for forest patrol as well as planning of forest use and resource management as encapsulated in the RPHJP (long-term development plans) • Proper identification of capacity building strategy, including pooling of credible and qualified trainers/champions and/or training institutions to deliver the required capacity building activities and mentoring	system, managing natural resources, forest resources, and biodiversity, conducting inclusive public consultations, promoting sustainable living, solving conflicts, gender mainstreaming. Four stakeholders stated that they have excellent capacities and the rest stated that they have no such capacities.	have adequate capacity to conduct E&S risks management	funding from Regency Budgets, regional transfer funds, and grants. 13 out of 24 stakeholders have the ability to finance capacity building programs. However, there are only 10 out of 24 stakeholders having the ability to finance E&S monitoring and evaluation.
Reducing Deforestation, Forest Degradation Within Licensed Areas	• DGCC as the Executing Agency, and Provincial Forestry Agency as implementing agency responsible for monitoring and evaluation • Environmental Agency (East Kalimantan Province) for training and regulation enforcement. Implementation of ESMF, FGRM, IPPF, and BMF • Involvement of conservation NGOs for establishing	• Community training/capacity development for small holders and private sector actors as well as government institutions on aspects related to good agroforestry practices, NTFP, zero-burning farming, etc. • Community capacity building on forest and land fire management/community-based forest and fire management • Incentive development to promote participation from the private sectors in land and forest fire management • Capacity building on participatory HCV mapping and strengthening engagement with *Adat*	• 15 out of 24 entities have sufficient technical capacity for E&S risks management, including capacity for reporting, monitoring, evaluating, managing grievances system, managing natural resources, forest resources, and biodiversity, conducting inclusive public consultations, promoting sustainable living, solving conflicts, gender mainstreaming. Four stakeholders stated that they have excellent capacities and the rest stated that they have no such capacities.	Available. More than half of the stakeholders, 13 out of 24, have internal staff who have adequate capacity to conduct E&S risks management	Available. Almost all stakeholders depend on Provincial Budgets (APBD). Some of them get alternative funding from Regency Budgets, regional transfer funds, and grants. 13 out of 24 stakeholders have the ability to finance capacity building programs.

Component ER Program	List of stakeholders	Roles and Responsibilities related to safeguards	Assessment of technical capacity	Availability of human resources	Availability of financial resources
	BMF and facilitate its implementation	communities and Indigenous Peoples, including those dependent on forest resources for sustainable HCV management • Development of a Biodiversity Management Framework (BMF) or inclusion of biodiversity management under HCV or non-carbon benefit • Enforcement and strengthening the existing safeguard including ESMF for relevant stakeholders especially private sectors as well as government institutions)			
Sustainable Alternative Livelihoods	• DGCC as the Executing Agency, and Provincial Forestry Agency as implementing agency responsible for monitoring and evaluation • Environmental Agency (East Kalimantan Province) for training and regulation enforcement • Involvement of conservation NGOs for establishing BMF and	• Strengthening FGRM, particularly to promote its accessibility and accountability • Participatory village planning and community training on sustainable livelihoods options, including access to financing and inputs, good agricultural practices, and market • Mainstreaming safeguards good practices in NRM, such as use of organic pesticides, revegetation, crop intensification, etc. • Enhancing access to information and participation in social forestry licensing processes • Capacity building to engage with Adat communities and	• 15 out of 24 entities have sufficient technical capacity for E&S risks management, including capacity for reporting, monitoring, evaluating, managing grievances system, managing natural resources, forest resources, and biodiversity, conducting inclusive public consultations, promoting sustainable living, solving conflicts, gender mainstreaming. Four stakeholders stated that they have excellent capacities and the rest stated that they have no such capacities.	Available. More than half of the stakeholders, 13 out of 24, have internal staff who have adequate capacity to conduct E&S risks management	Available. Almost all stakeholders depend on Provincial Budgets (APBD). Some of them get alternative funding from Regency Budgets, regional transfer funds, and grants. 13 out of 24 stakeholders have the ability to finance public consultations and capacity building.

Component ER Program	List of stakeholders	Roles and Responsibilities related to safeguards	Assessment of technical capacity	Availability of human resources	Availability of financial resources
	facilitate its implementation	Indigenous Peoples as well as other vulnerable groups dependent on forest resources. A participatory Indigenous Peoples Plan (IPP) may be developed to establish a strategy for such engagement			

1.4 Where specific capacity building measures (e.g., training and professional development) have been required by the ER Program or Safeguards Plans, describe the extent to which these measures have been carried out.

The ESMF document outlined several training programs for enhancing the capacity of community or forest management units. The following table describes training sessions that were carried out in 2020.

Table A1.3. The Summary of Capacity Building Measures Required by the ER Program Safeguards Plans

Capacity Building Measures	Type	Description	Justification	Objective	Target Groups
Fire prevention training	Safeguard coaching	Training for fire prevention and control is the most intensive training organized primarily by FMU/KPH and companies. In 2020 alone, 41 training activities were held from 61 trainings as the initial target. Prior to training, KPH/companies usually initiated to form a voluntary group consisting of community members to be acknowledged as a local fire brigade. KPH/companies are responsible for providing standard tools and equipment for this local fire brigade	Fires are considered one of the drivers of deforestation and forest degradation, leading to emissions of CO_2 averaging 68 million tons per year	Establishing Fire Awareness Community (MPA), increasing capacities and facilities to support land and forest fires prevention	Farmers and communities
GPS training	Technical training	Yayasan BUMI conducts GPS training for supporting 6 villages in Central Mahakam region to produce village development plan and spatial planning	Unintended mismatches between land cover and land use could lead to habitat loss or deforestation. In	Preparing and producing village development plans incorporated with village spatial planning to strengthen village	Village governments and communities

Capacity Building Measures	Type	Description	Justification	Objective	Target Groups
			addition to that, there is a risk of conflicts over village boundaries	development and spatial planning	
Forest Integrity Assessment Tool (FIAT) training	Technical training	PT Gunung Gajah Abadi forest concession has conducted Forest Integrity Assessment Tool (FIAT) training to ensure the methodology and technical procedure in HCV areas monitoring plan and, therefore, will strengthen the management capacity within the State Forest Area	The remaining High Conservation Value Forests (HCVF) need to be protected	Reducing deforestation and degradation within the State Forest Area	FMUs
Geographic Information System (GIS) and drone training	Technical training	The Crop Agency and KPH conduct this GIS training. This training will enable the stakeholders to manage and utilize spatial data	Developing and strengthening the management capacity of spatial database will be useful for improving screening and reviewing capacity	Strengthening the management capacity within the State Forest Area as well as in APL	FMUs
FMU business plan development training	Safeguard coaching	Training for Preparation of Long-term Forest Management Plan Document in Lati Petangis Grand Forest has strengthened the management capacity within the State Forest Area	Weak forest management leads to forest and biodiversity loss. Long-term forest management plan is needed to protect remaining forests and support sustainable forest management	Strengthening the management capacity within the State Forest Area	FMUs
Management Effectiveness Tracking Tool (METT) training	Technical training	The METT training is delivered in Lati Petangis Grand Forest	-	Strengthening the management capacity within the State Forest Area	FMUs
Conflict resolution training	Safeguard coaching	The conflict resolution training conducted in East Kutai is supported by GIZ-SCPOPP. This training is part of the Dispute Settlement program in ERPD	The SESA findings indicate that key social risks are primarily associated with existing tenurial conflicts between people and private companies (forestry and palm oil concessions) and conflicts on natural resource use between forestry and palm oil companies. Therefore, conflict resolution skills become crucial	Identifying tenurial conflicts, and dispute settlement	-
Village heads training	Basic training	Sixty village heads representing six East Kalimantan districts have been trained to enhance their capacity as local government bodies. The training was supported by East	The Safeguards mechanisms involve 99 villages in East Kalimantan. Strengthening village heads' capacity is needed to ensure safeguards	Strengthening village development	Village Heads

Capacity Building Measures	Type	Description	Justification	Objective	Target Groups
		Kalimantan District Community Empowerment and Village Government Agency (DPMPD Kaltim) in 2020	mechanisms are implemented effectively at the village level		

2. ER program activities are implemented in accordance with management and mitigation measures specified in the Safeguards Plans.

2.1 Confirm that environmental and social documents prepared during program implementation are based on the Safeguards Plans. Provide information on their scope, main mitigation measures specified in the plans, whether the plans are prepared in a timely manner, and whether disclosure and consultation on the plans are carried out in accordance with agreed measures.

It is confirmed that environmental and social documents prepared during program implementation are based on Safeguards Plans. However, there are some gaps as identified by the EK Retroactive Report that need to be addressed. The EK Retroactive Report clarified that the ER activities being reported were implemented prior to ERPA. Therefore, specific management plans per the ESMF requirements may not have been prepared.

Based on the EK Retroactive Report, 13 out of 24 stakeholders stated that they have mechanisms for E&S risks identification, management, and mitigation in place. However, the identification and management were not always implemented consistently. The implementation of E&S risks identification, management, and mitigation depends on the type of the project, whether large, medium, or small projects. According to Government Regulation Number 22 Year 2021, business or planned activities need an Environmental Impact Analysis (Analisis Mengenai Dampak Lingkungan / Amdal) or Environmental Monitoring Scheme (Upaya Pengelolaan Lingkungan Hidup / UKL – Upaya Pemantauan Lingkungan Hidup / UPL) to receive the Central or Local Government's approval. Large projects involving construction works that have the potential to cause significant environmental and/or social impacts are required to obtain a business license to begin the projects. They need to prepare an Amdal, Environmental Management Plan (Rencana Pengelolaan Lingkungan Hidup / RKL), and Environmental Monitoring Plan (Rencana Pemantauan Lingkungan Hidup / RPL) documents. The medium-scale projects only need UKL-UPL documents. Existing government regulations push the large and medium program activities to follow, but not for the smaller ER program activities. For the smaller projects, the risk management and mitigation measures depend on the internal mechanisms of implementing agencies. Not all of those implementing agencies have such mechanisms due to a lack of human resources, lack of experts in their institutions, lack of understanding of its urgency and obligation to prepare E&S documents, and lack of funding. In order to fill the gap, the Governor's Decree 522/K.28/2022 on the establishment of Provincial Project Management Unit is issued. The decree mandates the Safeguard working group is in charge to facilitate capacity building processes and knowledge sharing for the sub-national staffs and members related to risk management and mitigation measures.

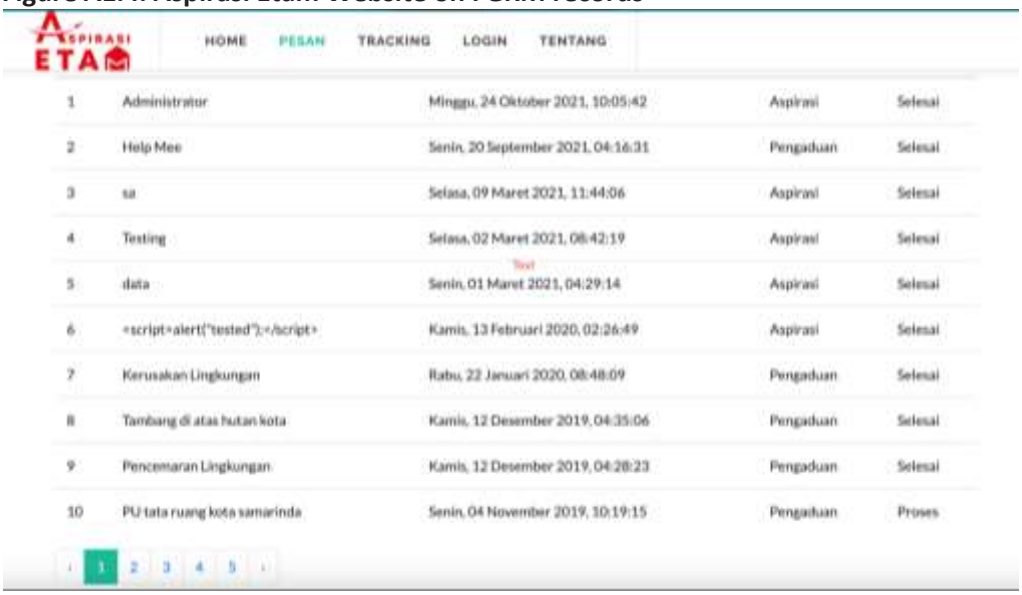
2.2 Confirm if entities responsible for implementing the Safeguards Plans maintain consistent and comprehensive records of ER Program activities such as records of administrative approvals, licenses, permits, documentation of public consultation, documentation of agreements reached with communities, records of screening process, due diligence assessments, and records of handling complaints and feedbacks under the Feedback and Grievance Redress Mechanism (FGRM).

Overall, the availability of supporting documentation for the above, including consultation records, is still lacking. Therefore, this gap needs to be addressed. Based on the e-survey conducted for the EK Retroactive Report, only 13 institutions have documentation and reporting

mechanisms for public consultations. The e-survey process enabled the participants to upload documentation and administrative records samples. However, only four entities can provide those documents. Those four entities are Global Green Growth Institute, KPH Delta Mahakam, WWF, and (DDPI) Dewan Daerah Perubahan Iklim. The documents can be accessed through this link:
https://1drv.ms/u/s!ApxFBBsaVYWCgsYXGPq0PHxnxrki-g?e=aog5f0

The capability to provide records of handling complaints and feedback is also lacking as only eight of 24 institutions received public complaints. The e-survey results also show that only five of 24 institutions have a Standard Operating Procedure (SOP) for handling complaints and feedback. Three of them stated that they had solved all complaints received from June 2019 to July 2020. Despite gaps in providing well established FGRM mechanisms at the institutional level, the EK Province Government launched the Aspirasi Etam website (aspirasi.kaltimprov.go.id) in 2019 under Governor Regulation 69 of 2019. The EK Communication and Informatics Agency is the institution that develops this website to receive online complaints and aspirations from the public. The Aspirasi Etam has provided information on submitting complaints and aspirations online. The public can track the progress of each complaint and aspiration through this website. There were 45 complaints or aspirations received, and 43 cases were resolved from July 2019 to December 2020.

Figure A1.4. Aspirasi Etam Website on FGRM records



2.3 *Summarize the extent to which environmental and social management measures set out in the Safeguards Plans and any subsequent plans prepared during Program implementation are implemented in practice, the quality of stakeholder engagement, as well as whether field monitoring and supervision arrangements are in place.*

Safeguards management has not been fully implemented, and not all of the safeguards from the activities carried out can be monitored due to a lack of financial support. To date, the activities related to safeguards done by OPDs were from government budgets (not from ER Payments). Since the COVID-19 pandemic, several activities have been postponed and the budgets were directed to address the pandemic in 2020. To mitigate this challenge, E&S concerns should be reflected in national and regional planning documents to ensure long term funding.

Not all implementing agencies are aware of the importance of implementing environmental and social management measures. Six institutions surveyed informed that they do not have mechanisms to mitigate environmental and social risks by preparing AMDAL, UKL-UPL, or SPPL documents (ESMPs) as required by the national legislation and outlined in the ESMF. Developing jurisdictional policies that make E&S risk management obligatory for the relevant institutions and awareness raising on the requirement is needed.

The efforts to engage with all stakeholders, including affected communities, indigenous people, governmental actors, companies, and NGOs, have been conducted inclusively. Overall, the quality of the stakeholders' engagement is good, considering that only one institution (UPTD KPH Damai) had not yet engaged with the stakeholders during reporting period due to budget constraints. Most of the institutions surveyed reported involving stakeholders in determining the locations of activities, identifying environmental and social risks, and in general public consultations. The stakeholders' engagement is not only program socialization. Almost half of the institutions surveyed shared that the inputs from the stakeholders changed the program slightly and significantly. One institution revealed that the program was cancelled after the stakeholders' engagement process. Even though the institutions surveyed claimed that they had carried out the stakeholders' engagement inclusively, some vulnerable groups, such as women groups, the Indigenous Law Communities (Masyarakat Hukum Adat / MHA) groups, and people with disabilities were not optimally engaged. For instance, most institutions did not report gender-differentiated data on participants in their reports. The stakeholders' engagement agenda lacks a clear legal mandate and SOPs to ensure optimal representation by potentially affected parties. The documentation procedure for engagement activities has been integrated into the Project Operational Manual as well as a participatory and inclusive engagement strategy is currently being developed.

Most institutions have monitoring and evaluation systems. They send field officers to monitor and evaluate the program and report the progress to relevant units at the district and provincial levels. Some of them hire consultants to conduct field monitoring. The institutions coordinate to supervise the program's implementation. Based on the survey, the participants stated that they have coordination mechanisms, both horizontal (between OPD or work partners) and vertical, (with leadership down to the regional heads), across and/or between units /institutions to ensure the implementation of environmental and social management of carbon emission reduction activities. Ideally, the Safeguards Working Group organizes the monitoring and supervision arrangements, which the EK Forestry Agency leads. However, this working group does not have a clear mandate to run this crucial task properly due to the absence of the Gubernatorial Decree as the legal basis for them to act accordingly.

2.4 Confirm that the FGRM is functional, supported with evidence that the FGRM tracks and documents grievances, is responsive to concerns, complaints or grievances.

The backbone of FGRM implementation in supporting ER Program in East Kalimantan is *Layanan Aspirasi Etam*, a web-based online application where all entities in East Kalimantan may submit any complaints and comments or aspirations regarding the positive or negative excess of ER program during the implementation period. This web-based application officially became functional on November 29, 2019 following the issuance of East Kalimantan Governor decree No. 69/2019. Since then, the Communication and Information Services Agency (*Dinas Komunikasi dan Informatika*) compiled 45 reports sent to *Layanan Aspirasi Etam* in December 2020. These reports are then grouped into two categories, i.e., complaint and aspiration. Typically, the essence of aspiration is more neutral and tends to be positive while complaints should be related to something that is not proper or disliked. Of 45 reports, 57 percent are complaints while the rest are aspirations. All reports were recorded in the Aspirasi Etam's system. The complained about waste management, waste pollution, illegal logging, illegal mining, and city cleanliness. These complaints have been handled and resolved by the sectoral agency.

Regarding the agencies' responsiveness in responding to the complaint, Dinas Komunikasi dan Informatika informed that only four reports are currently under processing while other 38 reports were completely resolved. There were 19 complaints and aspirations related to the ER programs, and all of these cases had been resolved.

In parallel with *Layanan Aspirasi Etam,* East Kalimantan agencies, i.e., Forestry Agency, Crop Agency, and Environmental Agency, are still receiving complaints through the system already established long before *Layanan Aspirasi Etam* existed. East Kalimantan Forestry Services (*Dinas Kehutanan*) reported 15 cases of land tenure conflict in 2019 and decreased to only five cases up to December 2020. Two cases have reached a settlement while others are still in the process of being settled. Some of the cases may not be solved in a short period because of the complexity and involvement of many government agencies at different levels.

3. The objectives and expected outcomes in the Safeguards Plans have been achieved.

3.1 Assess the overall effectiveness of the management and mitigation measures set out in the Safeguards Plans.

Twelve relevant ER activities were subject to social and environmental due diligence (EK Retroactive Report). Most of the ER activities are capacity-building programs with minimum social and environmental risks. There were no records of negative social and environmental impacts. However, there are some downstream and indirect risks in the medium- or long-term regarding suboptimal implementation of the activities that may cause unintended impacts or potentially adverse implications on social and environmental aspects. The finding from the e-survey shows that six out of 19 institutions with ER activities have no mechanisms for management and mitigation measures, while the institutions that have management and mitigation mechanisms in place do not consistently and fully implement the mechanisms they

have. For instance, some of them do not commence screening measures prior to implementing activities due to limited expertise, limited human resources, or time constraints.

The ER implementing agencies conducted several relevant training and capacity building programs during the reporting period to improve the effectiveness on implementing the management and mitigation measures. Some of the training and capacity building programs are presented in Table A1.4.

Table A1.4. List of Several Relevant Training and Capacity Building Programs During the Reporting Period

Activities	Description	Year	Location	Implementing Agencies
Assistance and supervision of the investment implementation in EK Province	Assisting and supervising corporations in investing in EK Province	2020	East Kalimantan	DPMPTSP (the Capital Investment and One Stop Service Agency)
Developing and Strengthening Spatial Database and Permit Preview Application	This capacity building program focuses on developing and strengthening the spatial database in Berau Regency. This program also develops permit preview applications to help relevant stakeholders monitor the issuance of permits	-	Berau Regency	GIZ-LEOPALD, Baplitbang, Diskominfo, Disbun, D-PUPR, Din. Pertanahan
Training on social conflict and tenurial dispute mediation	This training aims to improve the mediation capacity of the government institutions to solve tenurial disputes in the estate sector	2019	Kutai Timur Regency	GIZ SCPOPP, Kutai Timur Regency Government
Establishing and strengthening the conflict mediation team for estate sector	This training aims to establish and strengthen the conflict mediation team in Berau Regency	2019 & 2020	Segah, Tabalar, Berau Regency	GIZ-LEOPALD, GIZ-FORCLIME, CRU-IBCSD, Disbun, Working group for business disturbance and estate conflict in Berau Regency
Technical mentoring sessions on fire prevention and countermeasures	These technical mentoring sessions aim to improve the capacity of government staff and stakeholders involved to conduct fire	2019 & 2020	West Berau, Bongan, Kendilo, Meratus, DAS Belayan, and Batu Ayau	EK Forestry Agency, FMU in Berau Barat, Bongan, Kendilo, Meratus, DAS

Activities	Description	Year	Location	Implementing Agencies
	prevention and countermeasures			Belayan, and Batu Ayau
GIS training	This GIS training is based on competency in managing and utilizing geospatial data	2020	East Kutai, East Kalimantan	UNDP Kalfor • GIS Training (Basic) : 30 (M) , 10 (F) = 40 (total) • GIS Training (Advance) : 11 (M), 4 (F) = 15 (total)
Capacity building on HCV management for companies	YKAN conducts this capacity building in East Kutai, East Kalimantan focusing on improving the HCV management capacity of the companies operating there	2019 & 2020	East Kutai, East Kalimantan	YKAN
Assisting and monitoring the permit holders operating in KPHP areas	This program focuses on disseminating and assisting in implementing Sustainable Production Forest Management (PHPL)	2019 & 2020	West Berau	UPTD KPHP Berau Barat
Improving the role of communities in environment management	This program aims to improve the institutional development of local communities (Adiwiyata, Adipura, Kalpataru, Climate Village)	2019 & 2020	East Kalimantan	EK Environment Agency

The details of other capacity building programs are available at this link: https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Other/1_FCPF_ERretro_Daftar Kegiatan OPD dan UPT.xlsx

Due to budget constraints and the capacity of the implementing agency to apply safeguards, the process of documentation and monitoring of safeguards implementation requires improvement. The Safeguards Working Group needs to be more active in capacity building and monitoring of the implementing agencies on safeguards management. Socialization of the safeguards SOP is expected to fill the knowledge and capacity gaps. Moreover, the technical capacity will be improved through the development of knowledge management system that allows the exchange and disclosure of relevant information, including cross-fertilization amongst technical experts. The knowledge transfers between consultants and members of the Safeguards Working Group will be continued during ERP implementation.

3.2 Are the arrangements for quality assurance, monitoring, and supervision effective at identifying and correcting shortcomings in cases when ER Program activities are not implemented in accordance with the Safeguards Plans?

Given that the project is in the early stage of implementation, the effectiveness of the arrangements for quality assurance, monitoring, and supervision, according to the Safeguards Plans, will be assessed later. Although an assessment is yet to be conducted, some arrangements for quality assurance are in place as of the date of reporting. The SIS-REDD+ Indonesia was developed for quality assurance to ensure proper safeguards implementations (http://ditjenppi.menlhk.go.id/sisredd/). If ER program activities are not implemented according to the safeguards plans, the public and stakeholders can submit their feedback and grievances through the Aspirasi Etam website.

Quality assurance, monitoring, and supervision are carried out with budget constraints. The COVID-19 pandemic has led to some budget tightening in East Kalimantan. The next steps are strengthening the Safeguards Working Group and hiring consultants to support them.

3.3 Describe the supervision and oversight arrangements to ensure that the Safeguards Plans and, if any, subsequent environmental and social documents prepared during Program implementation are implemented. Are these supervision and oversight arrangements effective (e.g., provide a meaningful feedback mechanism to implementing entities to allow for corrective actions)?

The supervision and oversight arrangements to ensure the implementation of the Safeguards Plans are coordinated by the Safeguards Working Group. During implementation, the Safeguards Working Group is supported by the Sub National PMU Secretariat, which consists of managers, staff, and experts. The PMU Secretariat assists the Working Group in carrying out its duties, both administratively and technically. From the administrative side, managers, staff, and related experts manage documents related to safeguards. These administrative activities include preparing meeting materials, documenting activities (minutes and photos), managing documents collected from parties for reporting materials, and others. From the technical side, experts will provide technical advice to the working group to carry out its roles and responsibilities, especially in the process of screening, implementation, monitoring and evaluation, and reporting of safeguards.

Safeguards implementation is conducted by the implementing entities, including the government, development partners, the private sector, village governments, and FMUs. The implementing entities carry out safeguards management and report to the Working Group. The Working Group will monitor the safeguards management and be evaluated by the Provincial Technical Committee (PTC). The Working Group will prepare an annual report on the implementation of safeguards, submit the report to the PTC, and inform the Ministry of Environment and Forestry and the World Bank. Standard operating procedures (SOPs) are being developed to implement safeguards. It is expected that the SOPs will be ready in the next reporting period. The effectiveness of these arrangements will be further assessed later since they are currently being developed and are not yet implemented.

4 Program activities present emerging environmental and social risks and impacts not identified or anticipated in the Safeguard Plans prepared prior to ERPA signature.

4.1 Does the scope of potential risks and impacts identified during the SESA process continue to be relevant to ER Program activities?

Analysis of Social and Environmental Risks of Different Governmental and Non-Governmental Program Activities for Reducing Emission in East Kalimantan

The scope of potential risks and impacts identified during the SESA process is still relevant to ER Program activities. However, some potential risks and impacts have emerged due to the COVID-19 pandemic, the issuance of Omnibus Law, and the Nusantara Capital City (Ibu Kota Negara Baru, IKN) policy. The COVID-19 pandemic occurred during the assessment period and impacted budget allocation for ER program activities. It led to diverting some government funding away from the ER program and may lead to unintended social and environmental risks caused by poor implementation of program activities. Only six out of 24 institutions surveyed reported that the existing budget mechanisms ensured that the budget for medium-term environmental and social management (two to three years) would be sufficient. Moreover, the government decided to impose large-scale social restrictions. This restriction caused unintended social risks such as inadequate consultation, lack of representation, and low participation rate due to technical limitations to joining virtual events or meetings.

The Omnibus Law is criticized by environmental and social activists, NGOs, think tanks, and scholars because it may lead to potential social and environmental risks and impacts. Many articles in the Omnibus Law can also be counterproductive to ER program activities. The following needs to be considered further:

1. The food estate agenda might utilize forest areas and trigger deforestation.
2. The weakening of the environmental impact assessment process (AMDAL) to ease the business permit process is counterproductive to safeguards arrangements to protect remaining forest areas.
3. The removal of the government's obligation to maintain a minimum of 30 percent forest area based on watersheds and/or islands will threaten the efforts to protect the remaining forest areas.
4. The limitation of public participation in the Amdal process is likely to reduce transparency and exclude the public from the Amdal process.
5. The elimination of opportunity for the public to challenge the Amdal permit is counterproductive to the FGDM mechanisms.
6. The 90 years of cultivation rights (HGU) for corporations has potential risks for the customary law recognition since the indigenous people have to wait 90 years if they want to claim their land back.
7. The lack of sanctions for corporations grabbing customary land (administrative sanctions only) is counterproductive as it will weaken the law enforcement efforts to prevent land grabbing activities.
8. The authority of the central government to revoke the regional regulations (Perda) has potential social risks for the indigenous people as many customary lands are recognized by Perda.

When this assessment report was drafted, the IKN was being planned and the capital city bill was being drafted. There were no social and environmental risks that could be assessed in detail. However, some potential risks were observed during the assessment period. Tenurial conflict is one of the most apparent risks observed. Speculation and enormous increases in land prices are inevitable in East Kalimantan. This situation caused overlapping land claims in the IKN area which may trigger tenurial conflicts. Extensive deforestation is another potential risk discovered. Even though the government claims to begin the development of IKN with reforestation and rehabilitation, the development of a capital city in East Kalimantan Province will attract investors to have properties and buy land there. This mega project to move the capital city to East Kalimantan and massive development threaten biodiversity. The IKN also causes negative social impacts. AMAN reveals that 20,000 indigenous people are at risk of being victims or expelled from their land due to massive development in East Kalimantan. The IPPF document prepared has not captured the impacts of IKN on indigenous people in East Kalimantan Province. Therefore, further assessment is needed at a later stage.

4.2 During implementation, have any ER Program activities led to risks or impacts that were not previously identified in those Safeguard Plans prepared prior to ERPA signature? If so, what are the proposed actions to manage such risks and impacts that were not anticipated previously?

Suboptimal implementation of ER program activities was a crucial factor that led to unintended risks or impacts not previously identified in the Safeguards Plans. For instance, poor implementation of spatial planning led to unintended environmental impacts such as loss of forest cover and habitat due to the mismatches between land cover and land use. Activities regarding HCVA had potential risk where local communities living around and inside oil palm concessions presumed HCV areas as vacant land and therefore available to grab. Unidentified social risks emerged in the implementation of conflict resolutions, recognition of customary land, spatial planning, conservation, and social forestry. The social risks were mainly caused by the communities' dissatisfaction with the activities.

Dissatisfaction with the conflict mediation process resulted in losing access to several stakeholders. Dissatisfaction with spatial planning outcomes led to conflict risks over village boundaries. Overlapping land claims over the conservation areas made enforcement challenging to commence. Enforcement may lead to loss of access to key local stakeholders. Each FMU has identified potential conflicts and carried out conflict resolution according to the characteristics of the conflict. SOPs have been owned by each sectoral agency to resolve conflicts. In addition, the settlement of tenure issues is carried out based on MoEF regulation No. P.84/Menlhk-Setjen/2015 and the mediation process is carried out based on the Regulation of the Director General of Social Forestry and Environmental Partnership No. .4/PSKL/SET/PSL.1/4/2016.

Improving land governance is a proposed action to manage those risks and impacts. Several capacity building programs have been started to improve the capacity of relevant stakeholders in land governance. Details of capacity building program can be found in section 3.1 of Annex 1. The development of the Aspirasi Etam website is another action taken to accommodate the dissatisfaction of stakeholders involved in the ER activities.

5. Corrective actions and improvements needed to enhance the effectiveness of the Safeguards Plans.

5.1 Provide a self-assessment of the overall implementation of the Safeguards Plans

All Safeguards documents have been designed to align with the World Bank's Safeguards policy, including SESA, ESMF, IPPF, RPF, PF, and FGRM. Overall, the implementation of the Safeguards Plans requires improvement. The documents and systems/mechanisms required are put in place. However, suboptimal implementation must be addressed to address unintended social and environmental risks.

As previously stated, the results of environmental and social management surveys, as part of the due diligence for the EK Retroactive Report, were conducted by government agencies and government partners related to carbon emissions reduction in the reporting period (observation period of June 2019 to December 2020). It was shown that there were still gaps between expected conditions and performances and/or with findings at the field level. Some of the gaps found in terms of relevance to support the success of ER program are as follows:

a. **Resource allocation/Financial aspect**

- **Security of environmental and social management budgets in a 'dependent budget' arena**

  In principle, if all management activities are linked to the regional and sectoral plans, budget availability for a specified duration should be secured since those plans are embedded in government services' budgets approved by the provincial council. On the other hand, when the COVID-19 pandemic started in East Kalimantan in early 2020, the provincial government was asked by the national government to readjust the budget for addressing the pandemic.[42] As a result, a lot of field activities were postponed. Field visits, including monitoring in the forestry sector (safeguards), were postponed. The postponed activities occurred until December 2020 due to the absence of adequate budgets provided by the EK provincial government. Therefore, it is necessary to provide an 'emergency plan' to overcome budget inadequacy, especially for field activities. Priority scales of components/activities with performance achievement measures must also be set.

- **Exploring sources of funding for environmental and social management efforts**

  Sources of funding for environmental and social management activities are diverse. For government partners, most of the funding comes from donor agencies, either based on allocations according to programs or, especially for non-governmental organizations (NGOs), partly through proposals' submission where the amount has been fixed. Meanwhile, for government agencies, it comes mainly from the APBD, APBN, and transfer funds. Programs with objectives that are in line (or complementary) could be carried out by convergence between various parties in the same area. Although budget allocation has been determined, public institutions often find it necessary to adjust (efficiency or change) based on the government's decisions (including regional government). The COVID-19 pandemic in 2020 has changed the budget amount that could be used to implement various development activity programs. To guarantee the availability of the budget, other sources of funding, including support or participation of international institutions/communities, are very important to be pursued.

[42] Pusat Minta Pemda Revisi Alokasi APBD untuk Penanganan Corona (bisnis.com)

b. Technical Capacity

- **Implementing social and environmental risk management in the regional apparatus**
  Survey results showed that while agencies, especially land and natural resources based sectoral OPDs, did not carry out environmental and social management, there were still perceptions that those were not part of their main duties and functions. Instead, they were perceived to be the Environmental Service's duty. In reality, those activities were linked as parts or stages of carbon emission reduction activities that each sector should also carry out respectively. In other words, work units (Division/Section/Section) that handle environmental issues are supposed to be owned by the OPDs, which have programmed emission reduction activities. The same situation can be found in private companies where environmental management and monitoring obligations are integral parts of activities designed to be implemented.

- **Limited capacities to face complex environmental and social risk challenges**
  One of the matters that was clearly stated during the survey was limited technical capacities of implementing personnel in many institutions, particularly the government. Several reasons can be considered from such a situation, including the following: The main tasks and functions of environmental and social management were considered to not be part of the duties of sectoral technical agencies, especially with relatively new carbon emission reduction activities. Furthermore, many government agencies have been accustomed to administrative work, even with more apparatus/staff who did not have scientific background in the sectors being handled and dependence on outside parties, especially academics and researchers from universities. The unfavorable (negative) conditions above must be a concern and urgently addressed because environmental and social issues related to climate change will always appear (even more complex) and continue to be linked to program activities from the land and natural resource-based sectors. Internal staff technical capacity building trainings must be continued. However, this does not mean that cooperation with outside parties—especially from universities as "back-stoppers"—is not important to maintain their updated knowledge. If the limitations were also due to lack of human resources, additional human resources through any channels (appointment or recruitment of new human resources, and also transfer) is deemed to be conducted.

c. Risk Identification and Management

- **Availability of environmental and social risk screening mechanisms**
  All institutions had not implemented environmental and social risks screening in East Kalimantan with programs related to carbon emissions reduction. Even those implementing such programs did not yet have filtering mechanisms, so there was no uniformity in activities' implementation. The reason for this situation that should not have happened was also related to the problem of lack of technical capacity. There were also other reasons put forward which were that environmental and social management had not become obligations attached to the main duties and functions of the said agencies, aside from the absence of regulations relating to the development of such mechanisms. This condition should not have happened because environmental and social risks would be logical consequences of programmed activities. Therefore, handling mechanisms were also necessary. However, if the legal basis must be used to resolve this gap, then at least regional leadership (Governor) or also relevant

ministries/institutions could renew the main tasks and functions of regional apparatus organizations (OPD)/technical work units as activity implementers and issue a basis for developing a screening mechanism of environmental and social risks.

- **Insufficient capacity to identify, analysis and develop mitigation plans for environmental and social risks**
  As with the issue of screening, the insufficient capacity to identify, analyze, and develop risk mitigation plans (prevention, mitigation, and control) was found before field implementations by all agencies conducting carbon emission reduction programs in East Kalimantan. The mitigation design was crucial to handle environmental and social risks in a more structured manner and work smoothly. The lack of Standard Operating Procedures (SOPs) was again underlined by survey target groups. If new SOPs would only be crafted when there are regulations covering them, efforts to overcome this gap were to issue the said regulations. The SOPs may not be implemented effectively and efficiently if reviews of an organization's (especially OPD) structural main duties and functions and job description of each official was not reviewed for improvement.

- **The need for improved monitoring and evaluation system for environmental and social risk management.**
  A further step needed after the availability of environmental and social risks screening and mitigation designs in carbon emission reduction activities is the need to improve monitoring and evaluation systems. The general assumption is that performance achievements of an agency's activities implementation could be reviewed from target achievement evaluation (both outputs and outcomes). However, it is often forgotten that target achievements are also very dependent on the input and process, which were only possible through a monitoring process (monitoring) of program implementation which runs periodically and at the same time takes corrective/revision steps to possible deviations. Mitigation designs could mean nothing if monitoring and evaluation designs were not made available. The bigger risk would impact activity plans for the following year, which could not be perfected, or implementation impacts could take worse turns. Therefore, this gap needs to be addressed by including the obligation to monitor and evaluate environmental and social risk management activities from carbon reduction activities for all parties without exception.

- **Barriers to implementing environmental and social management systems**
  There were other findings of gaps related to environmental and social management activities' implementation from public consultation to evaluation stages, which are consistency or orders in implementation. Some similar reasons were also raised as causes, such as limited technical capacities and budget availability, where handling efforts have been previously reviewed. However, something new was raised in relation to this issue, which was difficulties of coordination between sectors/agencies that either have carbon emission reduction activities or those that do not have programs but are needed in implementation. If not resolved, the condition would manifest a gap in the support of successful handling or will become a source of failure because coordination between agencies is part of the enabling factors for the success of activities. The simplest suggestion that can be made is periodic/scheduled regular meetings (for example, once every three months) coordinated by regional leaderships (Governor/Deputy Governor)

as communication forums for implementing carbon emission reduction activities with the opportunity to invite other required parties.

- **Need to improve reporting mechanisms for environmental and social management.** Data and information obtained from implementation of environmental and social management in the framework of emission reduction activities should not only be limited for internal needs (especially if it was obligatory) and not even disseminated (accordingly to the situation and conditions). There are several considerations such as decisions from superiors as the highest decision makers (if needed) which could cause late implementation, the support needed for activities' success from sectors/parties of interests/influential parties could not be obtained, and also no less important is the convergence and/or integration of carbon emissions reduction program activities could not be performed. Therefore, reporting mechanisms and exchanges of information between agencies are very important and, if necessary, be made mandatory through the issuance of its legal basis.

d. Stakeholders Engagement, including Community Consultations

- **Impacts/potential impacts on local communities**
  Activities that were physically carried out directly on the fields have the potential to impact and have impacts on surrounding communities. Nearly two-thirds of the institutions with physical field activities had reported this. However, one-third of the respondents stated that the communities were not directly or indirectly affected by carbon emission reduction activities. The difference in responses like this is feared to occur because of a gap in implementers' understanding. Theoretically, development activities should have been understood as processes of changing the environmental balance to receive greater/increased benefits by trying to reduce risks. These changes occur because of physical changes in the environment, at least because of the need for space. However, efforts to reduce risks often resulted in new/other risks. Note that positive impacts of development were often referred to as benefits, while the negative ones were referred to as risks.

- **Impacted societies involvement in public consultations**
  Communities' involvement or participation is an important part of the effectiveness and sustainability of a public activity, including activities to reduce carbon emissions in East Kalimantan. However, public consultations might not be effective if the impacted societies were not involved. Public consultations were meant to disseminate activities' programs and accommodate aspirations. However, several public consultation implementers sometimes neglected to involve district/city and village governments or other partners. The involvement is important to build understanding and cooperation with key parties at the activities' locations. The collaboration could take various forms, such as coordination, collaboration, and also convergence. The relevance of stakeholders involved could be based on objective and comprehensive observations of activities designs that would be implemented. In other words, there is a need to address this gap through mandatory public consultations and stakeholder engagements. Forms of public consultations must be designed so that all parties would be well represented because this representation is the most challenging part of an engagement, especially from elements of affected communities.

- **Gender bias in public consultation and reporting/documenting processes**
  An important part of the context of community engagements in Indonesia is looking at gender positions, especially in women's groups. In most communities in Indonesia, the family representations (as with many organizations) were generally male. It is generally known that women were posed with many tasks, especially those related to daily life. The survey results reflected that most institutions did not report gender-differentiated data on participants in their reports. Moreover, men tend to act as household representatives within a patriarchal society. Involving women in ER activities became challenging. The focus on gender issues was not solely caused by activity grids from the World Bank and the Ministry of Social Affairs. It is feared that a lot of data/information was lost, which may be valuable. Therefore, there is a need to improve awareness of government agencies to involve women groups in ER events, especially in consultations and implementations.

- **Increased social inclusion and participation of vulnerable groups in public consultations**
  The principle that could be absorbed from an equitable process is that every party that can be affected must be given the same opportunities/chances to be able to convey their views in the context of carbon emission reduction activities in East Kalimantan. While usually there could be groups that were relatively less noticed or overlooked in many development processes, they were generally "groups who have not been strong enough to speak out compared to others." The weaknesses are either caused by their relatively small numbers or because they were not yet known widely. This survey proved that apart from women's groups, the Indigenous Law Communities (*Masyarakat Hukum Adat/MHA*) group and especially groups of people with disabilities were not actively participating. Therefore, there is a need to refine approaches in the future so that these groups are provided with the opportunity to participate, and their views and concerns can be listened to by relevant decision-making authorities.

e. Compliance and Feedback and Grievance Redress Management (FGRM)

- **Handling of complaints from communities or other stakeholders**
  Within the past year (2019/2020), only about one-third of all institutions that performed environmental and social management activities in East Kalimantan's carbon emissions reduction frameworks have received complaints, especially from affected communities. This relatively small percentage is certainly well if there were no complaints because activities implementation did not pose risks. However, as already mentioned, what is referred to as physical activities in the fields always leads to change, and these changes potentially turn into risks (logical consequences) that will be felt by affected communities. On the other hand, a small number of the implementing agencies have applied their complaint/grievance mechanisms. Capacity building and awareness of grievance systems within the agencies need to be improved and strengthened.

  In the efforts to cross-check complaints' substance, based on the survey, most of those complaints were from land conflict issues, implementation of social forestry, and wildlife poaching. This could also indicate that physical activities related to natural resources on which communities depend their lives on always created risks, either environmental, directly or indirectly to related communities. Currently, three out of six agencies related to ER programs are not yet fully implementing the Grievance mechanism. Therefore, to

mitigate and follow up on the complaints, the provincial government is building the FGRM system through the *Aspirasi Etam* Service Application (Online Service for the Delivery of Aspirations/Public Complaints of the Province of East Kalimantan) with the support of the East Kalimantan Governor Regulation No.69 of 2019. It is the law that regulates all government services sectors and stands as a guide. It also ensures the implementation of effective and transparent complaints services, which are expected to encourage greater attention to public complaints. Since *Aspirasi Etam* is still dealing with general issues for complaints, it is necessary to assess whether the system can also capture the ER issues arising from the fields. The assessment will help the government to improve the system so that all complaints related to the ER program can be well captured.

- **The absence of SOPs related to receiving and handling complaints**
  The facts generated based on the survey show that not all institutions implementing carbon emission reduction/reduction activities have Standard Operating Procedures (SOP) to receive and follow up on complaints/reports from affected communities. Therefore, even though the Governor Regulation No. 69 of 2019 has been issued, some institutions (government agencies) did not effectively address the complaints. Based on the survey, one of the reasons is the capability of the agencies to develop SOPs related to ER program. Capacity building to develop and formulate the SOPs and facilitation from national agencies, including development partners, are required.

f. Legal Aspects

- **The absence of scientific studies as part of the policy making process**
  It is widely known that scientific studies are urgently needed to support the formulation of laws and regulations, as well as more objective policies in accordance with juridical, philosophical, and sociological aspects, although there is no obligation to implement those for preparations of all laws and regulations (Law No.12 of 2011). Scientific studies for policies/regulations formulation in the East Kalimantan level are also important because climate change issues are relatively new in the region (both natural and social) in such areas where humid and tropical environments are known to be complex but dynamic (in their economic and social contexts). East Kalimantan is the location of many universities, including Mulawarman University (Unmul). Its Principal Scientific Pattern (PIP) is Moist Tropical Forest and its environment, which would help implement the required scientific studies. The issue of the implementation of the emission trade system at the sub-national level is one of the examples to be explored. The draft Presidential Regulation on Carbon was discussed at the National Level and included the carbon trading system. However, it is a challenge for sub-national governments to implement the system, especially for the trading system. The policy at sub-national level is required. However, it needs a scientific study before the policy can be issued.

5.2 List any corrective actions and areas for improvements. Take care to distinguish between: (i) corrective actions to ensure compliance with the Safeguards Plans; and (ii) improvements needed in response to unanticipated risks and impacts

1) Corrective Actions to ensure compliance with Safeguards Plans:

a. Data collection.

EK Environment Service has provided an MMR web-database online system to collect and update information from the field. The relevant entities are encouraged to update their ER activities and their safeguards implementation to the PMU at the provincial government by submitting the data to the MMR online system. However, since the internet connection was too slow, the data could not be updated. Submission by Post Mail was conducted instead, but it took time. Clarification on the data was done over the phone.

b. Capacity Building.

Implementation of the carbon emission reduction programs clearly showed limited technical capacities of related institutional apparatus, especially those of district Government agencies as executors. Therefore, it is necessary to conduct technical training for the apparatus of concerned work units. If possible, recruitment should be pursued, focusing on functional groups or those with skill backgrounds as needed (not too many administrative staff). Increasing technical capacities would also reduce dependency on external parties, especially from universities or development partners (donors or NGOs). However, as stated, it is recommended that cooperation remains important in several aspects of activities to update knowledge and learn improvements.

c. Provide Standard Operating Procedures.

There are still many activities in the carbon emissions reduction framework in East Kalimantan which were conducted under the basis of initiatives and in various forms. The conditions above were results of the absence of Standard Operating Procedures (SOP). To improve implementation and enable easier activities' evaluation and monitoring, it is necessary to prepare an SOP that is as practical as possible. Considering that there are various types of physical field activities, it is hoped that each agency would prepare an SOP by referring to one policy provision which is applied/issued by a higher agency (ministry/ provincial government). The POB must be compiled together and disseminated to all related work units in implementing agencies. Important stages that require SOP are identification and measurement of risk (environmental and social), design of risks mitigation management and monitoring, complaint and complaint handling mechanisms, risks evaluation, and reporting systems.

d. Formulating Supporting Policies.

Many of the environmental and social risk management stages were "consciously" not implemented by many agencies because there was no legal basis, either from ministries/agencies or the regional government. Therefore, those institutions must be encouraged to issue various policy regulations needed to implement carbon reduction activity programs and especially environmental and social risk management as part of program implementation. In this regard, academics/researchers and field activists are expected to play their roles in submitting proposals, whether in the form of policy briefs or others. Especially for East Kalimantan, institutions such as DDPI East Kalimantan, which are also part of the task force formed by the East Kalimantan Province Governor, could take more significant roles.

e. Governmental Coordination Strengthening.

Emission reduction could not be completely limited by jurisdiction because the matter is almost impossible to be localized in just one area. However, handling responsibility would mainly be under the government responsibility. Therefore, coordination between levels of government, vertically (from the center, province, district/city to the village) and horizontally (both in governmental and technical contexts) must be strengthened. This is needed so that mitigation efforts can run more optimally. On this basis, a coordination mechanism must be developed, among others, through regular/periodic meetings to discuss issues faced and to learn from each other based on respective

experiences. Coordination will be better if it can continue into collaboration and convergence of activities across governments, agencies, and/or sectors according to their needs.

f. Applying Active Corporation.

Corporations here are state-owned or private companies, especially those engaged in the utilization of natural resources (Forestry, Plantation, and Mining). All of those corporations' work areas covered more than 50 percent (some even calculated nearly 70 percent) of East Kalimantan's land area, both inside and outside forest areas. In this survey, corporations have not been targeted, not only because environmental risk management programs are still considerably new among government agencies, but also because there were already mechanisms for managing and monitoring corporations' impacts. The important issue is that corporations have sufficient capital (financial, natural, physical, human, and social capital) to participate in handling environmental and social risks. The regional government of East Kalimantan can coordinate with various existing corporate associations to mobilize active roles for the business world in reducing emissions.

g. Building Public Participation.

The interests of public participation is, among others, for the sake of sustainability and also the breadth of service coverage to affected communities without exception (including affected vulnerable groups). What must be understood is how to identify interest groups and groups influencing the success of program activities, either from individuals, groups, or institutions/organizations. Participation as an element of good governance enables information disclosure as the ultimate purpose of this process is self-mobilization, at least in the affected communities. Building public participation must be initiated from basic education until a college graduate works in the community, and therefore in the future can place environmental issues—especially climate change—as part of local content in the education sector which has become very important.

2) Improvement to unanticipated risks and impacts:

a. Budget Revision due Pandemic Covid-19 and Potential International Support

Since July 2019 to December 2020, budgets for ER programs were revised by the provincial government to address the COVID-19 pandemic in East Kalimantan. As a result, several field activities were postponed. The budget was transferred to EK Health Service to provide health care services to COVID-19 patients. There is potential to support the EK budget through harnessing international support. In East Kalimantan, there are several international institutions with activities or that are indirectly funding several non-governmental organizations to perform activities related to environmental and social risk mitigation efforts. International support, both technical and financial, will be significant in supporting the success of programs. However, various international activities taking place in East Kalimantan still need to be controlled and synchronized by the East Kalimantan regional government to move forward together towards a single point of purpose and target of activities.

b. How to manage unanticipated risks of Omnibus Law? (refer section 4.1 above)

c. How to manage unanticipated risks of IKN? (refer section 4.1. above)

5.3 Describe the timeline to carry out the corrective actions and improvements identified above.

Table A1.5. List of Corrective Actions and Improvements

Activities	Schedule	Responsible Entity
1. Capacity building and training on Safeguards application for Implementers	Annually (September – October)	EK Forestry Service
2. Working Group on Safeguards Coordination meetings with relevant parties (implementing agencies)	Quarterly	EK Forestry Service
3. Funding preparation (discussion with Bappeda and BPKAD) and seeking additional funding	June-August every year	EK Bappeda
4. Updating Standard Operational Procedure and relevant policies	2022	Bureau Economics Affairs on Provincial Secretariate Office
5. Designing public communications that involve all stakeholders including private corporations	2022	EK Communication and Information Service

ANNEX 2: INFORMATION ON THE IMPLEMENTATION OF THE BENEFIT-SHARING PLAN

I. Requirements of FCPF on Benefit Sharing Plans

The Indonesian BSP was finally approved in November 2021. The conditions of effectiveness for ERPA have been met. However, no ER payment have been received to finance the implementation of BSP activities. Between the advance draft and final BSP[43] (2020-2021), consultations were mostly conducted between the provincial government of East Kalimantan and the central government on the issue of responsibility costs from result-based payments. Consultations occurred through online meetings due to the COVID-19 pandemic. Exchanges were conducted between Director General of Climate Change Control (Echelon 1) from MoEF and the Governor of East Kalimantan to agree on the proportion of responsibility costs between national and sub-national levels. Consultations with communities on ER Program including BSP were conducted through FPIC process covering 99 villages. The policy on Benefit Sharing Mechanism (BSM) within the Province of East Kalimantan was issued in 2021 through Governor Regulation No.33/2021. The regulation outlines a) type of benefits, eligibility, and beneficiaries, b) proportion and allocation, c) the use of benefits, d) monitoring and evaluation, e) FGRM, and f) finance.

Three main allocations of benefits are agreed[44] as follows: a) Responsibility Allocation to incentivize governments in governing the ER Program (25 percent); b) Performance Allocation to incentivize beneficiaries in reducing emissions (65 percent); and c) Reward Allocation to incentivize communities who have demonstrated continued protection of forests (10 percent). Based on the Ministry of Environment and Forestry Letter No. S.187/MENLHK/PPI/PPI.3/5/2021 to the Government of East Kalimantan, the agreed proportions of benefits for operational costs are as follows (Table A2.1):

> **"Central Government (MoEF and Indonesian Environment Fund - IEF/BPDLH) will receive 13.91 percent, whereas sub-National Government will receive 11.09 percent."**

Table A2.1. Agreed Proportions of Operational/Responsibility Cost between Central and Sub-national Government level

Beneficiary	IDR	%	IDR	%	IDR	Total
Central Government (13,91%)	**Operational Cost**		**Incentive**		214,214,000,000	13.91%
- MoEF/KLHK	32,340,000,000	2.10%	98,714,000,000	6.41%	131,054,000,000	8.51%
- IEF/BPDLH	83,160,000,000	5.40%	0	0.00	83,160,000,000	5.40%
Sub National Government (11,09%)	**Operational Cost**		**Incentive**		170,786,000,000	11.09%
- Province and 7 Districts and 1 City	84,700,000,000	5.50%	86,086,000,000	5.59%	170,786,000,000	11.09%

[43] Indonesia - East Kalimantan Project for Emissions Reductions Results : Benefit Sharing Plan (worldbank.org)

[44] Discussed in October 2018, agreed in Mission in December 2018. The Responsibility Allocation came up in the April 2019 Stakeholder Consultation (SC) which agreed to replace the operational cost (in ERPD) in May 2019 SC.

Beneficiary	IDR	%	IDR	%	IDR	Total
Total Responsibility Cost					**385,000,000,000**	**25%**
Total ER Payment					1,540,000,000,000	100%

The other consultations regarding payment arrangements were undertaken between IEF/BPDLH, MoEF, and the provincial government of East Kalimantan. This includes arrangements from IEF/BPDLH to beneficiaries (see Final BSP document, Section 4 – Benefit Distribution).

The main modifications and updates in the approved version include the following:

- FPIC
- BSP Timeline
- Fund Disbursements (at national level, MoEF will use an intermediary agency for funds disbursement, whereas for the adat community and village government, the funds will be disbursed by the local intermediary agency with acknowledgment by the provincial government).
- Institutional arrangement

- FPIC:
  Consultations on FPIC were conducted in six districts per city and 99 villages between July and November 2020. It covered one city (Balikpapan) and five districts (Kutai Barat, Kutai Timur, Berau, Paser and Penajam Paser Utara). For two districts, Kutai Kartanegara and Mahakam Ulu, FPIC consultations could not be done due to COVID-19 pandemic conditions in those areas. All consultation processes followed COVID-19 health protocols.

  Inputs from communities on participation, payment arrangements, and benefit allocations were put into the BSP document. The estimated calculation for ER Payments was simulated with communities and relevant stakeholders. See BSP document section 6.1 on summary consultations and incorporation into the BSP.

- Timeline BSP:
  The timeline for the BSP was set up in early 2020. It was estimated that the ER payments would have been delivered at the end of 2021. However, the payment could not transpire since the first verification of ERs is now expected to conclude in 2023. As a result, no activities based on ER Payments can be reported at this time. The estimated timeline for BSP for distributing benefits to beneficiaries can be found in BSP document section 4.2.2.

  The first benefits are expected to be delivered in early 2023 from IEF/BPDLH following the completion of the first validation (see the next section on the fund disbursement scenario). Once IEF/BPDLH receives the payment, it will take at most three months to disburse the funds to MoEF (through the selected intermediary agency), provincial and district governments, and village government and *adat* communities (through appointed Intermediary Agency by the provincial government).

- Fund Disbursement Scenario:

The IEF/BPDLH will make four ER Payments contracts with 1) the intermediary agency for disbursing funds to MoEF (UPT of MoEF operated in East Kalimantan, known as BKSDA and National Park Kutai), 2) provincial BPKAD on behalf of the provincial government of East Kalimantan for disbursing funds to provincial services/agencies, 3) the intermediary agency for disbursing funds to village governments and *adat* communities (indigenous people), and 4) district BPKAD on behalf of the district government for disbursing funds to district services/agencies. The contracts will be signed once the confirmed information on the delivery of ER payments from the Carbon Fund to IEF/BPDLH is received. The agency has to have an acknowledgement letter from the Governor as a requirement to disburse the funds to village governments and *adat* communities.

The selection of the agencies as eligible agency for funding disbursement took place in 2021. Nine NGOs were awarded as eligible intermediary agencies.[45] However, these agencies need endorsement from Provincial Government in order to disburse ER Payments. The government might select only one or two agencies. In addition, since the ER payments have not been received yet, then endorsement from the provincial government has not been conducted. The contracts for number 1) will be conducted when IEF/BPDLH receives endorsement from MoEF, whereas for number 3) gets endorsement from Provincial Government of East Kalimantan. The announcement will happen once the confirmed ER Payments from the Carbon Fund conveyed to the GoI. The IEF/BPDLH provides two (2) months for the agencies to submit their proposals (Article 15 Perdirut BPDLH No.7/2020) (see Figure A2.2).

The contract for number 2) and 4) will be conducted directly between IEF/BPDLH and the Beneficiaries, in this case, the provincial BPKAD and district BPKAD. The IEF/BPDLH will request the proposals as conditions for receiving benefits from the ER payments from the BPKADs (by sending a formal letter to Governor and Bupatis/Head of Districts of East Kalimantan) after the confirmed information of ER Payments from the Carbon Fund is delivered to the IEF/BPDLH. The IEF/BPDLH provides two (2) months for the agencies to submit their proposals (Article 15 Perdirut BPDLH No.7/2020) (see Figure A2.2).

The team developed by the IEF/BPDLH will then assess the proposals either from the BPKAD or Intermediatory agency. The team consists of staff from the Directorate of BPDLH, relevant ministry, provincial government, technical expert, NGO, and university. The proposal assessment process will take 14 (fourteen) days, starting from the proposal declared by the team as being completely submitted. The Executive Director will send a letter to the BPKAD or Intermediatory agency if the proposal meets the requirements and passes the assessment. This letter will also note that the IEF/BPDLH will require a contract with the BPKAD on behalf of Provincial Government or Intermediatory agency (Article 20 Perdirut BPDLH No.7/2020). If the contract is delayed, then there is a risk of delay for fund disbursement. In order to avoid the delay, the establishment of contract has to be started when Provincial Government receives notification from BPDLH about the confirmed information of ER Payments.

[45] Based on Announcement of Executive Director BPDLH No.PENG-1/BPDLH/BPDLH.3/2022, the following nine agencies have been awarded as intermediatory agencies for REDD+ Fund Disbursement: a) Kehati Foundation, b) Penabulu Foundation, c) Samdhana Institute, d) Kemitraan, e) KKI Warsi, f) Huma Indonesia, g) Gemawan, h) Satunama Foundation, i) Sulawesi Community Foundation.

If the proposals are not awarded or do not pass the assessment, the Executive Director of BPDLH will send a letter to explain the refusal of the proposals to BPKAD or the intermediatory agency. See Figure A2.3.

Once the Governor and Bupatis receive the formal letter from the IEF/BPDLH regarding the delivery of ER Payments, the Governor and Bupatis will notify the Parliaments so that they are aware of the ER activities to be conducted using the fund from ER Payments in the 2022 annual budget. The predicted timeline for distribution of the benefits can be found in the Final BSP document (see section 4.2.2, page 30).

Figure A2.1. Fund Disbursement and ER Contract

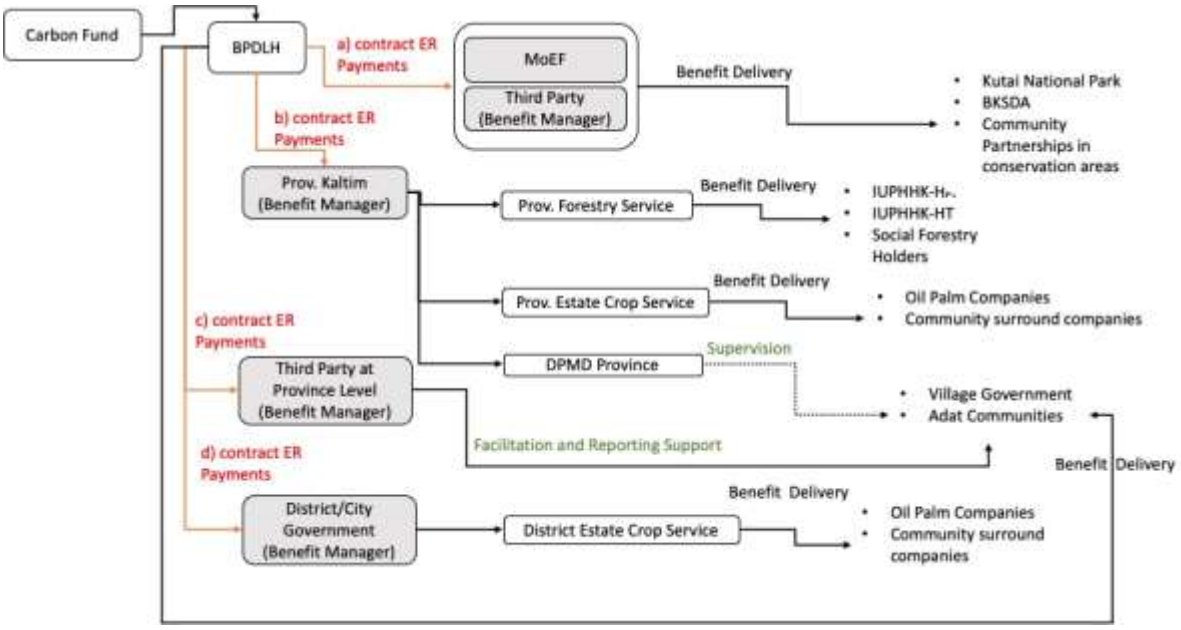
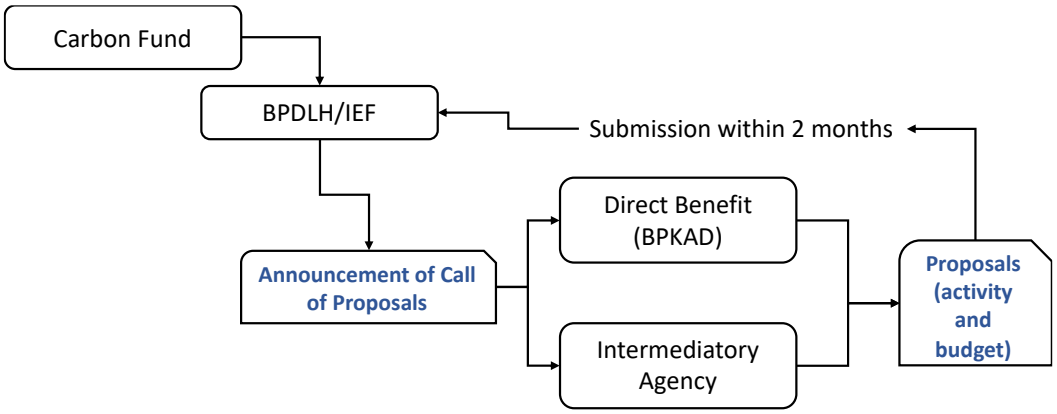
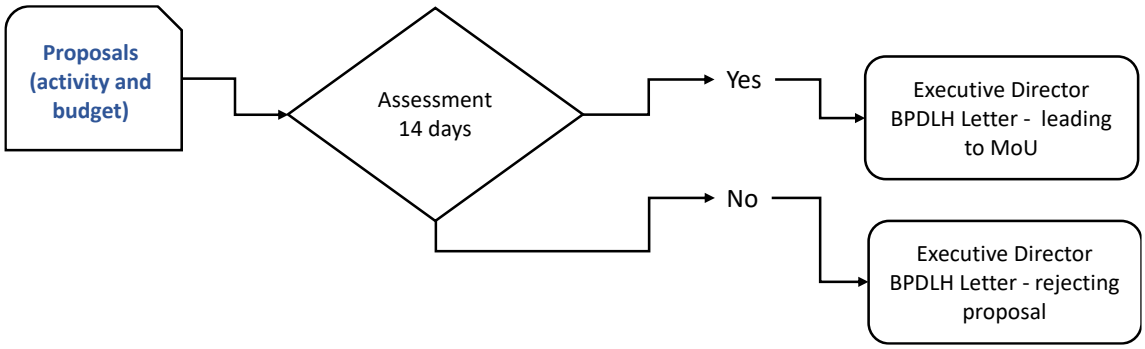


Figure A2.2. Timeline Proposals from BKAD and Intermediatory Agency to IEF/BPDLH

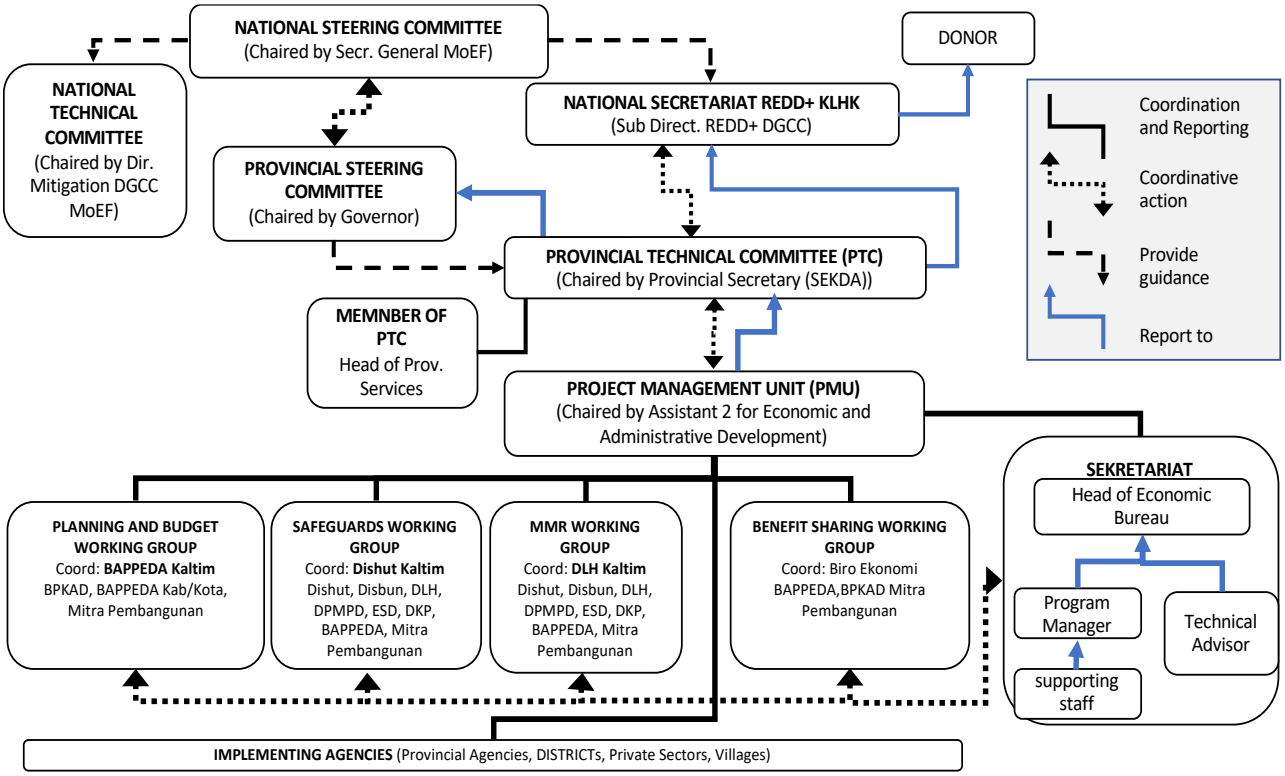




- Institutional Arrangements

  At the national level, it was agreed that there would be a National Steering Committee (NSC) chaired by the Secretary-General of MoEF, whereas at the provincial level, the Provincial Steering Committee (PSC) would be chaired by the Governor. The NSC is supported by the National Technical Committee chaired by the Director of Mitigation DGCC from the MoEF. On the other hand, the PTC is supported by members from the Provincial Services. A Project Management Unit (PMU) is established to manage oversight of the ER program at the provincial level. The PMU is supported by four working groups, namely a) Planning and Budget working group chaired by Bappeda Kaltim, b) Safeguards working group chaired by Dishut Kaltim, c) MMR Working Group chaired by DLH Kaltim, and d) Benefit Sharing Working Group chaired by Economic Bureau of Provincial East Kalimantan (Figure A2.3). The institutional arrangement for ER Program has been issued through Governor Decree No. 522/K.8/2022. The Provincial PMU was launched in April 2022. The program manager and technical advisors will be recruited soon after the confirmation of delivery of ER Payments to the IEF/BPDLH is received by the Provincial Government. There is a risk of delay for recruitments if the ER Payment has not been received by the Provincial Government. In order to mitigate the risk, the role of PMU is supported by appointed staff from Bureau Economic Affairs under Secretariat Government Office.

Figure A2.3. Institutional Arrangements for ER Program



II. Monitoring and Reporting Requirements

1. Benefit Sharing Plan Readiness

1.1 Confirm that the BSP has been completed and endorsed by all relevant parties. Are there any aspects of the BSP which remain unclear or require further review of endorsement by beneficiaries or other stakeholders? Has the BSP been made publicly available?

This is confirmed. The BSP document has been completed and endorsed by the Secretary of Provincial Government of East Kalimantan, Executive Director of BPDLH/IEF, and Directorate General of Climate Change - MoEF.

On the other hand, the Final BSP document only covered five districts and one city (West Kutai, East Kutai, Berau, Paser, Penajam Paser Utara, and Balikpapan for FPIC consultations (see Table 1 FPIC report). The other two districts, namely Kutai Kartanegara and Mahakam Ulu, could not conduct the consultations yet due to COVID-19 pandemic conditions in those district areas. Virtual meetings could not happen due to limited internet connection and mobile/computer device for the meeting. Due to the limited budget of the FCPF Readiness Fund for the FPIC process and additional time constraints, the FPIC process for the districts of Kutai Kartanegara and Mahakam Ulu are allocated to be funded by development partners. GIZ Pro-peat supported the FPIC process in Kutai Kartanegara District in 2021, whereas WWF Indonesia supported the FPIC process in Mahakam Ulu in 2022. FPIC

for Kutai Kertanegara has been done for six villages, but the report is not completed yet. The FPIC process for Mahakam Ulu has been started yet, the report has not been completed yet. The results of these consultations will be input for the Safeguards Working Group to adjust the BSP activity plan for 2023.

The process of FPIC consultations for the five districts and one city covering 99 villages can be found in BSP document Section 6, Table 6.1.

The BSP is publicly available on the Directorate General of Climate Change Control's website: (http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/dokumen/mitigasi/fcpf/Benefit_Sharing_Plan_.pdf) and Bank website (https://documents.worldbank.org/en/publication/documents-reports/documentdetail/606071637039648180/indonesia-east-kalimantan-project-for-emissions-reductions-results-benefit-sharing-plan).

1.2 In cases where capacity building initiatives have been included as part of the BSP, confirm whether the Program Entity has completed the required capacity building measures to ensure system effectiveness. What other measures are still outstanding?

The format of the reporting form from the village and community needs to be reviewed since the fund disbursement will be from BDPLH through an intermediary agency. Training provided by BPDLH will be delivered to village governments and *adat* communities on the financial and technical reports to intermediary agencies and the Provincial Environment Service copied for MMR purposes. Once the first ER Payment is delivered, capacity building for the participating village and *adat* community will start. The intermediary agency is responsible to provide capacity building for the village and community. A Quick Training Need Assessment (TNA) was undertaken during the FPIC consultations. Some inputs that are relevant and important themes for villages and the *adat* community capacity building are as follows:

- Village Financial Management and Budgetary Plan
- Village Emission Reduction Activity Report
- Sustainable community livelihoods
- Participatory Village Land Use Plan
- Participatory Adat Community Area
- Village Forest Management Plan
- Village Forest Monitoring

IEF/BPDLH selects the intermediary agency for disbursements to villages and the *adat* community. However, the agency has to have an acknowledgment letter from the Governor to work as an intermediary agency for fund disbursements to villages and *adat* community in the province. The intermediary agency's selection and criteria are already set up and regulated under Executive Director BPDLH's Regulation No.7/2020.[46] One of the criteria selections is the capability of the intermediary agency in facilitating and channelling the funds to communities. The draft MoU between intermediary agency and Provincial Government has been developed and is under reviewed by both parties. The agreed MoU is expected to be launched before the ER Payment is delivered.

1.3 Where relevant, confirm whether any agreed changes to the benefit sharing arrangement identified during the previous reporting period have been completed.

[46] Perdirut-Nomor-07-Th-2020-Tentang-Penyaluran-Dana-REDD.pdf (komitmeniklim.id)

Not applicable at this stage. This section is intentionally left blank.

2. Institutional Arrangements

2.1 Confirm that the agreed institutional arrangements under the BSP are in place and that implementing entities are appropriately resourced to carry out their respective responsibilities.

The institutional arrangement for the ER Program, including BSP, has been set up and issued under Governor Decree No.522/K.28/2022. The arrangement has been discussed and consulted with relevant stakeholders in East Kalimantan and the central government (MoEF). Government staff have been appointed. Technical advisors and a program manager will be recruited soon after the ER Payment is received. The institutional arrangement is ready and in place to implement the ER program. .

The National Steering Committee (NSC) meeting will be conducted annually and chaired by the Secretary General of MoEF. The members of NSC will be Echelon 1 from MoEF, Governor and Secretary of the provincial government of East Kalimantan, and Echelon 1 from BPDLH/IEF. The Echelon 1 from MoEF will be DG Climate Change, DG SFM, and DG Nature Conservation. The Echelon from BPDLH/IEF will be the Director of Fund Disbursement. The NSC members can be added when necessary based on the result of the NSC meeting.

The Provincial Steering Committee (PSC) meeting will be conducted every six months and chaired directly by the Governor of East Kalimantan. The members of the PSC will be Echelon 2 from the MoEF (Ditjen PPI, Ditjen KSDA, Ditjen PHPL) and Echelon 1 and 2 from the provincial government of East Kalimantan (Provincial Secretary, Forestry Service, Environment Service, Development Planning Service, Mining Service, Estate Crop Service, Village and Community Service, and Economics Beaureu of Governor Office).

The Provincial Technical Committee (PTC) meeting will be conducted every six months and chaired by the Provincial Secretary of East Kalimantan. The members of the PTC will head the Provincial Services (Forestry Service, Environment Service, Development Planning Service, Mining Service, Estate Crop Service, Village and Community Service, and Economics Beaureu of Governor Office) and district services (Estate Crops Service, and Village and Community Service).

Day to day operation of the ER Program will be implemented by the Project Management Unit (PMU). The PMU will be chaired by Assistant 2 for Economic and Administrative Development of Governor Office. The PMU will be supported by Four Working groups, namely a) Planning and Budget Working Group coordinated by the Development Planning Service (Bappeda), b) Safeguard Working Group coordinated by the Forestry Service (Dishut), c) MMR Working Group coordinated by the Environment Service (DLH), and d)Benefit sharing Working Group coordinated by the Economic Beaureu of Governor Office (Biro Ekonomi).

The IEF/BPDLH as Fund Agency has adopted international standards for fund management and distribution. The financial management of BLU-BPDLH/IEF has been assessed by Pricewaterhouse Cooper (PwC). The process for distributing benefits to beneficiaries is outlined in the Final BSP

Document (section 4.2.1). The IEF/BPDLH was launched in October 2019, the acting President Director was appointed in December 2019, and the personnel (i.e., staff and directors) have been operational since October 2020. The BLU-BPDLH/IEF President Director and personnel have been selected through the procurement (bidding) process and authorized by the Minister of Finance Decree as the responsible entity. The disbursement of funds for FCPF Carbon Fund is under the authority of the Director of Fund Distribution BPDLH. The selection of intermediary agencies to channel the funds to village and *adat* communities has taken place (see section 1 above).

2.2 Confirm that any regulatory or administrative approvals required for implementing the BSP have been obtained.

This is confirmed. The formal approval is in the form of regulations issued by the provincial government under Governor Regulation No.33/2021. The regulation outlines a) type of benefits, eligibility, and beneficiaries, b) proportion and allocation, c) the use of benefits, d) monitoring and evaluation, e) FGRM, and f) finance.

2.3 Assess whether all BSP stakeholders (beneficiaries and administrators) clearly understand their obligations, roles, and responsibilities associated with the BSP. This assessment could be based on, for example, findings and feedback received during field implementation support missions, during interviews with beneficiaries, issues raised through public consultation meetings, beneficiary monitoring, or grievance mechanisms.

The information about BSP is one of the materials disseminated to the stakeholders during the FPIC consultations both at the sub-national and village level. During the FPIC process, inputs and feedback were collected and responded accordingly before being integrated into the revised BSP document. Further inputs and feedback during the consultations can be found in BSP document Section 6 and Table 6.1. One of the responsibilities of Intermediary agencies is to support beneficiaries on financial management and reporting.

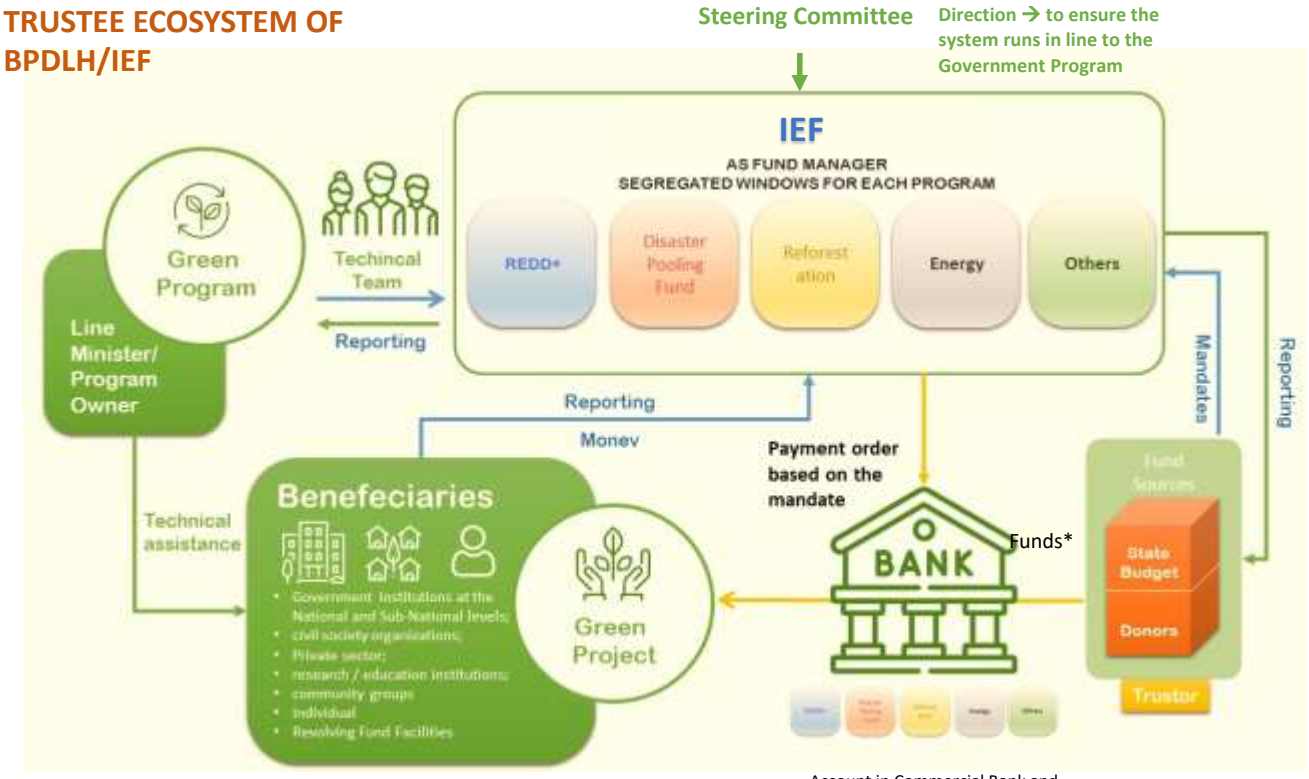
The monitoring process will be carried out by the government agency in charge of the beneficiary area based on the plans and implementation. Monitoring will be conducted jointly between DPMPD and the selected intermediary agency for the village and *adat* community. The government agency and intermediary agency will report to the PMU Sub-National and the East Kalimantan MMR Portal and then report to the National PMU and SRN. The report on the use of funds will be a subject for the Indonesia Supreme Audit Institution (BPK). The report will be accessible to the public.

2.4 Confirm that a system is in place for recording the distribution of benefits and associated obligations to eligible beneficiaries. For example, are payment information systems, payment tracking and monitoring systems, bank accounts, accounting and financial control mechanisms, and payment modalities in place and functional?

Ministry of Finance has approved the fund disbursement system through the issuance of Ministry of Finance Decree No. 124/2020. The details of fund disbursement at the Indonesian Environment Fund were detailed through Indonesian Environment Fund Executive Director Regulation No. 7/2020. It includes the selection criteria for an intermediary agency for fund disbursement. Figure A2.4 shows the funds flow for disbursement that will apply also for East Kalimantan.

The IEF/BPDLH is still operating conventional financial management for fund disbursements. The IEF/BPDLH, with support from the World Bank, is now developing a Management Information System (MIS) that will provide information on funds disbursement and reporting on fund utilization. The MIS will replace the conventional financial management of BPDLH. It will include payment information systems, payment tracking and monitoring systems, bank accounts, accounting and financial control mechanisms, and payment modalities. The development of comprehensive MIS is expected to be completed by the first quarter of 2023.[47]

Figure A2.4. IEF/BPDLH Trustee Ecosystem (Fund Disbursements Flow)



2.5 Confirm that agreed accountability mechanisms are in place and functional (e.g., stakeholder participation arrangements; agreed public information disclosure procedures; independent third party monitoring and or performance audit mechanisms; dispute resolution and grievance redress mechanisms.)

The Government has developed the accountability mechanism for BSP implementation under Governor Regulation No.33/2021 and Governor Decree No.522/2022 including responsible party for decisions, funds flow, and reporting as follows:

a) At the Provincial level the Governor of East Kalimantan Province through the Provincial Secretary (Sekda Provinsi Kaltim). In implementing the BSP, the Provincial Economic Bureau as the coordinator of the Provincial Benefit Sharing Working Group, will support Sekda.

[47] Director of Fund Collection and Development, Ms. Endah Tri Kurniawaty (*pers.comm., 24th April 2022)*

b) At the District level each relevant Bupati of the District through their District Secretary (Sekda Kab/Kota). In implementing the BSP, the District Economic Bureau will support Sekda.
c) At the village and *adat* community level the selected intermediary agency will be responsible for monitoring funds flow and supporting and facilitating reports.
d) At the National level (MoEEF) the selected intermediary agency will be responsible for monitoring funds flow and supporting and facilitating reports.
e) The audit mechanism will be referred to the Government Audit systems. The report on the use of funds is subject to audit by the Indonesia Supreme Audit Institution (BPK), and all BPK audit reports are accessible by the public.

In order to provide information to the public related to BSP implementation, the Government of East Kalimantan has provided a web portal under MMR system. The detail procedures on public information disclosure for MMR web portal will be put under Provincial Government Policy. The issuance of that policy is scheduled by first quarter 2023.

2.6 Confirm that the Feedback and Grievance Redress Mechanisms (FGRM) is functional to record and address feedback and grievances related to the implementation of the BSP. Confirm the number and types of grievance received and submitted to the FGRM and how and whether they were addressed.

This has not been implemented yet. However, an existing web-based public feedback platform, namely ASPIRASI ETAM (https://aspirasi.kaltimprov.go.id/), is being utilized to support public participation and promote accountability in government affairs in East Kalimantan, including green growth activities. The same platform is adopted for the ER Program to handle feedback and grievances, including those related to the BSP and benefit sharing more generally. The Governor's Regulation on ASPIRASI ETAM (East Kalimantan Governor Regulation No. 69/2019) has been issued and is a guideline for the implementation of receiving and handling complaints.

During the FPIC process with 99 villages, the aspirasi etam was introduced. Further capacity building to the community on how to make a complaint through a website/mobile application is needed. The capacity building will be provided when the ER Payment is received. Currently the complaint is sent to the nearest local authority (government office). Government staff then help to register the complaint through the aspirasi etam. The grievances collected through government offices are handled following the existing procedures of the respective institutions. These procedures also apply for grievances submitted directly by individuals through Aspirasi Etam. The feedback, redress, and grievances related to the BSP implementation will be filtered and analyzed by Provincial Communication and Information Service (Diskominfo) before those complaints sent to respective institutions to be addressed.

Up to January 2022, the Aspirasi Etam system has worked properly. Most of the complaints coming to the system are questions from the community about the timing of delivering funds to their village or *adat* community. These questions have been answered by Diskominfo by replying directly on the website (Aspirasi Etam's website).

2.7 Confirm that adequate human and financial resources have been allocated or maintained for implementing the BSP.

This is confirmed. IEF/BPDLH as the fund manager has been set up and issued under the Ministry of Finance's Decree PMK No.799/2019. The organizational structure has been established and staff

have been recruited. The fund disbursement system has been regulated under BPDLH/IEF Executive Director's Regulation No. 7/2020. The process of selection for the intermediary agency was undertaken in 2021. At the sub-national level, human resources from governments have been appointed (under Governor Decree No. 522/K.28/2022 on the PMU FCPF Carbon Fund). Once the provincial government receives confirmation of the delivery of ER Payments, recruitment for the program manager and technical advisors, including supporting staff, will be conducted. There is a risk of delay for recruitments if the ER Payment has not been received by the Provincial Government. In order to mitigate the risk, the role of PMU is supported by appointed staff from Bureau Economic Affairs under Secretariat Government Office. The provincial and district governments have allocated budget line items for planned fund utilization in the 2023 proposed budget (DIPA), which allows them to channel funds from the IEF when they are disbursed. The amount of budget will be further amended and reported to local government's parliament once the actual payment is made from IEF to the local government's treasury based on the contract between IEF and provincial and district governments.

3. Status of Benefit Distribution

3.1 Summarize the distribution of all monetary and non-monetary benefits during the reporting period.

This section is intentionally left blank since ER Payments have not been received yet.

3.2 Indicate in a table format the number and type of beneficiaries who received benefits during the reporting period (examples of tables to be used and expanded upon below).

This section is intentionally left blank since ER Payments have not been received yet.

3.3 Do beneficiaries receive adequate implementation support to assist in the management and use of benefits distributed to them?

This section is intentionally left blank since ER Payments have not been received yet.

3.4 Describe and assess the effectiveness of the mechanisms for ensuring transparency and accountability during the implementation of the BSP, such as participatory monitoring by beneficiaries.

This section is intentionally left blank since ER Payments have not been received yet.

3.5 Assess whether Benefit Sharing distributions continue to be relevant to core objectives and legitimacy of the ER Program objectives (e.g., benefit sharing is considered equitable and effective; seeks active participation of recipients; is respectful of customary land rights; enjoys broad community support of Indigenous People; benefit distributions incentivize adoption of emission reduction measures, among others).

This section is intentionally left blank since ER Payments have not been received yet.

3.6 Describe the mechanisms that are in place to verify how benefits are used and whether those payments provide sufficient incentive or compensation to participate in program activities to change land use or reduce carbon emissions. To what extent are distribution mechanisms viewed as credible and trusted by beneficiaries?

This section is intentionally left blank since ER Payments have not been received yet.

3.7 Do beneficiaries understand their continued obligations once benefit distribution has taken place? Is there any evidence that there is a mismatch of expectations among beneficiaries regarding the nature and value of benefits accruing to them? What mechanisms are in place to manage such risks?

This section is intentionally left blank since ER Payments have not been received yet.

4. Implementation of the Environmental and Social Management Measures for the BSP

4.1 Assess to what extent the measures for managing the environmental and social aspects of BSP activities have been implemented. Refer to applicable sections in the Safeguards Plans where relevant.

This is not implemented yet for ER activities funded by ER Payments. However, ER program implementers (government agencies, development partners, the private sector, village government, and Forest Management Unit/KPH) have conducted ER activities with their allocated budgets. It is still necessary to improve the SOPs in risk identification, including monitoring and reporting on environmental and social aspects of the impacts of the ER program. Safeguards guidelines from BPDLH will be used as additional reference for the ER program implementers.Improving SOPs through capacity buildings will improve the measurement of management for environmental and social aspects in BSP activities. Please see Annex 1 on Safeguards Implementation for additional information.

5. Recommendations for BSP Improvement or Modifications.

5.1 Based on experience during the current reporting period as well as feedback from recipients, identify any specific recommendations for modifying the procedural or substantive content of the BSP, if necessary. Substantive changes may include modifications to eligible beneficiaries; rationale or justification for benefits sharing; form or modality of benefit distribution; structure of dedicated funds established to distribute benefits; obligations of recipient among others.

This section is intentionally left blank since ER Payments have not been received yet.

5.2 Are there procedural or administrative obstacles to timely distribution of benefits (e.g., adequacy of financial channels, ability to use funds)? Are benefits distributed in a timely manner?

This section is intentionally left blank since ER Payments have not been received yet.

5.3 Is there evidence of other emerging risks that may affect the sustainability or effectiveness of the BSP?

Since ER Payments have not been received yet, benefit sharing has not been tested so there are no additional emerging risks identified.

5.4 Provide a suggested timeline and an outline of administrative arrangements to introduce any recommended changes.

This section is intentionally left blank since ER Payments have not been received yet.

ANNEX 3: INFORMATION ON THE GENERATION AND/OR ENHANCEMENT OF PRIORITY NON-CARBON BENEFITS

Priority Non-Carbon benefits

1. *List the **identified set of priority Non-Carbon benefits** and provide necessary details on activities for generation and enhancement of these Non-Carbon benefits. (See questions in sections 2 and 3 below for examples of details on potential specific non-carbon benefits identified)*

Priority Non-Carbon Benefit	● Details on activities for generation and enhancement ○ Approach (as defined in ERPD, including relevant indicators)	Number of Beneficiaries
Improved access to forest resources for local communities, leading to improved livelihoods	From mid-2019 to December 2020, 19 entities representing local communities in East Kalimantan received new social forestry licenses from the MoEF. By adding up these new licenses, the area of the social forestry program in East Kalimantan increased by 53,141 hectares in 1.5 years. Up to December 2020, the accumulation of social forestry in East Kalimantan reached 193,846.75 hectares. These new licenses are distributed in nine forest management units (FMUs), i.e., Berau Barat, Kelinjau, Meratus, Santan, Sub DAS Belayan, Mook Manor Bulatn, Damai, Delta Mahakam and Telake). As the social forestry program is mandatory for each FMU to promote in their working area, it is foreseen that new licenses will be growing in coming years. FMUs facilitating the acquisition of social forestry licenses for local communities that live inside or adjacent to forested areas is a priority for all FMUs in East Kalimantan to fulfill the East Kalimantan annual target of as much as 32.000 hectares (Click for the information). The social forestry licenses is expected to allow forest-dependent communities developing sustainable livelihoods based on Non-Forest Timber Products (NFTPs) and other forest ecosystem services. Activities for promoting social forestry to local communities often involve a civil society organization (CSO) or "*mitra pembangunan*" (development partner) such as *Kawal Borneo* Community Foundation (KBCF), Yayasan BUMI, etc. These two CSOs work hand in hand with the FMU to obtain social forestry permits for local communities. Consultations, workshops, and facilitations to meet the requirements of social forestry permits were conducted. The facilitations include development of village development plans, village boundaries, and village land use plan, and village forest working plan. KBCF is recently working with Damai FMU in West Kubar district to facilitate two villages, i.e., Penarung and Muara Begai, in order to receive the permits (Click for the information). Meanwhile, during the reporting period, *Yayasan BUMI* has successfully assisted local communities of five villages (*Genting Tanah, Muhuran, Sebelimbingan, Teluk Muda, and Tuana Tuah*) in Middle Mahakam Basin) to receive the Village Forest licenses.	Households living inside the Forest Management Unit below the poverty line affected by improved access to forest resources are as follows: FMU Berau Barat = 753 households FMU Kelinjau = 1550 households FMU Meratus = 2324 households FMU Santan = 3630 households FMU Balayan = 1334 households FMU Mook Manor Bulatn = 687 households FMU Damai = 1419 households FMU Delta Mahakam = 2059 households FMU Telake = 931 households Total households affected = **14,867** households Source: Integrated Data on Households below Poverty Line by National Team for Poverty Allevation (TNP2K) Secretariat of Vice President of Republic Indonesia (2012 – 2019).
	According to the 2020 Annual Performance Report of East Kalimantan Forestry Services (*Laporan Kinerja Instansi Pemerintah - Dinas Kehutanan*), the production of non-timber forest products (NTFPs) increased significantly from 99.73 tonnes in 2018 to 864.9 tonnes in 2020. Among these reported NTFPs are corn (20 tonnes), bee's honey (0.075 tonnes), bark (9 tonnes), and rubber (835.82 tonnes).	

	Increased income of participating communities Communities are often involved in various activities organized by the FMU (KPH) as participants of technical training or participants in dissemination programs on specific themes such as social forestry or land and forest fire prevention. In 2020, there were 6,630 people involved in 27 activities organized by six FMUs. At the end of the activities, each participant received an allowance of IDR 100,000 ≅ US$7. Although it is a small amount of money, it means a lot for rural village people. This allowance is expected to be additional income for local people.	Participants = 6,630 in six FMUs The allowance of IDR 100,000 per participant as transportation payment for participating in the KPH's activities is based on the existing government regulation (Governor Decree No 027/K.543/2020 on Standard Price and Fee for Government Activities)
	Increased food security The Forest Management Unit of Kendilo in Paser District has successfully managed their cooperation with local communities to grow corn in their unproductive forest area through agroforestry. The program was initiated in 2018 and continues up to now. The program has contributed as much as 1,725,000 IDR to the PNBP (http://phpl.menlhk.go.id/tabular) from 21 tonnes of corn production from forest areas between June 2019 and December 2020.	FMU Kendilo = 1315 households under the poverty line.
Protection of Biodiversity	There was a reduced decline in habitat for key species, such as HCV forests and primary forests. The driver of deforestation in East Kalimantan is primarily the expansion of oil palm plantations in non-state forest areas ("Areal Penggunaan Lain/APL" or "land for other purposes"). Deforestation is a major threat to habitat loss, especially Orangutan (OU), as a key species in this region. Orangutan habitat mostly occupies forests in the north side of Mahakam river i.e., Berau, East Kutai, West Kutai, and Kutai Kartanegara region. Unfortunately, some of this OU habitat is already occupied by forestry licenses and oil palm plantations. The government's roles and actions are pivotal to ensure the habitat of OU is not further depleted. The East Kutai district government is currently working together with the UNDP Kalimantan Forest project to save the remaining forests in APL. The East Kutai District head (Bupati) issued a formal letter addressing the obligation of oil palm companies to preserve 10 percent of their working areas as HCV areas. In early 2020, those companies were urged to submit this HCV location and other necessary information. HCV area collection data inside oil palm plantations continued to all districts in East Kalimantan led by the Crop Agency (Dinas Perkebunan Kaltim) in 2020. The results are compilation data and a map of 93,037 hectares of remaining forests in oil palm companies. Managing this HCV area will lead to the protection of key species' habitats in this region. Berau district has issued the committed areas of 83,876 hectares as HCV protection within the Bupati's Decree on the HCV indicative map No 287, 2020. Additionally, three Essential Ecosystem Areas (KEE) in East Kalimantan are promoted to be further managed and protected, i.e., Danau Mesangat and Kenohan Suwi KEE in Muara Ancalong sub-district, East Kutai district (13,570 hectares) meant for conserving the habitat of Crocodylus siamensis (Siamese crocodile) and Tomistoma schlegelii (The false gharial). Wehea-Kelay KEE is the habitat of Orangutan located in Berau and East Kutai district (532,143 hectares). Karst Sangkulirang-Mangkalihat KEE, also in East Kutai and Berau, protect the unique karst landscape (1,867,676 hectares).	

	Reduced decline in populations of key species According to the Directorate General of Natural Resources and Ecosystem Conservation (*Ditjen KSDAE*), Ministry of Environment, and Forestry Decree Number 180/IV-KKH/2015, the priority of endangered species in East Kalimantan are Orangutan, Bekantan, Owa, and Rhino that was recently discovered in West Kutai District. Orangutan habitat in East Kalimantan is vast but potentially reduced by land-based development activities by the government, private sector, or communities. The Conservation Agency on East Kalimantan Natural Resources (*BKSDA Kaltim*) has the responsibility to protect the population of key species in six conservation sites (four natural reserves (*cagar alam*), one wildlife sanctuary (*suaka margasatwa*), and one Natural Park (*taman wisata alam*)). Many activities have been reported in 2020 aim to reduce these species' declination. One of the important roles of BKSDA Kaltim is handling wildlife and human conflict. Through a call center 0821-1333-8181, there were 60 reported cases of wildlife entering farmer crops or oil palm plantations in 2020. Most of the cases involved OU, Sun Bear, and Crocodile. Once the call center receives information from the public regarding wildlife issues, BKSDA responds by sending a wildlife rescue team to save and protect wildlife from further unlawful actions. Returning captive wildlife to its habitat is key to maintaining a wildlife population balance. In 2019, BKSDA Kaltim reported that the Bekantan population in Teluk Adang natural reserve increased by 192.7 percent from the baseline survey in 2013. However, the Orangutan population, especially in Sungai Lesan protection forest in Berau district, decreased by 63.9 percent from the baseline survey in 2013.	
Reduced conflict over land	Records of settlement achieved Fifteen cases of land tenure conflict in 2019 have been reported by the East Kalimantan Forestry Services (*Dinas Kehutanan*). Two cases have reached a settlement while others are still in the process of being settled. The conflict between the people of *Sungai Payang* village in Kutai Kartanegara district and PT IHM company was facilitated by the *Meratus* Forest Management Unit (*KPHP Meratus*). This conflict has ended with points of agreement, i.e., normalization of the river environment and the corporate social responsibility program. The other settled conflict is between *Santan* FMU (*KPHP Santan*) and a small group of farmers (*Bapak Mogi*) who raised a claim on the social forestry area of *Santan* FMU.	Sungai Payang Village = 296 households living inside FMU Meratus FMU Santan = 2324 households living inside the FMU

	Reduced number of conflicts reported In 2019, the East Kalimantan Forestry Services (*Dinas Kehutanan*) reported 15 cases of land tenure conflict. There were six reported conflict cases between a forestry license holder and local communities. Meanwhile, one case occurred between a mining company and the community. Six cases of conflict involved forest management units (government institutions) and communities in 2019. Another conflict over land was reported between forestry license holders and oil palm companies (one case) and between forestry license holders versus a mining company (one case). All 15 conflicts occurred in forest areas covering more than 60 percent of East Kalimantan jurisdiction. In 2020, the number of land tenure conflicts decreased to only five cases that were reported to the East Kalimantan Forestry Services (Dinas Kehutanan). Four of them are conflicts between forestry license holders and local communities, while the other conflict is between a mining company and the community.	

Other Non-Carbon benefits and additional information as linked to Monitoring and Evaluation Framework

2. *If applicable linked to **any other (non-priority identified) Non-Carbon benefits**, or if not already covered above linked to Priority Non-Carbon benefits, provide the following additional details:*

Livelihood enhancement and sustainability

2.1. Is your CF program testing ways to sustain and enhance livelihoods (e.g. one of your program objective/s is explicitly targeted at livelihoods; your approach to non-carbon benefits explicitly incorporates livelihoods)?

Yes, it is. The CF program in East Kalimantan clearly addressed Sustainable Alternatives Livelihoods for Communities as one of the CF programs. It is expected that CF activities will provide livelihood opportunities within sensitive areas (areas vulnerable to conflict), including peat areas, mangroves, and conservation areas. Promoting social forestry programs within the State Forest Area to the communities is expected to improve local communities' access to forested areas. Furthermore, it will contribute to improved land governance and community livelihoods. The program achieved the following:

- From June 2019 to December 2020, 19 entities of local communities in East Kalimantan received new social forestry licenses from MoEF covering an area of 53,141 hectares.
- Ninety-nine villages committed to participate in the ER program.
- Plantation 100 hectares of oil palm for a community group in Samarinda supported by the East Kalimantan Estate Crop Agency in 2020.
- Plantation 225 hectares of Pepper for a community group in Samarinda and West Kutai districts supported by the East Kalimantan Estate Crop Agency in 2020.
- Plantation 180 hectares of cocoa for community group in Samarinda and East Kutai district supported by East Kalimantan Estate Crop Agency in 2020.
- Plantation 135 hectares of rubber tree for a community group in Samarinda supported by the East Kalimantan Estate Crop Agency in 2020.

- Plantation 260 hectares of coconut trees for a community group in Samarinda, East Kutai, and Paser districts supported by the East Kalimantan Estate Crop Agency in 2020.
- Replanting 160 hectares of Pepper plantation for a community group in Samarinda supported by the East Kalimantan Estate Crop Agency in 2020.
- Replanting 50 hectares of Cocoa tree plantation for a community group in Samarinda supported by the East Kalimantan Estate Crop Agency in 2020.
- Replanting 200 hectares of rubber tree plantation for a community group in West Kutai district supported by the East Kalimantan Estate Crop Agency in 2020.
- Plantation 40 hectares of Agarwood trees (Pohon Gaharu) in *Nehes Liah Bing* village, East Kutai supported by the PT Gunung Gajah Abadi (forestry company).
- Establishment of a demonstration plot for sustainable agriculture and crab culture in five villages in Mahakam Delta supported by Yayasan BUMI and Planete Urgence.
- Seven villages adjacent to four nature reserves (*Teluk Adang, Teluk Apar, Padang Luway,* and *Muara Kaman Sedulang*) are currently involved in a conservation partnership scheme in 2020. The area under this scheme is 50 hectares.
- Six villages adjacent to Kutai National Park are currently involved in a conservation partnership scheme in 2020.
- Twenty thousand sugar palm trees (Aren) were planted in Kutai National Park for purposes of supporting the livelihoods of communities of Kandolo village inside the park.

Biodiversity

2.2. Is your CF program testing ways to conserve biodiversity (e.g., one of your program objective/s is explicitly targeted at biodiversity conservation; your approach to non-carbon benefits explicitly incorporates biodiversity conservation)?

Yes, it is. Components of the ER Program, as mentioned in ERPD, are explicitly targeted biodiversity conservation, particularly in preserving remaining forests (HCV areas) in plantation areas. The target is to respond to deforestation, which leads to biodiversity loss, mainly due to forest conversion to the plantation. In this case, target locations are specific to APL. East Kalimantan Regional Crop Agency (Dinas Perkebunan Kaltim) has successfully identified 93,037 hectares of HCV areas in existing oil palm plantations. This new data append East Kalimantan's biodiversity conservation sites as mentioned in the 2019 East Kalimantan Biodiversity Profile.

Biodiversity conservation in the East Kalimantan ER program is expected to be implemented in all areas (forest and APL).

Protected/conserved areas

2.3. What amount (in ha) of protected or conserved areas are included in your CF program area? Has this amount increased or decreased in the last year? If so, by how much?

East Kalimantan Spatial Planning (RTRWP Kaltim) 2016-2036 has allocated 1,844,969 hectares of protection forests (*hutan lindung*) and 438,390 hectares of conservation forests (*hutan konservasi*). However, following the CF program, the East Kalimantan government and the Ministry of Environment and Forestry commit to protecting as many remaining forests as possible in this region, including the APL areas. APL is an area designated to support non-forestry activities which include oil palm plantation. According to the East Kalimantan Crop Agency data, as much as 93,037 hectares of

remaining forests in oil palm companies have been reported as HCV areas in 2020. The oil palm companies are committed to protecting these HCV areas.

On the other hand, the Conservation Agency on East Kalimantan Natural Resources (BKSDA Kaltim) and Regional Environment Office of East Kalimantan (DLH Kaltim) are concerned with managing and protecting Essential Ecosystem Areas (KEE). In 2020, BKSDA Kaltim successfully conducted stakeholder meetings to initiate the management of *Danau Mesangat and Kenohan Suwi* in Muara Ancalong sub-district, East Kutai district, as a KEE area. *Danau Mesangat and Kenohan Suwi* cover approximately 13,570 hectares of wetlands known as the habitat of *Crocodylus siamensis* (Siamese crocodile) and *Tomistoma schlegelii* (The false gharial). The local NGO Yayasan ULIN is also working in this area to conserve this unique habitat.

Another KEE named Wehea-Kelay is the habitat of Orangutan located at the cross border between Berau anda East Kutai district. The KEE covers an area of 532,143 hectares. BKSDA Kaltim and DLH Kaltim are currently working together to protect and manage this landscape.

The geological-based landscape (*Karst Sangkulirang-Mangkalihat*) in East Kutai and Berau is also another KEE in East Kalimantan. The area is even larger than *Wehea-Kelay* or *Danau Mesangat and Kenohan Suwi*, covering approximately 1,867,676 hectares of land. However, only 307,337 hectares of this karst area are already designated as protected areas according to East Kalimantan Spatial Planning 2016-2036. DLH Kaltim is a leading agency for managing this landscape and has been continuously working in this area since 2011. Last year, the DLH spending budget for KEE Wehea-Kelay and Karst Sangkulirang-Mangkalihat was IDR 180 million Rupiah, or nearly US$13,000.

Adding up three KEEs and HCV areas in the oil palm plantation to the existing protection forests and conservation forests data, currently East Kalimantan protects and conserves approximately 3,229,446 hectares of forests.

Re/afforestation and restoration

2.4. *Total forest area re/afforested or restored through the program*

East Kalimantan is the province that contributes to national timber production by harvesting the natural forest. Therefore each year this province receives a special allocation budget from the central government for forest rehabilitation activities (*Dana Reboisasi*). In 2020, East Kalimantan Forestry Services (*Laporan Kinerja Instansi Pemerintah - Dinas Kehutanan*) reported that 38,738 hectares of critical land and forest had been rehabilitated. One of the mandatory tasks and responsibilities of the Forest Management Unit is conducting forest and land rehabilitation.Meanwhile, Kutai National Park reported that 7,759 hectares of open area inside the park were rehabilitated in 2020. The number increased significantly compared to 2019 which only saw an increase of 1,342 hectares.

Finance and Private Sector partnerships

2.5. Update on CF program budget (as originally presented in ERPD), with updated detail on secured (i.e. fully committed) finance, in US$

2.5.1. Detail the amount of finance received (including ER payments) in support of development and delivery of your CF program. Figures should only include secured finance (i.e. fully committed): ex ante (unconfirmed) finance or in-kind contributions should not be included:

Table A3.1. Detailed financing received for CF program

Amount (US$)	**Source** (e.g., FCPF, FIP, name of government department)	**Date committed** (MM/YY)	**Public or private finance?**	**ERP, grant, loan, equity, or other?**
$ 1,335,307	Provincial Government	02/20	Public	Other (APDB 2021)
$ 6,976	GGGI	02/20	Public	Grant
$ 23,928	GIZ – LEOPALD	02/20	Public	Grant
$ 13,045	GIZ – SCPOPP	02/20	Public	Grant
$17,440	GIZ – Propeat	02/20	Public	Grant
$80.015	YKAN	02/20	Public	Grant

2.5.2. Not including ER payments from the FCPF Carbon Fund, what is the value of REDD+ ER payments that your CF projects have received, and that your country has received overall?

Table A3.2. Total value of REDD+ ER payments received to date

	Total REDD+ ER payments received to date ($US)
Carbon Fund project/s (i.e. ER payments from sources other than the Carbon Fund)	$ 0.-
All other national REDD+ projects	$ 0.-

2.5.3. How many formal partnerships have been established between your CF program and private sector entities? Formal partnerships are defined as:

- *The partnership is based on a written MoU (or equivalent), and/or*
- *The partnership involves tangible financial exchange/s, and/or*

The partnership involves tangible non-financial exchange/s (e.g., in-kind contributions)

Since the beginning of the program, the private sector has played an important role in the discussion of program design and emission reduction targets, and the benefit-sharing plan.

Private Company such as oil palm company has to look after their concessions from fires. In order avoid forest fires, the Company has established partnerships with communities living surround the concession. Public awareness on fires was conducted. Fire extinguishers such as portable fire pumps, shovels, and fire axe were distributed to communities.

Up to 2022, 57 out of 99 community-based fire management (KTPA or Kelompok Tani Peduli Api) has been supported by oil palm companies in East Kalimantan[48][49]. Total 50 oil palm companies have been involved in both financial and non-financial exchange to support villages in avoiding fires. The villages that have maintained successfully zero fires in their lands receive awards from private companies. These partnerships were put into Memorandum of Understanding between private

[48] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Other/50_KTPA__Bermitra_Dengan_Perusahaan_Perkebunan.pdf

[49] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Other/DISBUN_KEGIATAN_KARLABUN_KTPA.pdf

companies and KTPAs. For example, in Paser district, four KTPAs received fifty million rupiahs (IDR 50 million) per village from the private company. These funds were donated from oil palm company (PT Muaratoyu Subur Lestari) as awards for villages that are successfully to keep their lands from fires in previous year. In Kutai Timur District, six KTPAs received fifty million rupiahs as awards from PT. Subur Abadi Wana Agung and PT. Etam Bersama Lestari (Oil Palm Company)[50]. The KTPAs not only receive the funds, but also firefighting tools (fire extinguishers).

Table A3.3. Formal partnerships established with private sector entities

	Established in the last year (Jul-Jun)	**Total to date**
Number of private sector partnerships involving financial exchange	47	50
Number of private sector partnerships involving non-financial exchange	47	50

3. Other Non-Carbon benefits and additional information

Policy development

3.1. Is your CF program involved in the development, reform, and/or implementation of policies to help institutions/people/systems/sectors? Please provide information on the approach and any other relevant or related indicators/results.

Yes, East Kalimantan CF program is involved in developing policies and is expected to be implemented on a regional scale at the provincial and district/city levels. In November 2019, the Governor of East Kalimantan issued a provincial regulation on a public participation mechanism called "Layanan Aspirasi Etam" (*Peraturan Gubernur Nomor 69 Tahun 2019*). The regulation aims to provide an official channel for all development stakeholders in East Kalimantan to send feedback and grievances related to the performance of public services offered by regional offices (*perangkat daera*h). It is an online-based application which can be accessed through https://aspirasietam.kaltimprov.go.id/. The CF program in East Kalimantan has set *Layanan Aspirasi Etam* as one of its backbones, especially for safeguards monitoring activities. This regulation was initiated by the Provincial Communication and Information Services Agency (*Dinas Komunikasi dan Informatika*).

Following the issuance of the East Kalimantan Regulation on Sustainability of Plantation Program (Perda Kaltim No. 7/2018), the Governor of East Kalimantan is currently processing another regulation that guides the plantation stakeholder, especially plantation companies and communities, to manage and protect their remaining forests or HCV areas. This new governor regulation was initiated in 2019 and is currently in its final stage. In the last two years, at least six focus group discussions (FGD) were established to review and collect input from many stakeholders in East

[50] https://mrv.kaltimprov.go.id/storage/guest/ERMR1/Other/DISBUN_KEGIATAN_KARLABUN_KTPA.pdf

Kalimantan. The FGD process is often supported by development partners (*mitra pembangunan*) as part of their contribution to East Kalimantan development.

Responding to the issuance of *Perda Kaltim No. 7/2018*, the Head of Berau district (*Bupati Berau*) issued a district regulation (*Perda Berau No. 52/2019*) that established a multi-stakeholder (communication) forum for a sustainable plantation in Berau district. The main task of this forum is to provide Bupati Berau with advice and recommendations regarding plantation development issues in Berau, especially related to dispute and conflict resolution. Furthermore, *Bupati Berau* has also issued the designation of indicative maps for HCV in Berau for 83,000 hectares through Bupati's decree No 287/2020.

Related to the Law of Job Creation known as UU CK (Law No. 11/2020 concerning Job Creation), it is still being contested at the Constitutional Court. It has impacts on environmental and forestry regulations. Since the Law is still being reviewed, there is no assessment and analysis related to the Omnibus law in this report.

Capacity building

3.2 Is your CF program involved in training, education, or provision of capacity building opportunities to increase the capacity of institutions/people/systems? Please provide information on the approach and any other relevant or related indicators/results.

Yes, it is. Sub-components of the ER program in East Kalimantan are clearly targeted to strengthen the capacity of government agencies, especially in the area of licensing and forest management, strengthening village development and spatial planning, strengthening the capacity of provincial and district governments to supervise and monitor the implementation of sustainable Estate Crops, implementation of HCV policies, and strengthening communities in terms of livelihoods generation and collaborative management of forests and land.

In the case of a forest management unit or KPH, capacity building is a necessity. Many aspects of KPH as an entity responsible for managing the forests need to be strengthened. The existence of KPHs in East Kalimantan began roughly five years ago. Some KPHs were sless than two years ago. As a site management body, KPHs have a wide range of duties in managing forests i.e., forest planning and blocking, forest utilization, forest protection, forest rehabilitation, community development, conflict resolution, supervision of license holders, and other programs for supporting national policies on forestry. Professional personnel of KPHs are required to ensure that all duties are properly carried out. Due to the personnel of KPH having varied backgrounds and experience, advanced training and education are needed. The training subjects may focus on aspects such as GIS and mapping training, drone training, MRV training, business planning training, ecotourism, and forest fire prevention.

Community and forestry company/oil palm plantation company areas are also part of ER entities that should be strengthened. In technical aspects related to forest operation and plantation, these companies may have been very experienced. Therefore, advanced training is required mainly for specific subjects such as HCV management, social forestry, and non-forest products development. Meanwhile, communities are an important subject of ER programs that are expected to improve at the end of this program. Nearly 37 percent of 841 villages (not including *kelurahan*) in East Kalimantan are underdeveloped. Therefore, specific training is essential for communities, especially related to livelihood improvement or income generation. Most of KPH and conservation forest

management in East Kalimantan are aware of this situation and are already conducting many trainings and disseminating information to enhance community knowledge and skills.

Other

3.3. Is your CF program involved in generation or enhancement of any non-carbon benefits not already covered in this annex? Please provide information on the approach and any other relevant or related indicators/results.

No, there is no generation or enhancement of new non-carbon benefits.

ANNEX 4: CARBON ACCOUNTING – ADDENDUM TO THE ERPD

Technical Correction

Indonesia notified the FMT on the intention to apply technical corrections to the reference level for the ER-Program before the signing of the ERPA.

Summary of Technical Correction

Technical correction is applied to the following areas as defined in paragraph 3 of the Guideline on the application of the Methodological Framework Number 2 – Technical corrections. The summary of the corrections are the following:

1. Activity data. The technical corrections for the activity data include
    - Adjustment of the boundary of East Kalimantan Province as the provincial boundary of the 2019 ERPD does not match with the provincial spatial plan. This adjustment results in a change in the total project area from 12,746,546 ha to 12,734,691 ha.
    - Refinement of method for estimation of burnt area. The 2019 ERPD used MRI (2013) method which depend solely on hotspot data, while the current method combine the hotspot data with the Landsat image (quick look original with composite band 645) and fire control activity that is able to delineate the burnt area and supervised by other data (ground check).
    - Change of stratification approach for the estimation of deforestation and degradation area using Sample Based Estimation (SBE) from post stratification to stratification following the procedure of Olofsson (2014), and adoption of the filtering method to avoid double counting of deforestation and degradation in recovered areas following the gross deforestation and forest degradation definition (gross). The change of the method from post stratification to stratification is to follow the proposed method of Olofson (2014) in which the sample is defined before the SBE analysis.

Comparison of the area of sample-based estimation of the original 2019 ERPD and the Technical Correction is given in Table 1 and that of burnt area is in Tables 2 and 3.

Table 1. Comparison of area of Sample Based Estimation between 2019 ERPD and Technical Correction

LC Change Classification	Map Area (Ha)	Adjusted Area (Ha)	SE for the Adjusted Area (Ha)	CI (95%)	U (%)
	Technical Correction[51]				
Deforestation	631,440	717,740	99,687.01	195,386.53	27.22

[51] See sheet 'UncertaintyAD' on file fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx (https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx)

LC Change Classification	Map Area (Ha)	Adjusted Area (Ha)	SE for the Adjusted Area (Ha)	CI (95%)	U (%)
Forest Degradation	103,448	140,974	61,236.19	120,022.93	85.14
Forest gain	0				
Stable Forest	6,509,063	7,525,408	195,722.67	383,616.44	5.10
Stable Non-Forest	5,490,741	4,360,569	193,622.34	379,499.79	8.70
Total	12,734,692	12,734,692			
	Original ERPD				
Deforestation	701,685	1,140,536	131,451.88	257,646	22.59
Degradation	93,979	276,780	72,953.51	142,989	51.66
Forest gain	372,712	-	-	-	-
Stable Forest	6,525,057	6,058,260	171,176.77	335,506	5.54
Stable Non-Forest	5,151,246	5,369,103	167,066.93	327,451	6.10
Total	12,844,679	12,844,679			

Table 2. Comparison burnt area of stable forest between 2019 ERPD and Technical Correction

Year	Land Use Code	Burnt Area-2019 ERPD(ha)	Burnt Area-Technical Correction (ha)
2007	2002	6,260	280
	20041	210	
	20051	154	
2008	2002	3,875	135
	20041	141	
	20051	-	
2009	2002	19,908	671
	20041	405	4
	20051	696	126
2010	2002	4,706	222
	20041	19	
	20051	469	21
2011	2002	7,996	435
	20041	167	13
	20051	159	63
2012	2002	11,716	1,216
	20041	56	12
	20051	194	30
2013	2002	7,731	695
	20041	120	
	20051	387	2
2014	2002	20,127	1,578
	20041	326	4

Year	Land Use Code	Burnt Area-2019 ERPD(ha)	Burnt Area-Technical Correction (ha)
	20051	1,405	
2015	2002	17,738	0.04
	20041	316	0.01
	20051	912	
2016	2002	2,923	1,179
	20041	105	395
	20051	257	116

Table 3. Comparison burnt area of peat between 2019 ERPD and Technical Correction

Year	Burnt peat 2019 ERPD (ha)	Burnt peat Technical Correction (ha)
2013	370	323
2014	-	-
2015	51	395
2016	23	674

2. Emission Factors. The technical corrections for the EF include the

- Replacement of emission factors of dryland forest by using data from permanent sampling plots of the National Forest Inventory (NFI) located in East Kalimantan Province rather than the smaller sample specifically collected for FCPF in 2018-2019.
- Replacing the allometric equation from Basuki *et al.* 2005 to Manuri et al. (2017); and
- Establishment of new FCPF plots in mangrove forest for increasing number of samples.

Allometric equations used for swamp and mangrove forest remains the same. The changes of the EFs compared to original values in ERPD are presented in Table 4.

Table 4. Comparison of EF (living biomass) between the 2019 ERPD and Technical Correction

Land Cover Types	2019 ERPD			Technical Correction		
	n	C Stock (t/ha)	U (%)	n	C stock (t/ha)	U (%)
Primary dryland forest[1]	55	281.3	37.5	79	167.3	40.0
Secondary dryland forest[1]	68	147.3	33.3	408	122.1	39.5
Secondary dryland forest (burnt area)				50	120.5	39.8
Primary peat swamp forest[2]	18	344.2	38.9	18	343.9	38.3
Secondary peat swamp forest[2]	42	233.5	41.3	42	237.3	40.9
Dry shrub[3]	7	29.9	41.0	25	28.8	44.9
Wet shrub[3]	6	26.7	41.0	12	32.4	52.8
Primary mangrove forest	37	160.8	36.4	80	168.2	29.8
Secondary mangrove forest	23	128.6	34.0	54	118.1	30.9

[1] Higher Uncertainty After Technical Correction For The Dryland Forest Due To Higher Uncertainty Of The Allometric Equation Of Manuri Et Al 2017 Compare To Basuki Et Al. 2009 (Dryland Forest)

[2] Slight Decrease In Living Biomass For Primary And Secondary Swamp Forest Due To The Decrease In Root:Shoot Ratio Of The Mangrove Forest Following The Assumption That The Ratio Of The Swamp Forest Is The Same As That Of The Mangrove Forest.
Data On Shrubs Are Taken From The National Forest Inventory Located In East Kalimantan. Previous Data Are All From Outside East Kalimantan, Thus They Are Excluded.

Start Date of the Crediting Period

The ER Program Start Date is: June 18, 2019

7. CARBON POOLS, SOURCES AND SINKS

Table 7.1 illustrates the REDD+ activities (adopted by 1/CP.16, paragraph 70) selected by the ER-Program and the associated emission sources and sinks.

7.1 Description of Sources and Sinks Selected

Table 7.1 Sources and Sinks Selected

Sources/Sinks	Included?	Justification / Explanation
Emissions from deforestation	Yes	Emissions from deforestation are identified as GHG emissions from the IPCC Land Use Change category of forest land to non-forest land, plus emissions from peat decomposition, peat fire, and mangrove soils that are linked to deforestation. Deforestation in this context is defined as a conversion of natural forest to other land uses (non-natural forest; see section 8.2). In the period 2006 to 2016 deforestation contributed 80% of total emissions in East Kalimantan. Conversion to agriculture, particularly to oil palm plantations, was the major cause of the deforestation, while conversion to monoculture timber plantations also contributed significantly. It is worthy to note that considering the lengthy reference period, i.e. 10 years, there is a chance for a deforested area to regrow into young secondary forest in 10 years or even earlier. To ensure this regrowth does not count twice as deforestation when it is deforested again during monitoring period, deforestation only identified in areas where it was consistently forest until the first year of monitoring.
Emissions from forest degradation	Yes	Emissions from forest degradation Forest degradation in the national FREL is defined as a change of a primary forest class to a secondary forest

Sources/Sinks	Included?	Justification / Explanation
		class. Primary forest classes include primary dryland, primary mangrove and primary swamp forests. However, this definition of forest degradation excludes losses of carbon in the secondary forest classes due to further disturbance. Identifying the degree of forest degradation within secondary forests is not a simple task, especially not on a routine basis with the currently used medium-resolution satellite imagery (Landsat); and at present, Indonesia has no capacity and data available to assess different levels of degradation within secondary forests. However, it is possible to estimate the loss of carbon due to fire within the secondary forest classes. Thus, included emissions from forest degradation comprise the following: Emissions due to the degradation of primary forest into secondary forest. This includes emissions due to the associated loss of tree cover; as well as emissions due to peat decomposition, where the change from primary to secondary forest occurs on swamp forest. Emissions due to fire within areas that are classified as secondary forest at the beginning and at the end of the measurement period (stable secondary forest). Emissions due to fire in secondary forests that have changed to a non-forest class (including shrubs) at the end of the measurement period, are reported under deforestation. Limiting consideration of fire to stable secondary forest avoids double-counting the emissions from fire with emissions from deforestation.
Emissions and removals from conservation of carbon stocks	No	The national REDD+ framework does not define activities for the conservation of carbon stocks.
Emissions and removals from sustainable management of forest	No	This activity is not included due to limited data and information.
Removals from enhancement of carbon stocks	No	The national FREL does not account for removals from the enhancement of carbon stocks. Also, there is limited data and information, especially on relevant emission factors. Inclusion of this activity would not be in line with the national REDD+ framework and would result in a higher uncertainty level.

Sources/Sinks	Included?	Justification / Explanation

7.2 Description of Carbon Pools and greenhouse gases selected

The following Table 7.2. explains which pools were recorded in the FREL for each activity.

Table 7.2 Carbon Pools

Carbon Pools	Selected?	Justification / Explanation
Above Ground Biomass (AGB)	Yes	According to Indonesia's FREL document, emissions from AGB accounted for around 70% of total emissions from biomass, making AGB the largest pool of emissions. Moreover, many studies for estimating above-ground tree biomass in Indonesia are available, enabling Tier 2 or Tier 3 approaches. AGB data are widely available and can be estimated from forest inventory or sample plot data.
Below Ground Biomass (BGB)	Yes	Based on research conducted at sites in Sumatra and Kalimantan, this pool accounts for an average of 13.6% of total biomass (MoEF, 2016). This pool is estimated using shoot-root ratios, following IPCC (2014).
Dead Wood	No	Based on research conducted at sites in Sumatra and Kalimantan, this pool accounts for an average of 14.3% of total biomass emissions. In spite of being significant, this carbon pool is excluded due to lack of sampling data.
Litter	No	Emissions from litter are excluded as per Indonesia's FREL document. It was estimated that emissions from litter accounted for only 1% of total emissions from biomass, and the pool is therefore considered insignificant.
Soil Carbon	Yes for organic Soils No for mineral soils	The ERP accounts for losses of carbon from organic soils (peat and mangrove soils) due to decomposition (gradual loss following deforestation or forest degradation) and fire. Emissions from soil carbon in other mineral soils is excluded, since they are not significant.

Table 7.3 Type of Gases

Greenhouse gases	Selected?	Justification / Explanation
CO_2	Yes	The ER Program shall always account for CO_2 emissions and removals
CH_4	No/Yes	Excluded for peat drainage due to insufficient data in estimating methane emissions and included for peat and forest fire following the IPCC (2014)
N_2O	Yes	Included only for forest fire following the IPCC (2014)

8. REFERENCE LEVEL

8.1 Reference Period

Following the Criteria 11 of the FCPF Methodological Framework (2016), the end-date for the Reference Period should be the most recent date prior to two years before the TAP starts the independent assessment of the draft ER Program Document (i.e. 2018-2 years = 2016) and for which forest-cover data is available to enable IPCC Approach 3; and the start date of the Reference Period is about 10 years before the end-date. Considering this criterion, the reference period selected for the ERPD is from 2006-2007 to 2015-2016. This period is chosen to cover a 10 year period from July 2006 to June 2016, reflecting the 10-year period between the forest cover map developed for 2006 and the forest cover map developed for 2016. To ensure consistency with the national framework, the land use/cover data for the development of the FREL for the ER Program are the same as the data used in the development of the national FREL supplied by the Ministry of Environment and Forestry, i.e. data of years 2006, 2009, 2011, 2012, 2013, 2014, 2015 and 2016.

8.2 Forest definition used in the construction of the Reference Level

In accordance with UNFCCC decision 12/CP.17, forest in Indonesia is defined as a land area of more than 6.25 ha with trees higher than 5 meters at maturity and a canopy cover of more than 30 percent. This is a formal definition of forest that mostly based on forest ecology. For the construction of the national FREL for REDD+, Indonesia used a different definition that considers limitations of methods and data used in generating the Indonesia forest data. A "working definition" of forest was used to produce land-cover maps through visual interpretation of satellite images at a scale where the minimum area for polygon delineation is 0.25 cm^2 at 1: 50,000 of scale which represents 6.25 ha. This definition is in accordance with the Indonesian National Standard (SNI) 8033:2014 on "Method for calculating forest cover change based on results of visual interpretation of optical satellite remote sensing image" (http://sni.bsn.go.id/product/detail/22270). Other definitions of forest submitted to international organizations by Indonesia can be accessed from http://ditjenppi.menlhk.go.id/kcpi/dokumen/national_frel_final%20revisi_10des.pdf.

The SNI defined forest based on satellite data features including color, texture and brightness. Forests were classified into 7 classes based on forest types and degradation or succession level, while non-forests were classified into 15 classes with one class being cloud (Table 8.1). The first six forest classes are natural forests, and the seventh class is plantation forest. These 23 land cover classes are based on physiognomy and biophysical appearance that is captured by remote sensing (Landsat at 30 meter spatial resolution). However, the object identification is purely based on the appearance in the imagery. Manual-visual classification through an on-screen digitizing technique based on key elements of image/photo-interpretation was applied as a classification method. Several ancillary data sets (including concession boundaries of logging and plantation, forest area boundaries) were utilized during the process of delineation, to integrate additional information valuable for classification. The process for analyzing satellite data to monitor the land/forest cover change is described in detail in Margono et al. (2016) and can be accessed from the following link https://nfms.menlhk.go.id/ and https://jurnal.ugm.ac.id/ijg/article/view/12496/9041. References for technical assessment related to the carbon accounting can be seen in Annex 8.2. The data/information/methodology was posted in http://puspijak.org/index.php/front/content/erpd

(official website of Research and Development Center for Social Economy, Policy and Climate Change, Ministry of Environment and Forestry).

For the construction of the national FREL, Indonesia only included natural forest in its forest definition; plantation forest is treated as non-forest land for purposes of the FREL, and the ERPD follows the same convention for consistency.

The submitted national FREL has successfully undergone technical assessment by the UNFCCC. In the construction of the FREL for the ER Program, the same definition has been adopted, which excludes plantation forests. The use of this definition is in line with the spirit of REDD+ activities as defined in paragraph 2e in the Appendix 1 of Decision 1/CP.16 that REDD activities should not be used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests.

Table 8.1 Characterization of natural forests in Indonesia used in national land cover mapping.

No	Land cover type	Code	Description
	Forests		
1	Primary dry land forest	2001	Natural tropical forests growing on non-wet habitat including lowland, upland, and montane forests with no signs of logging activities. The forest includes heath forest and forest on ultramafic and lime-stone, as well as coniferous, deciduous and mist or cloud forest, which shows no, or little, influence from human activities such as logging.
2	Secondary dry land forest / logged forest	2002	Natural tropical forests growing on non-wet habitat including lowland, upland, and montane forests that exhibit signs of logging activities indicated by patterns and signs of logging (appearance roads and patches of logged-over area). The forest includes heath forest and forest on ultramafic and lime-stone, as well as coniferous, deciduous and mist or cloud forest.
3	Primary swamp forest	2005 biics2020test	Natural tropical forests growing on wet habitat in swamp form, including, brackish swamp, marshes, sago and peat swamp, which shows no, or little, influence from human activities such as logging.
4	Secondary swamp forest / logged forest	20051	Natural tropical forests growing on wet habitat in swamp form, including brackish swamp, marshes, sago and peat swamp that exhibit signs of logging activities indicated by patterns and signs of logging (appearance roads and logged-over patches).
5	Primary mangrove forest	2004	Wetland forests in coastal areas such as plains that are still influenced by the tides, muddy and brackish water and dominated by species of mangrove including Nipa (Nipafrutescens), which shows no, or little, influence from human activities such as logging.

No	Land cover type	Code	Description
6	Secondary mangrove forest / logged forest	20041	Wetland forests in coastal areas such as plains that are still influenced by the tides, muddy and brackish water and dominated by species of mangrove and Nipa (Nipa frutescens), and exhibit signs of logging activities, indicated by patterns and signs of logging activities.
7	Plantation forest	2006	The appearance of the structural composition of the forest vegetation in large areas, dominated by homogeneous trees species, and planted for specific purposes. Planted forests include areas of reforestation, industrial plantation forest and community plantation forest.
	Non-Forests		
8	Dry shrub	2007	Highly degraded logged over areas on non-wet habitat that are ongoing process of succession but not yet reach stable forest ecosystem, having natural scattered trees or shrubs.
9	Wet shrub	20071	Highly degraded logged over areas on wet habitat that are ongoing process of succession but not yet reach stable forest ecosystem, having natural scattered trees or shrubs.
10	Savanna and Grasses	3000	Areas with grasses and scattered natural trees and shrubs. This is typical of natural ecosystem and appearance on Sulawesi Tenggara, Nusa Tenggara Timur, and south part of Papua island. This type of cover could be on wet or non-wet habitat.
11	Pure dry agriculture	20091	All land covers associated with agriculture activities on dry/non-wet land, such as tegalan (moor), mixed garden and ladang (agriculture fields).
12	Mixed dry agriculture	20092	All land covers associated with agriculture activities on dry/non-wet land that is mixed with shrubs, thickets, and log over forest. This cover type often results of shifting cultivation and its rotation, including on karts.
13	Estate crop	2010	Estate areas that has been planted, mostly with perennials crops or other agriculture trees commodities.
14	Paddy field	20093	Agriculture areas on wet habitat, especially for paddy, that typically exhibit dyke patterns (pola pematang). This cover type includes rainfed, seasonal paddy field, and irrigated paddy fields.
15	Transmigration areas	20122	Kind of unique settlement areas that exhibit association of houses and agroforestry and/or garden at surrounding.
16	Fish pond/aquaculture	20094	Areas exhibit aquaculture activities including fish ponds, shrimp ponds or salt ponds.
17	Bare ground	2014	Bare grounds and areas with no vegetation cover

No	Land cover type	Code	Description
			yet, including open exposure areas, craters, sandbanks, sediments, and areas post fire that has not yet exhibit regrowth.
18	Mining areas	20141	Mining areas exhibit open mining activities such as open-pit mining including tailing ground.
19	Settlement areas	2012	Settlement areas including rural, urban, industrial and other settlements with typical appearance.
20	Port and harbor	20121	Sighting of port and harbor that big enough to independently delineated as independent object.
21	Open water	5001	Sighting of open water including ocean, rivers, lakes, and ponds.
22	Open swamps	50011	Sighting of open swamp with few vegetation.
23	Clouds and no-data		Sighting of clouds and clouds shadow with size more than 4 cm2 at 100.000 scales display.

8.3 Average annual historical emissions over the Reference Period

Description of method used for calculating the average annual historical emissions over the Reference Period

The following is a high level overview of the steps taken to calculate the average annual historical emissions over the Reference Period. These steps are discussed in more detail in the following sections.

- Activity Data, the estimated areas of deforestation and degradation, are generated from a sample-based approach called as Sample Based Estimation (SBE) following the procedure of Olofsson (2014), with stratification using land cover maps. In the previous assessment (ERPD), the study area were stratified after selection of the sample called post-stratification.
- Emission Factors come from forest inventory data and biomass equations (for forest land and shrubs) and from published literature (for other non-forest land, fire and soil), with IPCC default assumptions for converting biomass to carbon.
- Activity Data and Emission Factors are combined to estimate emissions from different activities.
- Historical Emissions will be calculated and reported for the following components:
    - Emissions from changes in biomass associated with deforestation (change from forest to non-forest cover class) and forest degradation (change from primary to secondary forest cover class).
    - Emissions from organic soil associated with deforestation of swamp and mangrove forest (change from forest to non-forest cover class)
    - Emissions from forest fires in stable secondary forest and peat lands (emissions from fires in primary forest are captured in the land cover mapping described above)

All Emissions are only counted from land which was in a forested class at the start of the Reference Period in 2006. Removals are not counted, only Emissions are counted.

The method used for the calculation of average annual historical emissions follows the method that is consistent with the IPCC Guidelines for National Greenhouse Gas Inventories. Historical emissions over the reference period is calculated as combination of the Activity Data (AD) and Emission Factor (EF) from different sources. According to the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, AD is defined as a data on the magnitude of human activity resulting in GHG emissions or removals taking place during a given period of time, such as area of deforestation, and area of forest degradation. AD is primarily taken from the analysis of land cover maps in certain periods, and also from the fire hot spots data sets.

EF is defined as the average emission rate of a given GHG for a given source, relative to units of activity. EF in this emission calculation comes from site specific forest inventory data in East Kalimantan, and from the literature published internationally.

Annual GHG emissions or removals over the reference period in the Accounting Area ($\mathrm{RL_{i,t}}$) are estimated as the sum of annual change in total living biomass, dead organic matter and Soil Organic Carbon and the non-CO_2 GHG emissions ($\mathbf{L_{fire}}$).

$$GHG_{i,t} = \Delta \boldsymbol{C_B} + \Delta \boldsymbol{C_{SOC}} + \boldsymbol{L_{fire}}$$

<u>*Changes in carbon stocks in the AGB and BGB pools*</u>

$$\Delta C_B = \sum_{\boldsymbol{j,i}} \left(AGB_{Before,j} x(1+R_j) - AGB_{After,i} x(1+R_i)\right) x\ CF\ x \frac{44}{12} \times A(j,i) \quad \textbf{\textit{Equation 1}}$$

Where:

$A(j,i)$	*Area converted/transited from old land-use category j to new land use category i during the period, in hectare per year.*
$AGB_{Before,j}$	*Aboveground biomass of land-use category j before conversion/transition, in tonne of dry matter per ha. This was obtained through terrestrial inventory and defined at the time of RL establishment.*
Rj	*ratio of below-ground biomass to above-ground biomass for land-use category j, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$. See column F on sheet 'EF_EKJERP' on file fcpf_ekjerp_ermr1_MC_24Juli2022b.xlsx , according to 2006 IPCC GL, TABLE 4.4, Volume 4, Chapter 4. This is the case for land-use category j1 and land-use category j2.*
$AGB_{After,i}$	*Aboveground biomass of land-use category i after conversion/transition, in tonnes dry matter per ha. This was obtained through terrestrial inventory and defined at the time of RL establishment.*
R_i	*ratio of below-ground biomass to above-ground biomass for land-use category i, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$ See column F on sheet 'EF_EKJERP' on file fcpf_ekjerp_ermr1_MC_24Juli2022b.xlsx , according to 2006 IPCC GL, TABLE 4.4, Volume 4, Chapter 4. This is the case for land-use category j1 and land-use category j2.*
CF	*Carbon fraction of dry matter in tC per ton dry matter. The value used is 0,47 is the default for tropical forest as per IPCC AFOLU guidelines 2006, table 4.3.*
$44/12$	*Conversion of C to CO_2*

<u>*Changes in Soil Organic Carbon*</u>

$$\Delta C_{SOC} = \frac{\sum_{j,i}\left(\left(SOC_{Before,j} - SOC_{After,i}\right) \times \frac{44}{12} \times A(j,i)\right)}{D}$$ ***Equation 2***

Where:

$A(j,i)$	*area undergoing conversion from old to new land-use category, ha.. This is the same as parameter* $\boldsymbol{A(j,i)}$ *above.*
$SOC_{Before,j}$	*the reference carbon stock, tonnes C ha-1 for land-use category j. This was obtained through terrestrial inventory and defined at the time of RL establishment. See sheet 'EF_EKJERP' on file fcpf_ekjerp_ermr1_MC_24Juli2022b.xlsx*
$SOC_{After,i}$	*the carbon stock, tonnes C ha-1 for land-use category i This was obtained through terrestrial inventory and defined at the time of RL establishment. See sheet 'EF_EKJERP' on file fcpf_ekjerp_ermr1_MC_24Juli2022b.xlsx*
D	*time period of the transition from land-use category j to landuse category i, yr. The Tier 1 default is 20 years.*
$44/12$	*Conversion of C to* CO_2

Emissions for biomass consumed by fire

Emission factors EF_f for biomass consumed by fire can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following formula:

$L_{fire} = A(i) * EF_f$ (Equation 5)

$EF_f = M_B * C_f * G_{ef} * 10^{-3}$ (Equation 6)

$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$ (Equation 7)

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CO2, CH_4, N_2O

A = burnt area, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Chapter 2-page 2.48). The default value of the IPCC combustion factor, C_f, is 0.36

G_{ef} = emission factor, g kg^{-1} dry matter burnt (1580 for CO2, 6.8 for CH4 and 0.20 for N2O, Table 2.5 of 2006 IPCC Guideline, Chapter 2- Page 2.47)

The M_B for the peat is 353 tons dry matter per hectare following IPCC default (Table 2.6 of the Chapter 2 in page 2.40, 2013 Supplement to the 2006 IPCC). The M_B depends on depth of peat and bulk density of the peat. Based on measurement in Central Kalimantan, the M_B is about 505 tons dry matter per hectare with assumption that the average depth of peat burn is 0.33 m and bulk density 0.153 t/m^3 (MRI 2013). However, we adopt the IPCC default as the default considering the data was based on measurement from multiple locations that may represent better general condition. The C_f is taken from the IPCC default value (Tables 2.6 of 2006 IPCC Vol. 4 Chapter 2). The G_{EF} for CO_2 is 1,701 g/kg dry matter burnt (Table 2.7 of the Chapter 2 of the 2013 Supplement to the 2006 IPCC, page 2.36) and for CH_4 is 21 g/kg dry matter burnt. *Detail data can be see on See sheet 'EF_EKJERP' on file fcpf_ekjerp_ermr1_MC_24Juli2022b.xlsx*

Activity data and emission factors used for calculating the average annual historical emissions over the Reference Period

Activity data

There are several kinds of activity data used in the historical emissions calculation;

- Activity Data from land cover mapping; for emissions calculation due to deforestation (forest to non-forest) and forest degradation (primary forest to secondary forest). The 23 land cover classification was built based on visual on-screen digitizing interpretation of Landsat mosaic data of East Kalimantan for periods 2006, 2009, 2011, 2012, 2013, 2014, 2015, and 2016. The activity data were shown in land cover change matrix transition to describe their emission. Land cover change can describe deforestation, forest degradation, forest and non-forest stable as well as forest gain. This information was combined with Reference Data to conduct a sample based estimation (SBE) analysis (see updated Annex 12.1 ERPD)
- Activity data from satellite based fire mapping or hot spot analysis, for emission calculation due to fire on stable secondary forest. These data are spatially explicit, derived from Modis mapping of fire activity (described below).

Deforestation

Description of the parameter including the time period covered (e.g. forest-cover change between 2006-2016 or transitions between forest categories X and Y between 2006-2016:	Area of land cover change between 2006-2009, 2009-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, and 2015-2016. The land use transition matrices between these periods are generated to estimate the change of area from forest categories to non-forest categories.
Explanation for which sources or sinks the parameter is used (e.g. deforestation or forest degradation):	Deforestation
Data unit (e.g. ha/yr):	Ha/yr
Value for the parameter:	<table><tr><th>Period</th><th>Deforestation area (ha/year)</th></tr><tr><td>2006-2009</td><td>214,691.44</td></tr><tr><td>2009-2011</td><td>65,629.95</td></tr><tr><td>2011-2012</td><td>113,544.25</td></tr><tr><td>2012-2013</td><td>81,758.93</td></tr><tr><td>2013-2014</td><td>38,106.56</td></tr><tr><td>2014-2015</td><td>69,754.53</td></tr><tr><td>2015-2016</td><td>134,254.55</td></tr></table> Detail data can be see on sheet 'AD_EF_DEF_XXXX' on file *fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx . XXXX ini year eq. 0609, 0911, etc.* *https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx*
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-) processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	National Forest Monitoring System (NFMS) named Simontana (*Sistem Monitoring Hutan Nasional*) (MoFor, 2014). It is available online at https://nfms.menlhk.go.id/, which is coupled with webGIS at https://sigap.menlhk.go.id/ for display and viewing. The two websites are part of geospatial portal under the one map policy. The description of methods for data derived from remote sensing images including type of sensors and the details of the images used can be found https://jurnal.ugm.ac.id/ijg/article/view/12496/9041

Spatial level (local, regional, national or international):	Regional (Province)
Discussion of key uncertainties for this parameter:	Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover) and that of land cover changes.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	The estimation of uncertainty follows method presented by Olofsson *et al*. (2014), substituting the post-stratified estimator of variance (Olofsson 2019). The uncertainty of the land cover change (deforestation) is 27.31% (see Annex 12.1).

Peat decomposition - deforestation and degradation

Description of the parameter including the time period covered (e.g. forest-cover change between 2006-2016 or transitions between forest categories X and Y between 2006-2016):	Area of land cover changes between 2006-2009, 2009-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, and 2017-2018. The land use transition matrices between these periods are generated to estimate the change of areas from forest categories to non-forest categories that occurred in the peatland for the estimation of emissions from peat decomposition from the deforested areas. The use of a longer time period than the reference period (2007-2016) for peatland deforestation is part of an agreement with CFPs considering the Indicator 13.1 of the Methodological Framework. Indonesia is not eligible for applying an upward adjustment to its reference level, while Indonesia has peatland in which such indicator is not possible to be applied for countries that have peatland forest. In peatland forest, that has been deforested, peat decomposition will continue to release emissions, leading to future inherited emissions. Following resolution CFM/19/2019/1, the CFPs and Indonesia agreed to remove the calculation for emissions associated with projected future deforestation in peat forest and apply the estimate of the most recent data not later than 2018 and the CFPs agreed to provide a one-time waiver to Indicator 13.1.
Explanation for which sources or sinks the parameter is used (e.g. deforestation or forest degradation):	Deforestation and subsequent land cover changes for peat lands. Tracking change over time is necessary to estimate the future inherited emissions because emissions are related to future land cover.
Data unit (e.g. ha/yr):	Ha/yr
Value for the parameter:	

Period	Peat Decomposition	Area
2017-2018	20041-2010	0.17
	20041-20071	23.88
	20051-2010	157.30
	20051-2014	4.06
	20051-20141	35.53
	2014-2014	*524.70*
	2014-20071	*312.25*
	20071-20071	*776.52*
	2010-2010	*1,260.11*

Note: The second column shows land cover change using cover class codes. Black figures are emissions from new land cover changes in each period, red numbers are continuing decomposition emissions from land cover change in prior years.

See sheet 'AD_ER_DEK_1718' on file fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx
https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx

Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-) processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	National Forest Monitoring System (NFMS) named Simontana (*Sistem Monitoring Hutan Nasional*) (MoFor, 2014). It is available online at https://nfms.menlhk.go.id/ , which coupled with webGIS at https://nfms.menlhk.go.id/ is for display and viewing. The two websites are part of the geospatial portal under the one map policy. The description of methods for data derived from remote sensing images including type of sensors and the details of the images used can be found https://jurnal.ugm.ac.id/ijg/article/view/12496/9041
Spatial level (local, regional, national or international):	Regional (Province)
Discussion of key uncertainties for this parameter:	Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover), that of land cover changes, and that of peatland.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of	The estimation of uncertainty follows a modified method presented by Olofsson *et al*. (2014), substituting the post-stratified estimator of variance (Olofsson 2019). The uncertainty of the land cover change (deforestation) is 27.31%, that of stable forest is

assumptions/methodology in the estimation	5.10%, and that of stable non-forest is 8.70%. Uncertainty of peatland is estimated to be about 10%.

Soil mangrove

Description of the parameter including the time period covered (e.g. forest-cover change between 2006-2016 or transitions between forest categories X and Y between 2006-2016):	Area of land cover changes between 2006-2009, 2009-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, and 2015-2016. The land use transition matrices between these periods are generated to estimate the change of areas from mangrove forests to aquaculture/fishpond for the estimation of emission from the loss of soil carbon
Explanation for which sources or sinks the parameter is used (e.g. deforestation or forest degradation):	Deforestation: Mangrove forest to aquaculture
Data unit (e.g. ha/yr):	Ha/yr
Value for the parameter:	

Period	Changes	Area (ha)
2006-2009	2004-20094	15.07
	20041-20094	915.17
2009-2011	2004-20094	-
	20041-20094	59.85
2011-2012	2004-20094	9.64
	20041-20094	445.09
2012-2013	2004-20094	-
	20041-20094	774.05
2013-2014	2004-20094	-
	20041-20094	-
2014-2015	2004-20094	-
	20041-20094	1,881.86
2015-2016	2004-20094	12.50
	20041-20094	684.62

Note: Second column shows land cover change using cover class codes.
See sheet 'ER_SMangrove' on file fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx

	https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-) processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	National Forest Monitoring System (NFMS) named Simontana (*Sistem Monitoring Hutan Nasional*) (MoFor, 2014). It is available online at https://nfms.menlhk.go.id/, which coupled with webGIS at https://sigap.menlhk.go.id/ for display and viewing. The two websites are part of geospatial portal under the one map policy. The description of methods for data derived from remote sensing images including type of sensors and the details of the images used can be found https://jurnal.ugm.ac.id/ijg/article/view/12496/9041
Spatial level (local, regional, national or international):	Regional (Province)
Discussion of key uncertainties for this parameter:	Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover) and that of land cover changes.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	The estimation of uncertainty follows a modified method presented by Olofsson *et al*. (2014), substituting a stratified estimator of variance (Olofsson 2019). The uncertainty of the land cover change (deforestation) is 27.31%.

Forest Degradation

Description of the parameter including the time period covered (e.g. forest-cover change between 2006-2016 or transitions between forest categories X and Y between 2006-2016):	Area of degradation, change of primary forest into secondary forests between 2006-2009, 2009-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, and 2015-2016 that occurred in all forested land. The land use transition matrices between these periods are generated to estimate the change of area from Primary forests to Secondary Forests.
Explanation for which sources or sinks the parameter is used (e.g. deforestation or forest degradation):	Degradation
Data unit (e.g. ha/yr):	Ha/yr
Value for the parameter:	This data is an aggregation of the degradation of the three natural forest classes (Dry land forest, swamp forest and mangrove forest)

	<table><tr><th>Period</th><th>Production forest (ha)</th></tr><tr><td>2006-2009</td><td>39,723.67</td></tr><tr><td>2009-2011</td><td>8,865.46</td></tr><tr><td>2011-2012</td><td>2,778.53</td></tr><tr><td>2012-2013</td><td>1,065.34</td></tr><tr><td>2013-2014</td><td>8,505.32</td></tr><tr><td>2014-2015</td><td>65,834.93</td></tr><tr><td>2015-2016</td><td>14,201.14</td></tr></table> Detail data can be see on sheet 'AD_EF_DEG_XXXX' on file *fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx . XXXX ini year eq. 0609, 0911, etc.* https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-) processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	National Forest Monitoring System (NFMS) named Simontana (*Sistem Monitoring Hutan Nasional*) (MoFor, 2014). It is available online at https://nfms.menlhk.go.id/, which coupled with webGIS at https://sigap.menlhk.go.id/ for display and viewing. The two websites are part of the geospatial portal under the one map policy. The description of methods for data derived from remote sensing images including type of sensors and the details of the images used can be found https://jurnal.ugm.ac.id/ijg/article/view/12496/9041
Spatial level (local, regional, national or international):	Regional (Province)
Discussion of key uncertainties for this parameter:	Two main sources of uncertainties are from image processing and interpretation of land cover types from the image (depend on quality of satellite images, method of land cover map generation process; uncertainty of land cover) and from land cover changes (uncertainty of land cover changes).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	The estimation of uncertainty follows stratified estimation (Olofsson *et al*. 2013) using 880 samples. This replaced the post-stratified estimation previously used. The uncertainty of the land cover change (degradation) is 85.14%.

Fire on stable forest

The estimation of burnt area follows the method developed by MRI (2013) that was applied by the REDD+ demonstration activity project in Central Kalimantan. There are three steps of the analysis to estimate the burnt area from the hotspot data (Figure 8.3). First, MODIS hotspot data are compiled annually and data with a confidence level of more than 80% are selected. Second, a raster map with 1×1 km grid (pixel size) is generated and overlaid on top of the hotspot data. Pixels without hotspots are considered as not burned and excluded from the activity data. Each 1km ×1 km (100 ha) pixel

with at least one hotspot is considered as burned but with the assumption that the burned area is 76.9% of the pixel area (76.9 ha). This rule applies for each pixel regardless of the number of hotspots within a particular pixel. Third, these burned areas were overlaid with the land cover map of 2016 to identify fires in stable secondary forest class. The calculation only on the stable secondary forest is for avoiding double counting of emission when the burnt secondary forest that occurred during the reference period is subsequently deforested. The calculation of fire emission is confined to secondary forest as carbon loss from forest fire in primary forest is captured in emission from the loss of carbon from the change of land cover from Primary to Secondary forests. It should be noted for the future that for forest areas that have been affected by fire during the reference period, when they are exposed to deforestation, the estimation of the emission during the reporting period should use separate emission factors.

Description of the parameter including the time period covered (e.g. forest-cover change between 2006-2016 or transitions between forest categories X and Y between 2006-2016):	Area of secondary forest affected by fires in 2006, 2009, 2011, 2012, 2013, 2014, 2015, and 2016. Burnt area estimated from Hotspot data, derived from NASA FIRMS (https://earthdata.nasa.gov/firms)
Explanation for which sources or sinks the parameter is used (e.g. deforestation or forest degradation):	Forest degradation. This is to estimate the loss of above ground biomass of the stable secondary forest due to fire.
Data unit (e.g. ha/yr):	Ha
Value for the parameter:	This data is an aggregation of the three secondary forest classes (Dry land forest, swamp forest and mangrove forest).

Year		Burnt Area (ha)
2007	2002	280.39
	20041	0
	20051	0
2008	2002	135.32
	20041	0
	20051	0
2009	2002	670.94

		20041	3.93
		20051	126.38
	2010	2002	222.17
		20041	0
		20051	21.22
	2011	2002	434.68
		20041	12.96
		20051	63.30
	2012	2002	1,216.04
		20041	11.83
		20051	30.00
	2013	2002	695.31
		20041	0
		20051	1.95
	2014	2002	1,577.89
		20041	4.19
		20051	0
	2015	2002	0.04
		20041	0.01
		20051	0
	2016	2002	1,179.18
		20041	395.23
		20051	115.51

Detail data can be see on sheet 'FireStableForest' on file *fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx* .
https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx

Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-) processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	Hotspot data, derived from NASA FIRMS (https://earthdata.nasa.gov/firms). Method for estimating the burnt area uses semi-automatic approach that replace the MRI (2013) method. In this approach, the burnt area is initially determined using point density analysis of hotspot data (with ≥80% confidence level) from spatial analyst tools and then followed by visual analysis using composite RGB of band 654 for LANDSAT TM 8 and composite RGB of band 543 for LANDSAT TM 5 supported by burnt data and ground check.

Spatial level (local, regional, national or international):	Regional (Province)
Discussion of key uncertainties for this parameter:	Key uncertainty comes from the processing of Hotspot data and selection of confidence level of the Hotspot data for this analysis, which is >80%, and processing of image and interpretation of burnt area.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Uncertainty level is about 15% (based on the analysis to fire data of 2014). The uncertainty of burnt area was calculating following Olofsson et al. (2013, 2014).

Activity Data for peat burn areas in deforested forest after 2006

The estimation of peat burn area follows the same method as the estimation of Activity Data for additional forest degradation in secondary forest from fire. However, in the third step the overlay of burned areas was done with the land cover and peat land map (produced by MoA) to identify the type of land cover being affected by the fire. The method for estimating burnt area has been improved from the previous method from MRI (2013) by combining the hotspot data with the Landsat image (quick look original with composite band 645) and fire control activity that is able to delineate the burnt area and supervised by other data (e.g. fire control activity and ground check). The technical guidance for the estimation of burnt area is regulated under the Regulation of Director General of Climate Change Number P11/2018. Comparison of the two methods in estimating peat burnt area can be seen in Rossita et al. (2019). The MRI tends to be overestimated.

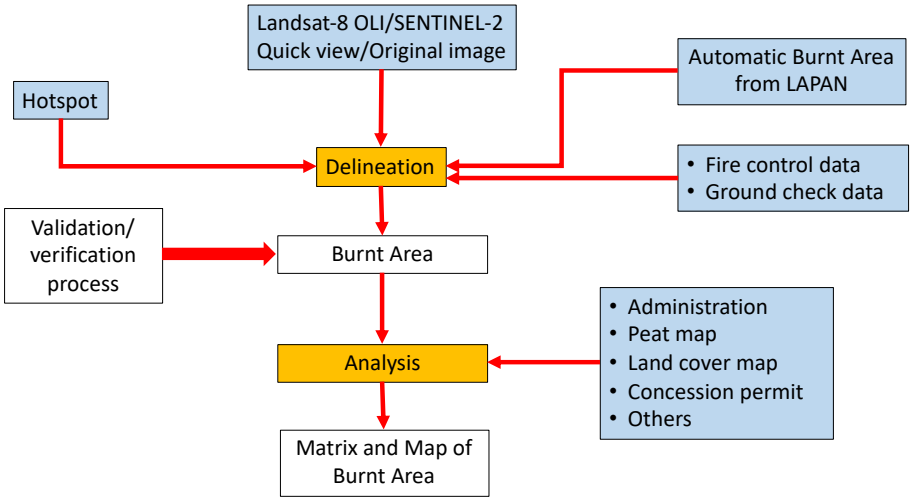


Figure 8.1 Method for estimating burnt area from hotspot data (MoEF, 2021)

<table>
<tr><td>Description of the parameter including the time period covered (e.g. forest-cover change between 2006-2016 or transitions between forest categories X and Y between 2006-2016):</td><td>Area of peat deforested after 2006 affected by fires in the period 2006-2016. Burnt area estimated from Hotspot data, derived from NASA FIRMS (https://earthdata.nasa.gov/firms)</td></tr>
<tr><td>Explanation for which sources or sinks the parameter is used (e.g. deforestation or forest degradation):</td><td>Deforestation. This is to estimate the emission from the loss of peat due to fire in non-forested land that was deforested after 2006.</td></tr>
<tr><td>Data unit (e.g. ha/yr):</td><td>Ha</td></tr>
<tr><td>Value for the parameter:</td><td><table><tr><td>Year</td><td>Burnt peat (ha)</td></tr><tr><td>2013</td><td>322.79</td></tr><tr><td>2014</td><td>-</td></tr><tr><td>2015</td><td>395.05</td></tr><tr><td>2016</td><td>674.14</td></tr></table>
Detail data can be see on sheet ‘PeatDefFire’ on file fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx .
https://mrv.kaltimprov.go.id/storage/guest/ERMR1/CarbonAccounting/fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx</td></tr>
<tr><td>Source of data (e.g. official statistics) or description of the method for developing the data, including</td><td>Hotspot data, derived from NASA FIRMS (https://earthdata.nasa.gov/firms). Method for estimating the burnt area follows the method described in the Regulation of Director General of Climate Change Number P11/2018.</td></tr>
</table>

(pre-) processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	
Spatial level (local, regional, national or international):	Regional (Province)
Discussion of key uncertainties for this parameter:	Key uncertainty comes from the processing of Hotspot data and selection of confidence level of the Hotspot data for this analysis, which is >80%
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation	Uncertainty level 13.25%. This is combined uncertainties of accuracy estimates of land cover classification estimated using Olofsson (2014, 2019) for stable non forest (8.7%) and that of sample burnt area (10%).

Emission Factors

Emission Factors from deforestation and degradation from change in land use/land cover class

ESTIMATES OF C/HA FOR FOREST CLASSES

The main sources of data used to derive emission factors for six forest types is from Permanent Sample Plots (PSP) established in East Kalimantan. Technical correction for the emission factors was conducted for the dryland forest and mangrove forest through the increase number of sample and change of allometric equations. For the dryland forest, the sample are taken from PSPs of the National Forest Inventory (NFI), while for swamp and mangrove forest, they are from PSPs established in 2016-2019 under FCPF Readiness program (the ones established in 2019 are additional plots for increasing number of sample of mangrove only as part of technical correction). Sample from the PSPs in the dryland forest developed under the FCPF Readiness program are not used in the estimation of the EF since the design of the FCPF plots are not the same as that of NFI. The number of PSPs of the NFI in East Kalimantan are much larger than that of the FCPF, while for the other two forest types the number of NFI plots are very limited.

The establishment of the Permanent Sampling Plot (PSP) for carbon measurement in East Kalimantan under the FCPF Readiness program follows stratified random sampling in which the locations are selected based on Ministry of Environment and Forestry land cover map. The method used for data collection is based on Indonesian National Standard (SNI) 7724:2011 regarding forest carbon accounting. The size of each plot is 20mx20m, and within the plot there are 3 nested plots with the size of 10mx10m, 5mx5m and 2mx2m (Figure 8.4). For aboveground carbon measurement, we collected vegetation data from seedlings (diameter < 2cm), saplings (diameter 2 cm to < 10cm), poles (DBH 10cm to < 20 cm) and trees (DBH ≥ 20cm). Seedlings data was collected in 2x2m sub plot, saplings in 5x5m sub plot, poles in 10x10m sub plot and trees in 20x20m sub plot. Species name and diameter of each individual found within the plots were recorded. The wood density for each sample tree is taken from species wood density database develop by ICRAF (http://db.worldagroforestry.org/wd). Summary of the sample trees is presented in Table 8.8.

A. Number of Permanent Sampling Plots (PSPs)			
Land cover types	**Number of PSP**	**Data summary**	**Location**
Primary swamp forest	18	Max D: 109.6 #genus: 20	Muara Siran; Genting Tanah
Secondary swamp forest / logged forest	42	Max D: 109 #genus: 23	Muara Siran; Penyinggahan Melak; Genting Tanah; Sebelimbingan
Primary mangrove forest	37+43	Max D: 76.8 #genus: 5	Delta Mahakam; BTNK
Secondary mangrove forest / logged forest	23+11	Max D: 89.2 #genus: 7	Delta Mahakam; CA Teluk Adang; PT. Inhutani I Batu Ampar; BTNK
Total A	**243**		
B. Number of NFI's Permanent Sampling Plots in the dryland forests and shrubs along with maximum D and number of species observed			
Land cover types	**Number of PSP**	**Data summary**	**Location**
Primary dry land forest	79	Max D: ? #genus: ?	Distributed throughout the province systematically in grids
Secondary dry land forest/logged forest	408	Max D: ? #genus: ?	Distributed throughout the province systematically in grids
Dry shrubs	7	Max D: ?	Scattered
Wet shrubs	6	Max D: ?	Scattered
Total B	**500**		
Total A+ B	**743**		

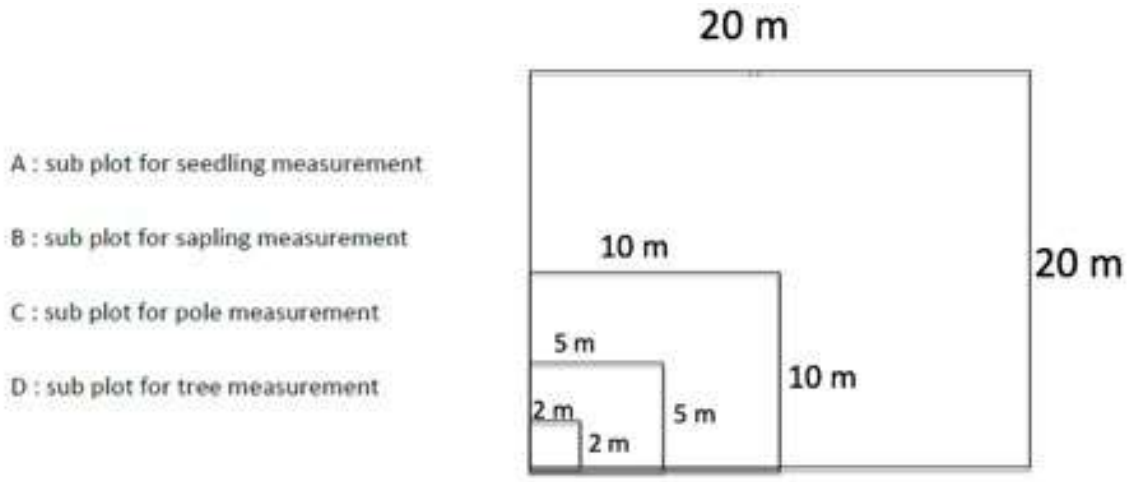


Figure 8.2 The design of permanent sample plot (PSP) in East Kalimantan

The NFI plots was primarily designed for conducting forest resource assessment at national scale initiated in 1989. The establishment of the NFI was supported by the Food and Agriculture Organization of the United Nations (FAO) and the World Bank. Sample plots are distributed systematically on 20x20 km, 10x10 km and 5x5 km grids across the country. Each cluster consists of a permanent sample plot (PSP) with a size of 100x100m surrounded by 8 temporary sample plots (TSP). Individual trees within the 1-ha PSP were measured within 16 recording units (RU) as numbered 25x25m sub-plots. Biomass estimation only includes PSP data. Since the main purpose of NFI was to monitor forest resources, data to generate timber volume or stocks were strongly required. These includes species name (local name), tree diameter at breast height or above buttress, tree height and bole height and buttress height. The quality of the trees was also recorded for both stem and crown quality. All trees measured in PSP according to the size class:

- Sub plot circle with radius = 5 m for measuring dbh between 5 cm – 19.9 cm
- All trees inside the recording unit with dbh > 20 cm are measured

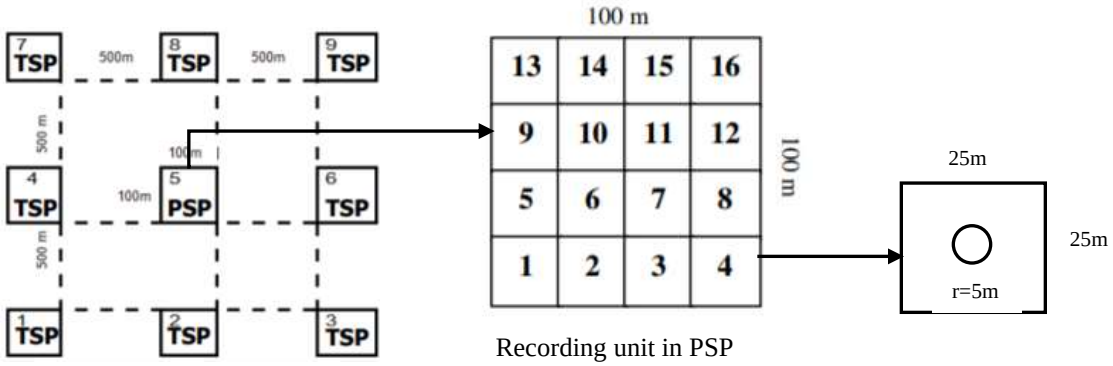


Figure 8.3. The design of permanent sample plots

East Kalimantan has published, peer reviewed biomass equations for the three forest types (Basuki 2009 for dry forest; Manuri 2014 for peat swamp forest; and Komiyama 2005 for mangrove forest). In order to decide whether or not to use the local equations, we considered several factors including the sample domain and forest type where the sample was collected; the sample size; and the maximum diameter included in the sample. Based on the assessment of the allometric equations

considering those aspects, it was found that the use of Basuki et al. (2009) equation for estimating the biomass of dryland forest tend to be bias (Manuri et al., 2016). The estimates of biomass using Basuki et al. equation are overestimated for small trees and underestimated for large trees. Improved allometric equations should use large sample with large diameter range.

The Chave equation clearly has the largest sample size, but this sample is an aggregate from all tropical regions of the globe and all forest types and may not well reflect the specific sample population of East Kalimantan. The three local biomass equations are much more specifically targeted to the specific populations of interest for East Kalimantan. The local equations also included higher diameter trees in the sample compared to Chave. This last factor is very important because extrapolation of a biomass equation beyond the range of its data can quickly lead to biased results. In general the Chave equation yielded higher estimates of the local equations; the difference was small within the range of D of the Chave data (up to about D=160), but Chave departed (increased) quite dramatically for higher diameters.

Specific allometric equations for Indonesia lowland (dryland) forests have been developed (Manuri etal, 2017) using 1300 sample representing large range of diameter and all major islands in Indonesia and Malaysia (Figure 8.6). These samples include the samples from Indonesia used in Chave etal, 2014 equations development, totalling of more than 30% of the samples. Manuri et al. (2017) provides various option of equation selection for accommodating available forest inventory data. Tree diameter and species name are the most common data collected during field inventory in Indonesia. Thus using the equation with diameter (D) and wood density (G) variables is recommended. In addition, Manuri et al. (2017) also found that region variable (East, Center and West) explains the variation of the AGB and Kalimantan situated in West Region.

This information is summarized in the table below:

	Equation source					
Attribute	Chave 2005	Basuki 2009	Manuri 2014	Komiyama 2005	Manuri et al. 2016	Manuri et al. 2017
Sample Domain	Global, pan-tropical	E Kalimantan	Sumatra and W Kalimantan	Indonesia	Kalimantan	Indonesia
Forest type	pan tropical	low dipterocarp	peat swamp	Mangrove	Low dipterocarp	Low dipterocarp
Sample size (trees)	2,410	122	148	104	108	1300
Max D(cm)	156	200	167	55	172	172

Based on this analysis we believe that the local equations are more suited for application in the ERPD and so have used these to generate estimates of AGB for calculating Emission Factors. The estimation of the carbon stock of the above ground biomass of the six forest-types uses local allometric models, i.e.

- Dryland forest (Manuri et al., 2017)
  $AGB = 0.167 \times DBH^{2.56} \times WD^{0.889}$ (Equation 2)

- Swamp forest (Manuri et al., 2014)
  $AGB = 0.242 \times DBH^{2.473} \times WD^{0.736}$ (Equation 3)

- Mangrove forest (Komiyama et al., 2005)
  $AGB = 0.251 \times WD \times DBH^{2.46}$ (Equation 4)

To convert AGB (t/ha) to C (t/ha) for each forest types, carbon fraction of 0.47 is used as suggested by the IPCC 2006 (C = 0.47 * AGB).

The below ground biomass (BGB) for dry forest is estimated using root-shoot ratio from the IPCC GPG LULUCF (Table 3A.1.8. page 3.168). The value of the ratio is 0.24 for dry forest. For mangrove forest the value is 0.36 based on measurement reported in Komiyama et al., 2005 for mangrove forest in Indonesia. For swamp forest is assumed to be the same as that of mangrove forest in Indonesia.

ESTIMATES OF C/HA FOR NON-FOREST CLASSES

The data source for the carbon stock of non-forest lands is derived from mainly Indonesian literatures (Annex 8.3.). The below ground biomass (BGB) of non-forest classes is also estimated using root-shoot ratio based on IPCC default values (IPCC GPG GL for LULUCF page 3.168 table 3A.1.8). The values of the ratio vary between land cover types, i.e. 0.32 for forest plantation and estate crops), 0.48 for dry and wet shrubs, mix dryland agriculture and transmigration area, and 1.58 for savanna/grassland, pure dryland agriculture, rice paddy, bare ground and settlement.

Description of the parameter including the forest class if applicable:	Emission Factor for deforestation and forest degradation, i.e. living biomass (AGB+BGB) of the six forest classes, primary and secondary dryland forests; primary and secondary swamp forests; primary and secondary mangrove forests; and non-forest lands
Data unit (e.g. t CO_2/ha):	Ton C/ha
Value for the parameter:	**Forest lands**

Land cover	Code	C stock (t C/ha)
Primary dryland forest	2001	167.3
Secondary dryland forest	2002	122.1
Primary swamp forest	2005	343.9
Secondary swamp forest	20051	237.3
Primary mangrove forest	2004	168.2
Secondary mangrove forest	20041	118.1

Non-forest lands

Land cover	Code	C stock (t C/ha)
Plantation forest	2006	82.6
Dry shrub	2007	28.8
Wet shrub	20071	32.4
Savanna and Grasses	3000	7.2

Pure dry agriculture	20091	19.4
Mixed dry agriculture	20092	33.3
Estate crop	2010	65.6
Paddy field	20093	11.4
Transmigration areas	20122	14.8
Fish pond/aquaculture	20094	0
Bare ground	2014	6.5
Mining areas	20141	0
Settlement	2012	10.3
Port and harbor	20121	0
Open water	5001	0
Open swamps	50011	0

Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	The primary data source for the carbon stock of dryland forest is derived from the measurement of AGB from the Permanent Sampling Plots (PSPs) in East Kalimantan under National Forest Inventory (NFI) and those of swamp and mangrove forests are from PSPs under the FCPF. The carbon stock data used are total of above ground (AGB) and below ground biomass (BGB). The estimation of AGB used local allometric equations (Manuri et al., 2015 for swamp forests; Manuri et al., 2017 for dryland forest; Komiyama et al., 2005 for mangrove. The below ground biomass (BGB) is estimated using root-shoot ratio from the IPCC GPG LULUCF (Table 3A.1.8. page 3.168). The value of the ratio is 0.24 for primary forest. For mangrove forest the value is 0.36 based on measurement from Komiyama et al., 2005. For swamp forest is assumed to be the same as that of mangrove. The data source for the carbon stock of non-forest lands is derived from mainly Indonesian literatures, except for shrubs are from the National Forest Inventory (NFI). The below ground biomass (BGB) is also estimated using root-shoot ratio based on IPCC default values (IPCC GPG GL for LULUCF page 3.168 table 3A.1.8). The values of the ratio vary between land cover types, i.e. 0.32 for forest plantation and estate crops), 0.48 for dry and wet shrubs, mix dryland agriculture and transmigration area, and 1.58 for savanna/grassland, pure dryland agriculture, rice paddy, bare ground and settlement.
Spatial level (local, regional, national or international):	Regional (Kalimantan island)
Discussion of key uncertainties for this parameter:	Key uncertainty comes from (1) sampling error (between 13 to 31%), (2) allometric model (27%-31%), (3) biomass conversion factor to carbon (5.3% Table 4.3 of the 2006 IPCC) and (5) root:shoot ratio (based on the IPCC GPG for LULUCF. And

	measurement, i.e. between 9% & 32%; See Annex 12.1 for details).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Method to estimate the uncertainty of the living biomass is using error propagation: sqrt(U_1^2+ U_2^2+ …+U_n^2), the subscript 1, 2, … n are uncertainties for source of error 1th, 2nd etc. respectively. For forests **Land cover** / **Code** / **Uncertainty (%)** Primary dryland forest / 2001 / 39.97 Secondary dryland forest / 2002 / 39.49 Primary swamp forest / 2005 / 38.25 Secondary swamp forest / 20051 / 40.91 Primary mangrove forest / 2004 / 29.79 Secondary mangrove forest / 20041 / 30.94 For non-forests **Land cover** / **Code** / **Uncertainty (%)** Plantation forest / 2006 / 22.5 Dry shrub / 2007 / 44.9 Wet shrub / 20071 / 52.8 Savanna and Grasses / 3000 / 44.9 Pure dry agriculture / 20091 / 35.5 Mixed dry agriculture / 20092 / 44.9 Estate crop / 2010 / 23.3 Paddy field / 20093 / 35.5 Transmigration areas / 20122 / 44.9 Bare ground / 2014 / 35.5 Settlement / 2012 / 35.5

Emission factors from fire in secondary forest

Description of the parameter including the forest class if applicable:	Emission Factor for biomass fire
Data unit (e.g. t CO_2/ha):	t CO_2e/ha
Value for the parameter:	

Forest Cover		EF_CO2	EF_CH4_ CO2	EF_N2O_ CO2
Secondary Dryland	2002	147.72	13.35	5.8
Secondary swamp	20051	287.14	25.95	11.27
Secondary mangrove	20041	142.93	12.92	5.61

The value is estimated from the multiplication of MB, C_f, G_{ef} for CO_2, N_2O and CH_4 (see equation 7), and GWP. GWP for C)2, CH4 and N2O are 1, 21 and 310 respectively.

Source of data or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	2006 IPCC Guideline (Table 2.5 and 2.6 of IPCC 2006 Vol 4-CH2 Table 2.6)
Spatial level:	Regional (province)
Discussion of key uncertainties for this parameter:	Key of uncertainty is error in estimating the amount of biomass available for burning, combustion factor and EFs of three gases (CO_2, CH_4 and N_2O).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	

Forest Cover	Code	U M_B	U C_f	U CO_2	U CH_4	U N_2O	U_{Pooled}
Secondary Dryland	2002	39.49	16,67	8.29	27.94	35.0	62.54
Secondary swamp	20051	40.91	16.67	8.29	27.94	35.0	63.45
Secondary mangrove	20041	30.94	16.67	8.29	27.94	35.0	57.53

8.3.1 ***Emission Factors from Peat fires***

Description of the parameter including the forest class if applicable:	Emission Factor for peat fire
Data unit (e.g. t CO_2/ha):	t CO_2e/ha burnt area
Value for the parameter:	756 t CO_2e/ha. The value is estimated from the summation of the result of the multiplication of MB, C_f, and G_{ef} for CO_2 and CH_4 (see equation 8)
Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4 IPCC 2013_Supplement Wetland (Table 2.6 and Table 2.7 of the 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, page 2.40 and 2.41).
Spatial level (local, regional, national or international):	Regional (province)
Discussion of key uncertainties for this parameter:	Key of uncertainty is error in estimating the amount of biomass available for burning, combustion factor and EFs of three gases (CO2, and CH4).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Uncertainty level is 66.5% (Pooled uncertainty based on confidence interval EF of Tables 2.6 and 2.7 of the 2013 Supplement to the 2006 IPCC Guidelines, $U_{Polled} = \sqrt{(U_{CO2}^2+U_{EF\text{-}CH4}^2)}$

Emission Factors from soil

EMISSION FACTORS FROM PEAT SOILS

Peat emissions happen slowly over time once land is cleared for a number of years depending on the depth of the peat soil. Thus the emissions in any given year is the sum of emissions from all peat lands disturbed over the previous years. These emissions from prior year deforestation are called 'inherited emissions' (e.g. Agus et al., 2011). This means that total emissions from peat decomposition is defined as accumulation of peat emissions from forested lands starting with the Reference Period base year of 2006 onward.
The procedures of calculating peat decomposition from deforestation follow three steps as shown in

Figure 8.6. First is defining natural forest in 2006 over peat land, and then step 2 is generating land cover change from each interval year to define a transition area matrix for the associated year of interval. The third step is calculating total annual emissions by multiplying the transition matrix of both areas and associated emission factors[2].

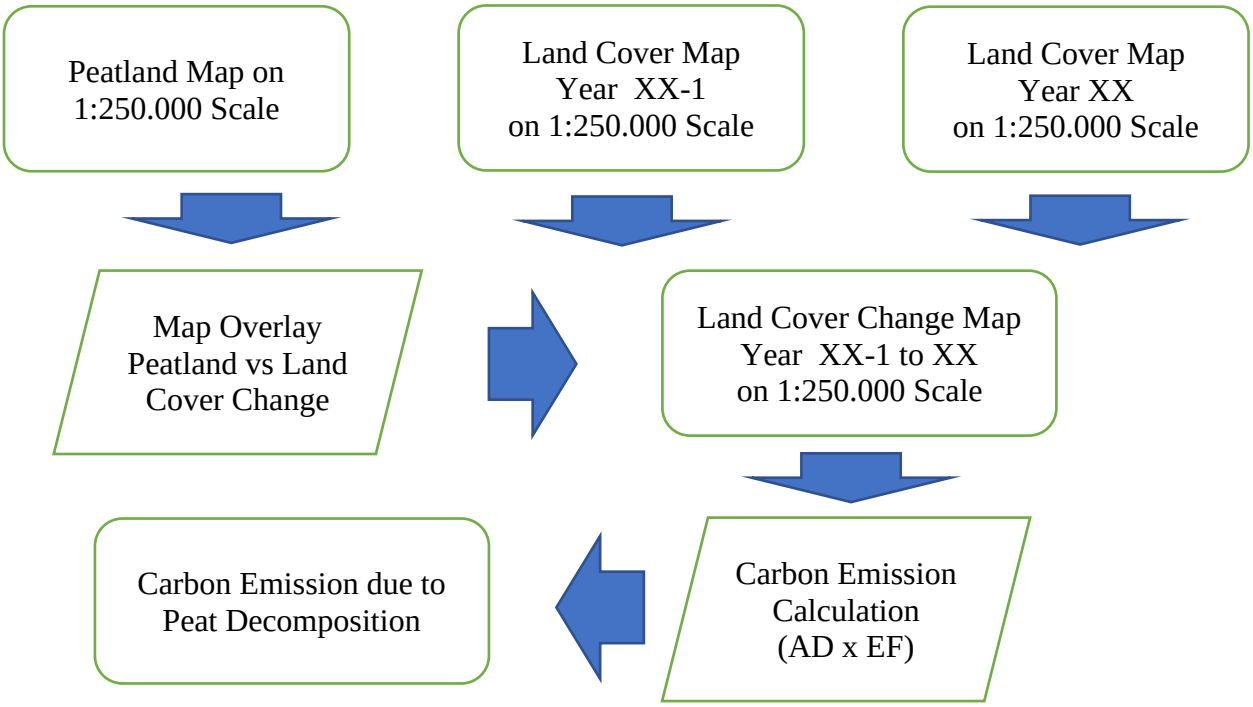


Figure 8.4 Flow chart for calculation of emissions from peat decomposition

The emissions from peat decomposition do not continue indefinitely, as they cease when the peat has completely decomposed or reached the water table. For the purpose of the ER Program, the time frame ends in 2024 by which time the peat will not be completely decomposed and should not thus affect the calculation. On average, the rate of loss of peat due to decomposition after drainage is about 5.6 cm per year in secondary forest (Maswar and Agus, 2015). After a period of 5 years of drainage in acacia and oil palm plantations, the rates appear to stabilize at around 5 cm per year (Hooijer et al, 2012). With an average peat depth of more than 2 m, it will thus take about 40 years to decompose the peat. By reference to the existing data on peat depth in Sumatra and Kalimantan, it appears that peat depth of deforested areas in Indonesia is generally more than 2 m (Ritung et al. 2011). A refinement of the peat depth map particularly in deforested areas is required for the development of the Reference Level beyond 2024.

Description of the parameter including the forest class if applicable:	Emission Factor for peat decomposition
Data unit (e.g. t CO_2/ha): **Value for the parameter:**	Ton CO2/ha/year

Land cover	Code	EF (t CO_2/ha/yr)
Primary forest	2001, 2004, 2005	0
Secondary forest	2002, 20041, 2051	19
Plantation forest	2006	73
Estate crop	2010	40
Pure dry agriculture	20091	51
Mixed dry agriculture	20092	51
Dry shrub	2007	19
Wet shrub	20071	19
Savanna and Grasses	3000	35
Paddy Field	20093	35
Open swamp	50011	0
Fish pond/aquaculture	20094	0
Transmigration areas	20122	51
Settlement areas	2012	35
Port and harbor	20121	0
Mining areas	20141	51
Bare ground	2014	51
Open water	5001	0
Clouds and no-data		Nd

Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	Paciornik and Rypdal (2006) and IPCC (2014). These emission factors are reported in 2013 Supplement Guideline to 2006 IPCC Guidelines for National GHG Inventory: Wetlands. Most of the data reported in this guideline come from Indonesian sites.
Spatial level (local, regional, national or international):	National
Discussion of key uncertainties for this parameter:	Key uncertainty comes from sampling error (number of sampling, timing of sampling, length of the time between sampling taken to processing in laboratory).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	The uncertainty is taken from the 2013 supplement for 2006 IPCC Guideline (IPCC, 2014)

Land cover	Code	Uncertainty (%)
Primary forest	2001, 2004, 2005	0.0

Secondary forest	2002, 20041, 2051	84.2
Plantation forest	2006	20.5
Estate crop	2010	55.0
Pure dry agriculture	20091	86.3
Mixed dry agriculture	20092	86.3
Dry shrub	2007	84.2
Wet shrub	20071	84.2
Savanna and Grasses	3000	108.6
Paddy Field	20093	108.6
Open swamp	50011	0.0
Fish pond/aquaculture	20094	0.0
Transmigration areas	20122	86.3
Settlement areas	2012	108.6
Port and harbor	20121	0.0
Mining areas	20141	86.3
Bare ground	2014	86.3
Open water	5001	0
Clouds and no-data		Nd

EMISSION FACTORS FROM MANGROVE SOILS

Description of the parameter including the forest class if applicable:	Emission Factor for mangrove soil and abandoned shrimp pond
Data unit (e.g. t CO_2/ha):	Ton C/ha
Value for the parameter:	902.91 (mangrove) 487.31 (abandoned shrimp pond) EF = 415.6
Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	Data on the soil carbon of mangrove and abandoned pond is taken from Kauffman *et al.* (2017) based on measurement from the 20 locations in East Kalimantan. The procedure for the sampling is described in Kauffman et al. (2016)
Spatial level (local, regional, national or international):	National

Discussion of key uncertainties for this parameter:	Key uncertainty comes from sampling error.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Uncertainty level 33.4%. The estimation of uncertainty is provided in Annex 12.1.

8.4 Estimated Reference Emission Level

ER Program Reference level

Crediting Period year *t*	Average annual historical emissions from deforestation over the Reference Period (tCO_{2-e}/yr)	If applicable, average annual historical emissions from forest degradation over the Reference Period (tCO_{2-e}/yr)	If applicable, average annual historical removals by sinks over the Reference Period (tCO_{2-e}/yr)	Adjustment, if applicable (tCO_{2-e}/yr)	Reference level (tCO_{2-e}/yr)
2019	23,949,437.31	3,520,419.08			27,469,856.40
2020	23,949,437.31	3,520,419.08			27,469,856.40
2021	23,949,437.31	3,520,419.08			27,469,856.40
2022	23,949,437.31	3,520,419.08			27,469,856.40
2023	23,949,437.31	3,520,419.08			27,469,856.40
2024	23,949,437.31	3,520,419.08			27,469,856.40

Calculation of the average annual historical emissions over the Reference Period

The reference level is calculated using: [average of deforestation (living biomass, mangrove soil, and fires on peat) in the reference year (2006-2016) added with peat decomposition of the deforested area in 2017-2018[, then added with [average of forest degradation (living biomass, fires in stable forest) in the reference year (2006-2016) added to peat decomposition in degraded areas in 2017-2018].

Period	Deforestation	Forest Degradation	Total
2006-2007	22,265,406.41	2,203,162.16	24,468,568.63
2007-2008	22,265,406.41	2,203,162.16	24,468,568.63
2008-2009	22,265,406.41	2,203,162.16	24,468,568.63
2009-2010	11,283,098.47	735,459.61	12,018,558.04
2010-2011	11,283,098.47	735,459.61	12,018,558.04
2011-2012	34,372,668.98	461,002.08	34,833,671.06
2012-2013	29,557,250.31	426,479.08	29,983,729.39
2013-2014	9,655,366.26	1,438,282.73	11,093,648.99
2014-2015	26,845,754.93	11,156,226.95	38,001,981.88

Period	Deforestation	Forest Degradation	Total
2015-2016	40,793,227.35	2,356,430.72	43,149,658.07
Average (2006-2016)	24,967,538.96	2,682,434.76	27,649,973.72
Peat decomposition (2017-2018)	55,852.41	987,517.06	1,043,369.48
Reference Level	24,967,538.96	2,682,434.76	27,649,973.72

8.5 Upward or downward adjustments to the average annual historical emissions over the reference period

Explanation and justification of proposed upward or downward adjustment to the average annual historical emissions over the Reference Period

Considering the unique case of accumulating emissions from peat soil over time, Indonesia in the January 2019 ERPD, proposed the inclusion of a slight upward adjustment above average annual historical emissions over the reference period. This was intended to account for the fact that (1) emissions from peat forests which had been deforested or degraded during the reference period would continue at levels equal to the end of the period, which is higher than the average of the reference period, and (2) future baseline deforestation or degradation projected during the ER period in peat forests will also have future cumulative emissions.

As Indonesia does not meet the qualifications for an upward adjustment as outlined in the Methodological Framework, and the Methodological Framework does not otherwise consider the uniqueness of peat forests, the CFPs agreed to provide a one-time waiver to Indicator 13.1 of the Methodological Framework, but Indonesia has to revise the approach used to estimate the emission from peat decomposition by applying the estimate of the most recent emission from peat decomposition not later than 2018. The implications of this decision for the final Reference Emission Level is that the estimated emissions from peat degradation will increase from 975.631 tCO_2e/yr (the average over the reference period) to 1,036,236 tCO_2e in 2017 and 1,043,684 tCO_2e in 2018, staying constant for years after 2018.

Thus, the projected reference level of this ERP for the peat decomposition is presented in Figure 8.9. The CFPs and Indonesia note that this decision is specific to this ER-Program and does not imply precedent for any program under the Carbon Fund or in Indonesia.

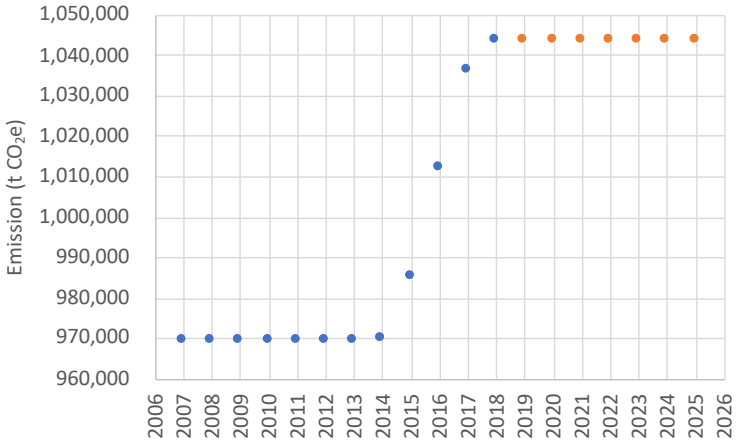


Figure 8.5 Projected emission from peat decomposition to 2025 taking into account the inherited emission

Final Estimated Reference Emission Level for East Kalimantan

Quantification of the proposed upward or downward adjustment to the average annual historical emissions over the Reference Period

Crediting Period year *t*	Average annual historical emissions from deforestation over the Reference Period ($tCO_{2\text{-}e}$/yr)	If applicable, average annual historical emissions from forest degradation over the Reference Period ($tCO_{2\text{-}e}$/yr)	If applicable, average annual historical removals by sinks over the Reference Period ($tCO_{2\text{-}e}$/yr)	Adjustment, if applicable ($tCO_{2\text{-}e}$/yr)	Reference level ($tCO_{2\text{-}e}$/yr)
2019	23,949,437.31	3,499,274.76			27,448,712.07
2020	23,949,437.31	3,499,274.76			27,448,712.07
2021	23,949,437.31	3,499,274.76			27,448,712.07
2022	23,949,437.31	3,499,274.76			27,448,712.07
2023	23,949,437.31	3,499,274.76			27,448,712.07
2024	23,949,437.31	3,499,274.76			27,448,712.07

8.6 Relation between the Reference Level, the development of a FREL/FRL for the UNFCCC and the country's existing or emerging greenhouse gas inventory

The RL for the ER Program was developed using the same approach as that used for the national FREL which Indonesia submitted to the UNFCCC in 2016 (http://unfccc.int/resource/docs/2016/tar/idn.pdf), with some enhancements, notably (1) application of sample based area estimation for Activity Data, (2) use of region-specific forest inventory data rather than national averages, and (3) use of locally derived biomass estimation equations rather than global equations. The National FREL is the result of a process involving a series of initial technical analyses followed by public multi-stakeholder consultation. The procedure follows FCCC guidelines as detailed in the annex of

FCCC/CP/2013/10/Add.1 The two REDD+ activities included in the national FREL were *Deforestation* and *Forest Degradation*, consistent with Decision 1/CP.16, paragraph 70 and covering national forest. The reference period used in the National FREL is 1990 to 2012 (22 years; MoEF, 2015). The use of this long reference period is to better capture the dynamic land policies in Indonesia[52].
The ERP's RL uses a reference period of 10 years (2006-2016) in order to conformity with the Carbon Funds Methodological Framework. The activity data used in the development of the reference level begin with the same data used in the National assessment but have been enhanced by application of the sample based approach (Olofsson) to improve accuracy in estimation of AD. The RL also includes activities which are not included in the national REL, namely the inclusion of below ground biomass and soil carbon for mangroves. The estimation of emission from peat soil is also consistent with the national GHG gas inventory and national FREL. This consistency would be enhanced by CFP agreement to allow a small upward adjustment to the historical emission level, to account for the unusual National Circumstance of inherited emissions from peat deforestation and degradation.
The emission factors (AGB) used for the estimation of historical emission do not use the national data as GHG Inventory and national FREL. This ERP used local data based on measurement in a number of permanent sampling plots of NFI and that of the FCPF. Thus, this ERP used higher tier of emission factor as suggested by the IPCC. In addition, the ERP's RL take into account the carbon stock after the conversion in the calculation of emission from deforestation. It is expected that the ER Program will generate lessons that will contribute to the next submission of the national FRL/FREL, e.g. the addition of REDD+ activities, or the improvement of activity data and emission factors.

Indonesia's GHG Inventory is managed by the Directorate for GHG Inventory and MRV, which also maintains the national registry system. The ER Program (through the local Environmental Agency) will report on the emission reductions generated by the implementation of the ER Program to the national registry system (see Section 9 for details). The implementation of the ER Program will also provide inputs to the development of the national GHG Inventory.

At present, the estimation of the GHG emission from deforestation and forest degradation in the National GHG Inventory is not consistent with the ones used in the ERPD. In term of method, the GHG Inventory used gain and loss approach while the ERPD used the stock difference approach. In term of sources, the GHG Inventory also does not include soil-carbon emission from mangrove conversion as in the ERPD. The emission factors used in the GHG Inventory are also not similar to the ones in the ERPP, particularly for the above ground biomass. As mentioned above, the ERPD used local data, higher tier while GHG Inventory and National FREL used national data. In addition, some of conversion factors are also not consistent. The GHG Inventory used the one conversion factor for all forest types and also one conversion factors for all non-forest covers. In the case of ERPD, the conversion factors differ between types of forest and non-forest. Most of sources of uncertainties of the AD and EF are included in the ERPD while in the National FREL and the National GHG Inventory only part of the uncertainty sources. The ERPD also used higher tier of method for estimating the uncertainty, i.e. Monte Carlo, while National GHG Inventory used Tier 1 (error propagation approach). The Directorate for GHG Inventory and MRV plans to change the method from Gain and Loss to Stock Difference methods and to apply best practices used in the ERPD for the development of GHG Inventory. These efforts are to increase the consistency between the ERPD and the National GHG Inventory.

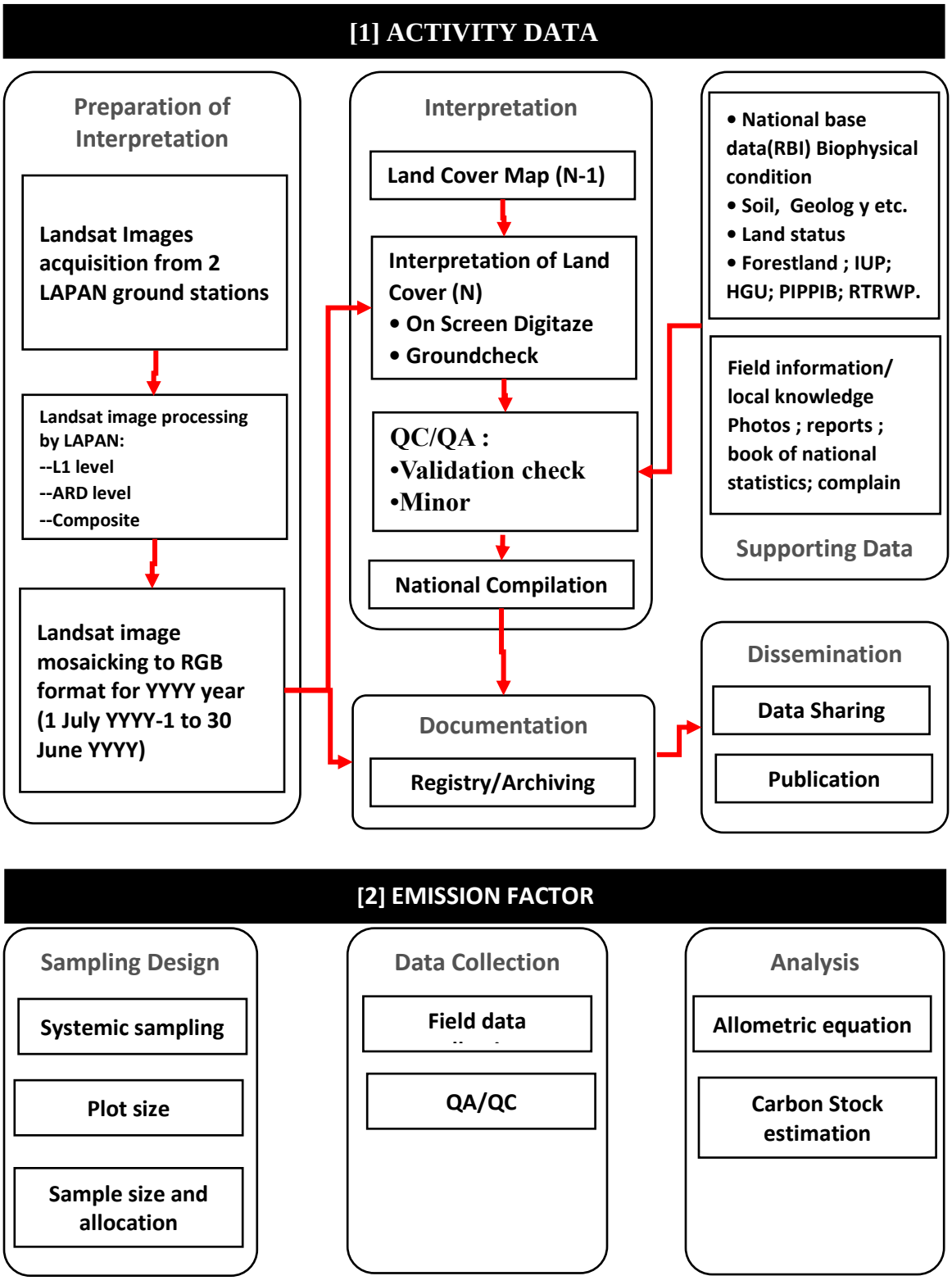
[52] MoEF, 2015, National Forest Reference Emission Level for REDD+ In the Context of Decision 1/CP.16 Paragraph 70, Directorate General of Climate Change. The Ministry of Environment and Forestry. Indonesia

9. APPROACH FOR MEASUREMENT, MONITORING AND REPORTING

The Ministry of Environment and Forestry regulation No.70/2017 includes guidance on MRV for REDD+. For example, the regulation states that measurement should take place at least twice a year (Article 10), that an independent verifier shall be used (Article 12), and that the system shall include a registry (Article 13). The ER Program's MRV design will conform to the regulation, and will involve an independent verifier in addition to verification by the Ministry of Environment and Forestry.

9.1 Measurement, monitoring and reporting approach for estimating emissions occurring under the ER Program within the Accounting Area

Line Diagram


[1] ACTIVITY DATA
Preparation of Interpretation
Landsat Images acquisition from 2 LAPAN ground stations
Landsat image processing by LAPAN:
--L1 level
--ARD level
--Composite
Landsat image mosaicking to RGB format for YYYY year (1 July YYYY-1 to 30 June YYYY)
Interpretation
Land Cover Map (N-1)
Interpretation of Land Cover (N)
• On Screen Digitaze
• Groundcheck
QC/QA :
•Validation check
•Minor
National Compilation
Documentation
Registry/Archiving
• National base data(RBI) Biophysical condition
• Soil, Geolog y etc.
• Land status
• Forestland ; IUP; HGU; PIPPIB; RTRWP.
Field information/ local knowledge Photos ; reports ; book of national statistics; complain
Supporting Data
Dissemination
Data Sharing
Publication
[2] EMISSION FACTOR
Sampling Design
Systemic sampling
Plot size
Sample size and allocation
Data Collection
Field data
QA/QC
Analysis
Allometric equation
Carbon Stock estimation

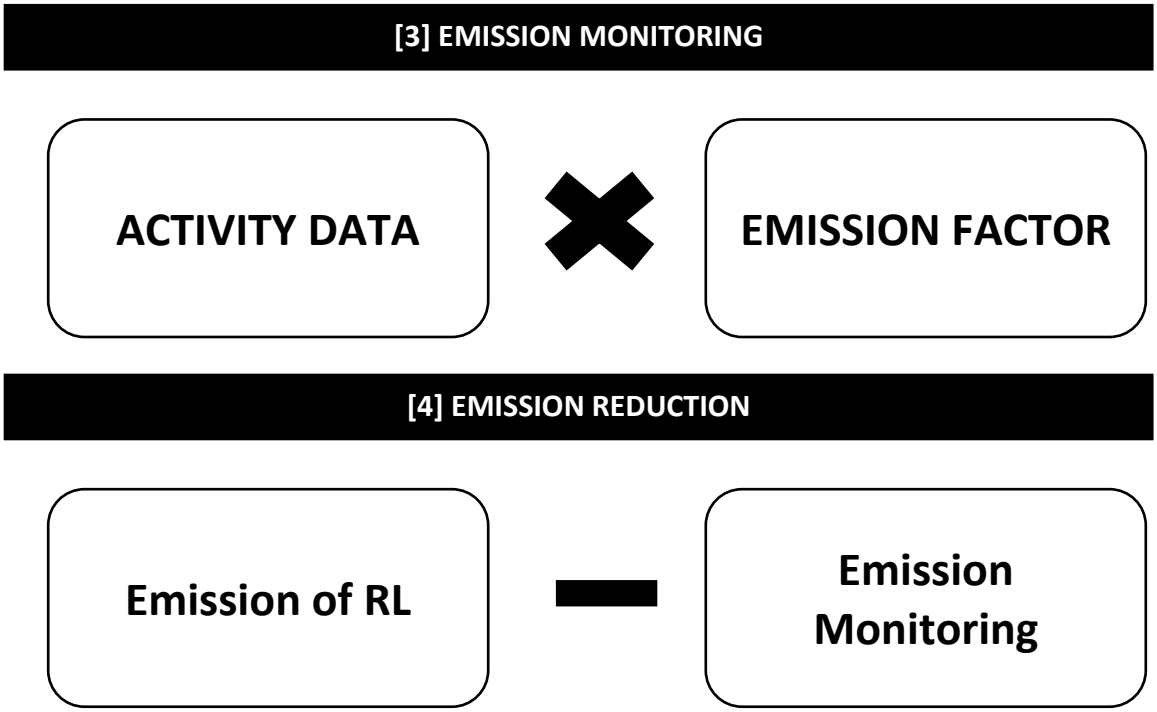


Figure 6. Flow chart for calculation of emissions from deforestation and forest degradation

Method for monitoring activity data and emission factors

The ER Program will apply methods for monitoring activity data and for estimating emission factors that are aligned with the approach used in developing Indonesia's FREL and that comply with established standards for the measurement of satellite imagery (LANDSAT) interpretation to estimate forest cover changes (SNI 8033:2014).[53] These standards have been defined in the annex of the Regulation of the Director General of Forest Planology Number P.1/VII- IPSDH/2015[54]. Technical guidelines for field observation and ground check procedure for land cover accuracy assessment can be seen in Annex 9.1. and Annex 9.2. of the 2019 ERPD, respectively.

Specifically:

1. Measurement of Activity Data for land cover change will continue to utilize the National Forest Monitoring System (NFMS) plus addition of the sample-based area estimation (i.e. Olofsson approach) to derive unbiased estimates of Activity Data when reporting during the ER program. This is the same process used for establishing the REL, with the addition of a stratified sampling approach and more sample locations in the future in order to ensure a minimum of 30 observations each for deforestation and degradation classes.
   Additionally the ER Program will collect Activity Data for fire areas using the same procedures utilized in developing the REL.

[53] Standar Nasional Indonesia (Indonesia National Standard) No. 8033 year 2014 regarding Method for Estimation of Forest Cover Changes based on Result of Visual Interpretation of Optical Remote Sensing Imagery.
[54] Perdirjen Planologi (2015).Pedoman pemantauan penutupan lahan (guidance for monitoring land cover change).http://appgis.dephut.go.id/appgis/download/Pemantauan%20Hutan%20Nasional/Perdirjen_Plano_2015_01_Pedoman_PSDH.pdf

2. Emission Factors for forest land classes will continue to be based on the forest inventory for East Kalimantan. There may be opportunity to increase sample sizes for the purpose of increasing precision. Methods and biomass calculations will be the same. Emission factors for non-forest land classes will continue to be based on published literature. Additional literature will be added to the data base as it becomes available and where appropriate estimates of C stock will be updated. IPCC conversion factors will remain the same.

Calculation

Emission reduction calculation

$$ER_{ERP,t} = RL_t - GHG_t \qquad \textit{Equation 1}$$

Where:

ER_{ERP}	=	*Emission Reductions under the ER Program in year t; $tCO_2e*year^{-1}$.*
RL_{RP}	=	*Gross emissions of the RL from deforestation and forest degradation over the Reference Period; $tCO_2e*year^{-1}$. This is sourced from Annex 4 to the ER Monitoring Report and equations are provided below.*
GHG_t	=	*Monitored gross emissions from deforestation and forest degradation at year t; $tCO_2e*year^{-1}$;*
t	=	*Number of years during the monitoring period; dimensionless.*

Reference Level (RL_t)

Following the TAP assessment of the ERPD, Indonesia notified the FMT on the intention to apply technical corrections to the reference level for the ER-Program before the signing of the ERPA. The corrected RL estimation may be found in Annex 4, yet a description of the equations is provided below. Gross emissions of the RL from deforestation over the Reference Period (RL_{RP}) are estimated as the sum of annual change in total biomass carbon stocks (ΔC_{B_t}) during the reference period.

●CARBON STOCK AND EMISSION FACTOR

The estimation of the carbon stock of the above ground biomass of the six forest-types uses local allometric models, i.e.

- Dryland forest (Manuri et al., 2017)
  $AGB = 0.167 \times DBH^{2.56} \times WD^{0.889}$ (Equation 2)

- Swamp forest (Manuri et al., 2014)
  $AGB = 0.242 \times DBH^{2.473} \times WD^{0.736}$ (Equation 3)

- Mangrove forest (Komiyama et al., 2005)
  $AGB = 0.251 \times WD \times DBH^{2.46}$ (Equation 4)

where:
AGB= Above ground biomass
DBH= Diameter at chest height
WD= Weight density

To convert AGB (t/ha) to C (t/ha) for each forest types, carbon fraction of 0.47 is used as suggested by the IPCC 2006 (C = 0.47 * AGB).

The below ground biomass (BGB) for dry forest is estimated using root-shoot ratio from the IPCC GPG LULUCF (Table 3A.1.8. page 3.168). The value of the ratio is 0.24 for dry forest. For mangrove forest the value is 0.36 based on measurement reported in Komiyama et al., 2005 for mangrove forest in Indonesia. For swamp forest is assumed to be the same as that of mangrove forest in Indonesia.

The data source for the carbon stock of non-forest lands is derived from mainly Indonesian literatures (ER-PD Annex 8.3.). The below ground biomass (BGB) of non-forest classes is also estimated using root-shoot ratio based on IPCC default values (IPCC GPG GL for LULUCF page 3.168 table 3A.1.8). The values of the ratio vary between land cover types, i.e. 0.32 for forest plantation and estate crops), 0.48 for dry and wet shrubs, mix dryland agriculture and transmigration area, and 1.58 for savanna/grassland, pure dryland agriculture, rice paddy, bare ground and settlement.

Emission factors EF_f for biomass consumed by fire can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following formula:

$L_{fire} = A * EF_f$ (Equation 5)

$EF_f = M_B * C_f * G_{ef} * 10^{-3}$ (Equation 6)

$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$ (Equation 7)

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CO2, CH_4, N_2O

A = burnt area, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Chapter 2-page 2.48).The default value of the IPCC combustion factor, C_f, is 0.36

G_{ef} = emission factor, g kg^{-1} dry matter burnt (1580 for CO2, 6.8 for CH4 and 0.20 for N2O, Table 2.5 of 2006 IPCC Guideline, Chapter 2- Page 2.47)

Emission factors EF_f for the peat fires can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following formula:

$L_{fire} = A * EF_f$ (Equation 8)

$EF_f = M_B * C_f * G_{ef} * 10^{-3}$ (Equation 9)

$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$ (Equation 9)

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CO2, CH_4, N_2O

A = burnt area, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Volume 4, Chapter 2-page 2.48)

G_{ef} = mission factor, g kg^{-1} dry matter burnt (default values in Table 2.7, Chapter 2 of 2013 Supplement to 2006, page 2.36)

The M_B for the peat is 353 tons dry matter per hectare following IPCC default (Table 2.6 of the Chapter 2 in page 2.40, 2013 Supplement to the 2006 IPCC). The M_B depends on depth of peat and bulk density of the peat. Based on measurement in Central Kalimantan, the M_B is about 505 tons dry matter per hectare with assumption that the average depth of peat burn is 0.33 m and bulk density 0.153 t/m^3 (MRI 2013). However, we adopt the IPCC default as the default considering the data was based on measurement from multiple locations that may represent better general condition. The C_f is taken from the IPCC default value (Tables 2.6 of 2006 IPCC Vol. 4 Chapter 2). The G_{EF} for CO_2 is 1,701 g/kg dry matter burnt (Table 2.7 of the Chapter 2 of the 2013 Supplement to the 2006 IPCC, page 2.36) and for CH_4 is 21 g/kg dry matter burnt.

Calculation of emission factor of mangrove soil, i.e. the difference between amount of carbon in the mangrove soil (C_M) and amount of carbon in soil on the floor of the aquaculture system (C_{AQ}). Data on the soil carbon of mangrove and abandoned pond is taken from Kauffman *et al.* (2017) based on measurement from the 20 locations in East Kalimantan. The procedure for the sampling is described in Kauffman et al. (2016). Based on measurement in 20 locations in East Kalimantan, the value of C_M is 902.91 tC/ha and the value of C_{AQ} is 487.31 tC/ha, thus the EF for conversion of mangrove soil to aquaculture system is 415.6 tC/ha (Kauffman, 2017[55]).

● EMISSIONS FROM DEFORESTATION

Emissions from deforestation include the following:

- Emissions associated with loss of living forest biomass
- Emissions associated with soil carbon

As described in the previous section, the carbon pools used to measure emissions from deforestation depend on the land type. For deforestation on mineral soils AGB and BGB are included. For deforestation on organic soils (peat forests and mangroves) soil carbon is also included. The methods for calculating emissions from deforestation are described below.

a. Deforestation emissions from living biomass

The method used for the calculation of average annual historical emissions follows the national method (MoEF, 2015)[56] that is consistent with the IPCC. Emissions from deforestation at a given period were calculated by aggregating CO_2 emissions resulting from newly identified deforested areas within that period.

The calculation of CO_2 emissions from deforested areas used the following equation:

[55] https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.1482
[56] https://redd.unfccc.int/files/national_frel_for_redd__in_indonesia_2015.pdf

$$GE_{ijk=} = A_{ijk} \times EF_{jk} \times (44/12) \quad \text{(Equation 10)}$$

GE_{ijk} = CO_2 emissions from deforested area-i at forest change class-j to non-forest class-k, in tCO_2e

A_{ijk} = Deforested area-i in forest change class-j to non-forest class-k, in hectare (ha).

EF_j = Emission Factor which is calculated as the difference between carbon stock of forest class-j and carbon stock of non-forest class-k, in ton carbon per ha (tC ha-1). Emission factors for each forest and non-forest class are listed in sub-chapter 3.1.1 ER-PD/Annex 4 ER-MR.

(44/12) is conversion factor from tC to tCO_2e

Carbon stock of the lands after the conversion used in the calculation of the emission from the deforestation is the lifetime average carbon stock. It is assumed that land-cover types after deforestation will not change. This assumption is adopted since it is not practical to track the changes of land cover after deforestation, and it is unlikely that the natural forest that have been converted to non-forest lands will change back to natural forest. The deforestation of primary or secondary forest to non-forested was also counted only once that occur at one particular area. Identification of primary or secondary forest area in particular year is filtered using the primary or secondary forests of the previous years. Thus, the deforestation of primary and secondary forest to non-forested will be detected only in remaining primary or secondary forests of the previous years that have never been deforested before.

The emission from gross deforestation at period t (GEt), was estimated using equation below,

$$GE_t \sum_{i=1}^{N} \sum_{j=1}^{P} GE_{ijk} \quad \text{(Equation 11)}$$

GE_t = total emission at period t from deforested area-I in forest class-j to non-forest class-k, expressed in tCO_2
N = number of deforested area units at period t (from t0 to t1), expressed without unit
P = number of forest classes which meet natural forest criterion.

Further, average emissions from deforestation from all periods were calculated as follows:

$$MGE_P = \frac{1}{T} \sum_{t=1}^{p} GE_t \quad \text{(Equation 12)}$$

MGEP = mean or average emissions from deforestation from all period P (expressed in tCO_2yr^{-1})
t = number of years in period P

The estimation of emission from deforestation from the loss of living biomass between two years (period) used the land use transition matrix.

The emissions from the change of a land use category to other land use category from the transition matrix used the equation 2 and their corresponding emission factors as defined in sub- chapter 3.1.1.

b. Deforestation emissions from soil carbon

b1. Emissions from Peat decomposition in deforested areas

Peat emissions happen slowly over time once land is cleared for a number of years depending on the depth of the peat soil. Thus the emissions in any given year is the sum of emissions from all peat lands disturbed over the previous years. These emissions from prior year deforestation are called 'inherited emissions' (e.g. Agus et al., 2011[57]). The reference level for peat emissions uses peat decomposition emissions that occurred in 2017-2018, and for the monitoring period uses peat decomposition emissions in the monitored year period.

The procedures of calculating peat decomposition from deforestation follow three steps as shown in Annex 4 E Figure 8.5. First is defining natural forest in 2006 over peat land, and then step 2 is generating land cover change from each interval year to define a transition area matrix for the associated year of interval. The third step is calculating total annual emissions by multiplying the transition matrix of both areas and associated emission factors.

Calculation of emissions from peat decomposition used the same basis as emissions from deforestation. This is due to the fact that once deforestation occurs in peat forest, there will be emissions from removal of the ABG at the time of conversion as describe above, and plus from peat decomposition subsequently. The formula for estimating the emission from peat decomposition is the following:

$$\mathrm{PDE_{ijt}} = \mathrm{A_{ijt}} \times \mathrm{EF_j} \qquad \text{(Equation 13)}$$

PDE = CO_2 emission ($tCO_2yr\text{-}1$) from peat decomposition in peat forest area-i changed into land cover type-j within time period-t

A = area-i of peat forest changed into land cover type-j within time period-t

EF = the emission factor from peat decomposition of peat forest changed into land cover class-j (t_CO_2 ha yr-1) [58]

Emission factor for peat decomposition of peat forest change using Paciornik and Rypdal (2006) and IPCC (2014). These emission factors are reported in 2013 Supplement Guideline to 2006 IPCC Guidelines for National GHG Inventory: Wetlands. Most of the data reported in this guideline come from Indonesian sites.

b2. Emissions from Peat Fire in deforested areas

[57] http://apps.worldagroforestry.org/sea/Publications/files/manual/MN0051-11.pdf

[58] Emission factor for an area of change is an average of the emission factors of the respective land cover before and after. This reflects the assumption that conversion of land cover on peatland between two time periods gradually affects the peat water table implying a gradual peat decomposition emission. For example, the emission factor of secondary forest is 19 tCO2 ha-1 y-1 and the emission factor of bare ground is 51 tCO2 ha-1 y-1, so that the average emission factor for an area changing from secondary forest to bare ground is 35 tCO2 ha-1 y-1.

Emission factors EF_f for the peat fires can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following formula:

$$L_{fire} = A * EF_f \quad \text{(Equation 14)}$$

$$EF_f = M_B * C_f * G_{ef} * 10^{-3} \quad \text{(Equation 15)}$$

$$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3} \quad \text{(Equation 16)}$$

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CO_2, CH_4, N_2O

A = burnt area, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Volume 4, Chapter 2-page 2.48)

G_{ef} = mission factor, g kg^{-1} dry matter burnt (default values in Table 2.7, Chapter 2 of 2013 Supplement to 2006, page 2.36)

The M_B for the peat is 353 tons dry matter per hectare following IPCC default (Table 2.6 of the Chapter 2 in page 2.40, 2013 Supplement to the 2006 IPCC). The M_B depends on depth of peat and bulk density of the peat. Based on measurement in Central Kalimantan, the M_B is about 505 tons dry matter per hectare with assumption that the average depth of peat burn is 0.33 m and bulk density 0.153 t/m^3 (MRI 2013). However, we adopt the IPCC default as the default considering the data was based on measurement from multiple locations that may represent better general condition. The C_f is taken from the IPCC default value (Tables 2.6 of 2006 IPCC Vol. 4 Chapter 2). The G_{EF} for CO_2 is 1,701 g/kg dry matter burnt (Table 2.7 of the Chapter 2 of the 2013 Supplement to the 2006 IPCC, page 2.36) and for CH_4 is 21 g/kg dry matter burnt.

Calculation of emissions from peat fire in the deforested area (L_{fire}) is calculated using the following formula (IPCC, 2014):

$$L_{fire} = A * EF_f = A * M_B * C_f * G_{ef} * 10^{-3} \quad \text{(Equation 17)}$$

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CH_4, N_2O, etc.

A = area burnt, ha

M_B = mass of fuel available for combustion, tonnes ha^{-1}.

C_f = combustion factor, dimensionless (default values in Table 2.6 of the 2006 IPCC Guideline, Volume 4 Chapter 2-page 2.48)

G_{ef} = emission factor, g kg^{-1} dry matter burnt (default values in Table 2.5 of the 2006 IPCC Guideline, Volume 4 Chapter 2-page 2.47)

b3. Emissions from *Mangrove Soil in deforested areas*

When mangrove forests are converted to aquaculture, they normally are being cleared and the soil being removed or excavated, normally 1.5 to 2 meters deep. When the organic soils are excavated, they exposed to aerobic condition and being oxidized that emit CO_2. Considering that soil mangrove has very high organic content (Kauffman et al, 2017[59] and Murdiyarso et al, 2015[60]), conversion of mangroves will result in a significant amount of CO_2 emissions.

Calculation of emissions from mangrove soil in the ER program is considered only for conversion to aquaculture. Emissions released are calculated as potential emissions assuming that emissions from organic soil removed from the floor of the aquaculture system are emitted once at the time of the conversion. Thus, the calculation of the emissions from conversion of mangrove to aquaculture (E_{MS}) used the following formula:

$$E_{MS} = A_{MA} \times EF_{MA} \quad \text{(Equation 18)}$$

A_{MA} is area of mangrove converted to aquaculture, EF_{MA} is emission factor, i.e. the difference between amount of carbon in the mangrove soil (C_M) and amount of carbon in soil on the floor of the aquaculture system (C_{AQ}).

Summary: Average Historical Emissions from Deforestation

Emissions from deforestation is calculated based on the emissions associated with loss of living forest biomass (AGB and BGB), and the emissions associated with soil carbon. The Emission from soil includes the emission from peat soil due to decomposition process, and fire events, and also the emission from mangroves soil due to mangrove conversion to aquaculture.

- **EMISSIONS FROM FOREST DEGRADATION**

The emission from degradation of natural forest include:

4. *Emissions due to the degradation of primary forest into secondary forest*
5. *Emissions due to further degradation of secondary forest caused by fire*
6. *Emissions from peat decomposition in secondary forests*

a. Emissions from forest degradation of primary forest to secondary forest

The assessment of changes of primary forest to secondary forest and the estimation of emissions from the removal of the living biomass (AGB and BGB) and decomposition of organic soils follows a similar procedure as that of the deforestation (Equations 2-4). The degradation of primary forest to secondary forest was also counted only once that occur at one particular area, similar to the procedure used in calculating the deforested area. Identification of secondary forest area in particular year is filtered using the primary forests of the previous years. Thus, the degradation of primary forest to secondary forest will be detected only in remaining primary forests of the previous years that have never been degraded before.

The estimation of emission from forest degradation from the loss of living biomass (change of primary to secondary forest) between two years (period) used the land use transition matrix in all forests (production and non-production forests).

[59] https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.1482
[60] https://www.nature.com/articles/nclimate2734

The emissions from the change of primary to secondary used the equation 8. For example, the emission from 41,722.33 ha degraded area (Primary dryland forest to Secondary dryland forests; 2001-2002) occurred in the period 2006 and 2009 is calculated as follow:

$$E_{2001\text{-}2002} = A * (EF_{BC} - EF_{AC}) * 44/12 \quad \text{(Equation 19)}$$

$E_{2001\text{-}2002}$ = 41,722.33*(167.3-122.06)*44/12 = 6,922,432.35 ton CO_2 or about 2,307,477.45 tCO_2e per year.

b. Emissions due to further degradation of stable secondary forest caused by fire

Emission factors EF_f for biomass consumed by fire can be developed based on Eq. 2.27 in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (GL), Volume 4, using the following equation 14,15 and 16. Gas emission factor from dry matter burnt for CO_2, CH_4 and N_2O is 1701.33 g kg^{-1}, 21 g kg^{-1} and 0.20 g kg^{-1} respectively.

Fire in secondary forest will result in further degradation and in more emissions. Estimation of the stable forest area affected by fire is by delineating burnt area of the stable forest (forests that remained as secondary forest throughout the reference period) hotspot (see Annex 4 section 8.4.3). This is to avoid double counting of emissions in which the loss of biomass due to fire in the deforested forest is not included. The implication of this is that when the secondary forests affected by fire are deforested during the future ERP reporting period, we will have to use separate emission factors in the calculation of the emission from deforestation which take into account the loss of carbon due to fire that occurred in the reference period.

For example, the area of stable secondary forests affected by fire in 2007 was 280.39 ha which is all secondary dryland forest (2002). The total fire emission reached 46,787.70 ton CO_2e (using equation 6). A similar approach was taken for all other years to estimate the emissions from fire in stable secondary forest.

c. Emissions from peat decomposition in secondary forests

The loss of carbon from the decomposition of organic soil occurs in secondary forest (IPCC, 2014). These are considered to be inherited emissions because the disturbance (which changed the forest from primary to secondary) occurred prior to 2006. The estimation of the emission from peat decomposition uses equation 5.

Parameters to be monitored

During the ERPA term (2020-2024), activity data (AD) and emission factors (EF) will be monitored in the Accounting Area to measure emissions from deforestation and forest degradation. Monitoring will follow the procedures defined in the NFMS (national forest monitoring system) and in the East Kalimantan forest inventory. Parameters to be monitored include the same parameters used to develop the REL, specifically:

Activity Data

- Forest cover change resulting in deforestation or forest degradation for all land that was

forested in 2016.

- Areas of burned forest land in stable secondary forest starting in 2016.

Emission Factors

Emission factors for live biomass by land cover classes (forested and non-forested)
Emission factors for peat and mangrove soils
Emission factors for fires

The following tables provide information on the monitored parameters.

9.1.1.1 DEFORESTATION AND DEGRADATION

Parameter:	**Area of forest cover change to estimate emissions from deforestation and degradation**
Description:	**Applicable to all transitions, including forest remaining forest (degradation, i.e. from primary to secondary forest) and forest to non-forest (Deforestation)**
Data unit:	**Ha/yr**
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	**Remote sensing data is processed by the National Forest Monitoring System (NFMS) named Simontana (*Sistem Monitoring Hutan Nasional*) (MoFor, 2014).** **It is available online at webGIS of MoEF https://nfms.menlhk.go.id/** **for display and viewing. The websites are part of the geospatial portal under the one map policy (http://tanahair.indonesia.go.id/portal-web).The detailed explanation of the methods for monitoring the forest resource can be s**een in Margono et al. (2016; https://jurnal.ugm.ac.id/ijg/article/view/12496/9041) Field observations to check t**he accuracy of the interpretation of land cover change are also conducted as part of the NFMS, with the involvement of ER Program Entities that include local communities.**
Frequency of monitoring/recording:	***Annually***
Monitoring equipment:	**National Forest Monitoring System (NFMS)**
Quality Assurance/Quality Control procedures to be applied:	***Following the Standard Operating Procedure on QA/QC developed by the IPSDH (Inventory and Monitoring of Forest Resources) unit under the Directorate General of Forest Planology, Ministry of Environment and Forestry.***

Identification of sources of uncertainty for this parameter	**Uncertainty comes from the quality of satellite images used, land cover map generation process, and the number of ground truth points.**
Process for managing and reducing uncertainty associated with this parameter	- ***Increase the number of ground checking*** - ***Provide additional training for the interpreters*** - ***Refine the selection of Landsat and other supported images (Hi-res)*** - ***Application of sample based estimation (Olofsson 2014) using a stratified random sample to estimate area of change, and to assess map accuracy.***
Any comment:	**In the current NFMS, the system is still not capable of monitoring the different level of degradation of the natural forests. Level of degradation is only able to be divided into two categories, i.e. primary intact forest called primary forest, and degraded primary intact forest called secondary forest. There is no category for shrubs as well. In fact some shrubs have regrowth and will be back into forest again (called old shrubs). As the current NFM only recognize this as shrubs, this land considered as non-forest. Based on the study conducted in two districts of Kalimantan, i.e. Kutai Barat & Mahakam Ulu, the category of degradation of the natural forest and shrubs can be monitored using the current method. The result of accuracy assessment indicates that this improved method can be applied for East Kalimantan or even national (see Annex 9.3 of the 2019 ERPD). The national government may use the method for the improvement of the land cover data given availability of resources.**

Parameter:	**Above ground biomass (AGB)**
Description:	**The above ground biomass is estimated based on the DBH (Diameter at Breast Height) and wood density that is measured from trees in the permanent sampling plots (PSP) using local allometric equations of Manuri et al. (2017), Manuri et al. (2014) and Komiyama et al. (2005)**
Data unit:	**Tonne of carbon per hectare**
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing	**Field measurement from the permanent sampling plots (PSPs) of the Kalimantan Timur established for the FCPF (for swamp and mangrove forests) and from PSPs of the National Forest Inventory (for dryland forest). New**

data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	**permanent sampling plots for mangrove have been established in 2019, in total 120 PSPs. These data were used for the technical correction of RL. The locations of the PSPs in all forest types in East Kalimantan Province are provided in Annex A9.2.**
Frequency of monitoring/recording:	***During the ERPA monitoring and recording will be carried out at minimum in 2022 and 2024. In the ER Program, the new data from the PSP will be used to improve the accuracy. In the case the improvement is significant, the recalculation of the Reference Level will be performed.***
Monitoring equipment:	
Quality Assurance/Quality Control procedures to be applied:	**Following the standard methods that have been developed for the NFI (SNI 7724:2011)**
Identification of sources of uncertainty for this parameter	**Sources of uncertainty for this parameter are due to:** 1. **Limited number of permanent sampling plots** 2. **Allometric equations** 3. **Root:shoot ratio** 4. **Biomass density** 5. **Human error in measuring tree diameters**
Process for managing and reducing uncertainty associated with this parameter	***Increasing number of PSP. The additional PSPs is planned to be established in the forest types will less number of plots, namely swamp and mangrove forest. With the plan to increase the categorization of forest based on level of degradation, the establishment of the new PSPs will also be allocated to this area.***
Any comment:	**In the secondary forest affected by fire during the reference period, the AGB of the fire affected secondary forest will be adjusted to avoid double counting if this fire-affected secondary forest becomes deforested during the ER period. Following the IPCC default factor, the AGB of the fire-affected secondary forest will decrease by 36% of the initial biomass. Thus the AGB of the secondary forest affected by fire during the reference period will be only 64% of the non-affected secondary forest.**

Emission Factors for peat decomposition and mangrove will continue to rely on the same published values used to calculate the RL. Above ground biomass of forest lands will be monitored as part of the NFI program in which the number of PSPs will be increased in East Kalimantan to reduce the uncertainties mentioned above, while for those of non-forest lands will not be monitored to maintain consistency with the EF used in the development of the Reference Level.

9.1.1.2 PEAT AND FOREST FIRES

Parameter:	**Area of stable secondary forest affected by fire each year**
Description:	**Stable Secondary forest (secondary forest in 2016 and in the measurement year) affected by fire is monitored based on hotspot data**
Data unit:	**Ha/yr**
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature),including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	**Hotspot data will be acquired from NASA FIRMS (https://nrt4.modaps.eosdis.nasa.gov/). The method for estimating the burnt area follows the method that combine the hotspot data with the Landsat image (quick look original with composite band 645) that is able to delineate the burnt area and supervised by other data (e.g. fire control activity and ground check).**
Frequency of monitoring/recording:	***Annually***
Monitoring equipment:	**National Forest Monitoring System (NFMS)**
Quality Assurance/Quality Control procedures to be applied:	**QA/QC are directed to ensure the consistency of the method and approach adopted for estimating burnt area with the one used in the RL development. Result of the estimation of burnt area will be verified by BAPLAN**
Identification of sources of uncertainty for this parameter	**Sources of uncertainty for this parameter are: (i) processing of Hotspot data; (ii) selection of confidence level of the Hotspot data for this analysis, which is >80%; and (iii) sample error**
Process for managing and reducing uncertainty associated with this parameter	***Developing SOP for the estimation of burnt area*** **using semi-automatic approach which combine the hotspot data with the Landsat image (quick look original with composite band 645) and supervised by other data**

	(e.g. fire control activity and ground check) for minimizing bias.
Any comment:	**The semi-automatic approach replaced the MRI (2013) method. Comparison of the two methods is available in Rossita et al. (2019).**

Emission Factors for peat and forest fire will not be changed in order to maintain consistency with the EF used in the development of RL (using the IPCC default values).

9.2 Organizational structure for measurement, monitoring and reporting

The ER Program has two sets of organizational structures for measurement, monitoring and reporting of emissions estimates as presented in Figure 9.2

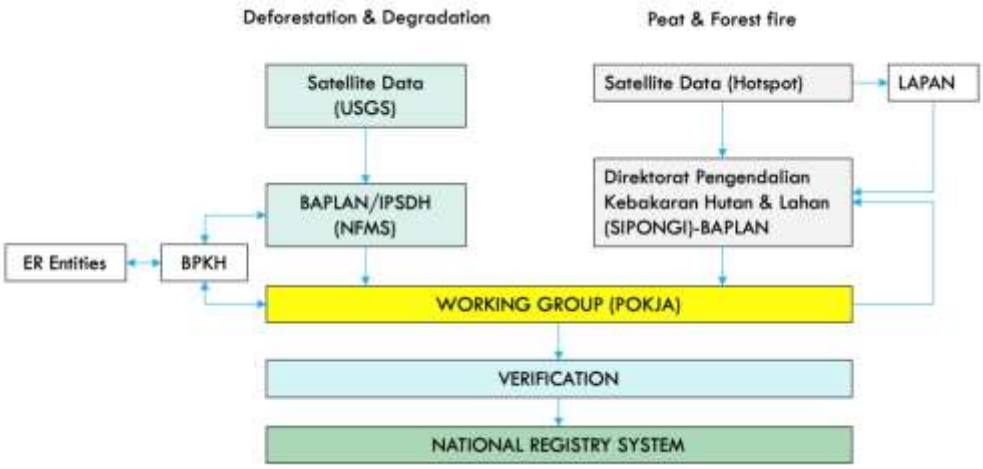


Figure 9.7 Organizational Structure for measurement, monitoring and reporting of the implementation of ER Program

The MMR system of the ER Program will be institutionally integrated with the national forest monitoring system (NFMS; Figure 9.3) as described in Regulation of Director General of Forest Planology Number P.1/VII- IPSDH/2015. The generation of national forest and land cover change data from satellite images is conducted by the Regional Office for the Management of Forest Area (BPKH) in East Kalimantan Province under the direction of the Directorate of Forest Resources Inventory and Monitoring (IPSDH), which is under the Directorate General of Forestry Planning and Environmental Arrangement (BAPLAN). The BPKH will receive satellite data from ISPDH. The satellite data are first acquired by LAPAN, which also does pre-processing of data up to mosaicking before sending the data to the respective institutions (including ISPDH). The visual interpretation is conducted by the BPKH using a standard methodology for land cover mapping (Margono *et al*, 2014, 2016). Results of the processing and ground check by BPKHs are sent back to ISPDH for validation by ISPDH including some necessary edge-matching as appropriate, as part of the QA/QC process. Finally, the accuracy of the interpretation is assessed by comparing the land cover maps to field data from the ground check using a contingency matrix (MoFor, 2012, Margono *et al.*, 2012). There are about 300 points for ground checking in East Kalimantan (MoEF, 2017), which are determined randomly by land cover classes. All the data from the BPKH will be consolidated to generate data on forest cover change.

The ER Program (through the Working Group) will analyze the data from the BPKH to estimate emissions from deforestation and degradation, peat decomposition, and loss of mangrove soil from the conversion of mangrove to aquaculture. Results of the estimation are then submitted to the Environmental Agency for internal verification. The Environmental Agency will then submit the results of the verified estimation to the national registry and verification system.

To facilitate the work of the Working Group, the Government of East Kalimantan has developed a web portal for the Sub-national MRV System for managing all the processed data from the national and also from local governments. The system can perform calculations of the emissions using the

national data & sub-national data. The system is to be operated by the Provincial Environmental Office (DLH) as the East Kalimantan MRV Focal Point. Measurement (data input pages) and Verification (verification purpose pages) sections need a user account but the Reporting section is publicly available to show the Emission Factor (Faktor Emisi), Activity Data (Data Aktifitas) and Emission include Reference Emission Level (Tingkat Emisi Rujukan), Actual Emission after reference period (Emisi Aktual) and Performance of Emission Reduction (Kinerja Penurunan Emisi). This menu is available on the left as an expandable menu. The MRV web portal has been tested using national data and the calculation method is the same with the national FREL. This MRV web portal will increase public participation of OPD to village communities or indigenous people to participate in monitoring the condition of forests and changes in the forest/land that occurs.

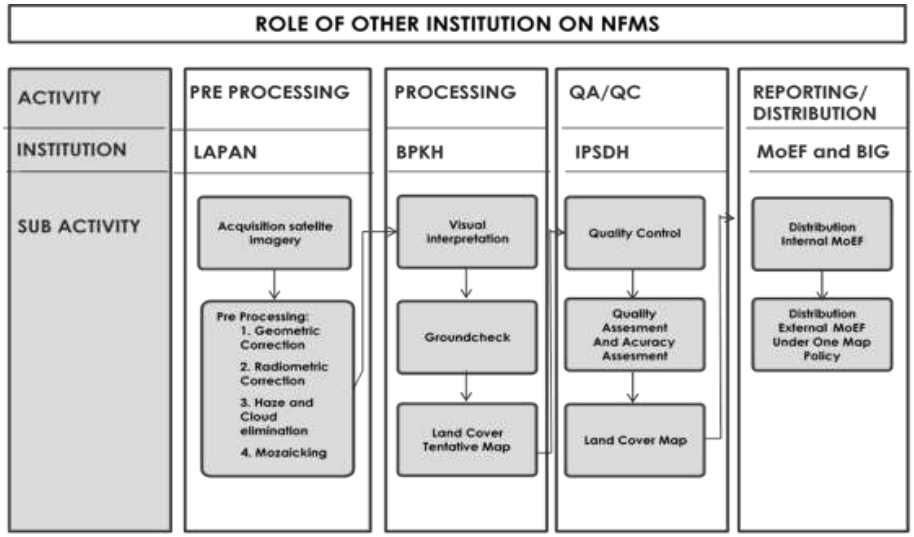


Figure 9.8 Related institutions on NFMS management (MoEF, 2017)

The process of the production of land cover maps will be on an annual basis as defined in the Regulation of the Director General of Forest Planology Number P.1/VII- IPSDH/2015. The timeline of the process is shown in Table 9.2. The collection of the LANDSAT images is conducted throughout the year by LAPAN and the pre-processing of the image is conducted as the data becomes available for producing the mosaic. The mosaic will be available by June to be distributed to IPSDH and to BPKH. BPKH under the supervision of IPSDH will do manual interpretation of the image during the period July-October, while land cover data from field visits (with defined coordinate) are collected in the period March-September. In October, all the results of the interpretation conducted by BPKH will be compiled to the national by IPSDH for QA/QC and accuracy assessment. By December the result of the interpretation is finalized and reported.

Table 9.1 Timeline of land cover change analysis under the current NFMS

No	Activity	Year (n-1)						Year (n)											
		J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
A	**LAPAN**																		
	Collecting Landsat Satelite Image																		
	Finalization of Mozaik (M)													M					
B	**IPSDH**																		
	Techncail evaluation																		
	Supervision																		
	Quality Control																		
	Data finalization (DF)																		DF
	Reporting ®																		R
C	**IPSDH/BPKH**																		
	Data distribution (DD)																		
	Interpretation																		
	Ground Checking																		
	National Compilation of results (NC)																NC		

As shown in Figure 9.2, the ER entities (village governments, community groups, concessions), will participate in monitoring deforestation (see section 4 for the entities in the accounting areas). The ER entities will be involved in conducting ground checking and in monitoring and reporting the occurrence of deforestation in the accounting area to the Working Group. The mobile application for this has been developed (Figure 9.4) which is connected to the MRV web-portal.

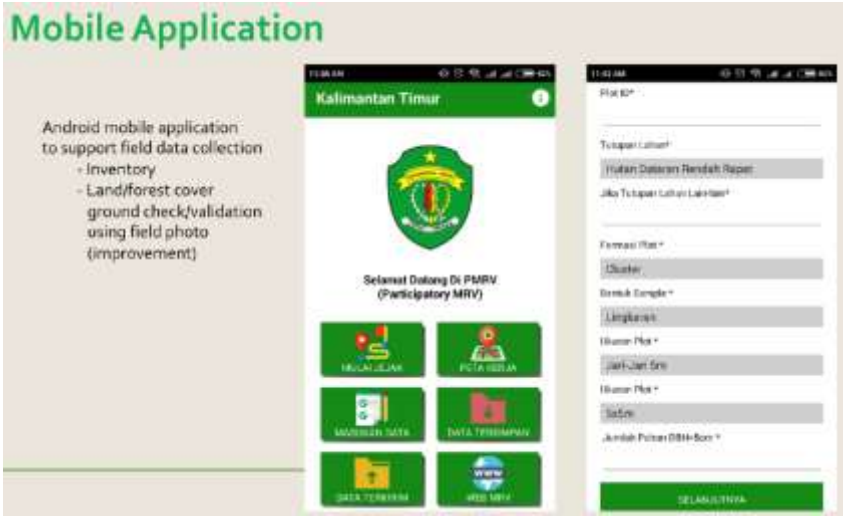


Figure 9.9 Mobile application for ER entities for supporting the MRV activities

Organizational Structure for measurement, monitoring and reporting of emissions from peat and forest fires

For MMR of peat and forest fire, as seen in Figure 9.1, estimation of peat burnt area will use data derived from hotspots sourced from NASA. The processing of the hotspot data is conducted by LAPAN for the Directorate for Forest and Land Fire Control, of the Ministry of Environment and Forestry. The ER Program (through the Working Group) will access and analyze the hotspot data to estimate burnt area and greenhouse gas emission. Results of the estimation are then submitted to BAPLAN for internal verification. The Environmental Agency will then submit the results of the verified estimation to the national registry and verification system.

9.3 Relation and consistency with the National Forest Monitoring System

As mentioned above, the ER Program will use the data generated by the NFMS, and the East Kalimantan forest inventory data will be integrated to the National Forest Inventory (NFI). The system provides continuous information on activity data and emission factors that can ensure the sustainability of activity data supply needed for estimating emission reductions from the implementation of the ER Program, thus ensuring consistency. The ER Program will continue to apply the sample based area estimation for ER purposes, and will consider whether this approach is also applicable to the NFMS for national reporting purposes.

In addition, the ER Program will also include ground checking activities, as mentioned above, to increase the number of points required for the accuracy assessment. At present, due to limited budget BPKH can only do ground check in a small number of observation points. Through the ER Program, it is planned for ER Entities, as shown in Figure 9.2. This implies an urgent need for capacity building and technical assistance for ER entities.

For the development of capacity of ER entities in the implementation of monitoring and evaluation activities, the ER program will implement a number of capacity building activities. The budget plan is 418,513 USD for the capacity building on monitoring and evaluation and 6,924,317 USD for measurement and reporting of the ER Program (Table 9.2).

Table 9.2 Cost for the implementation of capacity building for monitoring, evaluation, measurement and reporting activities

Year	Implementation of monitoring and evaluation for ER program implementation (USD)	Measurement and Reporting (USD)
2020	63,654	556,415
2021	62,060	593,774
2022	66,226	3,606,316
2023	70,673	676,187
2024	75,418	721,588
2025	80,482	770,037
Total	**418,513**	**6,924,317**

12 UNCERTAINTIES OF THE CALCULATION OF EMISSION REDUCTIONS

The process for addressing uncertainty related to the REL and the calculation of emission reductions follows a stepwise process. The process involves the identification of sources of uncertainty, the minimization of uncertainty where feasible and cost effective, and the quantification of the remaining uncertainty through application of Monte Carlo analysis. The ER Program uses the 2006 IPCC Guideline for estimating average annual GHG emissions in the reference period, i.e. multiplication of Activity Data with Emission Factors (AD x EF) as described in Section 8.3.1. Therefore, uncertainty in the emission estimates is linked to the uncertainties of the AD and EF inputs.

12.1 Identification of sources of uncertainty of AD

The activity data used to estimate the emissions of deforestation, forest degradation, peat decomposition, and mangrove soil came from the national land cover maps produced by MoEF. The land cover map consists of 23 land cover classes derived by remote sensing data analysis (Landsat at 30-meter spatial resolution). The object identification is purely based on the appearance on the images. Manual-visual classification through an on-screen digitizing technique based on key elements of image/photo-interpretation was applied as the interpretation/classification method. Several ancillary data sets (including concession boundaries of logging and plantation, forest area boundaries) were utilized during the process of delineation, to integrate additional information valuable for classification. The detailed explanation on the method for generating the activity data can be accessed from https://nfms.menlhk.go.id/ and https://jurnal.ugm.ac.id/ijg/article/view/12496/9041

Manual classification is time-consuming and labor intensive (Margono et al., 2012, Margono et al., 2014). It involves staff from district and provincial levels to manually interpret and digitize the satellite images, to exploit their local knowledge. Data validation was carried out by comparing the land cover maps with field data. Stratified random sampling is the selected approach to verify the classification map to the field reality. Compilation of several field visit data within a specific year interval was exercised for accuracy assessment. Comparison of results was performed on a table of accuracy (contingency matrix MoFor, 2012, Margono *et al.*, 2012).

Emissions from peat decomposition are estimated using the activity data derived from the peatland map, which is separated from land cover maps produced by MoEF. The development of the peatland map in Indonesia is closely related to soil mapping projects for agricultural development programs, conducted by the Ministry of Agriculture. Indonesia has developed a procedure for peatland mapping based on remote sensing at a scale of 1:50,000 (SNI 7925:2013). The map of Indonesia's peat land has been updated and released several times due to the dynamics of data availability. The latest Peatland Map version 2011 at a scale of 1:250,000 (national scale) is used for the emission estimation.

Based on the above practices, there are a number of main sources of uncertainty for the Activity Data used for estimating the emission from deforestation, degradation, peat decomposition, and mangrove soil. The AD for forest cover and forest cover changes used in the estimation of emissions from deforestation, degradation, peat decomposition and mangrove soils have at least three sources of uncertainty, namely quality of the satellite images, interpretation procedure, and sampling error that is related to the process of ground truthing.

Sources of uncertainty	Analysis of contribution to overall uncertainty	Contribution to overall uncertainty (High / Low)	Addressed through QA/QC?	Residual uncertainty estimated?
Activity Data				
Measurement	• There are two sources of error related to the Landsat images. First stripping problem that leads to a loss of some data from the images and the need for manipulation using different images. Second, Indonesia almost always has a lot of cloud clover. The cloud's shadows and cloud coverage will affect the quality of the images as it generates data gaps. These constraints affect the image interpretation process. • Interpretation of satellite images to produce land cover maps is done by trained interpreters who use manual or visual interpretation digitization technique. Standard Operating Procedures (SOPs) and manuals are provided to guide the interpreters to do the satellite image interpretation	*L (random)*	*YES*	*NO*
Representativeness	The ground truthing uses stratified random sampling. Compilation of several ground truthing results within a specific year interval was used for accuracy assessment that will provide level of accuracy of the land cover classes interpretation.	*L (bias)*	*YES*	*NO*
Sampling	The number of points to represent land cover categories will determine the level of accuracy of the assessment. Ground truthing will reflect the accuracy of the interpretation with real condition. It helps to determine the accuracy of the satellite interpretation results. Therefore, the number of points of ground check will significantly affect the level of uncertainty. The number of sampling plots will be increased in order to reduce the uncertainty rate.	*H (random / bias)*	*YES*	*YES*
Extrapolation	MoEF land cover data which has 23 classes and is reclassified into 5 (five) classes of land cover change, namely deforestation, forest degradation, forest gain (forest growth), stable forest (fixed/unchanged forest cover) and stable non-forest (non-forest cover that remains / does not change).	*H (bias)*	*YES*	*NO*
Approach 3	The approach is carried out by only calculating deforestation from forested areas from the beginning of the reference period until the	*L (bias)*	*YES*	*NO*

Sources of uncertainty	Analysis of contribution to overall uncertainty	Contribution to overall uncertainty (High / Low)	Addressed through QA/QC?	Residual uncertainty estimated?
	measurement year, after which it changes to non-forested areas, while degradation is calculated in primary forested areas from the beginning of the reference period until the calculation year.			
DBH measurement	Measurement officers in the field have gone through a training process and are provided with technical instructions for measuring, which are accompanied by a process of supervision and QA/QC.	*L (random)*	*YES*	*NO*
H measurement		*L (random)*	*YES*	*NO*
Plot delineation		*L(random)*	*YES*	*NO*
Wood density estimation	The calculation of wood density is carried out through a laboratory measurement approach on the species in the sample plot.	*L (random)*	*YES*	*NO*
Biomass allometric model	The sample tree data used to construct biomass allometric models is still relatively limited to trees of a certain size. Standard errors are also documented in the allometric model process.	*L(random)*	*YES*	*NO*
Sampling	Determination of the location of the sample is done based on proportional random based on forest class area.	*H (random)*	*YES*	*YES*
Carbon Fraction	Carbon fraction uses the values listed in Table 4.3 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4: Agriculture, Forestry and Other Land Use https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf	*H (bias / random)*	*YES*	*YES*
Rootto-shoot ratio)	Root shoot ratio using the IPCC GPG LULUCF Table 3A.1.8 - https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Anx_3A_1_Data_Tables.pdf	*H (bias / random)*	*YES*	*YES*
Representativeness	Representative sample by purposive sample in each land cover class	*L (bias)*	*YES*	*NO*
Model	The combination of AD & EF does not necessarily need to result in additional uncertainty. QA/QC carried out by the MMR East Kalimantan team	*L (bias)*	*YES*	*NO*
Integration	This source of error is linked to the lack of comparability between the transition classes of the Activity Data and those of the Emission Factors. QA/QC carried out by the MMR East Kalimantan team	*L (bias)*	*YES*	*NO*

Steps to minimize uncertainty

The minimization of error of interpretation that normally results in systematic error, as required by Indicator 8.1 of MF of the FCPF, is through the implementation of a consistent and comprehensive set of standard operating procedures (SOP), including a set of quality assessment and quality control processes, and that of sampling error is through increased sampling. The implementation of QA/QC procedure will be enhanced, through the consistent use of the SOPs for the interpretation and training procedures. The consistency checks will be conducted by interpreters that were not involved in the original classification. Following the provisions on verification provided in Chapter 3 – Volume 1 of the 2006 IPCC GL, QA/QC measures will be complemented with verification, i.e. through an accuracy assessment. The verification will be conducted by a third party, which will serve to confirm the acceptable quality of the estimates and will enable the correction of biases and respective uncertainties. The accuracy assessment is conducted using Olofsson *et al*. (2014) with stratified reference data. The assessment is not only to assess accuracy but to also calculate the sample based estimates of areas and to quantify the degree of uncertainty for analysis purposes. In applying Olofsson et al. (2014) for the estimation of the accuracy of land cover change and the calculation of the sample based estimates of areas, Indonesia used a reference data set of 880 observations.

Similar to activity data, the uncertainty in Emission Factors is reduced through strengthening the consistency in the use of SOP including through trainings, and through increasing the number of samples. Indonesia plans to increase the number of sample plots in different categories of secondary forest based on tree cover density of secondary forests and shrubs (Annex 9.3). The implementation of this effort will involve FMUs. Activities to be implemented for reducing the uncertainty of the emission factors will include the following activities:

- Developing and improving the monitoring protocol;
- integrating the monitoring protocol into the curriculum of the national forest training center to produce skilled staff within FMUs in east Kalimantan. The training should be conducted periodically by inviting key related field staff from FMUs; and
- providing proper supporting tools/equipment to make the monitoring processes more efficient .

12.2 Quantification of Uncertainty in the Reference Emission Level

Parameter included in the model	Parameter values	Error sources quantified in the model (e.g. measurement error, model error, etc.)	Probability distribution function	Assumptions
Project Area	12,734,692 ha			ER program document
Length of reference period	10 years			ER program document
Carbon Fraction	0.47	Measurement	Triangular (lower bound = 0.44, upper bound = 0.49, mode = 0.47)	IPCC 2006
Ratio of molecular	44/12			Default

Parameter included in the model	Parameter values	Error sources quantified in the model (e.g. measurement error, model error, etc.)	Probability distribution function	Assumptions
weights of CO_2 and C				
Root shoot ratio	See sheet 'EF_EKJERP' excel file fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx			2006 IPCC GPG LULUCF Table 3A.1.8.
AGB sample	See sheet 'EF_EKJERP' excel file fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx	Sampling	Normal distribution	
Activity data	See sheet 'UncertaintyAD' excel file fcpf_ekjerp_ermr1_MC_26Juli2022c.xlsx	Sampling	Non-parametric bootstrapping	

Quantification of the uncertainty of the estimate of the Reference level

		Deforestation	Forest degradation	Enhancement of carbon stocks
A	**Median**	23,910,110.75	3,499,907.39	
B	**Upper bound 90% CI** (Percentile 0,95)	21,692,563.78	2,360,708.84	
C	**Lower bound 90% CI** (Percentile 0,05)	26,214,647.70	4,732,375.53	
D	**Half Width Confidence Interval at 90% (B – C / 2)**	2,261,041.96	1,185.833.35	
E	**Relative margin (D / A)**	0.09	0.34	%
F	**Uncertainty discount**	9.46	33.88	%

Sensitivity analysis and identification of areas of improvement of MRV system

Sensitivity Test	Median	Lower bound (5th percentile)	Upper bound (95th percentile)	Half-width confidence interval at 90%	Relative Margin	Uncertainty (%)
All on	35,404,709.61	31,595,294.53	39,343,003.80	3,873,854.63	0.10	10.94
R:S Uncertainty	35,471,602.13	35,001,607.79	35,949,894.69	474,143.45	0.01	1.34
CF Uncertainty	35,463,547.88	34,959,756.78	35,968,679.38	504,461.30	0.01	1.42
Sampling uncertainty	35,479,001.24	33,736,204.15	37,220,024.41	1,741,910.13	0.05	4.91
Emission Factor uncertainty	35,447,106.81	33,535,207.34	37,352,701.23	1,908.746.94	0.05	5.38
Activity Data	35,476,198.51	32,158,638.15	38,852,025.32	3,346,693.58	0.09	9.43

The sensitivity analysis was done using Monte Carlo approach by removing one estimation parameter at a time, i.e.:

No	Parameter Used	Approach
1	All on	Using the uncertainty for Root shoot ratio, Carbon Fraction, Sampling uncertainty AGB, and Activity Data
2	R:S Uncertainty	Using the uncertainty for Root shoot ratio, and other uncertainty parameter near zero.
3	CF Uncertainty	Using the uncertainty for carbon fraction ratio, and other uncertainty parameter near zero
4	Sampling uncertainty	Using the uncertainty for AGB biomass sampling, and other uncertainty parameter near zero
5	Emission Factor uncertainty	Using the uncertainty for Root shoot ratio, carbon fraction, and AGB biomass sampling, but uncertainty for activity data near zero
6	Activity Data	Using the uncertainty for activity data (AD), and other parameter near zero