Peatlands in Indonesia's National REDD+ Strategy

Responding to the Public Consultation of the draft National REDD+ Strategy of Indonesia issued on August 18, 2011

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- version 2

Recommendations by:

Wetlands International Indonesia
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Table of Contents

Summary and conclusions

Very large greenhouse gas benefits can accrue by prioritising investments in the active conservation and rehabilitation of peatlands. The draft National REDD+ Strategy of Indonesia demonstrates that Indonesia has major ambitions to tackle its significant emissions from peatlands and conserve these unique ecosystems. This ambition is greatly welcomed and urgently needed. Some critical issues in the report, however, need to be addressed if Indonesia is to achieve its targets effectively and in a way that is environmentally, socially and economically sustainable.

Tropical peat swamp forests represent a unique ecosystem comprising interdependent biotic and abiotic components. Any change to the natural balance between water, soil and vegetation will result in GHG emissions. Conservation and restoration must target the maintenance and rehabilitation of this balance.

According to the draft National REDD+ Strategy, Indonesia aims to keep emissions from peatlands constant to the 2010 level. Because of the enormous peat carbon pool (in average per hectare 10 x larger than the entire biomass carbon stock), its high sensitivity for disturbance, the continuing emissions long after conversion, and the virtual irreversibility of peat carbon losses, this aim implies that Indonesia should halt any further degradation of its peatland resource. This requires development and stringent implementation of the following policies:

1. Conservation of all remaining pristine peat swamps. Further conversion and drainage of pristine and relatively intact peatlands will render the REDD+ program null and void and forms a tremendous threat to biodiversity. Conservation of intact peat swamps should therefore be clearly identified as a primary priority in Indonesia's REDD+ Strategy.

2. Prevention of further degradation and rehabilitation of degraded peat swamp forests. This should include

   - no further intensification of artificial drainage in already drained areas but instead raising water tables;

   - no further expansion of drainage dependent agricultural practices, oil palm plantations and Acacia pulpwood plantations on peat, but instead the development and implementation of paludicultures;

   - no further uncontrolled selective logging and illegal logging.

3. Reformation and development of suitable policies. Policy reformation and development and law enforcement are necessary to carry out regular monitoring for successful REDD+ programs and to enable a significant emission reduction from peatlands. Therefore this report gives recommendations for improving relevant policies.

4. Financial resourcing of peatland conservation, management and rehabilitation. To enable financial resourcing the government of Indonesia should facilitate private sector engagement in managing long-term Ecosystem Restoration Concessions for carbon emission reductions. This engagement is in demand both for non-protected peatland areas (including areas designated for plantation development, agriculture or production forestry) as well as for peatlands designated as Protection Forests (Hutan Lindung) for carbon emission reductions. It will be necessary to develop additional policy and legislation and to streamline inter-ministerial and inter-departmental procedures that now impede the rapid development of the innovative voluntary carbon market in the National REDD+ Strategy.

As approximately 95% of Indonesia's peatlands are already degraded, restoration should be a priority action in the REDD+ Strategy. Restoration of drained peatlands cannot be used to justify new conversions of intact peat swamp forests because on a per hectare basis carbon losses from conversion and drainage are generally (much) higher than the emission reductions achieved through restoration. Restoration can furthermore only be effective if complete hydrological systems (full peat domes, sub-domes, other integral hydrological units) are available for re-wetting. These issues need to be considered as a key item in all spatial planning related to peatlands. In addition to rewetting, reforestation with indigenous tree species, fire prevention and establishment of fire control capacity are critical for successful and sustainable rehabilitation.

We cannot stress enough the importance of working together with local communities and other local players in conservation and restoration programs. Community-based approaches are not only useful but also essential for successful peatland rehabilitation and we suggest innovative incentive mechanisms to promote this.

We noticed that the IFCA report, which forms the basis of Indonesia's Reference Level Scenario, includes a fundamental deficiency: it fails to recognise that the emission of greenhouse gases from deforested or drained peatlands is a continuous and long-term process that will stop only if appropriate restoration measures are put in place or when the entire peat carbon store is depleted as a result of oxidation or fires. Indonesia's baseline calculations assume only three years of emissions from drained peatlands, which is fundamentally incorrect. The result of this wrong assumption is that annual emissions from drained peatlands are strongly underestimated, which has a major impact on Indonesia's proposed reference level scenario and may misguide priority setting for policy development and implementation.

When developing methods for emission accounting for REDD+, a standardized MRV system designated especially for peatlands must be considered. While highlighting the importance of a practicable and reliable MRV system, we stress that the development of a MRV system should not delay the process of implementation. Action on the ground is more urgent.

While the draft National REDD+ strategy strongly recognises the values of biodiversity, there is a strong impression that biodiversity of peat swamp forest is being undervalued. Unlike other forests, the tropical peatswamp forest is a unique ecosystem with diversity represented at ecosystem, species and genetic levels. Peat swamp forest provides a key habitat for a wide variety of endemic plant and animal species. Indonesia should therefore ensure that the protection of relatively intact peat swamp forests (HCVF) and the rehabilitation of degraded peatlands with indigenous species (after rewetting) will be a priority in its REDD+ programs.

In Sumatra and Kalimantan almost all peat domes are affected by plantation concessions that impact not only the land area under concession but as a result of hydrological conductivity of the system also the other parts of the peat dome. To mitigate these impacts, we strongly recommend the development of a nationwide program of land swaps to facilitate relocation of existing concessions on peat to other more suitable areas. Any remaining agriculture and plantation on peat domes should be implemented as paludicultures, i.e. wetness adapted cultures.

This report provides critical input into the National REDD+ Strategy of Indonesia, but can also provide guidelines for other countries with significant peatland carbon stocks and emissions. From a climate mitigation perspective we suggest that on a worldwide scale peatland areas (which cover only 3% of the world, but hold 10% of the world's freshwater and 30% of all soil carbon) should be treated as no-go-zones or Protected Areas.

At UNFCCC level the important role of peatland conservation and restoration should be much better recognised as it risks falling between the cracks of programs with a focus on reducing emissions from forestry (with a bias to above ground carbon pools) and agriculture. Within the Agriculture, Forestry and Other Land Use (AFOLU) sector of the UNFCCC, peatlands might in the short term need a separate strategy, which deals with forested, deforested and non-forest peatlands. On a technical level the UNFCCC should provide guidance on peatland particularities relevant for MRV and for determining reference levels and emission reduction scenarios. In general, peatlands should get more prominent attention of the UNFCCC as, despite their global importance for climate change mitigation and adaptation, these carbon-rich ecosystems still risk being overlooked.

1. Introduction

In a unilateral effort, Indonesia committed to voluntarily reduce its GHG emissions by 2020 with 26% compared to a business as usual scenario. If assistance from foreign countries is made available, this target will be increased to up to 41%.

In the draft National REDD+ Strategy (issued for public consultation on August 18, 2011), the Indonesian Government has identified peatland conservation and restoration as key measures for reducing emissions in Indonesia. Under the 26% reduction scenario, emissions from peatlands in 2020 are envisaged to remain close to the 2010 level (draft National REDD+ Strategy fig. 3, p. 17, Bappenas 2010). We strongly welcome these ambitions as part of the global effort to mitigate climate change.

We believe, however, that the current draft Indonesian National REDD+ Strategy deserves to be advanced with respect to land use and land use change in peat swamp forests. Therefore this report discusses the particularities of reference levels, MRV-ability, and biodiversity of peatlands and gives recommendations for improving relevant policies and methodologies.

We hope that our recommendations contribute to strengthening the development of the global REDD+ mechanism (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries) with respect to peat swamp forests and other types of peatlands, both in Indonesia and in other regions.

Box 1: Peat swamp forests and peatlands

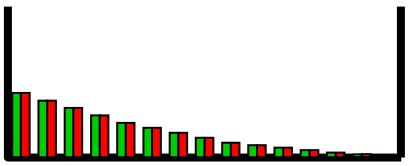
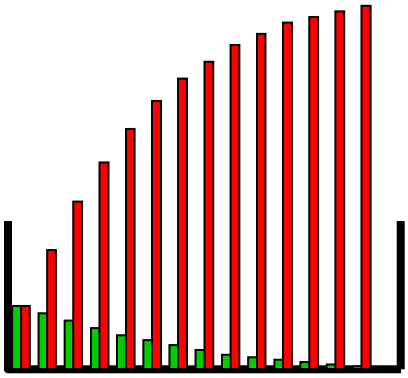
Peatlands are ecosystems where - under conditions of permanent water saturation - dead and decaying plant material has accumulated to form a thick organic soil layer (peat). Peatlands are the most concentrated and most important reservoirs of terrestrial carbon. They play an important role in global climate regulation by keeping huge amounts of carbon from being released to the atmosphere (Parish et al. 2008).

In natural peat swamp forests, the forest provides the plant material and facilitates the wet conditions for peat formation, carbon sequestration and carbon storage. When drained, deforested or degraded, peat swamp forests release the peat carbon much faster than it has been sequestered (Couwenberg et al. 2010, Dommain et al. 2010, 2011).

In Indonesia peat swamp forests range from pristine to severely degraded. Large areas of peat swamp forest have been reclaimed for agriculture and plantations or lay abandoned after deforestation. These deforested, degraded and drained areas, where the remaining peat soil continues to emit, are currently responsible for over 60% of Indonesia's greenhouse gas emissions (DNPI 2010) (cf. table 1).

2. Emissions from peat swamp areas: different from forests

The enormous pool of soil carbon in their peats (in average per hectare 10 x larger than the carbon stock of tropical forest on mineral soil) makes peat swamp forests in their emission behaviour fundamentally different from ‘normal’ forests. Figure 1 illustrates this difference and the enormous effect it has on long-term emission patterns and resulting reference emission levels. Indonesia’s draft National REDD+ Strategy has not taken these peatland particularities adequately into account: the calculation of the reference emission level wrongly assumes that drained peatlands emit for only three years after conversion. This fundamental flaw is caused by not differentiating sufficiently between the emissions from deforestation and the emissions from peat soil draining. Emissions from deforestation involve the removal and oxidation of forest biomass. These emissions can indeed be considered to be instantaneous, but they stop (or are reversed, cf. succession, reforestation) shortly after cutting the forest. In contrast, emissions from peatland drainage continue until the area is effectively rewetted or the entire peat is depleted, i.e. for decades and even centuries (see Figure 1).

Forest biomass	Peatland soil
1 	2 
A **decreasing** rate of deforestation and forest degradation **decreases** annual GHG emissions.	A **decreasing** rate of peatland conversion and drainage ***increases*** annual GHG emissions because the emissions from newly drained peatland add to those of already drained peatland.

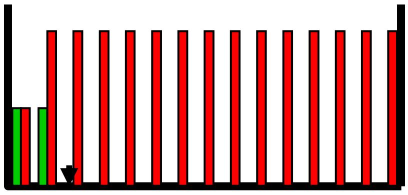
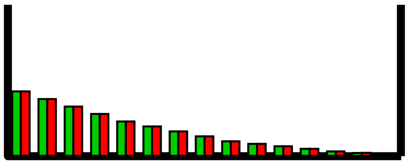
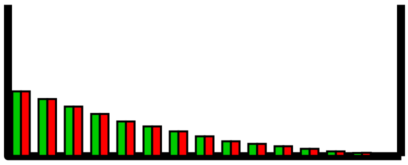
3  **Stopping** deforestation and forest degradation **stops** GHG emissions.	4  **Stopping** peatland conversion and drainage expansion does not decrease GHG emissions because existing drained peatlands will ***continue*** emissions at the same level.
5  Decreasing the **rate of deforestation** is indeed Reducing Emissions from Deforestation and forest Degradation.	6  But only ***decreasing the absolute area*** of drained peatland is Reducing Emissions from Deforestation and Degradation.
REDD+: STOP DEFORESTATION!	**REDD+: STOP NEW DRAINAGE + REWET!**

Fig. 1: *The relation between annual land use change ([1]-[5]) / land use ([6]) (ha/year, green) and total annual emissions (ton/year, red) when considering forest biomass (left) and peat soil (right).*

In the IFCA report the incorrect assumption that emissions from peatland stop three years after conversion leads - for a typical plantation on peatland (including conversion and a standing crop cycle of 25 year) - to presumed emissions of 860 ton CO_2/ha over the 25 years period (cf. MoFor 2008), including only a quarter from peat oxidation (Figure 2A). When, however, the continuing emissions from the peat soil over the full 25 years, are adequately taken into account the total emissions will be 2462 ton CO_2/ha, with the large majority (74%) resulting from peat oxidation (Figure 2B). Moreover, if the plantation is abandoned after 25 years but the area not adequately rewetted (see Box 3), peat oxidation will continue, for decades or longer.

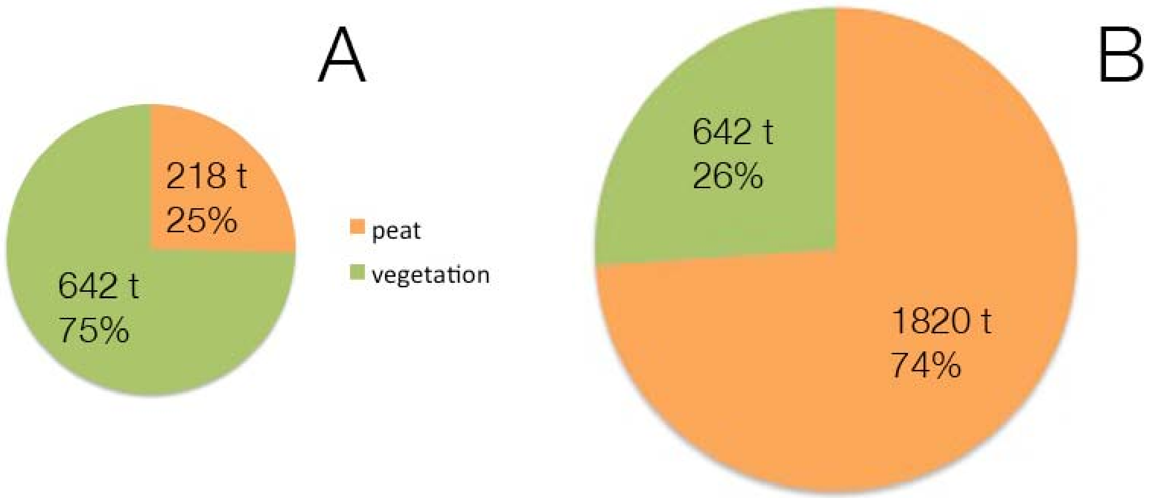


Figure 2: *Emissions (in tonnes CO_2 per ha) from a peat swamp forest converted to and used as plantation (involving deforestation and drainage) over a typical 25 year palm oil crop cycle. The area of the circles refers to the total emissions. A): According to the assumptions of the draft National REDD+ Strategy of Indonesia, which incorrectly limits emissions from the peat soil to the first 3 years after conversion. B): According to the realistic situation that emissions from peat oxidation continue over the full 25 years. Note that GHGs from the peat soil will continue after these 25 years, i.e. when the plantation enters a new crop cycle or is abandoned, resulting in a continuous increase of emissions and a higher share of peat emissions in the total.*

The fundamental flaw in dealing with peatland drainage thus results in a wrong estimation of the relative importance of emissions from (one-off) peat swamp deforestation on the one hand and (continuous) peatland use on the other. It leads to a severe underestimation of the annual emissions from drained peatlands and consequently to a wrong proposed reference level scenario. It thus results in wrong guidance for planning, policy review and development.

We recommend that Indonesia reconsiders its reference level taking continuous emissions from drained peatland adequately into account.

The consequence of the continuous emissions from drained peatland is that reducing emissions from peat swamp deforestation and degradation (REDD+…) is only possible by the combination of

1. **Preventing** any further peatland degradation and drainage (from new conversion or intensified drainage on already drained peatland) in order **to maintain** annual GHG emissions from peatland on the status quo level; and

2. **Rewetting** already degraded and drained peatlands, i.e. decrease drainage intensity and reforestation, in order **to reduce** annual emissions from peatland.

3. Trends in peatland emissions and consequences for REDD+ action

Indonesia's reference emission level is based on projecting historic emissions (derived from remote sensing evidence and scientific literature) into the future. Table 1 shows how between 1990 and 2008 land use and land cover on peatlands in Sumatra and Borneo (separate data for Kalimantan are not available for 1990) have changed and how this has lead to a change in emission from peatlands.

Table 1: *Annual average CO_2 emissions from peatland drainage related peat oxidation for the 1990 and 2008 situation for Sumatra and Borneo (peat and-cover classification based on Miettinen & Liew 2010, emission calculation after Dommain et al. submitted).*

Year	1990*				2008*			
Peat land cover type*	**Peat land cover area**		**Total CO_2 emissions**		**Peat land cover area**		**Total CO_2 emissions**	
	ha	**%**	**t yr^{-1}**	**%**	**ha**	**%**	**t yr^{-1}**	**%**
Water	63,000	0.4	0	0	63,000	0.4	0	0
Seasonal water	214,000	1.5	0	0	303,000	2.1	0	0
Pristine Peat Swamp Forest	7,351,000	50.3	-18,868,000	0	1,456,000	10.0	-3,737,000	0
Degraded Peat Swamp Forest	3,952,000	27.0	71,136,000	34	4,717,000	32.3	84,906,000	17
Tall shrub/sec, forest	725,000	5.0	13,050,000	6	1,228,000	8.4	22,104,000	4
Low shrub/ferns	650,000	4.4	11,700,000	6	1,613,000	11.0	29,034,000	6
Small-holder agriculture	1,340,000	9.2	108,540,000	51	2,558,000	17.5	207,198,000	41
Industrial plantations	48,000	0.3	3,456,000	2	2,072,000	14.2	149,184,000	30
Build-up area**	8,000	0.1	0	0-	19,000	0.1	0	0
Cleared/burnt area	194,000	1.3	3,492,000	2	534,000	3.7	9,612,000	2
Mangrove	67,000	0.5	-**	0	49,000	0.3	-**	0
Total	**14,611,000**	100.0	**192,506,433**	100	**14,611,000**	100.0	**498,300,933**	100

*) the figures are combined for Sumatra and Borneo together
** no data

The following conclusion can be drawn:

- Peatland degradation has proceeded with such speed in Sumatra and Borneo that only 10 % of the pristine peat swamp area has remained (a decrease from 50% in 1990 to 10% in 2008) and that 87% of the peatland area is currently a permanent source of greenhouse gas emissions.

- Average net annual emissions from peat oxidation from peat swamp forests have increased from 193 Mtons in 1990 to 498 Mtons in 2008 (+ 305 Mtons).

- Responsible for the bulk of this increase are industrial plantations (+ 146 Mtons) and small-holder agriculture (+ 100 Mtons).

- There is no indication that the long-term average emissions from peat fires (some 400 Mt CO_2 per year and additional to emissions from peatland drainage and related peat oxidation) have changed substantially between 1990 and 2008 (Heil 2007).

- Emissions from microbial peat oxidation in drained peatland are currently 20% higher than the long-term average annual emissions from peat fires.

These figures show that it is critical that the emissions of all peat soils in Indonesia are included in the baseline of REDD+, both of forested and deforested peat swamps, as these emissions are strongly interlinked. Although currently without canopy cover, deforested and abandoned peat swamps are 'temporarily destocked as a result of human intervention' and 'are expected to revert to forest' (16/CMP.1) in the absence of human management and anthropogenic fires. Non-abandoned lands are converted to small-holder agriculture and industrial plantations, which are the most substantial and most rapidly growing sources of peatland emissions (see Table 1).

If these areas are excluded from the REDD+ baseline, Indonesian emissions will continue and increase without any incentive to reduce them. Moreover, new plantations will then preferentially move to deforested and abandoned peatlands leading to intensified (deeper and denser) drainage and larger but unaccounted (!) emissions (leakage!). This can not be the purpose of Indonesia's National REDD+ Strategy.

We recommend that UNFCCC makes in its guidance explicit that all peat soils are included in REDD+ accounting.

4. Peat swamp conservation and rehabilitation

4.1 Introduction

Indonesia's draft National REDD+ Strategy identifies rehabilitation and conservation of peatlands as core means to reach Indonesia's climate goals. Indonesia's unilateral effort includes keeping emissions from peatlands at about 2010 level (draft National REDD+ Strategy fig. 3, p. 17). The Strategy remains, however, unclear by which means Indonesia would expect to achieve this goal, in regard to expansion of plantations and agriculture on peat, peatland conservation and/or restoration.

Indonesia plans to achieve over the period 2011-2025 annual economic growth rates of 7% ("Master plan Program of Acceleration and Expansion of Development Indonesia") with expansion of oil palm plantation being among the 22 major economic activities to reach this goal.

Plantations in Indonesia now cover several million hectares of peatland, and many more peatland areas have already been allocated as concessions for oil palm or pulp wood plantations. The development of these (except those that already have ministerial approval) has been put on hold with the current temporary Moratorium.

We believe that Indonesia will not be able to achieve its emission reduction targets if the Moratorium comes to an end, and therefore we strongly recommend including the perpetuation of the Moratorium as a key item in the National REDD+ Strategy. We suggest a three-pronged approach to address plantation concessions on peatland:

i. Avoiding the establishment of new plantations on peat and natural forest areas;

ii. Relocating existing or prospective concessions from peat and natural forest areas to degraded lands; and

iii. Replacing these concessions with new Ecosystem Restoration Concessions to restore these areas.

4.2 Avoiding the establishment of new plantations on peat and natural forest areas

In view of the rapidly growing emissions from plantations on peatland (Table 1), we consider it essential for achieving Indonesia's REDD+ goals that new plantations on peat and natural forest areas are prohibited. Plantation development must be focused entirely on degraded non-peat land (with exception of paludiculture: plantations of indigenous species on non-drained peat (see section 4.6). This implies the following steps:

- ’Natural Forest‘ and ’Degraded Land‘ should be defined on the basis of ecosystem function, conservation value, and carbon stock. Such definitions should go beyond ‘production-based’ criteria;

- Natural forest and peat areas should be mapped as part of the definitional process. For areas within Production Forest (*Hutan Produksi*), no new licenses or requests for release (*SK Pelepasan Kawasan Hutan*) or exchange (*Tukar Menukar Kawasan Hutan*) should be considered;

- Where such areas lie *outside* the National Forest Estate (within *APL*) they should be prioritized for forest exchange (*Tukar Menukar Kawasan Hutan*) so that they can enter the Forest Estate and be protected (see point 4.3 below); and

- Peat and natural forest areas within the Production Forest areas should be designated for Ecosystem Restoration Concessions (*IUPHHK-RE*) where appropriate (see 4.4 below).

4.3 Relocating concessions from peatland and natural forest areas to degraded lands

The relocation (e.g. as proposed as ‘land swaps’ in the current draft National REDD+ Strategy) or revocation of existing and pending plantation licenses within natural forest and peat areas should be incentivized and enforced. While this may be a considerable challenge, we believe that both legal and economic options exist to support such measures.

- Where existing plantation licenses or pending applications (both *HTI* and *IUP*) relate to peat soils with a peat depth greater than 3 meters, such licenses should be revoked under provisions of Ministry of Agriculture Regulation 14/2009, Presidential Decree 32/1990 and Government Regulation 26 /2008, all of which prohibit such development. These provisions should also be considered as the basis for relocation or revocation on lands that are:

    - unsuitable for plantation development for physical reasons, such as frequently or deeply flooded areas;

    - High Conservation Value (HCV) areas with high levels of biodiversity and areas providing important hydrological or other ecosystem functions;

    - providing important socio-economic benefits, such as freshwater swamps and riparian forests that provide river bank protection or breeding and nursery areas for fish; and

    - storing large amounts of carbon such as forests with significant above-ground biomass and shallow peatlands.

- Consideration could be given to the identification of areas of degraded land suitable for establishing new plantations (see point 4.2 above) and for fast-track land exchange deals (*Tukar Menukar Kawasan Hutan*) under provisions of Government Regulation 10/2010. In this context, 'degraded land' does not refer to land with poor soil quality but rather to areas that were cleared of forests, now contain low levels of biodiversity and low stocks of carbon, and are not used for productive agriculture, such as alang-alang (*Imperata cylindrica*) grasslands.

- The process can be conceptualized as 'land swaps', wherein areas sensitive for plantations are swapped with degraded areas. The government could begin the swap process by calling for the plantation sector to voluntarily enter into land swap negotiations, offering equitable land in exchange for concessions located in sensitive areas. After the voluntary period is over, the government could consider relocation and revocation measures for remaining tracts of inappropriate and sensitive areas.

- The designation of degraded production forest areas as suitable for conversion (designation of *Hutan Produksi Konversi*) should be avoided as the law allows their release from the forest estate *without* exchange. Instead, the provisions for exchange alone could be strengthened and fast-tracked, allowing the extent of the national forest estate to remain constant.

4.4 Establishing new Ecosystem Restoration Concessions to restore sensitive areas

The creation of Ecosystem Restoration Concessions (ERCs) has a huge potential to attract investment for forest restoration and to provide state revenue through carbon markets and other environmental finance mechanisms.

We believe that the concept of ERCs is unique to Indonesia. Hence the country could provide an example to the rest of the world on how to develop a comprehensive network of ERCs for carbon storage, emission reductions, and biodiversity conservation while maintaining sustainable development opportunities in e.g. fisheries and tourism. Furthermore, this approach could leverage substantial private sector investment and create major employment opportunities for local communities.

Currently, several obstacles prevent the widespread uptake of carbon-financed forest restoration through ERCs:

- While the criteria for designation are clear, the basis on which areas are selected and designated for forest restoration requires further attention. Streamlining and clarification of the identification and designation processes will open greater opportunities to attract inward investment for forest restoration.

- The protection of peatland and natural forest areas within production forests is currently limited. ERCs could be employed as a means to strategically protect and restore areas without the need to remove them from the production forest estate. ERCs could also be used as part of land swap deals whereby land exchanged into the national forest estate could become an ERC.

- Many of the areas that would be suitable for ERC management are already allocated (in whole or part) to plantation licenses, many of which are not yet operational. When identifying ERCs in peatlands, the potential to safeguard or restore complete hydrological units (i.e., a peat dome, see below) is crucial. Restoration and sustainable management is not feasible when the peat dome is threatened by long-term drainage from an existing or future operating plantation.

We recommend that the Strategy explicitly addresses the issue of plantations on peat by

- **including the perpetuation of the Moratorium in the National REDD+ Strategy;**
- **avoiding the establishment of new plantations on peat and natural forest areas;**
- **relocating existing and prospective concessions from peat and natural forest areas to degraded lands; and**
- **replacing them with new Ecosystem Restoration Concessions (ERCs) to restore these areas.**

4.5 Restoring degraded peatlands

As most peatlands in Indonesia are already to some extent degraded and continuously emitting greenhouse gases (GHGs) (table 1), large-scale peatland restoration must be a strong priority in Indonesia's REDD+ Strategy. However, while restoration is urgent, it is only effective when it is combined with a **complete stop** of further peatland degradation, i.e. with conserving all remaining pristine peatland and preventing stronger degradation (deeper drainage) of already degraded sites. Conversion of one ha of natural peatland can only be compensated by the simultaneous rehabilitation of at least 2 - 3 ha of degraded and drained peatland (box 2). In order to achieve the aimed emission stop, Indonesia should

- **actively protect all its remaining intact peatlands;**

- **prevent further degradation (i.e. further deforestation, forest degradation and enhanced drainage) of already degraded peatland.**

If real reductions of peatland emissions are required (cf. REDD+!), these actions should be complemented with

- **rewetting and reforesting already degraded peatland.**

BOX 2: Restoration and conservation

Peatland restoration is a good way to reduce emissions from drained peatlands, but cannot justify new conversion of pristine peatland. Restoration of a peatland site can only reduce the emissions to zero, if the entire area can be adequately rewetted. The experiences in Indonesia have shown that the latter is often very difficult – or impossible- to achieve, because drainage has induced irreversible changes in peatland relief. Stronger soil subsidence immediately adjacent to drainage channels results in the formation of 'mini-domes' in between such strongly subsided areas which prohibits full rewetting over large areas. The areas that are not sufficiently rewetted will continue to emit GHGs until a new hydrological equilibrium is reached. Achieving full rewetting will often take several decades. This implies that restoration of degraded peatland cannot compensate for peat swamp conversion on a hectare-by-hectare basis. To compensate for emissions of newly drained peatlands much larger areas of degraded peatland landscapes will have to be subject to long-term rewetting and reforestation.

The main principles to peatland restoration are:

- **Rewet** as quickly as possible. In the short to medium term, restoration will only reduce emissions from the part of the degraded peatland that is closest to the drainage channels. It will take considerable time before full hydrological integrity of the entire ecosystem is restored and the system will reach carbon neutrality (if at all). The effectiveness of peatland restoration strongly depends on the degree of degradation. The longer a peat dome has been dissected by drainage channels, the more the new mesorelief of 'mini-domes' will frustrate full-scale rewetting and emission reduction.

- **Reforest**. Reforestation is an integral part of hydrological rehabilitation. The hydrology of natural (zero-emission) peat swamp forest is maintained by the forest above-ground root system and related surface elevation differences (Dommain et al. 2010). Therefore reforestation must be part of any restoration effort. Reforestation may, however, be hampered by flooding and fires (cf. Box 3).

- **Involve local communities** at the earliest stage and ensure their support! Drainage infrastructure often provides access to the peatland to local people. Restoration may restrict this access again (by blocking canals) and thus results in opportunity costs. Locals therefore may oppose restoration. It is thus of crucial importance to consult local communities and involve them actively in the planning, design and implementation of restoration work (cf. Box 3).

- **Stimulate community development**. To enable communities to overcome dependence on unsustainable peatland use, peatland rehabilitation projects, which may result in opportunity costs for local communities, should include community development as an integral component to offset such opportunity costs.

4.6 Adapting agricultural and plantation practices: paludicultures

Restoration measures in abandoned land are not sufficient to effectively reduce carbon emissions. As small-holder agriculture and industrial plantations are the largest - and fastest growing - source of emissions from peat swamp areas (Table 1), the necessity to freeze and reverse emissions from peatland will inevitably interfere with these social and economic interests. Even the carbon gains of highly productive plantations cannot outweigh the simultaneous carbon losses from associated peat oxidation by drainage. Therefore drainage based peatland agriculture, forestry and plantations have urgently to be replaced by cultures that can thrive on (very) wet peat soils. Such *paludicultures* (e.g. of productive tree species like Jelutung rawa [*Dyera polyphylla*], Tumih [*Combretocarpus rotundatus*], Meranti rawa [*Shorea pauciflora*], and Nyatu [*Palaquium* sp.]) provide an option for sustainable economic development in degraded peatland areas in combination with rewetting and emission reduction.

In many peatlands only part of the dome is converted to agriculture or plantations. The converted parts will over time impact the rest of the dome, as a dome is a hydrological unit with a delicate hydrological balance that can be seriously affected by drainage in any part of the dome. Successful conservation and restoration of remaining 'pristine' peat swamp forests thus requires the restoration of their entire hydrological units by re-installing and maintaining high water levels in the associated utilized lands. Paludicultures can be an attractive means to achieve this. Agriculture on alluvial and adjacent shallow peat soils has tradition in SE-Asia and collection and harvest of renewable natural resources (including fisheries) is still common practice in the remaining wet peat swamps. These traditional types of wetland use provide both models for peatland utilization after rewetting and the possible range of cultivatable species. Paludicultures can build up on existing wet production techniques and can be adopted in ongoing smallholder farming and industrial plantation settings.

We recommend with respect to drained and degraded peatlands

- **to include large-scale peatland restoration/rewetting as a strong priority in Indonesia's REDD+ Strategy;**

- **to identify, develop and implement options for agricultural and plantation practices adapted to wet conditions (paludicultures).**

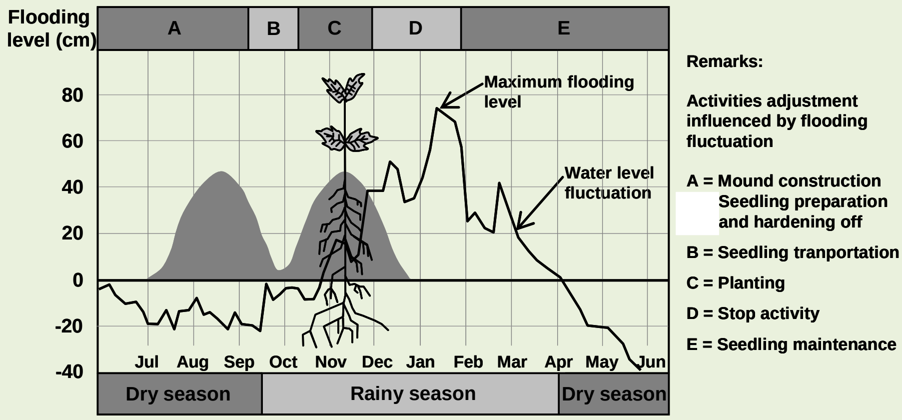
Box 3. Peatland restoration in Indonesia: Lessons learnt

Peatland restoration is urgently needed in Indonesia but is rather new in tropical peatlands. Experiences in pilot projects show that restoration is possible but often also challenging and expensive. It requires building of a common (national/international) knowledge base in order to decrease risks and optimise results.

1. *Revegetation in Berbak National Park*

The Climate Change, Forests and Peatlands in Indonesia Project (CCFPI, 2002-2007) aiming for peatland rehabilitation in Berbak National Park (Jambi province) showed that determining appropriate planting sites is key in successful reforestation and that revegetation can only succeed with sufficient hydrological knowledge.

In collaboration with local communities, Wetlands International planted 22,000 seedlings of 12 local species on 20 hectares of previously burnt area. Flooding from the Air Hitam Laut river was taken into account by using hydrological data to guide field activities and by planting the seedlings on artificial mounds of 0.3-0.5 m high. Constructing this mound system caused much work and high costs. The system proved to be effective until a certain level of inundation, but useless in case of extreme flooding. The first planting failed (survival rate < 10%) due to extreme (1.2 meter high) flooding, while the second planting succeeded with the survival rate (8 months after planting) of 85%. The species Jelutung rawa (*Dyera polyphylla*), Tumih (*Combretocarpus rotundatus*), Meranti rawa (*Shorea pauciflora*), and Nyatu (*Palaquium* sp.) showed good performance in terms of survival rate and growth (Wibisono 2005).



Picture 3: *Mound system applied by Wetlands International in Berbak NP*

2. *Hydrological rehabilitation in the Ex-Mega Rice Project (EMRP) area, Central Kalimantan*

The Central Kalimantan Peatland Project (CKPP, 2007-2009) focused on peatland rehabilitation in Block A North of the Ex-Mega Rice Project (EMRP), Central Kalimantan. This project showed clearly that, along with plant maintenance, fire prevention must be an integral part of every reforestation program. The project area covered 48,000 hectares of deep peat, mostly hydrologically damaged as a result of the large uncontrolled drainage system and regular occurrence of severe peat fires.

A total of 24 large dams were constructed in the EMRP channel system to restore hydrology (8 dams by CCFPI, 16 by CKPP). Post project evaluation learned that the effect of the dams was limited to only 1700 ha or 3.5 % of the project area because the water table rose only up to a distance of 200 meters from the blocked canals. The vast majority of the area thus remained too dry, highly fire prone and with high peat oxidation rates. Another reason for the limited results was the limited number of dams (due to limited funding) and the consequent long distance between and large head differences over the dams. The main obstruction to successful rewetting was, however, that after a decade of continuous subsidence, a completely new topography of numerous ‘mini-domes’ had developed that could not effectively be rewetted anymore by raising the water level in the strongly subsided and much deeper laying canals.

Figure 4: Dams constructed at canal in Block A North, Ex-Mega Rice Project

Simultaneously 200,000 seedlings of 7 local species were planted in five different areas, covering a total of 500 hectares. Survival rate ranged from 65-85 % one year after planting. *Dyera lowii*, *Shorea belangeran* and *Alstonia pneumatophora* appeared to have the best performance in terms of survival and growth. Unfortunately, a large part of the rehabilitation site along the primary canal was razed by fire in 2009, several years after the project ended, illustrating the need for continued vigilance against fires and that peatland rehabilitation requires long-term commitment and funding.

Picture 5: Dyera polyphylla planted along canal dikes

Both activities were supported by a “Bio-rights” scheme (www.wetlands.org/bio-rights) that actively involved local communities in canal blocking and reforestation in exchange for micro-credits for sustainable development that were converted into definite payments after the achievement of the goals. This enabled sustainable development and environmental conservation to go hand in hand.

5. Measurement, Reporting, and Verification (MRV)

Peatlands have unique emission features that make them significantly different from other types of ecosystems (Fig. 1). The complexity of monitoring emissions from peatland ecosystems may tempt to develop complex and sophisticated MRV methodologies. On the other hand, there is the intrinsic tendency of peatland emissions to increase if no radical stop of peatland conversion and further degradation is achieved. The latter urges to come to a practical, readily implementable MRV system. Certainly with respect to reducing emissions from peat swamp degradation we should take care that 'the perfect does not become the enemy of the good'.

While peatland emission behaviour may be complex, the monitoring of policy implementation with respect to maintaining peatland emissions at 2010 levels is rather simple as this aim in essence implies that no further degradation of peatlands takes place (see chapter 2). An increase of emissions of peat swamp areas may take place in three ways:

a. by removing (substantial) tree biomass from a peatswamp;
b. by increasing drainage from the peatlands;
c. by fire.

All these activities and processes can easily be monitored in the framework of REDD+ because they are associated with changes in crown cover of forests on peat soil and/or expansion or alteration (intensification) of drainage structures (canals/ditches) in peatlands,

A simple yet meaningful system of monitoring peatlands at the national level in Indonesia can be based on the existing peatland atlases as compiled by Wetlands International (Wahyuntu et al 2003, Wahyuntu et al 2004, Wahyunto et al 2006), extended with higher resolution data that the Ministry of Forestry (BAPLAN) are currently collecting. This information can be combined with

- wall-to-wall remote sensing of land use and land cover change using high-resolution satellite imagery,
- simple conservative algorithms for assessing the emission effects of land use change, and
- default emission factors for the identified types of land use/cover that can be extracted from the rapidly expanding and increasingly consistent literature data (Couwenberg et al. 2010, Jauhiainen et al. 2011).

Such simple monitoring system would for the time being be sufficient to guard the pursued maintenance of the 2010 peatland emission situation.

On a district and project level, this system could be refined further, e.g. by using (direct) water level and subsidence measurements to assess emission reductions and carbon removals related to rewetting and reforestation activities. Further knowledge gain will over time enable further refinement of the monitoring system.

With respect to MRV we recommend

- **to include all peatland, i.e. forested and non-forested, not used, abandoned and used, in the REDD+ monitoring system;**

- **to rapidly implement a simple and practical MRV system: don't let the perfect become the enemy of the good.**

Box 4: MRV-relevant particularities of peat swamps

- In peatlands the interdependency between vegetation, peat and water is very tight, far tighter than in dryland ecosystems. As a consequence deterioration of any of these components leads to the degradation of the overall system, and in peatlands this relates directly to emissions. On the other hand, each of these components can be used as an indicator for the conditions of the entire system.

- The major carbon stock in peat swamps is in peat, hence below ground. This carbon will be released to the atmosphere when the peatland is drained, when the tree cover is (partly or totally) removed, and when peat fires occur. Thus all peatland should be monitored as part of REDD+ in Indonesia, including primary peat swamp forests, degraded peat swamp forests, secondary peat swamp forests, deforested peatland areas, agricultural areas on peat, plantations on peat and abandoned agricultural areas on peat.

- In dry land forest where most carbon stock is in the vegetation, remote sensing can be used to estimate changes in carbon stock. This applies also to the above ground carbon stocks in peat swamp forests (which are also hydrology relevant! See chapter 4.5). Similarly, deforested peatland areas can be monitored by using remote sensing techniques focused on detecting and monitoring drainage ditches. The latter is easy in case of large-scale systematic drainage systems as in plantations. But also illegal logging channels that are dug without fully removing tree cover can be detected using decreased forest cover as a proxy, because all illegal logging in peat swamp forests is associated with the construction of transport canals.

- Peatlands are strongly coherent systems. Water flow connects various parts of a peatland with each other and the larger surroundings with the peatland. A change in water flow in part of the peatland or in its surroundings may therefore affect every part of the peatland and its emission characteristics. These interdependencies must be considered when developing a MRV system for peatlands.

6. Biodiversity and ecosystem services

The draft National REDD+ Strategy strongly recognises the values of biodiversity and encourages the adoption of the Climate, Community and Biodiversity Standard (CCBS) to ensure that biodiversity is properly considered in REDD+ projects. This position is strongly welcomed. Biodiversity of peat swamp forest is, however, not adequately valued. Unlike any other forest, peat swamp forest is a unique ecosystem with specialized and endemic flora and fauna. Indonesia should therefore protect its undisturbed peatlands (HCVF) and with priority rehabilitate degraded peatlands by rewetting and by facilitating the establishment of indigenous species.

Simply comparing species numbers in dry land and peat swamp forest, respectively, could result in the conclusion that biodiversity in the latter is much lower than in dry land forests (cf. Paoli et al. 2010, p.4). Such comparison is, however, not appropriate. Not only has the inventory intensity of peat swamp forests been much lower than that of the much better accessible dry land forests, but – more importantly - biodiversity is not only a matter of quantity but most of all of quality. Peat swamp forests harbour a unique biodiversity with highly specialised, often endemic species (Box 5), and recent increase in peat swamp survey work is resulting in new swamp forest species being regularly discovered.

Box 5: Peat swamp forest biodiversity

Unlike other forest, peat swamp forest is a ‘unique ecosystem’ with very close interactions between vegetation, peat and water that operate as 'self-regulation' mechanisms and enable these domed organic landscapes to persist under varying climatic conditions for thousands of years (Dommain et al. 2010). Furthermore peat swamp forests are the habitat of many endemic plant and animal species.

Endemic fauna recorded only in this habitat include False Gharial (*Tomistoma schlegelii*), Storm’s stork (*Ciconia stormy*), White-winged Wood Duck (*Cairina scutulata*), Hairy-nosed Otter (*Lutra sumatrana*), Black Partridge (*Melanoperdix nigra*), many species of fish, many species of dragonflies, Proboscis monkey (*Nasalis larvatus*), and Flat-headed Cat (*Prionailurus planiceps*). There are also many species of birds found only in peat swamp forests.

False Gharial is listed by IUCN as an ’endangered species‘ because its population is estimated to be below 2,500 mature individuals. A joint study by Wetlands International Indonesia and Wahana Bumi Hijau in 2002 revealed that Merang Kepahiyang peat swamp forest (South Sumatra Province) harbours its worldwide largest population. Government officially declared this as protected species by issuing government regulation No.7/1999.

Until recently many biologists considered the black water of peat swamp forests to be low in biodiversity and productivity. In fact peatlands have simply been poorly studied. In Peninsular Malaysia 10 % of all fish species are found only in peat swamps. Unpublished data show this figure is even higher in Borneo. Most .of these species are small and have been overlooked by fishery biologists. They occupy niches that are also easily overlooked and difficult to sample.

Many species are found only in peat soils and persist there even when the streams themselves are dry. They include several species of small worm-like fishes (Kottelat and Lim 1994) and catfishes. Such very specialised organisms have very localized distributions and are confined to specific drainages. As a result peat swamp freshwater fauna exhibit an unusual high degree of endemism (Kottelat and Whitten, 1996).

Peat swamp forests are also home to many endemic tree species including Ramin (*Gonystylus bancanus*), *Dactylocladus stenostachys*, *Copaifera palustris*, Belangeran (*Shorea belangeran*), Swamp meranti (*Shorea pauciflora*), Jelutung rawa (*Dyera polyphylla*), Pulai rawa (*Alstonia pneumatophora*), Perapat (*Combretocarpus rotundatus*), and Gemor (*Alseodaphne coriacea*). Peat swamp forests are inhabited by many species of the family Dipterocarpaceae. From forty-five Dipterocarps tree species found in peat swamp forest in Sumatra, Kalimantan, Sarawak and Sabah, twenty are classified by IUCN as Critically Endangered, eight as Endangered, three as Vulnerable and one as Least Concern (Paoli et al. 2010).

Ramin (*Gonystylus bancanus*) is one of peat swamp forest endemic species with a high economic value. It was heavily exploited by timber companies and illegal loggings following rocketing international demand. CITES listed this species in Appendix 3 in 2001 and then followed by government through Ministry Decree No.127/ 2011 on moratorium of ramin exploitation. In 2004, CITES lifted up the status to Appendix 2. These serious measures had successfully resulted in a significant drop in Ramin exploitation. This example proves that policy intervention can be very effective for conserving and protecting selected species.

The draft National REDD+ Strategy correctly anticipates the risk that projects at sub-national levels will choose exotic fast-growing species and monoculture plantations for carbon enhancement and therewith will ignore the ecological functions. In peatlands in Sumatra and Kalimantan, the exotic *Acacia crassicarpa* has been widely planted in timber plantations. It has expanded widely to peatlands areas beyond the concessions where it is disturbing indigenous biodiversity. REDD+ must promote the use of indigenous species for restoration and enrichment planting in peatland projects and strictly forbid the use of exotic or invasive species. Suitable local tree species for peat swamp reforestation include Jelutung rawa (*Dyera polyphylla*), Pulai rawa (*Alstonia pneumatophora*), Belangeran (*Shorea balangeran*), Ramin (*Gonystylus bancanus*), and Rengas manuk (*Gluta walichii*).

Box 6: Jelutung in the picture

Jelutung (*Dyera polyphylla*) is a protected species with promising prospects for peat swamp reforestation within REDD+. The species is well adapted to open conditions and degraded peat and is fast growing with a long life cycle. Besides timber, it produces high quality latex that makes a very good price on the market. In Jambi province, Jelutung has been successfully planted on 2120 ha of degraded peat swamp forest in 1991-2008 by PT. Dyera Hutani Lestari and commercially exploited for latex. Unfortunately, part of the area was severely damaged in 2008 by fires that spread from adjacent degraded peatlands. Planting this protected species may assist in conserving biodiversity when done in polycultures, mixed with other appropriate indigenous species.

The draft National REDD+ Strategy also aims at the preservation of watershed functions, but these functions, and other ecosystem services, are not well elaborated for peatlands. Peatlands play an important role in water regulation (flood control), fresh water provision, and as buffer against salt water intrusion. Presidential decree 32/1990 requires all peatlands deeper than 3 meters ‘that are located upstream’ to be protected for their water storage functions. As tropical peat swamp forests are rainwater fed bogs, they are without exception located ‘upstream’ in comparison to the adjacent lands and rivers. This is often not understood or ignored by authorities as well as certifiers such as SGS.

In addition, the importance of these and similar ecosystems for climate change adaptation deserves more analysis and attention. The lowland peatlands in SE Asia constitute important water buffers against salt water intrusion. As a result of plate tectonics most of the elevation of these lowland areas in relation to the sea level has been decreased. The base of many peat domes therefore also lie under sea level. When these areas are drained, the water buffer capacity is affected (reduced water retention capacity) thus increasing salt water intrusion risks. In addition, as a result of subsidence (both physical compaction and as a result of peat carbon oxidation) the areas will become prone to flooding from the rivers and sea and in the long term will reach a stage in which no further drainage is possible rendering them as wastelands. This process will only be reinforced by sea level rise resulting from climate change.

Peat Swamp Forest is very sensitive from any disturbances that unfortunately would trigger prolonged negative impacts to global climate, environment and people. Degradation and deforestation occurred in this ecosystem will put biodiversity in danger and reduce drastically its capacity in providing environmental services. Field experience has proved that rehabilitating peatlands is very difficult, requiring more time, resources, and is costly. In this regards, prevention measures would be more effective and efficient rather than rehabilitation after degradation. Therefore, REDD+ would be appropriate to be used as best strategy to conserve remaining intact Peat Swamp Forest, safeguard unique biodiversity and sustain environmental services.

We recommend the National REDD+ Strategy

- **to recognize the high biodiversity value of peat swamps as habitat of many endemic and endangered species and as unique ecosystems;**
- **to forbid the use of non-indigenous species for reforestation and enrichment planting in peatlands;**
- **to pay more explicit attention to the role of peatland ecosystem services in hydrology and climate change adaptation.**

7. Policy

In REDD+, emission reductions are expected to be achieved by reducing deforestation and forest degradation. The UNFCCC Decision 16/CMP.1 defines deforestation as “the direct, human-induced conversion of forested land to non-forested land”. Degradation reflects a decrease in carbon stocks leaving a tree cover above the minimum threshold required under the definition of forest. The last definition (degradation) unfortunately sends the strong impression that it only limits to forest and doesn’t put peatlands into account. This has put peatlands in a disadvantage position and sometime overlooked. Although not mentioned specifically, peatland degradation therefore must be stated in the definition of forest degradation.

Indonesian policy development regarding peatlands has long been subordinate to forestry policy as the economic value was considered to be restricted to the aboveground forest biomass. In this perception other values such as fisheries, water retention and supply functions (irrigation and potable water), prevention of saltwater intrusion in coastal areas, and carbon storage were not taken adequately into account. In addition, there has been a prevalent lack of awareness on the severely increased risk of fire in degraded peatland and the economic ramifications of peat fire related smog. This perception has over the last four decades resulted in an increasingly rapid conversion of peat swamp forests in western Indonesia.

The growing attention for carbon emissions and especially the disproportionately high contribution of peatland emissions to Indonesia’s overall carbon footprint has brought about a shift in awareness culminating in the current Moratorium in which further conversion of peatlands has been halted.

The changed perception implies that inconsistencies and conflicting policies that hamper the achievement of Indonesia’s REDD+ targets need to be reviewed and revised. Consideration should be given to revoking or amending the following policy documents:

- The Ministry of Forestry Regulation (Permenhut no. P.3/Menhut-II/2008), which allows utilization of wood from natural forest as raw material for pulp and paper until 2014. This decree accelerates forest conversion and frustrates the potential of the forestry sector to achieve emissions removals. Peat swamp forests have been disproportionately affected as they represented the last remaining extensive areas of natural lowland forests in the vicinity of the mills;

- The Ministry of Forestry Decree SK. 292/Menhut-II/2011, which granted land use change of 1,168,656 hectares from Forest Zone (Kawasan Hutan) into Non Forest Zone (APL/Areal Peruntukan Lain). This decree was signed by the Ministry of Forestry on 31 May 2011, eleven days after the moratorium letter signed by the President (under

- The Integrated Food and Energy Estate (MIFEE) launched by the Ministry of Agriculture (MoA) on August 2010. According to the original plan, this project planned to cover 1.2 million hectares, mostly wetlands and including peatlands. As many as 32 companies have obtained principle licenses and some are currently operating in a range of plantation sectors (palm oil, sugar cane, corn, others).

- Presidential Decree 30/1992 on protection of peatlands deeper than 3 meter(seems to only protect part of the peat domes, in stead of all peatlands).

- Regulation of the Minister of Agriculture /Permentan No 14/2009, which stipulates that if there is a concession in peatlands with an area of more than 30% of its total concession having a peat thickness > 3 meters, then the entire concession should not be opened. This regulation can be abused as concession maybe split into smaller areas where less than 30% of peatland area with 3 m depth can be reduced.

- Government regulations about swamp (PP Rawa), which majority (over 50%) of this swamp is represented by peat swamp, which currently being developed by the Ministry of Public Works. In order to avoid contradictory objectives especially in relation to reduce GHG emission, the development of this regulation should also consider and link with other peatland related policies.

- There are many regulations decrees and guidelines on fire prevention. Tacconi (2003), however, questioned the wisdom of forbidding all forest and land fires (Reg. 4/2001), without distinguishing peat fires or between useful and destructive fires. In many (non-peat) areas of Indonesia fire has been a useful and non-destructive tool for clearing and preparing agricultural land. The exceptional nature and destructive capacity and impacts of peat swamp forest fires, however, would justify special legislation and guidance to strengthen the prevention of fires in these vulnerable areas.

We believe that the key challenges with regard to Indonesian peatland-related policy development and implementation involve:

- **The extension and perpetuation of the Moratorium as part of a long-term Indonesian climate mitigation and REDD+ Strategy**. The current Moratorium only extends for two years and many peatlands that fall under the Moratorium have already been allocated for conversion and plantation development. If these concessions will indeed be developed, Indonesia’s emissions will hugely increase, far beyond the current (erroneous) forward looking baseline.

- **Improvement of the Ecosystem Restoration Concession (ERC) legislation and prioritization and streamlining of the procedures for ERC allocations in peatlands**. This should also include:

- facilitating land swaps (as proposed in the current draft National REDD+ Strategy) of existing plantations and plantation concessions (see the suggested three-pronged approach in chapter 4);

- privatizing management of Hutan Linding and other protected areas in peatlands, e.g. by enabling establishment of ERCs to enhance investment, management and monitoring capacity and enable investment in hydrological restoration, reforestation and fire prevention and control as well as enhanced community involvement in sustainable buffer zone development (outside of park boundaries).

- changing Production Forests concessions (HPHs) on peat into ERCs as soon as the concession period comes to an end and facilitating early voluntary hand-over of HPHs to ECR.

Given the many existing and operational plantations on peat we recommend the adoption of best management guidance for such plantations, with the aim to maximally reduce emissions from over-drainage. Such Best Management Practice guidance for existing plantations on peat is currently being developed by the RSPO (Round Table for Sustainable Palm Oil).

With respect to timber concessions, the draft National REDD+ Strategy restricts itself to ‘reduced impact logging’ (RIL), ‘intensive silviculture’ (SILIN) and certification for timber (acacia) plantation. It, however, does not or insufficiently address water management, although peatland drainage for timber and pulp wood plantations is responsible for a substantial part of the emissions in the forestry sector. In this regard the Moratorium should be equally implemented and extended to Acacia plantations as to oil palm plantations and to any other plantation that requires drainage of the peat soil. Options for revocation should be explored for concessions that have inappropriately been granted or obtained, especially where concessions and plantations are clearly allocated in areas that are in contradiction to existing legislation.

Presidential decree 32/1990 regarding peat deeper than 3 meter should be reviewed in order to recognise the long-term hydrological impact of drainage of shallow peat areas on the adjacent deep (> 3meter) peat and to recognise the importance of the water retention and carbon storage values of all peatlands, including shallow peats.

In addition, insufficient implementation of existing policies and law enforcement has also enabled widespread illegal logging to occur in peat swamp forests, which invariably is accompanied by the establishment of transport channels that have a similar peatland drainage effect as other channels. Policy alone is not enough. The degradation of Indonesia’s peatlands calls for urgent and consistent action.

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