Managing Peatlands to Cope with Climate Change: *Indonesia's Experience*

Ministry of Environment and Forestry
Republic of Indonesia

Jakarta, March 2018

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Foreword

For more than 40 years, in particular during El-Nino, a massive peat and forest fire is unavoidable and causing severe haze and along with the huge environmental economic and social costs. Hence, the current regime has set ultimate goals, which great changes: **No more peat and forest fires in Indonesia**. Indonesia has prioritized environmental strategy to restore degraded peatland while conserving the good ones with focus for alternative livelihood for communities reside within and surrounding peat areas. In addition, learning from the severe 2015 forest fires, the government has also undertaken firm legal actions by bringing responsible individuals and corporations before the law with both administrative and criminal accusation.

The results of the new approach in managing the drivers of fires are very significant. Indonesia has proven dramatic reduction of fire spots by 93.6% from 2015 to 2017. This achievement significantly led to reduction of emissions from forests and lands, including from peatlands. We can proudly claim emission from peat fires in 2017, which was 12,5 million tons CO2e, is equal to only 1.56% of emissions from peat fires in 2015. We keep maintaining our vigilance at all levels of government, from national to sub-national at province and district untill village councils. We should also nurture the excellent support from all stakeholders, including the Civil Society and especially the private sector. This great achievement need to be continuously maintained and improved in the future.

Several other measures were also taken to improve peatland management, from issuing policy and regulations; developing institutional arrangements; conducting research and development; as well as providing incentives for conservation and sustainable management of peatlands. We also build international cooperation to foster global environmental benefits. Indonesia's active participation in the Global Peatland Initiative (GPI) should significantly contribute to the development for excellent platform for policymakers, scientists and private sector. We are keen to make Indonesia as an international centre of excellence and to share our experiences and lessons learned to global stakeholders.

Jakarta, March 2018

Dr. Siti Nurbaya
Minister of Environment and Forestry
Republic of Indonesia

Figure 1. Pristine Peatland of Indonesia, Giam Siak Biosphere Reserve, Riau Province (2017)

Introduction

Managing Peatlands, to Cope with Climate Change: **Indonesia's Experiences**[1]

Indonesia has over 15 million ha of peatlands, which is over 12% of its forest land spreading across islands of Sumatra, Kalimantan, Sulawesi and Papua. This is the largest tropical peat land in the world, followed by Democratic Republic of Congo, with the peatland area reaches 9 million ha, and the Republic of Congo with the area reaches about 5.5 million ha (Miles et al., 2017).

Peatland can be defined as soil formed from the accumulation of organic matters such as the remnants of plant tissue that lasted for a long time (Kelompok Kerja Pengelolaan Lahan Gambut Nasional, 2006). According to Government Regulation (GR) No. 71 of 2014 that has been amended by GR No. 57 of 2016 on the Protection and Management of Peat Ecosystem, peatland is defined as a naturally occurring organic material of plant residues that decomposes imperfectly and accumulates in swamps. Furthermore, the regulation also defines peat ecosystem as the order of peatland components that forms an integrated system affecting one another and forming a balance, stability, and productivity.

As the home for the largest peatland areas, the local lives in harmony with peat. They have developed an environment sustainably method. As for example, the Dayaks and Banjareses, living in Kalimantan island continue preserving rotating farming system which maintain balance between utilization process to natural cycle (Suwardi et al., 2005). They divide the land use into zones comprising settlement, bushes, harvested paddy field *(jurungan)*, dry paddy field *(pahumaan)*, plantations, sacred zones, and protected zones *(kayuan)*. Sacred zones are customary protected zones that should not be cleared for agricultural land. They also have what so called *"Handils"* a small canal only for access to their small agriculture areas without damaging peat hydrological system. Peat areas uses for subsistence only and conducted sustainably.

1. Policy Paper of the Indonesian Delegation at Global Peatlands Initiative: 3rd Meeting of Partners, Brazzaville 21 – 23 March 2018

In 1960's, as part of national transmigration program, many people from Java;- the most densely populated areas;- were moved to Kalimantan and Sumatra islands. Coupled with timber boom in 1970s, Sumatra and Kalimantan were also opened for logging followed by the development of industrial plantation forest and estate crop, especially oil palm, since 1990s. These two main drivers (transmigration and industrialisation of forest and peat areas) significantly cause peat degradation. It was estimated almost half of Indonesia's peatland have been degraded and mostly located in Sumatra and Kalimantan (Wahyunto et al. 2014 in Masganti, Wahyunto, Dariah, Nurhayati, & Yusuf, 2014; Setyawati et al., 2014). For more than 40 years, in particular during El-Nino, a massive peat and forest fire is unavoidable and causing severe haze and health problem in addition to other economic and social costs.

Figure 2. Industrial Plantation Forest in Peatlands, Riau Province

Considering the significance of Indonesia's peatlands for the environment as well as for the livelihoods of the communities surrounding the area, Indonesia has prioritized its environmental strategy to restoring degraded peatland, conserving the remaining good peatland and providing alternative livelihood for communities living inside and surrounding peatland. Several measures were taken including issuing policy and regulations reflecting the commitment for better peatland management, developing institutional arrangements to deal with problems in peatland management, conducting research and development to better manage Indonesia's peatland, and providing incentives for conservation and sustainable management of peatland.

In addition, Indonesia is also strengthening its international cooperation to deal with peatland and fire management since it is not only important for domestic benefits, but also influential to global environmental benefits. One of Indonesian participation in international fora is the Global Peatland Initiative that provides an excellent platform for scientists, policymakers and private sector to share experiences and lesson learnt between the major tropical peat countries within the world and international centres of excellence.

Indonesia's Peatland Governance

Governing a vast peatland across several islands in Indonesia is a huge task. In the past, Indonesia experienced unsustainable peatland management leading to the degradation of peatland and peat fires. Thinking over the negative impacts resulted from peat degradation and fires, the government of Indonesia has prioritized the protection and sustainable management of peatlands, including the restoration of heavily degraded peatlands.
Presidential Instruction No. 8 of 2015 on the Suspension of New

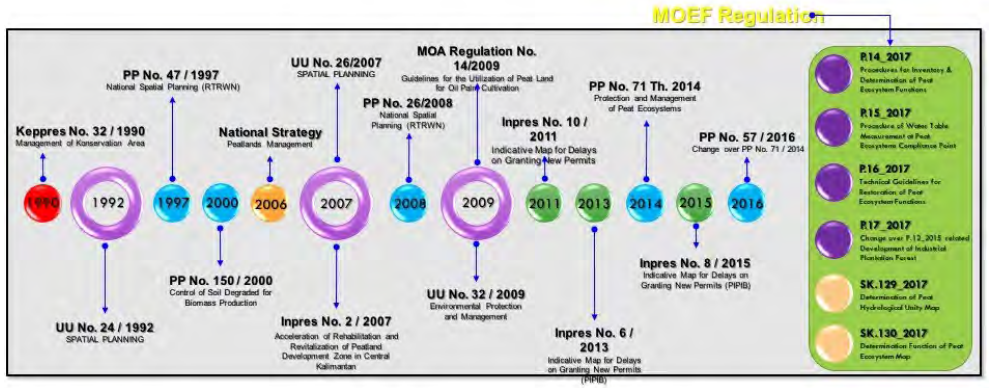


Figure 3. The Development of Policies and Regulations for Peatland and Fire Management

Licenses and the Improvement of Primary Forest and Peatland Governance or commonly referred to as *Inpres Moratorium* is a monumental decision reflecting the commitment of Indonesian government to reform its peatland and forest management. It has targeted the postponement of formal licenses for companies. The coverage of peatlands and primary forests affected by this policy has been mapped and update every six months. This political will has been supported or followed up by other regulations, including:

1. Government Regulation No. 57 of 2016 on the Amendment of the Government Regulation No. 71 of 2014 on the Protection and Management of Peat Ecosystem;
2. Environment and Forestry Ministerial Regulation No. 15 of 2017 on the Procedures for Measuring Water Table in the Peat Ecosystem Management Area;

3. Environment and Forestry Ministerial Regulation No. 16 of 2017 on the Technical Guide for Recovering the Function of Peat Ecosystem; and
4. Environment and Forestry Ministerial Decree No. 77/2015 on the Mechanisms to Deal with Burnt Area within Production Forest Concessions;
5. Environment and Forestry Ministerial Regulation No. 17 of 2017 on the Amendment of the Environment and Forestry Ministerial Regulation No. 12 of 2015 on the Development of Industrial Plantation Forest.
6. Environment and Forestry Ministerial Decree No. 129 of 2017 on the Development of Peat Hydrological Unity Map
7. Environment and Forestry Ministerial Decree No. 130 of 2017 on the Development of Peat Ecosystem Function Map.

Government Regulation No. 57 of 2016 is intended to intensify the efforts for protecting and sustainably managing peatland, responding to the big peat fire in 2015. Environment and Forestry Ministerial Regulation No. 15 of 2017 guides the measurement of water table at the peat ecosystem management sites, while Environment and Forestry Ministerial Regulation No. 16 of 2017 is providing guidance to improve efforts for protecting vulnerable peat ecosystems. In addition, Environment and Forestry Ministerial Decrees No. 129 and 130 of 2017 classify peat hydrological unit as protection and cultivation areas

Figure 4. President Jokowi's visit for field directives to the Minister of Environment and Forestry, Chief of Army, and Chief of Police at a burnt peatland forest, Central Kalimantan September, 2015

Environment and Forestry Ministerial Decree No. 77/2015 guides the restoration of peat ecosystem in production forest. This regulation is an effort to have a better management of timber within Indonesia's peatlands. Furthermore, Environment and Forestry Ministerial Regulation No. 17 of 2017 provides directions for concession holders in restructuring and reforming their working areas. These regulations may be lesson learned for other countries such as Democratic Republic of Congo that now has about 20% of its peatlands under forest concessions, and approximately 53% of these are in the process (Miles et al., 2017).

The results of Indonesia's political will and commitment to implement sustainable management of peatland are dramatic. The extent of fire in 2017 decreased by 61.8% compared to fires in 2016 and by 93.6% compared to the extent of fire in 2015. Table 1 shows the reduction of the area burnt and number of hotspot during 2015 – 2017.

Table 1. The Extent of Burnt Area and Number of Hotspots from 2015 to 2017

Year	Number of Hotspot	Burnt Area (Ha)		
		Peat	Mineral	Total
2015	70,971	891,275	1,720,136	2,611,411
2016	2,844	97,787	340,576	438,363
2017	2,440	13,555	151,929	165,484

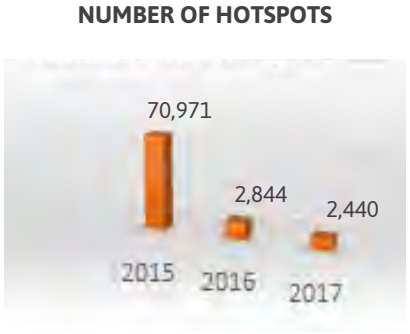


Figure 5. Number of Hotspots from 2015 to 2017

The success to reduce the number of hotspots and the area burnt during the last three years has led to the reduction of emissions from forests and lands, including from peatlands. Emissions from peat fires in 2017 was about 12,5 million tons CO2e or only 1.56% of emissions from peat fires in 2015 that reached 803 million tons CO2e. This is a big achievement that need to be maintained and institutionalized at all level of governments, from central to provincial and district until village governments.

Figure 6. Police lines by MoEF investigators, 2015

Policies and regulations developed for governing Indonesian peatland have also been supported by law enforcement implemented by the Ministry of Environment and Forestry and other law enforcement bodies. After big land and forest fires in 2015, about 500 cases have already been brought to justice and some of them have received sanctions, including a historic USD 1.2 billion fine to a private corporation proven to have committed crimes against the environment. This law enforcement does not only prevent others to do similar crimes, but also improves public trust in environmental law enforcement in Indonesia.

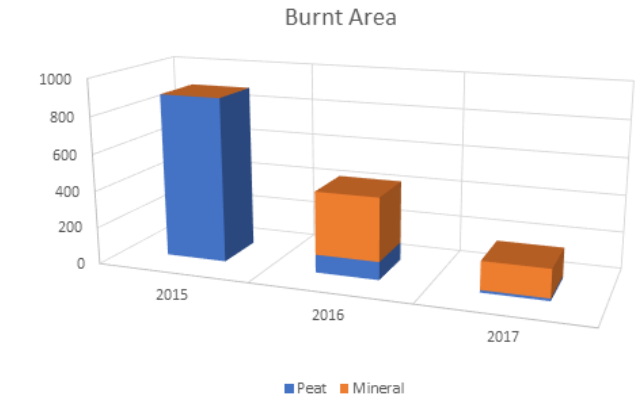


Figure 7. Peatland areas burnt from 2015 to 2017

International Cooperation for Managing Peatland

As indicated in the previous section, Indonesia does not only work by itself to mitigate problems in relation to peat management and peat fires. We also communicate and collaborate with other countries and international agencies to stop peat degradation and prevent peat fires. In the Southeast Asia Region, as the ASEAN member, Indonesia has ratified the ASEAN Agreement on Transboundary Hazard Pollution (AATHP) through Law No. 26 of 2014 on AATHP Endorsement, dated 14 October 2014. AATHP aims to prevent and control cross-border smoke pollution as a result of land and/or forest fires particularly in peatlands that must be implemented through intensive national, regional and international efforts based on commitment, a spirit of partnership, and a tradition of solidarity to achieve peace, progress and prosperity among ASEAN countries.

The ASEAN Task Force on Peatlands (ATFP) was established to assist monitoring and supporting the implementation of the ASEAN Peatland Management Strategy (APMS 2016-2020). Its main role is to achieve the objectives of the APMS through overseeing the design and implementation of the ASEAN Program on Sustainable Management of Peatland Ecosystems (APSMPE 2014-2020) and other relevant program/projects and facilitating cooperation with relevant partners, and reporting the progress of APMS implementation to COM to AATHP.

An ASEAN cooperation project is the "Measurable Action for Haze-Free Southeast Asia" (MAHFSA) funded by the International Fund for Agricultural Development (IFAD) and involves Cambodia, Indonesia, Malaysia, Lao PDR, Philippines, Thailand and Viet Nam. The MAHFSA Initiative will help strengthen existing ASEAN coordinating mechanisms to engage all stakeholders, strengthen capacity, harmonize relevant programs and projects, and facilitate donor agencies to promote fog-free agriculture, sustainable management of peat swamp forests and implementation of ASEAN Haze Roadmap.

At the international level, Indonesia is one of the three founding countries of the Global Peatlands Initiative, together Peru and the Republic of Congo, as well as 11 international organizations lead by the UN Environment. Among the members, Indonesia is the first ever country undertaking large scale peatland restorations. The establishment of GPI aims to protect peat from degradation based on long-term field research. The GPI undertakes a thorough assessment of the world's peat status and stored carbon where peat can help in achieving climate change mitigation as mandated by Paris Agreement. In addition, the GPI assists countries by strengthening knowledge and finding options for reducing peat degradation and improving sustainable peat management.

Figure 8. L-R: Tim Christophersen, UN Environment; Minister Arlette Soudan-Nonault (Republic of the Congo); MInister Siti Nurbaya (Indonesia); and Minister Amy Ambatobe Nyongolo (DRC)

Best Practices of Peatland Management

Indonesia's peatlands have been utilized since the end of 19th Century. Prior to 1920, *Dayak* rural communities in South Kalimantan have begun to manage shallow peatlands in the area behind the river bank (*back swamp*) which they call the *lawau* and manage it for rain-fed rice fields (Suwardi et al., 2005). The river area is a fertile area because it is influenced by sediment runoff from rivers. Basically *Dayak* people are very environmentally friendly. In managing the land, they have a rotating farming system that always maintains a balance with the utilization process following a natural cycle (Suwardi et al., 2005). They divide the lands into zones comprising settlement, bushes, harvested paddy field *(jurungan)*, dry paddy field *(pahumaan)*, plantations, sacred zones, and protected zones *(kayuan)*. Sacred zones are customary protected zones that should not be cleared for agricultural land. When the agricultural land has become infertile, they will move to look for similar land in other places. After being left for 1-7 years the former fields will become bush and after 7-12 years the bush will become a forest. They will reopen the former field after 30 years, when it has become a forest again. This is done continuously and sustainably.

In 1950's, Banjar people started to access peatland for farming (Suwardi et al., 2005). First, they build *"handil"*, a main drainage canal. *Handil* is made upraised with a large river, and is usually an extension of the existing river branch that is excavated and extended to an annex land up to 4-10 km long. The depth of the canal may reach 1 meter, with 2 meter width. *Handil* serves as: (1) drainage canal; (2) irrigation; and (3) communication channel. Secondly, they build *"parit"*, the secondary canal upraised to the *handil* and located every 30 meter along the *handil*. The depth and width of the parit are 1 m and 50 cm respectively. Using this traditional *parit and handil*, an excessive drain can be prevented and soil subsidence can be slowed. These are the example of how traditional knowledge and wisdom can manage peatland sustainably and prevent peat degradation that may lead to fires.

Figure 9. Traditional Utilisation of Peatland for Farming

Indonesia is also developing modern and advanced techniques in managing peatland and preventing fires. Forestry and Environmental R&D and Innovation Agency (FOERDIA) has provided scientific-based techniques and policies in managing peatlands and preventing fires. In the last 8 years, FOERDIA has been able to provide information related to: (1) Typology and distribution of peatland in Indonesia; (2) Technology to rehabilitate degraded peatland; (3) Phenology of tree species that can adapt to peatland; (4) Alternatives for participatory peatland management; and (5) the impact of deforestation in peatland on GHG emissions.

Another institution, Agency for Assessment and Application of Technology (*Badan Pengkajian dan Penerapan Teknologi*/BPPT) also provides technology for monitoring water table level in peatlands. They provide two technologies for monitoring the main parameter for determining the soundness of peatland.

First technology is provided in collaboration with Japanese scientists to monitor water table using Sensory Data Transmission Service, called SESAME. The second technology is called MORPALAGA (*Monitoring Real Time Tinggi Permukaan Air Lahan Gambut*/Realtime monitoring for peatland water table level).

The Role of Private Sectors in Supporting the New Policies in Managing Peatland

Figure 10. Canal Blocking Perimeter of a private company in Riau Province

The role of private sectors in balancing economic and ecological aspects of peatland management is important. As they manage the peatland based on regulations and technical guides provided by the government, their compliances to the regulations will ensure the sustainability of Indonesian peatlands. Some of the peatland has been utilised for commercial purposes by 100 concessionaires, including 99 concessions for industrial plantation forest and 1 concession for logging natural production forest concession. In 1990s the number of concessionaires were only 12, in 2000s the number increased significantly to become 73. Since 2010, the number of concessionaires have increased by 17 to become 100 concessionaires in total.

Figure 11. Canal Blocking Perimeter of a private company in Riau Province

Of the 99 concessionaires developing industrial plantation forests in peatlands, 55 concessionaires have fully adjusted their working plans to comply with the new regulation on peat ecosystem function, 20 concessionaires are being assessed, and 12 concessionaires need to revise their new plans. This is a significant measure in ensuring the ability of peatland to provide economic benefits and social welfares through an environmentally friendly way.

Peatland Management and Nationally Determined Contribution (NDC)

Figure 12. Forest Fire in South Sumatra, November 2015

Peatland is a storage of huge amount of carbon. It is estimated that peat can contain about 6 tonnes per hectare of 1 cm depth. Overall, Indonesian peatlands stores about 46 Giga tons, or about 8-14% of the carbon stored in the world peatlands. It is this carbon content that has become source of problems due to its emission when burnt, and at the same time also become a potential solution if well managed, in the context of climate change mitigation and adaptation. In our First National Determined Contribution submitted to the UNFCCC, 17% or over half of the 29% of the emission reduction target, comes from land based sector, which are mainly forest and peatlands.

The Indonesian NDC has targeted to restore 2 million ha of degraded peatland by 2030 with about 90% success rate. The strategy to restore 2 million ha of degraded peatland can be implemented by restoring 150,000 ha of peatland every year from 2018 until 2030. This strategy may reduce emissions for about 1 GtCO2e within 13 years from now (Muttaqin, Suryandari, Alviya, & Wicaksono, 2017). This is a significant contribution to the achievement of Indonesian NDC. To be able to achieve this target, collaborative actions among parties such as Ministry of Environment and Forestry, Peat Restoration Agency, Research Centres, Universities, Local Governments, Communities and NGOs are a must.

The restoration of degraded peatland has been conducted through:

1. Application of peat restoration techniques that include water management on site level (operational scale);
2. Construction, operation and maintenance works, including the arrangement of canal blocking installation (rewetting infrastructure);
3. Application of cultivation according to local wisdom; and/or
4. Research and development, taking into account and adhering to the development of science and lessons learnt from international perspectives.

As the NDC requests for 90% success rate, peatland restoration needs to comply with indicators of success. According to Environment and Forestry Ministerial Regulation No. 16 of 2017 on the Technical Guides for Recovering Peat Ecosystem, the recovery of peat ecosystem function is declared successful when:

1. There is no exposure to pyrite and/or quartz sediments under the peat layer at the point of compliance;
2. Water table level in peatlands are less than 0.4 (zero point four) meters below the surface of peat at the point of compliance;

Figure 13. Fire-fighting by Manggala Agni, MoEF, 2015

3. The condition is better than the standard criteria for degraded peat ecosystem as specified in the Environmental Permit;
4. The condition is better than the "degraded standard" of spatial analysis resulted from field survey activities or data analysis and information scale 1: 250,000 (one in two hundred fifty thousand) or the results of monitoring of the point of compliance; and/or
5. The number of plants growing at least in a healthy condition are 500 (five hundred) stems/hectares in the third year.

The importance of peat restoration is also related to the prevention of peat fire that may lead to a huge amount of carbon released to the atmosphere. To deal with the fire problem, a Grand Design of Forest, Estate and Land Fire *(Karhutbunla)* Prevention in 2017-2019 has been developed by the Coordinating Ministry for Economic Affairs, National Development Planning Agency and Ministry of Environment and Forestry to improve coordination, synergy and harmonisation between central and regional governments and increase the participation of other sectors. The scenario of the reduction of *karhutbunla* in the grand design uses two approaches comprising: (1) Ensuring that the 2.4 million hectares of peat land area under Peatland Restoration Agency are not burnt; and (2) Ensuring that 731 villages identified by MoEF as fire-prone villages are not burnt.

Peatland Management and Sustainable Development Goals (SDGs)

The ultimate goal of the sustainable development goals is to end poverty, protect the planet and ensure prosperity for all. Hence, managing peatlands should also comply with the goals. However, managing peatlands to provide livelihoods for local communities as well as to conduct intensive agriculture and forestry may contradict with the protection of the environment. The options are whether peatlands should be drained or to be sustainably managed

If peatlands should not be drained, then the question is what are the alternatives for economic activities? Paludiculture and agroforestry could be the answer. Paludiculture is the agricultural or silvicultural system of wet and rewetted peatlands (Wichtmann & Joosten, 2007). Hence, the agriculture or forestry is conducted in wet peatlands under conditions in which the peat is conserved or even newly formed. Indonesians have experiences in paludiculture by utilizing or cultivating *jelutung (Dyera sp.)*, a latex producing tree. Other species that are also utilised in a wet peat situation include *Belangiran (Shorea balangeran), Ramin (Gonystylus bancanus), Alstonia pneumatophora, Combretocarpus rotundatus and Macaranga pruinosa.*

People also utilise *Gemor (Alseodaphne coriacea)*, well-known as peat swamp tree of which the bark is harvested and is used as a mosquito repellent and sold on local markets. There are many more species

Figure 10. Agroforestry in peatland at Lakitan FMU, South Sumatra

of which the timber and non-timber products can be utilised using paludiculture in Indonesia. Even a wet peatland is also sources of food such as Sago *(Metroxylon spp.)* and nipah *(Nypa fruticans)*. Table 2 shows examples of species that have been used for paludiculture in Indonesia. Table 2. Suitable Species for Paludiculture in Indonesia

Table 2. Suitable Species for Paludiculture in Indonesia

No.	Benefit / Use	Species
1.	Food (fruits, carbohydrate, protein, spice)	Sago (*Metroxylon sago*), Kerantungan (*Durio oxyelanus*), Pepaken (*Durio kutejensis*), Mangga Kesturi *(Mangifera casturi*), Kweni (Mangifera ofodara), Nipah (*Nypa fruticans*), Durian (*Nephelium* spp.), asam kandis (*Garcinia xanthoxymus*)
2.	Fiber	Geronggang (*Cratoxylum arborenscens*, Terentang (*Campnosperma auriculatum*), gelam (*Melaleuca cajuput*)
3.	Bio-energy	Gelam (*Melaleuca cajuput*), sago, nipah
4.	Latex	Jelutung (*Dyera polyphylla*), nyatoh (*Palaquium leiocarpum*), sundi (*Payena* spp. *Madhuca* spp.)
5.	Medicine	Akar kuning (*Coscinium fenestratum*), pulai (*Alstonia penumatophora*)
6.	Others (Non-timber)	Gemor (*Alseodaphne* sp.*; Notaphoebe* sp.), purun (*Elaeocharis dulcis*), rattan (*Calamus tracycoleus*), gaharu
7.	Conservation-value	Ramin (*Gonystylus bancanus*), *Shorea* spp.

Source: Tata and Susmianto (2016)

Secondary crops *(palawija)* and horticultural plants, that have a short root system, such as corn, cassava, and pineapple are also able to grow well in shallow peatlands with closed water channels, therefore, in some locations, agroforestry can be applied in peat forests (Tata & Susmianto, 2016). Furthermore, if paludiculture is also conceptualised as a broader technique to utilise peatland for productive uses, silvofishery, silvopasture and peatland-based ecotourism can also be classified as paludiculture, as long as the role and function of the peat ecosystem is not disturbed (Tata & Susmianto, 2016).

When peatland is drained for forestry and agriculture, an option that can be taken is Land Clearing without Burning *(Penyiapan Lahan Tanpa Bakar/PLTB)*. PLTB is a practice that needs to be done to prevent the use of fire in clearing plant remnants in the area to be planted. Litter or crop residues can be processed into several types of products such as:

1. Compost; plant remnants can be utilized for composting raw materials so that during the growing season farmers can use compost as a natural fertilizer that is environmentally friendly because it can reduce the use or even do not have to use chemical fertilizers.
2. Wood vinegar; making wood vinegar is a PLTB strategy that is relatively new and is still being disseminated to communities. Wood vinegar is useful as a fertilizer as well as compost. Wood vinegar helps restore soil fertility; therefore farmers can produce it and use it for plating purposes.
3. Charcoal briquettes; the use of waste wood or twigs for the production of charcoal briquettes can also be done so that agricultural waste in the form of wood and twigs are not burned away. Charcoal briquettes can be used as more environmentally friendly fuel for cooking. It is also cheaper. However, there are still obstacles in community-based charcoal briquettes production since the equipment for producing the briquettes is expensive.

Figure 15. Measuring Water Level

Peatland Restoration Agency:
A smart way to obtain a quick win

The Jokowi Administration have seen that improving forest and land governance may take times. Thus, it needs an acceleration and simultaneous actions to have results in a relatively short period. In terms of fire prevention strategy, the Government of Indonesia then established Peatland Restoration Agency *(Badan Restorasi Gambut/BRG)* in January 2016, after the big fire incident of 2015. The Agency is tasked to rehabilitate 2 million hectares by 2019, and the current program is to carry out 2.49 million hectares restoration, which include 1.1 million ha to be performed by the Government and partners, while 1.39 million hectares by relevant private companies. This agency focuses on rehabilitating and restoring heavily degraded peatlands in fire-prone areas. Thus, this agency supports the grand strategy for peatland management developed by Directorate of Peatland Degradation Control, Directorate General for Pollutant and Environmental Degradation Control, Ministry of Environment and Forestry

By the end of 2016, peat restoration priorities of 2,492,527 hectares have been mapped. Another achievement is social intervention through community support in 104 villages in four priority districts of 806,312 hectares. Social intervention is crucial in order for a community consultation process and consensus agreements where canals and a drill canal will be built. Thirty six concession holders have been assigned, spreading in South Sumatra, Central Kalimantan, West Kalimantan, Riau and Jambi Provinces for peat restoration on 650,389 hectares or 26% of the area of peat restoration. In the restoration, concession holders also obtained technical guidance including water level and humidity monitoring techniques.

Figure 16. Canal Blockage for Rewetting Peatland

By the end of 2017, activities in 75 villages had been initiated in six provinces, with a total area of 1,180,446 hectares. These villages are called peat-caring villages, with thousands of its population are considered as guards in the maintenance of peat ecosystems. Revitalization has been undertaken for the livelihoods of 101 community groups (kelompok mayarakat/pokmas) through assisting community to clear lands without burning, developing local commodities, providing training of freshwater fish cultivation, livestock breeding and bee honey production. The area of restored land reaches 1.2 million hectares. This figure does not include 93 thousand hectares of peatlands restored by partners, and is spread over six provinces.

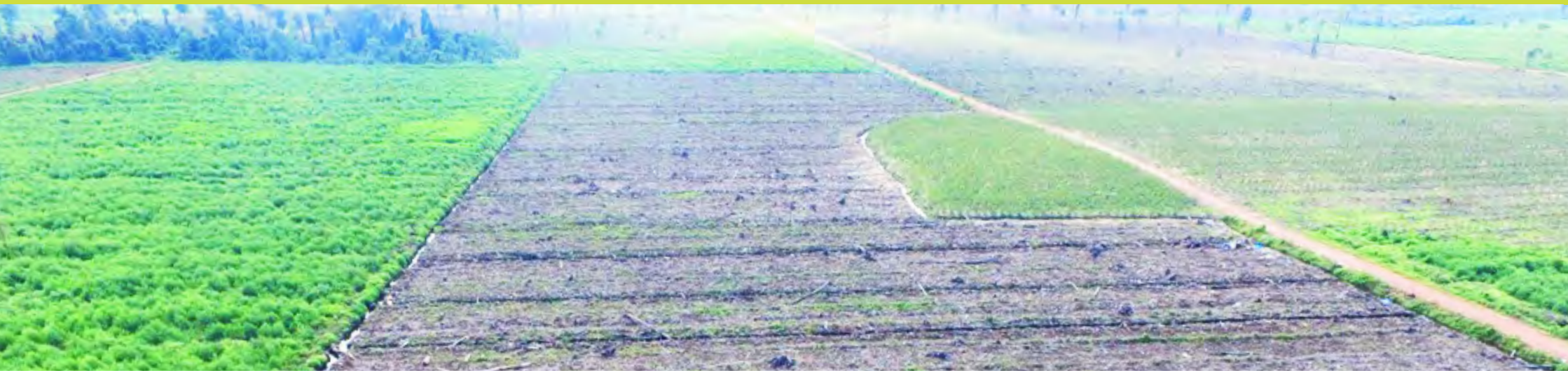
Other accomplishments are the preparation of the National and Provincial Peat Ecosystem Restoration Plan *(Rencana Restorasi Ekosistem Gambut/RREG)* and Peat Ecosystem Mapping Inventory. The RREG objective is to restore degraded peat ecosystem area caused by forest fires and 2 million hectares of land, with the focus being the Peat Hydrological Units *(Kesatuan Hidrologis Gambut/ KHG)*.

Peat ecosystem data is very important, as it can be used to identify and intervene degraded peatland based on the causes of degradation. Using Light Detection and Ranging (LiDAR) technology, very detailed ecosystem data can be obtained including topographic data, land cover, hydrological conditions, and carbon content estimates.

Observation points of peat water level have been established, that is eight in South Sumatra, seven each in Riau, Jambi, and Central Kalimantan, and one in West Kalimantan. The water level data can be accessed in real time modes. Monitoring the peatland water level is important to identify potential fires and forests. Drained peatlands is a trigger for forest fires that have been a relatively persistent problem for Indonesia. The restoration measures are relatively comprehensive. Not just wetting, trying to restore the peat ecosystem, making the community a vanguard for sustainable peatland management, but also early prevention of fire disasters.

Another initiative to support peat management in Indonesia and other tropical countries is the development of Tropical Peatland Research Centre (TPRC) to serve as a networking platform. The development of TPC in Indonesia is very strategic as Indonesia has extensive experiences in managing and conserving tropical peatland and has plenty of research and development agencies working on peatland that can be the backbones of the centre. The proposed scopes of the TPC are:

1. Database Development
2. Networking and Research collaboration
3. Paludiculture, Agroforestry, & Restoration techniques
4. Utilization zone of Peat Hydrological Unity (PHU) for social forestry
5. Tenure allocation in the utilisation function of PHU
6. Strengthening method of GHG emission estimation on peatland
7. Conservation and sustainable peatland management
8. Bio-technology for mitigating peatland fire



Lessons learned

Indonesia has gained extensive knowledge on peatland management through experiences, research and development, and institutional arrangements. In the past, Indonesian people have traditionally utilised peatland for their livelihoods, but some unsustainable management of peatland have also been experienced by Indonesia during timber boom and agricultural expansion era. These experiences have led Indonesia to focus on the conservation and sustainable management of its peatland.

A comprehensive actions have been taken by Indonesian government including formulating policy and regulations, establishing a special agency for peat restoration, and coordinating actions with all levels of government and stakeholders. Policies, regulations, law enforcement and institutional arrangements in improving management of Indonesian peatland have dramatically reduced the degradation of peatland and peat fire events. This also reflects a better governance of Indonesian peatlands that can ensure protection of good peatland areas from degradation and stop degraded peatland from further damage.

Indonesia also collaborates with international partners to implement its target and ambition in achieving sustainable peatland management. Indonesia is aware that addressing peatlands properly will prevent fire and carbon emissions that will avoid damaging disaster and contribute to global action in mitigating climate change.

Indonesia intends to share these experiences with other countries with peatlands in the tropical world through south-south and triangular collaboration. Indonesia deems it important to share and to assist other tropical countries as parts of its contribution to wider efforts towards achieving sustainable development for the betterment of the planet. The GPI and the UN Environment support the establishment of international research centre on tropical peatlands in Indonesia.

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