Ramsar Advisory Mission N° 85

Berbak National Park Ramsar Site N° 554

(with references to Sembilang National Park Ramsar Site N° 1945)

Peat fire prevention through green land development and conservation, peatland rewetting and public awareness

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Glossary

Indonesian acronyms and names are listed in **bold**:

BGPP	Berbak Green Prosperity Partnership
BRG	**Badan Restorasi Gambut:** peatland restoration agency
CCBA	Climate, Community and Biodiversity Alliance
ERC	Ecosystem Restoration Concession
HLG	**Hutan Lindung Gambut:** peatland protection forest
HPH	license for selective logging in an official forestry concession
HPT	**Hutan Produksi Terbatas:** limited production forest
HTI	licence for industrial timber plantation
IPPU	Industrial Processes and Product Use
IUP RAP/PAN	**Izin Usaha Pemanfaatan Penyerapan dan/atau Penyimpanan Karbon:** business utilization license for the sequestration and storage of carbon
LLA	Landscape Lifescape Assessment
MOEF	Ministry of Enviroment and Forestry
MPA	**Masyarakat Peduli Api:** copmmunity fire awareness group
NGO	Non-Governmental Organization
NP	National Park
PPI	**Pengendalian Perubaan Iklim:** climate change mitigation
PP71	Government Regulation for Protection and Management of Peatlands, issued in 2014
RAM	Ramsar Advisory Mission
RKT	**Rencana Kerja Tahunan:** annual work plan
RKU	**Rencana Kerja Usaha:** 10 year business work plan
RTRW	local spatial area planning
Tahura	**Taman Hutan Raya:** great forest reserve

Executive Summary

1. In March 2017, a Ramsar Advisory Mission (RAM) was carried out to Berbak National Park (NP) in Sumatra, Indonesia, an area listed as a Wetland of International Importance under the Convention on Wetlands (Ramsar Site N° 554). The RAM analyzed the local situation and developed advice for appropriate peatland management in the area, and in Indonesia in general, to prevent peat fires and to conserve peat swamp forests.

2. The RAM involved a brief visit to the area west of Berbak NP, meetings at Suak Kandis village and in Jambi, and a workshop in Jakarta. The Mission team was able to meet with key people responsible for the management of the area and local experts and to collect a wide range of information, including from many hitherto unpublished sources and remote sensing results. This helped to assess the situation and threats to Berbak NP, particularly the aspect of recurrent fires. The Berbak NP management office was recently merged with the adjacent Sembilang NP (Ramsar Site N° 1945), and administratively is now called the Berbak Sembilang National Park. This report includes also information on the Sembilang area, being exposed to similar challenges as Berbak NP. Both parks share corridor areas and some deep-peat water catchment areas.

3. The report provides a succinct review of knowledge about the Indonesian dome-shaped lowland peatland landscapes and how they function as eco-hydrological systems. High biodiversity value peat swamp forests exist as a result of a precarious balance of precipitation and the capacity of the ecosystem to retain water. Lowland peatlands generally lie above mean sea and river levels and are therefore dependent on rainwater for their hydrological balance. Once the water is gone, accumulated peat starts decomposing (through biological oxidation processes) and can become so dry during drought periods that it becomes extremely prone to fire.

4. Indonesian peat swamps have been subject to major development schemes since the 1980s, many of which failed. This left extensive peatlands barren and drained. Other peat swamp areas were targeted by large scale industry, mainly oil palm and pulp-for-paper companies, on formerly wet areas that had not been subject to traditional land uses (providing therefore less potential for land-use conflicts with local communities). The access to such hitherto secluded areas provided by large-scale development schemes and oil palm and pulp-for-paper concessions drew in many spontaneous settlers that ventured into unoccupied forest areas, cleared them with fires and converted former swamps to agricultural land. Such small scale developments impact on many peat domes in Sumatra and Kalimantan.

5. A major, but as yet insufficiently recognized, threat is linked to soil subsidence caused by the loss of peat as a result of peat swamp drainage that creates soil desiccation, peat oxidation and fires. Draining soils down to levels at the base of their peat layer will perpetuate the continued loss of peat and bring the land surface down to levels at which gravity-based drainage will no longer be possible. Peat swamp drainage in coastal plains, or further upstream along rivers, creates more frequent and longer flood periods. Floods that will not allow agricultural or forestry uses any longer. These drained, and subsequently flooded areas, are likely to become abandoned again. And during dry periods, they are easily exposed to fires.

6. Current large-scale land-uses on peat need drainage to enable the production of agricultural and forestry products, such as palm oil and pulp wood for paper. These practices create fire prone conditions. Combined with widespread spontaneous developments by local settlers, this exacerbates the threat of fires. Repeatedly, millions of hectares of such desiccated and converted peatlands in Indonesia were impacted by fires, particularly in years with an “El Niño” meteorological phenomenon that creates very dry conditions in Indonesia. Peat fires burn largely underground and produce more smoke than forest fires. This resulted in smog events blanketing South-East Asia, impacting on the economy, public health and quality of life in all affected regions.

7. Officially about half of all Indonesian peatlands are protected. The Ministerial Decree SK.130/MENLHK/SETJEN/PKL.0/2/2017 about the Establishing of a National Peatland Ecosystem Function Map, mentions that 12.398.482 ha of peatlands are protected, and 12.269.321 ha are used. However, many and extensive areas of the protected peatlands have been subject to illegal logging and fires. In 2015, only 6% of the peat swamp forests in Sumatra were still in a pristine stage, and in Kalimantan 7.4%. Most protected areas, including most National Parks, have been subject to significant impacts from illegal activities and encroachments. Berbak NP is no exception. In 2015, Berbak NP was surrounded by a ring of fire eating away at its high biodiversity area.

8. Berbak NP and the adjacent Sembilang NP were recently merged, resulting in an overall reduction of their management capacity and budget. Both Parks belong to the top category of high biodiversity areas, with a full range of remaining lowland wetland habitats and many rare, endangered and endemic fish, mammals, birds and plants. Sembilang NP includes the largest mangrove forest of South-East Asia (besides Papua) with a tremendous economic importance as fish breeding and nursery area. The Parks are facing challenges of illegal logging activities that cause a high fire risk in drained areas. Illegal logging channels ease human access to drained areas with increasing encroachments from adjacent land-uses, threatening to cut the wild areas of the National Parks into separate fragments with negative consequences for rare species and ecosystem resilience. Major quantities of carbon are stored in the peat swamp soils. When drained, peat oxidizes (mainly due to biological decomposition) and adds greenhouse gas emissions (CO_2) to the atmosphere. Drained peatlands are prone to fire and smog events, adding substantially more greenhouse gas emissions. In addition, drainage of lowland peatland creates soil subsidence that may result in a reversal of water flow, depriving coastal mangroves from sufficient freshwater inflow from the hinterland. This would cause the destruction of the entire ecosystem.

9. Following the huge extent and impact of peat fires during the dry year 2015 (with an El Niño Southern Oscillation), a Presidential Decree was issued in January 2016, and the Indonesian government is undertaking serious action to address the peatland fire issues, including the development of a range of new policy measures and regulations to halt any new canal development in peatlands. A national Peatland Restoration Agency was established with the aim to restore over two million hectares of peatlands. The Ministry of Environment and Forestry has developed new regulations to strengthen the management of peatland areas under different land uses. But the capacities for law enforcement and the implementation of restoration activities remain still limited. Concerted collaboration of all stakeholders from government, industry and local communities is needed.

10. Fire prevention and control capacities in the village areas and their surrounding agricultural and forestry plantations are still minimal. The procedures for the coordination of fire-fighting are still cumbersome and too time consuming to allow for necessary rapid responses. The upgrading of the fire prevention and fire control capacity in the villages surrounding Berbak and Sembilang NPs is therefore a high priority. The capacities of the relevant government agencies to coordinate and implement fire risk monitoring, fire control activities and emergency actions need to be strengthened. This will require a review of current procedures, increase in budgets and investment in capacity building and training, to enable rapid and adequate responses of any starting peat fire.

11. Even so, extinguishing peat fires will be difficult. Prevention is therefore the better option. This will necessitate a major shift in the management of the surrounding land of the National Parks, major investments in the restoration of the hydrology and vegetation cover of drained and degraded peatlands, and a significant strengthening of the management capacities of the National Parks.

12. The RAM provides suggestions for alternative sustainable wet peatland uses (paludiculture) in the surroundings of the NPs to protect the protected areas core zones, to provide economic development prospects for local people and to provide additional income potential for and from the carbon sector. Examples include plantations of Sago for starch production, Jelutung for rubber

production, Illipe Nut (Tengkawang) for vegetable oil production, Rattan for furniture and Kayu Puti (*Melaleuca*) for production of pole wood as well as oil for massage and medicinal use. Over 500 indigenous peat swamp plant and tree species have been identified and about 80 were shortlisted for paludiculture developments. Development of some paludiculture crops is constrained by regulations that require separate permits for harvesting, processing and marketing of NTFPs, and also impose heavy taxes on certain products. While these regulations were intended to regulate harvesting of NTFPs from natural forests, they may now impede the development of paludiculture.

13. The alternative – paludiculture - crops are also vulnerable to prolonged flooding and require a naturally fluctuating dynamic hydrology with high water evels in the rainy season and somewhat lower water levels in the dry season. If drainage of peat soils is allowed to continue for too long and the resulting subsidence has consequently brought the soil surface down to the drainage base, even paludiculture may not be possible anymore. It is therefore necessary to start planning for a responsible phasing-out of drainage-dependent crops and to introduce alternative crops before soil subsidence has progressed too much.

14. To continue current business as usual is likely to create increasingly frequent and prolonged floods of the lowland areas that will leave no further options for alternative land-uses. Time to accomplish the necessary paradigm shift in peatland use is limited. Being one of the global biodiversity hotspots, and a major emitter of greenhouse gases from degraded peatlands, Indonesia needs to be supported by the international community as part of the sustainable development Agenda 2030.

Recommendations

General recommendations regarding peatland management

Recommendation 1 – recognize the impacts of peatland deforestation and drainage:

Policy and land use planning at all levels need to recognize and take into account the impacts of peatland deforestation and drainage which lead to:

a. peat soil oxidation (resulting in high CO_2 emissions);
b. high methane (CH_4) and nitrous oxide (N_xO) emissions;
c. high risk of fires as a result of soil desiccation (during frequently occurring dry years, linked to the El Niño meteorological phenomenon, and the improbability that such fire risks can be contained if peatland landscapes remain managed under drained conditions);
d. soil subsidence (as a consequence of carbon emissions and loss) lowering the soil surface to levels at which drainage will be increasingly difficult (and will lead to more frequent and prolonged flooding);
e. potential water flow reversal in coastal peat landscapes (including reduced freshwater inflow in rivers and mangrove areas, and intrusion of salt water inland);
f. large scale flooding and loss of productive areas on drained peatlands (in areas with the base of the peat layer lying around or below mean sea or river level); and
g. existential threats to these areas and the people and biodiversity that depend on them.

Recommendation 2 – accept the need for international support:

Given the extent of the above-listed impacts on all major peatland areas of Indonesia, a large-scale international support facility should be established under the Green Climate Fund to upscale the capacity for fire prevention and control through large-scale peatland restoration measures. Indonesia included in its Nationally Determined Contributions (to implement the Paris Climate Accord) an emission reduction target of 29% by 2030, and of 41% including external assistance.

Recommendation 3 – understand the need to restore peatlands through full rewetting:

The only way to effectively restore peatlands is through full rewetting and revegetation of peatland witn a permanent vegetation cover. In that order: revegetation should always happen after rewetting. For effective mitigation of issues related to peatland degradation, the hydrology needs to be restored to (near-)natural conditions (including the natural dynamics of water levels between wet and dry seasons). Hydrological restoration requires full blockage of drainage canals. Water management elevating water levels only to between 80cm and 40cm below soil surface still perpetuates peat oxidation and related issues. The drainage depth of maximum 40cm below the soil surface, stipulated in the recent peatland legislation (PP71), constitutes a target for improved water management under drained land-use practices. However, this does not provide a full hydrological restoration, because a drainage of 40 cm perpetuates peat carbon oxidation and peat subsidence – albeit at a slower rate than under deeper drainage. Many crop species that require drainage of at least 40cm (e.g. *Liberica* coffee, *Aloe vera*, pineapple, betel nut (*pinang)*, dragon fruit (*buah naga*) are being promoted by governmental agencies and NGOs as suitable for 'rewetted' peatlands. However, while such crops on 'rewetted' peatlands may temporarily contribute to improved livelihoods, they will result in the same social, economic and environmental impacts in the longer term as those occurring in areas with deeper drainage.

Recommendation 4 – accept that restored peatlands can be used economically:

Peatland restoration does not have to exclude large-scale and smallholder economic use of restored areas. To the contrary, sustainable commercial utilisation of restored areas can provide necessary economic incentives for maintaining sustainable management capacities and a semi-permanent vegetation cover. Existing concessions in peatlands should revisit their Management Plan, reviewing the needs for rewetting of drained peat and possible use of species that can be economically productive on rewetted peat. Such land-use can be combined with protection and restoration of

remaining peatswamp forest within the concession area and its surroundings as a contribution to successful landscape-wide restoration.

Recommendation 5 – prevent further irreversible losses of the production potential of peatlands:

Safeguarding drained peatlands against irreversible loss of their production potential needs to occur within a limited period of time. Depending on the elevation of the peat soil base and surface, the depth of the drainage, and the local climate and soil characteristics, safeguarding measures need to be taken in many areas not later than after one or two decades of drainage cultivation (and in most areas after less than 50 years). Land managers need to assess drained peatlands as a basis for the development of time-bound plans for their restoration and conversion to sustainable land uses. This includes a strict enforcement of the existing Moratorium on new drainage licences for peatlands and natural forests. Where the Moratorium appears to have been ignored in the process of licensing, particularly where new licenses have been issued for peatland, such licenses should be revoked.

Recommendation 6 – conserve remaining peat swamp forests:

Appropriate protection status should be granted to all remaining peatland and peat swamp forests (as required by the Presidential Decree on Forest and Peat Moratorium, and P14_KLHK_TATA CARA INVENTARISASI DAN PENETAPAN FUNGSI for concession areas). In view of the potential occurrence of point endemics (e.g. fish, dragonflies) and other rare or threatened species, the need for higher levels of conservation status should be assessed for any sizeable remaining peat swamp area, as well as the importance of such areas as genetic reservoirs and because of their ecosystem services.

Recommendation 7 – maintain the hydrological connectivity of peat domes:

Current legislation provides recognition of the hydrological connectivity of peatlands (i.e. each peat dome forms a separate hydrological unit, where partial drainage or rewetting will impact all other parts, and where impact zones may stretch over several kilometres). This needs to be enforced through consequent landscape-based management planning, multi-stakeholder coordi-nation and implementation in peatland dominated landscapes.

Recommendation 8 – reduce off-site impacts from plantations on drained peatlands:

Plantations on drained peatlands have off-site drainage impacts on adjacent peatland areas, particularly if these are still forested. To reduce off-site impacts from drained plantations, it is recommended to adopt a Green Belt approach by blocking perimeter drains (i.e. without spill ways) to minimise off-site drainage and to reduce fire risks in adjacent areas. This also reduces the fire risk of desiccated areas inside and around the plantation. Newly created rewetted zones inside the plantation perimeter can be used for testing and creating of appropriate paludiculture crops.

Recommendation 9 – develop a policy for sustainable peatland use without further deforestation:

Deforestation, peatland drainage and fires contribute disproportionally much to Indonesia's carbon footprint. Trying to lower these impacts, an Indonesian low carbon economy should primarily focus on sustainable forms of peatland use and land development without further deforestation. This can be achieved by development and implementation of positive incentive mechanisms for sustainable use of peatlands and disencitives for unsustainable practices.

Recommendation 10 – raise awareness and management capacities:

Develop and implement awareness raising and capacity development programmes on peatland issues and solutions, targeted to civil servants of relevant ministries and departments, at national, provincial and district levels.

Recommendations concerning Berbak-Sembilang National Park

Recommendation 11 – provide Berbak and Sembilang National Park with priority support:

Recognise the disproportionately large value of the Berbak and Sembilang National Park areas, as well as other remaining natural peat swamp forests and protected areas in Indonesia for climate change mitigation, biodiversity conservation and water regulation, by granting these areas (as part of the Peatland Restoration Agency/BRG's plan) highest priority for restoration measures in order to prevent further peat and forest fires.

Recommendation 12 – restore the buffer zones through rewetting and revegetating:

Address the fire risks created by unsustainable (drainage-based) land-uses in the surroundings of these two Ramsar Sites. Further spreading of fires threatens to reduce these areas of international importance to ashes. To prevent this, all drainage canals inside the NPs and their buffer zones need to be blocked. Then, the vegetation of burnt areas needs to be restored with the plantation of indigenous trees. In the NP buffer zones, planting of economically interesting indigenous species under a paludiculture programme, can provide incentives and increase local support for reforestation efforts. This will need cooperation and coordination with local stakeholders.

Recommendation 13 – provide the NP management with the necessary means:

Ensure that the Berbak-Sembilang NP management is provided with the authority, mandate, capacity and budget to enforce the law, to prevent and extinguish fires and to address the threats inside the NP boundaries, including:

a. allowing and enabling park rangers to immediately stop any ongoing illegal activities, including but not limited to illegal logging, encroachment, poaching and trespassing;
b. allowing and enabling park rangers to block or close any artificial drainage infrastructure, including illegal logging canals;
c. allowing and enabling the NP authorities to give notice to owners of illegal agricultural areas and infrastructure (encroachments);
d. enabling frequent monitoring of all key access points to the NPs, and taking appropriate measures to reduce and prohibit such access.

It is recommended to compensate the recent budget cuts of the NPs, to develop management and restoration plans for the NP, with an appropriate level of staffing, facilities and recurrent budgets to address the issues described in this report. The international community is encouraged to help Indonesia with this, through the provision of technical assistance and co-financing.

Recommendation 14 – develop a trans-sectoral management approach and committee:

Develop a roadmap for restoring and safeguarding the Berbak-Sembilang NP, involving all major stakeholder groups including the NP authorities, Bupati, Governor, local villages, local industry and plantation owners and managers, NGO's as well as international stakeholders (conservation and climate community, donors). The roadmap should be reflected in any related legal document or planning revision, e.g. Spatial Plan (RTRW), RKU/RKT (Long term and annual work plans), issuance of new licenses and revision of existing licenses.

Recommendation 15 – include remaining peat swamp forest as compensation areas in the NP:

No further accommodating of illegal encroachments, particularly within protected area boundaries, should be accepted. Adjusting NP boundaries to illegal encroachments on the ground cannot be a sustainable policy. To compensate for reductions of the NP area in the past, as a result of the legalisation of illegal encroachments, the inclusion into the NP of remaining natural peat swamp forest in the vicinity should become a high priority. A key area for inclusion is the forest concession licence HPH (59,000ha) and the Hutan Lindung (21,000ha) southwest of Berbak NP and the plantations west of Sembilang NP, which form part of an important ecological corridor between both parks and contain a key part of the water catchment of both areas, including much of the source of the Air Hitam Laut river and the freshwater supply to the Sembilang mangrove ecosystem.

Recommendation 16 – use economic incentives for carbon sequestration and storage:

Recognise the important contribution that the emerging (voluntary) carbon sector can play by mobilising private sector capacity for peatland restoration and conservation. Facilitate investment in Ecosystem Restoration Concession development by reducing tariffs, shortened bureaucracy during application procedures, clarifying taxation issues, provision of incentive mechanisms and ensuring benefit sharing with local communities. Enabling direct foreign investment on basis of appropriate plans with stringent safeguards and involvement or support mechanisms for local communities and biodiversity conservation. Provide the necessary sub-regulations for businesses operating under the Indonesian carbon sequestering and storage licence (IUP RAP/PAN), in order to stimulate private sector involvement in restoration efforts in conservation/protection areas. Require international Verified Carbon Standard (VCS) and Climate, Community and Biodiversity Alliance (CCBA) certification for such businesses.

Recommendation 17 – provide the NP with the necessary authority and means for fire fighting:

Restore and enhance the mandate of the NP authority (review PP07/2016) and its emergency response budget to enable rapid responses to emerging fires in the NP areas and the vicinity of the NPs, including but not limited to the recognised buffer zones (e.g. Tahura/grand forest parks). Emphasis should be provided to preventive measures as peat fires are notoriously difficult to extinguish. Key preventive measures include the rewetting of drained areas, including blocking of illegal logging canals in the NPs as well as in their buffer zones, and the revegetation of such areas, either with peat swamp forests or the establishment of commercial buffer zones (e.g. paludi-culture plantations) between NPs and community land, which can provide a disincentive to create fires in the boundary areas of the NPs. Such restoration and buffer zone development should be given highest priority, and the NP Authority should be enabled to implement (inside the NP) and encourage (outside of the NP boundaries) these. Current regulations with regard to NP manage-ment, however, may impede the implementation of no-regret measures such as closing of illegal or old logging canals that keep draining these areas. Many of the older but still active regulations have not been designed in relation to the special management requirements of peatland areas. Such regulations should therefore be reviewed and revised to allow NP management authorities to directly engage in restoration and fire prevention measures of peat swamp areas.

Recommendation 18 – develop concerted action to fight and stop illegal logging in key areas:

Implement concerted action by NP authorities with local and – if necessary – national police to stop illegal logging activities and apprehend the people involved, especially those providing financial backing. A short-term and a longer-term plan should be developed and implemented by the NP and other law enforcement authorities to secure all access points to the NPs and their forested buffer zones, to constrain or stop the possibilities for transport of illegally obtained logs and timber. Illegal saw mills should be immediately closed and illegally used equipment confis-cated. Current claims that illegal activities (logging, planting without license) are being carried out in the two logging concessions (HPH) southwest of Berbak NP should be independently investi-gated and licenses should be revokedif proven to be true. These two areas should in any case be considered for the establishment of an ecosystem restoration concession.

Recommendation 19 – support and provide follow-up to innovative partnership programmes:

The Berbak Green Prosperity Partnership (BGPP, Kehijau Berbak) programme should be provided with the necessary co-funding and continued support beyond the project's current mandate running until March 2018. The achievement of its aims and rewetting and revegetation objectives is crucial to protect the Grand Forest Park (Tahura Orang Kayo Hitam) and the adjacent Berbak NP from future fires.

Recommendation 20 – establish sustainable development plans for villages on peatlands:

Extended Strategic Environmental Assessments and Cost-Benefit Analysis should be undertaken for villages located on deep peat in the in the buffer zone of the two NPs, to assess their long-term

viability. For villages that appear unviable under any reasonable (and legal) development scenario, land-swap options for to enable moving to other, more suitable areas should be identified and discussed with the inhabitants. Potential candidate villages are Tanah Pilih in the Terusan Dalam area and Petaling Jaya/Gambut Jaya/Sungai Gelam. Removal of Tanah Pilih may be the only viable option to prevent the fragmentation of the Sembilang NP and its important ecological corridor to Berbak NP, as the village appears to have a disproportionately large negative impact on the park, as is clear from the remote sensing pictures used by the RAM team that show an enormous fire scar that crossed almost the entire northern part of the NP from east to west.

Recommendation 21 – increase cooperation with large plantation companies:

The efforts by the one of the large pulp for paper companies in Indonesia to retire its pulp plantations from areas with high hydrological sensitivities, fire risks and risk of water flow reversal (including the plantation on the western boundary of Sembilang NP) are much welcomed, and the long-term involvement of the company in the management and restoration of such areas is to be endorsed. While the companies are held to the existing government legislation PP 71/2014 (requiring dariange levels to maintained at a maximum of -40 cm) juncto PP 57/2016 and LHK Ministerial Regulation number 14-17 / 2017, in these buffer zone areas to the NPs full rewetting (i.e. stopping all artificial drainage) is needed to optimally protect the NPs from drainage impacts. The active participation of large companies in peatland restoration and piloting of economic and ecologically sustainable solutions is much needed. Large companies have much experience in managing large landscapes and a well-developed capacity to mobilise necessary financial and human resources. In a similar vein, cooperation with large companies is needed to extinguish fires, making good use of their available material resources and human capacities.

Recommendation 22 – use rewetted areas as a buffer to limit uncontrolled developments:

Recognise the buffer zone function of rewetted peatland areas inadjacent retired plantations, the large HPH forest concession and other large scale landscape elements south-west of Berbak NP and west of Sembilang NP, as barriers between the Berbak and Sembilang National Parks on one side, and the rampant uncontrolled smallholder developments on the other side, e.g. in the Merang-Kepahiyang area and other economic transition areas in the vicinity of the NPs. Current limited rewetting should progress to full rewetting to enable a long term sustainable buffer function.

Recommendation 23 – provide adequate equipment and training to community fire groups:

Communities surrounding the park are at the forefront of fire fighting and preventive actions. They are the ones who could react the fastest if any fire or hazard occurs in the field. Therefore, all villages in and around Berbak and Sembilang NPs need to be supported in establishing, equipping, and training community fire awareness groups (*Masyarakat Peduli Api,* MPA). Local communities can and need to play a key role in fire prevention and control, and much effort will have to go into building their capacity and commitment, and the establishment of facilities such as watch towers. It will be useful to draw lessons from other community-based fire control programmes in Indonesia, such as the Fire-Free Villlage Programme run by a pulp-for-paper company in Riau[5], and the community-based approach implemented by an ERC holder in Katingan, Central Kalimantan.

Recommendation 24 – use remote sensing technology to monitor fires:

With current remote sensing capacity, especially radar-based imageries, it is easy and cheap to detect when and where fires have started. Time series of radar imageries (with satellites flying over every few days) can be used to accurately detect fire scars and enable identification of the single agricultural land plots or plantation areas (and their owners) where larger fires were started. Such imageries can strengthen the evidence base in court cases and enable the government to hold the land-owners of these areas fully accountable under Indonesian law.

[5] Note: At the request of the Ministry of Environment and Forestry (MOEF), no company names are mentioned in this report, neither regarding unsustainable practices, nor positive actions. The companies are, however, known to the MOEF.

Recommendation 25 – study the risk of water flow reversal in the Air Hitam Laur basin:

In follow-up to earlier studies by Wösten et al. (2006), a more detailed hydrological study should be undertaken to assess the risk of water flow reversal in the Air Hitam Laut river catchment and the peat swamps along the western boundary of the Sembilang NP, in relation to the land subsidence caused by peatland drainage for plantations and agriculture. Water flow reversal could have severe consequences for the viability of the Sembilang NP including its entire High Conservation Value mangrove zone, i.e. the largest mangrove area in South-East Asia.

Recommendation 26 – support the development of the national peatland restoration policy:

The regulatory and practical efforts of MOEF and the Peatland Restoration Agency (BRG) to improve the management and to restore large areas of degraded peatlands are very positive and ambitious steps in the combat against forest and peatland fires and the recurrent devastating haze events. Related policies, legislation, plans and coordination need further review to become more efficient. The investment and recent steps by the key agencies deserve full support from the local, national and international community. Tropical peatland restoration is an new endeavour that requires trials, pilot projects, evaluation and exchange of know-how and lessons learned, to enable gradual improvement of concepts and approaches. This is a long term process that requires long term investment and commitment from all stakeholders.

Recommendation 27 – prepare a strategic land-use map for the surroundings of the NPs:

For the Berbak and Sembilang NPs and their surrounding areas, a proper science-based base map should be developed and adopted for detailed planning. This will also enable the identification of conflict areas, illegal settlements, and threats - particularly to remaining peat swamp forests and degraded peatlands. In view of the overriding priority to prevent and stop further fires, all decision making should be focused on reducing fire risks, reducing drainage, stopping deforestation, blocking drainage canals and introducing commercially interesting alternative land uses utilizing indigenous valuable peat swamp forest species. However, the production of such a map should not delay the implementation of other conservation and restoration efforts in the area.

Recommendation 28 – develop landscape-based sustainable perspectives for the area:

Development is a prerequisite for successful peatland restoration and conservation. Protected peat swamp forests have to be considered within the broader landscape, including physical, ecological and social elements. Development approaches should adopt a fully integrated landscape-based approach, be inclusive, and take account of sustainable development needs and potentials within the villages, in the mineral soil areas, along the rivers and roads and in the peatlands. This should also include development options that are not peatland-based or dependent, such as e.g. the production of edible swiftlet nests, poultry, fisheries, beekeeping, aquaculture, household industries, etc. On peat, all efforts need to focus on piloting and upscaling crops that require no artificial drainage (paludiculture), and include options for development and enhancement of (formerly often peat swamp forest-based) non-timber forest products, such as rattan, Jelutung, Tengkawang, etc. These products will require market research and development. And their production may be combined with carbon market-oriented initiatives.

Recommendation 29 – create incentive financial mechanism for smallholders and communities:

Consideration should be given to the establishment of various incentive mechanisms and access to finance, such as micro-credit facilities, to enable and encourage the participation and empowerment of local communities as key stakeholders in the effort of peatland restoration and fire prevention.

Recommendation 30 – develop appropriate health facilities to cope with future smog events:

While all efforts need to be made to prevent the recurrence of major haze events, there is a need to be vigilant and establish appropriate health facilities for the people that are most vulnerable to smog events, e.g. children and elderly, people with asthma or other respiratory illnesses, etc. These measures need to be taken well in advance of smog events, before logistics become difficult and impeded by smog.

Recommendation 31 - provide conditional land tenures to communities adjacent to the park:

The areas west of Berbak and Sembilang NPs have experienced rapid illegal encroachment by uncontrolled settlers, often involving illegal logging and the use of fire to clear land for agriculture. The current government policy to accelerate the issuance of community forest licenses is commendable, but should be conditional to the protection of remaining forest areas and use of sustainable land-use practices. In peatland areas, the requirement should include rewetting and paludiculture of permanent tree crops. Well-managed and monitored community forest areas could develop into useful buffer zones for the Berbak and Sembilang NPs. Without proper conditions, monitoring and support, community forest areas can become a threat, as evidenced in the Tahura area west of Berbak.

Recommendation 32 – develop long term international collaboration and funding:

We welcome the recent call for experts by UNDP for the development of a Green Climate Fund proposal (http://procurement-notices.undp.org/view_notice.cfm?notice_id=37553) for the Musi Banyuasin District, incorporating the Berbak and Sembilang NP. With this call, UNDP aims to assist the goal of restoring 2.4 million ha of degraded peatlands through Green Climate Fund projects that support the district government to establish a Sovereign Wealth Fund and to develop a theory of change for peatland restoration. This seems a useful tool to address the issues identified by the Ramsar Advisory Mission.

Introduction and Context

Aim of Ramsar Advisory Missions

1. Ramsar Advisory Missions (RAMs) are a means by which the Convention on Wetlands (Ramsar Convention) provides technical assistance to Contracting Parties in the management and conservation of listed Wetlands of International Importance (Ramsar Sites) whose ecological character has changed, is changing or is likely to change as a result of technological developments, pollution or other human interference (according to Article 3.2 of the Convention).

2. The 3rd meeting of the Conference of the Parties (COP3) in 1987 adopted Recommendation 3.9 urging Parties to take swift and effective action to prevent any further degradation of Ramsar Sites and to restore, as far as possible, the value of damaged sites. To give effect to this Recommendation, the Standing Committee of the Convention subsequently established the "Ramsar Monitoring Procedure" which received special initial funding for its operation, and after its first operative years many expressions of support.

3. As a consequence, COP4 endorsed in 1990, through Recommendation 4.7, the measures taken and instructed the Ramsar Convention Secretariat to continue to operate the Monitoring Procedure when it receives information on adverse, or likely adverse changes in ecological character at Ramsar Sites. A text for the operation of the Procedure (Annex 1 of Rec. 4.7) was adopted and it was determined that Monitoring Procedure reports shall be public documents once the Contracting Party concerned had an opportunity to study the reports and comment on them.

4. The name of the Monitoring Procedure was later modified to become the "Management Guidance Procedure" and again in 1999, in order to make the purpose of this tool more immediately obvious, the term "Ramsar Advisory Mission" was adopted by COP7 through Resolution VII.12 (paragraph 39).

5. The benefit of a Ramsar Advisory Mission is often in providing an additional (international) source of assurance for a national decision-making process, through auditing and peer-review. It is an opportunity for the relevant authorities to test and demonstrate the quality (thoroughness, precaution, transparency, consistency etc.) of the decision-making processes involved, in the context of Ramsar requirements. This means that it is not necessarily expected to generate ideas or insights that have not already been thought of; but it will cast them in a new light, bring independent scrutiny, and distil those issues that have particular relevance to the requirements and the adopted guidance of the Convention.

6. The process overall assists implementation, reinforces standards and credibility and raises awareness. And the availability of the RAM tool is often seen as one of the benefits of being a Ramsar Party. Where relevant, the Convention's Scientific and Technical Review Panel (STRP) is available as a network of expertise that can offer lesson-learning benefits for the Convention as a whole.

Indonesian Government plan to prevent and fight peat fires

7. During the period September-October 2015, Indonesia suffered a major El Niño-linked dry spell which contributed to the spreading of major fires, particularly in the lowland areas. Extensive fires occurred in the lowland peatlands in Sumatra and Kalimantan, affecting a total area of over 0.8 million ha (Huijnen et al. 2016), as part of over several million ha of forest fires. Emissions from these fires exceeded the fossil fuel CO_2 release rate of the European Union (8.9 Tg CO_2 per day; Huijnen et al. 2016). It should be noted that although peat fires cause large temporary peaks in carbon flux to the atmosphere, year-round emissions from peat mineralization are of a similar magnitude (Page and Hooijer 2016). The peat fires are the main contributor to the major smog events that have

regularly blanketed South-East Asia. The smog in 2015 lasted for many months, and resulted in pollution levels that had not been seen before. Fires and smog resulted in significant negative impacts on the economy, affecting key sectors such as agriculture, forestry, transport and tourism as well as having serious impacts on public health. Fires occurred also in some of Indonesia's Ramsar Sites, including the Berbak and Sembilang National Parks, and thus formed a serious threat to local people and globally important biodiversity. The economic damage caused by the fires and smog was estimated by the World Bank at over 16 billion USD for Indonesia alone. This triggered the Indonesian Government to take a number of steps to combat peatland fires and to prevent future fires. In November 2015, an international roundtable was organised by the Ministry of Environment and Forestry to try to develop mechanisms to prevent the reoccurrence of fires. In January 2016, the central Government met with other stakeholders, including the Ministries of Agriculture, Public Works and Home Affairs, to discuss ways of preventing fires.

8. A Presidential Decree (N° 1/2016) on the establishment of a national Peatland Restoration Agency (*Badan Restorasi Gambut*, BRG) was issued on 6 January 2016. This new agency aims to coordinate and facilitate the restoration of over 2.0 Mha of degraded peatland in a period of 5 years (2016-2020), focusing on the provinces of Riau, Jambi, South Sumatra, West Kalimantan, Central Kalimantan, South Kalimantan and Papua. These steps taken by the central government are encouraging. It is now important to distil the lessons to be learnt from the activities triggered and their results. Cooperation between all stakeholder groups is crucial. Local governments, private sector and communities need to be fully involved in the process to prevent future peat fires.

Objectives of the Ramsar Advisory Mission to Berbak-Sembilang National Park

9. In March 2016, the Ministry of Environment and Forestry (MOEF), i.e. the national Administrative Authority responsible for Ramsar implementation, sent an invitation to the Ramsar Secretariat to carry out a Ramsar Advisory Mission to Berbak NP, in particular to develop advice to local governments and communities regarding the role of appropriate peatland management in the prevention of fires and on the importance of peat swamp forest conservation. The Mission was to address the need to enhance the understanding of relevant governmental decrees and the local responsibility to implement them, the need for raising awareness and to involve local communities, practical concerns of the enforcement of existing rules, including the existing moratorium on new development licenses for peatlands, and the need to improve the understanding of ecological and economic benefits provided by intact peatlands to the local communities and the society overall, as well as the need to provide protection to lands outside of the jurisdiction of the central government.

10. The Ramsar Secretariat was able to secure expert support from its International Organisation Partner (IOP) Wetlands International and from the Berbak Green Prosperity Partnership (*Kehijau Berbak*), funded by the Millennium Challenge Account Indonesia and implemented by a con-sortium led by Euroconsult Mott MacDonald, while the MOEF, together with the local Berbak-Sembilang National Park authorities, organised the programme and logistics of the on-site visit and the subsequent workshop in Jakarta.

Acknowledgements

The Mission team is indebted to Mr Antung Deddy Radiansyah, the Ramsar Convention National Focal Point for Indonesia and Director of the General Directorate for Essential Ecosystems (*Direktorat Bina Pengelolaan Ekosistem Esensial*) in the Ministry of the Environment and Forestry, and Ms Cherryta Yunia from the same Directorate, for all her help and leadership in organising the Ramsar Advisory Mission, arranging the official requests and facilitating all meetings and travels.

The team is grateful for all the help and support provided by the Berbak-Sembilang National Park Office and to those who participated in the local stakeholders' meeting at the resort office in the village Suaka Kandis on 15 March 2017. Ir. Pratono Puroso, the head of the Berbak-Sembilang NP, helped the team greatly with his presentation. And Ms Novirin Razanah Jati, of the General Directorate for Essential Ecosystems, took minutes of the meetings that were held in Jambi and Jakarta.

Previsional programme and itinerary of the Mission

Date	Time	Activity
Day-1	**Field Visit to Jambi**	
Tuesday, 14-3-2017	09.00 - 11.00	Flight to Jambi
	12.00 – 14.00	**Lunch Break**
	14.00 – 16.30	Informal Disscussion with the Head of Berbak-Sembilang National Park and NGO
	16.30	Back to Hotel
Day-2	**Field Trip**	
Wednesday, 15-3-2017	08.00 – 17.00	*Field trip*: to see the location of fires and canal blocking in Berbak-Sembilang NP
Day-3	**Meeting with Local Government**	
Thursday, 16-3-2017	09.00 – 10.30	Informal Discussion with Local Government of Jambi Province: Cooperation Opportunities on Peatland Fires Security in Berbak-Sembilang National Park
	10.30 – 11.30	**Lunch Break**
	11.30	Back to Jakarta
Day-4	**Workshop**	
Friday, 17-3-2017	09.30 – 09.30	Registration
	09.30 – 11.00	Welcome and Opening
		Panel Presentation
		- The background behind the visit and the findings from the site visit. - STRP Contribution to Ramsar Site Management Concerning Peatland Fire in Ramsar Site Locations
		Role of Research and Lessons Learnt in Peatland Management in BerbakSembilang NP
	11.00 – 12.00	**DISCUSSION**
	12.00 – 13.00	**Lunch Break**
	13.00 – 15.00	Peatland Recovery Policies in Indonesia (in particular in Conservation Areas) Directorate of Peatland Control, DG of Pollution Control and Environmental Degradation, MOEF
		Restoration of Degraded Peatlands in Conservation Areas (Especially in Berbak-Sembilang NP) Peatland Restoration Agency (BRG) Mr. Alue Dohong, Deputy II
		Discussion
	15.00 – 15.30	Multimedia on Berbak-Sembilang
	15.30 – 15.45	Conclusion

Key Peatland Issues

Underlying causes

11. Peatlands are areas with soil that consists of dead and partly decomposed plant material that has accumulated over thousands of years because of waterlogged and often acidic conditions. Peat soil is also known as organic soil or *histosol* (as opposed to mineral soil). Indonesian lowland peatlands consist of swamp forests (i.e. waterlogged and flooded forests) which are 4000-8000 years old (Dommain et al. 2011). They consist of two main types: the most abundant type is represented by dome-shaped bog type peatlands (**Figures 1 and 2**). These peat domes lie largely above groundwater and flood levels from rivers and are thus hydrologically dependent on rainwater. The mineral subsoil underneath the peat soil of these domes generally lies around mean sea water level or mean river level. The second type of lowland peatlands in Indonesia are valley peatlands (Andriese 1974) further inland, having their mineral subsoil base well above mean sea level and following the slopes of the hills and mountains that they cover.

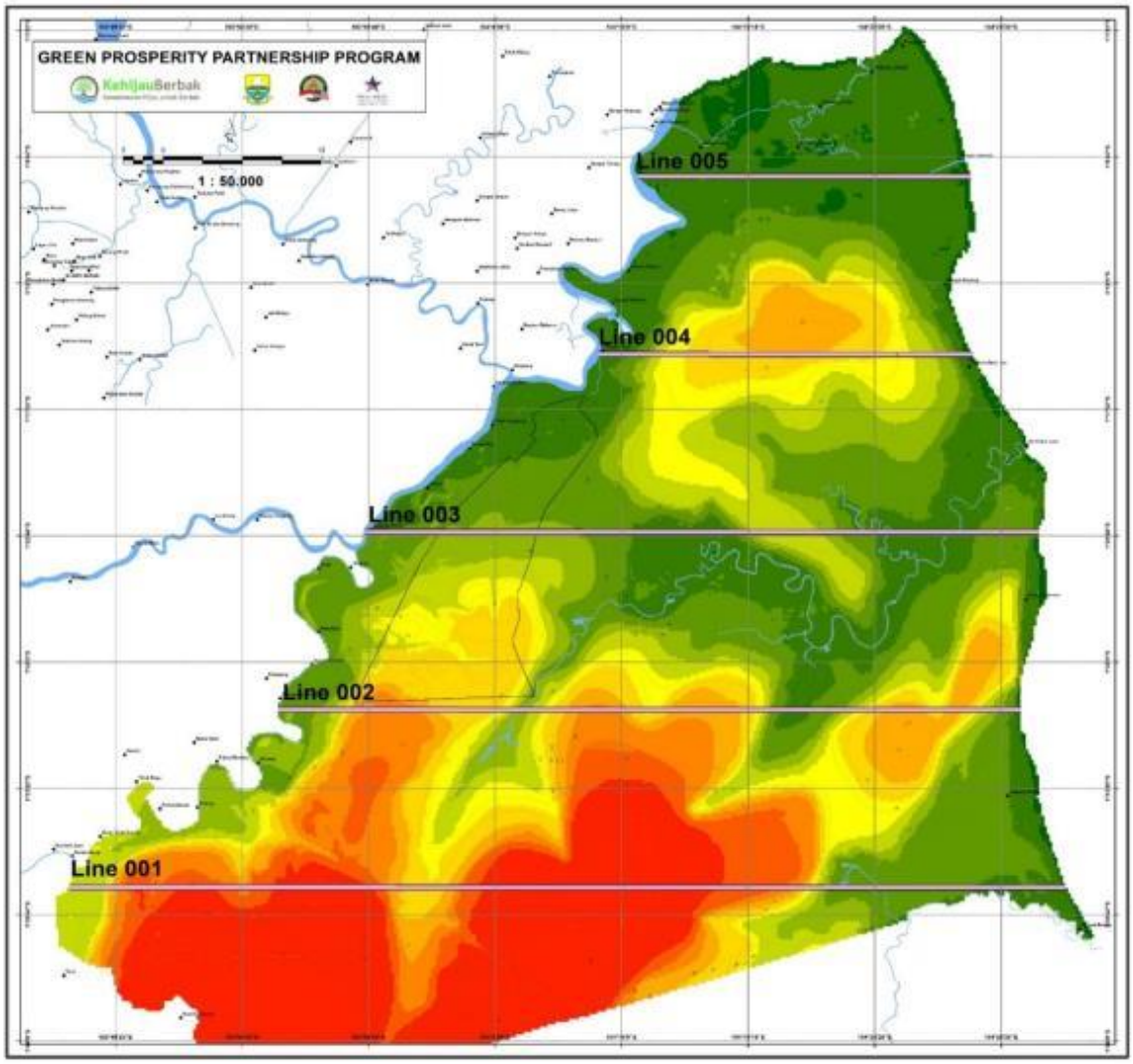


Figure 1: LiDAR-DTM profile of the peat landscape in the Berbak region, Sumatra, Indonesia, prepared by Deltares for BGPP. The profile has a variable gradient with elevations up to 12 meter above mean sea level. The five lines depict the cross-sections shown in the figures below. (Source: courtesy of Nasrul Ichsan, The Kehijau Berbak GIS expert, Euroconsult Mott McDonald).

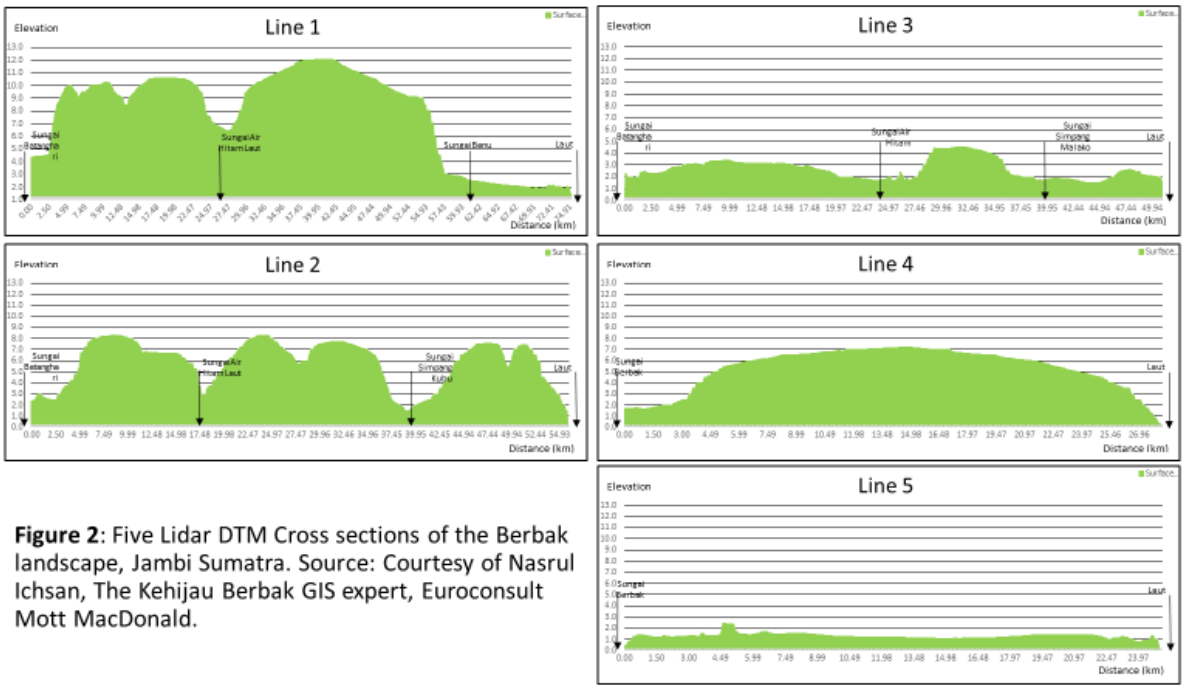


Figure 2: Five Lidar DTM Cross sections of the Berbak landscape, Jambi Sumatra. Source: Courtesy of Nasrul Ichsan, The Kehijau Berbak GIS expert, Euroconsult Mott MacDonald.

12. Intact lowland peatlands in Indonesia are almost always forested. In Berbak NP, the forests reach 30-45 meters height and with emergent trees of over 50 meters (Silvius et al 1984). The peat swamp forest vegetation plays an essential role in the capacity of the peat ecosystem to remain waterlogged, through its influence on the micro-climate (keeping it cool and damp) and through the dense network of roots at the soil surface, which enhances the water retention capacity of the system.

Peatland drainage

13. Extensive areas of peat swamp forests have been drained for agriculture and forestry practices, including widespread illegal logging. To enable logging, small channels are often excavated in the peat soil as a means of extracting logs from the forest. Deforestation is a first step in the process of land conversion to agriculture, palm oil and pulpwood plantations for which drainage networks have been dug for intensive drainage, mostly without adequate means for maintaining or managing water levels.

The history of peat swamp conversion in the Berbak area

14. Conversion of peat swamp forests in the Berbak area started in the late 1960s with the arrival of Buginese settlers from Sulawesi (Silvius et al. 1984). Large scale government-led peatland conversion started in the 1980s with transmigration schemes being developed in the lowlands of Sumatra and Kalimantan. The areas were chosen because they held extensive areas without traditional land claims. Many of the development schemes on peatlands failed and were rapidly abandoned. This created large areas of deforested and degraded fire-prone peatlands, with a continued artificial drainage resulting from the extensive canal network that had been established for drainage and transport. Even after the establishment in 2011 of a Moratorium on the licensing of new developments on peatland, peatlands have been subject to rapid conversion. This happened because of the existence of large areas that had been licensed already, as well as through widespread illegal developments, many of which have also impacted conservation areas. Other peatland areas were not recognized and/or not mapped as peatlands, and subsequently licensed for conversion during and despite the Moratorium. Miettinen et al. (2016) showed that in 2015 from the peat swamp forests in Riau, Jambi and South Sumatra only 6% remained in pristine stage, 13.2% were degraded, 6.5% consisted of tall shrub or secondary forest, and 4.6% of ferns or low shrub, 33.1% were occupied

by smallholder areas, and 33.3% by industrial plantations, the remainder being mainly permanently or seasonally flooded areas.

15. The failure of many development schemes in the lowland peatlands invoked a new kind of shifting cultivation, with many settlers moving into new areas using slash and burn techniques to claim new land and reap profits of illegal logging. An example of such development has taken place over the last years. Remote sensing (**Figures 7, 9** and **10**) commissioned by Wetlands International for this study, and implemented by Satelligence (Wageningen, The Netherlands) show major land-use change in the hinterland of the Sembilang NP. Observations by several of the RAM team members in September 2016 in the area, indicated that this has been done by thousands of illegal settlers who have recently arrived and have subsequently deforested and burned extensive land areas on both peat and mineral soils and established smallholder oil palm plantations. Active signs of illegal deforestation were seen in the form of logging rafts on drainage canals and logs being transported on motorbikes.

16. In the late 1980s and early 1990s the development of two types of plantations appeared to be successful on peat: oil palm plantations and pulp-for-paper (*Acacia*) plantations. The development of these plantation types is booming since and industrial plantations now cover over 3.2 million ha on peat in Sumatra and Kalimantan (Miettinen et al. 2016) in addition to many small-holder plantations which may cover several million hectares as well. These plantations require relatively deep drainage of at least 50 cm. However, in many plantation areas, water management focuses on creating access for boats, rather than on the maintenance of optimal water levels. This resulted in generally deep (>1m) drainage, followed by severe desiccation of the peat soil during dry periods, creating an increasing fire risk.

17. In most development areas, peat swamps have been subject first to licensed selective logging, often followed by illegal or uncontrolled logging involving drainage through log canals, or by licensed conversion to agricultural land or forestry plantations. Big companies have the capacity to implement large-scale developments with heavy equipment not using fires. Smallholders generally lack the necessary investment capacity for this and rely on land clearance methods that involve burning.

Limited protection of peat swamp forests

18. Officially about 50% of all Indonesian peatlands are protected. The Ministerial Decree SK.130/MENLHK/SETJEN/PKL.0/2/2017 about the Establishing of a National Peatland Ecosystem Function Map, mentions that 12.398.482 ha has the function of protection, whereass according to this decree 12.269.321 ha has the function of land-use. However, many and extensive areas of the protected peatlands have been subject to illegal logging, conversion and fires including the Berbak and Sembilang NPs, and now only 6% and 7.4 % of the peatland areas of Sumatra and Kalimantan respectively, remain in a pristine stage (Miettinen et al. 2016).

19. The position of peatlands within river basins (watersheds) and the related potential impacts of developments in downstream and upstream areas have not been well considered in land allocations for conservation, agriculture and forestry, and the special eco-hydrological aspects and management needs of peat bogs have long been disregarded. Only recently, new legislation recognizes Peat Hydrological Units for land-use planning (*Kesatuan Hidrologis Gambut* KHG). There is, however, still a need for increased acknowledgment and awareness of the fact that drainage in one part of a peat dome will affect all hydrologically connected parts. A recent regulation (No. 15/MENLHK/SETJEN/KUM.1/2/2017) pays specific attention to water level monitoring aspects in plantations, but does not require plantation owners to monitor and address the off-site impacts of drainage inside the plantation boundaries on the hydrological functioning of the peat landscape and eco-hydrological unit of which it is a part. Hence, off-site impacts of drainage systems for plantation roads and drained plantation areas are not monitored or managed. The regulation No. 15/MENLHK/SETJEN/KUM.1/2/2017 requires monitoring only within the concession boundaries.

However, drainage canals have direct measurable hydrological impacts on their immediate surroundings up to 500 meters, and in some cases such impacts may reach up to several kilometers or even longer distances, as described by Wösten et al. 2006 and Silvius 2005 for the upper catchment of Berbak NP. This is an issue that needs to be urgently addressed, as the off-site impacts create major fire risks as well as the other drainage-related impacts in the uncontrolled areas adjacent to the plantations. Nowadays, hardly any peat dome in western Indonesia is not affected by (illegal) logging, drainage and/or reclamation for agriculture and forestry plantations, also within protected areas.

20. Industrial plantations and smallholder areas on peatlands in insular South-East Asia increased much in recent times: they covered 11% (1.7 million ha) of the peatlands in 1990, 33% (5.2 million ha) of the peatlands in 2007 and 50% (7.8 million ha) in 2015. Industrial plantations nearly doubled since 2007: covering 27% of the peatlands (4.3 million ha) in 2015, up from 2.3 million ha in 2007 (15%). The majority (73%, 3.1 million ha) being oil palm plantations, nearly all of the rest (26%, 1,1 million ha) being *Acacia* pulp wood plantations (Miettinen et al. 2016).

21. Although peat fires have been occurring for years in drained peatlands, the problem has been exacerbated by the massive expansion of such drained areas and the increased strength of the El Niño meteorological phenomenon. This global phenomenon is known to occur at regular intervals of 4 to 5 years, with particularly strong El Niño events occurring in 1982-3, 1997-98 and 2014-16.

Consequences of human impacts

Peat oxidation and CO_2 emissions

22. Once the peat soil is drained and the peat is exposed to oxygen, microbiological processes start to break down the peat (which consists of plant matter), and as part of this process peat carbon is turned into CO_2 and released as gas into the atmosphere. Another part of the peat carbon is dissolved, washed out of the system and may be oxidized elsewhere. The oxidation of peat carbon takes place at a rate of 9.1 tonnes CO_2 $ha^{-1}yr^{-1}$ for every 10 cm of drainage depth (Hooijer et al. 2010) and is an inevitable consequence of peat drainage. Recent legislation (Peatlands Regulation PP71), allows drainage to a level of minus 40cm. This seems to be based on a study of peat fires in the ex-mega rice area in Central Kalimantan indicating that minus 40cm was a kind of cut-off point for fire risk (Putra & Hayasaka, 2011). However, in a more recent publication, the same author and several co-authors showed that most fires occur already in areas with groundwater levels below minus 20cm, indicating that fire is coincident with this level of drainage (Putra et al 2016). It should be noted that, irrespective of fire risk, with a drainage level of minus 40cm, peatland degradation processes (oxidation, subsidence) still continue, albeit at a proportionally slower rate than with even deeper drainage.

23. Over half of Indonesia's greenhouse gas (GHG) emis-sions is derived from the land-use sector, including forestry and agriculture. By far the largest contribution comes from drainage of peatlands, even without emissions from fires. About one third is related to fossil fuel use for energy (**Figure 3**). The disproportionnally high emissions from peatland degradation are astounding, considering that only around 6% of Indonesia's agriculture takes place on peatland. Estimates of land-use and peatland related emissions vary greatly and have a significant impact on the total emisions of Indonesia. Miettinen et al (2017) estimated that in 2015, levels of peatland emissions (excluding fires) were at around 146 Mt C /yr (= 535 Mt CO_2/yr) in SE Asia, mainly from Indonesia. 44% of the emissions came from industrial plantations (mainly oil palm and Acacia pulpwood), followed by 34% of emissions from smallholder areas. Fire-induced carbon dioxide emissions have been estimated to average 122 Mt C /yr, mainly from Indonesia (www.globalfiredata.org/_index.html).

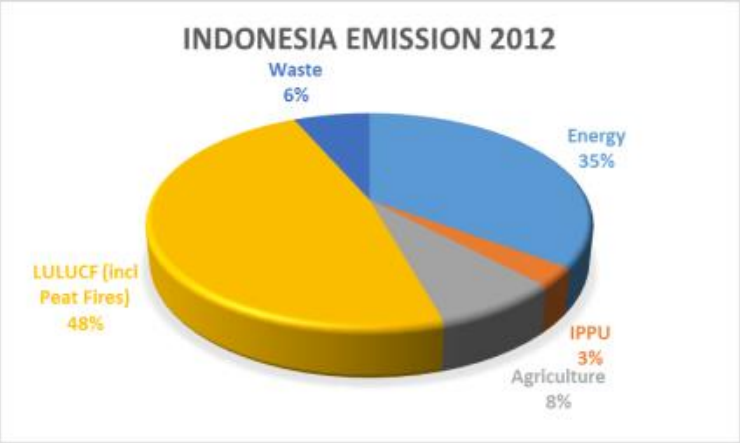


Figure 3: Sources of greenhouse gas emissions in Indonesia in 2012. Source: Republic of Indonesia. 2015b. "Indonesia First Biennial Update Report (BUR) under the United National Framework Convention on Climate Change". http://unfccc.int/resource/docs/natc/idnbur1.pdf

Peatland subsidence and flooding

24. Peat consists mainly of water (90%) and carbon (10%). The loss of water and carbon emissions from the drained top peat layer represent the loss of the main constituents of the peat, thus resulting in a gradual subsidence of the organic soil layer. The subsidence continues until all organic soil has disappeared, or the drainage is stopped. Where the layer of organic soil goes below the limit of gravity drainage, oxidation may stop when the drainage limit is reached (**Figure 4**), although in very dry years such areas could still be subject to further degradation and fires. Greenhouse gas (GHG) emissions and soil subsidence can be limited only by decreasing drainage depth, i.e. uplifting the groundwater level, or rewetting peatlands. Ultimately, a point will be reached whereby gravity drainage is no longer possible and the landscape will then be subject to regular and prolonged flooding, impeding productive use for agriculture or forestry purposes. Recent studies in the Rajang delta in Sarawak and the Kampar peninsula in Riau indicate that because of the ongoing drainage-based land use, vast peatland dominated lowland landscapes of South-East Asia will become increasingly subject to such flooding because of subsidence, with over 60% of the currently drained peat areas prone to prolonged flooding by 2050 under a business as usual scenario (Hooijer et al. 2015a, 2015b). This may have devastating socio-economic impacts, and such landscapes will become economically unproductive waste lands. These areas will experience prolonged flooding in the rainy season. In dry periods they may still become fire prone, and may be at particular risk of catching fire without productive land-use.

Fires and smog

25. Burning of the desiccated peat has been the main contributor to the regional haze problems in South-East Asia (**Photo 1**). Peat fires can affect millions of hectares in one dry season and are responsible for the largest proportion of the huge peat-based CO_2 emissions. Particularly during El Niño periods the problem may take on gigantic proportions. The first large peat fires occurred during the El Niño period of 1982-3 with over 3 million ha burned in Sumatra and Kalimantan (Wirawan 1984). Fires recur every year with peaks during El Niño events, which occur more or less every 4 or 5 years. In 1997/98 a total of at least 2.1 million ha of peatland was burned in Indonesia, causing a major haze event that blanketed South-East Asia (Photo 2) and caused huge economic damage and high public health impacts (Tacconi 2003), as well as international tensions. The Indonesian peat fires in 1997/98 were responsible for an equivalent of 15-40% of the global fossil fuel emissions (Page et al. 2002). During the 2015-2015 El Niño event about 800,000 ha of peatland in Sumatra and Kalimantan was burnt, and as a result about 500,000 persons were hospitalized for respiratory tract illnesses, economic losses in Indonesia were estimated to total at least USD 16 billion[6] (World Bank 2016) and

[6] http://www.worldbank.org/en/news/feature/2015/12/01/indonesias-fire-and-haze-crisis

perhaps as much as USD 47 billion[7], and 11.3 Tg of carbon was released to the atmosphere (Huijnen et al. 2016).

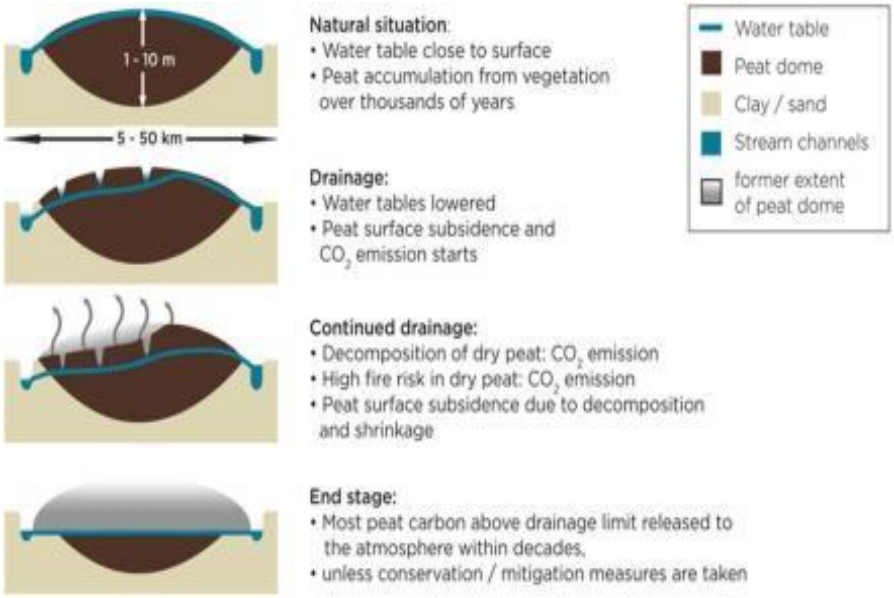


Figure 4: Schematic view of a peat dome between two rivers, in different stages of drainage and subsidence

26. The total area of degraded peatlands in South-East Asia covers less than 0.1% of the global land surface. However, over the period 1997-2006, close to 8% of the global CO_2 emissions came from these degraded peat-lands (i.e. about 2000 million tonnes CO_2 per annum, with an average of 635 million tonnes from peat oxidation and a minimum of 1400 million ton-nes from fires, Joosten 2009). Around 90% of these emissions stem from Indonesian degra-ded peatlands, especially in Sumatra and Kalimantan (Hooijer et al. 2006).

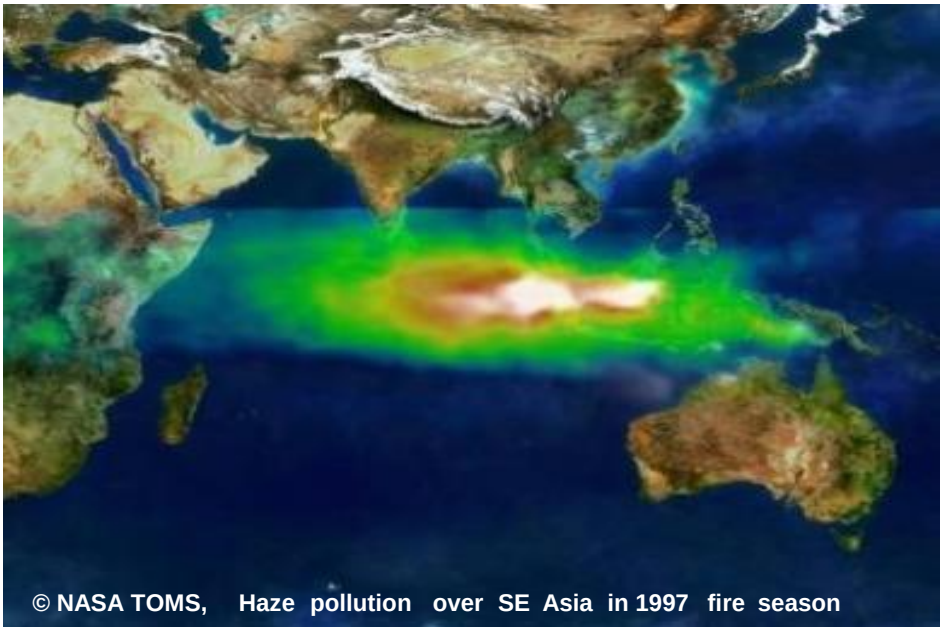


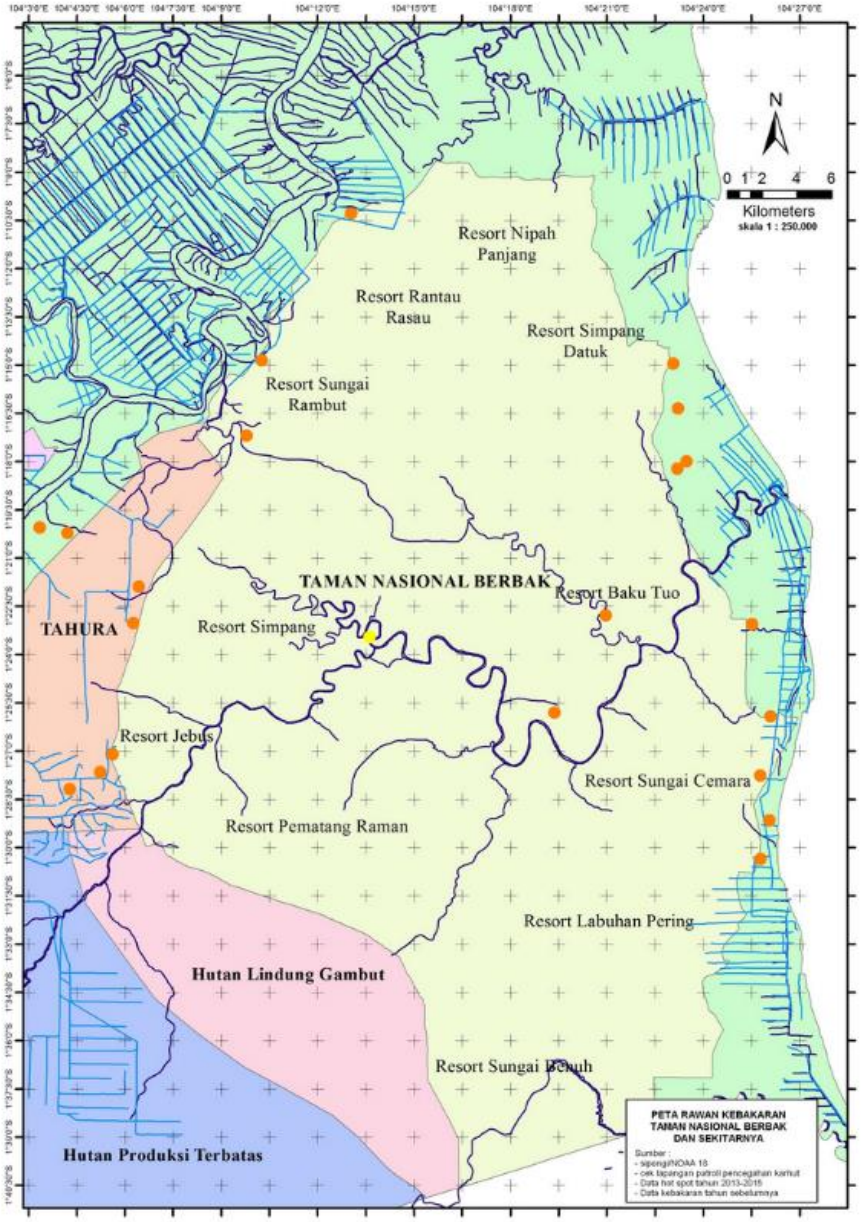
Photo 1. The haze from peat fires in 1997 blanketed South-East Asia, and even reached India and East Africa (image from NASA TOMS).

[7] http://www.straitstimes.com/asia/47b-indonesia-counts-costs-of-haze

Peatland rewetting - the key to solving problems

27. Emissions and soil subsidence may be stopped through the restoration of the ecohydrology of the peatland. This requires not only the rewetting through blocking of drainage canals, but also the restoration of a vegetation cover with trees to reduce desiccation and establish the required micro-climate in support of a wet ecosystem. The network of roots, developing close to or even on top of the forest floor and the resulting micro-topography of hummocks and hollows, contributes to the water retention capacity of the ecosystem (Baird et al 2016).

28. Rewetting constitutes the rehabilitation of the hydrology to its natural or near-natural dynamics, including normal periods of flooding as well as droughts. A key aspect of natural peatland hydrology is the fluctuating nature of the water table, reaching sometimes above the ground surface and sometimes down to 1 meter during very dry seasons. Usually, though, ground water levels are near the surface. Peat forest vegetation requires this dynamic. Under continuous flooding, even a peat swamp forest will drown.



Map 1: Berbak National Park and surrounding areas

Berbak-Sembilang National Park as a Local Case Study

Introduction

29. Berbak National Park (162,000 ha, **Map 1**) was designated in 1992 as Indonesia's first Ramsar Site (globally N° 554) with a special emphasis on its representativeness for South-East Asian peat swamp forest. In 2016, its management was merged with the adjacent Sembilang National Park (205,100 ha), also designated as a Ramsar Site (N° 1945), comprising the largest mangrove area (77,500 ha) of the Indo-Malayan region, the only one that still has an intact natural transition towards inland freshwater and peat swamp forest. The hydrological integrity of this transition is of crucial importance to the survival of the mangrove ecosystem and its biodiversity.

Photo 2:
View of the Air Hitam Dalam river in the Berbak National Park (Photo: M. Silvius).

30. The rivers in both parks are lined by riparian vegetation (**Photo 2**) that attains a height of 15– 25m with emergent trees of up to 40m, while the freshwater swamp forest is usually 35–45m tall with many emergent trees of 50–55m. Peat swamp forests are tall and relatively diverse, lacking the so-called Padang (pole-) forest type found in central peat dome areas elsewhere (Whitmore 1984). Both Ramsar sites are famous for their rich biodiversity, including many fish that are restricted or endemic to peat swamp black waters, as well as rare and endangered species, such as the Sumatran Tiger (*Panthera tigris sumatranus,* **Photo 3**), Malaysan Tapir (*Tapirus indicus*), Malaysian Sun Bear (*Helarctos malayanus*), Whitehanded Gibbon (*Hylobates lar*) and Siamang (*Symphalangus syndactylus*), False Gharial (*Tomistoma schlegelii*), Painted Terrapin (*Batagur borneoensis*), Storm's Stork (*Ciconia stormi*) and the White-winged Duck (*Cairina scutulata*). In Berbak NP a total of 261 flowering plant species have been recorded of which 67% are trees and shrubs, with climbers accounting for a further 17 % and herbs and epiphytes 8% each. The flora is still poorly studied, but includes a first record in Sumatra for the rare mistletoe *Lepidaria kingii* and at least 23 palm species, among them rare species such as *Johannesteijsmannia altifrons* and *Cyrtostachys renda*. The Sembilang NP is famous for its large numbers of resident and migratory waterbird species, and ranks among the most important waterbird areas in South-East Asia. The area is one of the most important wintering sites for the Asian Dowitcher (*Limnodromus semipalmatus*) with a maximum count of 10,000 individuals at the Banyuasin Peninsula. Wader counts have revealed a total of 30 species, including some very rare and endangered species, such as Nordmann's Greenshank (*Tringa guttifer*), Far-Eastern Curlew (*Numenius madagascariensis*) and Oriental Plover (*Charadrius veredus*), (Silvius et al. 2016, Giesen et al. 2016).

Photo 3: Berbak and Sembilang NP together form one of the largest lowland tiger areas in Sumatra. Here a picture of one of the tigers in Berbak NP. (Source: courtesy of MOEF)

31. The peat swamp forms part of the vast coastal plain of south-eastern Sumatra, comprising flat and swampy areas stretching from the coastal mudflats and sandy beaches to inland areas with an elevation of around 15 m above main sea level. Together they make up some of the last remaining intact peatlands in Sumatra which are an important active carbon sinks, sequestering carbon in the biomass and subsequently storing it in the peat soil. The total peatland area in Berbak NP is about 70,000 ha with a peat depth reaching over 15 meters in its deepest parts (Silvius et al. 1984). Peat swamp forests in Sembilang NP cover approximately 80,000 ha (about 31% of the total NP area), with an average peat thickness of about 4 m. The thickest and most extensive peat lays in the northwestern part adjacent to Berbak, reaching 7.5 m depth. In the South-East smaller peatland areas with thinner peat layers are located. The deep peat areas stretch far beyond the boundaries of the NP with significant parts (>100,000 ha) of the peat domes, that serve as water catchments for the main black water river *Air Hitam Laut* being located in unprotected areas. A huge amount of carbon is stored in the peat of the Berbak-Sembilang ecosystem, estimated at over 250 million tonnes carbon (Giesen et al. 2016).

32. A significant and rapidly growing local community lives adjacent to the Berbak-Sembilang NP ecosystem, including many traditional Malay villages along the inland rivers and Buginese migrant communities along the coast. Along road and canal systems that have recently been constructed for large scale pulp-for-paper (*Acacia*) plantations and to access official transmigrant villages with oil palm plantations, is an increasing influx of spontaneous migrants that use slash and burn techniques to rapidly convert and subsequently claim land areas to eke out a living in previously inaccessible areas. This has been specifically a major issue over the last years in the area west of the Sembilang NP, as can be seen on remote sensing material and was observed by several members of the RAM mission in September 2016 (i.e. prior to the mission).

33. The Berbak-Sembilang ecosystem and the adjacent lands are threatened by illegal logging and expanding agricultural and oil palm plantation development. This starts with the construction of canals for floating out the logs. Once deforested, the drainage system is intensified for agricultural purposes. Once drained, the peat soil oxidizes and in very dry years, linked to the El Niño Southern Oscillation (ENSO) phenomenon, peat soils become desiccated and fire prone. Areas that have been subject to drainage are invariably affected by fire, either as part of the conversion process, or because of such fires going wild. The latest major fire event occurred in 2015, covered several million hectares including over 800,000 hectares of peatland in Sumatra and Kalimantan (Huijnen et al., 2016). It significantly affected Berbak NP, triggering the request of the Indonesian government for the RAM.

Stakeholders and fires

Communities

34. Local communities are often seen as only the victims of fires and smog. Indeed, in the past, before the large-scale land developments started in Sumatra and Kalimantan, there were few or no large-scale fires or smog events, and so fires have been often blamed on the large-scale developments only, especially from the private sector. But the term 'local communities' has become diffuse, as many of the official and spontaneous transmigrant communities are now also well settled in the peatland landscapes, including in the Berbak and Sembilang regions, with official governance structures and they are thus considered local. All communities, whether transmigrant or not, are looking for land expansion, and as most of the fertile mineral soils on the river banks have been occupied already since long, much of the expansion is focused on the hitherto unoccupied and undeveloped peatlands. Land claims by spontaneous transmigrants have often been acknowledged and granted. For instance, the areas developed along the coast of the Berbak NP used to be part of the protected area when it was a Wildlife Reserve (*Suaka Margasatwa*), but were excised from the protected area in the 1980s and the migrants were given tenure rights over the land. Such examples have stimulated others to follow, and wherever access is provided by e.g. new roads or canals to hitherto inaccessible areas, rapid spontaneous occupation by settlers generally follows. Over the last years, a huge migration has happened west of the Sembilang NP in the Merang-Kepahyang area, opening up tens of thousands of hectares through illegal logging. Much of the developments and land clearance by such settlers happens with the use of fires. So local communities are both stakeholders in the management of the land as well as part of the problem

35. The Berbak-Sembilang NP management authority is trying to address encroachment within the NPs through counseling, socialization and patrolling the boundaries of Berbak-Sembilang NP. Some communities surrounding Berbak and Sembilang NP continue the use of fire for land clearing in order to develop plantations and agriculture, involving the risk that this will creep further into the Berbak-Sembilang NP. Capacity to address this remains limited and significant investment is needed in capacity enhancement of the NP management as well as the community awarenss and vigilance.

Traditional businesses

Districts & subdistricts	Rice	Non-rice food crops	Horticulture	Plantations	Capture fisheries	subtotals
Tanjung Jabung Timur						
Berbak	5	0	0	1	0	6
Sadu	0	0	0	8	1	9
Muaro Jambi						
Kumpeh	5	2	1	9	0	17
Rantau Rasau	1	0	0	10	0	11
subtotals	11	2	1	28	1	43
%	26%	5%	2%	65%	2%	100%

Table 1: Major socio-economic activities of 43 villages around Berbak (adapted from the provincial Potensi Desa statistics 2016)

36. A total of 43 villages occur around Berbak NP, some bordering directly the Park, others bordering its buffer zone. According to provincial statistics that list the main socio-economic activity of each

village, 28 out of 43 villages (65%) are classified as 'plantation villages' (mainly oil palm), while a quarter has a rice-based economy (Table 1).

37. **Sago**: There is no history of sago cultivation in or around Berbak NP. One exception is a small village trial area at Sungai Rambut, to the northwest of Berbak NP near Air Hitam Dalam. In this area, a small grove of sago was established by local villagers more than ten years ago. But this has remained small and very local as the product requires processing in a mill and there is none nearby.

38. **Jelutung**: This is a latex derived from two species of *Dyera,* namely *D. costulata* (primarily on mineral soils) and the swamp jelutung *D. polyphylla* found in peat swamps only. The latex is used for chewing gum, dentistry (moulds), and in the past also for insulation material. Initial economic studies in Jambi indicate that the monetary returns per hectare are higher for oil palm than for jelutung plantations on peat. However, the return on labour is higher for swamp jelutung. This indicates that swamp jelutung might be an interesting alternative for smallholders. During the 1980s, jelutung latex was one of the primary sources of income for farmers living in the Berbak NP buffer zone. Originally, farmers harvested jelutung latex from wild trees. Massive logging outside of Berbak NP significantly reduced the number of mature jelutung trees by the late 1990s. Thus, jelutung extraction drastically decreased, and this industry has now disappeared.

39. In order to avoid further loss of jelutung trees in natural forests, and to restore degraded peatlands, jelutung plantation trials have been carried in Jambi province since the 1990s. From 1991-2004 a 2,000 ha swamp jelutung plantation was established on deep peat at Sungai Aur[1] by a commercial company pioneering also jelutung domestication near Berbak NP. The jelutung concession was primarily established to address the timber needs of pencil manufacturers, not for its latex. Nevertheless, after 5-6 years, latex tapping occurred also in this plantation. However, as the plantation was established well before rewetting was being discussed as a peatland restoration measure in Indonesia, and paludiculture was unknown, drainage of this land was unfortunately continued. As a result, the area remained fire prone and was eventually destroyed by fires entering from adjacent peatland and subsequently abandoned (Giesen 2004). This creates an important lesson learned for many of the current peatland restoration projects where only partial rewetting takes place.

40. Comparing the price of jelutung latex with the price of rubber, farmers acknowledge the competitive pricing of jelutung latex. This sparked an interest in cultivating jelutung, and nurseries gradually sprung up in local communities. However (as with the jelutung concession) these plantations were on drained peat and succumbed to fires. Since about 2009, the World Agroforestry Center (ICRAF) and the Jambi Forestry Department began replanting degraded peatland with swamp jelutung, among others under a greenhouse gas emissions reduction (REALU) programme. However, none of these attempts were successful, as the hydrological conditions of the drained peatland areas were not taken into account (i.e. no rewetting) and all areas have succumbed to fires, especially during the dry year 2015. Without lowering the high annual fire risk on drained lands, investments for tree planting were often wasted. Social surveys associated with the recent Kehijau Berbak project on Landscape Lifescape Assessment (LLA) found out that the local 'farmer gate price' for planted jelutung latex was not better than for rubber. Hence many farmers opted for the more familiar rubber crop rather than for jelutung. This shift was further hastened by the fact that jelutung traders facing stiff regulations shifted to other commodities (Janssen et al. 2017). Various current peatland restoration projects in the Jambi region (e.g. BGPP, Rimba Corridor) also include jelutung plantations in their revegetation programmes for 2017-2018.

[1] The former DHL plantation at Sungai Air is located on the northwest bank of the Batanghari River, while Sungai Aur village lies within the Berbak NP buffer zone, adjacent to the Tahura.

41. **Fisheries:** In the past, all villages along the eastern coast in Sadu district (*Sungai Cemara, Air Hitam Laut, Sei Benuh, Sungai Itik, Sungai Jambat, Sungai Lokan, Sungai Sayang, Labuan Pering, Remau Bako Tuo*) had economies largely based on capture fisheries, along with some coconut groves. Especially the prawn fisheries were lucrative. A small ice plant was already existing at Air Hitam Laut in 1991 enabling much of the produce to be sold abroad. Coastal fisheries still exist. But except for *Sungai Benuh*, all coastal villages have now economies based on plantations, with almost all the expansion being oil palm. Riverine capture fisheries are less lucrative than the coastal fisheries, but still occur along most rivers, albeit at a very low level. The trend of river fishing of native species continues to decrease, despite the fact that the earlier, destructive methods (with electricity, explosives and poison) are no longer used during long drought periods.

42. Now, only a few individuals in the villages around Berbak NP fish in the rivers to supplement their income or diet, sometimes only for recreational reasons. Fishing also occurs on rivers within the Berbak NP. In the past this was carried out by fishermen and was combined with the collection of rattan and tapping of jelutung. Nowadays it is often an additional activity by those encroaching the park with their plantations or engaged in illegal logging.

Expansion into modern sectors

43. The oil palm sector expanded very significantly in Jambi region, not only via commercial companies but also via smallholders that in the last 10-15 years have transitioned from traditional socio-economic activities, such as rice production, rubber, fisheries and non-rice food crops to oil palm. Since the early 1990s, *Hevea* rubber was the preferred smallholder plantation crop in Jambi and the region was once a key producer. However, with the decline in world market prices and the rise of oil palm, most smallholders have made the switch to oil palm. This was confirmed in social surveys (Euroconsult Mott MacDonald 2016) where the trend of farmers moving out of rubber due to unattractive market prices, and out of rice and field crops due to almost annual river flooding and crop losses, was leading more and more farmers to smallholder oil palm (which unfortunately are also negatively affected by peak floods that seem to return every 5 years).

44. By 2017, almost two thirds (65%) of all villages around Berbak NP are classified as having plantation-based economies. In most cases this is related to oil palm and no other tree crops, although there are still some rubber plantations, while on the coast some coconut groves remain. Over the past decade, eight out of nine villages along the Berbak coast have established oil palm based economies, and some of this included developments in Berbak (see table 1, Potensi Desa Statistics 2016).

45. On the inland side of Berbak, the communities living along the Kumpeh river to the West and Batang Hari river to North have been locked in the production of rice, soy bean and maize, due to the strong adherence of local district of village-level government to the national agriculture extension and research policy. This policy was well designed for drylands on Java. But it proved to be a failure in practice and inappropriate for the increasingly flooded east Sumatran lowlands. This policy offers little hope of modernisation to Berbak buffer zone farmers, whose flood affected rice and soy bean crops fail almost annually, with only maize left - having some higher level of flood tolerance. There is therefore a need to shift the agricultural research and policy away from the current national norm, towards flood adapted livelihoods in the surroundings of Berbak National Park (e.g. return to flood tolerant rice varieties).

Business sector

46. **Palm oil and Acacia/pulp for paper:** Miettinen et al. (2016) analyzed the changes of land cover and industrial plantations since 1990 in the peatlands of Peninsular Malaysia, Sumatra and Borneo in 2015. The results reveal continued peatland deforestation and conversion into managed land types:

76% (11.9 million ha) of the land area covered by peat swamps in 1990, 41% (6.4 million ha) in 2007, and 29% (4.6 million ha) in 2015. And a parallel increase of industrial plantations and smallholder areas from 11% (1.7 million ha) in 1990, to 33% (5.2 million ha) in 2007, and 50% (7.8 million ha) in 2015. Industrial plantations nearly doubled their area since 2007 to cover 27% (4.3 million ha) of peatlands in 2015. Most of these were covered by oil palm plantations (73%, 3.1 million ha) while nearly all of the rest (26%, 1.1 million ha) were pulp wood plantations.

47. Over the last decade, the larger palm oil and pulp-for-paper companies pledged not to use fire in the development of plantations any longer. But many smaller companies still use fire. Even companies with clear 'no-fire policies' have not always succeeded in keeping their plantations fire free. In 2015, 26% of the estates of the pulp for paper giant APP were reportedly on fire in South Sumatra region (Butler 2016). It is often not clear who caused the fires, or how they started. But the general assumption is that 100% of the fires are man-made, and even 'wild' fires are caused by man-made fires gone wild or started by sparks or embers from man-made fire.

48. The Government has over the last years stepped up the enforcement of the no-fire regulations. Especially since the major fire disaster of 2015, the Ministry of Environment and Forestry (MOEF) has cracked down on companies that had fires in their concession areas. In December 2015, the MOEF issued a letter forbidding (re)planting of burned plantation areas. Also the finance sector is becoming increasingly aware of the risks linked to oil palm and pulp-for-paper plantations, and some investors (e.g. the Singapore banking alliance) are reviewing their sustainability criteria and social, environmental and biodiversity safeguards. Banks, especially international banks, are active in the Roundtable for Sustainable Palm Oil. However, local Indonesian banks seem to work without special safeguards for the environment.

49. The use of fires for the clearing of land was banned in 2016 by means of Presidential Decree No. 57/2016 on Protection and Management of Peat Ecosystems, but this regulation made an exception for the use of fire by smallholders with less than 2 ha of farmland. Following the 2015 El Niño related fires, when it became clear that many fires were directly related to smallholders, the use of fire for (peat-)land clearing has been banned for all farmers including smallholders.

50. **Carbon sector:** The Indonesian Government allocated substantial areas for the establishment of Ecosystem Restoration Concessions (ERC, Decree 159/Menhut-II/2004). Also outside of these areas, local companies can apply for ERC licenses in areas with a forest status. The main purpose of these concessions is to have the forests restored to enable renewed logging in the future. The Ministry of Forestry (now MOEF) issued a regulation (PP.36) aimed to facilitate the expected carbon market to enter Indonesia. The law outlines the options for public or private companies to apply for carbon sequestration (PenyeRAPan-Karbon) and storage (PenyimPANan-Karbon) licenses in production and protection forest. This regulation is linked to the REDD+ programme. Its emphasis is on environmental service-based business with community development (private development-based forest conservation) including the provision of profit from the carbon sales among its stakeholders. Despite stipulating that RAP/PAN activities can occur in production and protection forest, the regulation does not provide the detailed definition of what RAP and PAN activities constitute, apart from that such actions involve "a type of environmental services utilization in production and protection forests." PAN activities may include postponing logging, expanding conservation areas and applying a timber harvest rotation, thus maintaining forest stands and enabling carbon sequestration (RAP). IUP RAP/PAN licenses are for 25 years only, which for ecosystem restoration and for carbon sequestration may be a too short time frame (e.g the Verified Carbon Standard requires permanence for 100 years). As of 2014, two Indonesian business entities have obtained an IUP RAP/PAN license.

51. Both ERCs and RAP/PAN licenses are providing a basis for the emerging carbon sector in peatland land use. The sector has been especially focusing on the opportunity offered by ERCs, as these have a life time of 60 years with a possibility for an expansion with another 35 years. It thus provides the 'permanence' required for certification of carbon credits under the Verified Carbon Scheme (VCS). A key example is the Katingan ERC in Central Kalimantan. The sole envisaged source of income of the company running this ERC is the sale of carbon credits derived from avoided deforestation, carbon sequestration through forest restoration and conservation, and decreased emissions from peatland restoration. As of July 2015, there have been 51 applications for ERC licenses. The enthusiasm from the private sector, however, was not met by a consistent commitment from the government side, resulting in the granting of only 14 applicants so far, four of which operate on carbon storage and/or sequestration. The realisation of ERCs is running far behind the initial target, only accounting for 24% of the total target since its initiation in 2004 (Forestry Statistic 2014).

52. Internationally, there has been some protest from NGOs against the development of this sector for various reasons: i) the sector could pose an additional threat for land grabbing, thus disenfranchising local communities, ii) successful emissions reduction through forest conservation and peatland restoration could lead to a reduction of the commitment of government and industry to reduce emissions from fossil fuel, and iii) carbon sequestration in forests is considered not permanent in view of the considerable logging pressures and fire risks.

	Provision in %		
	Govenment	Communities	Developer
Natural timber forest concession (HA)	20	20	60
Timber estate concession (HTI)	20	20	60
Ecosystem restoration concession (ERC)	20	20	60
Community plantation forest concession (HTR)	20	50	30
Plantation forest (HT)	10	70	20
Community forest	20	50	30
Customary forest	10	70	20
Village forest	20	50	30
Forest management unit	30	20	50
Forest for special purpose	50	20	30
Protection forest	50	20	30

Table 2: Distribution of benefits of IUP RAP/PAN enterprises in production and protection forests (Minister of Forestry Regulation No. 36/Menhut-II/2009)

53. However, other NGOs are supporting the development and point to the fact that private sector companies also certify their carbon credits under the standard of the Climate, Community and Biodiversity Alliance (CCBA), which provides all necessary social and biodiversity safeguards. The ERC can provide employment, creates environmental security and provide support to the local communities for sustainable development activities, which also help to enhance the security of the ERC. Regarding b), the issue can be addressed by ensuring that the emission reductions and carbon sequestration from forest and peatland conservation and restoration is counted over and above the targets set by government and industry. Regarding c), while carbon sequestered in forests may be less secure, the carbon stored in peatlands is considered fossil and should be treated similar to oil and gas.

54. According to regulation No 36/Menhut-II/2009, benefits from IUP RAP/PAN Carbon operations should be divided over three stakeholder groups: Government, Communities and Developer, with different divisions made for areas under different forest status (see **Table 2**) . The Ministry of Finance has challenged the regulation on the ground that Ministry of Forestry did not have the authority to

manage fiscal policy. It therefore remains unclear whether the benefit sharing is valid or not, and this situation creates uncertainty for private investors to apply for such licenses. But in order to attract investment it is very important that the regulation is improved and finalized.

Government

55. **Peatland Restoration Agency** (BRG): In January 2016, the President of Indonesia established the Indonesian peatland restoration agency (*Badan Restorasi Gambut*) with the task to restore over two million hectares of degraded peatlands by 2020. The BRG has since identified priority regions and areas. They include as a priority the restoration of degraded peatlands in and around protected areas.

56. **Berbak-Sembilang NP**: Berbak NP was established as a wildlife reserve in 1935, and demarcated in 1974 by the Forestry Department. In 1992, it was recognised as Indonesia's first Ramsar Wetland of International Importance, and in 1997 its status was upgraded to National Park (Min. Decree No. 185/Kpts-II/1997). The total area is about 168,000 ha and the Park is managed from the Balai office located on the outskirts of Jambi township. Sembilang NP was established in 2001 under Forestry decree SK No. 76/Kpts-II/2001 and until recently managed from a Balai office in Palembang.

57. In February 2016 (via PP Menhut 07/Feb 2016) Berbak NP was combined with Sembilang NP that lies adjacent in South Sumatra province. From an ecological point of view this makes sense as the peatlands of Sembilang are contiguous with those of Berbak; in addition, Sembilang has the most extensive mangrove areas of Southeast Asia (outside Papua) and combined they form a last stronghold for the endangered Sumatran tiger. The merger resulted in the combining of the management of Berbak and Sembilang national parks and all is now ostensibly managed from Jambi. Originally Berbak NP and Sembilang NP each had three resorts, but these have been combined and only three remain in total, with two for Berbak and one for Sembilang. Budgets have been combined and reduced: in the past Berbak NP had an annual budget of 15 billion IDR and Sembilang NP had 8-12 billion IDR, but the combined NPs now have an annual budget of 19 billion IDR only. Staffing for Berbak NP has remained at 76 (this includes 40 Forest Police/Polisi Hutan staff), but out of the 60+ staff for Sembilang NP only 16 remain available for conservation of the Park and the remainder have been transferred to the newly established PPI (Pelaksanaan mitigasi Perubahan Iklim/Agency for Implementation of Climate Change Mitigation) in Palembang, which forms part of Ditjen (Directorate General) PPI. There are 15 guard posts throughout the overall combined NP, with 2-3 staff based at each post.

58. A second set of changes brought about by PP07/2016 affects the way in which the National Park deals with threats such as fires or responding to illegal activities. These changes are described in the section under threats in the next chapter.

Neighbouring countries

59. While much of the smog from forest and peat fires affects the people of Indonesia and their economy, people in Malaysia and Singapore often jokingly call the smog from Indonesia its main export product. It affects their quality of life and impacts on important economic sectors such as transport and tourism. Smog from fires in and around Berbak NP can easily reach Singapore and Malaysia, and so the people of these countries are important stakeholders in the endeavour to stop fires and smog events from happening again.

Underlying causes of fires in Berbak-Sembilang National Park

Under natural circumstances, peat swamp forests do not burn, and the fires seen in and around Berbak NP over the past two decades can be attributed to a number of underlying causes that are disussed in this chapter.

Land conversion and fires within the National Park

60. Encroachment in Berbak NP is regarded as the single greatest threat by the park authorities, as it directly leads to loss of forest (illegal logging), drainage and fires. Most encroachment has occurred to the north of the NP and from the villages along the coast. The level of encroachment has rapidly increased over the past 5-10 years in tandem with the rapid expansion of oil palm in the province. To the north, villages have encroached into the NP by almost 4km and extending over roughly 670ha (according to the local NGO Warsi, this extended over 3,400ha in 1998, while along the east coast the encroachment has extended into the Park by about 2km, extending over 690ha). General disturbance from illegal logging and clearing, followed by fires, has extended much further from the coast to the Simpang Melaka, a tributary of the Air Hitam laut river, over a length of more than 10km. There is also illegal conversion ongoing to the northwest of Berbak NP in the Tahura, where about 1,250 ha has been converted by smallholders, and to the southwest of Berbak NP on the edge of (but within) the logging concessions where a further 1,530ha has been converted to oil palm. **Map 1** indicates boundaries of legal plantations and actual plantations (red line) around Berbak NP. Note that smallholder plots have not yet been included as digitization is still ongoing.

Logging and fires within the National Park and peatland protection forests

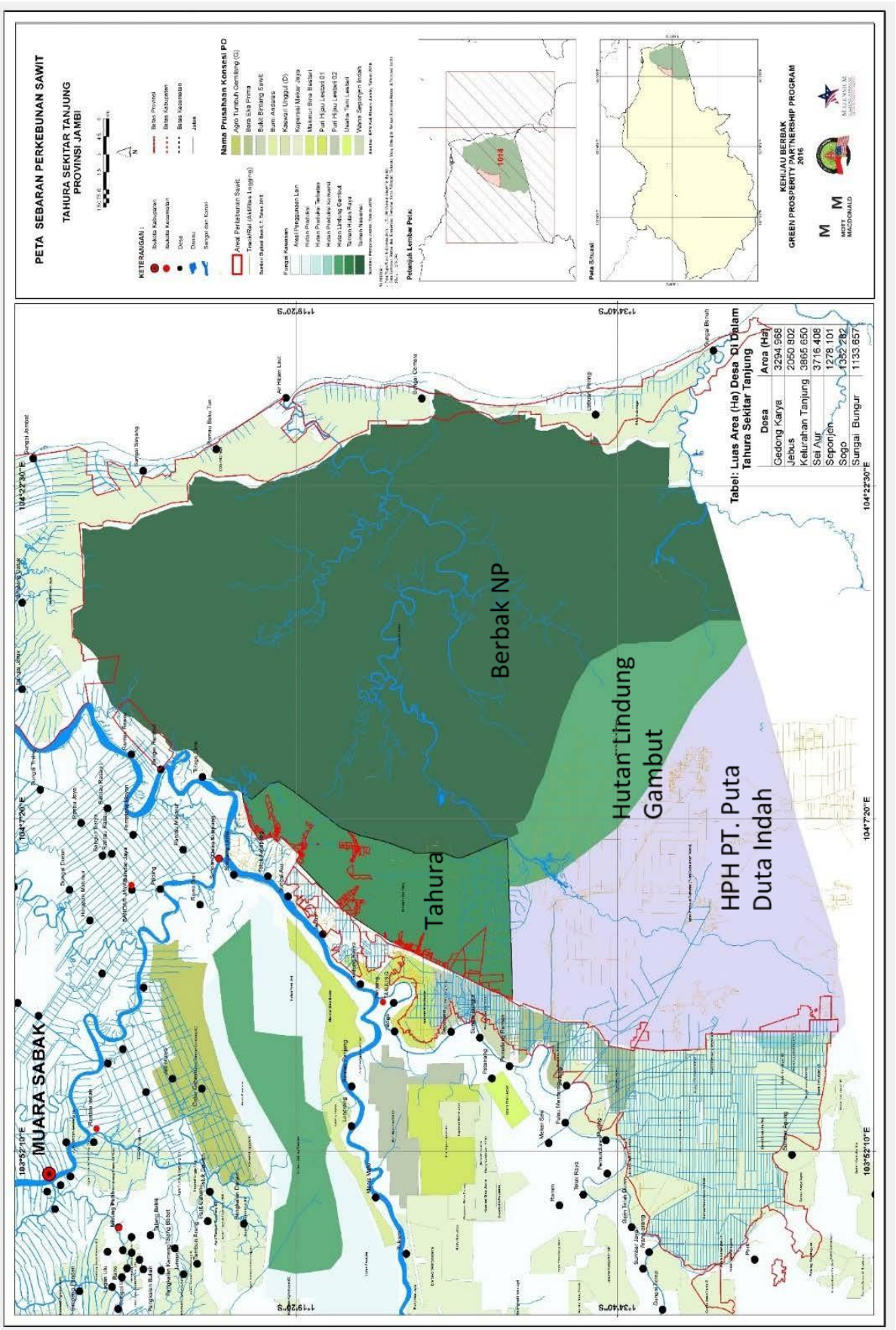
61. Illegal logging has been ongoing in Berbak NP for many decades and at least since the early 1980s. It occurs all around the NP, but the largest, most organized and widespread illegal logging appears to occur via the logging concessions to the southwest of Berbak NP and to a lesser extent through the Tahura in the west. This is especially via the forestry concession (HPH) located south-west of Berbak NP, that has been operational since about 1979. Logging trails (and possibly canals) lead from their concession area to areas within the NP and the peatland protection forest (HLG), see **Map 1**. The large degraded area in the central part of Berbak NP along the Air Hitam Laut river started with illegal logging in the mid 1990s, and expanded rapidly with major fires over 17,000ha in 1997 (Giesen 2004) and fires in all dry years since, especially in El Niño years. The HLG that lies to the south-west of Berbak NP and extends over 20,000ha has been logged to about 40-50% over the past 10-15 years. Two logging companies south-west of Berbak NP have a combined licensed area (HPH) of about 58,000ha, and this area has a legal status of limited production forest (HPT). The southern license has been suspended pending an investigative audit, as the company has planted pulp species such as jabon (*Neolamarckia cadamba*) and sengon (*Falcataria moluccana*) and converted part of the concession to oil palm, which is against regulations for HPT. The license of the northern area remains unchanged, and reportedly neither company is pursuing a plantation license status (HTI).

Fires in the great forest reserve (Tahura)

62. The Tahura (**Map 2**) originally extended over 20,800ha but has been reduced to 18,300ha as some areas have been re-allocated to villages in the north (Gedung Karya and Sungai Aur). It once was part of Berbak NP, but was excised and logged in the 1990s before formally being gazetted as a great forest reserve (Tahura). The Tahura management unit (UPTD) of the forest agency (Dinas Kehutanan) is in charge. By 2017 more than 90% of the Tahura area had been burnt and was devoid of forest land, i.e. impacted by repeated annual burning over the last five years, and probably longer. Around 2013, at the southern end of the Tahura, several thousand hectares were cleared and prepared for oil palm

planting (hence a denser network of canals). The oil palm plantation was destroyed by the 2015 fires. About 300ha of this southern area was also planted with jelutung in a programme involving local community members, but there was no rewetting and this was burned almost entirely during the 2015 fires, with only a few jelutung trees remaining. At the northern end, and at a few locations in the north-west, about 2000ha of the Tahura has been converted to oil palm by smallholders, mainly from Gedung Karya and Sungai Aur village. None live in the area but some shelters (pondok) have been constructed.

Figure 5: **Logging in limited production forest (HPT) and peatland protection forest (HLG**) **areas**. The SPOT 7 satellite image of 13 July 2016 shows Berbak NPP (top right), the great forest reserve Taman Hutan Raya (top left), the limited production forest Hutan Produksi Terbatas (bottom left) and the peatland protection forest Hutan Lindung Gambut (bottom right). Both, the HPT and HLG have a dense network of logging trails. About half of the HLG (see also **Map 2**) has been logged over the past 15-20 years, judging from the network of logging trails visible on the satellite image. Fires have not (yet) occurred in the HLG area, which may indicate that logging trails (and/or rails) have been used and not canals, but this needs to be ascertained.



Map 2: Boundaries of Berbak NP, the Tahura, peatland protection forest (Hutan Lindung Gambut) and the forestry concession for selective logging (HPH PT. Puta Duta Indah). The red lines indicate illegal oil palm plantation encroachments. In the north of Bebak NP, small oil palm plantation incursions occur within the NP boundaries.

63. An oil company has started a programme for restoring 300ha as part of their Corporate Social Responsibility (CSR) programme, and this is located at the southern end of the Tahura. To date, five box dams have been constructed in the canal and 200ha replanted by local community members, contracted by a sub-contractor. Species used are bintangur (the one planted here is reportedly *Calophyllum inophyllum),* gelam (*Melaleuca cajuputi*), jelutung (*Dyera polyphylla*), pinang (*Areca catechu*), pulai (*Alstonia penumatophora*) and tengkawang (mainly a group of *Shorea* species).

64. The Berbak Green Prosperity Partnership project aims to rewet the southern half of the Tahura in 2017. Rewetting the northern end has been deferred until 2018-19, because of disputes with local communities. The rewetting will be implemented by means of about 170 compacted peat dams, and perhaps a number of box dams along the western side near the communities. The aim is to replant 50ha in 2017, and a further 5,000ha in the following four years, provided that additional funding will be provided.

Fires and illegal logging in the northern peat swamp of Sembilang National Park

65. Illegal logging in the northern peat swamp of Sembilang NP is conducted by people who have encroached into the forest land west of the pulp-for-paper concession, immediately adjacent to the NP. They have settled along the road that runs along a mineral soil ridge to the north and north-west of the concession area. This area was until recently a heavily logged and degraded concession area. The area of the local community, mostly recent arrivals from Palembang, had its status changed to that of a village forest (Hutan Desa). Within two years though, all remaining trees had been felled and the area converted to a smallholder oil palm plantation. People from the same area are involved in illegal logging of peat swamp in and around the Sembilang NP, using the roads of the concession area for access. Some villages may have no official status and are considered hamlets. To access the areas in the Sembilang NP, the villagers make use of the roads and sometimes also the canal infrastructure of the company that operates in the concession area. Logs are converted to sawn timber in the field and taken out of the area on converted motorcycles. The Ramsar Mission team observed stacks of sawn timber under many of the houses in the recently established hamlets, and in the evening trucks loaded with sawn timber were driving on the road towards Jambi township.

Figure 6: Satellite pictures showing major land cover changes between 1989 and 1998 in and around the Berbak Sembilang area.

Figure 7: Forest loss between 2013 (orange) and 2017 (red) in and around Berbak and Sembilang NP, with highlighted pulp and oil palm plantations.

Ring of fire

66. Comparison of satellite pictures from 1989 and 1998 shows major changes in and around Berbak and Sembilang (**Figure 6**). Large areas within the National Park have lost their forest cover, including a substantial area in the middle of Berbak, a large area (Terusan dalam) on the border of Jambi and South Sumatra regions that separates both parks, a significantly widened denuded area along the Berbak coast and huge areas of peat swamp deforestation in the hinterland affecting the water catchment of the Air Hitam Laut river. The deforestation has removed most of the natural forests behind the Sembilang National Park.

67. **Figure 7** shows the forest loss that has occurred over the last years, since 2013, including major losses within and outside of the National Parks. It also shows the location of pulpwood and palm oil plantations behind the parks. The light grey areas in the middle of Berbak NP result from fires that happened already in 1997/1998 (**Figure 8**). These burnt areas have further developed into lake areas, presumably as a result of burning of a deep layer of peat causing subsidence and prolonged flooding. Extensive areas behind the Sembilang NP have been replaced with palm oil and pulpwood plantations, which require intensive drainage. To the south-west of Berbak there remains a large forested area outside of the NP boundaries, comprising of a forest protection area and a logging (HPH) concession (**Maps 1** and **2**). This HPH area is bisected by a long canal, presumably to transport logs.

68. **Figure 10** shows the occurrence of fires in this region between August and December 2015. In July, few fires existed, but in August fires started to the west of Berbak, a small patch in the north and some patches in the Terusan dalam area. In September, the fires in the north and in the Terusan dalam area had significantly expanded, and some fires started in the Tahura area and in the HPH. In October, the Berbak NP was surrounded by a ring of fire (**Figure 9**), eating away at the park from virtually all sides. The Sembilang National park seemed relatively safeguarded at the inland side by the occurrence of pulpwood plantations, especially the Tripupa plantation which at that time had been retired and rewetted, but some small fires did occur also there at the boundary of these plantations and the protected area. Near the provincial boundary between Jambi and South Sumatra (the Terusan Dalam or Tanah Pilih area) fires substantially expanded, covering more than twice the size of the earlier disturbed patch. Also the sides of the long canal in the forestry concession (HPH) south-west of Berbak NP were burnt, detaching a substantial part of the remaining concession forest (HPH) from the protected area. Overall, the trend seems clear that the NP is under major threat of fires. Unless fires can be prevented, Berbak NP, and also the peat swamp forest of Sembilang NP, are under high risk of being destroyed in the coming decades.

30 May 1997 1 May 1998

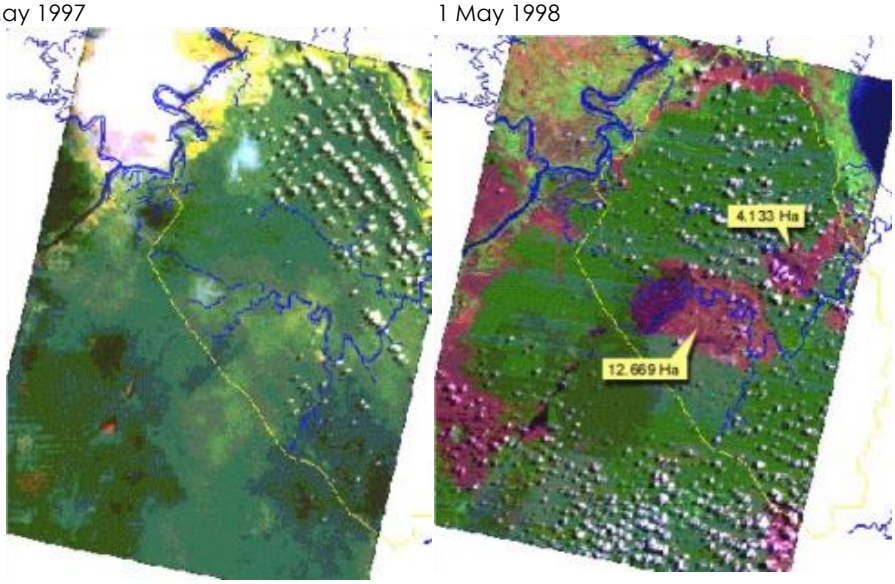


Figure 8: Satellite images, showing the fire scars (in red) of the 1997/98 fires that hit the centre of Berbak NP (adapted from the WARSI website; www.warsi.or.id).

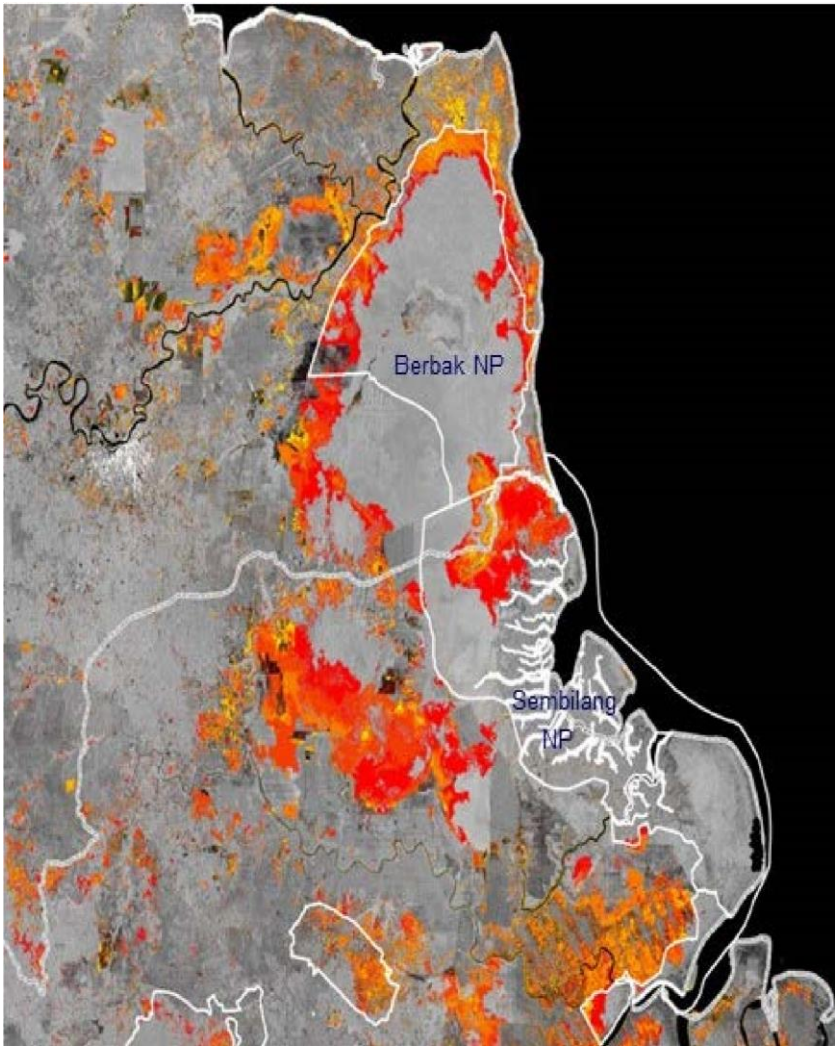


Figure 9: The ring of fire around Berbak NP, huge fire scars west of Sembilang NP, and the area of fire on the border of both parks (Tanah Pilih village, Terusan Dalam area).

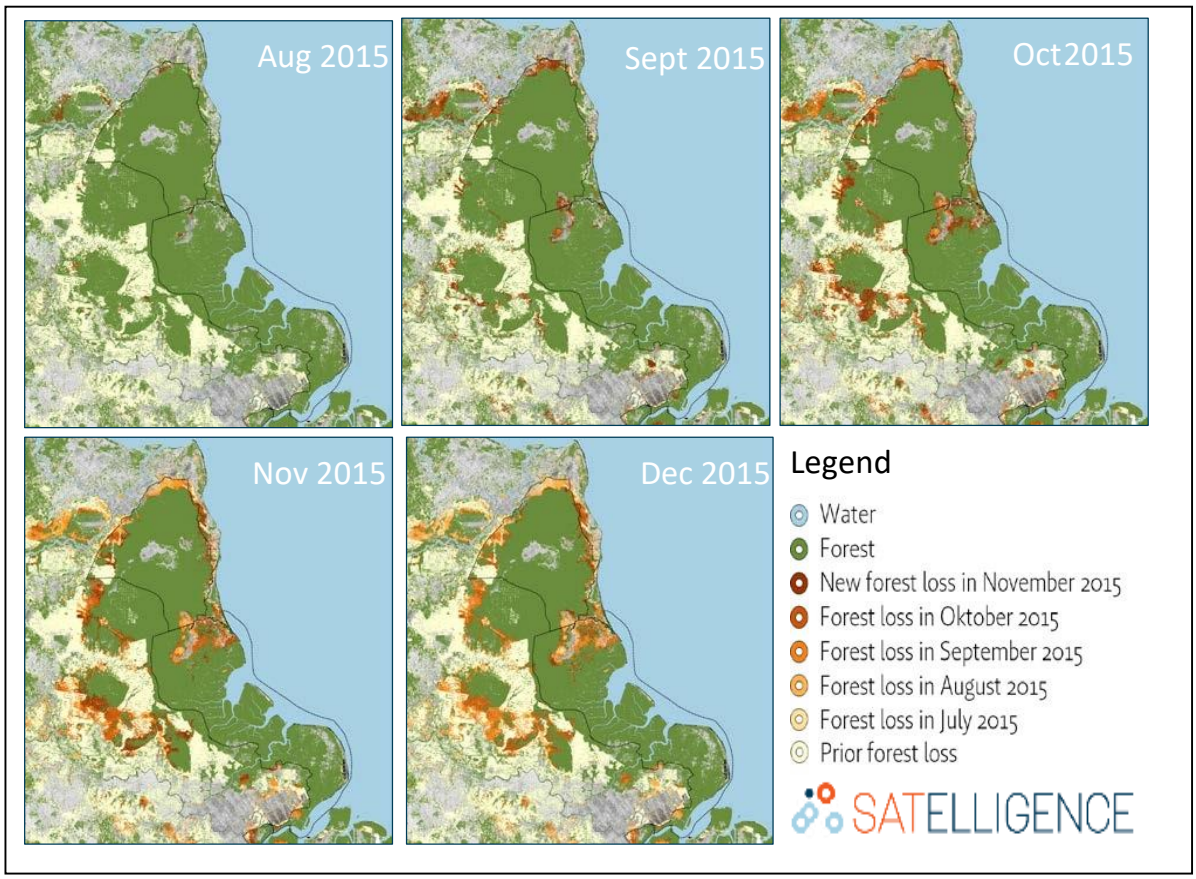


Figure 10: Forest loss in the Berbak-Sembilang region, Jambi and South Sumatra provinces, Indonesia, between August and December 2015, as observed with radar data. The forest loss in this period occurred mainly due to fires.

Consequences of fires: fragmentation and loss of connectivity

69. If the trend continues, and more fires occur that will expand further within the boundaries of the parks, the remaining peat swamp forests will be reduced in size and become fragmented (**Figure 11**). This would divide the peat swamp forest in the parks into smaller areas without forest corridors necessary for exchange between vulnerable animal populations. It would significantly affect the value of both areas for biodiversity conservation, as it will impact on the viability of the populations of peat swamp forest dependent species such as Tiger, Clouded Leopard, Otter-Civet, Binturong, Tapir, etc. Moreover, such smaller forest patches, lying in a sea of fire will stand not much chance of surviving in the longer term. Area III (**Figure 9**) is in effect already cut off, but a rapid restoration programme and prevention of further fires could result in recovery. If the fire scars in the Terusan dalam area are allowed to spread further to the west, the key corridor between the Berbak and Sembilang National parks will be lost.

Figure 11: Areas in the Berbak-Sembilang greater ecosystem that run the risk of being cut off by the expansion of fire scars.

Water flow reversal

70. Another major risk is the possibility of water flow reversal (**Figure 12**). The drainage of the peat soil in the hinterland of the Berbak and Sembilang areas affects areas that are part of the same hydrological system as the peat swamp forests in the national parks. The subsidence (compaction and peat carbon oxidation) caused by the impacts of illegal logging and drainage for oil palm and Acacia (pulp for paper) cultivation, can in the longer-term affect the flow direction of the freshwater in the peat domes. Water flow reversal could reduce the overall water flow of the Air Hitam Laut river in Berbak NP by diverting water from the Air Hitam laut catchment to the adjacent watersheds. This could have major impact on the river's freshwater biodiversity as well as on its role in freshwater provision to the coastal communities and their agricultural areas. The subsidence of areas behind the Sembilang National Park may result in a direct water flow reversal of waters that normally would have travelled from the peat domes into the mangrove area. The mangrove area reaches at some points around 10 km width, which indicates a very large freshwater input. When the part of the peat dome behind the Sembilang NP subsides too much, this freshwater may flow in the future into the opposite direction: to the hinterland. The reduced freshwater availability for the mangroves may then result in substantially enhanced saltwater intrusion into the mangrove, thus upsetting the conditions along which the various zones of mangrove vegetation zones have developed. Each zone is dominated by species that have adapted to certain saltwater regimes. If the hydrological regime changes too much, these zones may die, and this may lead to destruction of this valuable mangrove reserve.

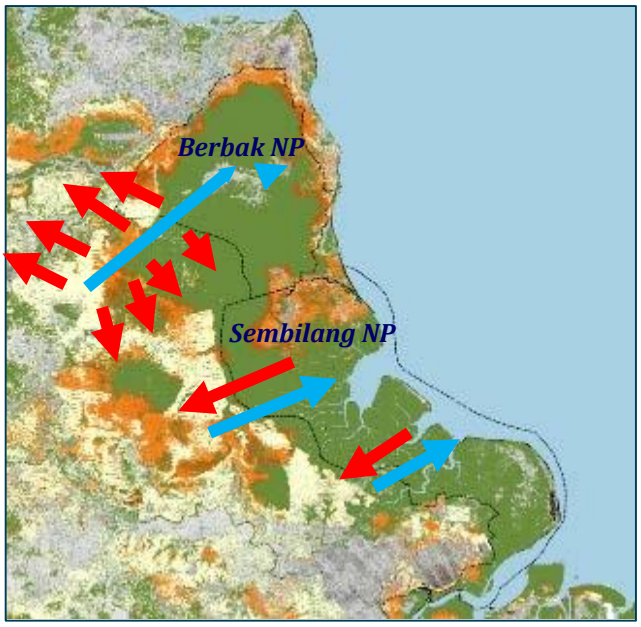


Figure 12: Risk of water flow reversal in the Berbak-Sembilang greater ecosystem. Blue arrows indicate normal water flow direction. The red arrows indicate potential reversal of flow as a result of inland soil subsidence caused by soil compaction and peat carbon

Addressing the issues in Berbak National Park (with Notes on Sembilang National Park)

Overview of current interventions and projects

71. **Berbak NP** has a replanting programme whereby they make use of seedlings produced by a locally operated nursery in Desa Simpang. If there is a need they place an order and seedlings are produced. In recent years, most replanting has been in Resort Cemara, i.e. along the east side of Berbak NP, where they planted 250 ha in 2011, 2400 ha in 2012 and 600 ha in 2016 (at densities of 400 trees/ha). Unfortunately, most of this has subsequently been destroyed by fire as it did not go hand-in-hand with rewetting, which Berbak NP staff recognize as being a need.

Photo 5: Canal blocks inspection by local rangers.

72. Current legislation makes it difficult to undertake engineering activities within the NP such as canal blocking and constructing dams. However, the Berbak NP staff are eager to observe the success of the planned compacted peat dam canal blocking program within the adjacent Tahura under the BGGP project over 2017. For blocking smaller (illegal logging) channels inside the forested NP, alternative dam constructions may need to be considered (**Photo 5** shows a dam constructed by local people).

73. **The Belantara Foundation** was established in January 2016 by the APP/Sinarmas company as a channel for CSR activities (to which other companies have also pledged funds). The focus is on sustainable landscape management and conservation around plantations that are managed by the group. As such, they have a particular interest in supporting peatland restoration programmes and are currently considering funding proposals from BGPP (see below) and the local NGO Gita Buana for peatland restoration in the Berbak buffer zone.

74. **The Berbak Green Prosperity Partnership** (*Kehijau Berbak*) programme is a project mainly funded by the Millenium Challenge Account Indonesia. It is being implemented by a consortium led by Euroconsult Mott MacDonald and including local NGO partners (Gita Buana, Walestra, Mitra Aksi), University of Jambi, a local palm oil company and international sub-contractors including Deltares, SNV, Forest Carbon and Financial Access. There are three components:
    i) sustainable peatland management, that includes restoration and replanting in the Tahura, and livelihoods programmes with local communities;
    ii) sustainable oil palm promotion, on mineral soils in areas near Berbak NP; and
    iii) support to the national peatland agency BRG.

    Due to delays, peatland restoration in the Tahura is not expected to start until mid-2017, along with first planting of 50ha.

75. **Cappa Ecological Justice** (*Keadilan Ekologi*) is a NGO based in Jambi, focusing on the monitoring of climate projects and the impact of policy operations, building community awareness, public policy interventions related to carbon market development and climate debt. They are the main implementer of a 500 ha peatland restoration project located in the Berbak buffer zone at Desa Simpang underway since 2015. Since 2016, they have been assisted by the NGO Gita Buana. To date, 15 box dams have been constructed, but water levels have been raised only to 80 cm below the surface, what ecologically still corresponds to deep drainage. This livelihoods programme therefore

consists mainly of planting of dryland species in the area, including cocoa, rubber, duku and betelnut (*pinang*).

76. **Gita Buana** is an NGO established in 1987 in Jambi, implementing projects with communities around Berbak NP since 2005, with funding from IUCN, World Bank, European Union, UNDP, Clinton Foundation and FAO. Their focus is mainly on promoting local sustainable livelihoods. They are implementing livelihoods projects in the villages along the Berbak coast, are a partner in BGPP, are involved on the restoration project at Desa Simpang being implemented by the NGO Cappa, and receive funds from the Belantara Foundation, among others.

77. **Koroar Berbak** was a programme implemented by the Tropical Forest Conservation Action, a consortium lead by the Zoological society London with Mitra Aksi, Walestra and Kehati, with a major focus on the Berbak buffer zone. It ended in 2016 and has not carried out interventions on the ground, the focus being on bringing about institutional changes.

78. **The Zoological Society London** ZSL is involved in research and implementation of conservation projects. Their Indonesia Programme began formally in 2002 and now operates under a MoU with the Indonesian Ministry of Environment and Forestry. Its geographic focus is on the regions of Jambi and South Sumatra. Its conservation and research work is targeted to Berbak NP since 2007. A Sumatran tiger conservation programme is ongoing.

Photo 6: Coordination of different authorities in the framework of fire control.

Existing fire prevention and control systems

Policies

79. Various Indonesian Government policies aim at preventing (peatland) fires, including:
    - extending the moratorium on new permits on primary forest and peatlands,
    - establishing the Peatland Restoration Agency (BRG) to rehabilitate and restore degraded peatlands by raising water levels and revegetation,
    - endorsing a policy to demote local heads of police and army who fail to prevent fires, and
    - establishing regulations that forbid the use of fire for land clearing, and preparing cases against those responsible for fires.

Photo 7: The fire brigade (*Brigdalkar Manggala Agni*) based in desa Simpang, consists of over 30 fire fighters.

80. However, these policies all have remaining weaknesses:

- The moratorium has not been very effective in preventing further conversion and loss of forests and peatland (Suwarno et al., 2016). Large areas that were already licensed before the Moratorium took effect have been logged since. Commercial companies have circumvented the regulation and local smallholders slip under the radar as individual impacts are small. Margono et al (2014) report that of the 15.79 Mha of forest cover loss for Indonesia in the period 2000–2012, 38% or 6.02 Mha occurred within primary intact or degraded forests. Annual primary forest cover loss increased in that period, with the highest total primary forest cover loss having occurred in 2012 (0.84 Mha). This was the first year of the Moratorium, put in place in 2011, which prohibits the issuing of new licenses for plantation concessions in primary forest areas and peatlands. However, substantial areas in Sumatra and Kalimantan, having already been licensed for conversion prior to the Moratorium, may still be legally converted (**Figure 13**, Wijaya et al 2012).

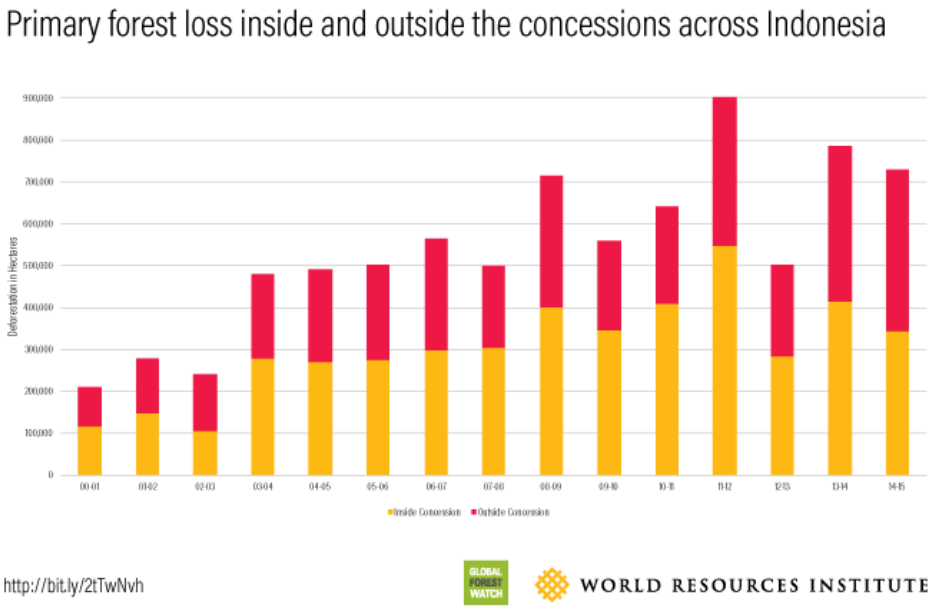


Figure 13: Deforestation is happening within existing concessions as well as outside concessions. (Wijaya et al. 2017)

Red - outside of concessions
Yellow - inside concessions

- Raising water tables is indeed called for by the latest peatland policies, but these still allow for drainage of soils down to 40cm without specifying if this is a maximum or average drainage level. Any drainage of peat soil leads to desiccation and increased fire risk. Keeping drainage at 40cm below the soil surface during the wet season means that water levels may be well below 1m below soil surface during dry months.
- Lastly, fire remains the tool of choice to clear and prepare land for most farmers, as this method is cheap, quick and effective, and the chance of getting fined or jailed is small (as evidenced by the many fires and the fact that hardly anyone is fined or jailed for this).

Institutional aspects at the level of the Indonesian Government

81. At present, responsibility for fire management is spread across various ministries and agencies, including the MOEF, Ministry of Agriculture, Ministry of Home Affairs, the Disaster Mitigation Agency, the Police and the Military. During meetings held with local authorities and communities on 15 March in Suak Kandis, it was mentioned that roles and responsibilities are unclear, as is the sequence in which the various parties are to undertake action. Coordination capacity needs to be enhanced and there has been a call to formulate an overarching fire policy and regulation, to improve actions.

82. With Menhut PP07/2016 of February 2016, the MOEF transferred the responsibility for fire management to the newly established central agency for the implementation of climate change mitigation (PPI: *Pelaksanaan Mitigasi Perubahan Iklim*) responding to fires. However, in order to be able to intervene rapidly, a letter of the Director General KSDAE, of 9 October 2017, returned the fire

fighting coordination role to Berbak-Sembilang NP. At central level, the Directorate General of the PPI agency also deals with measuring, reporting and verification of climate change adaptation and mitigation, besides forest fire control.

Photo 8: MPA members fighting fires run major risks, and require some kind of compensation and insurance.

83. At the provincial level, natural resources conservation centers (BKSDA), the local agency of PHKA, supervises the office of forest fire fighting (DAOPS) and its forest fire control brigade (*Manggala Agni*) tasked with patrolling and extinguising fires. Jambi has only four *Manggala Agni* units with 253 staff that need to cover the entire region with a limited budget (1.1 million USD in 2011). They are not mandated to access agricultural land to extinguish fires. However, political pressure is often exerted to have them extinguish fires in plantations.

Community fire programmes

84. Community fire awareness groups *Masyarakat Peduli Api* (MPA) have been established in 32 communities throughout Jambi (data of 2011), and their task is awareness raising, early detection , patrolling, and fire extinguishing (**Photo 8**). While in principle this could be an effective way of addressing fires, there are only a small number of groups in the entire Jambi region. Ideally, every village should have a well-equipped and trained MPA. These groups are little trained and not sufficiently equipped or paid, which are tasks of the District authorities). This requires direct funding support and a different approach to payment. Often, MPAs are only paid if they extinguish fires, and this can create perverse incentives. The personal security and insurance of members of the MPA is largely ignored. With the absence of an established system, any assistance provided to a fire fighter that has an accident whilst fightin a fire, is at the discretion of the local authorities. MPA representatives are therefore calling for an insurance system that covers mishaps in their call of duty.

Prevention and early detection of fires

85. The focus needs to be more on prevention and early warning, than on fire extinction which is difficult, even under best circumstances, and extremely difficult in peatlands that are difficult to access, and where fires may continue underground for long periods. The main tool in prevention of peat fires is full rewetting of peat soils up to the surface - i.e. not simply limited drainage down to 40cm below the soil surface, as the new regulation (PP71) stipulates. Any drainage limit below the soil surface will leave desiccated dry soil layers, particularly during dry periods. Soils drained to 40cm below their surface are extremely prone to fires and carbon oxidation, and will therefore not sufficiently reduce peat fire risks. The method to be used for sufficient rewetting of peatlands, is full canal blocking. This will also prevent easy access to rewetted areas, and so reduce the risk of illegal logging and subsequent soil oxidation and fires.

86. Early detection of fires, as well as rapid response capacity, is necessary if one is to be successful in extinguishing a fire. The sooner a fire is recorded and responded to, the better the chance for its extinction. Fires covering several hectares are very difficult to extinguish. At present, the MPAs depend on visual detection of fires from the ground level, which is not very efficient. The have then to send a warning via their mobile phone. This does not work when batteries are not charged or where there is no signal. A system of simple watch towers manned during the fire season is more promising. The towers need to be equipped with compasses to precisely record the angles and locations of fire sightings, and a waterproof communication system, possibly including a charging facility for mobile phones in the watch towers.

Integrated planning and implementation

87. There has been significant improvement in spatial planning and peatland management over the past two decades. Indonesia has committed to re-arrange its mapping resources by ensuring that all mapping products should refer to only one single designated national map, knows as the One Map Policy. This should help to coordinate all mapping issues in Indonesia, preventing irregularities and inappropriate developments. Local autonomies have in some cases also created impediments for efficient planning and policy implementation, with district heads (*Bupati*) until recently having discretionary powers for issuing permits. The power of the District heads has recently been restricted, especially in the land use-related sector, by moving the authority to the central government. Other improvements stem from the relatively detailed provincial spatial plans (*Rencana Tata Ruang Wilayah*, and earlier *Rencana Umum Tata Ruang*) that have been prepared for Jambi since the 1990s, and these are used to guide development. Also, in the past 10 years it has been recognized that peat domes need to be managed as single peatland hydrological units[1] or *Kesatuan Hidrologi Gambut* (KHG) and not as parts of other river basins they happen to flow into, and this understanding has been incorporated into legislation (SK-menlhk-no.129-th2017_ttg peta). Forest management has been overhauled in the last 10 years and in terms of spatial forestry planning the focus is on the establishment of forest management units *Kesatuan Pengelolaan Hutan* (KPH). Under the KPH system, three broad management functions are recognised: conservation, protection and production. Forest management units are to be the smallest management unit for forestry, and are to consist of single ecosystems or to cover only on one watershed. More than one function may occur in a single KPH, but it is to be classified according to the dominant type of function (KepMenKLHK No. SK.130/MENLHK/ SETJEN/PKL.0/2/2017).

88. These positive developments in terms of integrated spatial planning are yet to bear fruit on the ground, as implementation remains an issue. The establishment of KPHs has stalled, including in Jambi province, and the one planned (but not operational) for Berbak (SK774/Menhut-II/2009) includes two concessions for selective logging (HPH) and the peatland protection forest (HLG) with a total area of 65,000ha, but does not include the National Park area. A larger peat dome-wide KPH is needed that also includes Berbak and Sembilang NP. This approach is now being considered by the forestry department *Dinas Kehutanan*. Remaining challenges for spatial planning include the need to work with accurate maps, to compare and align maps between different agencies, and to assure consistancy with the provincial spatial plan (RTRW), before issuing permits.

Reducing the impacts of unsustainable villages/hamlets

89. Uncontrolled or poorly planned development has led to the establishment of hamlets and villages in areas where it is difficult for communities to eke out a livelihood without impacting the national park. Some villages were established a long time ago, such as those along the east coast, where villages such

[1] Indonesia defines a peatland hydrological unit (KHG) as the basis for the management of peatland landscapes.

as Air Hitam Laut have existed since the 1960s. Being hemmed in between the sea and the national park, these coastal villages originally focused on coastal fishing and coconut plantations. However, over the past ten years there has been a significant expansion westward into the park, especially for conversion to oil palm plantations, but also for illegal logging. Given the lack of space for legal expansion this is not surprising, but the approach taken to date has been to accommodate, accept the status quo and adjust the park boundary. However, this attitude is approaching its limit as Berbak NP now threatens to be cut in two. While the NP boundary needs to be acknowledged, this needs to go hand-in-hand with the creation of sustainable livelihood opportunities. This may also require different approaches, such as establishing small-scale local industries, e.g. krupuk, terasi (shrimp paste), handicrafts, nipah sugar, and so on, based on adding value to already available local products. Another approach that could be taken is offering opportunities outside the village (e.g. land, and initial financial support) and away from Berbak NP, thereby encouraging outward migration.

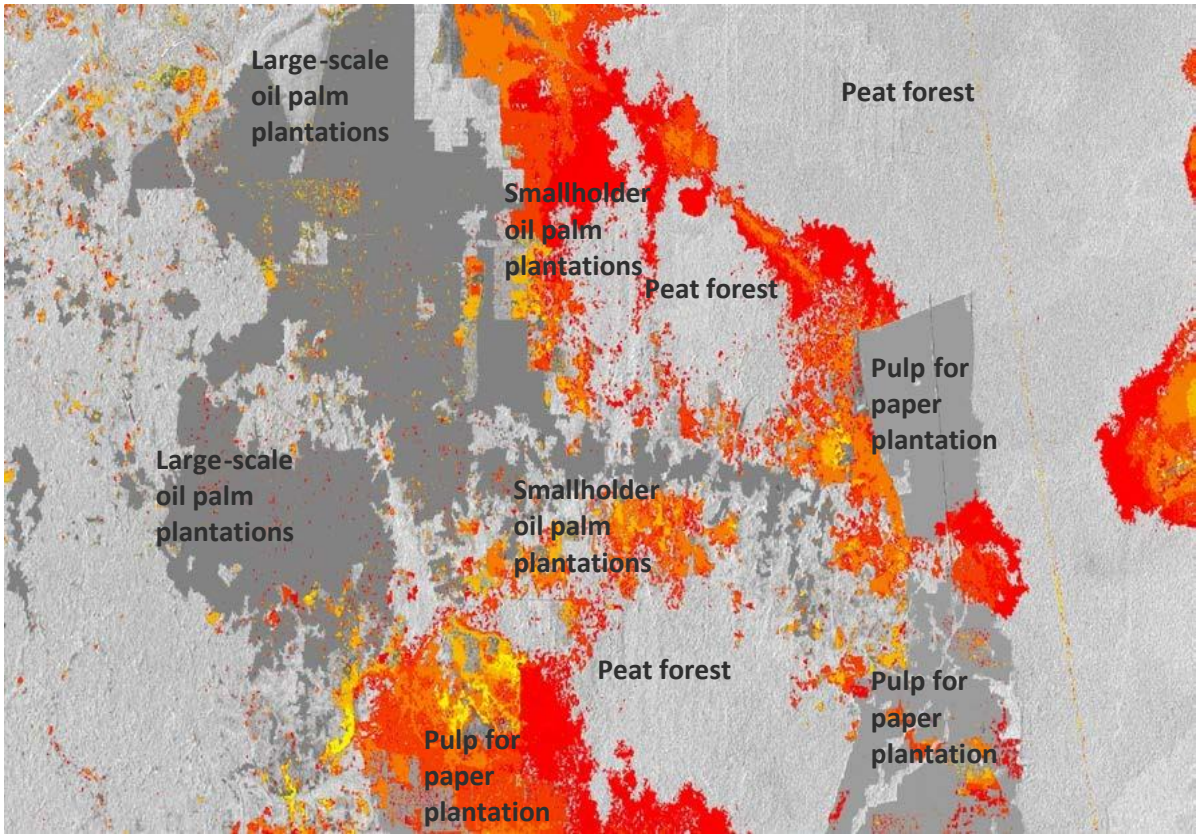


Figure 14: Fire scars observed with radar, west of Sembilang NP and in the HPH selective logging concession west of Berbak NP. Fires were linked mainly to smallholder palm oil development, HTI industrial plantations and the canal system in the HPH area. In the east, the fire scar of Terusan dalam (Kampung Pilih) is visible, and south-east of the HTI plantation in the north east, fires are entering the Sembilang NP from the west. Source: Satelligence 2016, commissioned by Wetlands International.

90. Other examples of poorly sited villages are (transmigration) settlements located on peatland. These are mainly located along the western border of Berbak NP and its buffer zone, and include Sungai Aur and Gedong Karya (to the northwest of the Tahura) and Petaling Jaya/Gambut Jaya[2] in the far southwest (bordering on the HPH area near provincial border). The latter, for example, have been established on deep peat (>5-6m) and their economic activities (mainly oil palm) directly affect the peat dome and the forests.

[2] In 2003-2004 this location was known as 'Sungai Gelam'; the name has since been changed.

91. Sustainable activities need to be promoted and unsustainable ones phased out. This includes rewetting the peatland, replacing oil palm with alternative species adapted to rewetted peat, and assisting with alternatives to illegal logging as a supplementary income. Saw mills need to be closed and the canal linking the village to the forested area needs to be blocked. Lastly, as with the coastal villages, similar incentives need to be created to entice people to migrate out of the area.

92. Similarly, over recent years, major uncontrolled developments have taken place west of the Sembilang National Park, with rampant illegal logging using canals and active removal of sawn timber by motorcycle. The deforestation has reached the HTI plantations, and the fires pose a serious threat to both the plantations as well as the remaining forests outside and inside the national park. The large-scale oil palm plantations had relatively few fires, but may be located more on mineral soils. The plantation adjacent and NW to Sembilang NP did not burn because it was retired by the concession holder and rewetted before the fires started (Pers Observation of several of the RAM Mission members, prior to the mission in Septrember 2016, and evidenced by the remote sensing materials presented in this report: **Figure 14**).

Required actions for Berbak National Park, with some notes on Sembilang NP

Integrated planning and implementation (Menko/Bappeda, Pemda)

93. Improve coordination between the different government bodies involved in land-use planning, as well as collaboration and coordination in monitoring and enforcement. This pertains to all aspects of land-use planning and boundary delineation, e.g. for national parks, Protection Forest, HPHs, HTI, as well as enforcement of such boundaries, inside as well as outside of the protected areas. The One-Map policy can help by providing one integrated basis for planning, but even this map has been subject to changes related to requests for permits instead of land systems and soil features. For the Berbak and Sembilang NPs and their surrounding areas a proper science-based base map should be developed and adopted for planning. This will also enable the identification of all conflict areas, illegal settlements, and threats - particularly to remaining pea swamp forests and degraded peat land. In view of the overriding importance of halting further fire occurrences, all decision making should be focused on reducing fire risks: reducing drainage, stopping deforestation, closing drainage canals and introducing commercially interesting alternative land-uses utilizing indigenous valuable peat swamp forest species.

94. Encroachments into the National Park boundaries should not be condoned, as this encourages further encroachment. Past boundary adjustments of the Berbak National Park have not been adhered to and local communities have failed to respect these. Also in the Sembilang NP, the village Kampung Pilih poses an existential threat, being the cause of major fires in the Terusan dalam area, which are now threatening to cut the Sembilang NP of from the Berbak NP and from the peat swamp forests in the HPH which forms an important corridor between the parks. There is an urgent need to reclaim for the NPs the areas that have been illegally encroached upon, and establish restoration programmes to restore the natural hydrology in these areas (by blocking illegal logging channels and the plantation drainage systems) and supporting natural revegetation. Options to realize such conservation area restoration include collaboration with private sector under RAP/PAN licenses and utilizing the potential to establish ERCs along the boundaries of the NPs to create physical and economic buffer zones. Such companies should also engage with local communities and can provide financial incentives to establish similar land restoration approaches for community-managed areas.

Enforcing the NP boundaries

95. **Blockage of access for illegal loggers:** Illegal logging has been rife in different parts of the Berbak and Sembilang NPs. Illegal loggers have access through roads owned and governed by the local government as well as access points provided by HPHs. The logs and sawn timber are collected in the villages and transported by trucks on an almost daily basis, which should make it not too difficult for law enforcement authorities to identify the buyers and link them to the networks behind.

96. **Access points to the National Parks should be closed** wherever possible. For instance, the Tripupa plantation, which was retired by APP in early 2015, has been rewetted, involving the blockage of drainage canals, especially also the perimeter drains. Some perimeter drains, however, have been left open, because local people claimed the right to use these for access to fishing grounds in the NP. In order to avoid conflicts with local people, APP reportedly felt therefore not to be in a position to close these canals. The canals have been used for transporting illegal logs (**Photo 9**). In 2015, fires started south-east of the Tripupa plantation. To prevent further illegal logging and fires, it should be considered a priority to close all access points to the NP from the west, including canals and roads.

Photo 9: Transport of illegal logs coming from Sembilnag NP, floating in the northern perimeter drain of the plantation adjacent to the Sembilang NP at its NW side. Photo: H. Joosten on 6 Sep. 2016

97. **Relocation of unsustainable villages/hamlets**: Apart from the illegal hamlets that have developed west of Sembilang NP, there are several official villages in the surroundings of both NPs that appear to be unsustainable. These include the 'Sungai Gelam' transmigration area (now named Gambut Jaya and Petaling Jaya) was established in the late 1990s on 5-6m deep peat close to the border of the HPT area and close to the border with South Sumatra. This village has been developing oil palm plantations on deep peat, which have no long-term viability as the drained peat soil will subside and become increasingly flooded (Silvius, 2005; Wösten et al 2006). The drainage for the plantations will also have an adverse effect on the hydrology of the nearby HPH, creating fire hazards to the remaining peat swamp forests. The Tanah Pilih village in the Terusan dalam area is another official village that seems to have major problems in surviving without seriously impacting on the protected area. It was developed after the Sembilang NP was established, and is located within the NP boundaries. Some of the other coastal villages, i.e. on the east side of Berbak, such as Sungai Jambat, have been suffering increasingly from salt water intrusion, impacting on their agricultural productivity. This may be caused by decreasing water retention and supply capacity from the adjacent peatlands in the Berbak NP, resulting from the illegal encroachment by the same villages which have dug drainage canals into the NP (Silvius et al. 2000). By degrading the peatlands in the Berbak NP, these villages are gradually removing the very freshwater buffer that is essential to maintain their resilience against salt water intrusion.

98. It would be useful to implement longer-term feasibility studies or extended Cost-Benefit Analysis for these villages, and determine what options and limitations there are for their continued existence and development. In view of the need to stop the additional income flow from illegal activities based on unsustainable resource exploitation in the NPs as well as the peatland subsidence and related emerging water management issues, consideration may need to be given to voluntary assisted relocation of recently established migrant-villages that appear to have no long-term economic viability.

99. To prevent further encroachment into the NPs, consideration should be given also to removal of the illegal smallholder plantations that are located within the NP boundaries. This pertains particularly to the oil palm plantations in the north of Berbak (**Map 2**). However, as some of the developments happened many years ago - and have existed for a considerable number of years, some recognition may need to be given to the status quo. Consideration could therefore be given to replace the plantations with sustainable land-uses that do not require drainage. This may involve various options of paludiculture, i.e. the cultivation of crops of indigenous peat swamp tree and plant species with an appreciable commercial value, such as Jelutung (for latex production), Sago (for starch production), Illipe nut (for vegetable oil production), Rattan (for furniture and weaving), etc. Such paludiculture zones can create useful buffer zones for people and nature, reducing fire (and smog) risks with all the devastating impacts on economic resources and public health, and creating a hydrological buffer for park and people. A plan should be developed with the communities to gradually phase out the current unsustainable land-uses, and phasing in of the alternatives. For instance, oil palm plantations could be removed at the end of their productive period (around 25 years), which will reduce the unnecessary loss of capital investment.

100. To uphold the law and remove any incentive to try further encroachment into the Parks, it will be key to implement rapid law enforcement with respect to the immediate removal of any new illegal encroachments and other illegal activities. Consideration should be given to the establishment of a special independent unit for the NPs focused entirely on such law enforcement.

101. **Intensification of land-use and economic activities outside of NP boundaries:** To enable enforcement of the NP boundaries, appropriate development opportunities need to be provided and supported within the legal boundaries of the settlements or elsewhere outside of the NP. While much of the development on the peatlands so far has been focused on drainage-based land-uses, these are likely to be jeopardized by the soil subsidence that results from the drainage. As most of the peat swamps in and around Berbak have their drainage limit around sea level, most agricultural areas will ultimately – with progressing subsidence – be subject to increased and prolonged flooding, impairing the productivity of the land. This counts for both smallholder agriculture as well as large-scale plantations.

Photo 10: The production of edible swiftlet nests is a booming sector, with swiftlet houses emerging everywhere in the lowland landscapes of Sumatra and Kalimantan. Here swiftlet houses are shown along the road to Suak Kandis, Berbak Region. Photo: M. Silvius.

102. Options for development may therefore best be sought in intensification of land-use on available mineral soils, while restoring the hydrology of adjacent peatlands as a resource of freshwater and to optimize the freshwater pressure needed to minimize salt water intrusion. Care needs to be taken, though, to check for acid sulphate soils, which occur widespread in the coastal regions of Jambi and South Sumatra provinces. Other options for development may lie in non-agriculture and forestry sectors. These could include poultry farming, the booming swiftlet nest industry (**Photo 10**) and small-scale household industries, such as krupuk production.

Provide alternative income sources - paludiculture

103. In view of the inevitable medium to longer-term consequences of continued drainage of the dome shaped peatlands in the lowlands of Indonesia, in terms of compaction, GHG emissions, related soil subsidence and flooding, which will ultimately affect plantation productivity and may eventually result in abandonment, it is recommended that land managers and policy makers should consider this increased risk of flooding in their economic and land-use decisions (Hooijer et al, 2015).

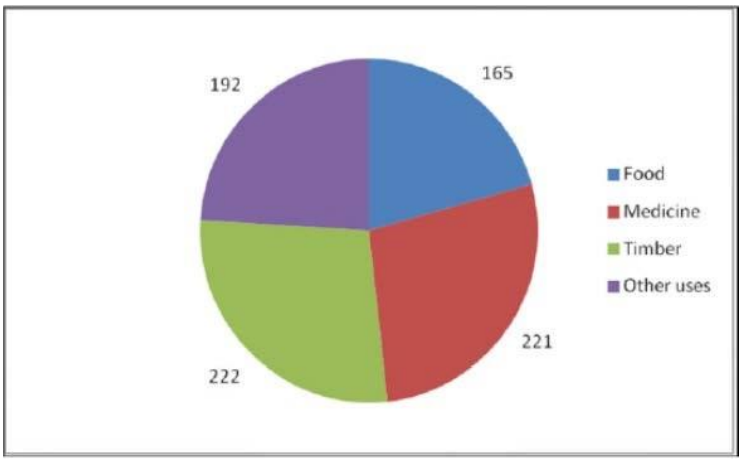


Figure 15: Different uses of peat swamp forest species in Indonesia (Giesen 2013).

104. A logical step, in order to prevent loss of productive land, is to stop drainage and develop nondrained land use options: paludiculture, as currently promoted by the BRG, the Peatland Restoration Agency. Paludiculture includes land management techniques that use biomass from wet and rewetted peatlands under conditions that maintain the peat body, facilitate peat accumulation and provide ecosystem services associated with natural peatlands (Joosten et al. 2012). Paludiculture can also be considered as a swamp cultivation approach used as a means of rehabilitating degraded peatlands, while making these economically useful at the same time.

105. Giesen (2013, 2015) developed a first overview of paludiculture options in Indonesia, identifying a long list of 500+ potentially useful species (see **Figure 15**), and further short-listing 82 species that could be used in paludiculture programs. Some of the most promising species include Jelutung (for latex and timber production), Illipe Nut (also known as Tengkawang, for vegetable oil production; **Box 1**), rattan (for furniture and weaving), Sago (for starch production) as well as a number of species for pulp-for-paper production (**Photo 11**). Giesen (2013) identified 111 high quality timber species, 84 fruit species, 47 species used as vegetables, 16 species of spices, 15 starch producing species, 8 edible oil and fat producing tree species, 7 edible nut species, 5 tea species, and a total of 222 species with medicinal uses and 191 species with other uses (**Figure 16**), such as for the making of utensils, for binding, weaving, damar/oil, dyes, ornamentals and latex.

106. In order to promote paludiculture options, models are needed for both large scale plantations and local communities, as needs and approaches differ considerably. Plantations will aim at a narrower

range of products to take advantage of economic scale, while communities can focus on a much wider range of products and can more quickly adapt to the market. Both can potentially tap into REDD+ funds in support of paludiculture, but communities will need to work together with NGOs or carbon companies to be able to fulfil the complex MRV requirements and link to the international voluntary carbon market.

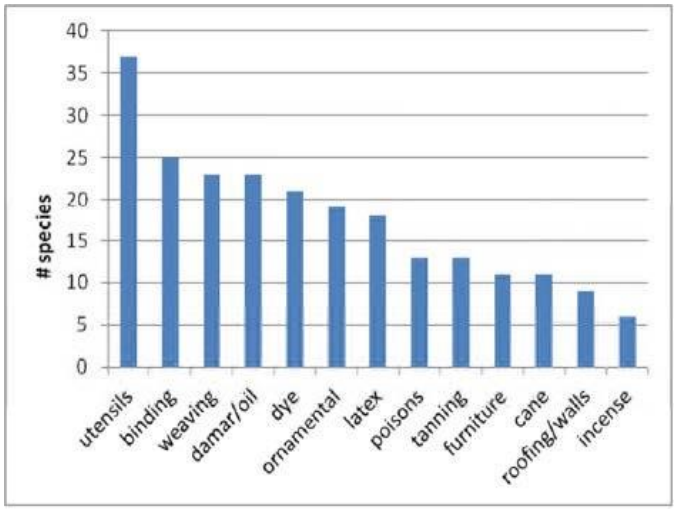


Figure 16: Different uses of peat swamp species (Giesen, 2013).

107. Key in fire prevention is the restoration of the peatland hydrology, i.e. the rewetting which involves optimally restoring the water levels to near natural water levels and dynamics. It should be noted that peat swamp forests are hydrologially dynamic areas and that even in natural peatlands water levels may fluctuate from well above the ground surface to over 1 meter below. Wherass the peat soil should remain waterlogged to prevent fires and peat carbon oxidation, the fluctuation of dry and wet seasons with drier and wetter periods are essential for the survival of the natural peat swamp vegetation, as even natural peat swamp forest will die if it will be flooded for too many and too prolonged periods. This means also, that for successful implementation of paludiculture the peat should not be flooded too much and often, and hence it is also important for paludiculture that peatland subsidence is not allowed to progress for too long.

Photo 11: Harvest of *Melaleuca*, a species that can also be used for pulp- for-paper production. (W. Giesen).

108. The permanent crop vegetation, also contributes to the maintenance of a wet micro-climate and a soil micro-relief that enhances water retention capacity of the ecosystem. All these aspects contribute to a fire-resilient system.

109. Unfortunately, many attempts to cultivate indigenous peat swamp trees have failed, because the implementers did not restore the ecohydrology of the system, thus perpetuating the high fire risks of drained peatlands. It is key that in peatland restoration programmes only peat swamp species are planted, as any other crop will either have limited or no production, or will require drainage, continuing the fire risks and demise of the peat layer. Attempts at promoting paludiculture crops

or establishing paludiculture plantations need to go hand-in-hand with full rewetting and fire prevention. From failed attempts, e.g. with Jelutung on drained peat, local farmers became wary and gave the products a bad reputation. However, the lesson to be learnt is that the restoration (rewetting) of the peatland ecosystem has to be carried out simultaneously. No further attempts should be promoted or supported to plant dryland crops on peatlands. Examples of dryland crops that are often promoted as 'sustainable' peat cultivation options are e.g. *Aloe vera* (**Photo 12**), dragonfruit, pineapple, maize, coffee, cacao, etc... Lastly, it has been noted that various regulations that were established to control the harvesting of non-timber forest products from natural forests, now hamper efforts to establish paludiculture crops, as farmers find they need permits for harvesting, processing and trading their commodities and are also heavily taxed at the same time. Obviously, these regulations were not intended for this purpose and need to be reviewed.

Photo 12: Cultivation of *Aloe vera* has often been promoted as a sustainable peatland crop. However, the opposite is true: *A. vera* is a desert species that requires drainage and exposes the soil surface to direct solar impact, thus leading to high levels of peat oxidation. Photo: W. Giesen.

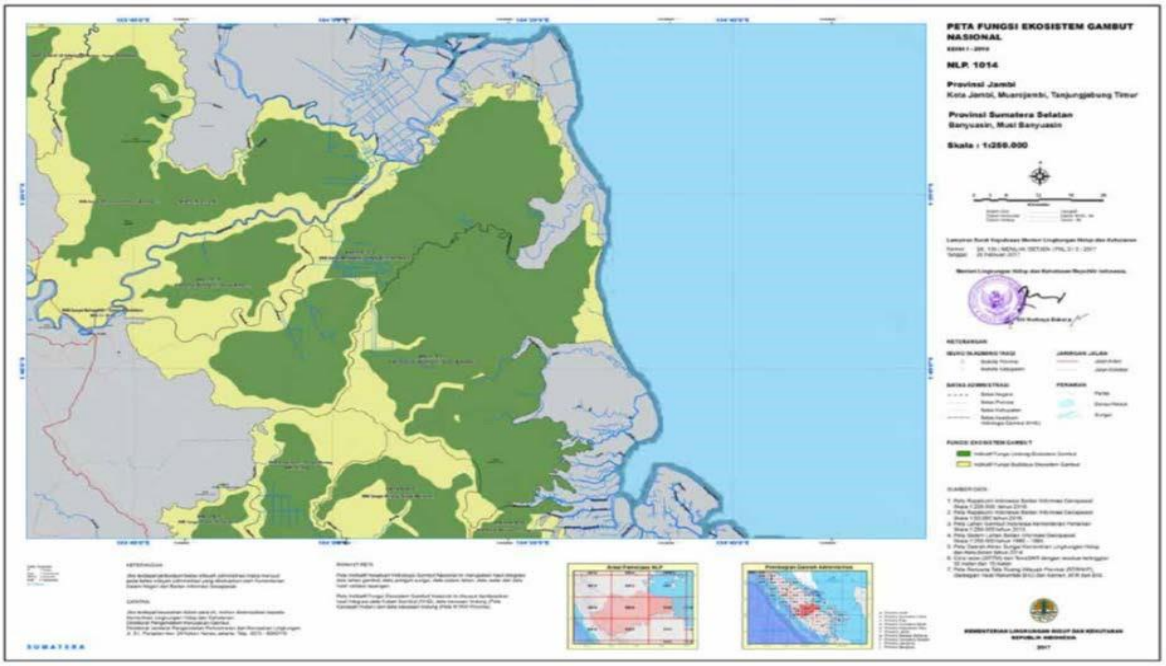
Carbon sector

110. A major new opportunity for the conservation and restoration of peat swamp forests is provided by the emerging carbon market. Options for the management authority of the Berbak and Sembilang NPs are to seek collaboration with carbon companies, to help with establishment of a PDD for approval by the Verified Carbon Standard (VCS). This can include establishment of additional capacity for conservation and restoration actions, fire prevention and control, development of buffer zones and collaboration with surrounding communities. Indonesian legislation allows such commercialization of the carbon potential (storage, sequestration) of (peat) forest areas under the IUP RAP/PAN licensing regulation. Private sector should be facilitated in such engagement, including provision for reduced licensing tariffs, tax breaks and succinct standard licensing procedures governed under the authority of the National park authorities (for within the NP boundaries).

Box 12: Illipe Nut / Tengkawang

The paludiculture of Illipe nut, known locally as Tengkawang (*Shorea stenoptera* and several other *Shorea* species), may present a both commercially viable and sustainable land-use option for vegetable oil production on rewetted degraded peatland, helping to avoid the impacts of drainage, including CO_2 emissions and soil subsidence and related flood and fire risks. *Shorea stenoptera* originates from West Kalimantan (Schulte and Schone 1996).

111. Government owned areas adjacent to national parks should be prioritised for protection, and incompatible land-uses (involving peatland drainage) should be prohibited. The recently established Keputusan Menteri LHK RI No. SK.130/MENLHK/SETJEN/PKL.0/2/2017, indicates such wide protection zones around Berbak and Sembilang NPs, and reaffirms the requirement to provide protection of the areas indicated on this map as 'Protection Zones') would provide a basis for restoring all peatlands that have been on fire in 2015 as well as removal of all incompatible land-uses in the buffer zones (**Map 3**).



Map 3: Attachment to the *Keputusan Menteri Lingkungan Hidup dan Kkehutanan, Republik Indonesia N0.SK.130/MENLHK/SETJEN/PKL.0/2/2017,* indicating all functional areas (dark green) for the protection of peat swamp ecosystems.

112. Many of the older but still active regulations have not been designed in relation to the special management requirements of peatland areas. Such regulations should therefore be reviewed and revised to allow NP management authorities to directly engage in restoration and fire prevention measures of peat swamp areas.

Emphasis on preventive measures

113. Emphasis should be provided to preventive measures. Peat fires are notoriously difficult to extinguish. Key preventive measures include the rewetting of drained areas, including blocking of illegal logging canals in the NPs as well as in their buffer zones, and the revegetation of such areas, either with peat swamp forests or the establishment of commercial buffer zones (e.g. paludiculture plantations) between NPs and community land, which can provide a disincentive to create fires in the boundary areas of the NPs. Such restoration and buffer zone development should be given highest priority.

114. **Community programmes**: Community fire awareness groups (*Masyarakat Peduli Api*) have been established in 32 communities throughout Jambi (2011 figure), and their task is awareness raising, early detection, patrolling, and fire extinguishing. This is an effective way of addressing fires, but the numbers of these groups need to be greatly increased, and they need to be better equipped, trained and encouraged.

115. In addition, incentive programmes, such as the Fire Free Village Programme implemented by a pulp-for-paper producer with communities in the vicinity of their Riau concessions, could be established. Their approach involves agreements with the communities, providing them with development investments (e.g. for infrastructure, mosques, schooling, etc.) for every fire free year in the area over which the communities carry responsibility. This approach has led to significantly reduced occurrence of fires in these areas, and thus also to a reduced fire risks for the company's plantations.

116. **Planning for preparedness**: Notwithstanding the preventive measures that can be taken, peat swamp areas will remain hazardous areas in terms of fire risks for many years to come, as huge areas currently are drained, either under active land use or abandoned. Some of these include areas where soil subsidence has already brought the soil surface down to undrainable levels, where any form of cultivation, even most forms of paludiculture, will face severe constraints. Such areas will constitute major fire hazards during very dry periods.

117. It will be key, as part of fire preparedness plans, to identify areas in the landscape where fire risks and the need for vigilance are highest. Vigilance may be aided by establishment of early warning systems (e.g. using remote sensing and weather prediction systems) for predicting of expected periods of high fire risk and identification of highest risk areas. Such systems are useful only, however, if an adequate response system is set up. In 2015 many early warning systems indicated that it would be an extremely hazardous year, but no adequate early response measures were arranged. To develop and adequate response plan for the Berbak and Sembilang NP and surrounding areas is key, including the establishment of appropriate capacities within public and private agencies and the local communities. This needs investments in equipment and training agencies and communities in fire prevention and fire response. It requires also an enhancement of the existing coordination mechanisms to enable rapid decision making for local responses and the capacity to mobilize rapidly.

118. **Preparing health facilities for vulnerable people**: In view of the current unabated risks of fires in very dry years, it will be important to adequately equip and train communities in and around peatlands to prepare for major fire and smog events. A plan should be developed and implemented to enhance health facilities, availability of good quality masks, clean air facilities for the most vulnerable people. Once the smog is around, it will be too late to organize this, as transport for such facilities will be significantly constrained by the smog.

119. **Addressing the lack of capacity**: As part of the preparedness, current capacity and existing systems of Government and communities need to be enhanced to address fire prevention and fire control needs. This will need the development, funding and implementation of a training and education programme, targeting all key stakeholders in the vicinity of the Berbak and Sembilang NP.

120. Community fire fighters have indicated a need for insurance measures, and options for compensation. Caution needs to be taken that compensation measures are established in such a way that they do not provide perverse incentives to communities to start fires. (If community groups are paid for extinguishing fires, this could provide an incentive for them to start fires.) The Fire Free Village programme, run by a pulp-for-paper company in Riau provides a useful example on how this can be arranged. Other options include the hiring of stand-by teams of fire fighters in each village, with payments made irrespective of occurrence of fires, and no additional payments when fires do occur. Such a system is currently implemented by the Katingan Ecosystem Restoration Concession in Central Kalimantan. In most cases, though, and particularly for publicly owned land, it will be useful to implement and contribute to the MPA system as promoted and supported by the government of Indonesia.

121. There is a need for awareness programmes on peatland issues, and an opportunity for key stakeholders to participate in training and information exchange meetings/workshops. There is much expertise around already at different levels in civil society organisations, communities and government, and all would benefit from sharing of knowledge and approaches. It would be conducive to build on the training programmes that are currently in development by the National Institute for Public administration (*Lembaga Administrasi Negara*, LAN), which develops and provides training curricula and programmes for all Indonesian civil servants.

Incentive mechanisms

122. In order to facilitate removal of illegal hamlets and plantations from the Berbak and Sembilang NP, and to mitigate conflicts, consideration should be given to applying various incentive mechanisms. The following section discusses some options:

123. **Social forestry tenure *Hutan desa***: In exchange for the phasing out of current unsustainable and illegal land uses from within the NP, options for provision of additional land tenure outside of the NP boundaries should be evaluated. This can involve the establishment of community forest areas, including the development of sustainable management plans for such areas, as provisioned under Permen LHK Nomor P.83 tentang Perhutanan Sosial. Area management should involve the restoration of peat swamps that are already deforested and/or drained, through blocking of drainage canals and the development of plantations under wet conditions (paludiculture). Different kind of land use systems can be considered for non-peat areas. Forested areas should remain protected.

124. **Access to finance**: Often local communities see no other way for development than by claiming and deforesting additional land, which is a cheap option that does not require major capital investment. Moreover, with lax law enforcement, illegal logging and encroachment into protected areas remain interesting options for enhancing income. However, when provided with access to finance, many people will opt for investments in legal developments, including intensification of cropping systems, investment in new sectors (chicken farming, edible nest swiftlet houses, aquaculture) and will become less interested in illegal activities.

125. A system that has been used by Wetlands International in Indonesia and which can provide a powerful incentive is Bio-rights. This system provides micro-credits for sustainable development under special business deals or agreements in which 'interest' over the credits is paid through achievement of agreed conservation or restoration targets. Once the targets have been achieved the micro-credit is turned into a grant as capital for a community-managed revolving fund for sustainable development. This system thus benefits the entire community and creates powerful financial and social incentives to refrain from unsustainable developments (Eijk and Kumar 2009, Wetlands International 2009).

126. **Access to markets and development of business chains**: One of the main development constraints, especially for paludiculture products, is access to markets. As part of community business planning, some assistance should be provided to communities in market research, to ensure that expectations are based on reality. For some paludiculture crops new business chains need to be developed, and much research is needed to identify the full potential of many of the paludiculture species.

Establishing Greenbelts

127. To reduce impacts from adjacent areas to the NPs and other protected peatlands or remaining peat swamp forests, consideration should be given to the establishment of Greenbelts. This includes several options:

128. **Greenbelts in plantations on peat**: Most plantations of oil palm and Acacia have a significant hydrological impact on the surrounding areas. Most of the plantations work with perimeter drains, which drain both the area within the concession as well as a substantial zone (at least 500 meters, and possibly up to a distance of 2 km) outside of the plantation. This creates significant risks to the plantation as many fires affecting existing plantation areas start outside of the plantation in areas that do not fall immediately under the control of the plantation manager. On the other hand, the advantage of perimeter drains for the plantation owner is that the total plantation area is optimally drained for production. However, this is the case only until the peat soil subsidence has reached a level at which drainage becomes impeded anyhow (See photo 17). Drainage-based land use on peat has, however, a limited potential production period, depending on the peat depth and distance to the drainage limit (Hooijer et al. 2015). Two studies by Deltares in the Rajang delta, Sarawak, and the Kampar peninsula in Riau (Hooijer et al. 2015), indicate that extensive areas of the lowland peatland areas in Southeast Asia that are currently under drained land use (e.g. oil palm or *Acacia* plantations) will experience increased flooding within 25 years from now, while after 50 years from now, more than half will be flooded so frequently and prolongedly that their productivity will be seriously impaired.

Photo 14: Flooded oil palm plantations with impaired productivity will become an increasingly common feature in the peatland landscapes.

129. For most plantations, phasing-out of drainage based production will be necessary at some stage, and this is where a Greenbelt approach may play a role. The Greenbelt approach for plantations involves the blockage of the perimeter drains. This will reduce or stop the drainage impact on the outside buffer zone, resulting in a reduced fire risk. The zone that will be rewetted within the plantation boundary can be used to experiment with paludiculture species, enabling the company to phase in sustainable land-use. A greenbelt approach is currently implemented by a pulp-for-paper company in their pulp-for-paper concessions in Pelalawan on the Kampar peninsula, involving drainage systems without perimeter drains. Their Greenbelts in the concession areas consist off a zone of up to 500 meters of natural peat swamp forest, followed by an undrained zone with plantation species, either *Acacia*, or species more adapted to wet circumstances such as *Melaleuca* or other potential pulp species.

130. Another pulp-for-paper company has over the last two years been blocking perimeter drains in their existing concessions, using mainly blocks with spill ways of 50 to 70 cm depth. This does not fully restore the hydrology and is unlikely to enable water control to fulfil Indonesia's requirement of maximum 40 cm drainage. In the Tripupa Jaya plantation adjacent to Sembilang NP, the company has blocked the perimeter drain fully between the concession and the NP. They also left a zone of several hundred meters of natural forest within the concession area as an additional safeguard for the NP. The rewetted areas within the concession are being restored or used for paludiculture pilot projects.

131. Other forms of Greenbelts are the legally required conservation of riparian zones, which large some of the larger pulp for paper and oil palm companies are often implementing but generally is not adhered to or enforced when it comes down to smallholder developments.

132. Smallholder Greenbelts: For phasing out of smallholder plantations in buffer zones of the NPs or other remaining peat swamp forests, it will be interesting to pilot options for a similar Greenbelt approach to phase in alternative commercial species that can be grown on rewetted peatlands (paludiculture). Planning for this will require community organization and community-based development plans.

133. Several situations will need to be considered:
For illegally established plantations within protected areas like Berbak NP, paludiculture could provide a useful compromise solution, enabling continued commercial utilization by the community, while safeguarding the remaining peat swamp forest. MOEF has issued regulation no 16/2017 regarding Guidelines for Restoration Peat Ecosytem Function where degraded protected function peatland can only be revegetated with peat native species, allowing the mandatory for land owners to practice paludiculture:

a) For existing plantations on peat adjacent to protected areas, it will be important to clarify the land tenure. If communities do not have tenure rights over the planted area, consideration should be given to different tenure options.

b) For areas that are located outside and/or adjacent to protected areas, and are claimed by communities, and are at least partly covered with remaining natural peat swamp forest, consideration should be given to establish Village Forests (*Hutan desa*). This can provide a basis for community-based land use planning, involving conservation of the natural forests, hydrological restoration and establishment of paludiculture plantations. Options could also be investigated for the development of business deals with carbon investors, to enable monitoring and certification of carbon emission reductions (from peatland rewetting), carbon emission avoidance (through forest conservation) and carbon sequestration (from forest restoration and establishment of permanent paludiculture tree plantations). A pilot for such a development is currently underway in Mendawei village, with Hutan desa development adjacent to the Katingan Ecosystem Restoration Concession in Central Kalimantan. Similar developments are promoted by the recently launched Indonesian Peatland Partnership Fund (*Dana Mitra Gambut Indonesia*). Provision of Community Forests or Village Forests (Hutan Desa) in peat swamp areas should be conditional to the conservation of remaining forests and the application of sustainable (paludiculture) agro-silviculture techniques. Clear disincentives for inappropriate development of Hutan Desa should be applied, to avoid conversion of these areas to oil palm, as has happened in certain instances.

Finance

Berbak-Sembilang National Park budget

134. Following the merging of the former Ministries of Forestry and Environment into the Ministry of Environment and Forestry, mergers and cutting of budgets have arisen. In this regard, different National Parks have been brought under single management units with staff and budgets reduced. This has happened in e.g. West Kalimantan with the Danau Sentarum NP (a freshwater and peat swamp forest area: Indonesia's 2nd Ramsar Site) and the Bentuang Karimun NP. It has also happened with Berbak NP and Sembilang NP: They have recently been merged under one management authority, based in in Jambi. The management capacity of both parks has been decreased with an overall budget reduction of 20-40%. The number of field facilities, such as resorts, has been decreased and overall staffing reduced by one third.

145. In view of the high priority of fire prevention, the severity of threats and the complexity of issues and tasks, these capacity reductions need to be compensated. Berbak and Sembilang NP represents one of the largest natural terrestrial carbon stores in Indonesia. The economic costs of this area becoming increasingly affected by fires will be considerable, both for Indonesia as its neighbouring countries, particularly in relation to aspects of public health. In addition, Indonesia, and through the Ramsar designation the entire world, recognized the BerbakSembilang area as a Wetlands of International Importance, key ecosystems for South-East Asia's lowland biodiversity.

146. It is therefore strongly recommended to compensate for the recent budget cuts of the NP, to develop feasible management and restoration plans for the NP, with an appropriate level of staffing, facilities and recurrent budget to address the complex issues described in this report. The international community is encouraged to help Indonesia with this, through the provision of technical assistance.

147. We welcome the recent call for experts by UNDP for the development of a Green Climate Fund proposal (http://procurement-notices.undp.org/view_notice.cfm?notice_id=37553) for the Musi Banyuasin District, incorporating the Berbak and Sembilang NP. With this call, UNDP aims to assist the goal of restoring 2.4 million ha of degraded peatlands through of Green Climate Fund projects that support the district government to establish a Sovereign Wealth Fund and to develop a theory of change for peatland restoration. This seems a useful tool to address the issues identified by the Ramsar Advisory Mission.

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