DIRECTORATE OF PEATLAND DEGRADATION CONTROL
DIRECTORATE GENERAL OF ENVIRONMENTAL POLLUTION AND DEGRADATION CONTROL
MINISTRY OF ENVIRONMENT AND FORESTRY REPUBLIC OF INDONESIA

CORRECTIVE ACTION ON PEATLAND PROTECTION AND MANAGEMENT IN INDONESIA

Toward Sustainable Peatland Management

2019-2020

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Preface

Indonesia is the home of the largest tropical peatland in the world and the 4th largest peatland in the world after Canada, Rusia and the United States. Indonesia Peatland area is 24.668 million hectares and consist of 865 Peat Hydrological Unit (PHU). Government of Indonesia, under the Leadership of the President of Republic of Indonesia, is consistent to highly commit to the protection and management of peatland ecosystem and has achieved high performance over the last few years, even during the pandemic COVID-19.

The Ministry of Environment and Forestry has carried out several actions, either at national or international level. Among other actions are completing the regulation, policies, and technical guidance for operational implementation in the field, inventorying peatland ecosystem characteristic scale 1:50.000, establishing Peatland Ecosystem Protection and Management Plan, as well as peatland ecosystem restoration in the field. In 2019, The Ministry of Environment and Forestry has enacted the Minister of Environment and Forestry Regulation Number P.60/Menlhk/Setjen/KUM.1/10/2019 concerning Procedure for Preparation, Stipulation and Amendment of Peatland Ecosystem Protection and Management Plan and The Minister of Environment and Forestry Decree Number SK.246/Menlhk/Setjen/KUM.1/6/2020 concerning the National Peatland Ecosystem Protection and Management Plan 2020-2049.

In the peatland ecosystem restoration, Indonesia has achieved the accumulative restoration area at about 3.6 million hectares in concession area and 46,248.7 hectares in community area, through the engagement of all related stakeholders among others central and local government, concession holders, private sector, and community. The achievement has also been counted as part of Indonesia *National Designated Contribution* (NDC) for Green House Gas Emission Reduction.

At the international level, Government of Indonesia has established several activities in promoting peatland ecosystem protection and management including initiative in founding the International Tropical Peatland Center (ITPC) in partnership with Democratic Republic of Congo (DRC), Republic of Congo and Peru. Indonesia has also sponsored the resolution on "*Conservation and Sustainable Peatland Management*" in UNEA 4, March 2019, and adopted as UNEP/EA.4/L.19. It shows that Indonesia has succeeded in gathering support from states member in adopting the resolution.

This book entitled "*Corrective Action on Peatland Management in Indonesia 2019-2020: toward Sustainable Peatland Management*" is to showcase the progress of peatland ecosystem management that has been carried out by the Government of Indonesia under the leadership of President Joko Widodo and expected to inspire all parties to do more and achieve more for global beneficiaries.

Jakarta, *2020*

Dr. Ir. Siti Nurbaya Bakar, M.Sc.
Minister of Environment and Forestry
Republic of Indonesia

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Introduction

Peatland ecosystem on earth is scattered in 5 (five) continents and exist in more than one hundred countries. This ecosystem is a specific environment with the uniqueness of its biodiversity, water content to support moisture balance during the dry, and role on climate stability. Every type of peatland has different ecological characteristic of ecosystem which possibly has different impact and phenomenon of the environment. In term of climate, peatland has an important role, either as carbon dioxide absorber or source of methane, nitrous oxide in some cases, and carbon dioxide from the dried and burn of peatland.

The natural and anthropogenic reason cause changing in land cover, water balance, and biodiversity life cycle on peatland ecosystem. The main problem in the peat ecosystem is the uncontrolled drainage for several purposes. This cause dried peatland and land depression, and lead to peatland fire and floods. With this regard, water management on peatland is essential.

Indonesia is the home of the largest tropical peatland ecosystem in the world and the 4th largest in the world after Canada, Rusia and the United States. Indonesia Peatland area is 24.668 million hectares and consist of 865 Peat Hydrological Unit (PHU). With this regard, Government of Indonesia, under the Leadership of the President of Republic of Indonesia, is consistent to highly commit to the protection and management of peatland ecosystem and has achieved high performance over the last few years, even during the pandemic COVID-19.

Corrective Action has been carried out in 2019-2020, among other fulfilling the regulation, policies, and technical guidance for operational implementation in the field, conducting inventory and determination of peatland ecosystem characteristic scale 1:50.000, establishment of Peatland Ecosystem Protection and Management Plan, as well as peatland ecosystem restoration in the field.

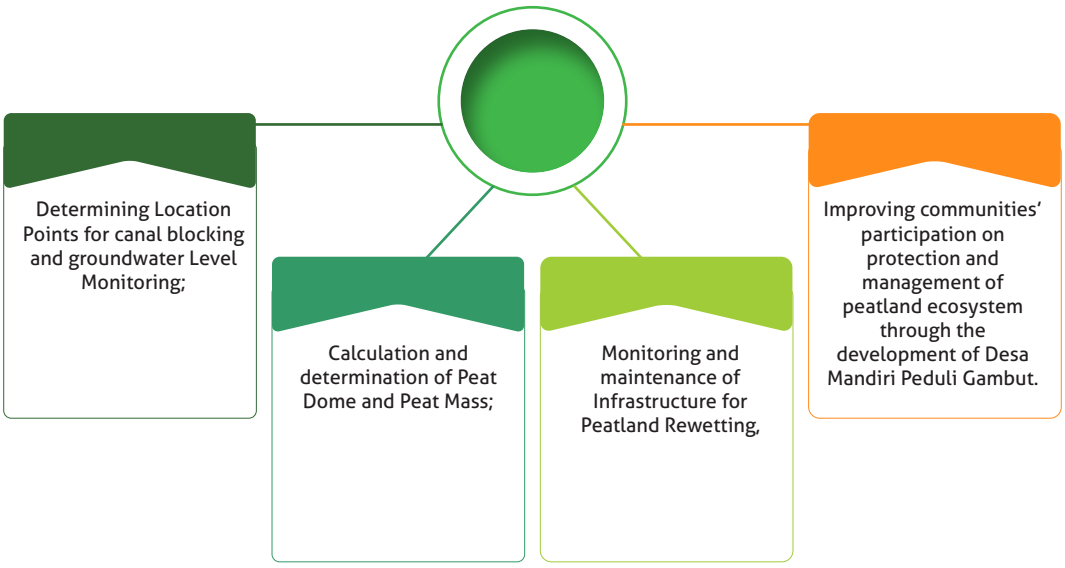
In improving stakeholders' capacity and inviting other collages with peatland, Government of Indonesia, in partnership with Peru, DRC, and Republic of Congo, has also launched the International Tropical Peatland Centre in October 30, 2018, to provide media/forum/institution for knowledge and experience exchange, as well as proposed resolution on Conservation and Sustainable Management of Peatland and adopted in UNEA 4 under UNEP/EA.4/L/19 in 2019.

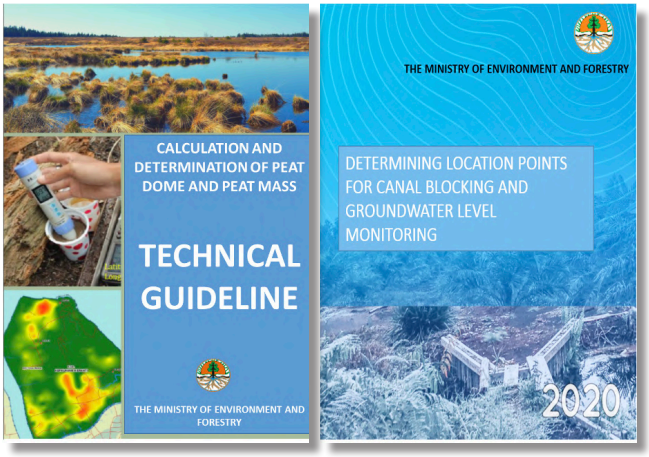
Progress has been made and more progress to be made in the future. Indeed, it is a work in progress in addressing Indonesia protection and management of peatland ecosystem. Government of Indonesia kindly invite colleague Governments for mutual recognition to what Government of Indonesia has carried out and looks forward for future engagement to gain a global benefits.

Policy Strategy on Protection and Management of Peatland Ecosystem

Policy strategy on Peatland Protection and Management refers to the Law Number 32 year 2009 regarding on Environmental Protection and Management and the Government Regulation Number 71 Year 2014 as revised by the Government Regulation Number 57 Year 2016 regarding on Protection and Management of Peatland Ecosystem. The enactment of the Government Regulation No. 71 of 2014 jo. Government Regulation No. 57 of 2016 on Protection and Management of Peatland Ecosystem, gives more power and authorities to protect and manage the peatland ecosystem with more focus on establishment of peatland degradation characteristics, criteria, and standard, as well as requirement and guide line for protection and management.

In fulfilling the technical guidelines for implementation in the field, the Ministry of Environment and Forestry has developed several guide line, among other technical guidelines for:

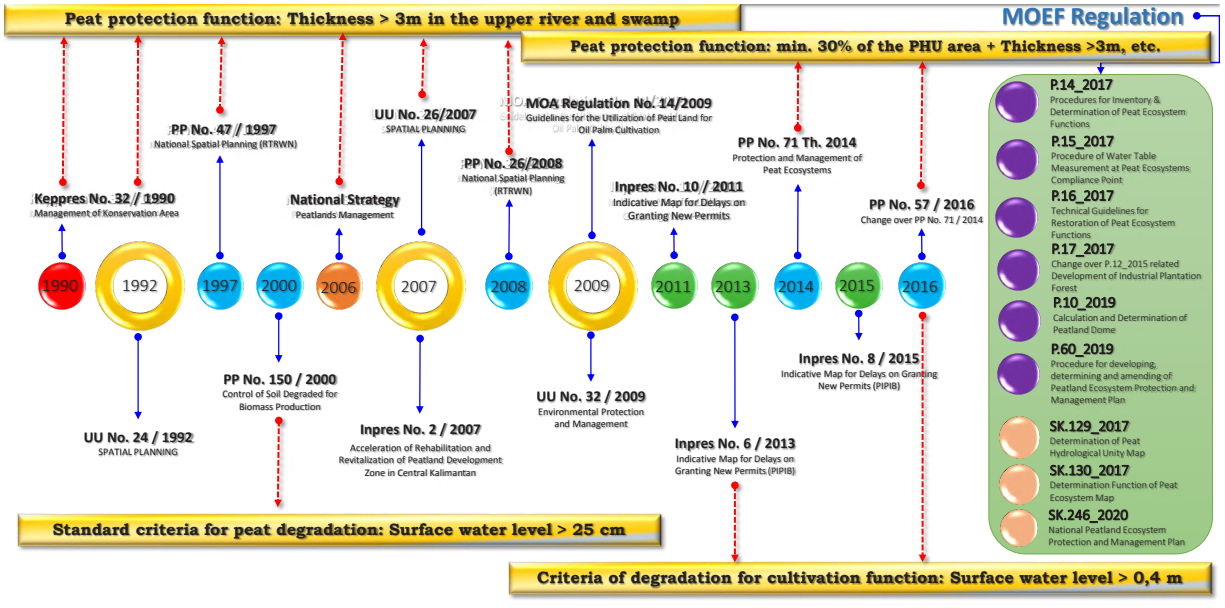




The newest regulation enacted are the Minister of Environment and Forestry Regulation Number P.60/Menlhk/Setjen/KUM.1/10/2019 concerning Procedures for Preparation, Determination and Amendment of Peatland Ecosystem Protection and Management Plan, and The Minister of Environment and Forestry Decree Number SK. 246/Menlhk /Setjen/KUM.1/6/2020 concerning the National Peatland Ecosystem Protection and Management Plan 2020-2049. The regulations provide direction to the Local Government at Provincial and District/City level on the Preparation, Determination and Amendment of Peatland Ecosystem Protection and Management Plan.

The update milestone of the regulation and policy on protection and management of peatland is provided in the figure 1 below.

Figure 1. THE MILESTONE REGULATION
ON PROTECTION AND MANAGEMENT OF PEATLAND ECOSISTEM



Inventory and Determination of Peatland Ecosystem Function

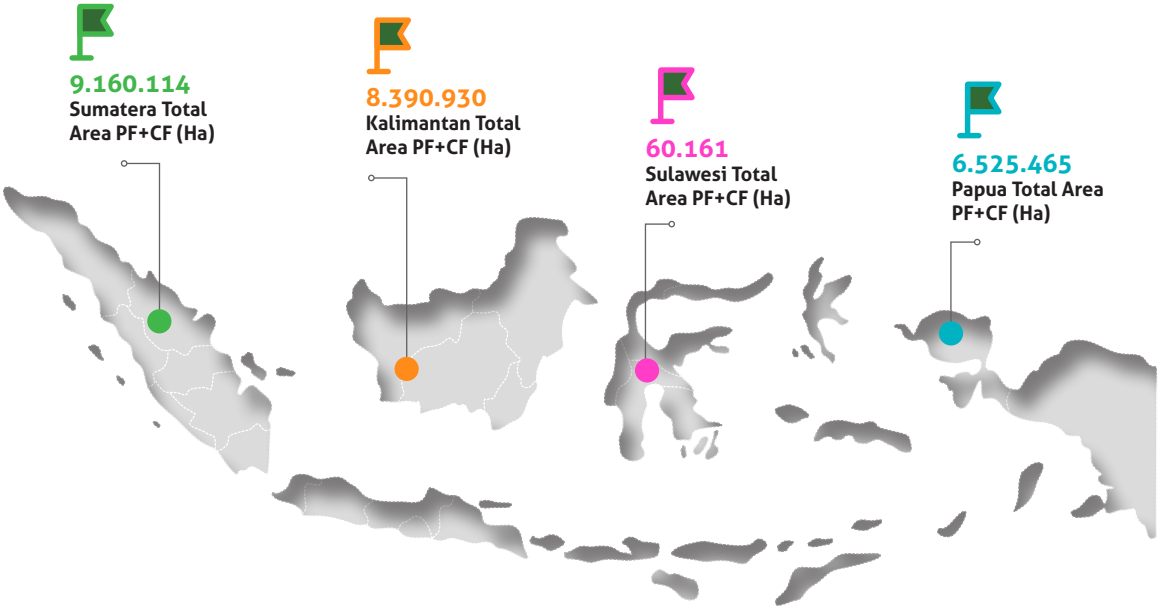
The Inventory of Peat Ecosystem Characteristics, as mandated in the Regulation of the Minister of Environment and Forestry Number P.16/MenLHK/ Setjen/Kum.1/2/2017 concerning Procedures for Inventorying and Determining Peat Ecosystem Functions, is an activity carried out to identify and obtain data and information on the characteristics of the Peat Ecosystem at the level of detail at a scale of 1:50,000. The data and information generated from this activity will be used in the process of determining the Peat Ecosystem Function Map based on the Peat Hydrological Unity (PHU) at a scale of 1:50,000, which will be used as the basis for the preparation of the Peat Ecosystem Protection and Management Plan (RPPEG).

Inventory of Peat Ecosystem Characteristics as referred to Article 14 paragraph (1) Regulation of the Minister of Environment and Forestry Number P.14/MenLHK/Setjen/ Kum.1/2/2017, is carried out through field surveys to obtain data on physical, chemical, biological, hydrotopography, and types of sediment under peat by observing the systematic grid method consisting of longitudinal and transverse transects:

- The distance between transects is 2 (two) kilometers long, with an observation distance between points of 500 (five hundred) meters;
- The distance between transects is 3 (three) kilometers, with an observation distance between points of 1,000 (one thousand) meters; and
- The starting point of the two transects was determined from one of the dome crests.

There are 13 parameters resulted from the implementation of Peat Ecosystem Characteristics Iinventory including physical, chemical, biological, hydrotopographic and sediment types of peat characteristics, as follows:

1. coordinates points of the observation;
2. land elevation;
3. groundwater, water pool/puddle or flooding;
4. land cover, land use, and condition;
5. the existence of protected flora and fauna;
6. natural and artificial drainage conditions;
7. water quality;
8. overflow type;
9. peat thickness;
10. weight proportion of peat material;
11. change in condition or level of peatlands damage;
12. characteristics of the substratum under the peat layer; and
13. Soil characteristics and depth of the pyrite layer.



The total area of PHU throughout Indonesia is ± 24,136,669 hectares, which is divided into the Protected Function of the Peat Ecosystem covering an area of ± 12,069,707 hectares and the Peat Ecosystem Cultivation Function covering an area of ± 12,066,962 hectares.

Article 5 paragraph (1) of the Regulation of the Minister of Environment and Forestry Number P.14/MenLHK/Setjen/Kum.1/2/2017, state that the Government through the Director General conducts a national Peat Ecosystem inventory.; Article 14 paragraph (3) required to the person in charge of the business and/or activity to conduct field survey and an inventory of the characteristics of Peat Ecosystem in their area under supervision of the Director General.

The total number of Peat Hydrological Units (PHU) in Indonesia is 865 PHU, there are 207 across Sumatra Island, 190 PHU in Kalimantan Island, 3 PHU in Sulawesi Island and 465 PHU in Papua Island. The total area of PHU throughout Indonesia is ± 24,136,669 hectares, which is divided into the Protection Function of the Peat Ecosystem covering an area of ± 12,069,707 hectares and the Peat Ecosystem Cultivation Function covering an area of ± 12,066,962 hectares. Data on the number of PHU per Province and the extent of Peat Ecosystem Functions in Indonesia are shown in **Table 1** as below.

Table 1. Number of PHU per Province and Area of Peat Ecosystem Functions in Indonesia

Island	Province	Number of PHU	Protected Function of PHU			Total Area of PF (Ha)
			Plantation Areas	Forestry Industries	Non Concession	
Sumatera	Aceh	36	38.907	0	138.995	177.902
	Bengkulu	3	1.524	0	11.330	12.854
	Jambi	13	55.929	73.220	397.568	526.716
	Kep. Bangka Belitung	17	473	10.907	46.219	57.599
	Kep. Riau	5	0	0	5.105	5.105
	Lampung	5	14.530	0	26.188	40.717
	Riau	59	391.153	735.116	1.251.881	2.378.150
	Sumatera Barat	14	19.355	0	58.254	77.608
	Sumatera Selatan	34	131.560	404.033	656.249	1.191.842
	Sumatera Utara	27	80.105	244	151.354	231.703
Sumatera Total		**207**	**733.534**	**1.223.519**	**2.743.142**	**4.700.196**
Kalimantan	Kalimantan Barat	126	104.947	152.854	859.464	1.117.265
	Kalimantan Selatan	4	29.809	0	45.434	75.243
	Kalimantan Tengah	35	84.697	3.601	2.468.668	2.556.967
	Kalimantan Timur	16	14.588	3.434	158.079	176.101
	Kalimantan Utara	13	18.929	26.594	113.221	158.743
Kalimantan Total		**190**	**252.970**	**186.482**	**3.644.866**	**4.084.318**
Sulawesi	Sulawesi Barat	2	7.593	0	3.893	11.486
	Sulawesi Tengah	3	1.012	0	12.356	13.368
Sulawesi Total		**3**	**8.605**	**0**	**16.249**	**24.854**
Papua	Papua	250	61.006	4.239	2.624.894	2.690.139
	Papua Barat	216	5.564	12.438	552.198	570.200
Papua Total		**465**	**66.570**	**16.677**	**3.177.092**	**3.260.339**
Total PHU of INDONESIA		**865**	**1.061.679**	**1.426.678**	**9.581.349**	**12.069.707**

Cultivated Function of PHU			Total Area of CF (Ha)	Total Area PF+CF (Ha)
Plantation Areas	Forestry Industries	Non Concession		
40.557	0	117.590	158.147	336.048
4	0	1.476	1.480	14.334
25.366	46.758	272.451	344.575	871.292
816	19.312	20.309	40.437	98.036
0	0	11.239	11.239	16.344
10.796	0	45.660	56.456	97.173
389.094	425.034	1.776.898	2.591.025	4.969.174
15.001	0	59.849	74.850	152.458
132.522	287.469	471.945	891.936	2.083.778
61.189	938	227.646	289.773	521.476
675.345	**779.511**	**3.005.062**	**4.459.918**	**9.160.114**
143.604	187.847	1.343.914	1.675.365	2.792.630
26.842	0	125.772	152.614	227.857
208.841	135.668	1.780.550	2.125.059	4.682.026
19.762	11.825	133.779	165.366	341.467
10.523	37.430	140.255	188.208	346.951
409.572	**372.769**	**3.524.271**	**4.306.612**	**8.390.930**
16.846	0	2.923	19.770	31.255
241	0	15.296	15.537	28.905
17.088	**0**	**18.219**	**35.307**	**60.161**
135.674	21.546	2.207.577	2.364.797	5.054.936
49.920	38.160	812.249	900.328	1.470.528
185.594	**59.706**	**3.019.826**	**3.265.125**	**6.525.465**
1.287.599	**1.211.986**	**9.567.377**	**12.066.962**	**24.136.669**

Source : Decree of the Minister of Environment and Forestry Number 129 of 2017 regarding Determination of Peat Hydrological Unity, and Decree of the Minister of Environment and Forestry Number 130 of 2017 regarding Determination of Peat Ecosystem Function

From 2015 to 2020 the Ministry of Environment and Forestry has carried out the Inventory of Peat Ecosystem Characteristics Scale 1:50,000 in 235 PHU or 27.2% of the total number of PHU with a total area of ± 12,729,926 hectares, 52.7% of the total area of PHU. In conducting the Inventory of Peat Ecosystem Characteristics, the Ministry of Environment and Forestry shares tasks with the Peatland Restoration Agency (BRG) or currently named –the Peatland and Mangrove Restoration Agency (BRGM).-The details of the number of PHU and the area Inventory of Peat Ecosystem Characteristics per year is as provided in **Table 2** as below.

Table 2. Number and Area of PHU Results of Peat Ecosystem Characteristics Inventory in 2015-2021

2015

Number of PHU		
MOEF	BRG	Total
5	0	5
Coverage of Inventory (Hectares)		
MOEF	BRG	Total
1.279.001	0	1.279.001

2016

Number of PHU		
MOEF	BRG	Total
8	0	8
Coverage of Inventory (Hectares)		
MOEF	BRG	Total
174.694	0	174.694

2017

Number of PHU		
MOEF	BRG	Total
4	13	17
Coverage of Inventory (Hectares)		
MOEF	BRG	Total
14.113	1.772.879	1.786.992

2018

Number of PHU		
MOEF	BRG	Total
12	7	19
Coverage of Inventory (Hectares)		
MOEF	BRG	Total
333.498	1.137.260	1.470.758

2019

Number of PHU		
MOEF	BRG	Total
42	8	50
Coverage of Inventory (Hectares)		
MOEF	BRG	Total
905.097	718.739	1.623.836

2020

Number of PHU		
MOEF	BRG	Total
136	0	136
Coverage of Inventory (Hectares)		
MOEF	BRG	Total
6.394.646	0	6.394.646

Total

Number of PHU		
MOEF	BRG	Total
207	28	235
Coverage of Inventory (Hectares)		
MOEF	BRG	Total
9.101.049	3.628.878	12.729.927

Source : Directorate of Peat Degradation Control MOEF, 2021

In 2020, the Ministry of Environment and Forestry determine the Peatland Ecosystem Function Map (scale of 1:50,000) for 42 PHU's, spread over the areas of South Sumatra Province, West Kalimantan Province, Central Kalimantan Province, North Kalimantan Province and Papua Province. The details information on the names of the 42 PHU's that have been enacted under the Decree Numbers of the Minister of Environment and Forestry is provided in Table 3 as below.

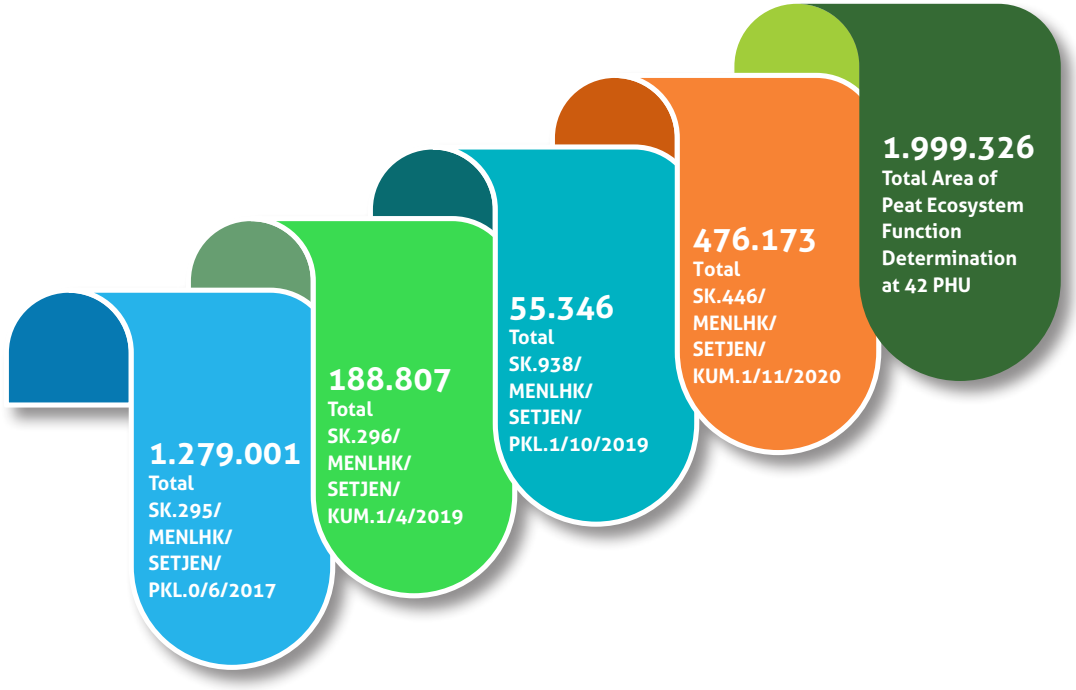


Table 3. Names of PHU and Decrees of the Minister of Environment and Forestry related to the Determination of Peat Ecosystem Functions in 42 PHU's (2015-2020)

Determination of Minister Decree	Inventory Year	Province	Name of Peat Hydrological Unity (PHU)	Implementing Unit		Total Area (Ha)
				MOEF	BRG	
SK.295/ MENLHK/ SETJEN/ PKL.0/6/ 2017	2015	West Kalimantan	PHU Sungai Kapuas - Sungai Terentang	23.497	0	23.497
		Riau	PHU Pulau Bengkalis	90.758	0	90.758
			PHU Pulau Tebing Tinggi	138.138	0	138.138
			PHU Sungai Gaung - Sungai Batangtuaka	315.555	0	315.555
			PHU Sungai Kampar - Sungai Gaung	711.053	0	711.053

Determination of Minister Decree	Inventory Year	Province	Name of Peat Hydrological Unity (PHU)	Implementing Unit		Total Area (Ha)
				MOEF	BRG	
SK.295/MENLHK/SETJEN/PKL.0/6/2017 Total				1.279.001	0	1.279.001
SK.296/ MENLHK/ SETJEN/ KUM.1/4/ 2019	2016	Aceh	PHU Krueng Surin - Krueng Muling	22.164	0	22.164
			PHU Krueng Tripa - Krueng Seuneuam	16.118	0	16.118
		East Kalimantan	PHU Sungai Kedangyantau - Sungai Sabintulung	37.900	0	37.900
			PHU Sungai Kelinjau - Sungai Kedangyantau	31.255	0	31.255
		West Sumatera	PHU Aek Lunang - Aek Sidang	14.084	0	14.084
			PHU Aek Ubar - Aek Lunang	23.251	0	23.251
		North Sumatera	PHU Sungai Kanopan - Sungai Kuala	9.173	0	9.173
			PHU Sungai Kuala - Sungai Kuo	20.749	0	20.749
	2017	Aceh	PHU Krueng Matee - Krueng Teumiyee	4.244	0	4.244
		West Sumatera	PHU Batang Ampu - Bah Mandiangin	5.472	0	5.472
		North Sumatera	PHU Aek Maraitgadang - Aek Sikapas	2.358	0	2.358
			PHU Batang Toru - Aek Maraitgadang	2.039	0	2.039
SK.296/MENLHK/SETJEN/KUM.1/4/2019 Total				188.807	0	188.807
SK.938/ MENLHK/ SETJEN/ PKL.1/10/ 2019	2018	Aceh	PHU Krueng Meureubo - Krueng Matee	5.026	0	5.026
			PHU Krueng Wonki - Krueng Gubon	10.356	0	10.356
		West Kalimantan	PHU Sungai Dadau - Sungai Sikan	14.012	0	14.012
		South Sumatera	PHU Aek Musi - Sungai Upang	25.952	0	25.952
SK.938/MENLHK/SETJEN/PKL.1/10/2019 Total				55.346	0	55.346

Determination of Minister Decree	Inventory Year	Province	Name of Peat Hydrological Unity (PHU)	Implementing Unit		Total Area (Ha)
				MOEF	BRG	
SK.446/ MENLHK/ SETJEN/ KUM.1/11/ 2020	2017	South Sumatera	PHU Sei Lalan - Sungai Bentayan	0	21.073	21.073
	2018	West Kalimantan	PHU Sungai Mempawah - Sungai Peniti	0	51.059	51.059
	2019	West Kalimantan	PHU Sungai Penyangkat - Sungai Selat Maya	0	92.993	92.993
		West Kalimantan	PHU Sungai Sambas Besar - Sungai Seiyung	0	68.280	68.280
		Central Kalimantan	PHU Sungai Lamandau - Sungai Arut	0	43.928	43.928
		Riau	PHU Pulau Labu	590	0	590
		Riau	PHU Pulau Merbau	21.617	0	21.617
		Riau	PHU Pulau Serapung	2.871	0	2.871
		Riau	PHU Pulau Topang	2.914	0	2.914
		Riau	PHU Sungai Boang - Sungai Basira	8.040	0	8.040
		Riau	PHU Sungai Indragiri	1.938	0	1.938
		Riau	PHU Sungai Indragiri - Sungai Ekok	4.271	0	4.271
		Riau	PHU Sungai Indragiri - Sungai Enok	56.013	0	56.013
		Riau	PHU Sungai Indragiri - Sungai Tuana	16.262	0	16.262
		Riau	PHU Sungai Kampar Kiri - Sungai Segati	20.234	0	20.234
		Riau	PHU Sungai Kanan - Sungai Buluh	12.999	0	12.999
		Riau	PHU Sungai Merusi - Sungai Belanak	5.584	0	5.584
		Riau	PHU Sungai Nidir - Sungai Enok	18.957	0	18.957
		Riau	PHU Sungai Pergam - Sungai Pucuk Besar	8.992	0	8.992
		Riau	PHU Sungai Rotoh - Sungai Bang	5.130	0	5.130
		Riau	PHU Sungai Senama Kecil - Sungai Rajaelok	12.427	0	12.427
SK.446/MENLHK/SETJEN/KUM.1/11/2020 Total				198.840	277.332	476.173
Total Area of Peat Ecosystem Function Determination at 42 PHU				1.721.994	277.332	1.999.326

Source : Directorate of Peat Degradation Control MOEF, 2021

Some photos of field visit for verification of peat ecosystem characteristics in Industrial Forest Plantation (IUPHHK-HTI) and Industrial Oil Palm Plantation (HGU/Oil Palm) are shown in figure below.

Figure 1. Field visit for verification of peat ecosystem characteristics at PT. Mayawana Persada (Industrial Forest Plantation) in Ketapang and North Kayong Distric, West Kalimanan Province

Figure 2. Field visit is conducted for verification of peat ecosystem characteristics at PT. Priatama Riau (Oil Palm Plantation) in Rupat Island, Bengkalis Distric, Riau Province

Figure 3. Field visit is conducted for verification of peat ecosystem characteristics at PT. Marita Makmur Jaya (Oil Palm Plantation) in Rupat Island, Bengkalis Distric, Riau Province

Figure 4. Field visit is implemented for verification of peat ecosystem characteristics at PT. Sumatera Riang Lestari Blok IV (Industrial Forest Plantation) in Rupat Island, Bengkalis Distric, Riau Province

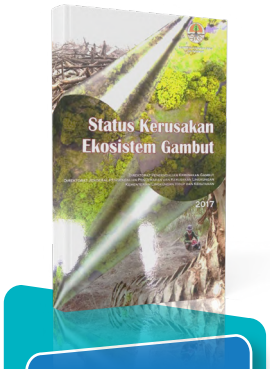
Peatland Ecosystem Protection and Management Plan

The Government Regulation Number 71 Year 2014 juncto The Government Regulation Number 57 Year 2016 on Protection and Management of Peatland Ecosystem provide direction for Ministry, Governor, Mayor and Head of District, according to their perspective authorities, to establish the Peatland Ecosystem Protection and Management Plan (RPPEG). RPPEG is a written document containing systematic and integrated efforts planned to preserve the function of the peatland ecosystem and prevent its deterioration.

Referring to the Government Regulation, in 2019, the Ministry of Environment and Forestry stipulated The Minister of Environment and Forestry Regulation Number P.60/Menlhk/Setjen/KUM.1/10/2019 concerning Procedures for Preparation, Determination and Amendment of Peatland Ecosystem Protection and Management Plan, and the enactment of The Minister of Environment and Forestry Decree Number SK. 246/Menlhk/Setjen/KUM.1/6/2020 concerning the National Peatland Ecosystem Protection and Management Plan 2020-2049.

NATIONAL LONG TERM PLANNING FOR PROTECTION AND MANAGEMENT OF PEATLAND ECOSYSTEM (2020-2049)

GUIDELINES FOR COMPILATION, STIPULATION AND ADDENDUM OF PLANNING FOR PROTECTION AND MANAGEMENT OF PEATLAND ECOSYSTEM

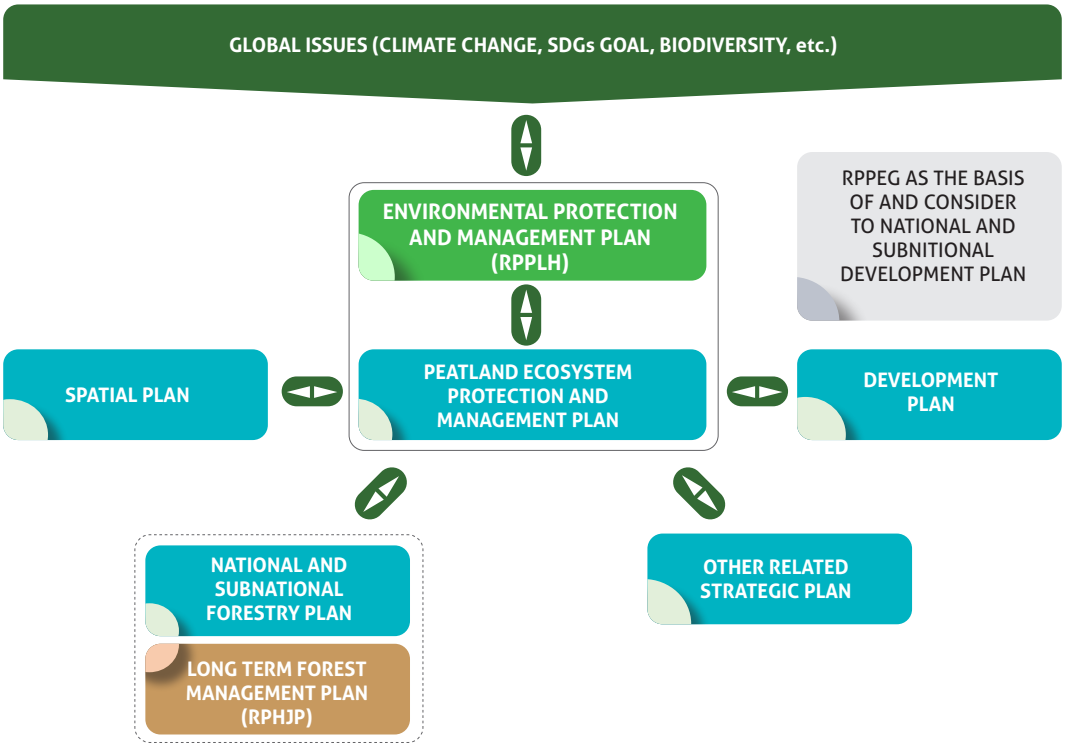


STATES OF PEATLAND ECOSYSTEM DEGRADATION [COVERS OF 24 MILLION HECTARES]

The Ministry of Environment and Forestry stipulated The Minister of Environment and Forestry Regulation Number P.60/Menlhk/Setjen/KUM.1/10/2019 concerning Procedure for Preparation, Stipulation and Amendment of Peatland Ecosystem Protection and Management Plan. This regulation gives the mandate and direction for local government at provincial and district/city level in establishing the Peatland Ecosystem Protection and Management Plan starting from the preparation stage to stipulation, amendment, monitoring, evaluation, and financing. The Ministerial Regulation also provides guideline for the Ministry Environment and Forestry to provide supervision, supporting data base on the peatland characteristic inventory with scale on 1:50.000, and technical recommendation to local government in establishing its Peatland Ecosystem Protection and Management Plan (RPPEG).

The National Peatland Ecosystem Protection and Management Plan (RPPEG Nasional) 2020-2049 contains strategic plan for peatland ecosystem utilization, peatland ecosystem degradation control (prevention, mitigation and restoration), peatland ecosystem maintenance (reserve and conservation), as well as climate change mitigation and adaptation on peatland ecosystem. The goals, objectives, policy directions, strategies, programs and activities are described in every stage of plan to provide guidelines for the stakeholders' involvement on peatland ecosystem protection and management. Furthermore, the RPPEG should be referred and taken into consideration in establishing other related development plans, among other long/medium term development plan at national/provincial/district/city level, spatial plan, forestry plan, as well as other strategic and sectoral plans.

Figure 5. Position of Peatland Ecosystem protection and management plan (RPPEG)



The Figure 6 shows the correlation of the RPPEG with other related national or subnational development plan, including the long term forest management plan, spatial plan, and environmental protection and management plan. Development of spatial planning should consider to the peatland ecosystem protection and management plan and vice versa. Establishment of peatland ecosystem protection and management plan should take into account to the global issues, among other mitigation, adaptation and climate resilience, as well as biodiversity and land degradation, etc.

In accelerating the establishment of the peatland ecosystem protection and management plan (RPPEG) at provincial and district/city level, The Ministry of Environment and Forestry carry out several activities including distribution of information and socialization, technical coaching, and supervision for local government and the closed university. The Ministry of Environment and forestry has also provide information on related expert or resource person who may available to assist the local government in preparation and development its RPPEG.

Figure 6. SUPERVISION TO ACCELERATE THE ESTABLISHMENT OF PEATLAND ECOSYSTEM PROTECTION AND MANAGEMENT (RPPEG) AT PROVINCIAL AND DITRSICT/CITY LEVEL

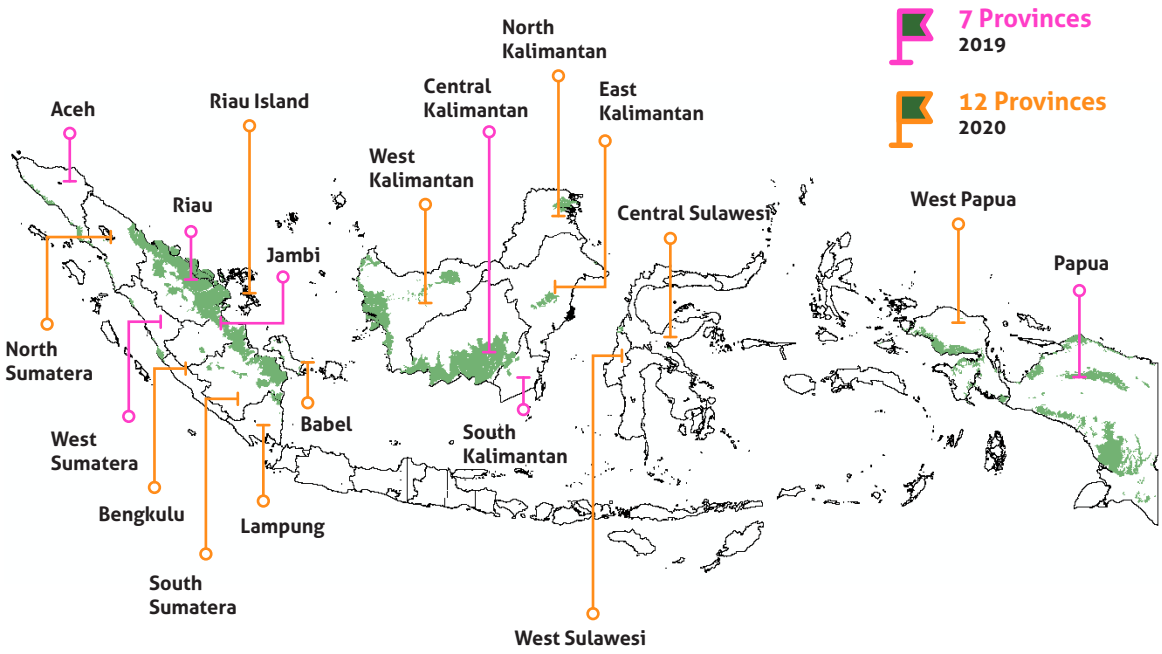


Figure 6. Shows that in 2019, the Ministry of Environment and Forestry has conducted supervision for 7 provinces of 19 province with peatland ecosystem, and the supervision was conducted in 2020 for the remaining provinces, 12 provinces. Until 2020, the province that has established the RPPEG is Central Kalimantan stipulated in the Governor of Central Kalimantan Decree Number: 188.44/684/2020, dated on 30 December 2020 regarding the Central Kalimantan Province RPPEG 2020-2050, and the district that has determined the RPPEG is West Kotawaringin stipulated in the Head of District (Bupati) West Kotawaringin Decree Number 660/04/DLH/III/2021, dated on 22 March 2021, regarding The west Kotawaringin District RPPEG 2020-2050. Some of the remaining provinces have reached the finalization stage and correction according to the National RPPEG.

Restoration of Peatland Ecosystem

The implementation of peatland restoration refers to Article 30 of the Government Regulation Number 71 year 2014 Government Regulation Number 57 year 2016 regarding Protection and Management of Peatland. **The Article 30 paragraph (1)** mention that the person in charge in the business/activity that causes damage to the peatland ecosystem inside or outside the company area is obliged to carry out the recovery as stated in the environmental permit. **Article 30** paragraph (2) mentioned that recovery inside and outside the business and/or activity area as referred to the paragraph (1) must be carried out by the person in charge in the business and/or activity to the damage as referred to in article 27 paragraph (2). Article 30 paragraph (3) mention that recovery is carried out with of natural succession, rehabilitation, restoration, and others in accordance with the development of science and technology.

For operational implementation of Recovery on Peatland Ecosystem, The Ministry of Environment and Forestry has established the Minister of Environment and Forestry Regulation No. 16 year 2017 regarding on the Technical Guideline for Peatland Ecosystem Recovery. **Article 2** of this Ministerial Regulation mention that this ministerial regulation aims to provide technical guidelines for the restoration of peat ecosystems for (a) government, (b) local government/ province, (c.) community and customary law community, (d) person in charge in the business and/or activity. **Article 9** mention that Recovery of peatland ecosystem in un-licensed (non permit) area is recovery in unlicensed areas is carried out by the government, provincial/district/city local governments or the person in charge of businesses and or activities in accordance with their respective authorities. This provides clear direction on the authority level of peatland ecosystem recovery. The appendix also explains the technical guidelines for implementing ecosystem restoration which include improving water management to restore peat water, monitoring groundwater levels, rehabilitation and revegetation as well as natural succession.

The implementation of peat ecosystem restoration in community area, is carried out with direct community involvement. In increasing the community direct involvement, the Ministry of Environment and Forestry develop the Self Supporting Villages for protection and management on peatland ecosystem, so called "Desa Mandiri Peduli Gambut".

Regarding to the above explanation, basically the main concept of restoring the peatland ecosystem consist of rewetting – to bring back the water-, rehabilitation, revegetation, and natural succession – to bring back the vegetation or land cover-, as well as improve community livelihood – to enhance community participation and direct involvement-. The detail explanation is provided in the Figure 7 Below.

Figure 7. THE CONCEPT FOR ENHANCHING COMMUNITY PARTNERSHIP

Bring back and preserve the water, bring back and preserve the vegetation, and improve local community livelihoods

1 **Canal blocking either in concession or community areas:**
Canal blocking construction is to preserve the peatland water and rewetting the areas those prone to forest and land fires.
The canal blocking also provides water for fish pond.

2 **Rehabilitation of vegetation:**
Rehabilitation of vegetation can be carried out by replanting of local timber tree and/or natural succession. Economic value plants can be applied for rehabilitation of vegetation in community areas.

CANAL BLOCKING

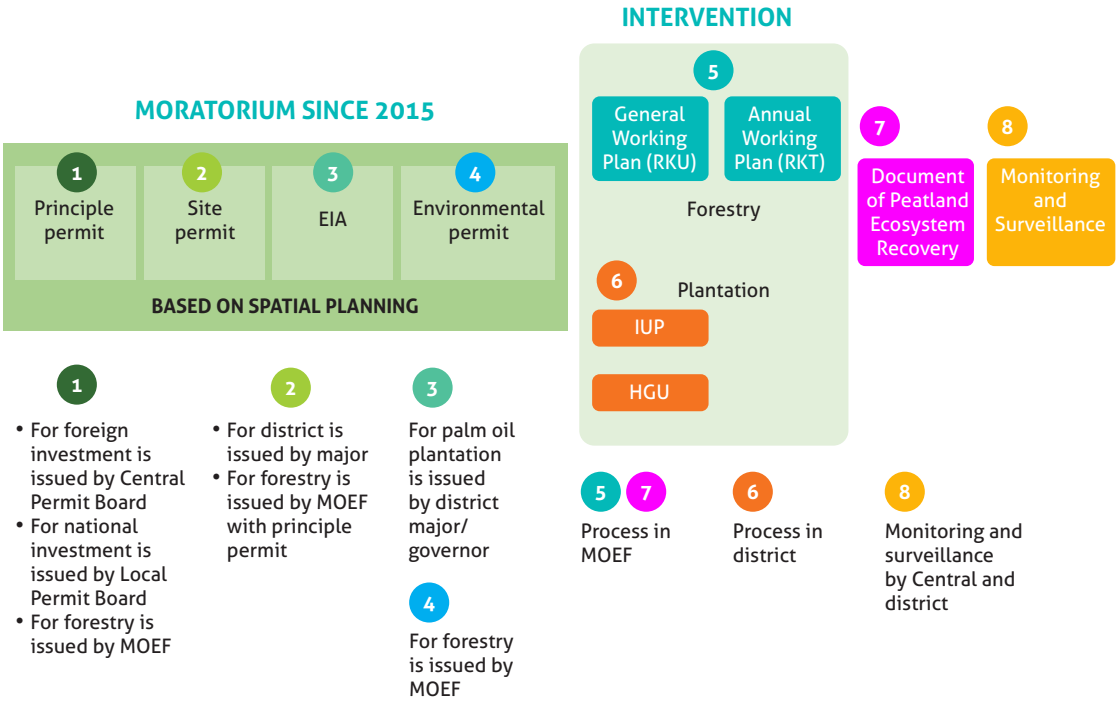
REPLANTING

3 **Improve Community Livelihood: Production – Diversification Product – Market Chain:**
Implementing Paludiculture, Agro-forestry, Environmental services in peatland area

AGROFORESTRY ON PEATLAND ECOSYSTEM

As stated in the article 30 paragraph (1), recovery of peat ecosystem restoration in concession holders is carried out as stated in the environmental permit. The detail safeguard for protection and management of peatland ecosystem in concession holders is provided in the Figure 8 below.

Figure 8. SAFEGUARDS FOR PROTECTION AND MANAGEMENT OF PEATLAND ECOSYSTEM -CONCESSION HOLDERS-

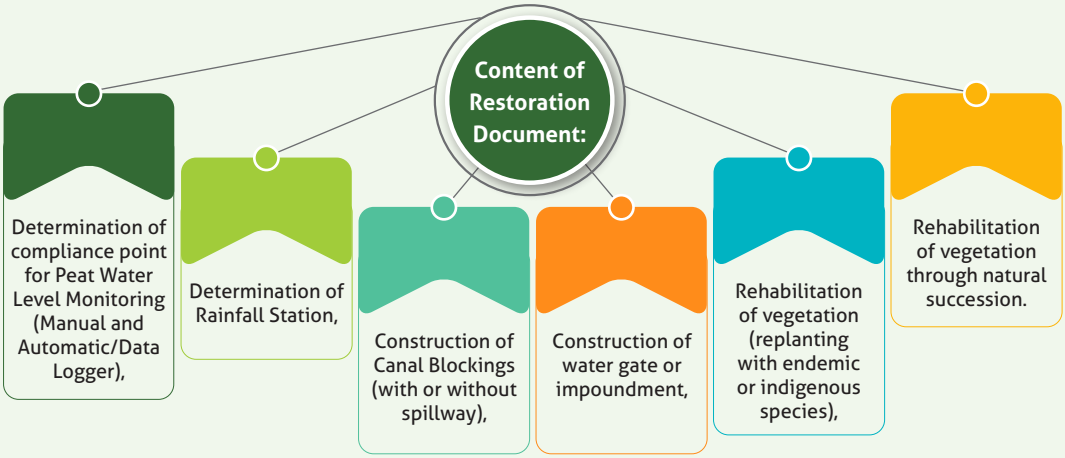


The Figure above provide information that the obligation to conduct peatland protection and management in concession holders started form the principle permit and followed with site permit, Environmental Impact Assessment (EIA) , and environmental permit, which are consider to the spatial planning. The Figure also shows the differences process between the Industrial Forest and Palm Oil Plantation. However, either the industrial forest or palm oil plantation have the same obligation to develop the document of Peatland Ecosystem Restoration Plan. All of these document, the series document from Principle Permits through the Document of Peatland Ecosystem Restoration Plan will be a legal basis to conduct monitoring, inspection and surveillance.
The document of Peatland Ecosystem Restoration Plan established by the concession holders should consist of description on development of rewetting infrastructure and monitoring station for water level either manually or with data logger and rain fall station, as well as rehabilitation, revegetation and natural succession. All of these document, the series document from Principle Permits through the Document of Peatland Ecosystem Restoration Plan will be a legal basis to conduct monitoring, inspection and surveillance. The Document of Peatland Ecosystem Restoration Plan will be reviewed by the Team from the Ministry of Environment and Forestry to get approval and after getting approval the document will be stipulated in the Decree of the Director General of Pollution and Environmental Degradation Control.

Up to 2020, there are 294 concession holders have developed the Document of Peatland Ecosystem Restoration Plan and conduct peatland ecosystem restoration in their area. The number is accumulated number from 2015 – 2018 and 2019-2020, consists of 70 from industrial forest and 224 from palm oil plantation. The total area restored are at about 3.6 billion hectares, with the number of canal blocking developed at about 30,961 units, either backfilling or spill way, number of water level (TMAT) monitoring station at about 10,857 unit, either manual or data logger, and rainfall station at about 816 unit spread in Indonesia. Detail achievement of peatland ecosystem in concession holders provided in below graphs and Figure 9.

2018			2019			2020		
Industrial Forest	Palm Oil Plantation (PMO)	total	Industrial Forest	Palm Oil Plantation (PMO)	total	Industrial Forest	Palm Oil Plantation (PMO)	total
∑ Company								
68	127	194	68	173	241	70	224	294
Areas of peatland restoration								
2.226.780,8 ha (di115 PHU)	884.580,9 ha (di 74 PHU)	3.111.360,9 ha	2,232,780.8 ha (di 115 PHU)	1,035,426.11 ha (di 74 PHU)	3.262.206,91 ha	2.354.7661,3 ha (in 115 PHU)	1.289.137,96 ha (in 74 PHU)	3.643.799,26 ha
∑ of compliance point for monitoring of peat water level								
5.669 unit	3.934 unit	9.603 unit	5.669 unit	4.662 unit	10.331 unit	5.688 units	5.189 units	10.857 units
∑ Rainfall Station								
263 unit	337 unit	600 unit	263 unit	416 unit	679 unit	265 units	551 units	816 units
∑ Constructed canal blockings								
8.012 unit	9.460 unit	17.292 unit	8.012 unit	12.802 unit	20.814 unit	8.641 unit	22.320 unit	30.961 unit
Vegetation rehabilitation (replanting)								
4.438,70 ha	-	4.438,70 ha	4.438,70 ha	-	4.438,70 ha	4.438,70 ha	-	4.438,70 ha
Vegetation rehabilitation (natural succession)								
306.112 ha	-	306.112 ha	306.112 ha	-	306.112 ha	306.112 ha	-	306.112 ha

Figure 9. RESTORED AREAS OF PEATLAND
(BASED ON RESTORATION DOCUMENTS OF CONCESSION AREAS, 5th NOV 2020)



Pulpwood Industrial Plantation

∑ Company: 70

Areas of peatland restoration: 2.354.766l,3 ha (in 115 PHU)	∑ of compliance point for monitoring of peat water level: 5.688 units	∑ Rainfall Station: 265 units
∑ Constructed canal blockings: 8.64l unit	Vegetation rehabilitation (replanting): 4.438,70 ha	Vegetation rehabilitation (natural succession): 306.112 ha

Palm Oil Plantation

∑ Company: 224

Areas of peatland restoration: 1.289.137,96 ha (in 74 PHU)	∑ of compliance point for monitoring of peat water level: 5.189 units	∑ Rainfall Station: 55l units
∑ Constructed canal blockings: 22.320 unit	Vegetation rehabilitation (replanting): -	Vegetation rehabilitation (natural succession): -

Total

∑ Company: 294

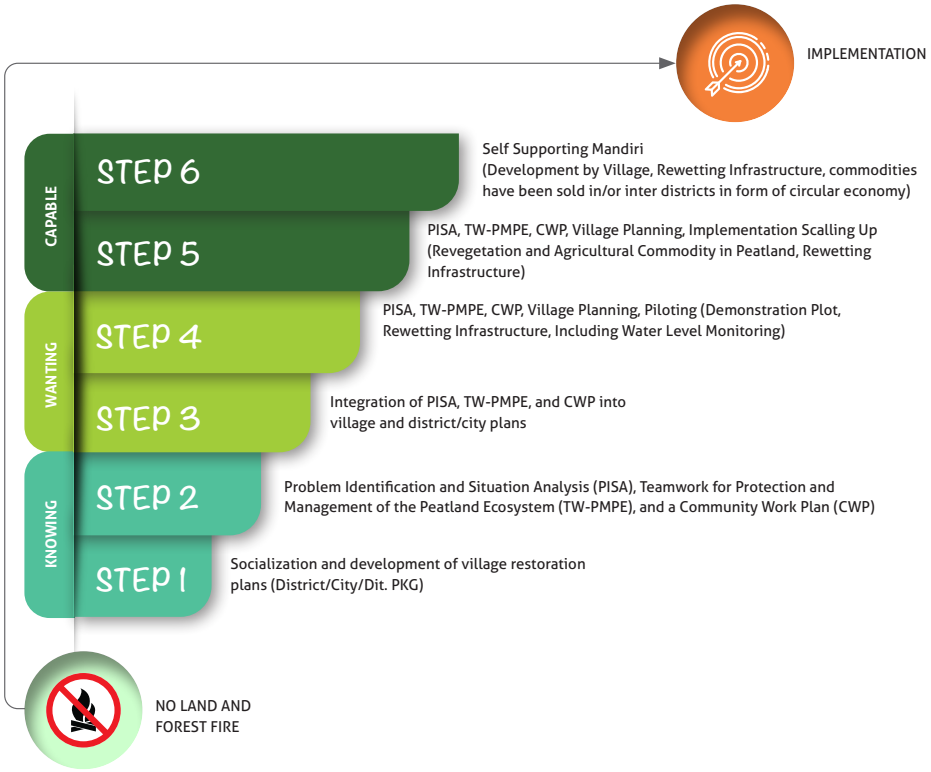
Areas of peatland restoration: 3.643.799,26 ha	∑ of compliance point for monitoring of peat water level: 10.857 units	∑ Rainfall Station: 816 units
∑ Constructed canal blockings: 30.96l unit	Vegetation rehabilitation (replanting): 4.438,70 ha	Vegetation rehabilitation (natural succession): 306.112 ha

Peatland restoration in community area

The Ministry of Environment and Forestry has developed ***Desa Mandiri Peduli Gambut*** or Peat Self-Supporting Villages, the communities based peatland conservation and restoration to encourage communities' involvement. This program established in collaboration with local government, universities, and private sectors. The principle concept of ***Bring Back the Water, Bring Back the Vegetation and Improve the Community Livelihood*** is implemented in this program.

The purpose of this program is to improve the community awareness and power or ability to actively participate in the protection and management of the peat ecosystem in the surrounding area. Step or stage of the implementation of Peat Self Supporting village are provided in the Figure 10 below.

Figure 10. RESTORED AREAS OF PEATLAND (BASED ON RESTORATION DOCUMENTS OF CONCESSION AREAS, 5th NOV 2020)



First Step is develop collaboration with university and local government to determine the facilitator and conduct training for facilitators.

Step 2: facilitator will assist local community to establish Problem identification and analysist, develop village institution for peatland protection and management, named TK-PPEG (Tim Kerja Desa Mandiri Peduli Gambut). This is the formal village institutional approved by the head of village government or Kepala Desa.

Step 3: the community and member of TK-PPEG establish Community Work Plan or RKM supervised by the facilitators. Community Work Plan consist of recommendation action for improving water management and revegetation on peatland ecosystem and economic revitalization.

The TK-PPEG with assistance of facilitators conduct Forum Discussion Group (FGD) to present the Community Work Plan. The FDC is attended by the representative of local government at village and district level. The purpose of the FDG is to gain feedback and recommendation for improvement, as well as synchronization with medium- and long-term plans at village and district level.

After get feedback and approval for implementation from the ministry and environment and forestry, the TK-PPEG will implement the Community Work Plan with support budged from the ministry of environment and forestry. In scaling up and replication of the Desa Mandiri Peduli Gambut may also supported by the local government funding, private sectors under the community development program, and other funding resource.

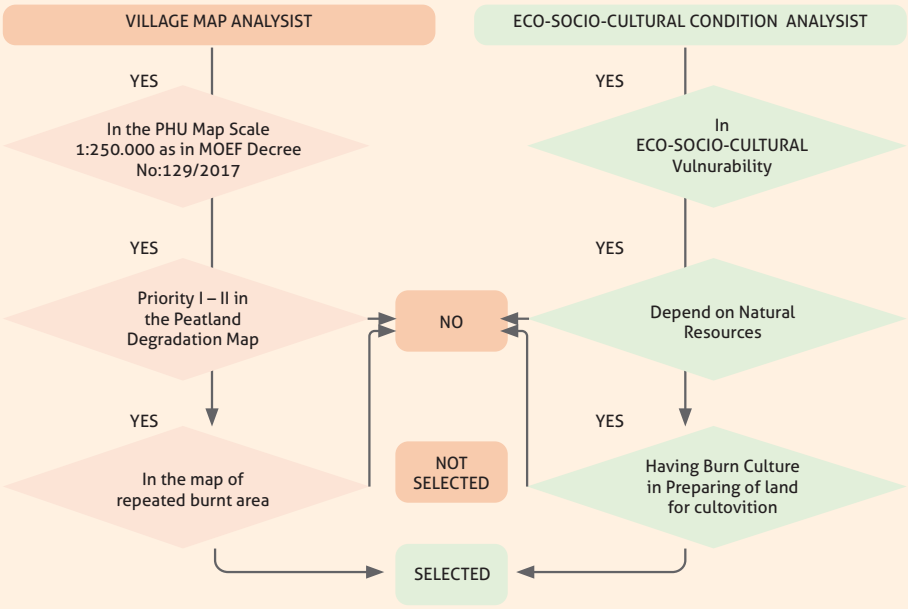
Step 4: Implementation of RKM, a pilots the activities in village and district/city plans. Activities could include establishment of demonstration plots, construction of rewetting infrastructure, and water level monitoring.

Step 5 is upscaling to new pilot activities, such as revegetation, planting agricultural commodities suitable for peatlands, and continued rewetting.

Step 6: the implementation of peatland ecosystem protection and management by the community independently.

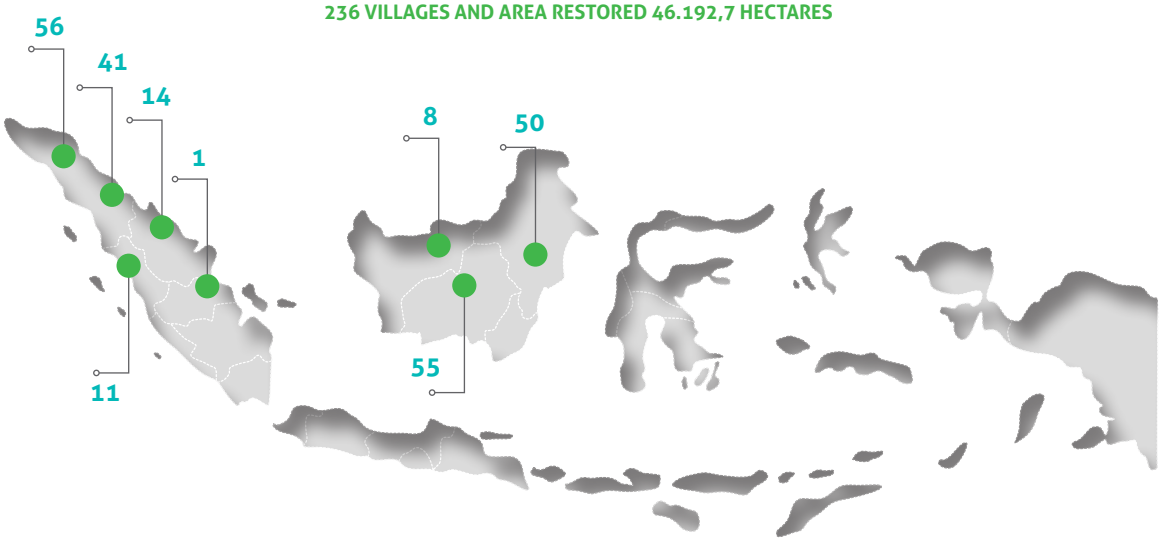
The Figure 11 Below is the detail description in determining location for peatland protection and management in Community Area with ***Desa Mndiri Peduli Gambut*** Program. The selected villages are in the PHU Map, Priority I-II for Restoration and in repeated burnt area, as well as in the eco-socio-cultural vulnerability, depend on the natural resources and having burnt culture in preparing the land for cultivation. The target of *Desa Mandiri Peduli Gambut* is at least 30 villages (desa) in every year.

Figure 11. STAGES OF DETERMINATION OF LOCATION FOR DESA MANDIRI PEDULI GAMBUT - SELF SUPPORT VILLAGES FOR PEATLAND PROTECTION AND MANAGEMENT-



The Figure 12 Below shows the achievement on the Desa Mandiri Peduli Gambut from 2016-2020. The Program has been developed in 236 villages in 8 Provinces. 8 university and more than 400 facilitators involved in this program, with area of restoration in community area are 46,192.7 Hectares.

Figure 12. ACHIEVEMENT ON DESA MANDIRI PEDULI GAMBUT YEAR 2016-2020: 236 VILLAGES AND AREA RESTORED 46.192,7 HECTARES



In supporting to the food security and improving community livelihood during the pandemic in 2020, Indonesia has also conducted several programs, among other are constructing 665 canal blocking for peatland rewetting restoration in 36,298.7 hectares in community area and established *Desa Mandiri Peduli Gambut* in 55 villages in Central Kalimantan Provinces.

The Figure 13 provides information on the documentation of facilitators training, IMAS Document, RKM Document, the process monitoring and evaluation as well as the result of Desa Mandiri Peduli Gambut.

Figure 13. TRAINING FOR FACILITATORS CONDUCTED IN COLABORATION WITH UNIVERSITY AND LOCAL GOVERNMENT

PROBLEM IDENTIFICATION AND ANALYSIST (IMAS) AND COMMUNITY WORK PLAN (RKM)




COMMUNITY IMAS AND RKM DOCUMENTS

FIELD MONITORING AND EVALUATION FOR DESA MANDIRI PEDULI GAMBUT




The Ministry Environment and Forestry monitor and evaluate the implementation of Desa Mandiri Peduli Gambut cycle regularly to ensure the implementation of community work plan (RKP) and potential opportunities for scaling up and replication of similar activities by the community in the village or in the neighboring village.

REWETTING AND REHABILITATION REVEGETATION ON DESA MANDIRI PEDULI GAMBUT ACTIVITIES




ECONOMIC REVITALITATION PRODUCT ON DESA MANDIRI PEDULI GAMBUT ACTIVITIES




Demo project and economic revitalization activities is implemented as part of the Community Work Plan (RKM) implementation to improve community livelihood, TK-PPEG. Among other activities implemented are cultivation of corn, pineapple, sago, red ginger, and honey bee in peatland ecosystem friendly, agro fisheries, paludiculture and agroforestry, ecotourism, etc. This activities generate revolving income for community and managed through the TKPP-EG.

Development of Information and Database

SiMATAG-0.4m

In managing the ground water level monitoring data on peatland ecosystem, the Ministry of Environment and Forestry has established Peatland Water Level Information System 0.4 meters (SiMATAG-0.4m). SiMATAG-0.4m was launched by the Minister of Environment and Forestry at Asia-Pacific Forestry Week (APFW), Incheon South Korea on June 18, 2019. Detail of information provided and The SiMATAG-0.4m function is shown in Figure 14 below.law enforcement; and (6) calculating greenhouse gas emissions reduction from peatland ecosystem restoration activities.

Figure 14. The SiMATAG-0.4m function

PPKL-PKG
KEMENTERIAN LINGKUNGAN HIDUP DAN KEHUTANAN

SiMATAG-0.4m

Sistem Informasi Muka Air Tanah Gambut

SiMATAG-0.4m has been launched by the Minister of Environment and Forestry in ASIA-PACIFIC FOREST WEEK, INCHEON, SOUTH KOREA (JUNED 19, 2019)

INFORMATION PROVIDED:

SiMATAG-0.4m

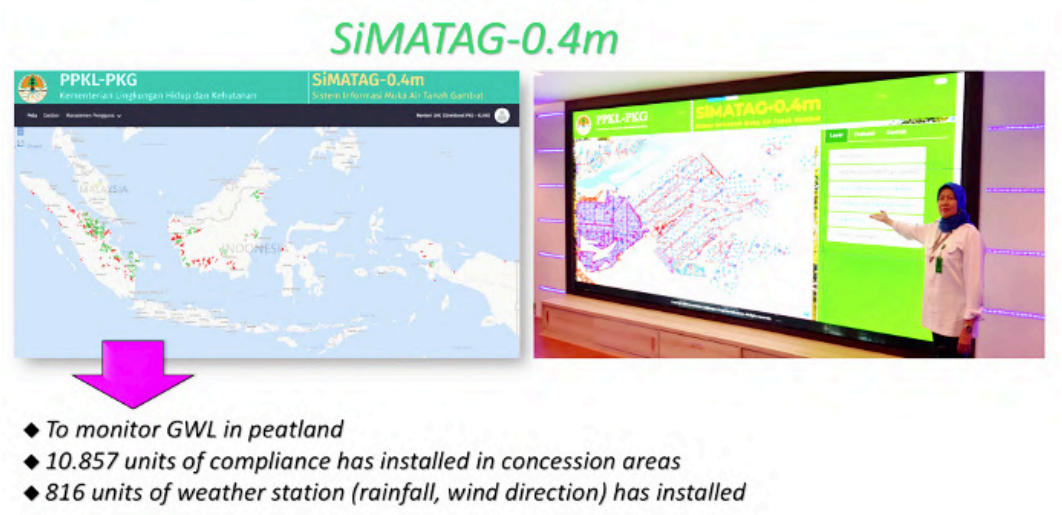
- Map of PHU
- Map of Peatland Ecosystem Function
- Map of Concession borders
- Map of Canal Blocking
- Map of Ground Water Level Monitoring Distribution,
- Map of Rehabilitation, revegetation
- Information of field verifivation.

SUPPORT SYSTEM (SEPAL)

- Vegetation Analysist
- Vegetation Changing Analysist
- Soil Moister Changing Analysist
- Time of Changing (day, date, month, year) of vegetation changing – planting and cutting-

The system was developed to provide information on the progress of peatland restoration through analysis of peatland water level monitoring data (TMAT), development of rewetting infrastructure and monitoring of vegetation rehabilitation results. The provided information may also be used, among others, as a basis for (1) establishing guideline for the improvement of water management in peatland ecosystem; (2) monitoring of the progress in the implementation of peatland ecosystem restoration; (3) providing water balance; (4) providing information on the early warning to potential forest and peatland fires; (5) providing information for compliance and law enforcement; and (6) calculating greenhouse gas emissions reduction from peatland ecosystem restoration activities.

Up to 2020, this system has managed monitoring data continuously and online from 10,857 peatland water level monitoring points (TMAT) both manually and data loggers and 861 rainfall stations scattered in areas that have been restored throughout Indonesia.



SiMATAG-0.4m also provides analyst on the fulfillments of peatland water level compliance with the ground water level (TMAT) at <0.4 meters below the peatland surface as regulated in Article 23 of the Government Regulation Number 71 Year 2014 juncto Government Regulation Number 57 year 2016 regarding Protection and Management of Peatland Ecosystem.

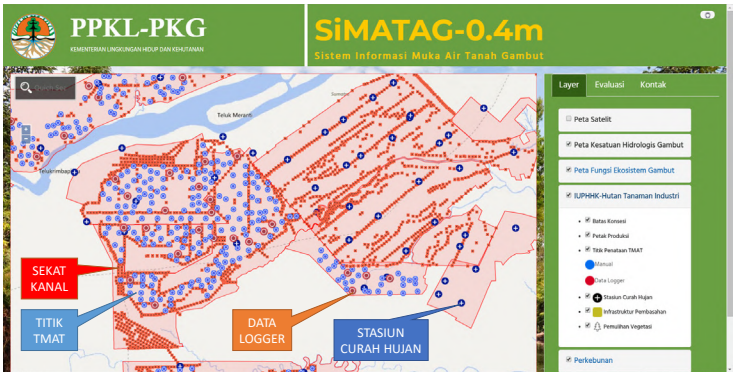


Figure 15 shows that SiMATAG-0.4m provide detail information on the peatland restoration carried out by the concession holder. The **Red Dot** on the Figure representing the canal blocking constructed in the concession holders to improve water management system. The data logger station and the manual station, the Dark Blue Dot with + in side is the rainfall station. It can be seen the massiveness of the canal blocking construction and water level monitoring in the certain concession holders area.

Figure 15. SiMATAG-0.4m provide detail information on the peatland restoration carried out by the concession holder

SiMATAG-0.4m FUNCTION

Centre for Ground Water Level and Rain Fall Monitoring Data in Concession area – it will be integrated with monitoring system in non concession area.

Centre for Monitoring data of Peatland restoration progress in concession holders area:
- Canal Blocking Development
- Rehabilitation and Revegetation

Provide information/ data of concession holders' performance on peatland protection and management: ground water level compliance and non compliance, and Rating of PROPER (black, read, blue, green and gold).

Support SiPPEG (Information System for Peatland Protection and Management) :
- Peatland Quality Index
- Water balance
- Early warning system

Figure 16. SiMATAG-0.4m provide the concession holder compliance to the water level requirement

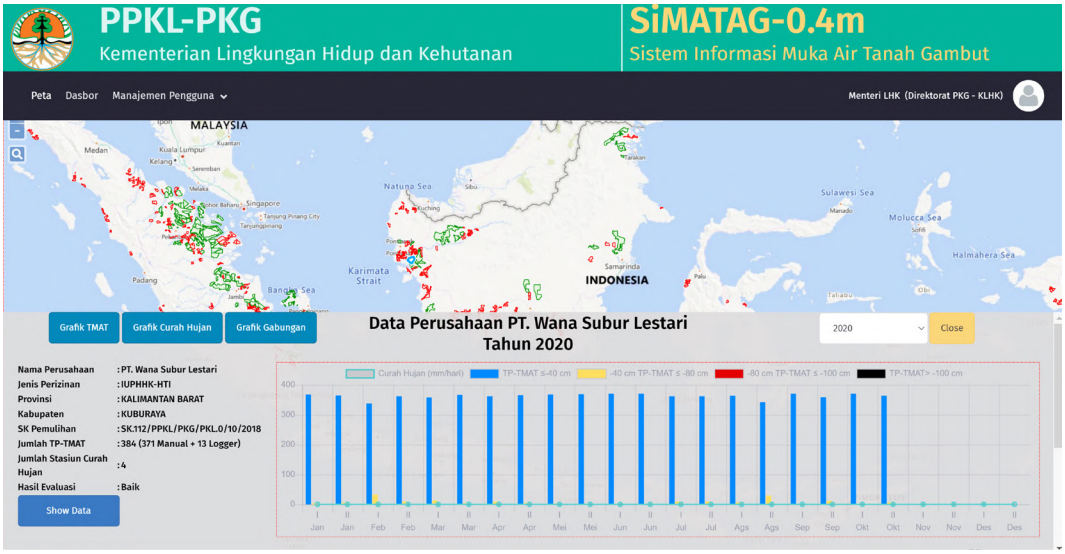
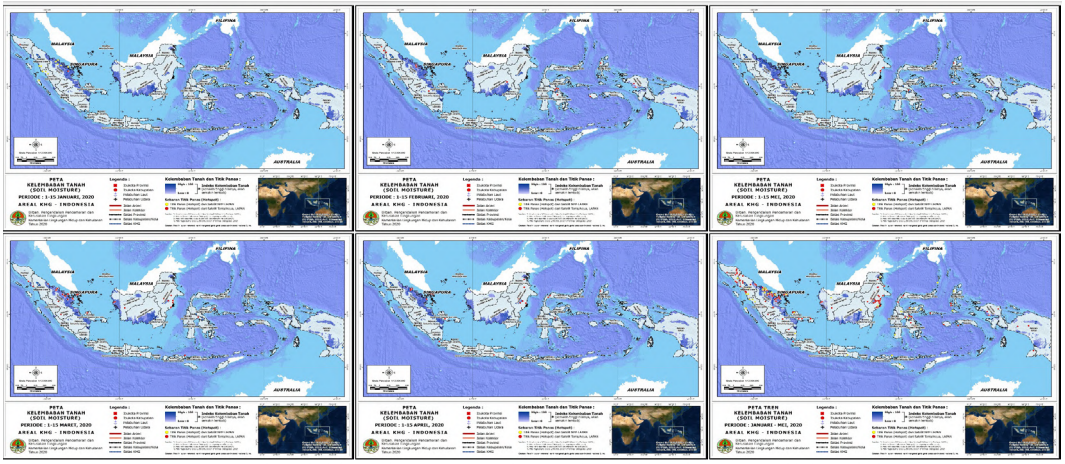


Figure 16 shows that SiMATAG-0.4m provide the concession holder compliance to the water level requirement. The blue color in the graph demonstrate the compliance, the yellow color means that the water level in between 0.4m to 0.8m below the peatland surface and the concession holder should carry out field checks immediately and improve or repair water management infrastructure in the field. The red and black color indicate the incompliance or disobedience for the water level requirement

The SiMATAG-0.4m function has been integrated with the satellite imagery to crosscheck and confirmation of the water level and rehabilitation-revegetation data with soil moisture land cover data. The potential of high soil moisture in peatland is identified with utilization of remote sensing technology using satellite imagery data (Sentinel-1, Band C) through the SEPAL Platform. The figure 17 below shows the soil moisture pattern identified in all PHUs in Indonesia. The process of soil moisture identification and mapping, are divided into 2 time periods in each month, Period 1 (1-15 of each month) and Period 2 (16-31 of each month).

Based on the results of soil moisture analysis, the trends/trends related to the potential of forest and land fires determined in every month, as shown in Figure 17 below. This analysis is carried out by integrating the burned area data and hotspots with the results of the soil moisture map analysis that have obtained in the previous stage using the SEPAL Platform.

Figure 17 Trends of Soil Moisture Map in Indonesia's Peat Ecosystem Area



Source Data : Analysis results of SMCmaps from Sentinel-1 (C-Band) Imagery, with SEPAL Platform
DG. for Environmental Pollution and Degradation Control, 2020

Tabel 4 Potential Soil Moisture and Hotspots for the Period of January-May, 2020 and Trends in Alertness to Potential Land and Forest Fire, 2020

No.	Province	Total of PHU	Soil Moisture Content Maps (SMCmaps) and Hotspot Potential Data										Trends for Alerting the Potential of Forest and Land Fires, 2020
			January, 2020		February, 2020		March, 2020		April, 2020		May, 2020		
			SMC	HSP	SMC	HSP	SMC	HSP	SMC	HSP	SMC	HSP	
1.	Aceh	36	85-90%	5	85-90%	6	80-85%	4	80-85%	2	80-85%	0	Safe, Low Potential
2.	North Sumatera	27	80-85%	7	85-90%	13	80-85%	6	80-85%	1	80-85%	0	Safe, Low Potential
3.	Riau	59	80-85%	41	75-80%	65	75-80%	141	75-80%	31	80-85%	1	Alert, High Potential
4.	Riau Islands	17	80-85%	1	80-85%	0	75-80%	37	75-80%	60	80-85%	2	Alert, Moderate Potential
5.	West Sumatera	14	85-90%	4	85-90%	0	80-85%	1	80-85%	0	80-85%	4	Safe, Low Potential
6.	Jambi	13	85-90%	0	80-85%	0	80-85%	1	85-90%	0	80-85%	0	Safe, Low Potential
7.	South Sumatera	34	85-90%	1	80-85%	1	80-85%	0	80-85%	1	80-85%	1	Safe, Low Potential
8.	Bengkulu	3	85-90%	0	80-85%	2	80-85%	0	80-85%	0	80-85%	0	Safe, Low Potential
9.	Bangka Belitung Islands	17	80-85%	7	80-85%	0	75-80%	2	75-80%	4	80-85%	0	Safe, Low Potential
10.	Lampung	5	80-85%	2	85-90%	2	85-90%	0	80-85%	4	80-85%	1	Safe, Low Potential

No.	Province	Total of PHU	Soil Moisture Content Maps (SMCmaps) and Hotspot Potential Data										Trends for Alerting the Potential of Forest and Land Fires, 2020
			January, 2020		February, 2020		March, 2020		April, 2020		May, 2020		
			SMC	HSP	SMC	HSP	SMC	HSP	SMC	HSP	SMC	HSP	
11.	West Kalimantan	124	80-85%	1	80-85%	0	75-80%	5	80-85%	0	80-85%	1	Safe, Low Potential
12.	Central Kalimantan	35	80-85%	1	80-85%	1	75-80%	0	75-80%	0	80-85%	0	Safe, Low Potential
13.	South Kalimantan	4	85-90%	0	85-90%	0	80-85%	0	80-85%	1	80-85%	0	Safe, Low Potential
14.	East Kalimantan	16	80-85%	10	80-85%	6	75-80%	17	75-80%	10	80-85%	5	Alert, Moderate Potential
15.	North Kalimantan	13	80-85%	2	80-85%	1	85-90%	0	80-85%	1	80-85%	0	Safe, Low Potential
16.	West Sulawesi	2	80-85%	4	75-80%	0	80-85%	1	75-80%	0	80-85%	4	Safe, Low Potential
17.	Central Sulawesi	3	80-85%	16	75-80%	3	80-85%	5	75-80%	4	80-85%	0	Safe, Low Potential
18.	West Papua	216	80-85%	1	75-80%	13	80-85%	0	75-80%	0	75-80%	1	Safe, Low Potential
19.	Papua	250	80-85%	2	80-85%	1	80-85%	0	80-85%	0	80-85%	4	Safe, Low Potential

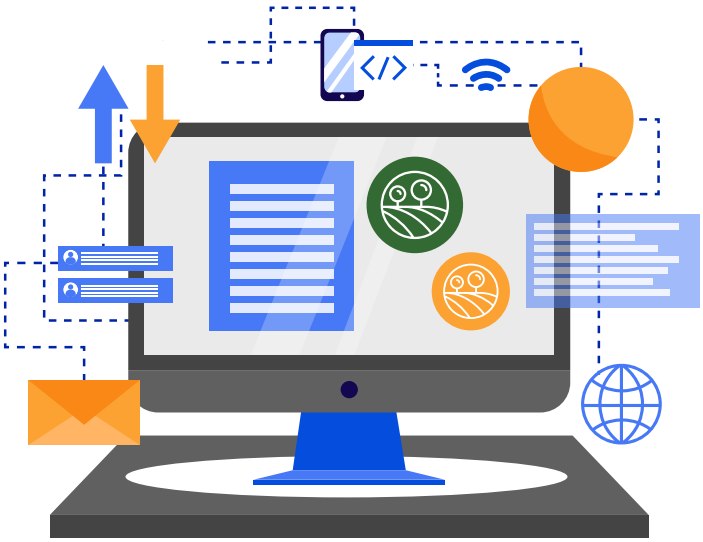
Note:

- SMC = Soil Moisture Map, generated from analysis of Sentinel-1 Imagery with C-Band, using the SEPAL Platform. SMCmaps values/ numbers indicate potential humidity levels in the selected PHU's area;
- HSP = Number of Hotspot Points in the PHU's area (using Terra/Aqua LAPAN satellite data with Convidential interval >80%, data source: http://sipongi.menlhk.go.id).

The SiMATAG-0.4m has been internationally recognized as the most massive of ground water peatland monitoring system in the world as it was presented in the Experts Workshop on Peatland Monitoring, including member of IPCC Panel Experts at FAO Headquarter, Rome-Italy, 22nd-23rd May 2019 and ASEAN member states in the ASEAN Task Force on Peatlands ATFP) meetings.

Figure 18 Expert Workshop on Peatland Monitoring, FAO Headquarthers, Rome-Italy, 22nd – 23rd, May 2019

SiPPEG
(Information System for Protection and Management of Peatland Ecosystem in Indonesia)



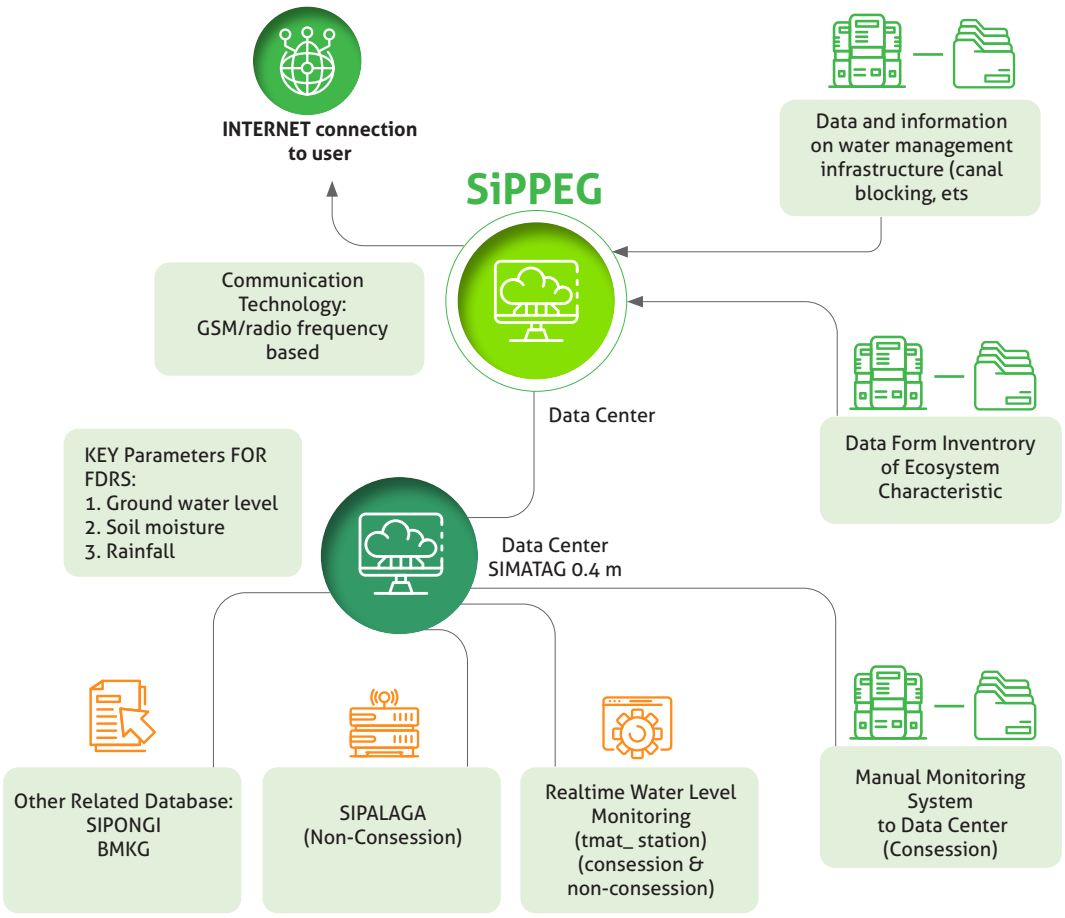
The Ministry of Environment and Forestry is currently developing the Information System for Protection and management of Peatland Ecosystem, so called SiPPEG. The system is developed from several existing subsystems, among other SiMATAG-0.4m, Sipalaga (water level monitoring data from community area provided by Peatland and Mangrove Restoration Agency), Sekat Kanal Infrastructure (the system that provide canal blocking infrastructure), etc.

The SiPPEG is under constructing now and the development process will be finished on December 2021, and will provide updated information on Peatland Ecosystem Quality Index (IKEG), water level monitoring data (TMAT) – the upper layer of SiMATAG-0.4m, water balance (N-Air), Early Warning System (FDRS) – Fire Danger Rating System) to prevent from the potential peatland fire, Green House Gas (GHG) Emission Reduction from the implementation of peatland ecosystem protection and management, Peatland Ecosystem Protection and Management Plan (RPPEG), Environmental Performance Rating for the concession holders (PROPER), Gender Mainstreaming and SDGs.

DEVELOPMENT OF INFORMATION SYSTEM FOR PROTECTION AND MANAGEMENT OF INDONESIA PEATLAND ECOSYSTEM -Integrated System From Field Monitoring and Satellite Imagery-

USES :

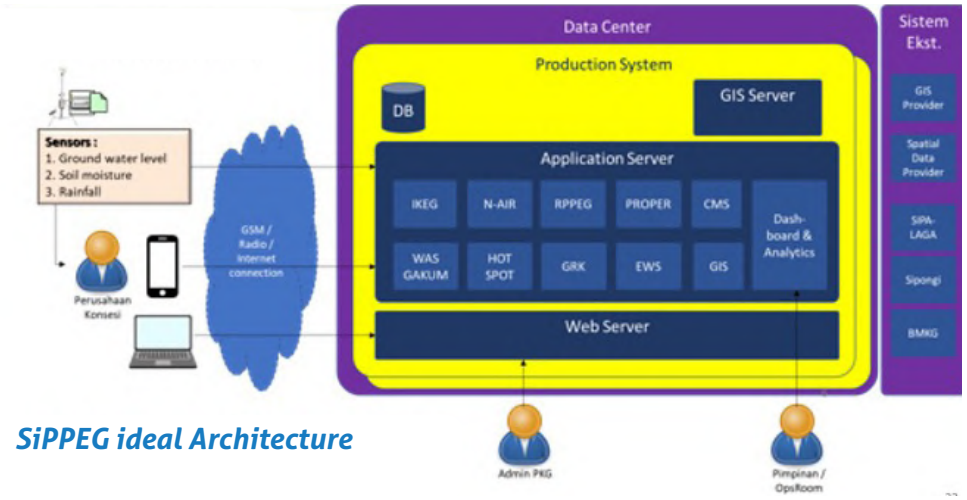
- Peatland Quality Index (IKEG)
- Peatland Water Level Monitoring (TMAT)
- Early Warning System Based on Peatland Water Level (EARLY WARNING/FDRS)
- Water Balance (N-Air)
- Calculation of GHG Emission reduction (GHG or GRK)
- Peat Environmental Performance Rating for Concession (PROPER)
- Compliance and Law Enforcement (GAKUM)
- Peatland Ecosystem Protection and Management Plan (RPPEG)
- Main Streaming Gender on Peatland Ecosystem Protection and Management. (GENDER)
- SDGs on Peatland Ecosystem Protection and Management (SDGs)



The system is also connected to the other related system, among other SIPONGI, SIPALAGA, Rainfall data system from the Meteorology, Climatology, and Geophysics Agency, and integrated with the satellite imagery. The Figure 18 below is the architecture of SiPPEG, the SIPPEG application processes thematic data represented in modules such as IKEG, N-AIR, RPPEG, PROPER, WASGAKUM, GHG and EWS.

Some information will be available to public and some other will only be available for decision support system (DSS). Sensor which has been equipped with a GSM network / Radio internet connection can be real-time transmit data to the SIPPEG languages. Concession holder companies are able to input data through mobile applications or computer connected to the internet access to send data to the application server and web server that will be forwarded to the SIPPEG database.

Figure 18 SiPPEG ARCHITECTURAL DESIGN



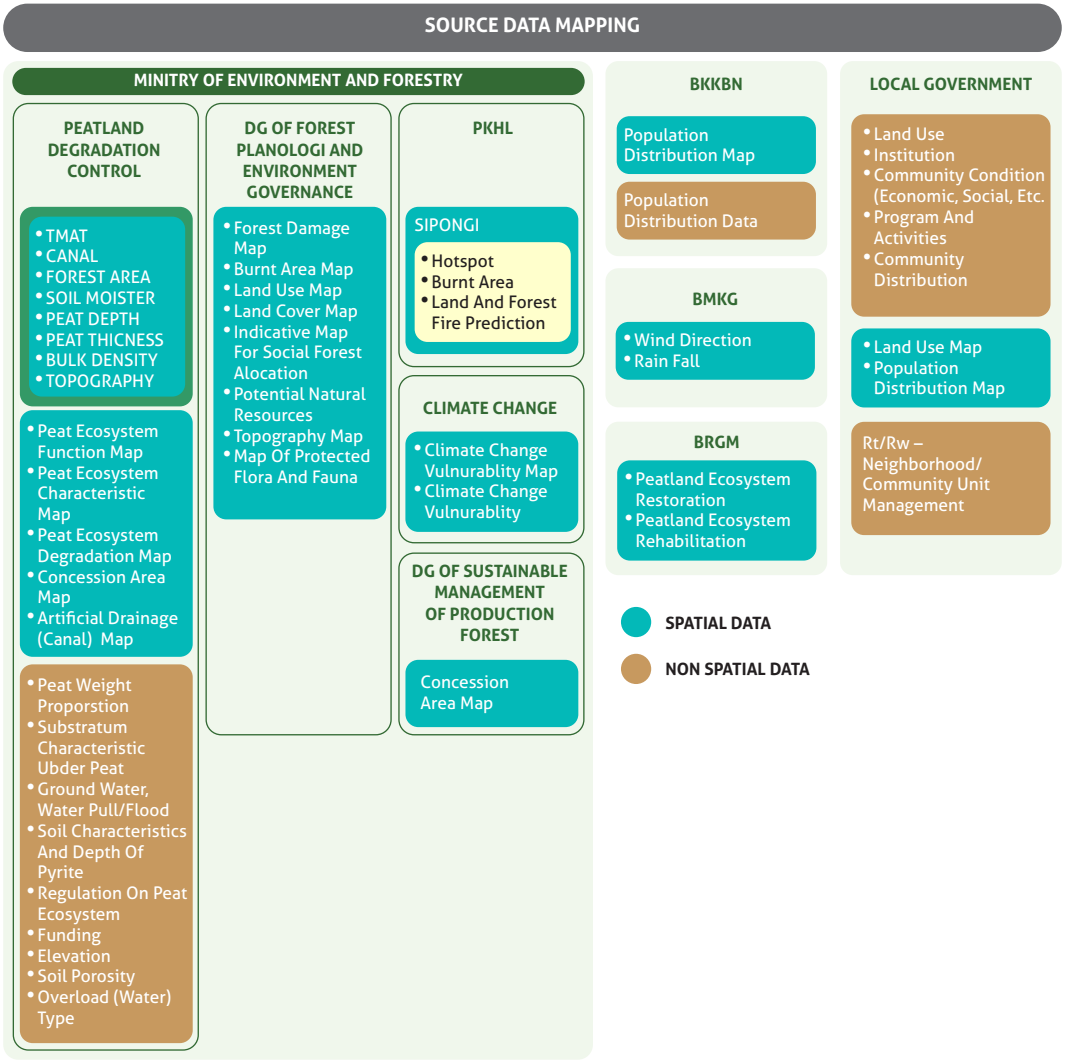
Development of the Peat Ecosystem Protection and Management Information System (SIPPEG) requires a comprehensive planning starting from data readiness, integration concept, technology selection, to financing (budged) so that it will obtained the ideal system in accordance with the main objectives of the development of this system. For this reason, as an early stage of planning, a systematic analysis is necessary to examine the resources already in place and to be developed.

There are four (4) main components observed, namely hardware and network infrastructure, readiness data (data readiness) and its applications, the operation center (Command center), and HR and Organization. The four (4) main components are analyzed to find the location of the Strengths, Weaknesses, Opportunities, and Challenges (threats) abbreviated with SWOT analysist. The result of SWOT analysist provided in the Fgure 19 below.

Figure 19 OBSTACLES, OPPORTUNITIES AND CHALLENGES

	S=STRENGTH	W=WEAKNESS	O=OPPORTUNITY	T=THREATH
IINFRASTRUCTURE (H/W)	Server and network are available.	Need for improvement	Opportunity to develop system and application modules	Demand for higher capacity and speed
Data readiness	1. SiMATAG-0.4m is available 2. Data from inventory of peatland ecosystem characteristic is available 3. Data from the Desa Mandiri Peduli Gambut – Peat Self Suficient Villages – Program is available 4. Updated data on Artificial Drainage (Canal) is available.	1. Some supporting data are still managed manually. 2. High dependence on data transmission from other directorates/ agencies. 3. Data for gender mainstreaming is not yet available. 4. Data for SDGs contribution from peatland ecosystem protection and management is not yet available.	Most of the data is in the government network.	Enhance government and local government network as data owner. Develop SOP for data transmission (computerized access and collect) data, including related data to gender and SDGs.
Operation Room	Lead/coordinate the collection of TMAT data in concession and non-concession areas, manually or censor (real time monitoring)	the internal operations center have not been provided yet.	Development of the internal operations center	Room/space availability
Human Resources	Proper expert on digital mapping	Less adaptive to renewable technology	Skill improvement on the collecting and management data	Funding and training schedule

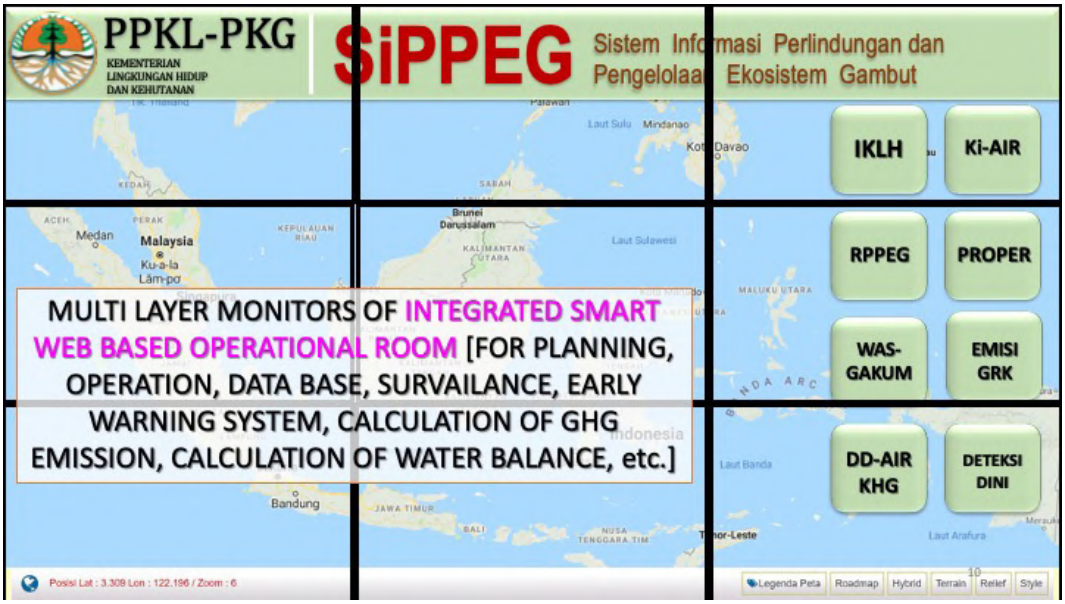
The SWOT Analysis above shows that the Readiness Data parameter is the biggest challenge in the SiPPEG development process, and it is necessary to conduct data group mapping based on the data source from related agency, internal Ministry of Environment and Forestry or directorate, and existing application as shown in the image below.



As seen in the Figure of Data Mapping Above, there are several units sources data from the Ministry of Environment and Forestry needed in developing the SiPPEG namely Directorate for Peatland Degradation Control (PKG), Directorate General for Forest Planology and Environmental Governance (PKTL), Directorate for Forest and Land Fire control (PKHL), Directorate General for Climate Change (PPI) and Directorate General of Sustainable Management of Production Forest (PHPL), while outside agencies expected to contribute as data sources are National Family Planning Agency (BKKBN), Meteorology, Climatology, and Geophysics Agency (BMKG), Peatland and Mangrove Restoration Agency (BRGM), and local governments. With this regard, the biggest challenge in developing the SIPPEG application system is how to establish technical and non-technical connections with various directorates and the agency in order to become a contributor in the development of the ideal SiPPEG.

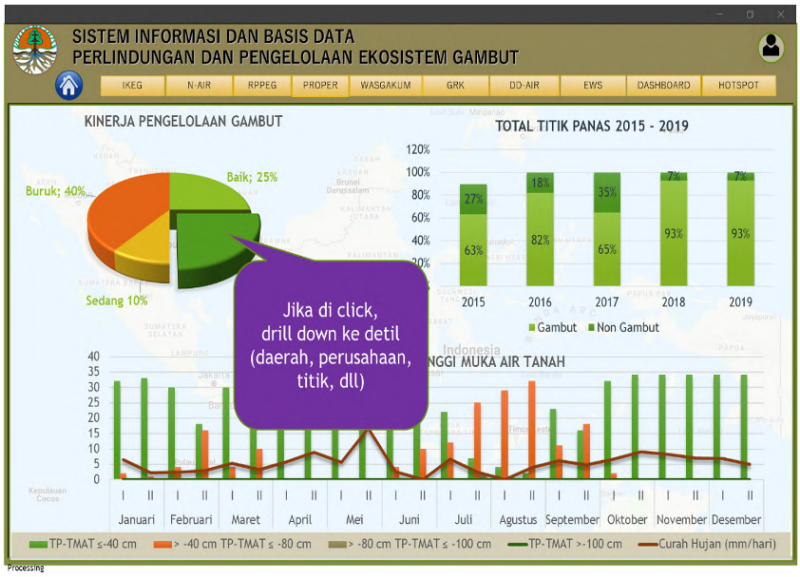
The SIPPEG system is developed with the concept of Multi-role involving internal PKG (operators), internal KLHK (stakeholders), other agencies (Local Government, BMKG, etc.), concessions holders, as well as the public. The Figure 20 shows the multi-layer monitors of integrated smart system and supported with the web based operational room.

Figure 20 shows the multi-layer monitors of integrated smart system

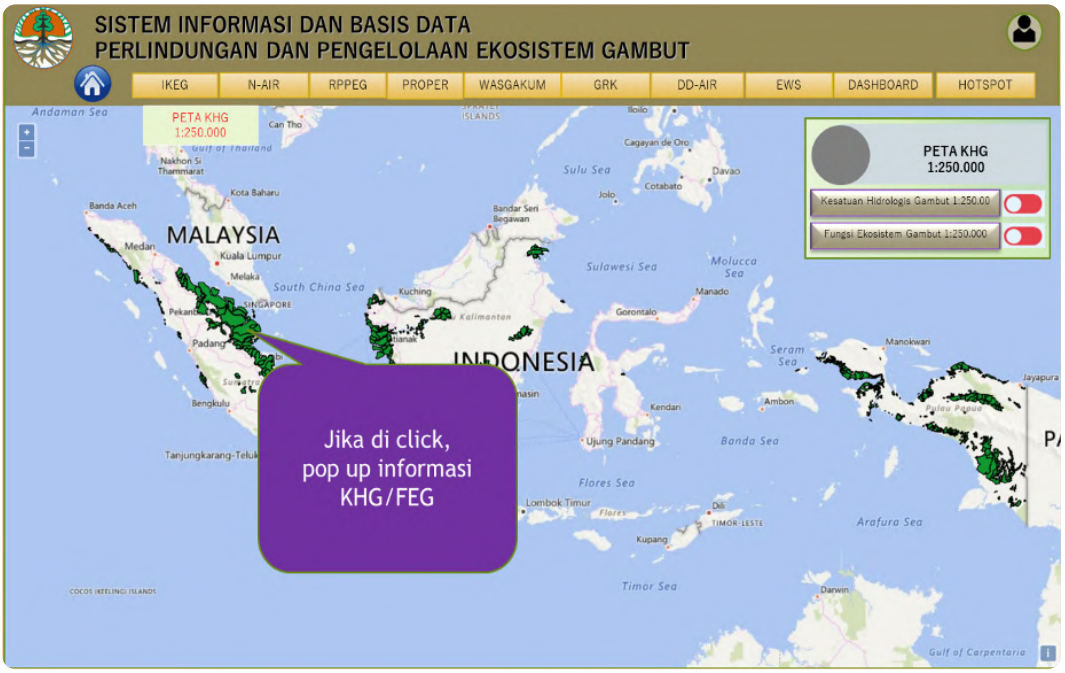


The Figure 21 below shows the screen for public to access information on the achievement of peatland protection and management including the compliance of concessions holders, as well as the peatland restoration in community area, from 2015 to the time the information accessed by public.

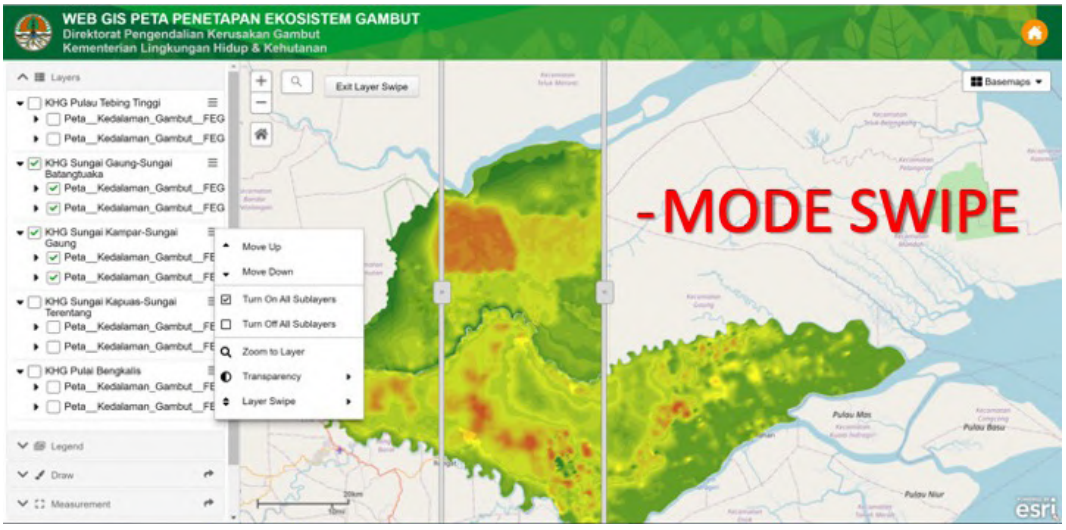
Figure 21 shows the screen for public to access information on the achievement



The Figure 22 below shows the screen for public to access information on the Peat Hydrological Unit (PHU) Map Scale 1:50.000.



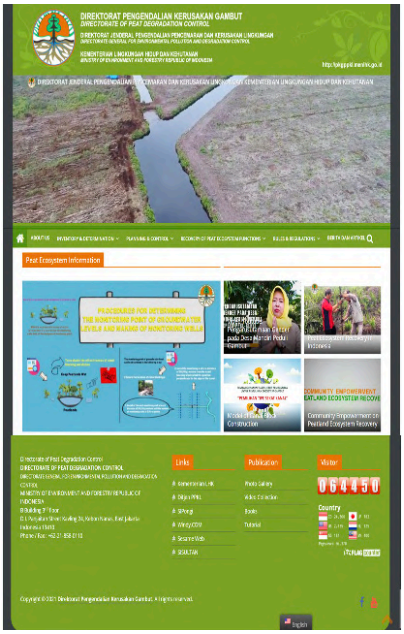
The Figure 23 shows the screen for information on the Peat Hydrological Unit (PHU) Map Scale 1:50.000 is a swipe mode, so that easy to get information on the peatland ecosystem function namely cultivation function, conservation function, and peat dome area.



The Grand Design of SiPPEG Development plan is a multi-year plan, starting from 2018 and the target for system completeness is in 2022, for all sub system completeness, but this system will be maintained and enhanced further in the future as part of e-Government initiatives in providing public information related to protection and management of peatland ecosystem in Indonesia.

Development of Portal Geographic Information system (GIS Portal Web site)

The Official Website for Peatland Protection and Management is provided through http://pkgppkl.menlhk.go.id in Bahasa Indonesia and English for delivering the Outreach of policies, publication of best practices on protection and management of peatland, tutorial on peatland restoration, as well as bank of peatland knowledge.



More than sixty thousand community around the world has accessed the website. Some of the gave feedback and questions that we response interactively.

Peatland Ecosystem Quality Index (IKEG)

Since 2019, The Ministry of Environment and Forestry has established the peatland quality index (IKEG) based on criteria and indicators for degraded peatland ecosystem function as stipulated in the article 23 of Government Regulation no. 71 year 2014 juncto Government Regulation no. 57 year 2016 regarding peatland protection and management, and refer to the article 18 of the Minister and Environment and Forestry Regulation No. 16 of 2017 regarding Technical Guidelines for Restoration of Peat Ecosystem Functions. The detail mandat for peatland ecosystem criteria and indicator is provided in Figure 24 below.

Figure 24. THE MINISTRY OF ENVIRONMENT AND FORESTRY No. 16 of 2017, ARTICLE 18 : CRITERIA AND INDICATORS FOR THE SUCESFUL RESTORATION IN PEATLAND ECOSYSTEM

Article 18 (1)

Peat Ecosystem function restoration is declared successful if:

- no exposure of pyrite and/or quartz sediments under the peat layer at compliance points
- water level in peatland more than 0.4m (zero point four meters) below the peat surface at compliance points
- better than the standard criteria for degraded peat ecosystems stipulated in the environmental permit
- better than standard for degraded peatland ecosystem from spatial analysis results from field survey activities or data and information analysis 1: 250,000
- The number of plants that grow healthy is at least 500 stems per hectare in the third year

Article 18 (2)

Water management systems and water infrastructures for peatland ecosystem restoration must be built in the first 6 months

Article 18 (3)

improvement of the ground-water level to reach less than -0.4 should be visible since the water infrastructure are constructed

The Figure shows that peatlan ecosystem in Indonesia catagorized into 2 (two) function as caltivation and conservation function and each function has different chriteria and indicators as mention in the Article 23 og Government Regulation No. 71 year 2014 junto Government Regulation No. 57 year 2016 regarding Protection and Management of Peatland Ecosystem. Article 23 (2) mention that Peatland Ecosystem with conservation function are declared as degraded peatland if it exceed the standard criteria for degraded peatland as follows:

- there is an artificial drainage on peatland ecosystem with protected function;
- there is an exposure of pyrite and/or quartz sediments under the peat layer; and/or
- there is a reduction in land area and/or land cover in peatland ecosystem with protection

GOVERNMENT REGULATION No. 71 of 2014, ARTICLE 23:
CRITERIA AND INDICATORS FOR DEGRADED PEATLAND ECOSYSTEM

Article 23 (1)

Degraded Peatland Ecosystem can occur in:
- Peatland Ecosystem in Conservation Function
- Peatland Ecosystem in Cultivation Function

Article 23 (2)

Peatland Ecosystem with conservation function are declared as degraded peatland if it exceed the standard criteria for degraded peatland as follows:
- there is an artificial drainage on peatland ecosystem with protected function;
- there is an exposure of pyrite and/or quartz sediments under the peat layer; and/or
- there is a reduction in land area and/or land cover in peatland ecosystem with protection.

Article 23 (3)

Peatland Ecosystem with cultivation function are declared as degraded peatland if it meet the standard criteria for degraded peatland as follows:
- water level in peatland more than 0.4m (zero point four meters) below the peat surface, and / or
- there is an exposure of pyrite and/or quartz sediments under the peat layer. These criteria and indicators are then used as the baseline for the restoration of the peat ecosystem.

Article 23 (3) Peatland Ecosystem with cultivation function are declared as degraded peatland if it meet the standard criteria for degraded peatland as follows:

- water level in peatland more than 0.4m (zero point four meters) below the peat surface, and / or
- there is an exposure of pyrite and/or quartz sediments under the peat layer.

The above criteria and indicators are then used as the baseline for the restoration of the peatland ecosystem. To indicate the suceesfully restoration implementation during monitoring and evaluation, the Ministry Environment and Forestry has enacted the Miniter of Environment and Forestry Regulation Number 16 Year 2017 regarding Technical Guidelines for Restoration of Peat Ecosystem Functions. Articles 18 regulate the criteria and indicator for succesful restoration in the field.

The Figure above shows that Article 18 (1) mentioned that Peatland Ecosystem function restoration is declared successful if:

- no exposure of pyrite and/or quartz sediments under the peat layer at compliance points
- water level in peatland more than 0.4m (zero point four meters) below the peat surface at compliance points
- better than the standard criteria for degraded peat ecosystems stipulated in the environmental permit
- better than standard for degraded peatland ecosystem from spatial analysis results from field survey activities or data and information analysis 1: 250,000
- the number of plants that grow healthy is at least 500 stems per hectare in the third year

Article 18 (2) of the Miniter of Environment and Forestry Regulation Number 16 Year 2017 mentioned that Water management systems and water infrastructures for peatland ecosystem restoration must be built in the first 6 months.

Article 18 (2) of the Miniter of Environment and Forestry Regulation Number 16 Year 2017 mentioned that improvement of the groundwater level to reach less than -0.4 should be visible since the water infrastructure are constructed

Base on the criteria and indicator above, the Minitry of Environment and Forestry develop the Peatland Ecosystem Quality Index (IKEG) with the formula as provide in the below Figure.

PEATLAND ECOSYSTEM QUALITY INDEX (IKEG) FORMULA

$$IKEG = w1*K + w2*B + w3*C$$

IKEG = (0,6 x IKEG FOR CONSERVATION FUNCTION) + (0,4 x IKEG FOR CULTIVATION FUNCTION)

EXPLANATION

w1-3 = WEIGHT/SCORE FOR EACH PARAMETER

K = CANAL AFFECTED AREA B = BURNT AREA C = LAND COVER

PEATLAND ECOSYSTEM FUNCTION	CANAL (K)	BURN AREA (B)	LAND COVER (C)
CONSERVATION FUNTION (F1) 60%	CANAL(K) 25%	BURNT AREA(B) 15%	LAND COVER (C) 60%
	WITH CANAL (K1) 20	BURNT AREA (B1) 20	FOREST (C1) 100
	NO CANAL (K2) 100	NO BURN AREA (B2) 100	BUSH (C2) 60
CULTIVATION FUNCTION (F2) 40%	CANAL(K) 25%	BURNT AREA(B) 60%	LAND COVER (C) 15%
	WITH CANAL (K1) 20	BURNT AREA (B1) 20	FOREST (C1) 100
	NO CANAL (K2) 100	NO BURN AREA (B2) 100	BUSH (C2) 60

PEATLAND QUALITY INDEX

		2019	2020
Sumatera	Aceh	58.47	57.81
	Bengkulu	84.19	58.48
	Jambi	72.39	69.14
	Bangka Belitung Island	84.46	79.51
	Riau Island	92.66	63.08
	Lampung	53.71	45.38
	Riau	52.03	67.49
	West Sumatera	55.84	52.91
	South Sumatera	44.32	61.7
	North Sumatera	52.86	46.2
Kalimantan	West Kalimantan	60.27	74.26
	South Kalimantan	48.32	53.15
	Central Kalimantan	50.72	78.98
	East Kalimantan	66.55	71.35
	North Kalimantan	76.86	84.04
Sulawesi	West Sulawesi	52	52.94
	Central Sulawesi	52	51.75
Papua	Papua	93.42	84.53
	West Papua	90.57	96.32
NATIONAL		65.37	65.7

Figure 25 Shows that IKEG at National level improved from 65.37 in 2019 to 65.70 in 2020. The graph also shows that every province has change in IKEG, either increase or decrease. The provinces having improvement on IKEG are Riau, South Sumatera, 5 provinces in Kalimantan, West Sulawesi, and West Papua. The remaining province has decreasing on IKEG. The parameter affecting the increasing or decreasing of IKEG is burnt area.

Green House Gas GHG) Emission Reduction from the Protection and Management of Peatland Ecosystem in Indonesia

The Indonesia achievement on protection and management of peatland ecosystem as describe above is the modality for calculation of Green House Gas (GHG) emission reduction and its contribution to the Indonesia National Designated Contribution (NDC) on Climate Change. The emission reduction from the activities of protection and management of peatland ecosystem activities can be calculated among others from:

- Vegetation Change;
- Land subsidence;
- Rising on ground water level (TMAT) in the peatland ecosystem area that can be counted with 2 (two) approach: soil moisture and increasing on water level.

The correlation between ground water level and CO2 Emission is provided in the Figure 26 Below.

Figure 26. CORRELATION BETWEEN THE GROUND WATER DEPTH AND CO2 EMISSION

$$CO_2 \text{ emission} = 91 \cdot \text{Groundwater depth } [R^2=0.71, n=8]$$

Where CO_2 emission is expressed in t ha^{-1} y^{-1} and groundwater depth is the average depth of the water table below the peat surface, expressed in metres. This linear relation implies that every 10 cm water table drawdown will result in an increase in CO_2 emission rate of 9.1 t CO_2 ha^{-1} y^{-1}.

A. Hooijer et al.: CO2 emissions from drained peat in Southeast Asia, Biogeosciences, 7, 1505–1514, 2010, www.biogeosciences.net/7/1505/2010/

CO2 emission reduction from the improvement of water management that lead on the rising of water level (TMAT) is calculated from the base line data before intervention to the current (existing) data after intervention in the field. Baseline data is obtained from the inventory of peatland characteristic and the data after intervention is obtained from the monitoring of water level management. Basically the calculation base on the empiric data in the field. The methodology in calculation of CO2 emission reduction from the raising water level is provided in the matric in Figure 27 below

No	Mitigation Action	Data of Activity (DA)	Source of DA	Emission Factor (EF) and other parameter	Method
1.	Peatland restoration (reduction of peat decomposition by construction of rewetting infrastructures)	Result of peatland water level monitoring (m) in concession and community area (ha) Year 2016-2017	Processed data from DG of PPKL & Dit. PKG)	• EF of CO_2 emission for every peatland water level • CO_2 emission = 91 x peatland water level [R2 = 0,71; n = 8], expressed in CO_2 emission ton ha^{-1} year^{-1} • Data source: A. Hooijer et al., 2010: CO_2 emissions from drained peat in Southeast Asia, Biogeosciences, 7, 1505–1514, 2010	• Calculation of activity data before (baseline) and after construction of rewetting infrastructure • Emission Reduction (ER) = Baseline Emission (BE) – Action Emission (AE)

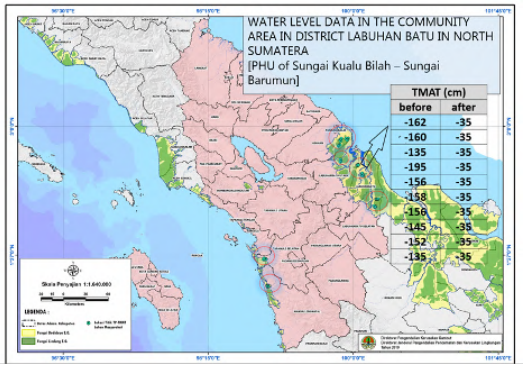
The result of CO2 emission reduction from the achievement of peatland ecosystem restoration either in concession holders or community area is provided in the matric in figure 28.

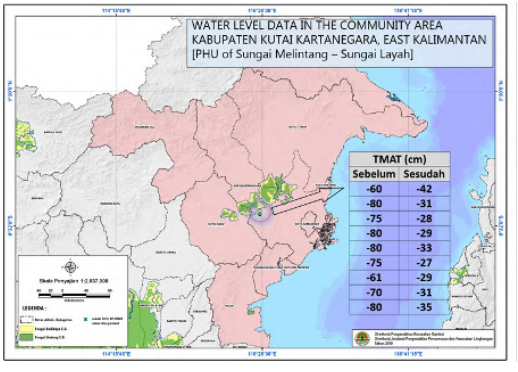
Peatland restoration (reduction of peat decomposition by construction of rewetting infrastructure)

Industrial Forest Plantation Baseline (tCO2eq) 257.140.461,40	Industrial Forest Plantation Action (tCO2eq) 85.713.487,13	Industrial Forest Plantation Mitigation (tCO2eq) 171.426.974,26
Palm Oil Plantation Baseline (tCO2eq) 140.773.865,23	Palm Oil Plantation Action (tCO2eq) 46.924.621,74	Palm Oil Plantation Mitigation (tCO2eq) 93.849.243,49
Community land Baseline (tCO2eq) 2.508.870,00	Community land Action (tCO2eq) 1.672.580,00	Community land Mitigation (tCO2eq) 836.290,00
TOTAL Baseline (tCO2eq) 400.423.196,63	TOTAL Action (tCO2eq) 134.310.688,88	TOTAL Mitigation (tCO2eq) 266.112.507,75

Notes:
- Calculation is based on formula developed by Hooijer *et. al.,* 2010, CO2 emission = 91 x GWL (TMAT)
- Emission baseline is based on average peat ground water level (TMAT) of 1.2 meter

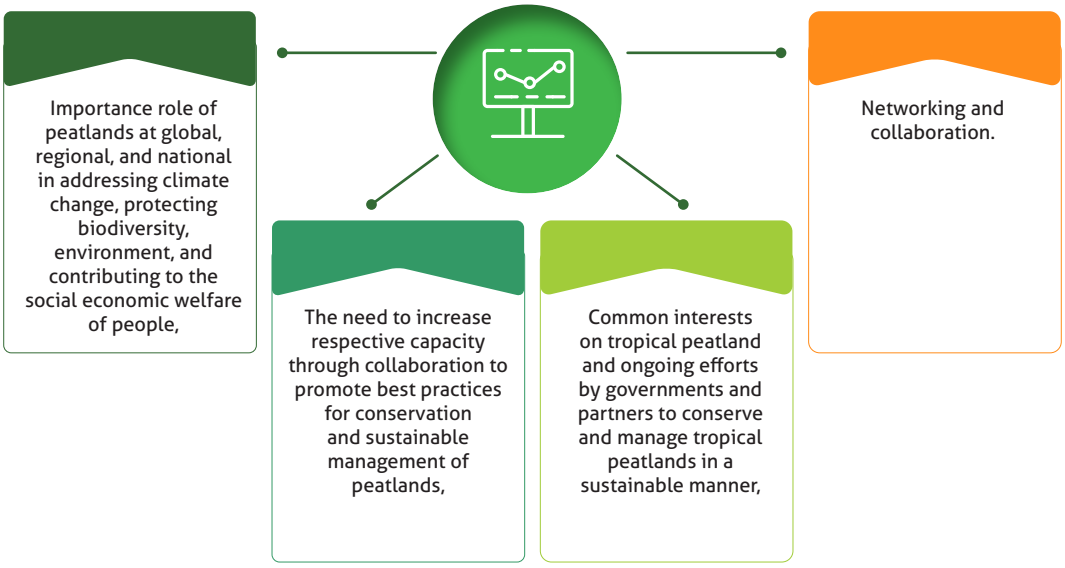
Figure below describes the empiric water level data in the field from baseline before intervention obtained from the inventory of peatland characteristic and after intervention on the improvement of water level management.





Recognition
International Tropical Peatland Center

The International Tropical Peatland Center brings cross-cutting collaboration and innovation to study and preserve important ecosystem – the importance of South-South exchange. Governments of Republic of Indonesia, the Democratic Republic of Congo (DRC), Republic of Congo (ROC) **signed a joint declaration:**



The collaboration is also recognize by the member states in UNEA4 in the adopted document UNEP/EA.4/L.19 paragraph number 6:

6

***Encouraging Member States**, international organization, private sector and all other actors involved in the conservation, management, and restorations of peatland at the national and regional level, including inter alia, the Implementation Tropical Peatlands Center being established in Indonesia, to cooperate with existing national, regional, and the international peatland management organization, and all actors, including the Global Peatland Initiative led by the United Nations Environment Programme, to foster the conservation and sustainable management of peatland.*

UNEA4th Resolution: Conservation and sustainable management of peatlands

Recognition of peatlands and their important role in global ecosystems

The adoption of Conservation and Sustainable Peatland Management in the UNEA 4th, in March 2019, as Indonesia Resolution Initiative, shows that Indonesia has succeeded in gathering support from states member in adopting the resolution under the adopted document UNEP/EA.4/L.19. UNEA-4 is the world's highest-level decision-making body on the environment and brings together governments, entrepreneurs, activists and others to share ideas and commit to action for sustainable peatland.

Government of Indonesia kindly invite more colleague Governments for mutual recognition to what Government of Indonesia has carried out and looks forward for future engagement to gain a global benefits.

UNEA4th Resolution: *Conservation and sustainable management of peatlands*

UNITED NATIONS

EP

UNEP/EA.4/L.19

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United Nations
Environment Assembly of the
United Nations Environment
Programme

United Nations Environment Assembly of the
United Nations Environment Programme
Fourth session
Nairobi, 11–15 March 2019

Conservation and sustainable management of peatlands*

The United Nations Environment Assembly,

Considering **the benefits and values of peatlands** including but not limited to providing vital ecosystem functions and services reducing the scale and mitigating the impact of flooding and drought, preventing, preserving biodiversity, and supplying food and water that maintains ecological systems and improves human livelihoods,

Recognizing **the value of improving the management of peatlands** to improve their carbon storage capacity on degraded sites, strengthen resilience and improve socio-economic livelihoods of population around peatlands and increase biodiversity

Recognition of peatlands and their important role in global ecosystems

5. ***Encourages Member States*** and other stakeholders to enhance regional and international collaboration for the conservation and sustainable management of peatland, including but not limited to the following:

(a) Sharing information, knowledge and best practice regarding the conservation and sustainable management of peatland;

(b) Continuing interdisciplinary research to advance the conservation and sustainable management of peatlands;

(c) Building capacity for conservation and management of peatland of peatlands

(d) Promoting a multi-stakeholders approach to the conservation and sustainable management of peatlands involving private landowners, concession holders, businesses, and other stakeholders;

6. ***Encouraging Member States***, international organization, private sector and all other actors involved in the conservation, management, and restorations of peatland at the national and regional level, including inter alia, the Implementation Tropical Peatlands Center being established in Indonesia, to cooperate with existing national, regional, and the international peatland management organization, and all actors, including the Global Peatland Initiative led by the United Nations Environment Programme, to foster the conservation and sustainable management of peatland.

Contributing to the implementation of the Paris Agreement, the UN Framework Convention on Climate Change (UNFCCC), the Convention on Wetlands of International Importance Especially as Water Fowl Habitat, the Ramsar Convention the Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets, the 2030 Agenda for Sustainable Development, and the Sendai Framework for Disaster Risk Reduction 2030, the Convention on Migratory Species and the convention on biological diversity as well as specific peatland related initiatives

DIRECTORATE OF PEATLAND DEGRADATION CONTROL
DIRECTORATE GENERAL OF ENVIRONMENTAL POLLUTION AND DEGRADATION CONTROL
MINISTRY OF ENVIRONMENT AND FORESTRY
REPUBLIC OF INDONESIA

D.I. Panjaitan Street Kav. 24, Kebon Nanas, East Jakarta
Building B, 3rd Floor – Indonesia 13410

Phone & Fax
Telp : 021-8520886
Fax : 021-8580105

Online
Website : pkgppkl.menlhk.go.id
Email : ditgambut.klhk@gmail.com