South Sumatra Forest Fire Management Project

Jl. Jend. Sudirman No 2837 KM 3,5 PO Box 1229 Palembang 30000 Indonesia

Phone/Fax : +62-711-377821/353176, e-mail: ssffmp.eu@telkom.net; homepage: www.ssffmp.or.id

Threat Analysis to Forest Coverage in Peat Swamp Forest in South Sumatra

A Contribution to an Assessment of Opportunities for Compensation Payments for Avoided Deforestation in South Sumatra

Report No. 000

DRAFT

Prepared by:

Gernot Rücker
ZEBRIS GbR
Lipowskystr. 26, 81373 Munich, Germany
Tel. + 49-89-58 99 88 86
Fax: +49-89-58 95 86 53
gruecker@zebris.com

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PREFACE

The South Sumatra Forest Fire Management Project (SSFFMP) is a technical co-operation project jointly funded, in terms of the financing memorandum IDN/RELEX/1999/0103, by the European Commission and by the Government of the Republic of Indonesia through the Ministry of Forestry (MoF).

This report has been completed in accordance with the project annual Work Plan (AWP VI) and

in part fulfilment of Activity 4.2.3: Risk analysis on land use change impact on carbon budget in peat land,

to achieve Result 4: "The impact of land and forest fires on climate change is better documented, information to relevant decision makers and stakeholders disseminated.",

to realise the project purpose, which is "Aid and facilitate the establishment of a coordinated system of fire management at province, district, sub district and village level throughout South Sumatra province in which all involved stakeholders, including the private sector, work together to reduce the negative impact of fire on the natural and social environment".

This report has been prepared with financial assistance from the Commission of the European Communities. The opinions, views and recommendations expressed are those of the author and in no way reflect the official opinion of the Commission.

The report has been prepared by:

Gernot Rücker

The report is acknowledged and approved for circulation by the Project Co-Directors when duly signed below.

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Dr. Ir. Dodi Supriadi	Dr. Karl-Heinz Steinmann
National Co-Director	EU Co-Director

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EXECUTIVE SUMMARY

When the 2007 Bali conference of parties to the United Nations Framework Convention on Climate Change called for the establishment of a mechanism for compensating the reduction in emissions from tropical deforestation and forest degradation in developing countries, it was also decided that a series of pilot projects should provide the experience necessary to successfully implement such a mechanism. In South Sumatra, the Merang Peat Swamp Forest area (MPSF) is a promising location for such a pilot project due to the still relatively intact forest cover and the large below ground carbon storage in peat, as well as the suitable location with connections to the protected areas of Sembilang National park in South Sumatra, and Berbak National park in Jambi. This report evaluates the current and potential threats to forest cover, which are to be mitigated by a carbon savings project, and based on these threats elaborates scenarios of potential forest cover change. These scenarios serve as an input for the estimation of greenhouse gas emissions, and thus form the basis of the establishment of a reference emission level or baseline, and the calculation of potential savings in emissions due to a forest conservation project.

The main land use threats and their changes over time have been identified and analysed. These are forest and vegetation fires mainly associated with illegal logging and encroachment, forest degradation by rampant illegal logging, forest conversion to agriculture on the dryland areas, and planned deforestation for plantation establishment.

Land use change has been analysed from historical satellite images in a 3,440 km² study area. Land use change and deforestation were found to be driven by uncontrolled fires in overlogged forests during the time from 1989-1999, leading to massive deforestation of dryland forest and considerable loss of peat forest, as well as severe degradation of peat swamp forest due to logging activities. Between 1999 – 2007, further loss of dryland forest could mainly be attributed to spontaneous conversion to agriculture in the Northern part of Merang area, while degradation of peat swamp forest continues in wide areas because of widespread illegal logging. Nevertheless, in some areas, there are signs of regeneration due to the cease of commercial logging operations. While most of the area deforested in 89 – 99 remained covered by secondary vegetation, shrubs and grasses in 2007, a considerable part of the shrubland is now being converted to oil palm plantations. Resource extraction by communities (e.g. *gelam* collection) is closely related to repeat fires in areas with secondary forest that spread into natural forest areas leading to degradation and deforestation at the fringes of the Merang peat dome.

Changes in land use are related to changes in policy, especially spatial planning. From 1970 to the late 1990s, large scale commercial logging was the dominant process leading to forest degradation. Large scale commercial

logging was closely related to a system of political patronage that led to an establishment of an oligarchic system in forest management. It has also been connected to devastating forest fires due to unsustainable management practices, which led to deforestation of most of the dryland forests in the study area. In the so called *reformasi* area from 1999 to 2002, decentralisation brought about fundamental changes in Indonesia's political system. This was accompanied by great uncertainty in spatial planning and natural resource use rights, increase in land use conflicts and conflicting decisions by the different levels of government. District based, short duration timber extraction licenses, together with illegal logging and frequent fires led to further degradation of already depleted forest resources. Starting in the 1990s, development of plantations for pulpwood became an increasingly important threat to natural forest cover. This development was pushed by national and local governments, who set ambitious targets for pulpwood plantation developments and heavily subsidized plantation and paper mill developments pursued by oligarchic industrial/financial conglomerates.

Today, we can observe two contradictory trends over the past years: while strategic objectives of national land-use planning emphasize on conservation to counteract the overexploitation of Indonesia's forests, the district level as well as parts of the national level focus on rapid expansion of plantation areas. This contradiction is also reflected in spatial planning: while the new National spatial plan of 2008 foresees the conversion of the Merang area to conservation forest, the Ministry still issued licenses based on recommendations from the district for establishment of industrial timber plantations in Merang area.

Scenarios of possible future developments have been established based on the extrapolation of trends in deforestation and current land use planning information. The main application of such a scenario would be the development of a proposal for carbon trading under a REDD (Reducing Emissions from Deforestation and Degradation) pilot project scheme. The scenarios therefore include a reference emission level or baseline scenario (i.e. "business as usual"), a scenario including a REDD project in a 24,000 ha block, and a scenario including a larger area for conservation involving stakeholders such as pulp and paper plantation business. In the baseline scenario, a large area of forest and secondary vegetation is converted to Acacia pulp wood plantations and oil palm plantations, involving partial drainage of the peat swamp and thus higher rates of oxidation of peat carbon. A large area is also deforested and degraded in areas that are not allocated for plantation development due to processes such as illegal logging, fire, and spontaneous conversion to agriculture. Depending on the scenario, between 5,000 and 10,000 hectares of natural peat swamp forest could be conserved when compared to the baseline scenario. From these findings, the basis for calculation of emissions from deforestation and degradation as well as potential savings through an REDD project were then

elaborated in close cooperation with the STE on carbon stock. The amount of carbon saved between 2008 and 2015 over the whole Merang area when compared with the baseline scenario was 14 and 32 Mt of CO2, respectively. The larger savings in carbon in the second scenario are partly due to avoided conversion of peat swamp forest to Acacia plantation, which would involve partial drainage and higher emissions from peat oxidation.

From the viewpoint of conservation and also from a management viewpoint, it is highly desirable for a potential carbon savings project to have a compact shape with safeguarded boundaries and a connection to the Sembilang National park. At the end of the consultancy it became clear that a number of licences for plantation development in the area will be revoked. This would give new options for a more compact shape of a potential project area. Potential options for area swaps should therefore be developed to achieve the objective of a compact, safeguarded and manageable area with good potential for carbon trading. In order to elaborate a successful REDD proposal, the definition of a credible baseline is of paramount importance. The result of this mission is a contribution to this effort. However, there are still large uncertainties involved in the scenarios as well as in potentially avoided greenhouse gas emissions. Furthermore, the reference area and reference time span for the scenarios do not yet correspond to the emerging standards for REDD projects. In order to define a reliable baseline and project scenario, an agreement with all relevant stakeholders (especially Sinar Mas Group as a major license holder, and forestry departments at national, provincial and district level) on the project area and activities for emission reduction is needed. Also, an agreement on a business as usual scenario based on planning data and extrapolation of current land use activities (as of December 2007, i.e. before Bali COP) should be reached. A spatially explicit land use change model based on the agreed upon business as usual scenario should be developed for the reference area. Such models exist and have been successfully used in similar project contexts. This model would have to be run for a period of thirty years. To improve the accuracy of carbon estimations, further research on the potential impact of forest and land fires and the effects of peat drainage on carbon emissions is needed.

RINGKASAN (INDONESIAN SUMMARY)

ABBREVIATIONS AND ACRONYMS

Abbreviation	Indonesian	English
BKSDA	Balai Konservasi Sumber Daya Alam	Office for Natural Resource Conservation
BPKH	Balai Planologi Kehutanan	Forest Planning Office
COP		Conference of Parties
Dishut	Dinas Kehutanan	District Forestry Department
Deptan RI	Departmen Pertanian Republik Indonesia	Ministry of Agriculture
EU	Uni Eropa	European Union
GIS		Geographic Information System
GOFC/GOLD		Global observation of forest cover/Global observation of land degradation (An international remote sensing taskforce)
GTZ		German Technical Co-operation/ Gesellschaft für Technische Zusammenarbeit
HPH	Hak Pengusahaan Hutan	Large scale forest harvesting concession rights
HTI	Hutan Tanaman Industri	Industrial timber plantataion
INTAG	Badan Inventarisasi dan Tata Guna Hutan	Directorate of Forest Inventory and Land-use Planning
IPCC		Intergovernmental Panel on Climate Change
IPPK	Izin Pemungutan dan Pemanfaatan Kayu	Timber extraction and utilization permits
IUPHHK	Izin Usaha Pemanfaatan Hasil Hutan Kayu	Forest timber product exploitation permits, better known as mini HPHs
MoF	Departemen Kehutanan	Ministry of Forestry
MPSF		Merang Peat Swamp Forest
MUBA	Musi Banyuasin	(District in South Sumatra)
OKI	Okan Komering Ilir	(District in South Sumatra)
PP	Peraturan Pemerintah	Government Decree
REDD		Reducing Emissions from Deforestation and Degradation
RHM	Rimba Hutani Mas	Rimba Hutani Mas, a plantation company (part of Sinar Mas Group)
RTRWN	Rencana Tata Ruang Nasional Kabubaten	National Spatial Land Use Plan
RTRWK	Rencana Tata Ruang Wilayah Kabubaten	District Spatial Land Use Plan
RTRWP	Rencana Tata Ruang Wilayah Propinsi	Provincial Spatial Land Use Plan
SK	Surat Keputusan	Decision Letter
SSFFMP		South Sumatra Forest Fire Management project
UNFCCC		United Nations Framework Convention on Climate Change

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1 Introduction

In December 2007, the Bali conference of parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) issued a declaration calling for the establishment of a mechanism for compensating the reduction in emissions from tropical deforestation and forest degradation (UNFCCC, 2007). This mechanism is supposed to be implemented in the second commitment period of parties starting from 2012. It is also foreseen that from 2008, a number of pilot projects be implemented in order to gain experience with the workings of such a mechanism. In South Sumatra, the Merang Peat Swamp Forest area (MPSF) is a promising location for such a pilot project due to the still relatively intact forest cover and the large below ground carbon storage in peat, as well as the suitable location with connections to the protected areas of Sembilang National park in South Sumatra, and Berbak National park in Jambi. The objective of the current report is to evaluate the current and potential threats to forest cover in MPSF, which are to be mitigated by a carbon savings project, and based on these threats, to elaborate scenarios of potential forest cover change. This effort is to serve as a basic building block for a project proposal for an REDD pilot project.

The first step in the climate related project cycle is the identification and formulation of potential projects. A project must be real, measurable and additional. To establish additionality, the project emissions must be compared to the emissions of a reasonable reference case, identified as the baseline. Thus, a baseline is the emission profile in the absence of a planned climate change mitigation activity. To establish a credible payment mechanism, a reliable baseline and an accurate monitoring mechanism must be in place to measure and compare mitigation activities against a business-as-usual scenario.

In the case of an REDD (Reducing Emissions from Deforestation and Degradation) project it is therefore important to identify a) the carbon stored in forest and soils and b) to estimate the amount of carbon that will be released with or without the project activities.

To do a successful and targeted planning for a mitigation project it is also necessary to identify the land use threats in the area, so that a strategy to counteract these threats can be developed and implemented by the project.

The current report has to meet two main objectives:

1. Identify past and present land use threats.
2. Create land use change scenarios that correspond to a baseline and a

project scenario, and from this to estimate the amount of carbon saved through the project.

The terms of reference for this contract translate this into five main tasks:

3. Identify the past, present and potential threats to selected peat swamp area, including fires, logging, encroachments and other land uses threats.
4. Compile information related to land use change and land use policy for selected area.
5. Carry out detail assessment on the relationship between forest policies made and forest condition using historical landcover data and forest regulation or other records, for instance forest concession plan, record on timber extracted and number of forest protection activities.
6. Predict scenario based future forest cover dynamic based on potential threats and possible forest policy.
7. Calculate carbon emission from predicted scenario of degradation and deforestation in the selected area.

2 Methods and data

2.1 Analysis of land use and land use change in the Merang area

2.1.1 The study area

The Merang – Kepayang peat swamp area is the largest remaining peat swamp forest area in South Sumatera. The area is located in the border of Jambi Province and connected to Berbak National Park in the northern part and Sembilang National Park in the eastern part. The area is an important component of the Merang and Kepayang water catchments area. The main thematic focus of this study is on the Merang Peat Swamp Forest (MPSF). For the analysis of land use change, threats to forest cover, and scenarios for future development, we refer to the study area comprising the Merang Kepayang peat swamp area and their vicinity as depicted in figure 1. The whole area covers about 3440 km².

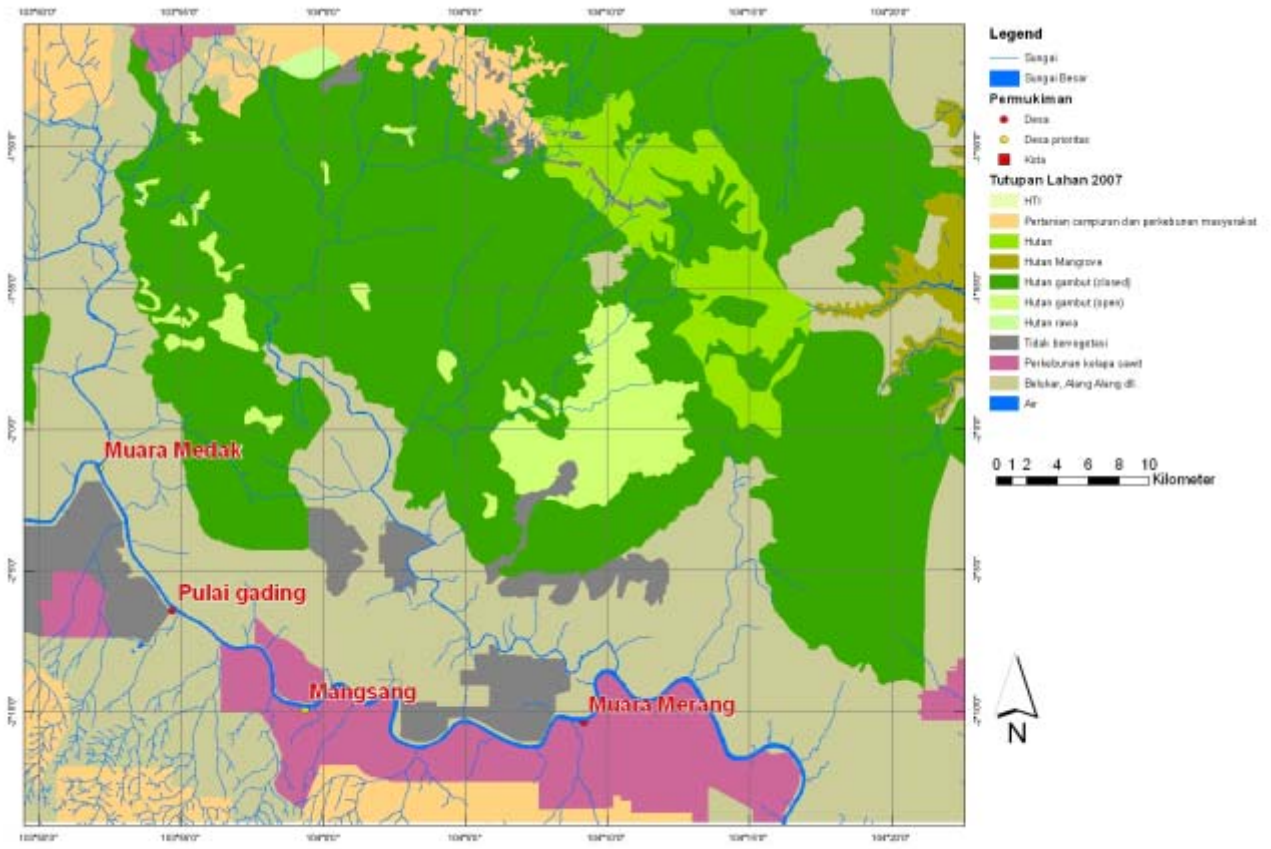

Figure 1: Overview of study area with current land cover

2.1.2 Change detection satellite image analysis

Landsat TM/ETM satellite images from 1989, 1999, 2002 and 2007 of parts of Merang are were made available by the project. To analyze changes from 1989 to 1999 and 1999 to 2007, a one by one kilometre rectangular grid was laid over the images and changes from one image to the other were assessed visually. Five main processes could be identified:

- Degradation
- Deforestation
- Regeneration
- Industrial plantation establishment
- Smallholder agriculture and plantation establishment

Each change was classified into one of these five processes. Each change was also assigned a direct cause, which identifies what caused the change, the means by which the change was brought about (fire, mechanical clearing, planting etc.), and a motivation – why this change was brought about. By doing so, information on the driving forces of changes was added to the mere record of changes. However, this information can not directly be deduced from satellite images. In many cases, the causes were evident (i.e. Plantation establishment), in others they had to be verified through an expert assessment, field visits or by accessing management data or planning maps.

Table 1: Land-Use change in Merang area: Processes, causes, means and motivation

Process	Direct cause	Means	Motivation
Degradation	Illegal Logging Legal Logging Unknown	Mechanical felling Mechanical felling Fire	Side effect Side effect Unknown
Regeneration	Regeneration after Logging Regeneration after Fire	Natural Process	Natural Process
Deforestation	Land clearing for plantations Transmigration, spontaneous Unknown	Mechanical clearing Fire	Plantation establishment Unknown (hunting, clearing for access, gathering, accidential, arson)
Plantation establishment	Planting Land clearing	Planting Mechanical clearing Fire	Plantation establishment
Smallholder agriculture and plantation establishment	Planting Land clearing	Planting Mechanical clearing Fire	Plantation establishment

2.1.3 Analysis of spatial planning data

The following digital spatial planning data have been acquired and were used to support the analysis:

- RTRWP 2006: the current provincial spatial plan
- RTRWP SK 76 from 2001: the provincial spatial plan from 2001 to 2006
- RTRWK Muba: the forest part of the current district spatial plan

To analyse logging and plantation establishment activities, the following data were available:

- Forest concessions (HPH) and their status by the end of the 1990ies
- Industrial timber plantations (HTI) and their status in 2004, 2007 and end of the 1990s
- Estate crop plantations (mainly oil palm) in the years 2008, 2004 and end of 1990s.

2.1.4 Expert interviews

A number of interviews have been conducted with experts to assess and verify supposed causes for land use change in historical data, and discuss implications on changes in forest policy on the ground. Experts interviewed were:

- Firman Bonaventura, from Dephut Propinsi Sumatera Selatan
- Gatot Sudarto, from Dephut Kabupaten Muba
- Solichin, from SSFFMP
- Zulfikar, from Dephut Propinsi Sumatera Selatan.

2.2 Analysis of the impact of forest policy and forest policy change on forest cover change

Excellent reviews on the causes and consequences of forest policy and policy change in Indonesia exist[1], and it is out of the scope of this report to give a thorough treatment of this complex issue. Instead, the chapter is limited to a brief historical introduction based on some of these works, and a review of relevant laws, regulations and planning documents and completed by an attempt to assess the consequences of implementation or non-implementation on the ground.

[1] e.g. Resosudarmo (ed.) (2005), Colfer and Resosudarmo (eds.) (2002) and Barber and Schweithelm (2000) on forest fires and policy

2.3 Establishment of scenarios to predict future forest cover dynamics

The scenarios developed have a limited temporal and spatial extent: the spatial extent is given by a rectangular study area encompassing the Merang Peat Swamp Forest and its direct vicinity, and the temporal extent is limited to a projection until the year 2015. This is a limited scope when compared to the emerging REDD standards, which focus on an administrative area such as a district, and a time period of thirty years (Dephut, 2008, and Buchholz, pers. comm.). However, with the available resources and information, it was not feasible to give a meaningful estimate over such a large spatial and temporal extent. The baseline scenario was elaborated on the basis of current spatial planning data, and an extrapolation of current land use change trends. The two project scenarios correspond to the baseline scenario, except for the areas where direct impact of project activities is expected. In these areas, simple assumptions as to the effect of potential project activities on the conservation of forest cover were made. Due to the short temporal extent of the scenarios, effects of potential rehabilitation activities were not included, as these only are assumed to take measurable effect over a longer time.

We did not assess leakage issues in the scenarios. Leakage refers to the avoidance of emissions due to project impact within the project area, while the emissions are produced outside of the project area. For instance, this may happen when illegal loggers are driven out of the project area by improved law enforcement due to project activities and continue their activities in another area leading to deforestation and degradation there.

2.4 Potential carbon emission according to scenarios

Potential carbon emissions have been calculated by the expert on carbon stocks (Moder and Siegert, 2008). The methods are based on the IPCC guidelines for assessing carbon emissions from land use, land use change, and forests (LULCF) and on the GOFC GOLD sourcebook for REDD projects (IPCC, 2003, and GOFC/GOLD, 2008). Estimation of carbon emissions and stocks are based on an approach described by IPCC as “tier 2”, i.e. we used national default values for carbon stocks in different land cover from published literature in our assumptions. We also used default values from the literature for the estimation of emissions from process such as peat oxidation and biomass burning. Details for carbon stock and stock change assessment as well as the corresponding literature sources can be found in the corresponding report (Moder and Siegert, 2008).

3 Results

3.1 Impacts of forest policy on threats to forest cover

3.1.1 Background

Large scale logging operations (1960s to 1990s)

Large scale exploitation of Indonesia's forest resources started in the late 1960s, when the government of President Suharto issued law 5/1967 on forestry and law 1/1967 on industrial investment, paving the way to large scale foreign investment and logging. Large 20-year forest concessions (HPHs) were granted extensively, and while in the beginning some went to foreign investors, many were used as a means to "disperse patronage and benefits, especially to the military" (Gellert, 2005). Generally, HPHs were established without the consent and consultation of local populations, often leading to land use conflicts. During the 1970s, fostered by a ban of exporting logs, a large plywood production capacity was established and became a $3-4 billion export industry in the early 1990s, dominating the global tropical plywood market (Gellert, 2005). This industry was largely run by an oligarchy including leading Chinese-Indonesian conglomerates and the military. At its peak the in 1989 forest products had a share of 15 % of total exports. Export was totally controlled by the timber oligarch Bob Hasan through his dominance of the Indonesian Plywood Producers association (Apkindo). Profits were extraordinary, and have for 1972 been estimated to 30 % to 40 % or even more (Koehler 1972, cited after Obidzinsky 2005). Such revenues were possible because of low taxes and also due to widespread tax evasion. Extraordinary profits and excessive overcapacities led to the rapid depletion of forests through unsustainable management practices.

The impact of decentralisation

When President Suharto was forced out of power during the Asian financial crisis in 1998, the way was opened for decentralisation reforms under his successor Habibi, starting with the first law on local government (law 22/1999). Decentralisation initialized a reshuffling of positions, responsibilities and beneficiaries in the forestry and plantation sector that is still ongoing. The years following thus saw a continuous struggle between district, province and national authorities as to who had the rights to issue licenses and permits and who would enjoy the benefits of economic operations. In the early years of decentralization (starting 1999/2009),

district heads issued hundreds of small scale logging permits to communities that usually acted as co-operations. This was based on government regulation PP 06/1999 and ministerial decree SK Menhut 310/1999. Permits were usually of short duration (about one year), and had no provision for sound management such as systematic felling or replanting. As the situation quickly started to get out of hands, the central government revoked the right of districts to grant logging licenses altogether after a series of contradictory decrees on the issues by issuing government regulation PP 34/2002 (after Fox et al., 2005). However, many districts continued to issue licenses, and the central government is only slowly regaining control over logging and plantation licenses and their implementation. As a consequence of these uncertainties, overlapping and legally questionable land use permits are commonplace in Indonesia's forests.

The pulp and paper boom

In the 1990s, against the background of rapid depletion of natural forest resources, focus started to move from plywood to pulp and paper. Again, a large scale pulp and paper industry emerged, and again it was run by a well connected oligarchy, and heavily subsidized by government, e.g. through tax benefits and equity capital from the government reforestation funds[1]. The industry is dominated by two large conglomerates: Asia Pulp and Paper (APP), connected to the oligarchic Widjaja family (Sinar Mas Group) on the one hand, and Asia Pacific Ressources Holdings International (APRIL), owned by Sukanto Tanoto, on the other, which together control over 75 % of Indonesia's total pulp capacity (Barr and Cossalter, 2005). Both are vertically integrated businesses, meaning that they control the raw material (plantations and logging operations) as well as the final product production. During the 1990s, the two companies established two giant paper mills in the Sumatran province of Riau, laying the foundations of a large overcapacity which was in no way covered by the available pulpwood production form plantations (Barr and Cossalter, 2005). Both companies therefore extensively rely on mixed tropical hardwood from natural forests, leading to an impressive acceleration in deforestation rates, as has been shown for the province of Riau, were deforestation for pulpwood plantations accounted to a quarter of the province's total deforestation from 1982 to 2007 (Uryu et al., 2007). Both in Riau and in South Sumatra, plantation development by the two companies is focusing on peat lands, partly because these lands are less attractive for conversion to industrial oil palm

[1] for a detailed account on the financing schemes involved during the New Order period see Barr (2001)

plantations[1].

The oligarchs control the business through pyramid ownership structures involving hundreds of subsidiary firms doing business with one another. It is therefore relatively easy to move money from one company to another as needed. This business model has been studied in detail for APP by Pirard and Rokhim (2006) after both conglomerates defaulted on their billion dollar debts 2001 and 2002, respectively. They show that the default had no real impact on the companies operations. The creditors were unable to recover large part of the debts due to weaknesses in Indonesia's legal system and an effective cancellation of part of the conglomerates debt through the national bank restructuring agency IBRA (Pirard and Rokhim 2006). These authors conclude that changes in the companies operating practices will most likely not be brought about through the restructuring process started after the debt default, but through increasing scarcity of wood supply for the mills, which puts even more pressure on remaining forests.

3.1.2 Current policy goals and relevant regulations

Spatial planning

Forest policy goals are reflected in the relevant spatial planning documents. In Indonesia, there are three spatial plans produced on national, provincial and district level. The national level (Government of Indonesia) has the competence for assigning or reclassifying forest areas. The district, however, is responsible for recommendations as to the use of forest areas and the issuance of licenses for forest resource use. The grant of licenses based upon district and provincial recommendations in turn is the responsibility of the Ministry of Forestry.

Forest conservation and rehabilitation

In the preface to the strategic plan of the Ministry of Forestry 2006 – 2009, weaknesses in former forest management are recognised that led to damage to environment, economic loss and adverse social impacts Ministry of Forestry, 2006). It is also stated that (for the short run) protection and rehabilitation activities shall have priority in order to achieve the greatest possible prosperity and justice for the people. This is reflected in the spatial planning of 2008 (RTRWN)[2], which includes a number of new protection forests (Hutan Lindung), and by the ten priority objectives of the strategic

[1] To convert forest peat land to oil palm plantation, a change in land status is necessary. For conversion to industrial timber plantations, the land can still remain production forest legally.
[2] Superseding PP 47/1997 regarding national spatial planning

plan, which include the establishment of twenty model National Parks[1] and the combating of illegal logging.

Merang area enjoys protection under a number of national laws and regulations:

- Government Regulation (PP) 26/2008 regarding National Spatial Planning (RTRWN): According to the map forming part of the RTRWP the whole of Merang area is classified as protected forest (Hutan Lindung), thus effectively reclassifying its status, which previously was Production Forest (Hutan Produksi). However, to date there is no Decision Letter (SK) issued by the Ministry regarding the reclassification of the Merang area.
- Presidential Decision (KePres) 32/1990 regarding protected areas (Kawasan Lindung):
  - All areas with peat deeper than three meters are peatland protection areas (Kawasan Bergambut), which is applicable to parts of the area according to SSFFMP surveys.
  - All areas within 100 m to the left and right from large rivers, and 50 m to the left and right of small rivers within production forest.
  - All areas within 200 m of a spring.
  - In Merang area, a buffer between one and two kilometres to the left and right side of Merang River is mapped as protection area for crocodiles in the provincial spatial plan (RTRWP) of 2006. To designate a wildlife protection area, a Ministerial Decision letter is required. Areas are then mapped in RTRWP.

Economic development

Although the aim of conservation is highlighted in the strategic plan of the Ministry of Forestry 2005 – 2009, economic development continues to be a high priority for the forestry sector. This leads to at times conflicting objectives which are hard to reconcile in spatial planning. This is reflected in a target to develop five million hectares of land for industrial timber plantation. Earlier, in 2004, the Minister of Forestry, through Decree No. 101/Menhut-II/2004, issued a policy on accelerating pulpwood development to supply the pulp and paper industry. In 2005, the Province of South Sumatra declared a strategy to develop 1,000,000 ha of industrial timber plantation in the province.

Although districts were revoked the right to issue licenses in forest land,

[1] The document is not very clear on this. Apparently, the parks are to be newly established.

they do have the right to issue licenses for plantation development outside state forest land (Surat Menhut No. 1794/Menhut VI-2001). Therefore, most available land is assigned for oil palm plantation development, leaving the less productive wetlands as potential areas for the less profitable development to industrial timber plantation.

3.1.3 Implementation of regulations

Implementation of regulations is hampered by a number of problems:

- Nine years after decentralization, conflicts and missing co-ordination in harmonizing planning and implementation activities between national, province and district administrations, and between different sectors of the administrations (e.g. planning, agriculture, forestry, industry, land management) are still widespread. This may lead to conflicting spatial plans at the district, provincial and national level, and to overlaps in land use permits between sectors; e.g. overlaps between oil palm plantation and industrial timber plantation licenses. These conflicts are also often observed in the issuing of permits (see also 3.1.1), although it appears that the processes of licence issuing is slowly being clarified in current administrative procedures.
- Law enforcement continues to be weak, and corruption is reported to be widespread. We could observe unchecked and open illegal logging activities in different areas of MPSF during our filed visits.
- Deficiencies in data quality, difficulty to acquire reliable planning data and documentation contribute further to a situation of uncertainty, were land-use change processes do not follow clearly laid out spatial plans, and thus land that is not under a clear ownership is often encroached and perceived as no-mans land that is free for all to use.

3.2 Land Use Change Dynamics and Trends in the Merang Area from 1989 to 2007

3.2.1 Forest Degradation

Legal Logging

Legal logging was the main process leading to forest degradation in the Merang area from 1989 to 1999. Some 208 km² were affected by degradation through logging and opening of canals. Table 2 lists the logging concessions that were active between 1989 and 1999. The bulk of the Merang peat dome are was part of the PT KMPI (Kurnia Musi Plywood Industries) concession. By the end of the 1990ies, this area was already listed as inactive. The Northern part was under license of PT RMTC and was later transferred into a cooperation scheme under Koperasi Wanakarya Lestari for industrial timber plantation. However, the cooperation never reached operation and was apparently only used for timber extraction. The license was later revoked (about 2001). District based licenses were then handed out to PT Tiesco Cahaya Pertiwi for HTI establishment and to Pesona Belantara Persada as a district based small scale logging permit (IUPHHK). According to data made available by the forestry planning department of MUBA, the area is currently under auction for IUPHHK.

Table 2: Production forest concessions in Merang area (1989-1999)

Name of HPH	Area_Ha	Area in Study Area	Area on peat
PT. KMPI (DH: BUMI RAYA)	127,714	127,622	116,638
PT.SENTOSA JAYA	12,437	7,347	
PT. PPUJ	27,062	6,913	5,842
KOPERASI WANAKARYA LESTARI (formerly RMTC)	36,729	34,300	23,359
PT. INHUTANI V (formerly Pt Sukses Sumatera TimberST)	91,725	52,797	41,702
PT. INHUTANI (formerly PT. SYLVA)	18,437	5,787	1,115
PT. INHUTANI V	11,043	4,689	
PT. BUMI PRATAMA USAHA	49,770	25,217	7,087

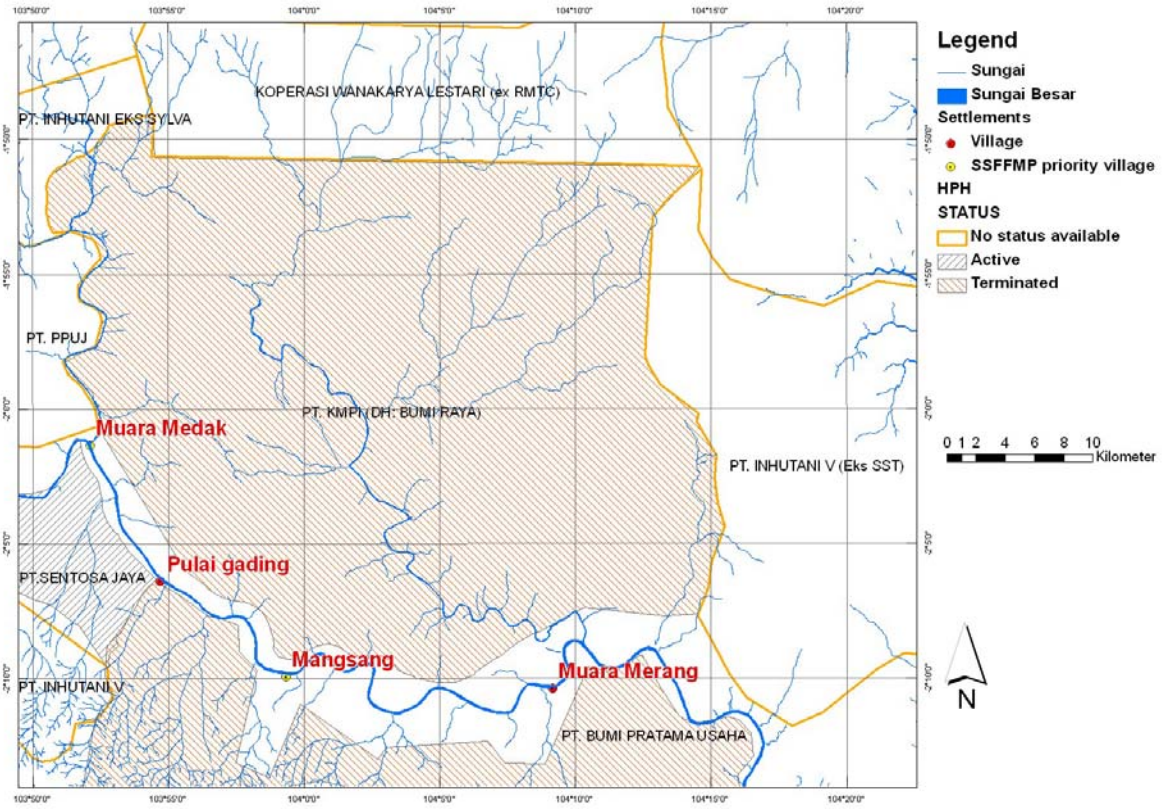

Figure 2: Logging concessions in the study area at the end of the 1990s

Illegal Logging

Illegal logging is referred here as logging activities which take place without a lawful licence[1]. Illegal logging started to be a severe problem in the area only after 2000. One of the most severe consequences is the repeat occurrence of increasingly severe fires in the peat swamp area due to these activities. Some 135 km² were affected by fires related to illegal logging activities. Fires presumably started accidentally or for clearing access to the area. According to interviews with experts, the illegal loggers come mainly from OKI district (Tulung Selapang). The logging is quite well organized by outside patrons ("*Tauke*"), who give small loans to loggers (~ 1 Million Rp.) to start activities and oblige them to sell the wood exclusively to the *tauke*. If no wood is harvested, the loggers can not pay back their debts and have to cover high interest rates.[2] The *taukes* are generally well connected, so that they are relatively immune against criminal sanctions. Our experience in the field was that the loggers apparently felt rather secure and were not irritated by being photographed or filmed when carrying out their activities. Illegal logging is also closely related to the *lebak lebung* system, which organises

[1] Some authors argue for a wider, and in fact more correct, definition of illegal logging, which contains all illicit logging activities, and thus includes over-cutting or logging outside the license areas or other logging activities by a legal license holder that do not conform with valid laws and regulations (Obidzinsky, 2005).
[2] Fiman, pers. Communication, and according to a draft management plan (Government of Musi Banyuasin, 2006)

fishing rights in an area. Fishing rights are granted by auctions in the district capital. However, the main source of revenue from the lebak lebung license holder is said not to come from fishing, but from illegal logging. According to estimates reported in the spatial management plan draft for Musi Banyuasing (Government of Musi Banyuasin, 2006), up to 200 rafts – each with four logs of three to four meter length - left the area each day in 2002/2003.

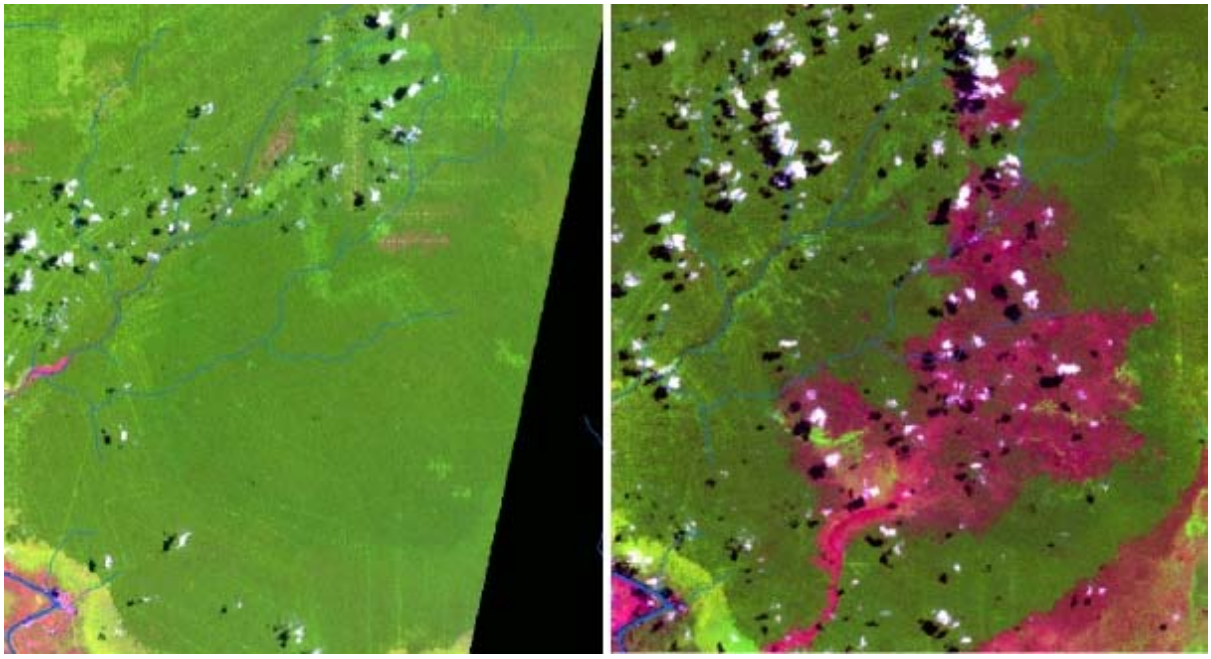

Figure 3: Impact of large scale fires due to illegal logging operations in MPSF: satellite images from 1999 and 2007

Figure 4: Illegal logging operations in MPSF. Right: SSFFMP team member at the spot of a recent felling, left: transport of rafts with illegally logged timber on Merang river

Resource collection (wood collection, fishing, etc.)

Other activities leading to forest degradation are mainly linked to uncontrolled fire use and fires that spread from other areas into the forest. This process is observed in many areas of MPSF. Frequent resource collecting activities are *gelam* wood collection, fishing and hunting. *Gelam* or paperbark tree (Melaleuca spp.) is a typical tree in secondary vegetation in shallow peat swamps (Witten et al., 2000). It is frequently used in construction for scaffolding. Often fire is used for removing underbrush and scrubs to clear access to an area to harvest *gelam* trees. Resource collecting activities are mostly carried out by local populations living in the villages of Muara Medak, Muara Merang, Pulai Gading or Mangsang. The current quantitative impact of these activities to past land use changes is unclear, but assumed to be considerable[1] and mainly due to uncontrolled fires.

3.2.2 Peat Oxidation

Peat oxidation accelerates when canals are dug to drain the peat soils. As a consequence, oxidation of organic carbon starts, leading to release of carbon dioxide to the atmosphere. Large scale peat degradation is therefore associated with the establishment of oil palm and industrial timber plantations (Hooijer et al., 2006). Establishment of drainage channels was initiated during the large scale logging operations of the 1970s, 80s and 90s, some of the channels are still active. The amount of peat oxidation due to logging, and forest cover degradation or deforestation is difficult to access. Peat oxidation can be expected to strongly increase, when canals are established for systematic water table management as necessary for HTI concession areas. Effects of peat oxidation are assessed in detail in the report of Moder and Siegert (2008).

[1] compare the studies by Chokkalingam (2007) for a similar environment in OKI district

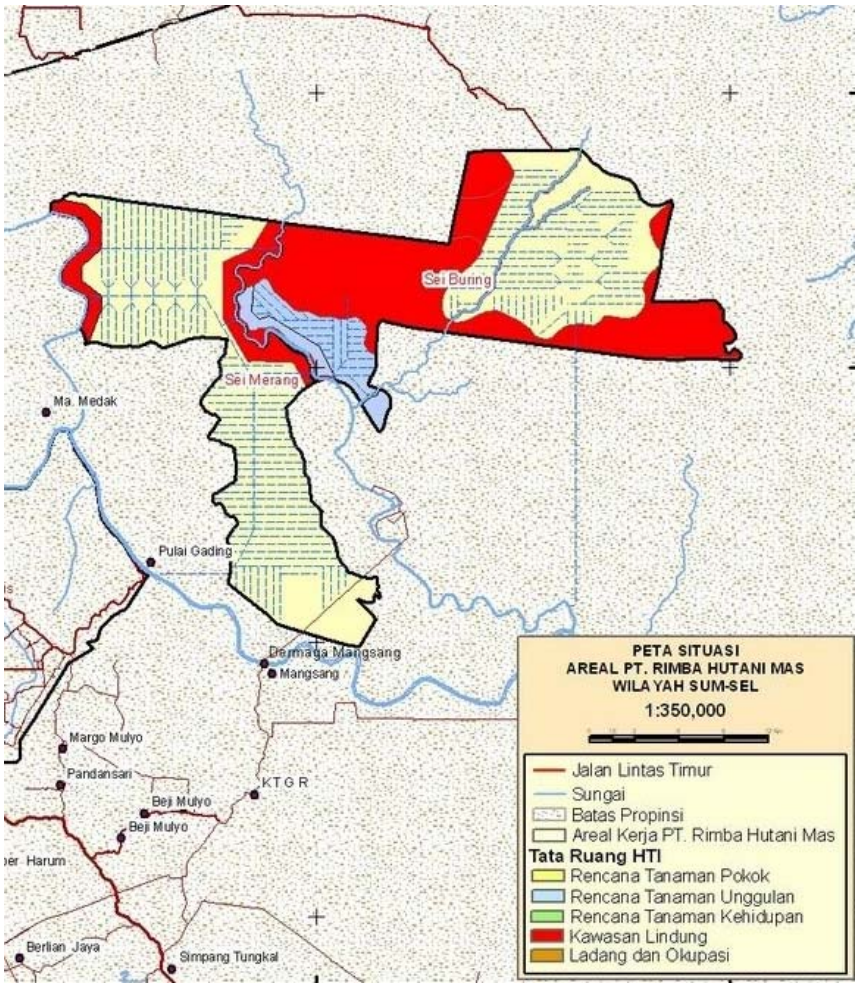

Figure 5: Planned drainage channel network (blue lines) in the concession area of RHM

3.2.3 Deforestation of natural forests

Planned deforestation

Planned deforestation is conversion of forest to another land use according to legal procedures and spatial planning. Two main causes are behind planned deforestation:

1. Conversion to oil palm (or less frequently to rubber) plantation:

Conversion to oil palm plantation is not allowed on land that is legally forest land, except if it is assigned as conversion forest (Hutan Produksi Konversi, HPK). Therefore, direct conversion from forest to oil palm is seldom observed. According to current spatial planning this is about to happen in Merang area North of Lalan river between the villages of Mangsang and Muara Medak. Before that, direct planned conversion from forest to oil palm in Merang area did not occur.

2. Conversion to industrial timber plantation

Conversion to industrial timber plantation does not require the land to be legally converted to another land use. Legally, therefore this process may not classify as deforestation, although an industrial timber plantation with a rotation cycle of eight years has little in common with a natural forest. The term "Deforestation" here is therefore used to describe the loss of natural forest cover. Up to 2007, no land was cleared for establishment of industrial timber plantations in Merang Peat Swamp forest area. However, in 2007, recommendations of a division of the MPSF into different blocks for licenses were passed to the government in Jakarta. Currently there is only one active and valid license in the area that has been handed out to PT Rimba Hutani Mas, which is part of the Sinar Mas Group, one of the major stakeholders in the pulp and paper business in Indonesia (see 3.1.1). Outside the Merang peat dome, two active and one inactive HTI license areas are located partly within the study area.

Recommendations have been given to the Ministry of Forestry for also allocating the area north of the current RHM license to the same company. Operations already started in the southern part of the RHM concession. For details on HTI and oil palm licenses see 3.2.4.

Table 3: Deforestation in lowland and peat swamp forests in Merang area 1989 - 2007

	1989-1999		1999-2007	
	Peat swamp forest	**Lowland forest**	**Peat swamp forest**	**Lowland forest**
Initial forest cover [km²]	1260	570	930	150
Forest cover at the end of the period [km²]	895	170	870	65
Loss in forest cover	365	380	64	84
Yearly loss in forest cover [km²]	36	38	9	12
Initial yearly deforestation rate [%]	3	7	1	8

Spontaneous deforestation

Spontaneous deforestation is any deforestation that is not planned and legalised by the relevant authorities. Spontaneous deforestation was the dominant process in MPSF during the period from 1989 to 1999, mainly related to the devastating forest fires of 1997 with over 740 km² affected

(table 3). The root causes for the fires have been subject to much debate, and degradation due to legal logging followed by abandonment and further resource extraction is probably one of them (Bowen et al, 2000, Dennis et al. 2000, Siegert et al. 2001). This process is still going on, and an area of close to 150 km² has been deforested from 2003 to 2007.

Spontaneous deforestation is going on in a more organized form in the North of MPSF, where people from Jambi are encroaching and after illegally extracting the timber converting large areas of forest land on mineral soil to smallholder rubber and oil palm plantations (see 3.2.6)[1].

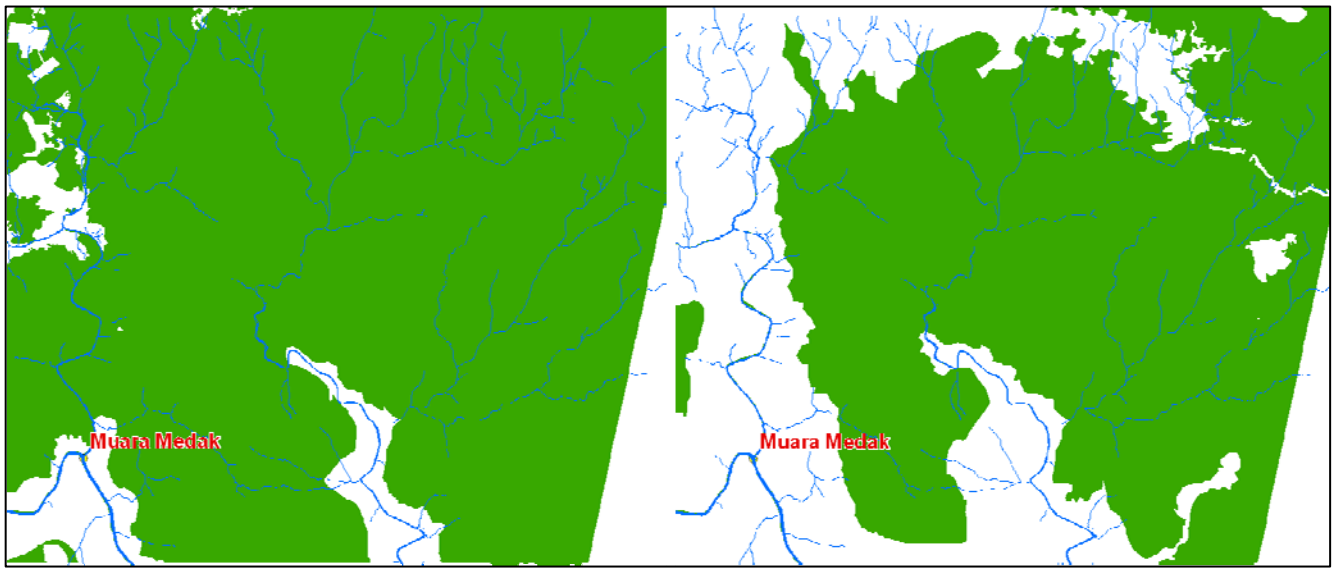

Figure 6: Forest cover in 1989 (left) and 2007 (right)

3.2.4 Establishment of Plantations

Industrial Oil Palm

Establishment of new oil palm plantations is a process that often happened with considerable time-lag after the deforestation or degradation took place. By 2007, however, 76 % of the area allocated to industrial palm oil plantation is either operational or in the process of being established, as can be seen from Landsat satellite images. Therefore it is to be expected that activities on the remaining area will commence soon, also. A large part of the area allocated for palm oil plantation is on peat lands (69 %). In the 2007 Landsat image, large burned areas can be observed that hint at illicit fire use in plantation clearing. Also, on our field trip to the Merang area, we found recently and obviously purposely burned secondary vegetation within the area allocated to PT Mentari Subur Abadi (see table 4).

[1] Firman Bonaventura, pers. comm.

Table 4: Oil palm plantation licenses in the study area, status of operations, and share of peat land

License holder	Status of operations	License Area [ha]	License area in study area [ha]	Peatland in study area [ha]	Peatland in study area [%]
PT. SWADAYA BAKTI NEGARAMAS	Active land clearing and planting operations	14,992	14,992	14,011	93%
PT. PINANG WITMAS SEJATI	Fully operational	14,895	12,190	6,963	57%
PT. ITA MANGKUREBEN	partly cleared, smallholder plantations in area, land use-planning conflict between district and national level (part of the license is in forest land)	9,252	8,651		0%
PT. PANCA TIRTA BUDI AGUNG	Operational, planting activities	7,024	7,024	2,138	30%
PT BANYU KAHURIPAN INDONESIA INTI	Unclear	7,853	5,030	3,153	63%
PT. MEGA HIJAU BERSAMA	Not active until 2007, status unknown	1,572	1,572	1,446	92%
PT. AGRO SUBUR MANDIRI	Active land clearing and planting operations, uncontroled fires observed	10,702	10,030	7,568	75%
PT. PANCA TIRTA BUDI AGUNG	Operational, planting activities	2,883	2,883		0%
PT. MENTARI SUBUR ABADI	Active land clearing and planting operations, uncontrolled fires observed	12,120	12,120	8,245	68%

Industrial Timber Plantations (HTI)

There were only two active HTI licenses in the study area up to 2008. These are PT Bumi Persada Permai in the Southern part of the area, which had already cleared and partly planted some of its license area, and PT Sumber Hijau Permai of Sinar Mas Group, which has commenced activities in the Eastern part of the study area. Up to 2008, no HTIs have been established on the Merang Peat dome itself, although two district based licenses had been handed out but were never active. Now, PT Rimba Hutani Mas of Sinar Mas group is the first concession to start activities in the area. Table 4 gives an overview of license status in the area.

Table 5: HTI license areas, license status, peatland share, and current activities

Name of Licence holder	Status of license	Current activities (2008)	Total area [ha]	Arra within study area [ha]	Area on peat in study area [ha]	Percent on peat in study area
Bumi Persada Permai	Licence SK.337/menhut-II/2004 from 7th Sept. 2004	Active HTI (planting started)	23,556	11,647		0%
Pakerin	License 226/Kpts-II/1998 from 27th Feb. 1998	inactive HTI	12,465	2,435		0%
Paramitra Mulia Langgeng	unclear: this license appears in province data, but no recommendation has been given by MUBA district	not active	42,521	18,233	17,508	96%
Rimba Hutani Mas	License 285/Kpts/VI/2007 from 4th June, 2007	Active HTI (land clearing ongoing)	54,747	54,747	51,198	94%
Sumber Hijau Permai	License 500/2639/IV/2002 from 27th Dec., 2002	Active HTI (Sinar Mas Group)	30,642	8,678	7,086	82%
Tiesico Cahaya Pertiwi	District based license, revoked	Inactive, encroachment	6,334	6,334	6,334	100%
Unallocated 2 (RHM requested)	Masterplan handed to Ministry , approvement pending	encroachment	38,558	38,552	28,211	73%
Unallocated 1	Requested for REDD project activities	illegal logging, fire	25,040	25,040	24,994	100%
Unallocated 3	Unallocated in province data, PT B.P.U.J. In district data	inactive HTI	23,801	7,253	6,202	86%
Wahana Lestari Makmur	Three license areas, winner of district based auction in MUBA and Banyuasin. Licenses have reprtedly recently been revoked.	HTI, not active	33,976	28,873	23,504	81%

Source: GIS data from Departmen Kehutanan MUBA, Departmen Kehutanan Propinsi SumSel, Haryanto, 2008

3.2.5 Regeneration

Regeneration takes place in logged over forest and burned areas. Regeneration is a process observed through all timesteps. It is defined here as regeneration from open to medium or from medium to closed canopy natural forest. Regeneration after commercial logging was recorded in an area of about 70 km² from 1989 to 1999, and between 1999 and 2007, some

50 km² were classified as regenerating. In both time periods, the area undergoing regeneration was considerably smaller the area undergoing degradation of natural forest cover (see 3.2.1).

3.2.6 Smallholder plantation establishment

Smallholder plantation establishment is taking place mainly in dryland areas. Generally, these plantations lack a legal basis and smallholders are at the risk of being driven out if investors acquire a license to clear the area for industrial oil palm or HTI development. Spontaneous transmigration from Jambi and smallholder plantation establishment following illegal logging and clearing takes place on large areas in the North of MPSF area. From 1989 to 2007, some 140 km² have been affected by these activities. The area requested for industrial timber plantation development by Rimba Hutani Mas in the North of MPSF overlaps with already established smallholder plantations (see 3.2.4). If the requested license is to go ahead, land use conflicts may arise. RHM is therefore proposing community development schemes to avoid land use conflicts and according to personal communication is not planning on driving out the smallholders. The exact form of the planned community development activities was not clear by the end of this consultancy.

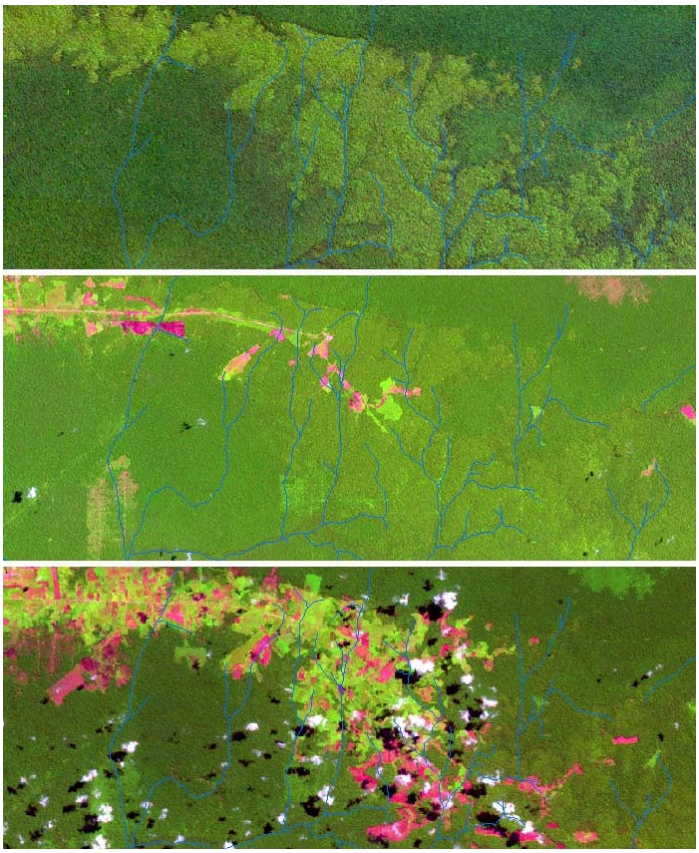

Figure 7: Forest cover loss due to encroachment in production forest as seen in satellite from 1989, 1999 and 2007 (from above)

3.3 Change scenarios 2008 to 2015

3.3.1 A potential baseline scenario

The most likely baseline scenario is the continuation of the current spatial allocation practices. This would mean that for the planned industrial timber plantations and oil palm plantation licenses are handed out and implemented. In the areas not allocated, illegal logging and encroachment will continue as observed in the years before. Our assumptions for a baseline scenario are laid out in table 6.

3.3.2 Potential project scenarios

Two project scenarios were developed, one aimed at a large area available for REDD under consideration of the existing or pending HTI licenses in the area, and another with a minimum feasible area only comprising one block of as of yet unallocated land.

In the “large” project scenario, forest conversion will only take place in already assigned areas, while the other areas are set aside for carbon trading under a REDD scheme. In the “small” project scenario, only the area in the Southern non-allocated block, and the area earmarked for conservation according to current plans for the PT RHM concession area are included in protection schemes for REDD, while the other potential license areas are developed to HTI plantation. Oil palm plantation development outside the forest area continues according to planning.

A third project scenario corresponds to a complete conservation of the MPSF, according to the protected forest status as mapped in the national spatial plan (see 3.1.2). This scenario is described in table 6, but no carbon content estimation and spatial representation is available at the time of writing this report, so it is mentioned here as an option that still needs further investigation.

The basic building blocks of the scenarios are presented in table 6.

Table 6: Overview of scenario characteristics

Process	Scenario							
	Baseline		"Small" project		"Large" project		Complete conservation	
	Activity	Area [ha]	Activity	Area [ha]	Activity	Area [ha]	Activity	Area [ha]
Forest conservation	• Preservation of conservation areas within the HTI areas where such plans are available. • A crocodile protection area as indicated in the spatial planning of 2006 is implemented. However, there is no active management for the protection of the area, meaning that encroachment and illegal logging in the area continues. This area is therefore counted as "unmanaged" • Sembilang National Park is effectively protected from land use conversion	57,000	• Setting aside 25.000 ha (Southern unallocated block) for conservation • Preservation of conservation areas within the HTI areas where such plans are available. • A crocodile protection area as indicated in the spatial planning of 2006 is implemented and actively managed	83,000	• Setting aside 25.000 ha (Southern unallocated block) for conservation • in co-operation with PT. RHM, areas with difficult access due to conservation restrictions are included in a REDD trading scheme • A crocodile protection area as indicated in the spatial planning of 2006 is implemented and actively managed • Preservation of conservation areas within the HTI areas where such plans are available. • Sembilang National Park is effectively protected from land use conversion	123,000	• Setting aside the whole of Merang peat swamp forest for conservation. Current land use is preserved • Sembilang National Park is effectively protected from land use conversion	216,000

Process	Scenario							
	Baseline		"Small" project		"Large" project		Complete conservation	
	Activity	Area [ha]	Activity	Area [ha]	Activity	Area [ha]	Activity	Area [ha]
Conversion to HTI	• Conversion of the parts of MPSF area to industrial timber plantations that already have HTI licenses assigned or which are in the process of handing out such licenses • The concessions convert 15,000 ha of natural forest per year to industrial timber plantation • One plantation production cycle lasts eight years	132,000	• Conversion of the parts of MPSF area to industrial timber plantations that already have HTI licenses assigned or which are in the process of handing out such licenses • The concessions convert 15,000 ha of natural forest per year to industrial timber plantation • One plantation production cycle lasts eight years	132,000	• Conversion of the parts of MPSF area to industrial timber plantations that already have HTI licenses assigned or which are in the process of handing out such licenses • in co-operation with PT. RHM, areas with difficult access due to conservation restrictions are included in a REDD trading scheme • The concessions convert 15,000 ha of natural forest per year to industrial timber plantation • One plantation production cycle lasts eight years	115,000	• All HTI licenses in MPSF are revoked, ongoing HTI development is stopped • HTI development outside MPSF continues as scheduled	23,000
Conversion to industrial oil palm	Conversion of the non forest land to oil palm plantation where oil palm plantation licenses are planned	76,000	Conversion of the non forest land to oil palm plantation where oil palm plantation licenses are planned	76,000	Conversion of the non forest land to oil palm plantation where oil palm plantation licenses are planned	76,000	Conversion of the non forest land to oil palm plantation where oil palm plantation licenses are planned	76,000

Process	Scenario							
	Baseline		"Small" project		"Large" project		Complete conservation	
	Activity	Area [ha]	Activity	Area [ha]	Activity	Area [ha]	Activity	Area [ha]
Peat drainage	Drainage of peat lands up to 30 cm in HTI and oil palm plantations	147,000	Drainage of peat lands up to 30 cm in HTI and oil palm plantations	147,000	Drainage of peat lands up to 30 cm in HTI and oil palm plantations	130,000	Drainage of peat lands up to 30 cm in oil palm plantations	53,000
Unmanaged areas	• Continuation of illegal logging activities and wildfires in parts of the area where no licenses have been handed out. • Occurrence of two severe wildfire seasons in the area until 2015. • Continuing conversion of (mainly) dryland forest to agriculture in the northern part of MPSF • For the unmanaged areas, a simple extrapolation of land use changes was therefore used to estimate land cover in the year 2015.	79,000	• Illegal loggers are driven out of the protection areas • Occurrence of two severe wildfire seasons in the area until 2015. Fires are kept out of the now protected area • Continuing conversion of (mainly) dryland forest to agriculture in the northern part of MPSF • For the remaining unmanaged areas, a simple extrapolation of land use changes was therefore used to estimate land cover in the year 2015.	53,000	• Illegal loggers are driven out of the protection areas • Occurrence of two severe wildfire seasons in the area until 2015. Fires are kept out of the now protected area • Conversion of (mainly) dryland forest to agriculture in the northern part of MPSF is stopped due to successful implementation of community development mechanisms and law enforcement in co-operation with RHM • For the remaining unmanaged areas, a simple extrapolation of land use changes was therefore used to estimate land cover in the year 2015.	30,000	• Illegal loggers are driven out of the protection areas • Fires are kept our of the protection areas • Conversion of (mainly) dryland forest to agriculture in the northern part of MPSF is stopped due to successful implementation of community development mechanisms and law enforcement • Unmanaged areas are limited to a minimum	30,000

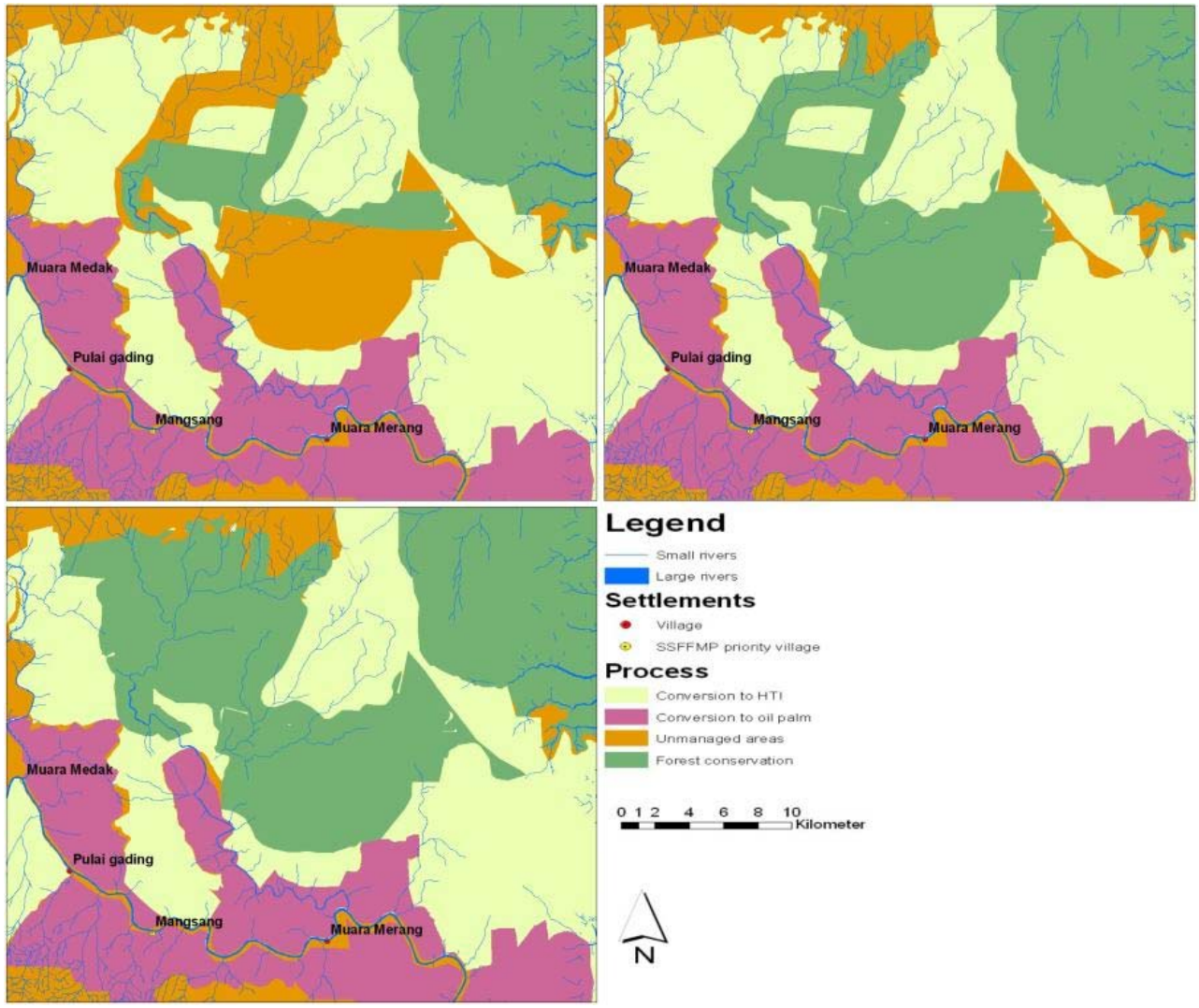

Figure 8: Maps of scenarios: above left: baseline, above right: small project, below: large project.

3.3.3 Change pathways for unmanaged areas

To establish the land use scenario that for unmanaged areas, we assumed a continuation of present land use change patterns. Unmanaged areas are all areas that are not under a clearly defined management, i.e. not allocated to HTI or oil palm plantation and not under a management plan for conservation. For each of the scenarios these areas amount to 79,000 ha, 53,000 ha or 30,000 ha for the baseline, small project and large project and protection scenarios, respectively (compare table 6).

Changes pathways for the baseline scenario of the unmanaged areas are illustrated in figure 9. The detail assumptions are as follows:

- Deforestation continues at a similar yearly rate as in 1999 – 2007. We assume that annually 900 ha of peat swamp forest and 500 ha of dryland forest are converted.in the unmanaged areas.
- Gains and losses between land cover classes continue in the same proportions as between 1999 and 2007
- As a consequence of large scale allocations to industrial plantations (timber and oil palm), the pressure of the remaining unmanaged land increases, since the areas used by communities and for illegal logging (which in fact corresponds largely to the unmanaged areas) diminishes while the resource need of communities do not. This assumption does not account for eventual community development activities or employment opportunities for communities in plantations, as there are no data available on that.

The area of a potential carbon saving project as pictured in the scenarios falls largely (large project) or completely (small project) within the unmanaged areas. Our assumption regarding the project impact is as follows:

- Land cover within the project area remains unchanged from 2007, i.e. effects of rehabilitation activities are not reflected in the land cover class until 2015, and degradation/deforestation is stopped.
- Within project leakage is prevented, i.e. the deforestation/degradation rates are reduced proportionally to the area of unmanaged land that comes under management by the carbon saving project.

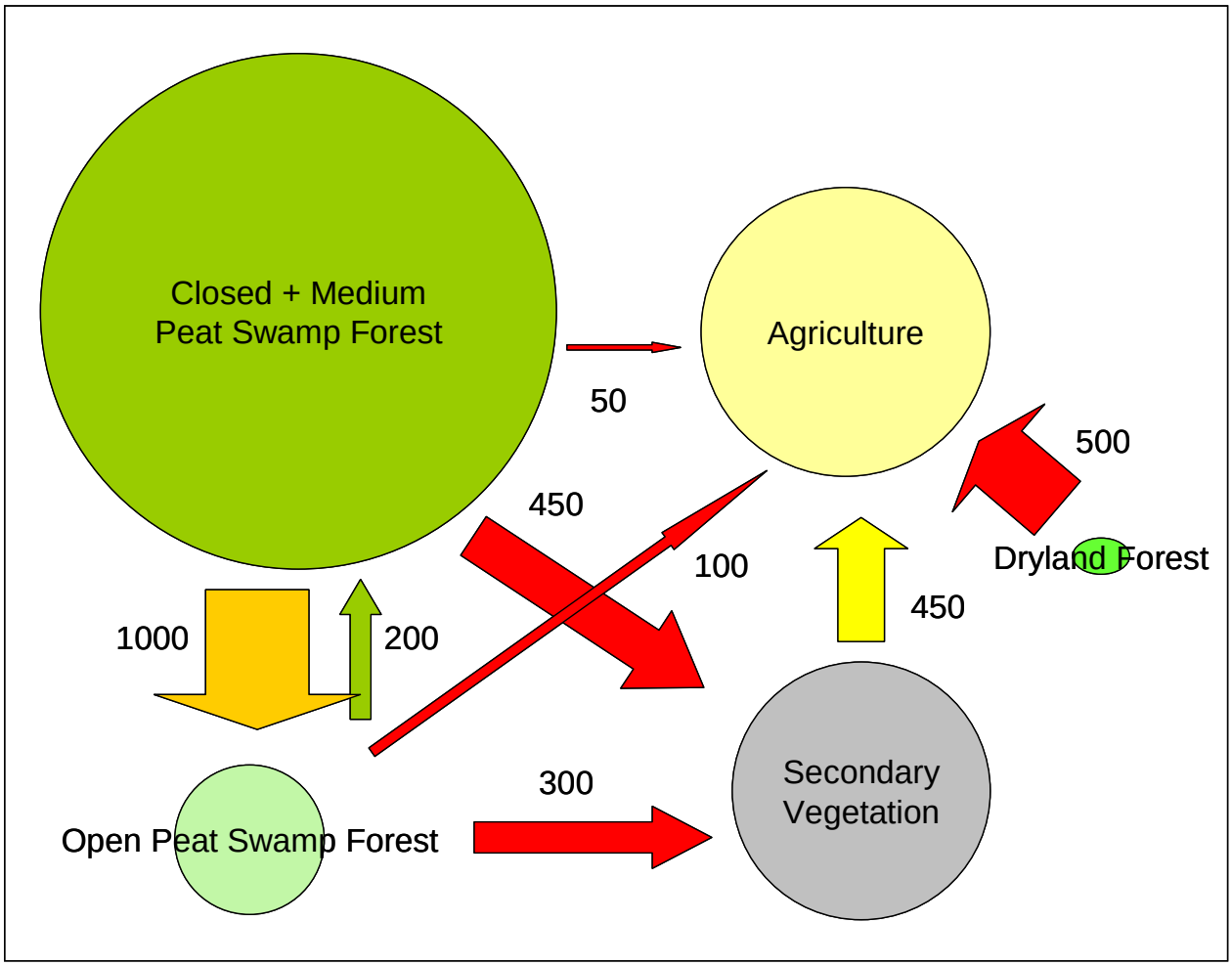

Figure 9: Change pathways for the unmanaged areas in the study area (baseline scenario). Arrow and circle sizes are drawn to scale to represent area size and change magnitude, respectively. Red arrows: deforestation process; orange arrow: forest degradation, yellow arrow: non-forest conversion to agriculture, green arrow: regeneration. Numbers are in ha/year.

3.3.4 Area distribution between different land cover types for scenarios

The area occupied by the different land cover types is depicted in figure 10. As can be seen from the figure, the area allocated to oil palm is not affected by the scenarios, as oil palm plantations are not to be established on forested land that is to be included in a potential project activity. In all scenarios except for the conservation scenario, large areas of natural forest are converted (approximately 40 % in the large project scenario and about 55 to 60 % in the small project and baseline scenario, respectively). Large areas are converted to industrial timber plantations, a land use not found previously in the area.

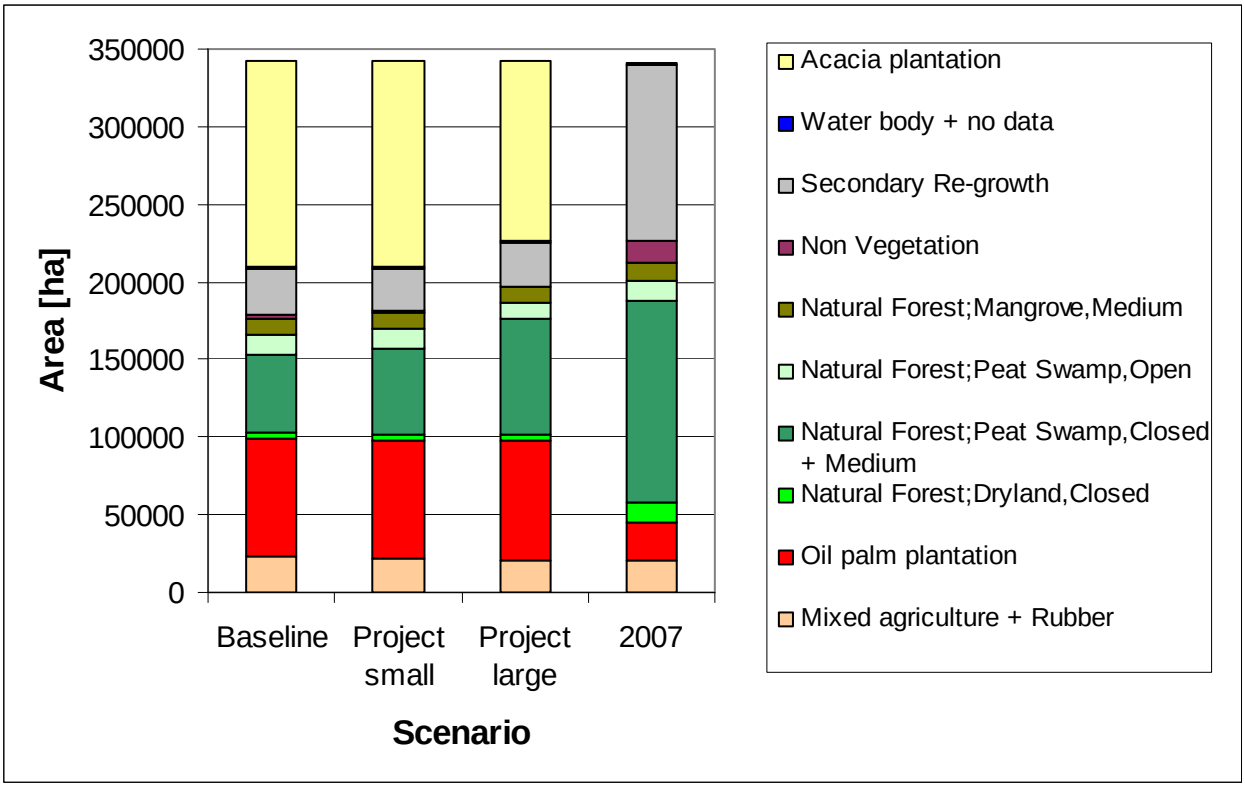

Figure 10: Land cover 2015 in the study area according to different scenarios

3.4 Potential carbon emissions from scenarios

Potential carbon emissions are reported in detail by the report of Moder and Siegert (2008). An overview of results is given here.

Due to the large forest conversions and large scale peat drainage, there is a considerable increase in CO2 emissions in all scenarios. This increase is largely attributed to peat oxidation and forest fires. Peat oxidation amounts to 60 % of the emissions and peat fires amount to 18 % of CO2 emissions in the baseline scenario (Moder and Siegert 2008). The yearly emissions of the baseline scenario amount to about 6 % of the yearly emissions from forest conversions reported by Indonesia to the UNFCC in 1994 (the last reporting year, UNFCCC 2008). This appears to be a very large number, but we have to bear in mind that current reporting mechanisms do not necessarily consider emissions from peat fires or peat oxidation. Nevertheless, it shows that the emissions are considerable, even when compared to the national level of a large country like Indonesia.

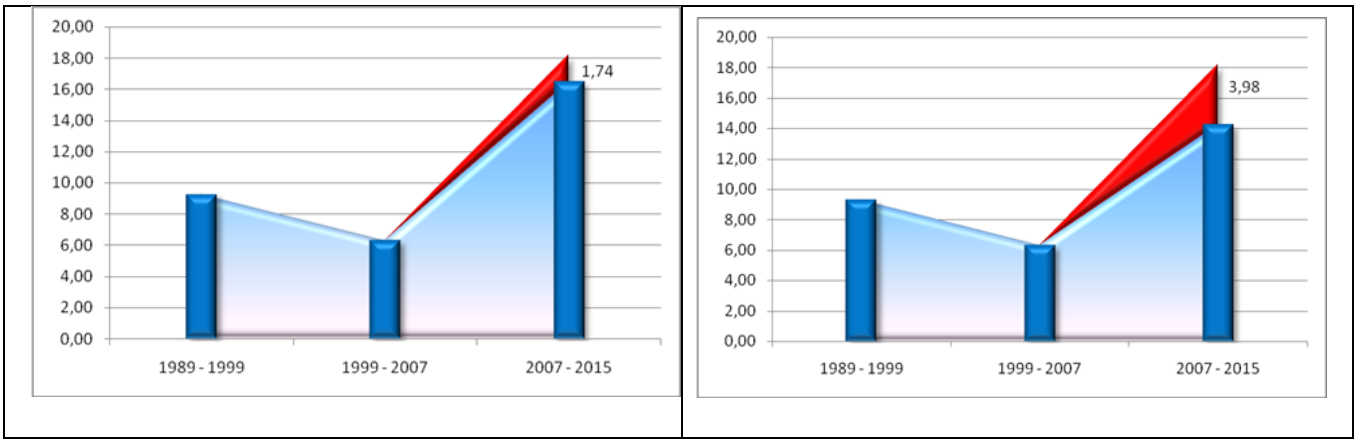

Figure 11: Estimated yearly CO2 emissions in the period from 1989 -1999, 1999 – 2007 and potential emissions for 2007- 2015 for small (left) and "large" (right) scenarios baseline (blue columns), and the baseline scenario (red area) (Moder 2008, pers. Comm.)

Table 7: CO2 emissions and potential saving for baseline, small and large project scenarios

	Baseline		"Small" project			"Large" project		
	Carbon emissions [Mt]	Yearly Emissions [Mt]	Carbon emissions [Mt]	Yearly Emissions [Mt]	Potential saving [Mt]	Carbon emissions [Mt]	Yearly Emissions [Mt]	Potential saving [Mt]
1989-1999	92.4	9.26	-	-	-	-	-	-
1999 – 2007	50.4	6.30	-	-	-	-	-	-
2007 - 2015	145.5	18.19	131.57	16.45	13.93	113.68	14.21	31.82

Source: Moder & Siegert 2008

3.5 Open issues for establishment of a reference emission level (baseline) for a potential REDD pilot project

3.5.1 Reference area and time period

According to the draft of the REDD regulation currently under preparation by the Ministry of Forestry (MoF, 2008), the maximum duration of a REDD implementation depends on the proponent. In case of a forest concession of similar right (e.g. community plantation forest), the maximum duration of the activity is the duration of the license. In case the project is proposed by an administrative unit (e.g. Forest Management Unit, KPHP) the maximum duration is thirty years.

The regulation is less clear on the reference area. It refers to a reference

emission level at the REDD activity location. Current discussions point that the reference area may be the forest management unit, or if it is not yet in place, the district where the activity takes place. In the case of Merang peat swamp forest this could involve the districts of Musi Banyuasin and Banyuasin. For an REDD pilot to be operational, the area and time period for the reference emission level still needs to be defined. This should be done in accordance with involved stakeholders (license holders, district, and national level).

3.5.2 Scenario definition

Land use change modelling

In order to establish a credible baseline over a larger area and for a longer time period, it is necessary to conduct spatially explicit land use change modelling. Thus, future land use could be anticipated based on realistic assumptions. To verify such a model, current or past land use status could be modelled and compared against actual land use. A number of land use change models have been developed over the past years, and some are already in operational use, e.g. for spatial planning purposes (see Koomen et al., 2007). Some of these models have also been used for modelling tropical deforestation (e.g. Verburg and Veldkamp, 2004, Dale et al, 2003). Application of such a model is necessary for solving the complex allocation problems posed by estimating future land use under various assumptions. It can also be used to optimize the project area and mitigation activities for an REDD project, e.g. to address issues of leakage that result from changes in land use allocation.

Forest fires and peat drainage

Forest fires and peat drainage are among the major sources of greenhouse gas emissions in Merang area. However, the assessment of emissions is still very crude, and real emissions may differ considerably. Further work and an improved understanding of the effects of peat drainage are therefore necessary. It is also not clear how drainage of large areas of peat will affect neighbouring undrained areas. Assessment of the potential impact of drainage on water table and vegetation in conservation areas could be assessed using hydrological modelling.

Both issues, land use change modelling and forest fire and peat oxidation issues could most effectively addressed by a research project that would accompany the implementation of a REDD pilot project in Merang area.

Achieving a common understanding of scenarios and project activities and their potential consequences

For a successful REDD project it is necessary that the involved stakeholders agree on the assumptions underlying a baseline and project scenario, and understand the consequences of land use change activities and project activities. Therefore, definition of baseline and project scenarios is as much an iterative and consultative process to be conducted in a participatory manner with inclusion of the relevant stakeholders as it is a technical and scientific challenge.

4 Summary of findings and recommendations

4.1 Main findings

The main land use threats and their changes over time have been identified and analysed. These are forest and vegetation fires mainly associated with illegal logging and encroachment, forest degradation by rampant illegal logging, forest conversion to agriculture on the dryland areas, and planned deforestation for plantation establishment.

Land use change has been analysed from historical satellite images. Land use change and deforestation ware found to be driven by uncontrolled fires in overlogged forests during the time from 1989-1999, leading to massive deforestation of dryland forest and considerable loss of peat forest, as well as severe degradation of peat swamp forest due to logging activities. Between 1999 – 2007, further loss of dryland forest could mainly be attributed to spontaneous conversion to agriculture in the Northern part of Merang area, while degradation of peat swamp forest continues in some areas because of illegal logging, while other areas are showing signs of regeneration due to the cease of commercial logging operations. While most of the area deforested in 89 – 99 remained covered by secondary vegetation, shrubs and grasses in 2007, a considerable part of the shrubland is now being converted to oil palm plantations. Changes in land use are related to changes in policy, especially spatial planning. Here, we can observe two contradictory trends over the past years: while strategic objectives of national land-use planning emphasize on conservation due to the overexploitation of Indonesia´s forests, the district level as well as parts of the Ministry of Forestry focus on rapid expansion of plantation area. This contradiction is also reflected in spatial planning: while the new National spatial plan of 2008 foresees the conversion of the Merang area to conservation forest, the Ministry still issued licenses based on recommendations from the district for establishment of industrial timber plantations in Merang area.

Scenarios of possible future developments have been established based on the extrapolation of trends in deforestation and current land use planning information. The main application of such a scenario would be the development of a proposal for carbon trading under a REDD (Reducing Emissions from Deforestation and Degradation) pilot project scheme. The scenarios therefore include a reference emission level or baseline scenario (i.e. “business as usual”), a scenario including a REDD project in a 24,000 ha block, and a scenario including a larger area for conservation involving stakeholders such as pulp and paper plantation business. In the baseline

scenario, a large area of forest and secondary vegetation is converted to Acacia pulp wood plantations and oil palm plantations, involving partial drainage of the peat swamp and thus higher rates of oxidation of peat carbon. A large area is also deforested and degraded in areas that are not allocated for plantation development due to processes such as illegal logging, fire, and spontaneous conversion to agriculture. Depending on the scenario, between 5,000 and 10,000 hectares of natural peat swamp forest could be conserved when compared to the baseline scenario. From these findings, the basis for calculation of emissions from deforestation and degradation as well as potential savings through an REDD project were then elaborated in close cooperation with the STE on carbon stock. The amount of carbon saved between 2008 and 2015 over the whole Merang area when compared with the baseline scenario was 14 and 32 Mt of CO2, respectively. The larger savings in carbon in the second scenario are partly due to avoided conversion of peat swamp forest to Acacia plantation, which would involve partial drainage and higher emissions from peat oxidation.

The work was developed in close coordination with national and international STE´s. Thus, the scenarios developed served as input for the work on developing carbon stocks and potential emissions and savings through conservation, assessment of biodiversity and options for carbon trade.

4.2 Recommendations

1. From the viewpoint of conservation and also from a management viewpoint, it is highly desirable for a potential carbon savings project to have a compact shape with safeguarded boundaries and a connection to the Sembilang National park. At the end of the consultancy it became clear that a number of licences for plantation development in the area will be revoked. This would give new options for a more compact shape of a potential project area, and for a link with the Sembilang Natinal park. Potential options for area swaps should therefore be developed to achieve the objective of a compact, safeguarded and manageable area with good potential for carbon trading. A dialogue with the relevant stakeholders has been initiated. SSFFMP is in an excellent condition due to a long and continues relationship with the major stakeholders involved to lay the grounds for such a process.

2. In order to elaborate a successful proposal, the definition of a credible baseline is of paramount importance. The result of this mission is a contribution to this effort. However, there are still large uncertainties involved in the scenarios as well as in potentially avoided greenhouse gas emissions. Furthermore, the reference area and reference time span for the

scenarios do not yet correspond to the emerging standards for REDD projects. The foreseeable standards are: a district or forest management unit as the baseline reference area and a time span of thirty years for the baseline vs. project scenarios. The effort to develop such a scenario was beyond the scope of a 22-day mission. The development of a credible baseline scenario for carbon trading would include:

- An agreement with all relevant stakeholders (especially Sinar Mas Group as a major license holder, and forestry departments at national, provincial and district level) on the project area and activities for emission reduction.
- Agreement with the relevant stakeholders on a business as usual scenario based on planning data and extrapolation of current land use activities (as of December 2007, i.e. before Bali COP)
- Acquisition of reliable and current planning data and accompanying documentation.
- Development of a spatially explicit land use change model based on the agreed upon business as usual scenario. Such models exist and have been successfully used in similar project contexts. This model would have to be run for a period of thirty years.
- Improved assessment of potential impact of forest and land fires.
- Improved assessment of effects of peat drainage on carbon emissions
- Assessment of the potential impact of drainage for plantation development close to a potential project area on water table and vegetation within the project area.
- Incorporation of a risk assessment to include foreseeable long-term developments such as a change in commodity prices and projected population development.

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Appendix 1
Spreadsheet for land use change modelling in unmanaged/unallocated areas

Appendix 2
Maps of base data and scenarios