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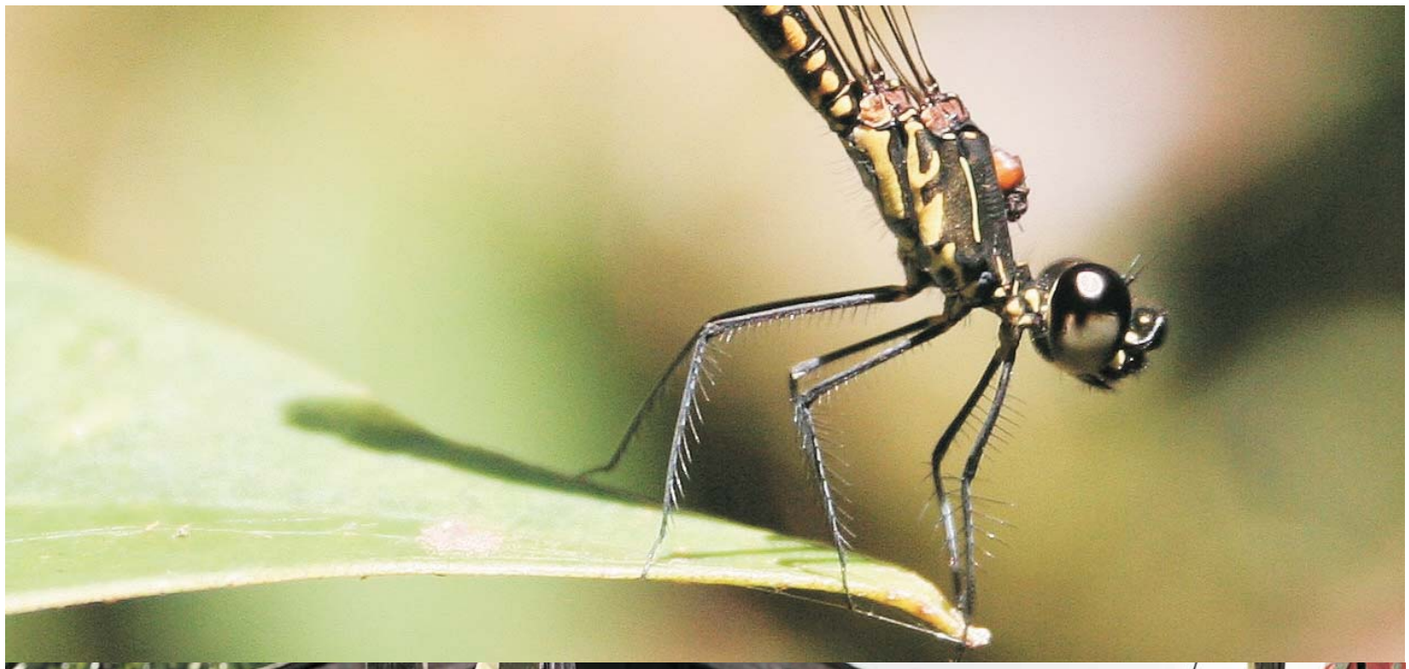

Provisional Report of the Central Kalimantan Peatland Project

November 2008

WETLANDS INTERNATIONAL

WWF for a living planet

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Foreword from CKPP Consortium

This provisional report of the Central Kalimantan Peatlands Project (CKPP) is presented as a preliminary draft. Through the production of this document, the CKPP consortium would like to invite comments from people interested in CKPP's work.

The draft report is intended to enable review and inputs from a wide range of parties who have engaged with the project over the past three years. In particular, we are interested in ensuring that this document fulfils the needs for specific information related to the project's approaches, methodologies, and the state of science.

This document will also be used as a basis for discussion during the Indonesian Symposium on Policy and Practice in Peat and Lowland Management to be held in Palangka Raya from 24-26 November, 2008.

At the time this provisional report was prepared, evaluation and documentation of the project's results were on-going. A final report and executive summary will be produced in early 2009. The final version will integrate inputs received in response to the current version, as well as results from the evaluations and documentation.

CKPP Consortium
11 November, 2008
Palangka Raya

Summary

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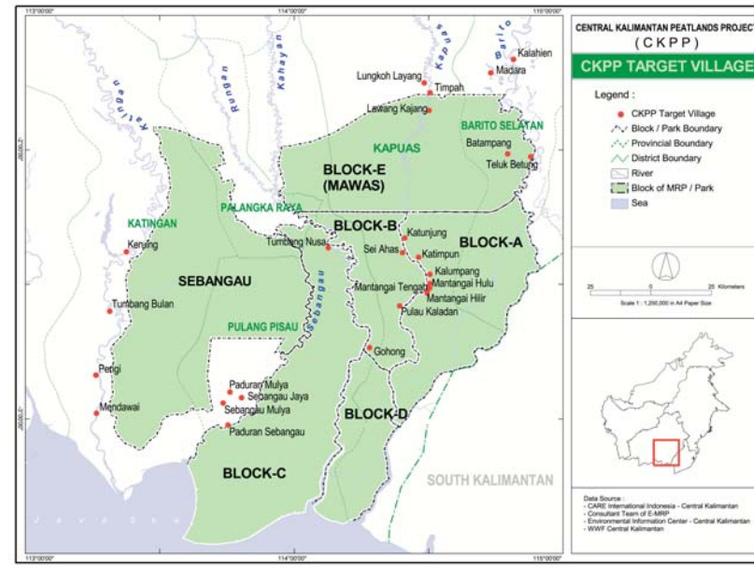
Figure 1.
Map Central Kalimantan

In December 2005 the Central Kalimantan Peatland Project (CKPP) was established with the overall objective of conserving the natural and economic value of the peatswamp areas of Central Kalimantan.
This report describes the experience and lessons learned over the three-year project. It explains the project's approach, the challenges of successful peatland restoration and conservation, the project's achievements, and future opportunities for this area and other peatland regions in Indonesia.

Peatland degradation will continue unless action is taken, with severe consequences for global climate, biodiversity and local communities. Peatland conservation and restoration is therefore extremely urgent. With its innovative approaches, CKPP can be seen as an example for provincial and country authorities, institutions and NGOs of how to integrate the principles of sustainable development into policies and programmes for large scale restoration of logged and drained peatlands and for the protection of intact areas.

Figure 2.
Map CKPP Project Area



CKPP's approach

Peatland conservation and restoration is not an easy task. Actions at different levels and in various disciplines are required to sustain and restore the natural values and life supporting functions of this sensitive ecosystem. The CKPP consortium was therefore designed as a partnership between poverty relief and conservation organisations; the Borneo Orangutan Survival Foundation (BOSF), CARE International Indonesia, the World

Wide Fund for Nature (WWF), Wetlands International and the University of Palangka Raya (UNPAR). The consortium was guided by a local advisory group, which was chaired by the provincial governor, and involved sectoral provincial agencies and relevant national level agencies. The project also worked closely with other local stakeholder organisations and local communities in the project implementation.

The priority of the project was peatland rehabilitation, which requires improving the hydrology of the peatswamp forests and degraded peatlands, regreening degraded peatlands and reducing incidence of and damage by fires, all to improve biodiversity conservation. This work was complemented by a range of efforts to reduce poverty. These included improving local health facilities, developing alternative livelihood strategies and investing in the socio-economic development of sustainable fisheries, agriculture and forestry. In addition, much effort was placed on building capacity and creating awareness of the problems and solutions among people in the area, by holding interactive training events and by involving local people in the project's work.

Integrating sustainable management of peatlands and poverty reduction

There is a clear linkage between peatland degradation and poverty. The occurrence of peatlands in developing countries often coincides with rural poverty. Remaining wilderness areas and their natural resources provide a buffer for communities that are located far from markets and trapped in poverty. The communities often rely on the natural productivity of these ecosystems or make use of their potential by converting them to subsistence agriculture. The natural ecosystems enhance their food security, and are also important for the survival of their cultures and as a basis for their livelihoods. We believe therefore that effectively promoting the sustainable use and conservation of wetlands and their resources involves focusing on their values to local people. This means that the solutions to peatland degradation must put people first and require development and community-based action.

Central Kalimantan has become one of the poorest regions in Indonesia, largely because of peatland drainage and peat fire disasters. The area has suffered from a loss of resources, loss of development opportunities and increased risk for investors, all while it copes with difficulties in providing schooling and health services. Environmental degradation and poverty mutually re-enforce each other, creating a vicious cycle that can only be addressed through a combined approach of development, peatland rehabilitation and conservation.

The CKPP partners have worked closely with the local communities and authorities to deal with these issues and share their expertise and experience to help resolve them. The design of the specific planning activities and the mode of implementation were entirely bottom-up. Good cooperation with the local stakeholders has been a critical success factor and this cooperation will also ensure the sustainability of the project's activities beyond the end of the project.

The project area

In Southeast Asia 12 million hectares (ha) of peatland are currently deforested and mostly drained, including over 1.5 million hectares of the tropical peatswamp forests of

Slash and burn pratice - an important source of large wildfires in peatlands

Central Kalimantan. The objective of the CKPP was to maintain and restore the Sebangau area, Block E (Mawas) and other parts of the Ex-Mega Rice Project (EMRP) peatlands in Central Kalimantan, Indonesia (see maps), in total over two million hectares. Under normal circumstances, these tropical peatswamp forests perform a range of environmental and social functions. They host thousands of plant and animal species and play an important role as carbon stores, crucial for global climate change mitigation. For local communities they provide vital resources including a continuous supply of clean water.

Unfortunately, unsustainable agricultural practices and logging activities pose a strong threat to the future existence of these locally and globally important ecosystems. Central Kalimantan has suffered severely from forest and peat fires and over-drainage, largely as a result of the failed Ex-Mega Rice Project, where 1.4 million hectares were intensively logged and drained. The EMRP involved about 4,400 kilometres of drainage channels, some of which were up to 10 metres deep. The thousands of people who moved to the area found the soils unsuitable for agriculture and many supplemented their income through illegally logging the forests around the EMRP area. Now the drained, logged areas are the scene of annual peat fires, which make a significant contribution to global carbon emissions. Very few intact peatswamp forests remain, and many of these are affected by illegal logging and the damage from illegal logging channels. This issue has significant impacts in the protected peatswamp forest areas.

The project's achievements

The Central Kalimantan Peatland Project has been a success on many levels. By using an innovative community-based approach, the CKPP consortium was able to considerably improve land use and management in the target areas through conservation, restoration and improving the livelihoods of local communities. Some key achievements are:

- *Reduced emissions from drainage and peat fires*. Every year peatland degradation in Southeast Asia leads to the emission of an average of 2,000 million tonnes of greenhouse gases, of which some 90% originate from Indonesia. To reduce carbon dioxide (CO_2) emissions from Central Kalimantan, 24 large dams were built in the biggest drainage canals and over 263 blocks (smaller dams) in smaller channels that were cut for drainage and illegal logging. The water table in these areas was raised substantially, leading to a reduction in peat decomposition (oxidation). In addition, the project facilitated the formation of 25 village fire brigades responsible for preventing and controlling fires in and around villages and in some more remote areas, including parts of the Sebangau National Park. The lessons from this experience are being incorporated into government plans for fire prevention and control.
- *Over 1,500 hectares of peatlands were reforested*. Seedlings of up to 40 valuable indigenous tree species that can live in waterlogged conditions were provided and subsequently planted by local farmers in hydrologically restored areas. One of the most commonly planted species was the Jelutung (*Dyera sp.*) which is also called the chewing gum tree because of its valuable latex, which can be harvested sustainably when the trees are eight years old. The value of these trees provides an incentive to local people to actively help prevent fires. Tree nurseries were also developed and managed by communities themselves. Reforestation of the rewetted peatswamps in the area also results in direct carbon sequestration. This may be further enhanced once the restoration leads to renewed peat formation. The vegetation can play an important role in this process by influencing micro-climate and eco-hydrological conditions.
- *Improved public health and the creation of alternative livelihoods*. Access to health facilities was improved in 17 villages. Malnutrition has been reduced. Also, local incomes conditions have improved. The promotion of alternative farming techniques (eg no-burning farming techniques), coupled with support for improved marketing, is starting to pay off for the local communities involved. Additional income sources may be developed, linked to planned incentives for biodiversity conservation and

carbon-related finance mechanisms. Households participating in CKPP activities have been able to stabilise their income. Communities were supported in adopting more sustainable land-use management practices, which may help to sustain important natural resources such as fish, timber and other peatland products. No-burning practices may reduce incidences of smog-related respiratory diseases in dry years. The project has resulted in 25 village development plans being produced, which have been welcomed by the local government. It may lead to improved spatial planning, better policies at provincial and national government levels, and better coordination between government departments on peatland matters.

- *Increased respect for peatlands*. There appears to be a renewed respect for the environment, especially peatswamps. This can be seen in the reduction of illegal sawmills around forest reserves and in the increased political, public and financial support for peatland conservation, such as the actions of the Provincial Government, which initiated the development of a Master Plan for peatlands rehabilitation, and of the National Government in issuing Presidential Instruction No 2/2007 regarding the rehabilitation of the Ex-Mega Rice Project area.

- *Agenda-setting of global policies on biodiversity and climate*. The consortium has raised global awareness of peatland problems in Indonesia. Thanks to media coverage and consortium members' presence at key meetings, the importance of peatlands to climate change is more widely recognised by the UN Convention on Climate Change (including REDD - UN climate policy on Reduceding Emissions from Deforestation and Degradation in developing countries-developments), the Convention on Biological Diversity and the Ramsar Convention on Wetlands. All took decisions in 2007 and 2008 that address tropical peatlands as a key ecosystem with high values for carbon storage.

The complexity of peatland ecosystems, further challenges and research

Peatland restoration and conservation requires dealing with complex scientific, technical and social challenges, including reducing greenhouse gas emissions, hydrological management and soft soil engineering, incentive mechanisms and the empowerment of local stakeholders. Throughout the project several areas were identified for improvement in terms of the types of activities and the target recipients. Many aspects have been identified that urgently require further research, particularly scientific monitoring of peatland restoration that will enable carbon payments, developing innovative financing mechanisms that will enable equitable sharing of revenues among stakeholders, identifying the impacts of peat degradation on freshwater biodiversity and fisheries, and species identification for replanting areas at different stages of degradation. A major challenge - but also an opportunity - is that while their conversion may be of interest to many development sectors, their conservation also benefits many sectors and stakeholder groups. Thus wise use will create losses to some, but will bring benefits for others, in mitigating against floods and droughts, climate change and improving biodiversity conservation and opportunities for sustainable forestry, fisheries and tourism.

Large scale action at the local and global level

CKPP is a first and small step towards the restoration and sustainable use of Central Kalimantan's and Indonesia's peatlands. The successes of the project's innovative approaches set an important example, but to date the results are still minor in comparison to the scale and intensity of problems and challenges of peatland exploitation in the area. The completion of the Master Plan for the over one million hectares of the EMRP will be the next step in stimulating the long process of rehabilitation and revitalisation of the troubled area.

The degradation of these former peatswamp forests is a major issue. The possibility that huge areas of potentially productive forests might be forever turned into wastelands is a problem of national and even international proportions. Annual peat fires can cause air pollution that even affects neighbouring countries.

CKPP has therefore also invested in significant awareness-raising on the enormous impacts of peatland destruction in Indonesia, at national, regional and global levels. In Indonesia alone, a minimum average of 2,000 megatonnes of CO_2 are emitted due to peatland loss. This is equal to eight per cent of all global fossil fuel emissions - and Central Kalimantan is one of the main areas causing this problem. The area is also of global importance in terms of biodiversity, as it hosts globally threatened species such as the Orangutan as well as many less known threatened species. Indonesia cannot solve the problems caused by peatland degradation by itself.

The global climate community offers increasing opportunities for the maintenance and restoration of peatlands. International support for long-term funding is an absolute necessity to enable poverty reduction and biodiversity conservation in Indonesia, and to significantly reduce global CO_2 emissions and land degradation. The CKPP consortium partners therefore continue to raise support from individual countries and international conventions such as the UNFCCC, CBD, and the Ramsar Convention, as well as interest from private sector partners.

2

Introduction

History of recent Dutch involvement:

In 2004, recognising the high conservation value of peatswamp forests in Indonesia, especially Central Kalimantan, and their rapid degradation and loss a group of Dutch NGOs asked the Dutch government to include support for peat swamp forest conservation and restoration in the area in its international development cooperation programme.

On November 14, 2004, the Netherlands parliament passed the Peat Forest Amendment. Then Minister of Development Cooperation, Mrs van Ardenne, said:

'There is the amendment No. 5 of Mrs Huizinga and Mr Brinkel to invest extra in Kalimantan in the combating of illegal logging, because the conservation of tropical rainforests is a big problem in Borneo. This is not only a matter of illegal logging by private citizens, but the government is also not directly addressing this. If we are to get involved it should be set up crystal clear with the Indonesian government and the local authorities. There should be sound control on what happens to be able to be effective. I wish to adopt this amendment, as I find it important to invest more in tropical rainforests, but we should not do this for a brief period only. We should clearly agree that the relevant authorities will also be involved, to enable this to be effectively addressed'.

Introduction to the Project

The Central Kalimantan Peatlands Project (CKPP) grew out an increasing recognition at the local, national and international levels of the urgency of halting and reversing degradation of the peatswamp forests of Central Kalimantan. Drainage, illegal logging and fire all devastated the peatswamps of the area through the latter part of the 1990s and into the 2000s. The impacts on local livelihoods, the broader economy and wildlife habitats were staggering and the annual contribution to global greenhouse gas emissions was massive.

The project was developed as an emergency response to establish a basis for a long-term multi-donor programme.

As peatlands are very complex and sensitive ecosystems, their conservation and restoration requires a high level of in-depth scientific knowledge and field experience. Prior to CKPP, no other project had attempted to restore tropical peatswamp forests through hydrological restoration combined with reforestation of indigenous tree species and poverty alleviation. CKPP is thus a pioneering project that demonstrates the economic and ecological feasibility of peatswamp conservation and restoration. Its approach and operational structure are innovative and have resulted in a wide range of lessons and recommendations for up-scaling, presented in this report.

CKPP was implemented by a local consortium with five members, the Borneo Orangutan Survival Foundation (BOSF), CARE International Indonesia, the University of Palangka Raya (UNPAR), Wetlands International Indonesia Programme (WI-IP) and WWF-Indonesia (WWF). The project was financially supported by DGIS (The Ministry of Foreign Affairs of the Netherlands). The project started in 2006 and is scheduled for completion at the end of 2008.

Wetlands International Headquarters (WI-HQ) was responsible for the overall project management, within a framework where the responsibility for planning and implementation was very much devolved to the members of the local consortium.

The CKPP would not have been possible without the full support and expertise of local authorities, especially the government of Central

Kalimantan. From its inception the CKPP has involved local authorities in all components of the project. To enable smooth communication, these actors were organised in a Local Advisory Group, chaired by the provincial Vice-Governor. An International Advisory Group provided advice at the international level.

The project's objectives and approach

The overall objective of the CKPP was to conserve the natural and economic value of Central Kalimantan's peatswamp areas. More specifically, the CKPP was designed to:

- Demonstrate the economic and ecological feasibility of peatswamp conservation through innovative financing schemes related to climate and carbon issues.
- Sustain and restore the Sebangau, Block E (Mawas) and Block A/B peatswamp forests and their buffer zones in Central Kalimantan by conservation of peatland areas, poverty reduction and biodiversity conservation.
- Be accomplished through a number of target interventions in Kalimantan's peatswamp forests: fire prevention; hydrological restoration; livelihood development and community empowerment; public health; regreening through reforestation and agro-forestry; conservation of the remaining peatswamp forests (biodiversity conservation); establishment of the Block E (Mawas) protected area; sustainable financing and commitment; and improved policies and coordination between government levels.

The core of the CKPP approach was community-based action. The project aimed to reduce the incidence of and damage by fires, to improve the hydrology of the peatswamp forests and degraded peatlands, to regreen degraded peatlands, to improve biodiversity conservation, to build capacity and create awareness of the problems and solutions and to support the livelihoods of local people in the area by involving them in the project's work and by facilitating development of sustainable income generating alternatives. Additionally, the project worked to ensure that policies related to land use planning, climate change and agro-fuels at the national and international levels reflected the unique characteristics of peatlands.

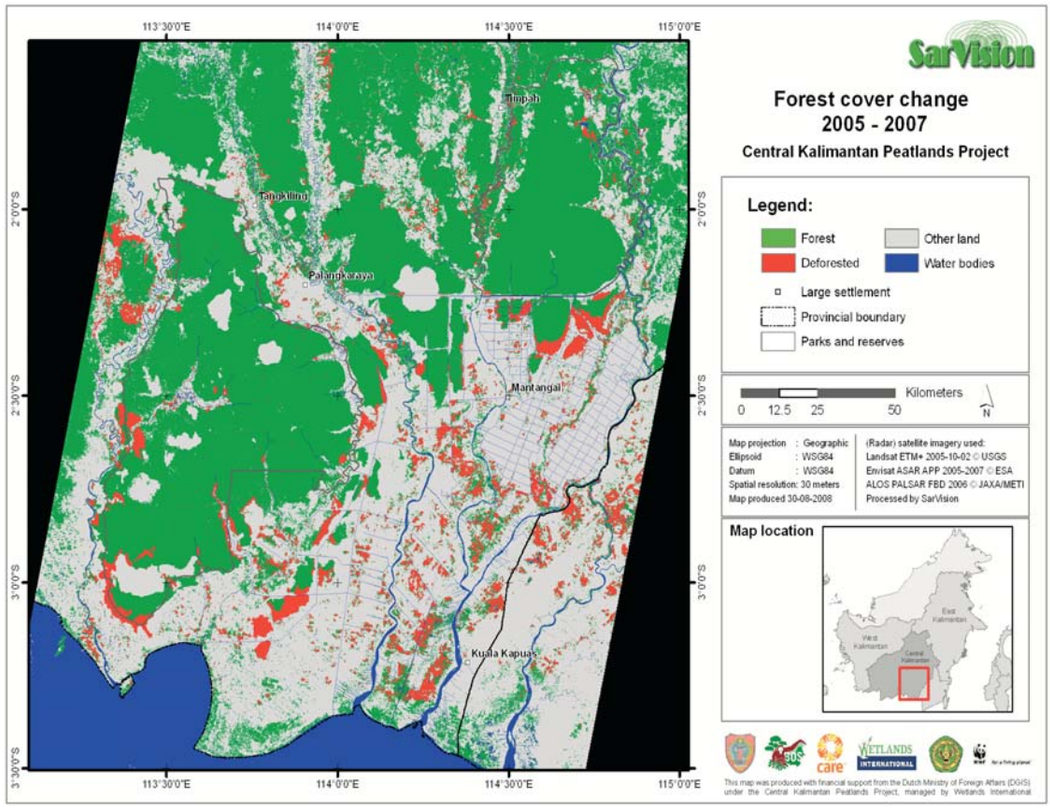
The main field interventions were implemented in and around Sebangau National Park and the Block E and Block A north areas of the ex-Mega Rice Project.

3

The Central Kalimantan peatlands: a general description of the area and the issues

Both peatswamp forests and deforested peatlands in Central Kalimantan have remarkable value for biodiversity conservation, community livelihoods and carbon storage. However, they also pose many management challenges and are affected by many threats, especially drainage, fire and illegal logging. These have resulted in the loss of large areas of internationally important tropical peatswamp forests, and a reduction in their capacity to deliver their valuable ecosystem functions.

Figure 1.
Map Location of Forest Cover Change 2005-2007



3.1. An introduction to the peatlands of Central Kalimantan

3.1.1. CKPP Target Areas

CKPP worked in two main areas of Central Kalimantan: Sebangau National Park Area and its surrounding areas, and the ex-Mega Rice Project (EMRP) area, especially Block A north and Blocks B, C and E (Mawas). In these areas, the activities focused on 25 villages in four districts, (Katingan, Pulang Pisau, Kapuas and South Barito). The working area was located within an area that contains over two million hectares of peatlands and remaining peatswamp forests.

- Five rivers bisect the project area. The 25 target villages that can be divided into six blocks: Katingan block consists of four villages, Karuing, Tumbang Bulan, Perigi and Mendawai,,spread along the Katingan river in the western part of Sebangau National Park's buffer

Many orchid species live in close association with Pandanus vegetation

zone. The land typology varies from acid sulphate in B-type tidal area to peat in C-type tidal area in the downstream, and dryland in upstream areas.

- Sebangau block consists of four villages, Paduran Mulya, Paduran Sebangau, Sebangau Jaya, and Sebangau Mulya, which lie on the Sebangau river in the eastern part of Sebangau National Park's buffer zone. Land typology is dominated by acid sulphate in C- and D-types of tidal areas, and a small amount of peat of in C-type tidal areas.
- Tumbang Nusa-Gohong block consists of two villages, Tumbang Nusa and Gohong, villages which lie near the Kahayan river in the eastern part of block C and southern part of block B of the EMRP, close to the Trans-Kalimantan Highway. Land typology is dominated by peat in C- and D-types of tidal areas, and a small amount of acid sulphate in C-type tidal area.
- Mantangai block consists eight villages, Pulau Kaladan, Mantangai Hilir, Mantangai Tengah, Mantangai Hulu, Katimpun, Kalumpang, Sei Ahas, and Katunjung, located on the Kapuas river in block A north and B east of ERMP. Land typology varies from acid sulphate, peaty soil, and peat, distributed in B- and C-type tidal areas.
- Timpah block consists of three villages, Timpah, Lungkoh Layang, and Lawang Kajang, located in the upper Kapuas river in the western part of block E of the EMRP. The land typology is dryland.
- Barito Selatan block consists of four villages, Madara, Kalahien, Teluk Betung, and Batampang, located on the upper Barito river in the eastern part of block E of the EMRP.

Figure 4.
Map Park and Ex-MRP Area

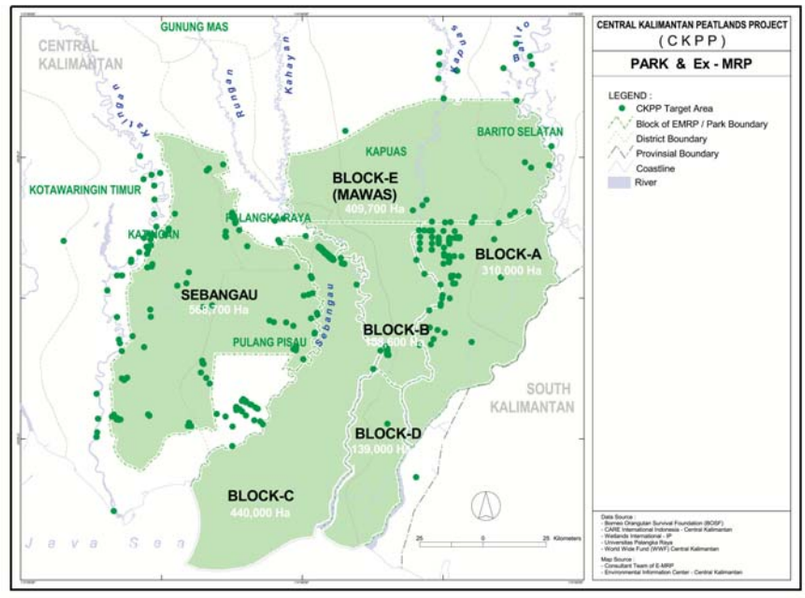
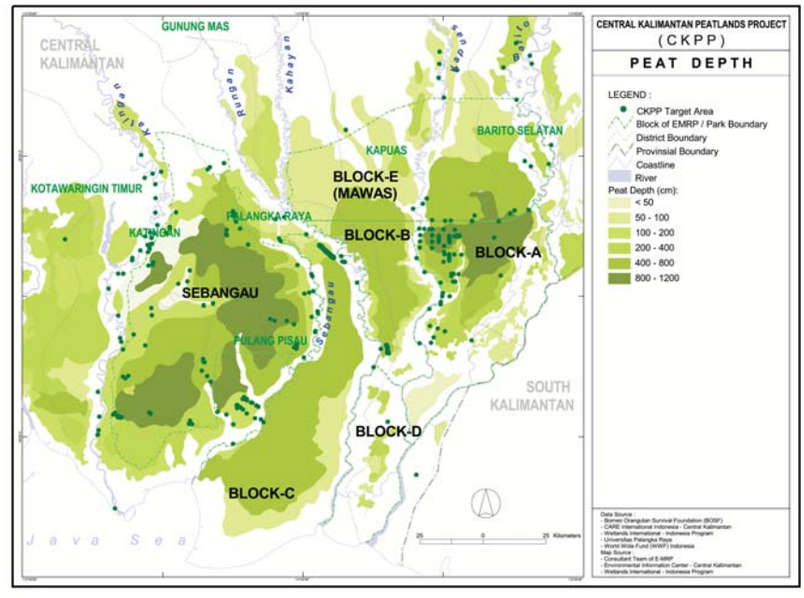


Figure 5.
Map Peat Depth Area



3.1.2. The functions and values of Kalimantan's peatlands

The predominant land uses of peatswamp areas in Kalimantan are forestry, plantations and agriculture, together with some hunting and gathering. Yet, peatswamp forests have many other values (see table 1). Their degradation has negative social and economic impacts and is a major threat to global biodiversity and climate.

Table 1.

Regulation of hydrology	
Flood and flow regulation	Mitigation of floods and droughts in downstream areas. Peatlands can serve as overflow or water storage areas during flooding periods, while in the dry season the water is slowly released.
Prevention of salt water intrusion	Agriculture in tidal areas may benefit from upstream peatswamps which provides a source of fresh water for irrigation and a continuous freshwater wedge, preventing or mitigating salt water intrusion.
Water supply	In rural coastal areas, peatswamps may be the only source of potable and irrigation water for many months in the year.
Climate stabilisation	
Carbon storage	Peatswamps are huge carbon storage areas. The carbon stored in peat represents 33% of the world's soil carbon pool, which in turn represents70% of all carbon stored in biotic systems. If disturbed by drainage and burning, this carbon is released into the atmosphere as CO_2, contributing to the greenhouse effect. Almost 20 times more carbon is stored underground as peat than above the ground in vegetation.
Carbon sequestration	Healthy tropical peatswamp forests actively accumulate carbon, thus helping to decrease the greenhouse effect. Release of methane has been found to be negligible.
Climate regulation	The existence of peatswamp forests and the associated large mass of freshwater effects the climate on micro and meso scales. The forests act as wind breaks and absorbs heat. Forested lowlands attract more rain than deforested areas.
Biodiversity	'Capturable biodiversity' value has been estimated at USD3/ha/year, excluding the intrinsic value of species, ecotourism potential or internationally marketed pharmaceuticals.
Gene pool	Peatswamp forests in Southeast Asia play an increasingly important role as a gene bank, as other lowland forests in the region have been even more affected by logging and land conversion.
Wildlife habitat	Peatswamp forests provide a habitat for many rare or endangered species, such as the Orangutan, Proboscis Monkey, Storm's Stork, Hornbills and the False Gavial. The black water rivers in Kalimantan have a high degree of localised endemism of fish species and have a very high ichthyologic biodiversity.
Plant habitat	At both regional and sub-regional scales, tropical peatswamp forest vegetation displays considerable diversity. Approximately 800 tree species have been recorded in the peatswamp forests of western Indonesia and Malaysia, comprising 71 families and 237 genera. Several tropical peatland trees are specialists and restricted to this habitat. The peatswamp forests of Borneo contain only three tree species that are widespread and there are striking sub-regional differences in the composition of the flora between the peatswamps of northern Borneo (Brunei and Sarawak), west, central and east Kalimantan.
Landscape	Peatswamp forests occupy a specific place in Southeast Asian lowland landscapes, providing a mosaic of different vegetation types in mangroves, between old beach ridges, in river levees and freshwater swamp forests.
Wilderness	Peatswamp forests have value as wilderness; i.e. remote areas far away from civilisation. This may offer an attraction to tourists.
Source of natural products	Peatswamp forests provide a large number of valuable timber species, including Ramin (*Gonystylus bancanus*), Jelutung (*Dyera lowii*) and Meranti (*Shorea spp.*). Socio-economic studies in Indonesia indicate that local communities may derive over 80% of their livelihoods from the peatswamp forests rather than from agriculture.
Research and education	The combination of the above functions, attributes and uses makes peatswamp forests very interesting subjects for research and education.
Social-cultural environment	Peatswamp forests, their natural products and wildlife play a substantial role in Dayak culture in Kalimantan, and as such have a considerable social-cultural value.

Tropical devil's ear with fruitflies

3.1.3. Peatland biodiversity

Peatswamp forests are complex ecosystems that exhibit highly characteristic ecological features. They are of international importance for biodiversity conservation, with many endemic and rare species. The peatswamp forests of Central Kalimantan hold the largest remaining population of Orangutans in the world. The black water rivers and streams have the highest diversity of freshwater fish in the world. They function as water buffers and carbon stores and have a high socio-economic value for the local people. The regulatory functions of these forests have an impact on areas far beyond their borders, by influencing the meso-climate in adjacent areas and providing temporary habitats for 'dryland' species. Peatswamp forests are among the last remaining lowland tropical rainforests of western Indonesia, as they have always been regarded as marginal lands. Thus they provide a barrier to landscape fragmentation and support adaptation by providing a habitat for endangered species. However, their specific eco-hydrology makes them extremely vulnerable to deforestation and drainage. Almost all the forested peat domes in Indonesia have been affected by logging and drainage, especially from illegal logging channels, and peatswamp forest biodiversity conservation nowadays invariably involves adopting some measures for habitat restoration. With these forests now at the frontier of new development attempts, their ecosystem values are increasingly threatened. Efforts to conserve and restore degraded peatlands can bring multiple benefits to local, national and international stakeholders.

Sebangau National Park is dominated by several peatland habitat types. including:

i) Tall Interior Forest: found in areas with a peat depth of up 12 metres; it, has a well stratified vegetation, with trees reaching a maximum height of approximately 45m, including *Agathis, Koompassia, Shorea* and *Palaquium*. This forest type has been logged extensively yet remains relatively pristine, despite fire damage in parts;

ii) Mixed Swamp Forest: restricted to the Sebangau water catchment, this has layers of peat up to 6m deep with 'peat islands' or hummocks that rise above the floodplain and shallow drainage channels. This stratified habitat contains commercially valuable trees such as *Gonystylus bancanus* (ramin), *Dactylocladus stenostachys* (mentibu) and *Cratoxylon glaucum* (geronggang), and has been intensively logged. Illegal logging activities are currently concentrated here and most of the remaining commercially important species are being logged to extinction.

iii) Low Pole or 'Padang' Forest: occurs on the deepest peat and contains very few trees of commercial importance. The forest floor is undulating with large hummocks and deep depressions containing pools. Tree pneumatophores are a constant feature and there is a dense root mat in the surface peat. Many trees show abnormal growth, often growing to a height of 9-12 m before the leading shoots dies. Because of the higher light levels penetrating the forest canopy and the high water table, there is a very dense growth of several *Pandanus* and *Freycinetia spp*. The most abundant pitcher plant in this forest type is *Nepethes ampullaria*, which forms dense carpets of pitchers on the ground but also extends upwards into the middle canopy.

Pandanus rasau, begantung

Sebangau National Park is home to 150 bird, 35 mammal and 36 fish species, and harbours about 10% of

Edible toadstool in peat swamp

Perupuk, section, peat swamp species

Kalimantan's Orangutan population. Inventories in EMRP areas that still have vegetation coverage, including Block A north, have revealed the occurrence of at least 62 bird, 12 mammal and 6 reptile species.

In Block E (Mawas area) 63 mammal species have been recorded, including nine primate species. 218 bird species, 21 amphibians and 45 reptile species have been identified. In addition, there are at least 44 fish species, including endemic ones, such as Tuka (*Channa bankanensis*) and Kapar (*Belontia hasselti*). There are also migratory white fish species, such as Saluang kahui (*Rasbora cephalotaenia*) and Banta (*Osteohilus triporos*).

Dragon fly at Begantung

3.1.4. The eco-hydrology of peatlands

Peat formation is strongly linked to the capacity of he ground to hold water. Peat consists of approximately 90% water and 10% vegetation, which together form a dome shape, like a drop of water on a flat surface. The system depends on the hydrostatic equilibrium that enables the peat to hold rainwater above the normal groundwater level. If something disturbs this equilibrium, for instance the digging of a small drainage channel, the balance of the huge 'water bell' is disturbed, leading to desiccation and the subsidence of the peat soil over large areas. This also leads to oxidation of the drained areas, resulting in carbon molecules linking to oxygen, thus creating CO_2, a greenhouse gas that is emitted into the atmosphere.

The interrelations between the peatswamp morphology, soil conditions and hydrology are so close that the slightest change in vegetation will have an immediate effect on the morphology and hydrology of the swamps, and any change in hydrology will change the vegetation.

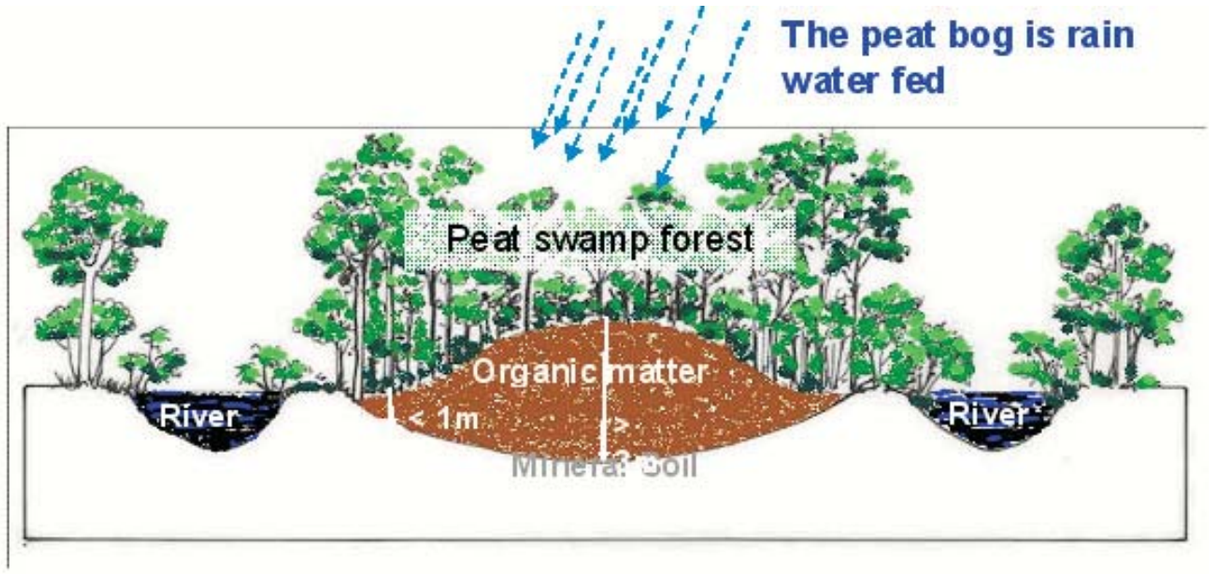
This can be observed in the vegetation zoning within a single peat dome. Nearest to rivers, lush forests receive abundant nutrients from the river water and produce tall productive trees. On the top of the peat dome, nutrients are scarce as rain water is the only source, and the forest has lower species diversity and often smaller trees ('Pole forest'), or only occasional stunted trees ('Padang'). Between these extremes, mixed swamp forest types are found that are intermediate in the size, structure and diversity of trees. These vegetation patterns are reflected in the slopes, which are lowest on top and bottom, and in the peat type, which is least decomposed at the top of the dome and most decomposed lower down, near the rivers. As the peatlands have developed over several thousands of years, these eco-hydrological zones have shifted to reflect internal and external changes. As the peat dome grows higher and wider above the river floodplains, as a result of continued accumulation of dead organic material, a larger area can eventually only sustain a pole or 'Padang' forest. Changes in river courses, river peak water levels and rainfall also affect the development of the peat dome. As such the peatlands are truly a dynamic and living landscape.

Cone-shaped pneumatophore in peat swamp forest

Knee-shaped pneumatophore in peat swamp forest

Freshwater swamp forest at the mouth of the Mentangai

Figure 6.
Schematic overview of a forested peat dome in an alluvial plain between rivers

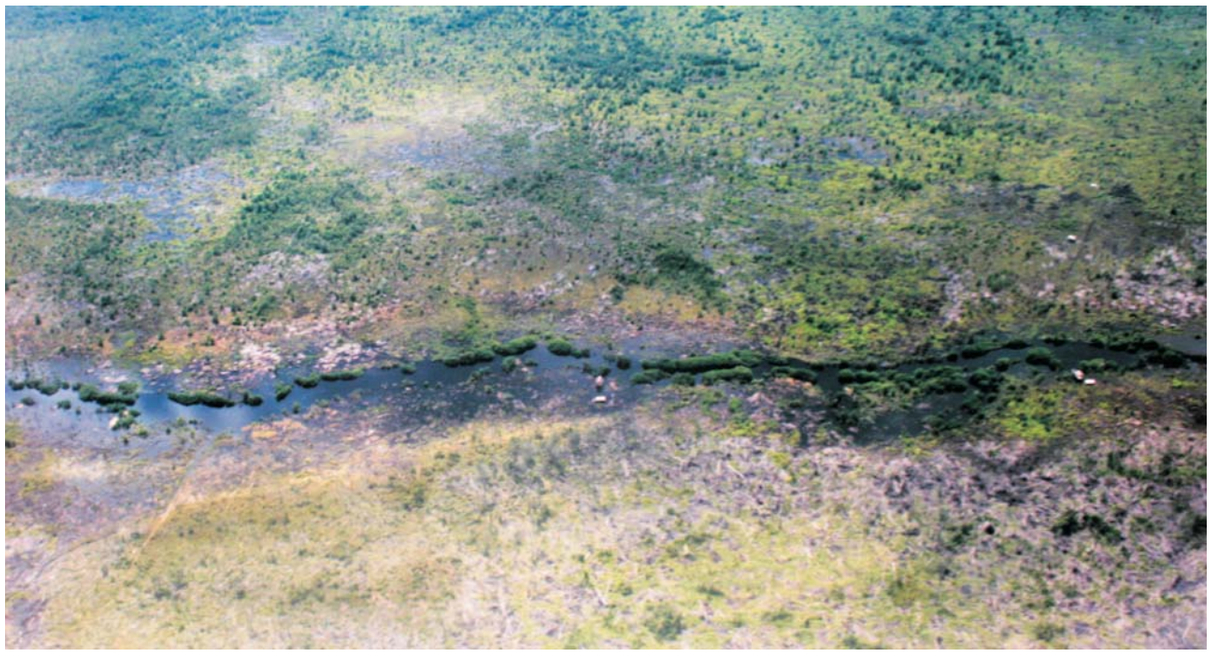


The management of peatland hydrology

Peatlands are wetlands, and need to be managed as such in order to prevent a loss of the water that supports the peat surface, i.e. to prevent peat subsidence. Until now most peatland water management in Southeast Asia has not recognised this fact. The widespread over drainage of peatlands is resulting in the degradation and loss of natural peatswamp forest, increased CO_2 emissions and ultimately in reduced agricultural productivity.

The unique nature of peatland eco-hydrology implies that only entire peatland landscape units - peat domes and river basins within peatlands - can in the long term be protected from degradation caused by drainage. The peatland landscape should therefore be the basis for development planning and management. Any drainage in or near peatland conservation areas needs to be avoided. Responsibly managed buffer zones with limited or no drainage, several kilometres wide, are required between drained areas and conservation areas as a minimum requirement for protecting a single peat dome.

Sebangau top of the dome, low pole or Padang forest



3.1.5. Peatland elevation

The domed shape typical of peatlands in Central Kalimantan is illustrated through profiles showing peatland elevation across sections of Block A North and Block E of the EMRP. CKPP commissioned Kalteng Consultants to implement high-resolution airborne laser scanning of the topography of the peatlands, which was carried out in August 2007 using a scanning device mounted on a helicopter. The resulting information enabled the generation of a three-dimensional digital elevation model for Block A North and Block E. This is the first time that this technique has been used to accurately map the relative height differences in this peatland landscape, allowing analysis of the exact dome shape and slopes.

The data showed that the highest peat domes in Block E area was 32m high, at 229km south of the equator and 29m high at 238km south of the equator: a difference of three metres over a distance of 9 km. This dome lies between the Kapuas and Mentangai Rivers. At the main channel of Block A the maximum elevation was 25m (247km south) between the two rivers. The lowest point of the cross section, at 21.3m, was on the main channel at the Mentangai River.

Profile 1 (Fig 8) shows a cross-section between the Kapuas and Mentangai Rivers and the Barito Basin in Block E (229km south of equator). The peat surface increases steeply from the Kapuas River. On the day of the scan the water level of the Kapuas River was 17.5m. Two mini domes of 24.7m and 25.3m in height were evident. Approximately 13km to the east of the Kapuas River the peat dome reached its maximum height of 32m.

Profile 2 shows a cross-section between Kapuas, Mentangai and Barito Basin in Block E at 238km south (maximum 29m elevation). The Kapuas River had a water level of 17.1m on the day of the scan. The peat surface increased gradually to 29m at the top of peat dome, approximately 14.5km east of the Kapuas River. The North-South channel of the EMRP is located 10.6km from the Kapuas River, with a height inside the channel of 26.2m. From the peat dome the peat surface fell to 25m at a distance of 24km from the Kapuas River. The Block E dome increased to 27m in height 32km from the Kapuas River, before decreasing in height to 20m.

Profile 3 shows a cross-section of the main channel, with the Kapuas River on the left and the Mentangai River in the middle at 247km south. At this time the water level in the Kapuas was at 16.6m. The North-South channel of the EMRP is located 9.4km from the Kapuas River, where the dome reached a height of approximately 25m. The peat surface then fell towards the Mentangai River,

Figure 7.
With a high-resolution Airborne Laser Scanner (ALS) the topography of peatlands was measured to achieve a 3-dimensional Digital Elevation Model (DEM) for the CKPP Block A + E-Mawas

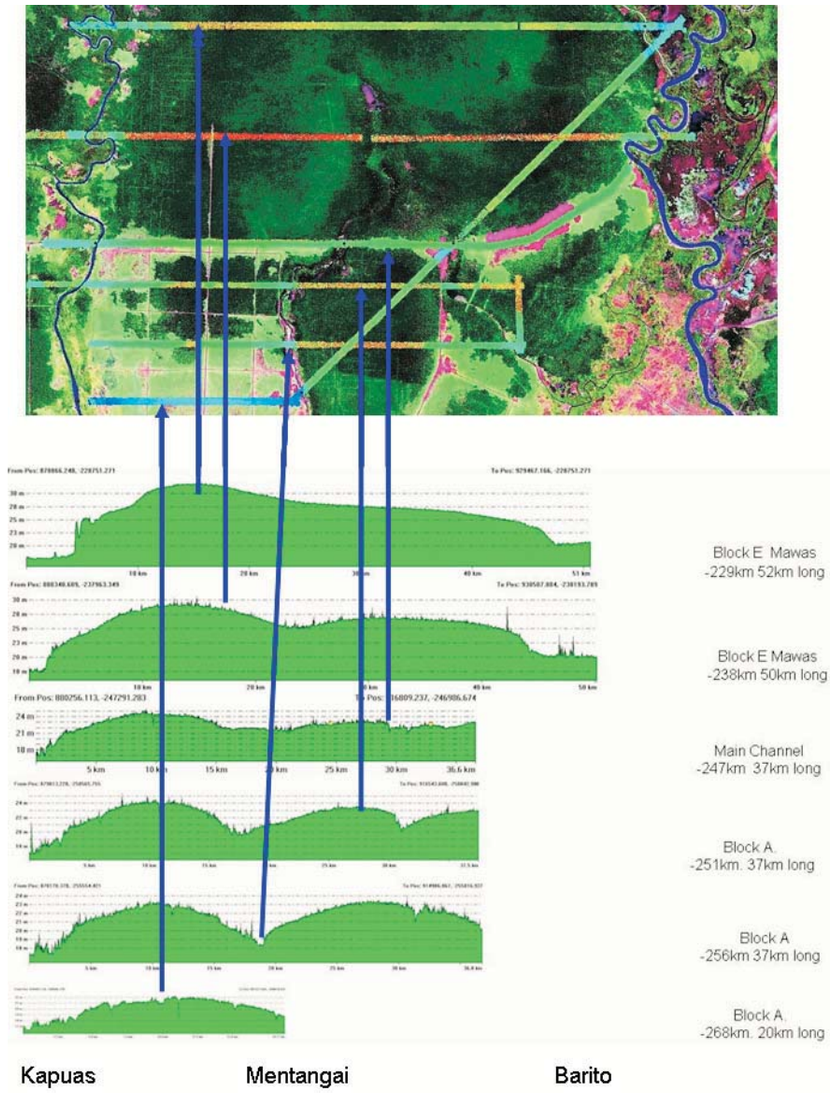
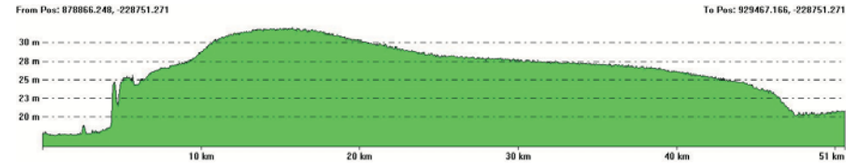


Figure 8.
Profile 1 shows a cross section between the Kapuas and Mentangai Rivers and the barito Basin in Block E (-229 km south of equator).



where it was approximately 21.4m high at a distance of 21km from the Kapuas River. From here the peat surface increased to 23m, 27km from Kapuas. The Putun River is located at 31km, and had a water surface level of 21m.

Profile 4 shows the cross-section between the Kapuas, Mentangai and Putun Rivers in Block A at 251km south. The Kapuas had a water level of approximately 16.9m. The peat dome rose to 24m, 10km from the Kapuas River and dropped to 19.5 at the Mentangai River, where the river splits into two channels . The peat surface then increased to 23.5m at km 27, after which it dropped down to the Putun River, where it had a height of approximately 20m. 500m prior to this there is a channel. The peat surface increased to 23m at km 37 from the Kapuas River.

Profile 5 shows the cross-section between Kapuas, Mentangai and down to the Putun River in Block A at 256km south. The Kapuas River had a water level of approximately 16.8m. The peat dome 11km from the Kapuas was approximately 23m in height. From there the surface dropped to 18.3m at the Mentangai River. Four channels cross this profile, with the one at km 12 being the most evident. After the Mentangai River the peat dome increased again to more then 23m. The surface then dropped to 18m at the Putun River at km38. A large channel is located at km32 from Kapuas.

Profile 6 (Figure 8) shows the cross-section between the Kapuas and Mentangai Rivers in Block A at 261km south (max. 22m elevation). The Kapuas had a water level of 16.4m at he time of the survey. The peat dome reached a height of 22m, 11 km from the Kapuas River. Five channels crossed this peat profile, at km2, 5.3, 10.7, 14.6 and at 17.6 respectively, with mini-domes in evidence between these channels.

3.1.6. Peatland carbon

In Southeast Asia, including in Central Kalimantan, almost all the lowland peat is derived from forest vegetation. The peat has a high wood, and therefore carbon, content. Most studies have identified a value in the order of 60 kilogrammes of carbon per cubic metre (kgC/m3). Based on this assumption, and the extent and thickness of peat, Asian peatlands store at least 42,000 Mt of carbon. While, this is only a small portion of the carbon stored in all peatlands around the world (550 Gt), the loss of Southeast Asian peatlands is occurring very rapidly and currently counts for approximately two thirds of all carbon losses from peatlands globally. The peatswamp forests of Central Kalimantan have some of the thickest peat layers in Indonesia, up to 20 metres deep, which contain large amounts of carbon. In the vast majority of cases the carbon sequestration process has been disturbed by peatland drainage and peat fires, turning the area from a carbon store into a major source of CO_2 emissions.

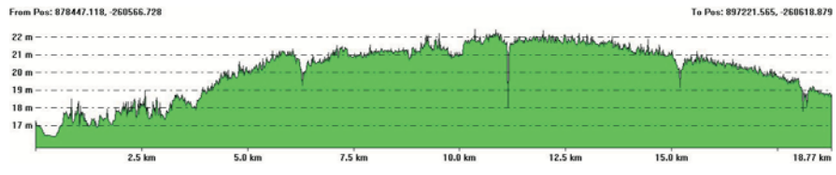
3.1.7. People in the project area

There are three main communities that live within the CKPP working area: Dayak communities; transmigrants and; mixed (Dayak and non-native) communities. The traditional Dayak communities are mostly found in the upstream stretches of the rivers. The mixed communities are usually found in downstream areas, along the Trans-Kalimantan Highway, the main roads that connect the area or in the capital city. The transmigrant group exists in three villages in Sebangau Kuala District; Sebangau Mulya, Sebangau Jaya and Paduran Mulya. In Central Kalimantan, the transmigrant community consists of mixed non-native and Dayak communities. The settlement of the Dayaks and mixed communities are mostly distributed along the rivers, in contrast to the transmigrant communities, whose settlements are usually perpendicular to the rivers and follow the drainage and irrigation channels. A socio-economic valuation study commissioned by the CKPP from the Institute of Environmental Studies of the University of Amsterdam provided a number of valuable insights about how to develop an effective community-supported conservation strategy:

- *Peatland forests provide multiple values and benefits:* as a result it is extremely difficult to value the hydrological, biodiversity and carbon storage functions of peatlands in economic terms. Moreover, estimating the monetary value of healthy peatlands may not adequately reflect their societal value. The poverty levels in degraded peatlands are two to four times higher than in the rest of Indonesia. Therefore, any intervention in peatland areas needs to consider both environmental and socio-economic needs. This indicates that any peatland conservation project needs to ensure more than just the benefits that relate to preventing climate change and biodiversity loss.

- *The opportunity costs of peatland conservation are crucial:* The CKPP peatland restoration and conservation measures include restoring water levels, fighting fires and replanting native species. Yet, the direct costs involved in building dams, hiring fire brigades or building and planting nurseries are not the only costs. Conserving peatlands often also implies the need to stop unsustainable agricultural, forestry and other practices, which can often conflict with the interests of local farmers and other landowners/users as it may cause them an income loss. Providing these groups with incentives to switch to more sustainable practices may be the major cost of a restoration project. At the same time this will also increase cooperation amongst farmers and the success of the project. Identifying the value of current practices, and the needs and attitudes of these stakeholders are crucial first steps in designing strategies and estimating the costs of effective interventions.

Figure 9.
Profile 6 shows the cross-section between Kapuas, Mentangai and down the river in Block A at -256 km.



A boy in native Dayak apparel

Few men smiling walking home from the field. Currently 70% of the income of households living in this region comes from farming and forestry

- *Agriculture is the main entry point for peatland conservation:* Peatswamp forests are valued by most local communities for many reasons, apart from the timber and non-timber products that they provide and often they are protected by traditional laws. Currently 70% of the income of households living in this region comes from farming and forestry, and some 57% of households farm solely for subsistence purposes. Therefore, any change that affects agriculture, such as blocking canals or restricting the use of fire, is critically viewed. This may imply that providing alternative sources of income and food is a crucial aspect in convincing farmers to switch to more sustainable practices.

- *Local communities support reforestation but question conservation measures:* The majority of interviewed farmers were supportive of peatland conservation, but more critical of the measures proposed to achieve it. Although farmers do not always comprehend the full scale of the impacts of deforestation and fires, most have experienced the direct effects of these activities on their own well-being, with 55% of respondents having suffered from fires in the past. Therefore, most farmers agree that peatland conservation is a good idea, especially for future generations. Yet, people are also wary when it comes to talking about taking concrete steps in their own villages. The majority of them fear that conservation measures might not be accompanied by compensation and could result in lower levels of economic welfare.

- *Farmers are willing to switch to sustainable practices:* it is possible to gain the support of local communities if proposed changes are perceived as beneficial and secure in terms of their long-term income and food supply. The survey showed that only two thirds of the respondents were currently using their land in a profitable manner. This suggests that people might be in desperate need of solutions and would be open to new approaches. The survey also found that 33% of farmers are willing to switch from agriculture to growing trees and 64% are willing to make a partial switch. Communities that are less dependent on agriculture alone are more open to switching land-use. Economically such changes can involve having half the land dedicated to agriculture and the other half to growing trees. Any further level of reforestation would cause economic losses and would require compensation.

- *Compensation is needed:* Sustainable peatland management may imply restrictions and thereby imply costs for farmers, who need to be compensated to curb their unsustainable practices and forest use. Field studies showed that compensation is a prerequisite for farmers to participate in reforestation initiatives. The farmers support loan-grant schemes, but have little experience with such schemes and lack trust in them. Other types of compensation that could benefit farmers include technical support (e.g. machinery and equipment) and access to fertiliser, seeds and pesticides. Farmers expressed interest in training in fire fighting and planting and harvesting techniques. Such skills might be extremely important if new tree and crop species are to be planted, or the existing forest maintained.

- *Economic benefits and losses:* Changing land use to forestry, through tree planting with the cooperation of farmers requires some degree of financial compensation, for instance through a micro-credit or loan-grant scheme. The study suggested that farmers would need around 15 million Rupiah (Rp) per hectare to reforest 100% of their land. This compensation would cover the increased costs of switching crops and ensuring their income and a supply of food over a period of five years. However, this does not cover any further assistance that may be needed after this initial period. To ensure that the reforested areas remain intact, the new trees and crop species need to provide enough income. Not only should the yield be sufficient, but market conditions (such as demand for the new species, market access and infrastructure) also need to be favourable.

- *Limited heterogeneity in attitudes and perceptions:* the heterogeneity of the population in Central Kalimantan forced the study to take a critical look at how different

Children playing on the boat parked at the back of their house

communities regard peatland conservation. While cultural values play a role, there are quite strong commonalities between the different communities. Several characteristics did influence people's perceptions.

- *Geographical location:* location determines land type, land cover, market access, infrastructure and other factors. Therefore, the villages that lay on deep peat areas, with extremely difficult conditions for agriculture, appear to be more open to participating in conservation activities. The same difference applies between villages that suffer from fires and those that do not. However, while the findings did highlight some influence on willingness to collaborate, overall the difference was quite small.

- *Ethnicity:* Ethnic background had very little influence on the attitudes and perceptions towards peatland conservation measures. One observable difference was in attitudes towards building dams, which could be explained by some communities' lack of awareness of the positive impacts of dams. Therefore, there is no immediate need to establish different policies and projects for communities with different ethnic backgrounds. The literature indicates that these differences were much more distinct at the beginning of the transmigration programmes, when transmigrants increased the pressure on natural resources by adopting unsustainable practices because of their lack of knowledge of the peatland ecosystem. Now that this group is more settled they have similar attitudes as the longer-established ethnic groups.

- *CKPP involvement:* the involvement of the CKPP did not have much influence on the attitudes of communities. Nevertheless, people from the villages where dams had already been established were much more positive about these measures than those in other villages. This confirms the notion that information and real life experience greatly influence people's perceptions. Other measures, such as the fire ban imposed by the government, could also benefit from this lesson. For reforestation, however, this may be of lesser importance since most people associate reforestation with a threat of losing agricultural land (which in many cases means losing their main source of income and food). Therefore, besides creating awareness, reforestation measures have to go hand in hand with arrangements that secure a stable supply of income and food.

3.2. The state of peatlands in the project area

In Indonesia most of the once extensive (more than 27 million ha) tropical peatswamp forests have been heavily degraded by drainage and peat fires. In some intensively drained areas extensive shallow peat layers have already disappeared. The tropical peatswamp forests of the project area in Central Kalimantan, its local economy, its globally important biodiversity and global climate have all been significantly affected. In the long-term, as a result of the soil subsidence, areas also become prone to

Fem covered degraded peatswamp

flooding, while the decreasing water retention capacity may result in increased floods and droughts in surrounding areas and further downstream.

3.2.1. Ex-Mega Rice Project

The EMRP area or *Pengembangan Lahan Gambut* (PLG) is an example of the failure of peatland ecosystem management and development that ignored sustainable management principles and rules. The project, implemented with the aim of growing one million hectares of rice, did not provide good results and had severe ecological impacts as a result of the deforestation and drainage that it led to. A network of canals was built, with a combined total length of more than 4,000km, and a depth in places of 10m. Thousands of people were moved to the area as part of a transmigration program. The intention was to accelerate development, but it created a situation where poverty was only shifted from one location to another, with further negative spin-offs such as poverty-driven illegal logging in areas that were not designated, or appropriate, for conversion.

Drainage of the peat ecosystem made the area extremely prone to forest and peat fires, resulting in massive carbon emissions (Hooijer et al 2006)[1]. The situation has caused great suffering for the communities living in and around the peatlands, who have suffered losses in their livelihood and health problems.

[1](http://ckpp.wetlands.org/Watchread/tabid/865/mod/1570/articleType/ArticleView/articleId/1491/Peat-CO2.aspx),

3.2.2. Sebangau and Block E (Mawas)

The peat ecosystems of Sebangau and Block E are relatively well maintained. Both areas are of international interest for biodiversity conservation, especially as they are the natural habitat of the endangered Orangutan. The CKPP supported efforts to obtain a clear protection status for the Block E (Mawas) area and supported efforts to identify appropriate boundaries for the Sebangau National Park. CKPP supported measures to improve the monitoring of illegal logging and established conservation management programmes. Although many integrated protection and ecosystem restoration measures were implemented, they have only reached some areas, where continued follow-up is required for consolidation. Forest and peat fires, drainage and illegal logging will continue to be major threats to the Sebangau National Park and the Mawas area in the foreseeable future.

Destroyed peat swamp at Tundai river

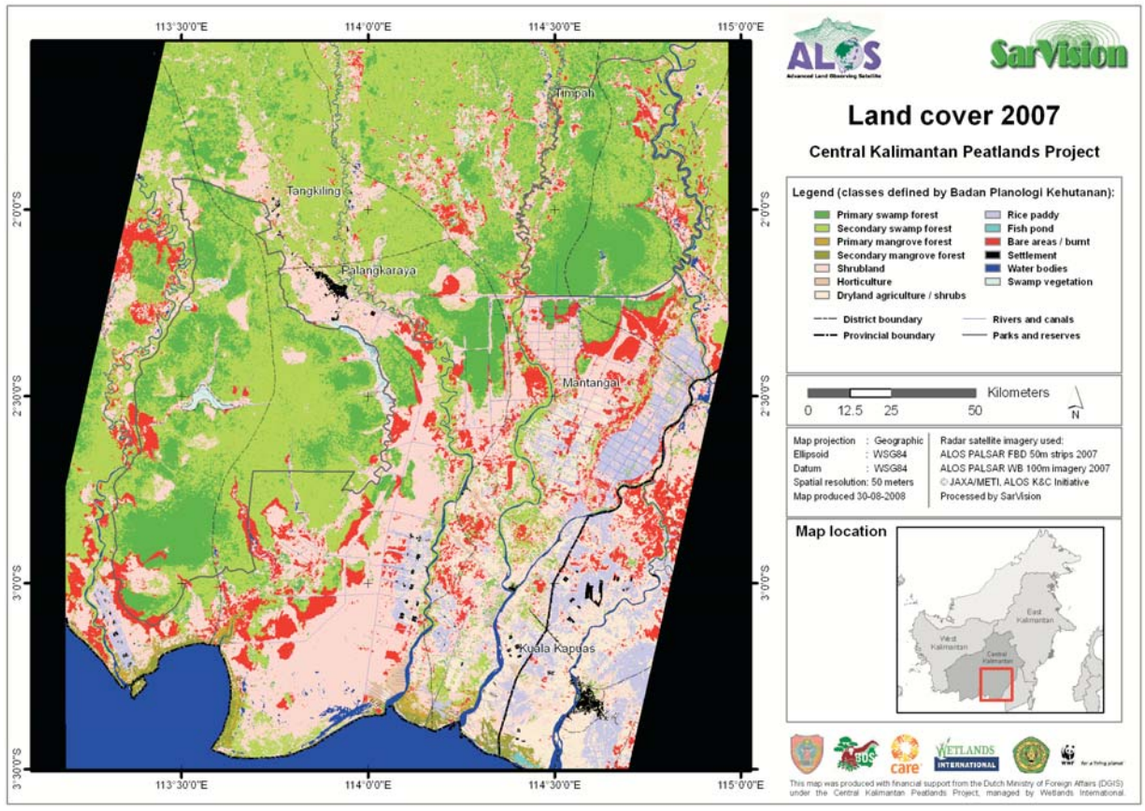
3.3. The causes of peatland loss

There are three significant and interdependent direct threats to the peatswamp forests of Indonesia. The first threat is **logging**, both commercial logging for timber and pulp and illegal logging, which mostly occur in areas where legal timber concessions have ended. To transport logging equipment and to remove logs, loggers have dug canals and ditches that result in the second major threat: **drainage**. While most people only consider the drainage in agricultural peatlands, it is actually hard to find a natural peatswamp forest area in western Indonesia that has not yet been affected by drainage. The drained peatlands not only emit significant amounts of carbon into the atmosphere but the huge amount of resulting desiccated dead plant material leads to the third threat, which is **fire**. In addition, there is a clear relation between the occurrence of fire and access to the areas, with most fires starting near villages, canals, roads or logging rail-lines.

The combination of these three threats, exacerbated by other threats such as the wildlife trade, has resulted in the degradation of Indonesia's peatland ecosystems, including systems that should have been secured under the existing protected areas network. The overall effect is the widespread degradation of ecosystem services that are naturally provided by intact peat swamp areas.

Fire for agriculture in peat, mentangai

Figure 10.
Causes of peatland loss: Map of Land Cover 2007



Clearfelled peatswamp forests often remain as wasteland

New drainage channel in Block A in shallow peat

3.3.1. Illegal logging

Illegal logging has a massive impact upon forest areas. The impacts include the disappearance of forest coverage, of biodiversity (genetic variation, species, habitat), of the environmental contributions of the forest, as well as the increase of climate change risks.

Area coverage change was observed between 2005 and 2007 using techniques developed by SarVision: satellite, radar and computer programme applications. 90 images of Envisat ASAR APP in the CKPP area (EMRP) were collected and analysed. Based on the analysis represented in the map that tracks changes in forest coverage, most deforestation occurred along transportation routes, such as rivers, channels, small channels and roads. The radius of deforestation in the forests around Kapuas River is about 5km and in the forests along the Barito River it is more than 10km.

Once a week the Area Monitoring Team of BOSF - Mawas carried out land and river patrols, covering 20-30% of the area. Based on their observations, 60,997 logs were removed from the area surrounding Block E in 2006-2007. The average length of the logs was 4m, with an average diameter of 25cm. The means 9,149 m^3 of wood were removed. With the assumption that the average wood density in a peat forest area is 30 m^3/ha, the deforestation level in this area amounts to a minimum of 3,000 ha/year. If the estimated remaining forest area is 50,000ha and the illegal logging is not addressed, the remaining forested area will be depleted within 15 years.

3.3.2. Striking at poverty as a root cause

The livelihoods of the local people in Central Kalimantan are largely dependant on the natural peatswamp forests and surrounding peatlands which are the main habitat in the province and project area. The forests serve as hydrological buffers, transport corridors (e.g. peatland rivers and canals) and a source of food (e.g. fish), water (e.g. for irrigation, households and nature), construction materials (e.g. timber, rattan), as well as many other (non-timber) forest products. In addition, the peatswamp forests provide options for additional developments, such as tourism. Many of the amenities, functions and values of the peatlands are crucial, not only for the environmental and food security of these people, but also for the survival of their cultures (Dayak) and as a basis for their livelihoods.

Rural poverty in Central Kalimantan is increasingly a factor in the degradation of natural resources and biodiversity values. Peat fires and smog have direct consequences for local communities, leading to health problems, loss of productive land, harvest failures, damage to tourism and the loss of natural resources. The high risk of peat fires also makes the area unattractive for small investors. While high levels of poverty continue to prevail it will be impossible to prevent the over-exploitation and degradation of natural resources.

3.3.3. Drainage for agriculture

One of the main drivers of peatland loss has been conversion to agriculture (e.g. transmigration) and agro-forestry, including oil palm plantations. Many attempts to establish agriculture on peatlands have failed, such as the EMRP in the project area, which resulted in millions of hectares of unproductive, drained and vulnerable peatlands. The total result of these processes has been one of the largest environmental disasters of our time, with about 12 million ha of peatlands and peatswamp forests rapidly deteriorating through drainage and fires.

The drainage of peatlands alters their hydrological functioning in fundamental ways, and therefore ends the fragile balance that naturally exists between hydrology, landscape and vegetation. From systems that maintain valuable forests and gradually sequester carbon (they are natural 'carbon sinks'), drained peatlands rapidly lose their natural vegetation as well as their carbon (and become 'carbon sources').

Over the past decade, the drainage of EMRP peatlands has had major and largely irreversible impacts over great distances. The most direct impacts include:

Acacia plantation

Illegally logged timber along a logging concession's railway system.

Main drainage canal in the EMRP

Peatland degradation has also caused decrease in fish populations

- Drainage canals have greatly affected surface water storage and flows, over large areas. The increased drainage has caused rapid desiccation and peat humification and has removed the characteristic hummock-hollow top layer that plays an important role in keeping peatlands wet in their natural state. This has prolonged the period when water tables are below the peat surface, which in turn has caused peat decomposition and hence subsidence, and has increased fire risk. Downstream of the peatlands, the result of drainage can be increased peak runoffs and thus more flooding risk.
- The impact of drainage is most severe in a zone of approximately 500 metres along the canals, where subsidence and possibly fire frequency are greater, resulting in relatively steep surface slopes away from canals. Peat surface elevations 1km from canals are now generally 0.5 to 1m higher than the canal sides. Instead of the original low-gradient peatland landscape that functioned as a single hydrological system over tens of square kilometres, a 'mini-dome' topography has developed because of drainage. This now controls the hydrology of the area.

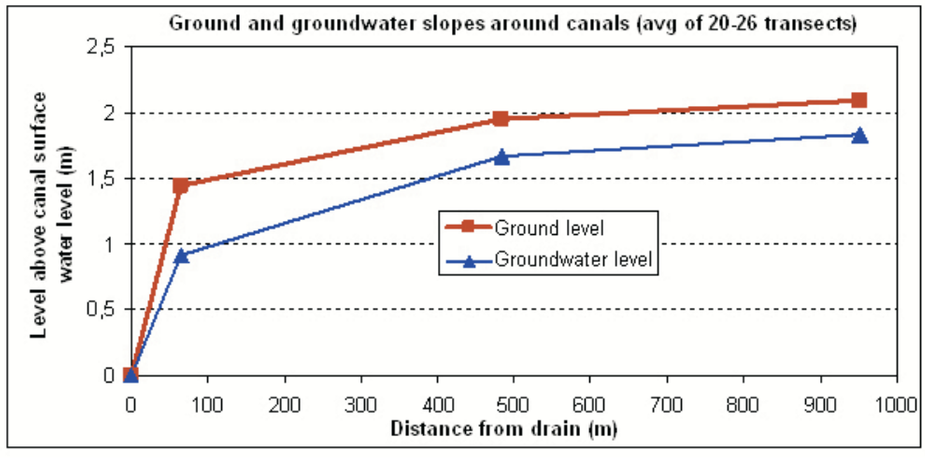
Figure 11 presents the average peat surface slope and water depth along 26 transects perpendicular to drainage canals, surveyed in July/August 2007 as part of the 'Peat Soil and Drainage Mapping' project (CKPP Expansion Activity 8). It shows that canal surface water tables are currently less than 1.5m on average; they were a little less than 3m shortly after drainage implementation. The image also shows how low water tables have affected the peatland shape: the average surface slope of the peat at 50 to 950m from canals is 0.71 m/km. This slope has been caused by subsidence; if we assume that drainage started 10 years ago (1997), subsidence near canals has been 7cm/year higher than 1km away from canals. Total subsidence is actually significantly higher, as it extends well beyond 1km from canals. These high subsidence rates are linked with high CO_2 emission rates.

3.3.4. Uncontrolled peat fires

Major fires started in 1982 with over 3 million ha of forests and especially peatlands burnt in Sumatra and Kalimantan. Peatland fires occur almost every year, and can reach disastrous levels in very dry years, such as the regularly occurring El Niño events.

The most damaging peatland fires in Central Kalimantan occurred during 1997/1998, when over 60,000 hotspots were counted. Nationwide a total of at least 2.1 million ha of peatland was burned, of which more than 31,000 ha were in the EMRP area. The economic damage caused by smoke from these fires was estimated at over

Figure 11.
Average surface slopes, canal water depth and groundwater depth, as measured along 1km cross sections perpendicular to canals in the EMRP peatlands.



1.4 billion US$, and the economic losses (mainly from tourism and timber) at 7 billion US$.[2]
Peatland fires in Central Kalimantan not only affect the livelihoods and health of local communities, but also result in environment destruction and the release of huge quantities of CO_2 to the atmosphere. Peatsoil fires release up to three times more carbon than surface peat fires. Areas that have been burned before have a greater risk of burning again than other areas.

It has been recognised that the main cause of fires in the peatlands of Central Kalimantan is the drainage created by the development of canal networks, especially in the EMRP area. In addition, logging activities, the development of settlements and land clearing, for both community agriculture and large plantation companies, contributed to the fire events.

[2] Tacconi, L. 2003. Fires in Indonesia: causes, costs and policy implications. CIFOR paper no. 38. Indonesia

3.4. Poverty due to peatland loss

Harvest failures

Drainage and irrigation channels were built far inland to manage water in agricultural areas. Problems occurred as the channels were often built too deeply into peat domes and into acid sulphate soil layers. The channels, often intended for irrigation, instead led mainly to drainage. As a result, the groundwater level lowered as water flowed out through the channels and land subsided. With the peatland layer gone, commercial lands downstream became more prone to flooding. The drainage of the acid sulphate soil layer causes pyrites to oxidize, resulting in severe acidification (pH<3) and severely affecting crops. Harvest failures have been frequent.

Harvest failures led to lower incomes for the transmigrant communities and encouraged them to switch to growing different crops, to seek other jobs, or to return to their original homes. The first choice is difficult because there is no money to buy seeds or to access technology to handle floods and plant intoxication. The most common strategies chosen included either returning to their homes or the (male) head of the household working as a seasonal worker elsewhere while his wife and children cultivated the remaining land. Prior to the enforcement of the laws against illegal logging, the male heads of households often worked as sawmill labourers. However, this is no longer an option, so they have increasingly tried to make a living by working their land and producing off-farm commodities. In addition, the options to work as casual labourers at oil palm plantations or in the city have increased.

Figure 12.
Fire hotspot data (number of fires counted per year) for Borneo as detected by satellites (NOAA, ATSR and MODIS) from 1997 to 2006. (Tentative data from Florian Siegert as published in Hooijer et al 2006)

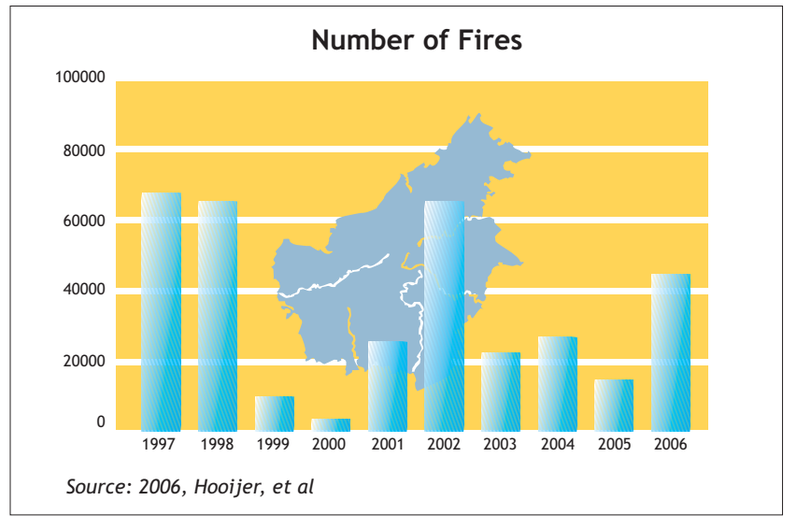
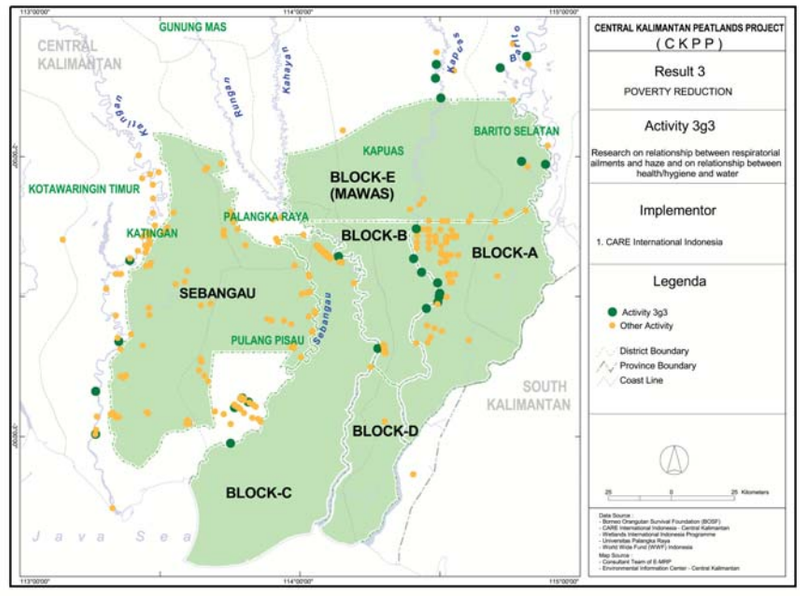


Figure 13.
Map: Health problems due to smog



Loss of cropland due to fires

The transmigration communities cultivate different farm commodities to the Dayak and mixed community groups. They have based their livelihoods upon growing mountain

rice types and working on rubber plantations. Their main problem is that they are still learning to farm on peatlands. Prior to the crackdown on illegal logging, they tended to work in the forestry sub-sector. Most adopt the life strategy of Dayak community groups, balancing farming with off-farm employment.

To decrease the acidity of farmlands, farmers burn the area to obtain charcoal. This measure is more practical and cheaper than spreading lime on the area. However, the serious environmental degradation and loss of crops as a result of frequent burning has decreased communities' interest in exploiting the land.

Economic problems due to smog

The smog caused by forest and land fires also has serious impacts on the community economy. In most years the thick smog reduces the productivity of plants for up to two or three months. The resulting poor harvest means lower incomes. When there is smog, the price of the essential needs skyrockets by between 100 to 300% because of transportation difficulties. As a result, communities have little available capital to invest in the next planting season. Due to the limited number of financial institutions, the community is trapped into using the services of *tengkulak*, intermediaries who dominate the commodity market. Other problems arising during the marketing of farmers' on-farm and off-farm produce include the low volume and quality of products, the absence of farmer groups to support their marketing and limited capital, technology and knowledge.

A woman plaiting rattan into a comercial product

Table 2.
family Access to land in CKPP targeted villages (MonQI-1 Data CKPP CARE Component, 2008)

Block	Average Land Ownership Potential per Family (Ha)	Average Land Usage Rate per Family (Ha)	Percentage Land Usage (%)
Katingan	4.4	2.2	47
Sebangau	2.2	0.8	36
Tumbang Nusa-Gohong	3.7	1	28
Mantangai	2.9	1.9	66
Timpah	1.9	0.6	31
Barito Selatan	4.6	1	22

3.4.1. Health problems

Smog also has serious impacts on health. The smog caused by the fires in 2006-2007 contributed to large numbers of people suffering from acute respiratory tract infections in Central Kalimantan. Some 91.4% of infants/toddlers were affected in February 2007 (CARE, 2007). The drought also increased the proportion of infants/toddlers with diarrhoea to between 31 - 52.4%. One of the measures to prevent the spread of both diseases is maintaining the nutrition level of infants/toddlers.

3.4.2. Peatland degradation and climate change

The degradation of peatland areas in Southeast Asia has a negative impact on a global level. In Southeast Asia alone, an average of 2,000 million tonnes of CO_2 are emitted per year due to peatland loss, of which 90% originates from Indonesia. In effect, this means that an area covering less than 0.1% of the global land surface contributes an average of about 8% of global fossil fuel emissions (Hooijer et al 2006). The peat-based CO_2 emissions have placed Indonesia in third place among global greenhouse gas emitters, after the United States and China. These emissions have increased rapidly since 1985 and are expected to increase further in the coming decade unless remedial action is taken.

The carbon stored in the peat is being released through two mechanisms, drainage and peat fires. Normally, peat is wet and the peat soil and vegetation in this area will not burn. However drained peat starts decomposing as a result of microbiological processes when the peat is exposed to air. Oxidation of the organic carbon into CO_2 is the result. Under the warm tropical conditions of Southeast Asia this process happens more rapidly than in temperate or boreal zones, and is accelerated by the frequent peat fires that occur due to increased vulnerability of drained peatlands. Under tropical conditions, drainage can lead to an annual subsidence of around 10% of the drainage depth, as a result of water and carbon loss and compaction. Depending on the specific

carbon content, a one metre drop in the water table may lead to CO_2 emissions of 90 tonnes per hectare per year. Central Kalimantan is one of the main areas causing this problem. In 1997-1998 a large part of the EMRP area burnt, releasing at least 150 million tonnes CO_2.

3.4.3. Biodiversity loss

Threatened species

The peatswamp forest of Central Kalimantan is home to threatened species, including among others the Orangutan (*Pongo pygmaeus wurnbii*), which lives in Sebangau National Park. There are an estimated 6,000-9,000 Orangutans in the area as well as six bird species recorded in the Red Data Book.

In the EMRP area there are 12 protected bird species, including one Bangau Tongtong Leptoptilos javanicus, and seven other species that are globally threatened with extinction.

In the Block E (Mawas) area, 21 mammal species have been identified that are nationally protected, 14 species are protected by IUCN and 20 species are protected by CITES. Four of them are endemic to the area : Lutung merah (*Presbytis rubicunda*), Bekantan (*Nasalis larvatus*), Orangutan (*Pongo pygmaeus wurmbii*) and Kijang kuning (*Muntiacus atherodes*). One resident bird species, Bangau storm (*Ciconia stormi*), is rare and threatened with global extinction. In the herpetofauna group, one reptile species, Buaya senyulong *(Tomistoma schlegelii)*, is protected both nationally and globally.

Burned and degradated

Asian boney-tongue fish-endangered

Proboscis monkey

Storm's stork Ciconia Stormi, one of the rarest storks in the world

Challenges for the project

4

4.1 Policy and Planning

Indonesian and international NGOs have expressed concern about the impacts of peatland degradation in terms of loss of biodiversity, carbon emissions and increased poverty in peatland regions and have called for the conservation and wise use of peatlands. Following the United National Framework Convention on Climate Change (UNFCCC) Conference of Parties (CoP) 13 in Bali in December 2007, public and political awareness in Indonesia of the impact of deforestation and peatland degradation has increased. This was also stimulated by national and international media attention to the emissions resulting from Indonesia's degraded peatlands. Increasingly, questions have been asked about issuing palm oil concessions on peatlands in Indonesia in view of the resulting greenhouse gas emissions and biodiversity loss. Policy proposals from the Netherlands and the European Union now exclude subsidies for agrofuel production on peatlands as the damage caused undermines any claims for these fuels being green energy.

There is a clear political interest in Indonesia to work on climate change mitigation and adaptation, and concrete plans are being developed. Indonesia has developed a National Strategy for Sustainable Peatland Management (*Strategi dan Rencana Tindak Nasional Pengelolaan Lahan Gambut Berkelanjutan*, 2006), and is developing a strategy for tidal lowland development. To enable the mainstreaming of these strategies, a Presidential Regulation on Peatland Area Management is being drafted. In addition, specific policy and regulations are being developed for Reducing Emissions from Deforestation and Forest Degradation (REDD). In early 2007 the President signed an Instruction (InPres 2/2007) to restore the EMRP area in Central Kalimantan through peatland conservation, restoration and sustainable development.

This provides an overarching national policy umbrella for the conservation and restoration of other peatswamp forest areas in Indonesia.

The most effective measures to stop the degradation Indonesian peatlands need to come from the Indonesian national and district governments and spatial planning agencies. One of the elements of the CKPP was to cooperate with the authorities and further raise awareness of the causes and problems of peatland degradation in Indonesia among key people so as to increase support for the conservation, restoration, and improved planning of activities in peatland areas

Such awareness raising activities have led to improved policies for peatland management, and also the recognition of opportunities for financial support from multilateral conventions such as the UNFCCC and the Convention on Biological Diversity (CBD).

The major policy challenges for Indonesia are:

- Policies should be put in place that no longer allow large-scale conversion of remaining peatswamp forests to land uses, such as palm oil and pulp plantations, that involve clear felling and drainage. Intensive policy, legislation and law enforcement are necessary.

- Degraded peatlands should be restored through water management measures such as the closing of drainage channels. Projects such as the CKPP prove that it is possible to work on solutions to the peatland problems.

- The causes of peatland degradation are complex. Illegal logging is one of them. Without appropriate economic measures it is impossible to invest in the conservation and management of remaining peatswamp forests or to restore degraded peatlands. Local people need to be able to sustain their livelihoods in alternative ways before they can be expected to worry about conserving their natural resources.

4.2 Solving poverty issues

Poverty is a root cause of all the problems, as explained in section 3.3.2. This means that solutions to biodiversity conservation and over-exploitation must be found through development. The peatlands must be turned from poverty traps into development opportunities. The transition to sustainable use requires traditional conservation as well as socio-economic and development thinking. Poverty will increase if peatlands are further degraded. Solving the most striking poverty issues is necessary, but poses an incredible challenge.

4.3 The need for support from local communities

Increasing local communities' understanding of the problems and the need for change were crucial and challenging aspects of the project. It was necessary to explain the causes of and links between the fires, the subsidence of soils and poor harvests, a complicated web of events. Moreover, local people use the drainage canals for transport and fires to clear land. Logging was and often is an essential contribution to the local economy. Closing canals, ending illegal logging and preventing fires are therefore very complicated as they require gathering support from local communities who depend on these activities.

4.4 Lack of science base

"We do not know much yet about the tropical swamp forests and swamp shrublands,'"wrote the famous German palaeobotanist Henry Potonié in 1907 in one of the first scientific papers on tropical peatswamps. Although in the previous 50-60 years the peatswamps of Kalimantan had been described incidentally in expedition reports, the scientific mainstream was convinced that peatlands could not exist in the tropics. This axiom that peatlands only occurred in cold climates severely hampered the study of tropical peatswamps.
Science still looks at equatorial peatlands with a northern

bias, applying concepts from moss dominated mires to completely different giant forest ecosystems. While both ecosystems share the property of peat accumulation the mechanisms involved differ completely: northern peat is formed by mosses growing upward, whereas in the tropics it is formed by tree roots growing downward. And where - because of their general poor tree cover - northern mires allow a open view of the landscape, tropical swamps prevent seeing the forest for the trees. Less available time (northern peatland science started 250 years ago in 1658), more difficult access, more complexity, and much less visibility are the reasons that we know so much less about tropical peatswamps than about their northern counterparts. No wonder we use northern mires as paradigms.

We know that in peatlands the essential components of vegetation, peat, and water are strongly interrelated: we cannot change one component without changing the others. But the tropical flora is so much more diverse than the northern. From the 400 *Sphagnum* species in existence, no more than five or six are able to form domed bogs in the north. But we have no idea which species are the real ecosystem engineers in tropical peat domes. We know that peat layers - as well as storing enormous amounts of carbon - contain a wealth of palaeoecological information that can help us to better understand the development and functioning of peatlands. But in the tropics we hardly know how deep the peat deposits are or how much carbon they contain, because the huge clumps of durable wood make coring extremely laborious. Consequently, our view of tropical peat is too strongly informed by places that are easiest to core (and that contain the least carbon). Even our knowledge of *where* peatlands are is still largely determined by a publication by Betje Polak from 1952, which estimated the total area of Indonesian peatlands to be 'roughly' 163,498.65 km2. Since then the destruction and disappearance of peatlands has proceeded more rapidly than their investigation.

We know that water is the lifeblood of the peatland and that northern bogs develop sophisticated self regulation mechanisms to ensure that water levels remain stable in spite of seasonally and annually varying weather conditions and even under long lasting climatic change. We understand that such mechanisms must also exist in tropical peatswamps, but we have hardly started to think about, let alone to study, them. We only suspect that vegetation composition and structure may determine and regulate hydrological conditions in tropical peatswamps even more strongly than in northern mires.

Last but not least, we know that vegetation, peat and water are strongly interrelated both at a site and at a landscape scale, but we still hardly grasp the consequences for peatland functions, for peatland management and for peatland restoration. Which forms of exploitation could be compatible with ongoing peat formation? How do peat type, water regime and available vegetation determine greenhouse gas emissions from natural, degraded and rewetted peatlands? What could be the role of vegetation in restoring water levels? To what extent is vegetation structure and zonation in peat domes an effect, and to what extent a cause, of the hydrological conditions we observe?

Tropical peatland management is therefore characterised by both severe societal challenges and a lack of scientific knowledge. It is wise to acknowledge the latter, by stimulating research, while - using a prudent approach - addressing the former.

4.5 Global policies and trends that affect peatlands

Global trends shape the situation of tropical peatlands. Global demand for tropical timber, palm oil and wood pulp have led to massive destruction of peatswamp forests and the conversion of large areas into unsustainable palm oil and pulp plantations. Global and national climate policies do not currently acknowledge the massive carbon dioxide emissions from tropical peatlands. Without addressing these global trends and policies, it is difficult to achieve a sustainable situation on the ground.

4.6 Sustainable finance and donor coordination

One of the key difficulties in resolving the unsustainable land use issues in Indonesia's peatlands is the lack of sustainable finance mechanisms and coherent finance strategies to support an integrated approach to poverty reduction, environmental management and biodiversity conservation. In the follow-up to the Bali roadmap, and also as a result of CKPP and Master Planning, bilateral donors are now paying much more attention to peatland issues in Central Kalimantan. This was not the case at the beginning of the project. However, the high interest in this particular area also carries the danger of exceeding the absorption capacity, and there is an increased need for donor coordination. Moreover, current project-by-project funding does not provide the financial security needed for local stakeholders to change their livelihood and investment strategies. There is a clear need for guarantees of a long-term sustainable funding flow that will enable the longer-term investment strategies that are essential for achieving conservation and sustainable development. The potential of innovative mechanisms such as voluntary carbon markets, REDD funding, Payments for Environmental Services, Bio-rights and Bio-diversity offsets, offer great potential for supporting government-led as well as community-based approaches to enhancing the sustainable management and conservation of these critical carbon stores and high biodiversity areas. There is now a need for international and local systems for managing funding flows in a way that guarantees accountability and transparency requirements and can ensure the equitable allocation of carbon rights and carbon funding, empowers local stakeholders and achieves maximum participation of the poor. None of these mechanisms exist at present. Yet these will be needed for gaining the necessary support of the local communities. With the emergence of a broadly shared understanding of the need for these innovative systems, and a global awareness of joint synergistic targets (e.g. climate change mitigation, biodiversity conservation and poverty reduction), there is a window of opportunity that has not existed before. Indonesia, and the peatlands of Central Kalimantan in particular, can provide an excellent basis for developing, testing and promoting these.

CKPP's Activities

5

Over three years the CKPP consortium implemented activities related to peatland restoration and conservation and improving livelihood options for local communities. These activities were not just restricted to the project area, but were also aimed at international media and policy fora, such as the UN climate conventions.

5.1. The formation and operation of the consortium

The CKPP consortium consists of the Borneo Orangutan Survival Foundation (BOSF), CARE International Indonesia, the University of Palangka Raya (UNPAR), Wetlands International Indonesia Programme (WIIP) and the World Wide Fund for Nature (WWF). The main sectoral expertise of partners includes conservation, rehabilitation, community development, strengthening livelihoods and research.

Why work as a Consortium?

The complexity of the situation in Central Kalimantan required an approach that integrated support for strengthening community resilience and livelihoods, conservation interventions, rehabilitation actions and policy development, all underpinned by a strong science base. CKPP partners recognised that by drawing together their complimentary strengths they could have a greater impact than by working individually.

What did a consortium mean in practice?

Working as a consortium meant that project interventions could be divided in terms of geographical areas and expertise. WWF had experience in conservation activities in the Sebangau National Park; BOSF in the remaining forest areas in Block E (Mawas). Both focused their activities on these areas (restoring hydrology, regreening, fire prevention and establishing fire brigades). WIIP had a history in restoring degraded peatlands, and took the drained areas of the EMRP in Block A as their focal area. UNPAR worked mainly in Block C on establishing fire brigades and implementing agricultural techniques not relying on drainage. UNPAR collated all the information about peatland restoration in an information centre at the University. They also took an active role in communication and outreach. In all these areas, CARE was the lead partner in dealing with supporting communities, for instance with health care. WIHQ in the Netherlands took the lead role in advocating conservation and restoration activities at the international level, for instance by advocating peatlands in REDD schemes.

Working as a consortium involved partners collaborating at all levels, from top management through to frontline community and field officers. This was not always easy, especially with an ambitious work programme spread over 25 communities, relatively short timelines, different organisational cultures and norms and challenging physical conditions. Monthly meetings of the Project Managers from each organisation took place in Palangka Raya and were at the core of the coordination efforts. These meetings allowed partners to update each other on their activities, explore opportunities for enhancing integration, share lessons learned and identify areas where the expertise of one or more of the organisations could support the activities of others. Also, the communications officers of the partners met monthly and produced a two-monthly internal newsletter to keep all the partners informed.

The strengths and weaknesses of working in a consortium

Members of the consortium, coming from the community development, conservation and academic sectors, were able to bring the necessary areas of expertise, working experience in the region and a large local network into the project. While recognising that there is always more that can be done to enhance coordination and integration of activities, partners acknowledge that overall they were able to have a broader impact over a shorter time period by working as a consortium than they would have done by working separately.

Working collaboratively also meant that it was easier for partners to engage with local government than it would have been if organisations were working individually. The space for NGOs, UNPAR and the government to interact in a structured format through consortium interaction with local authorities helped to improve communication flows and cooperation between the consortium and the government, especially in the early stages of the project.
Being part of a consortium can also be time consuming. It requires a commitment from all parties to establish coordination mechanisms, engage in those mechanisms, share the lessons learned, and support each other in a variety of ways. It takes effort to build a common vision and shared expectations, especially as each partner has its own organisational vision and mission to which it must adhere.

One of the challenges to working in a consortium is ensuring that the consortium is not exclusive; there need to be mechanisms for ensuring that other organisations have the opportunity to participate, whether as a core member or collaborator. This applies not only to NGOs, academic institutions and government departments, but also to the private sector.

At the request of a number of partners, the CKPP consortium was established as a flat structure, with no lead organisation. While this approach implies that each partner has an equal say in project decisions, it also means that deliberations and decision-making took longer than they otherwise might. Responsibilities were not always automatically clear and needed explicit decisions which differed from case to case.

Beyond the consortium - Advisory Groups

CKPP had the challenge of working at maximum reach and impact in a very short period of time. A additional complexity was the innovative approaches, both technically -

restoring peatlands, rewetting drained areas - and socially - helping people out of extreme poverty while at the same time providing alternative livelihoods for loggers. To overcome this challenge, the project recognised explicitly the need for technical support from both local and international advisors.

An eight member International Advisory Group (IAG) was chaired by a representative of the Dutch Government and co-chaired by the Governor of Central Kalimantan. Members were drawn from the government, non-governmental, private and academic sectors, with expertise covering the range of CKPP's technical and social interventions. The IAG was charged with providing a range of technical advice to the project, and helping to ensure that the project's experiences and the lessons learned were raised to the international level, as appropriate. The IAG met regularly throughout the project's lifetime, including two meetings in Central Kalimantan.

The Provincial Programme Coordination Team (PPCT) consisted of 24 members, mostly government officials, and was chaired by the Vice Governor. Its Secretariat was based in the Central Kalimantan Environmental Management and Protection Agency. The PPCT was supported by a five member Expert Team. The PPCT was responsible for coordination within government related to the CKPP, monitoring and evaluation, and facilitating approvals for the CKPP with different levels of government. The PPCT and the Expert Team played a prominent role in the early stages of the project when the detailed design of activities was being completed. Once full implementation began, the PPCT took a less active role.

5.2. Hydrological restoration, including dam design, dam locations

Introduction

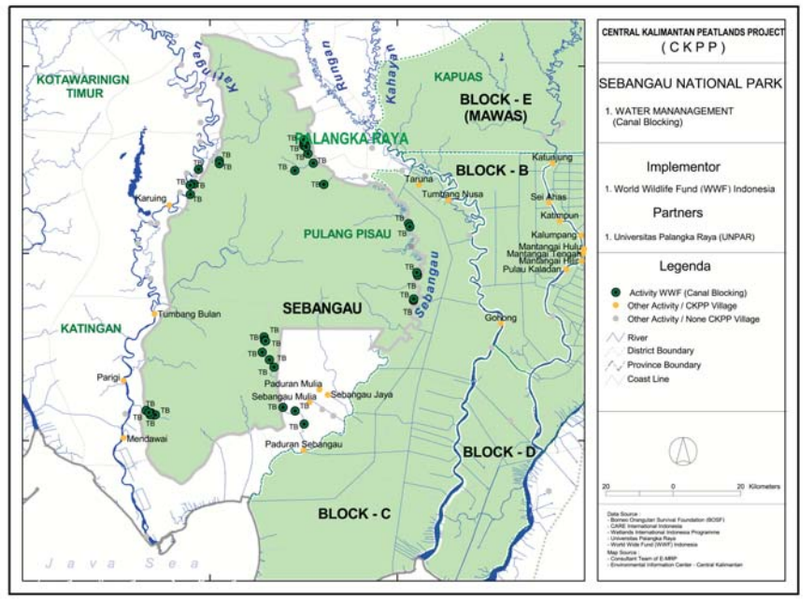
The EMRP area has experienced massive hydrological disturbance because of the development of drainage channel networks totalling more than 4,000km in length. This has had catastrophic impacts on the peatlands of the area, including drying out of the peat, ongoing rapid decomposition of the drained peat, an increase in subsidence, and increased risk of fire. Drainage in blocks A, B, C and D of the area was established as part of the EMRP, the failed attempt in the early 1990s to start rice cultivation in these peatlands. Drainage in Sebangau National Park and Block E (Mawas) was mainly due to illegal loggers digging ditches in order to remove wood.

Restoring the peatswamp hydrology is the only way to prevent the problems of soil subsidence, peat decomposition and annual wildfires. In practice, this means closing drainage canals to rewet the peatlands and restoring vegetation cover to protect the peatsoil from direct sunlight and to reduce waterstreams at the surface level.

CKPP's hydrology restoration activities focused on Block A, North and East of the EMRP, and Sebangau National Park. Interventions to restore the hydrological systems involved the development of technical a design for dams, their construction and maintenance and hydrological monitoring. Hydrological restoration was linked closely to regreening activities.

Dams in hell's canal section

Figure 14.
Map: Canal blocking area in Sebangau National park



5.2.1. Hydrological restoration: the social challenge

Hydrological restoration could have provoked opposition from local communities. Many communities were hardly aware of the role of drainage in creating the conditions for wild fires and land subsidence, which would eventually destroy their lives. In the short run, drainage literally keeps their feet dry; drainage canals also provide transport routes for boats. In this respect, closing drainage canals was not just a technical challenge, but also a social one.

Community involvement started in the planning stages and continued through the construction and monitoring phases. Ongoing engagement of communities in maintenance activities over the long term, even after the project has been completed, is of critical importance.

The challenge was to provide alternatives that offered higher incomes compared to the livelihood situation before the project started, but which also provided a long-term and sustainable source of income as an alternative to logging and drainage-dependent agriculture.
In the short term, many people could earn an income by working for the project: building dams, creating wells for fire brigades, and regreening areas. For the long term, alternatives were developed. Local people were supported to establish nurseries and plant commercial crops that do not need drainage, such as Jelutung (a source of latex for chewing gum), rubber and peatswamp hardwood species. Fish ponds were established behind the dams in drainage canals.

5.2.2. Hydrological restoration: a technical challenge

In the last decade, through similar work in Sumatera and Central Kalimantan, Wetlands International has developed and experimented with dam designs that can withstand enormous pressures of water while standing in the very soft soils of peatlands. These types of dams were built in the project areas to block major drainage canals, some of them are over twenty metres wide. In the EMRP and Sebangau National Park, the consortium built 24 large dams (tabat) and 263 small dams.
More than 900 workers, divided into 39 groups, were involved in building these dams.

Determining dam locations

Determining the optimal locations for dams involved field surveys to observe the physical form and dimensions of canals, hydrological patterns (water flow and current rate), vegetation condition, community activities, availability of materials and access to the location.

The field surveys identified two priority locations for hydrology restoration activities: the area of the EMRP covering Block A - North, Block E and the area of Sebangau National Park and its buffer zone. Blocking drainage canals in these areas appeared to be feasible and would also lead to the hydrological restoration of large areas, some of them still containing forests with a high biodiversity value.

Dam design and construction

Information from the field surveys formed the basis of the design and technical specification of the dams. CKPP used a design of winged blocks with a spill way. This design was based on the culmination of experience from previous designs. It was used in both blocking large canals (EMRP) and the smaller canals used for illegal logging. The main materials used were round timber (*galam - Melaleuca sp*), mineral soil in bags for filling the dam, wooden boards and geotextile/tarpaulin to cover the spill way, which is there to reduce pressure on the dam.
In this project a new design feature was incorporated in which trees were planted on and behind the dams. Eventually, the dams should become redundant when vegetation and peat start to block the channel. The trees on the dam would help to keep the soil inside the dam in place.

Dam construction involved three phases:

Pre-construction: including group preparation and capacity development; preparation of work agreements; mobilisation of manpower, equipment, and materials; preparation of a camp; and determining the reference points of the dams.

Construction: Building materials were transported to the site in the wet season, which is also the best season to construct the dams. In this phase, the wood structure for the block was constructed followed by filling the blocks with sandbags filled with mineral soil and planting trees on the dams.

Community involvement in peatland restoration -blocking drainage channel

Dam design and construction

Post-construction: this involved demobilising the groups, equipment and camps.

Maintaining the dams

After construction, maintenance of the dam is very important, especially in the first years. At a later stage, the canals will close and disappear as water plants and trees start to add blockades. This process is very visible even within a few years of construction.

In order that the blocks remain functional, monthly monitoring and maintenance activities were conducted. A common issue that arose was the subsidence of the soil filling as it compacted. This was addressed by adding more soil bags. Another issue was the leaking of the blocks due to high water pressure, leaving the blocks vulnerable to structural damage. This was addressed by strengthening the wood structure. Damage also occurred from illegal loggers who continued using the canals to transport wood.

Monitoring hydrology and other aspects

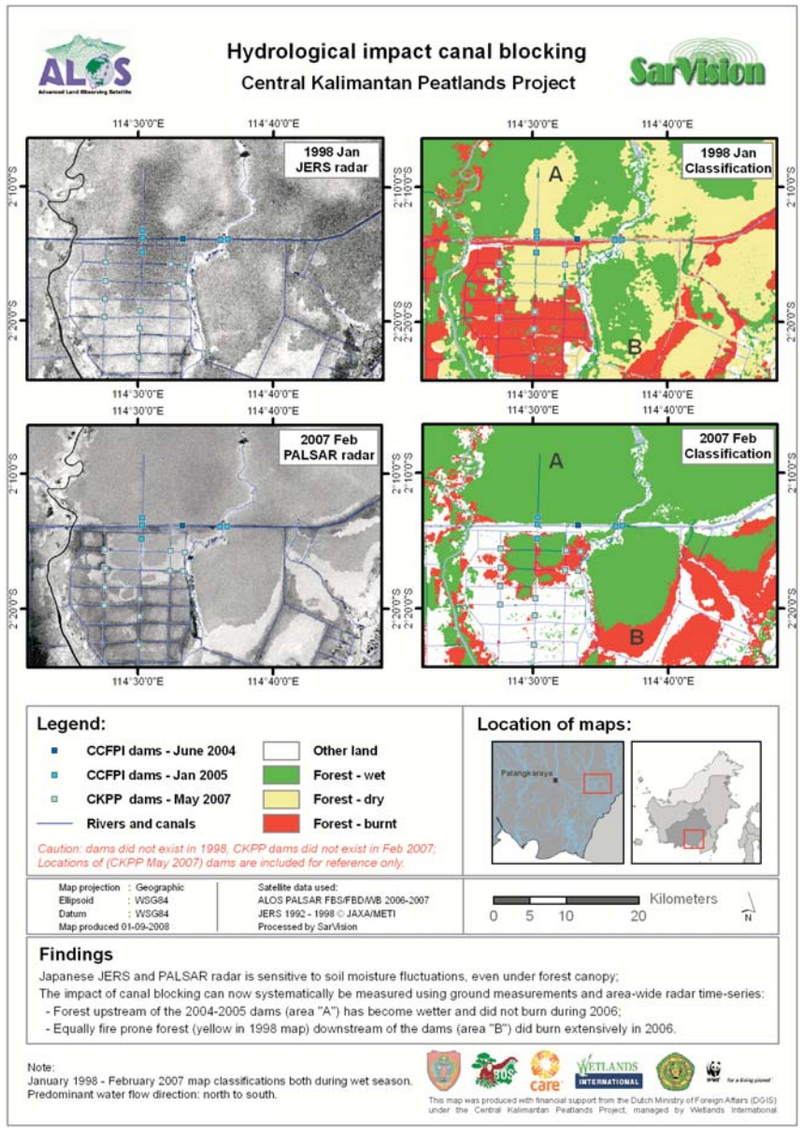
To monitor the effect of the dams on local hydrology behaviour, especially in Block A, North of the EMRP, instruments were installed in key locations. Forty seven staff gauges were installed to monitor the surface water fluctuation and 69 deep wells on nine transects served to monitor groundwater fluctuation. To complete the analysis of changes in hydrology behaviour, five manual instruments for measuring rainfall, one thermometer and three instruments to measure subsidence were also installed. Field staff collected data from these instruments twice a month, with relatively regular time intervals.
In addition to hydrology monitoring, monitoring was also carried out on the impact of the dams on the surrounding wildlife. The results of identification and the preliminary qualitative conclusions indicate that the construction of the blocks had a positive effect on wildlife, especially in terms of improving animal mobility from one location to another and reducing the risk of fire. There were indications of both positive and negative impacts to aquatic life and further investigation of this is needed.

CKPP dam no. 10 in block A north

Jelutung seedlings for reforestation, Sebangau

Jelutung tree trunk with harvest scars

Figure 14.
Map: Canal blocking area in Sebangau National park



Some lessons obtained from the implementation of CKPP hydrology restoration include:

Hydrology restoration is the main pre-condition that must be implemented before replanting of vegetation. For this reason, the sequence cannot be reversed; hydrological must occur first, followed by replanting activities;
Hydrological restoration influences the agriculture and transport options for local communities. Involving them and providing advantages in the short and long term is crucial for success.
Hydrology restoration through the construction of blocks with the correct design and technical specifications is an appropriate way to restore degraded peatlands;
The local community can be trusted as the lead in carrying out hydrological restoration activities, provided that the blocking groups are supported by appropriate capacity building programs;
The correct installation and placement of the hydrology monitoring instruments, as well as consistency in collecting and recording field data, are the main pre-conditions in evaluating the success of hydrology restoration of peat.

- The dams have shown a positive impacts on hydrological conditions, as shown by changes in water levels in the canals and the ground waters levels in blocked areas. The same applies for the impact on wildlife.
- Still these conclusions needs to be further supported by detailed studies and long-term monitoring.

5.3. Fire prevention and control

Introduction

Forest and land fire prevention programmes were among the first to be agreed by the consortium, mainly due to the very serious fire situation in Central Kalimantan in 2006. It is clear that in the long run, rewetting the peatlands is the only sustainable way of preventing fires. Ending the countless fires that occured in the project area in dry seasons was an almost impossible task. Controlling the fires remains the best option until the peatlands are rewetted by closing drainage canals.

5.3.1. Fire brigades

In 2006, CARE worked together with UNPAR to establish, train and equip 25 fire brigades (1 fire brigade per village). A total of 399 people (33 females and 366 males) were members of the birgades. The capacity of fire brigades to extinguish fires increased from the rate of 0.173 ha/hour in September 2006 (measured at the first training) up to an average rate of 1.75 ha/hour in November 2006 (during their first attempts to extinguish fires). CARE was responsible for activating all the brigades in Katingan and Pulang Pisau districts; BOSF did the same in Kapuas and Barito Selatan Districts.

Villagers were also trained in the development of deep wells to provide water for both fire fighting and other uses during the dry season. A total of 50 wells were developed in the Block E area, 75 units along the Trans-Kalimantan Highway and others in villages in the buffer zone of Sebangau National Park.

During the fires of 2006, BOSF organised fire suppression by village fire brigades on some 650 ha. for about 47 working days, involving at least 310 fire brigade members. In addition, two BOSF fire fighting teams also suppressed 20 fire events in Block A and B on 4,000 ha for 171 working days.

The brigades' working programme also included development of yearly fire calendars, fire patrols and the development of hydrants and long fish ponds (locally known as '*beje*'), which also function as firebreaks. The fire controls activities not only targeted fires but also illegal activities, such as illegal logging and destructive methods of land clearing.

Figure 15.
Map: Fire prevention area of community-based firefighting

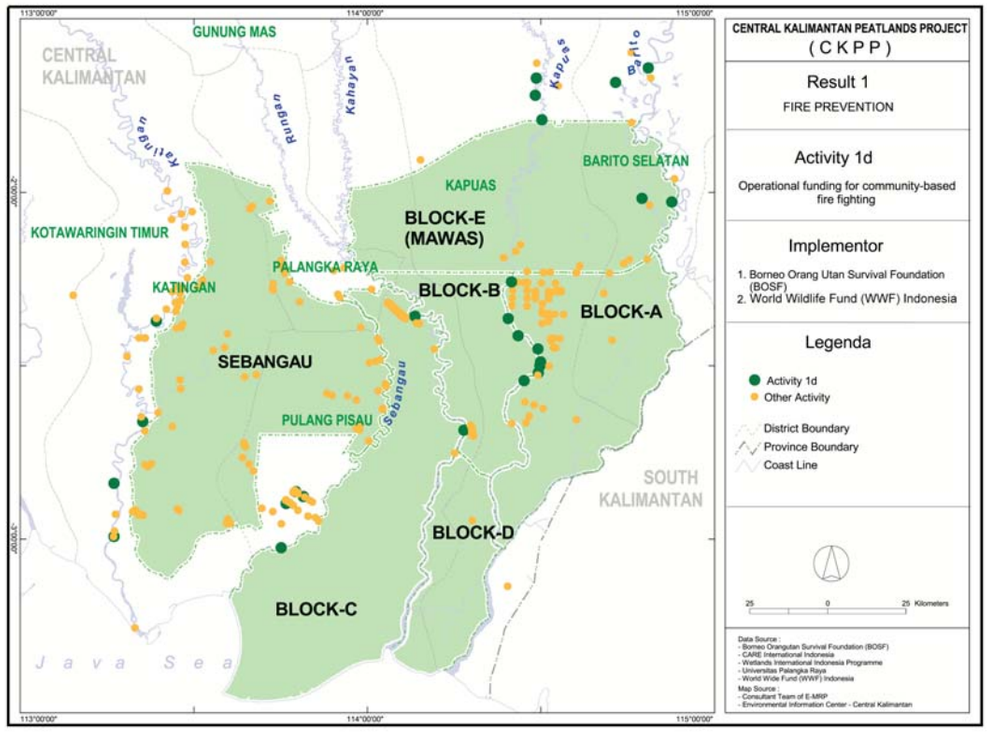
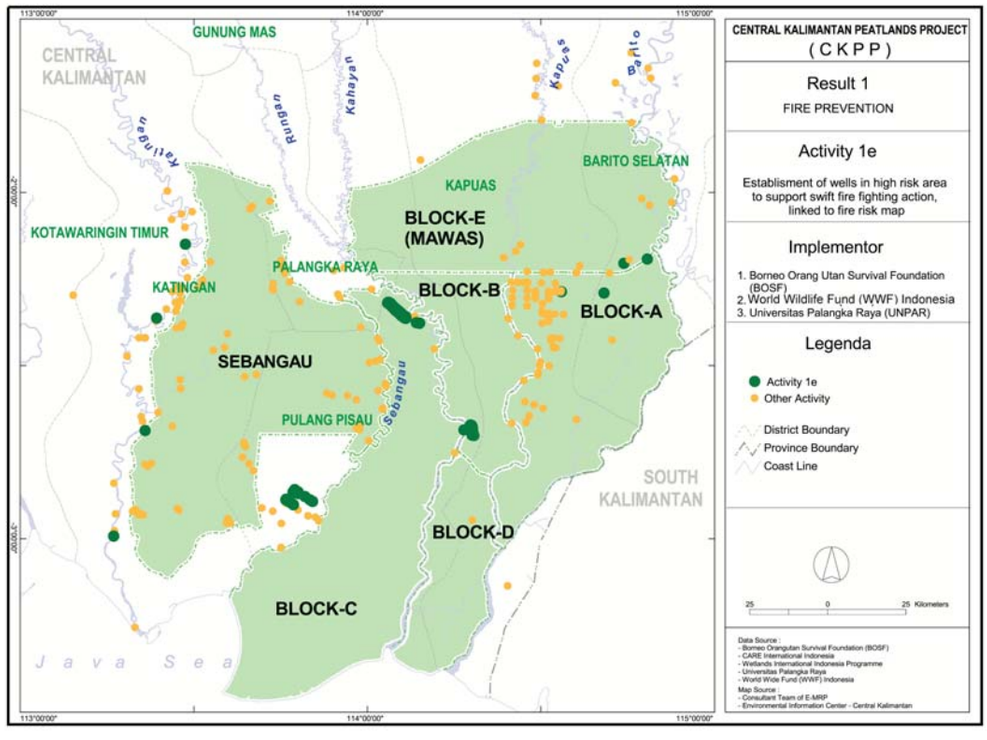


Figure 16.
Map: Establishment of wells in fire high risk area



Early Warning System Workshop

5.3.2. Fire early warning system

CKPP has delivered a forecast and climate monitoring tool in Central Kalimantan to predict the fire risk. The objective is to have an early warning of the danger of forest and peatland fires by forecasting rainfall anomalies. These tools keep users up-to-date with the rainfall monitoring system (collected 10 days after) and rainfall anomalies forecasting system (three months in advance). All reports can be easily printed and analysed in software such as Microsoft Excel. Then the users can decide who needs to receive the report, what information it will contain, and when it needs to be distributed. The data and information can be accessed freely at http://www.pil.or.id and http://iridl.ldeo.columbia.edu/maproom/.Fire/.

The tool was developed by CARE, the Environmental Information Center of Central Kalimantan (PIL Kalteng), the International Research Institute for Climate and Society - The Earth Institute-Columbia University, and the Center for Climate Risk and Opportunity Management in Southeast Asia and Pacific-Institute Pertanian Bogor (CCROM SEAP-IPB). Up to 20 national, provincial and district government agencies involved in climate forecasting and monitoring have been trained to use the tools.

5.3.3. Changing land clearance methods

Apart from creating village fire brigades through organising local communities and providing training and equipment, there was also a need to strengthen policies and regulations at the village level. Using fire for land clearance is now more of a problem since so much land is drained. Local people are often unaware of the new risks of these ancient methods.

The Government of Central Kalimantan Province adopted a new risk tool through Governor's Regulation No. 52/2008 on Guidelines of Land and Yard Clearing for the Community of Central Kalimantan *(Pedoman Pembukaan Lahan dan Pekarangan bagi Masyarakat di Kalimantan Tengah)*. Following this regulation, permits for land clearing can only be given if the fire risk index is categorised as 'not dangerous'.

5.3.4. Lessons and conclusions

- Fire brigades appear to be an effective direct response when fires occur.
- The tool for predicting fire risks has been widely used, including by the government. Preventing the use of fires to clear lands is crucial in controlling the number of fires in dried-out areas. Banning land clearance at times when the fire risk is high is therefore a big step in preventing uncontrolled fires.
- However, rewetting areas is the only effective way of reducing the alarming numbers of fires in the dry season.

5.4. Regreening

Introduction

Regreening is a crucial element in restoring the peatlands. Vegetation cover protects the peat against direct sunlight, creates a wet microclimate at the soil level, stores water and reduces surface waterflow. Roots keep the peat in place and also help in storing and maintaining water.

Regreening can only follow hydrological restoration. Without that, the area will be too dry in the dry season for wetland species to survive (and also too wet in the wet season for non-wetland species).

Why regreening?

Forests might naturally recover in many rewetted areas without planting trees, although in some areas this is

Life after death

CKPP tree nursery

Sebangau SPI channel, dam contructed to prevent further

WI peatland reforestation with jelutung and other species

uncertain. Regreening is crucial to restore the hydrological situation, and the hydrological conditions are crucial for successful regreening. Without regreening the recovery of peatlands will certainly take much longer, especially in areas where fires have entirely destroyed the original vegetation, where a thick cover of ferns frustrates the growth of other species and in areas that remain dry and fire-prone despite the closure of canals.

Commercial forest species

For regreening, the project used only native forest species, mostly those with a commercial value such as jelutong (rubber for chewing gum) and belangiran (a tree precious for its meranti wood) were selected. Other tree species planted included *Gerunggang, Jambu-jambuan, Pulau rawa, Pasir-pasir and Tumih*. Planting of species that will, eventually, have a commercial value is crucial for success: local people will see the benefit of rewetting the area and will be motivated to prevent and control fires. In some areas, species with a value as food for Orangutan were replanted, to help this threatened species to survive.

How to regreen an area

The regreening program in Block E can serve as an example of how regreening should be carried out. The following steps were taken.

1. Formation of community regreening groups with responsibility for the development of nurseries to raise seedlings. Target communities included those living in areas considered critical for conservation purposes.
2. Training the groups to ensure good growth levels during the seedling and planting stages.
3. The development of community-based nursery units to provide seedlings. Seedlings were obtained through stem-cutting, wildlings and fruits. To create ownership by local communities, commercial species were selected.
4. Planting of the seedlings when they are robust enough. Often, the cover of ferns has to be removed first.
5. Maintenance during the first and sometimes second year and monitoring of tree growth.

Where should regreening take place?

The potential area for regreening is enormous; the entire rewetted area (around 60,000 hectares) is suitable. Regreening is, however, a very labour intensive activity. The following matrix was used to determine priority areas for regreening activities, based on the level of critical land and management zonation of the areas.

Criteria of critical land	Priority	Protection Zone	Research Zone	Buffer Zone
Critical/barren land (open land with bushes) resulting from fire and illegal logging	First Priority	• Community-based reforestation • Trees for Orangutan (OU) food	• Community-based reforestation • Trees for Orangutan (OU) food	• Community-based reforestation • Multi-purpose tree species (MPTS) and agroforestry
Critical/barren land resulting from abandoned farmland, plantations or other community usage due to changes in agricultural patterns or community livelihood (burning, illegal logging, farmland clearing, plantation, etc.)		• Community-based reforestation • Trees for Orangutan (OU) food	• Community based reforestation • Trees for Orangutan (OU) food	• Community based reforestation • MPTS and agroforestry
Secondary land closure (canopy closure level (due to illegal logging, etc.)	Second Priority	Enrichment and monitoring	Enrichment and monitoring	Enrichment and monitoring

The project consortium was able to successfully regreen hundreds of hectares, mainly in Sebangau, Mawas and Block A north.

5.4.1. Conclusions and lessons

- Regreening is a crucial element in restoring peatlands. Often, restoration of the hydrological situation will not take place or will take a long time without active regreening.
- Planting of species with a commercial value creates ownership by the people and provides additional motivation to control fires in the area.
- Regreening activities have been successfully conducted over hundreds of hectares. Rewetted areas at risk of fires are the first to regreen.

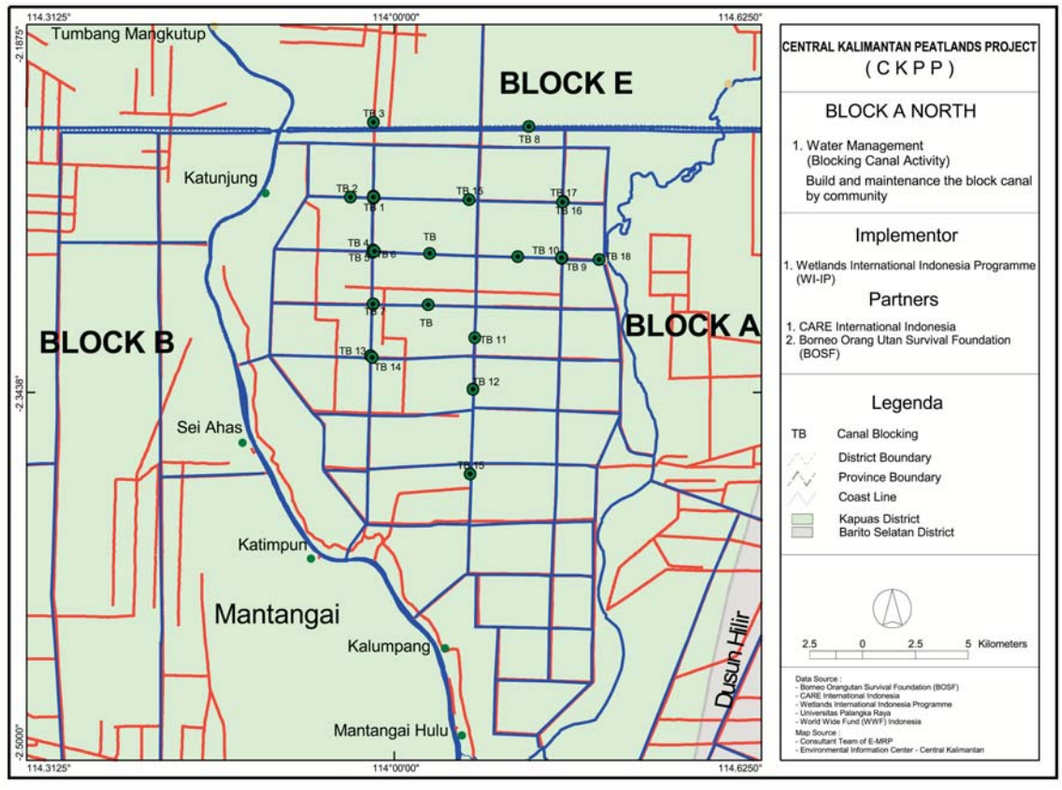
5.5. Reducing CO2 emissions, enhancing carbon sequestration and measuring these

The CKPP dams, including the 18 large dams in Block A north, 6 large dams in the Sebangau National Park and 263 smaller dams in Block E and the Sebangau National Park, have increased water levels along channels bisecting an area of over 50,000 ha of drained peatland and peat swamp forest.

CKPP also invested in maintaining seven dams that had been built in previous years by Wetlands International, with financial support from the Canadian International Development Agency (CIDA), which rewetted an area of approximately 43.000 ha in Block A north and part of Block E. This also involved adding some further dams (cascading) to decrease the difference in water head levels between dams and thus make the dam system more sustainable. The dams in the large channels in Block A north and Block E led to an increase in the water level during the dry season over 1 metre and at several dams the difference was more than 2 metres.

The effects of the dams in elevating groundwater levels laterally was limited as a result of the formation of mini-domes between the channels that occurred over the 10 years drainage period (see section 3.3.3). This restricted the effect to about 500 metres away from the channels. However, in some areas the effect may have been wider. For example, remote sensing (radar) pictures revealed a full hydrological recovery of the area around the main channel that bisects Block E, which previously had desiccated areas stretching for several kilometres from the channel. Also in smaller EMRP channels, the water levels were raised significantly between 50 cm to over a metre, and in illegal logging channels cascading dams raised water levels by an estimated average 50cm. During the wet season much of the landscape is naturally inundated, submerging the dams for extended periods.

Figure 17.
Map: 18 new dams were constructed to improve water management and reduce emissions in Block A North of EMRP



The CKPP did not intend to create Verified Emissions Reductions VERs (carbon offset mechanisms which allow individuals and organizations to "balance" emissions of greenhouse gases produced in one place by helping fund emission reductions that occur elsewhere), and the REDD and carbon offset mechanisms were not yet operational at the start of the project, at least not for tropical peatlands. There is an urgent need to develop a REDD methodology for tropical peatlands. The CKPP was not designed to establish a scientific baseline for measuring reduced carbon emissions but throughout the project the potential for doing so this became increasingly clear. CKPP co-financed a study that was carried out by Delft Hydraulics, Wetlands International and Alterra on the overall impact of peatland drainage in Southeast Asia, resulting in the publication of a report entitled *Assessment of CO2 emissions from drained peatlands in Southeast Asia* (Hooijer et al 2006; and known as the Peat-CO_2 report). The study estimated that the 12 million ha of degraded Southeast Asian tropical peatlands were responsible for 2,000 million tonnes of CO_2 emissions per annum, including an average of 632 million tonnes CO_2 (355-874 mt/y) from oxidation and a minimum annual estimate of 1,400 million tonnes from fires (over a 10 year period). This means that an area of less than 0.1% of the global land surface is responsible for an equivalent of 8% of global CO2 emissions.

Data in the Peat CO_2 report indicated that the relationship between drainage depth and CO_2 emissions is more or less linear: with drainage of 50cm resulting in annual emissions of about 45 t CO_2/ha and drainage of 1 metre in emissions of about 90 t CO_2/ha/yr. In addition, there is an increased risk of fires in drained areas, and fire related CO_2 emissions add an additional average 65% of the total emissions to the drainage effects. The direct relationship between drainage, the occurrence and impact of fires and CO_2 emissions enables us to develop a very rough estimate of the CO_2 emission reductions achieved by CKPP.

Other aspects that need to be taken into account are the relatively higher occurrence of fires in areas that are highly degraded, lack useful crops and are relatively uninhabited, which is the case for most of the CKPP focal areas. In such areas, fires occur where there is easy access, including along roads and channels. Fires are also assumed to have more impact (e.g. deep burning) in areas with more drainage impact (e.g. areas near channels). So despite the limited lateral hydrological impacts of dams, their impact on CO_2 emissions is still substantial as they elevate water levels in the most vulnerable areas where fires generally start, and they limit access to those areas by blocking the transport route. In addition, the building of the dams by community groups has raised awareness on drainage and fire issues and regular presence of project staff and patrol groups has limited illegal activities.

CKPP water level monitoring using staff gauges and deep wells was done only after dam building, at some of the large dams in Block A north. Data were provided to the Master planning team for further analysis (see section 5.11).

Assuming an average water level increase of 50 cm to 1 metre in small to medium sized channels and of over 1 metre in the large channels in Block

A north, combined with the assumed positive impact on fire prevention, we estimate that the CKPP dams may have achieved a reduction of potentially five million tonnes per annum.
However, 2007 and 2008 were relatively wet years, and in the absence of an accredited methodology and proper baseline, these estimates require further assessment. It is clear that impacts should be monitored over a longer period that includes wet and dry years and involves comparison with areas where no restoration efforts have taken place. CKPP has commissioned a separate independent study from the University of Greifswald to make a more comprehensive, although still provisional, estimate of drainage-related emissions reductions achieved.

5.6. The conservation of remaining peatswamp forests

The project area still has some forest areas in good state, some even intact. These areas are the last refuges for species such as Orangutan, whose conservation status is very high. Most of healthy forest areas are in the Sebangau area and in Mawas (Block E and A North).

5.6.1. Securing Sebangau National Park, Block E and Block A North

Sebangau National Park: boundary definition

Sebangau National Park was established in 2004. The park boundaries have to be agreed by consensus between local district authorities, a process that is still not totally completed. Many communities fear losing their income from harvesting forest products and logging. A committee that covers the affected areas has been established and is working in close coordination with the Ministry of Forestry to delineate the National Park boundaries. It cover the Katingan and Pulang Pisau districts and the Municipality of Palangka Raya.

By the time CKPP was completed, an agreement had been reached on the National Park boundaries in Pulang Pisau District, following a series of intensive discussions. In Katingan

Figure 18.
Map: Securing Sebangau National Park: biodiversity and conservation for Orang Utan

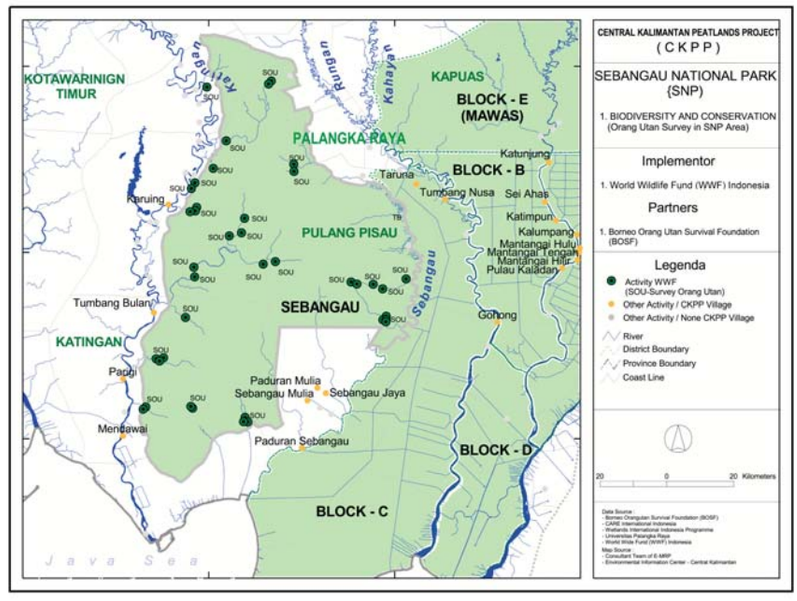
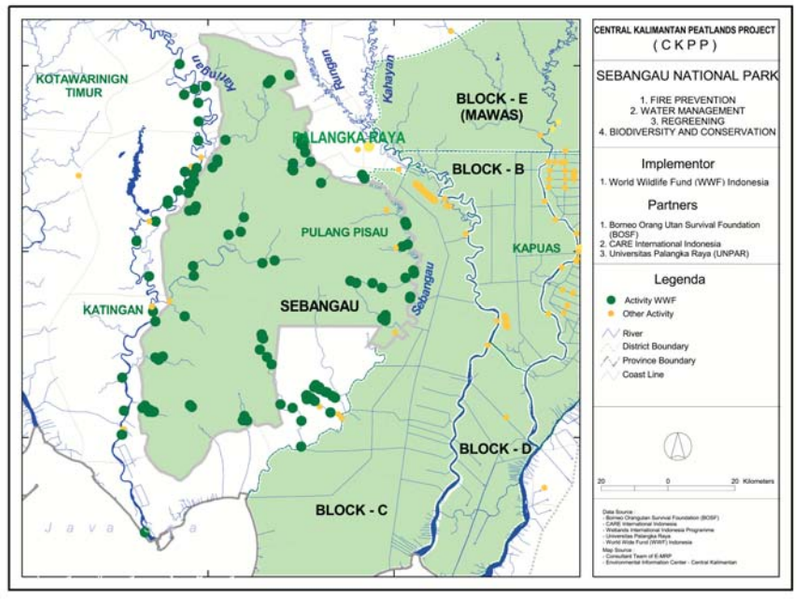


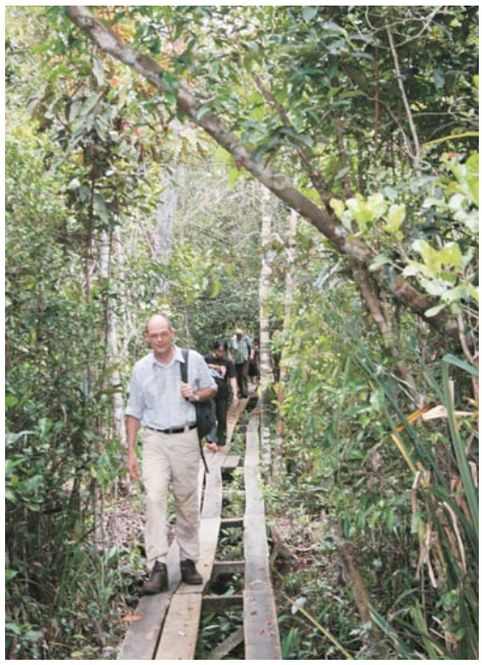
Figure 19.
Map: Securing Sebangau National Park: fire prevention, water management, and regreening area



District, further work was needed as the local government had submitted a proposal to the Ministry of Forestry to reduce the area of the National Park so as to construct a road between Mendawai and Bukit Kaki. This road, cutting right through the forest and a peat dome, would have a very negative impact on large parts of the park area. Preparatory drainage for the road has already caused severe fires and construction of the road has been halted for the time being.

In the Municipality of Palangka Raya, the delineation process has been postponed as the provincial spatial plan has not yet been completed.

Without clear boundaries, restoration and conservation of the Park area remains problematic. Strong disagreements by local people about the Park will also be a problem and might undermine conservation activities in the area.



Board walk in Mawas area

Figure 20.
Map: Biodiversity conservation: establishment of permanent camps

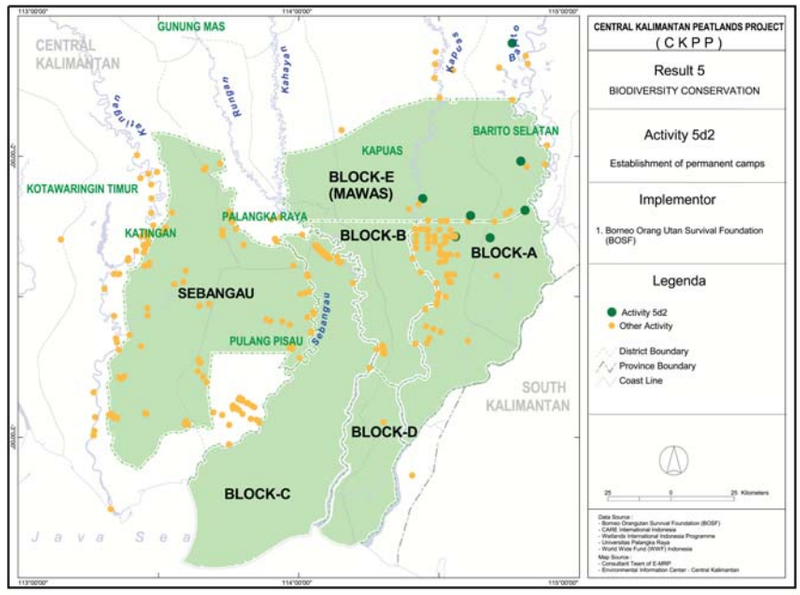
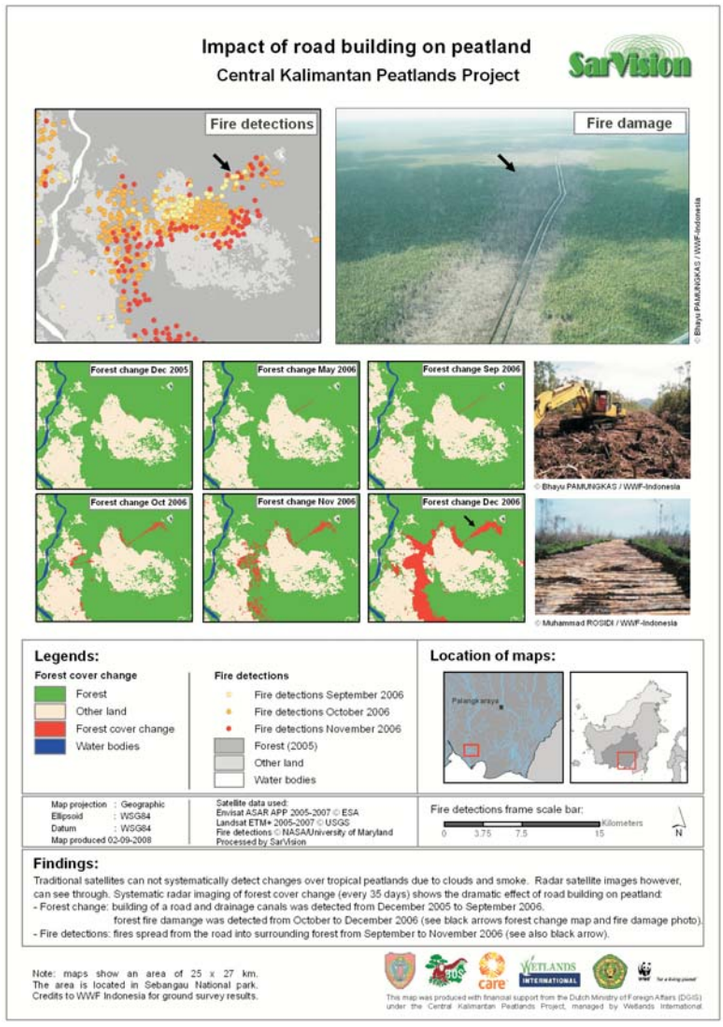


Figure 21.
Map of Impact of road building on peatland



5.6.2. Mawas: working towards conservation status

The status of the remaining forest in Mawas is still unclear. For the Block E (Mawas) area (approximately 377,406 hectares), preparations to establish the conservation area have been based on baseline data, including the spatial plan, master plan of area zoning, classification of vegetation and land closure, critical land data base, a transect of wild Orangutan distribution, data on the depth and distribution of peat, biodiversity data and social economic profiles of the villages within the working area of the Mawas Conservation Program. Based on these data, the proposed master plan of the Block E (Mawas) area includes:

1. Protection zone: an area that must be protected because the peat is deeper than three meters.
2. Research zone: an area for research activities on Orangutan and other animals and their habitats.
3. Utilistion zone (buffer zone): a zone utilised by the communities. The peat depth is less than three metres. Most of the land is the property of the community;
4. Rehabilitation zone: an area damaged by illegal activities and forest fires, which needs rehabilitating. This zone might be located in the research or utilisation zones. Reforestation programmes will be implemented in this zone.

5.6.3. Infrastructure for conservation

In order to support better on-the-ground management of Sebangau National Park, CKPP facilitated the development of infrastructures to facilitate conservation. This included the construction of five National Park resort offices and one guard post. Three of the five resort offices are located along the Katingan River, while the two others are located in Pulang Pisau District and the Municipality of Palangka Raya.

To support efforts to manage the Block E (Mawas) area, BOSF-Mawas established a programme office unit in Palangka Raya, site offices in Kapuas and Barito districts, and five sub-site offices, two of which are in Kapuas (sub-site Mentangai and Timpah) with the other three in Barito (sub-site Dusun Selatan, Dusun Hilir, and Karau Kuala). In addition, two research stations were established: the Orangutan observation station in Tuanan and the peat research station in Begantung. CKPP also funded four weather stations in the region (Mentangai, Timpah, Masimpun and Rantau Upak).

5.6.4. Monitoring and law enforcement

The project supported law enforcement to ban illegal logging. Studies were conducted and patrols supported.

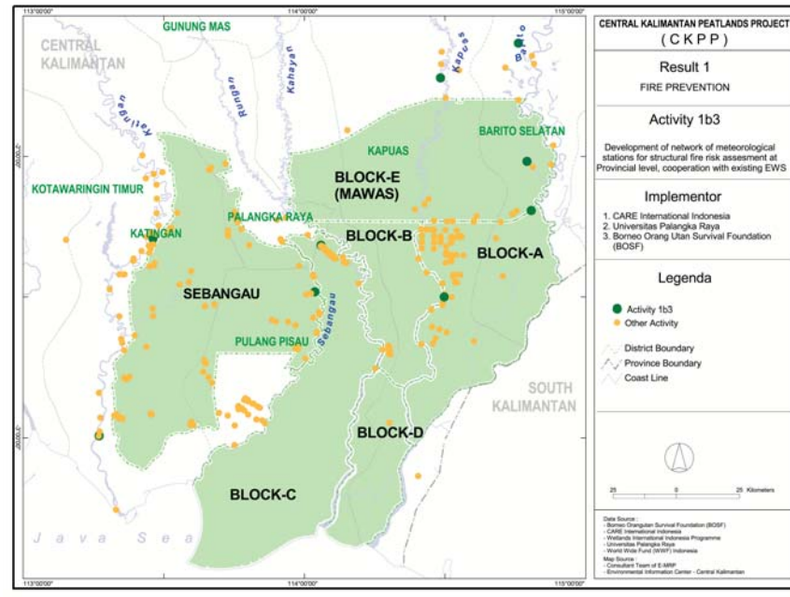
Patrols

In order to reduce illegal logging activities inside the National Park, a series of 34 joint patrols were facilitated, involving National Park authorities, representatives of local communities and NGOs. These regular patrols resulted in reports to, and actions by, the authorities and a subsequent significant decrease of sawmill operations in Katingan District. A clear indication of this has been a significant decrease in log supplies. In 2006 there were 147 sawmills in Katingan Regency, 102 of which were still operating[3]. This number had been reduced to two by the end of 2008.

Data shows that during an anti illegal logging campaign in June 2006 a total of 1,078,360 logs, equal to 134,795

[3] Report made by the Provincial Office of the Ministry of Forestry and WWF - Indonesia

Figure 22.
Map: Fire prevention area



m^3, were confiscated. Most of the logs originated from Sebangau National Park and were being transported through the Bulan River and Tampelas village.

Monitoring

In the Block E area (Mawas), monitoring was conducted by means of air, land, and river patrols. The purpose was to detect both illegal activities and fires within and around the area. During the project, 27 air patrols were carried out using ultra light aircraft; 342 river patrols were carried using small motorised boats; and 393 land patrols were carried out. Monitoring was also conducted every 35 days in order to determine changes in land cover. Cases of significant change (such as deforestation, damage from fire, road construction, etc.) were followed with field checks using ultra light aircraft and navigation cameras.

Illegal logging, raft near Sebangau

Saw mill on the Kahayan river

5.6.5. Community involvement in conservation

Communities that live in and around the forest were approached and invited to become involved in conservation activities such as reforestation, constructing canal blocks and participating in fire monitoring and control. The project also sought to increase environmental awareness through regular environmental campaigns and distributing environmental information through various print and electronic media.

Participatory village mapping

Twenty one of the 44 villages surrounding Sebangau National Park became involved in participatory mapping activities. Participatory mapping is based on the premise that local people's involvement and access to their village land should be recognised by the government and that the local community should have responsibility for their area, working with the government to manage it.

Community-based agro-forestry

The implementation of community-based agro-forestry systems (combining trees with commercial value with crops) was closely linked to regreening programmes, especially in Blocks E and A-north. This was challenging, as local communities were not familiar with agro-forestry systems and because there is a long interval before harvests from the trees are possible. It appeared that local communities were only interested in income generating activities with a short time horizon rather than investing in longer-term sustainable livelihoods. To address this it may be necessary to provide incentives and also to create an understanding of the need to develop long-term sustainable sources of income and for ecosystem rehabilitation.

From historical data on the biophysical degradation of the areas, the project was able to identify the native tree species that were appropriate for each degraded land area. Subsequently a manual was produced on the development and management of strategic buffer zones, through planting indigenous but commercially important tree species under community-management regimes.

Village meeting in WI CKPP office

5.7. Livelihood development

5.7.1. Principles of the livelihood work

CKPP prioritised improving the welfare of communities in the peatlands. This was a crucial element of the project: restoring the peatlands and supporting the people were not parallel goals but were strongly inter-dependent. Poor people often have no alternative other than illegal logging or clearing rainforest areas by slash and burn. Peatland degradation that results in floods, fires and soil subsidence worsens poverty. CKPP prioritised stopping this downward spiral.

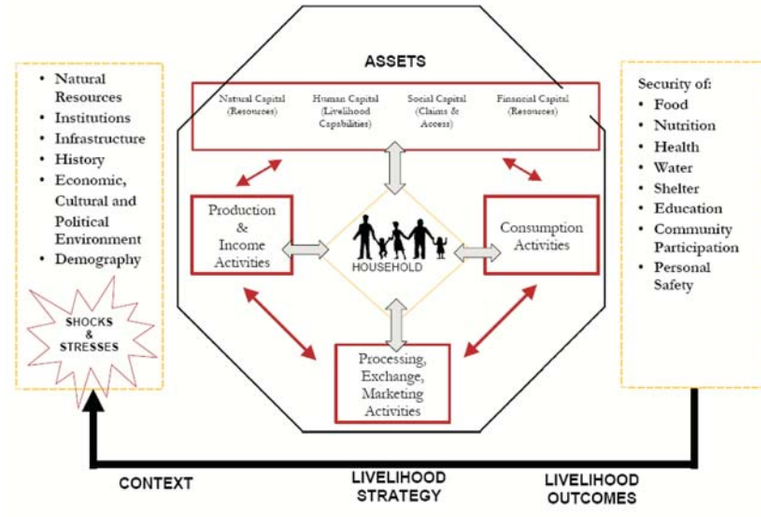
The project's approach used three main principles.

1. Finding the balance between the production and environmental functions in the peatland ecosystem.
2. Involving the community as the planner, actor and beneficiary of peatland conservation and restoration activities. This principle is critical, especially where communities feel disempowered or even apathetic about their future.
3. Supporting the appropriate approach for improving livelihoods that are sustainable. Local conditions showed that agriculture and fisheries were the most promising sectors.

5.7.2. Setting a baseline

CKPP started by carrying out participatory rural appraisals. These appraisals aimed to determine the current status of resources belonging to the communities, those that needed to be developed to obtain a sustainable production level and to avoid the emergence of unwanted pressures. With this, the consortium initiated a set of collective planning processes prior to programme implementation, which were adjusted to meet the needs of the communities, according to the status of resources that the communities had at their disposal.

CARE's livelihood security model Sitiran: After Swift, 1989, Drinkwater, 1994, Carney, 1998, Frankenberger and Drinkwater, 1999



Empowering community to plan the village's future

Women are encouraged to play equal role with men in village planning

5.7.3. Development of a plan for villages, by villagers

A thorough planning process was conducted with the communities themselves to come to decisions about how to provide the most effective and sustainable support. This increased commitment and ownership.

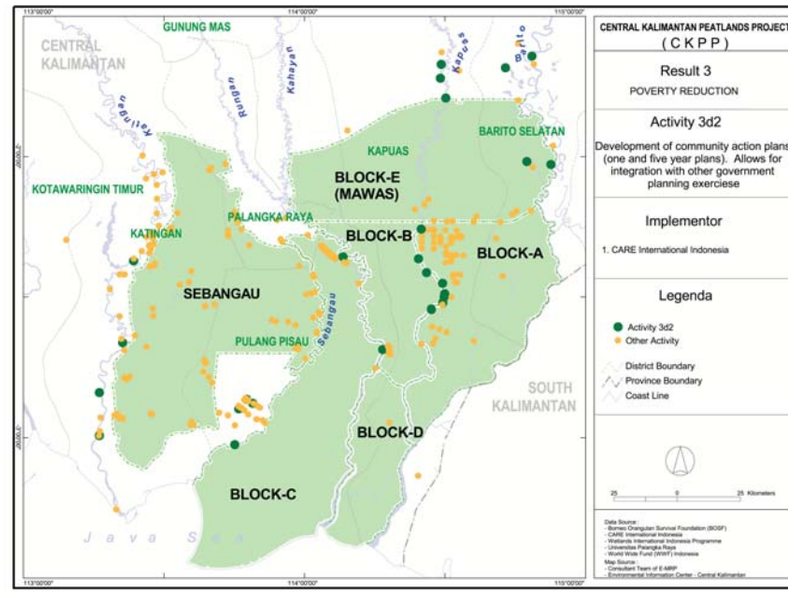
As a first step, CKPP facilitated communities in developing a community vision and mission. These were identified by using projection scenarios, based on the information about the current status of community resources.

To reach the vision and mission, the community developed village development programmes. They used land use maps, which included potential disasters - such as flood, food scarcity, and forest and land fires - to examine the measures and identify and find ways of avoiding the problems.

The results were documented within five-year Village Medium Term Development Plans (*Rencana Pembangunan Jangka Menengah Desa or RPJMDesa*). Each step included details, such as funding resources, the timeframe for implementation, those responsible, and necessary supporting activities. While developing these comprehensive development plans, communities identified stakeholders who could help them reach their vision and mission, including CKPP.

The completion of Village Medium Term Development Plans is the first step in communities becoming actively involved in planning their own futures.

Figure 23.
Map: Development of community action plans area



The process allows them to realise that they are the ones who must determine their destiny, not CKPP or other outside agencies. Before CKPP finished, all the target communities had developed their own Village Medium Term Development Plans, complete with land use maps.

5.7.4. Strengthening community groups

CKPP's interventions included in the Village Medium Term Development Plan were implemented by community groups. CKPP prioritised strengthening existing local groups.

Groups encouraged participation from their members, for example in discussing the problems they face as well as their solutions. Through such processes, the groups built strength, solidarity and support amongst their members. This started to reverse the dominant perception of many members that they are weak, hopeless, lacking in intelligence and backward.

By its completion, CKPP had strengthened the institutional capacity of 125 farmer groups (5,159 households consisting of 620 female household heads and 4,539 male household heads), 25 fire control teams, and 32 groups of health cadres, spread across the 25 villages.

5.7.5. Promoting sustainable agriculture

One major activity of CKPP was awareness raising in order to increase

the adoption of sustainable agriculture systems such as agroforestry.

Farmers need to adapt their practices to take account of (and improve) the degraded natural environment. Improving the quality of the environment is a key to increasing agricultural production. In recognition of this, stakeholders' workshops were held to identify appropriate and sustainable agricultural technologies and practices. The workshops organised by CKPP, farmers, NGOs, government officials, state-research institutions and academics discussed agricultural practices which have a minimal negative impact, and/or a positive impact on the environment, focusing on the sub-sectors of food crops, plantations, livestock and fisheries. The outcome of these workshops was a set of standards (PEAT-GAP) identifying good agricultural practices for peatlands within each every agricultural sub-sector.

At first communities thought that sustainable agriculture would only inhibit production, but by the end of the project this perception had changed. Some 3,540 households (828 female household heads and 2,712 male household heads) in 25 villages have adopted PEAT-GAP technology and sustainable agriculture practices that are adapted to local conditions and specified standards. In addition, farmers were encouraged to try sustainable practices and let others imitate what they have done successfully. The number of farmers who adopted PEAT-GAP is predicted to increase since CKPP used a Participatory Technology Development (PTD) approach. Through PTD, farmers are encouraged to formulate their own solutions and share these. Once they try the approach, they become more aware that sustainable agriculture is only possible if they also maintain the quality of the environment.

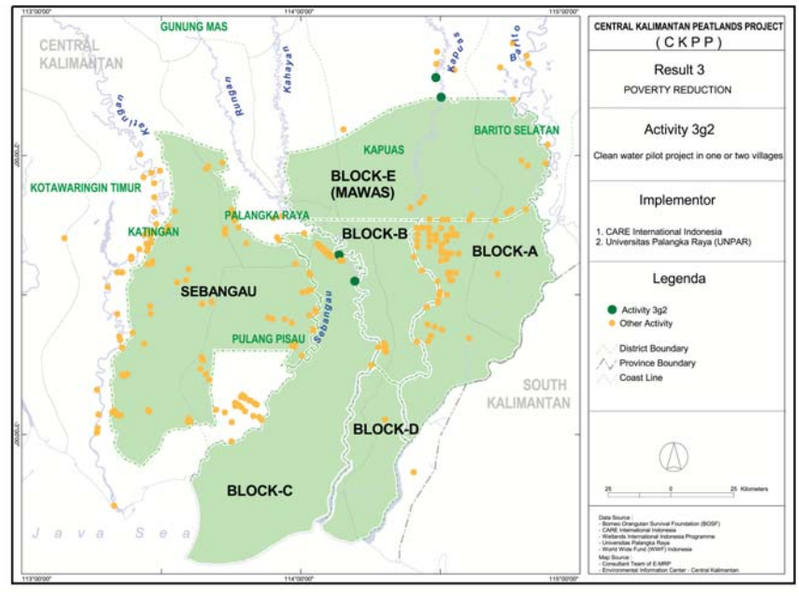
The project also sought to improve access to markets, with farmers' groups playing an active role in this activity. CKPP prioritised local production for local consumption, a model intended to create more equal profit sharing along the marketing chain in villages and sub-districts. The profit obtained by farmers is optimised as there are no transportation costs, which are typically borne by farmers when they sell their products to intermediaries. A lower selling price enables the poorer members of the community, with limited buying power, to reduce their expenses.

CKPP facilitated the establishment of 11 partnerships and opened access to markets for 1,094 farming households, covering 36.5% of the target population (48 females and 1,046 males). Farmers were encouraged to grow crops that are usually widely sold in the local markets yet supplied from other areas. By maintaining quality, quantity and regular supplies, farmers were able to become the main supplier of these commodities to local markets.

To increase bargaining power and

UnPar trial of alternative reduced impact agriculture

Figure 24.
Map: clean water pilot project



minimise the risk and selling costs, farmers worked together in groups. The groups were able to overcome some major obstacles, such as limited access to extension programmes and their dependency on intermediaries.

The Bio-rights mechanism is a model that allows direct integration of conservation and development. Bio-rights approaches in the project's target area depart from the assumption that poverty is the cause that triggers damage to peatlands. When the environment is damaged, its ability to support the production function decreases, which triggers a decline in incomes. Bio-rights seeks to build a establish a direct solution that links the causes of poverty and environment conservation.
Bio-rights interventions were implemented through a public awareness phase and subsequent selection of interested groups. Groups were selected on the basis of their proposals, which were assessed for their conservation value, the contribution to the Village's Medium Term Development Plan, their contribution to community self-reliance their economc feasibility. The selected groups received technical guidance, including training and other inputs according to the agreement. By the completion of CKPP there were nine village-based Bio-rights schemes involving 1,272 household (36 female household heads and 1,236 male household heads).

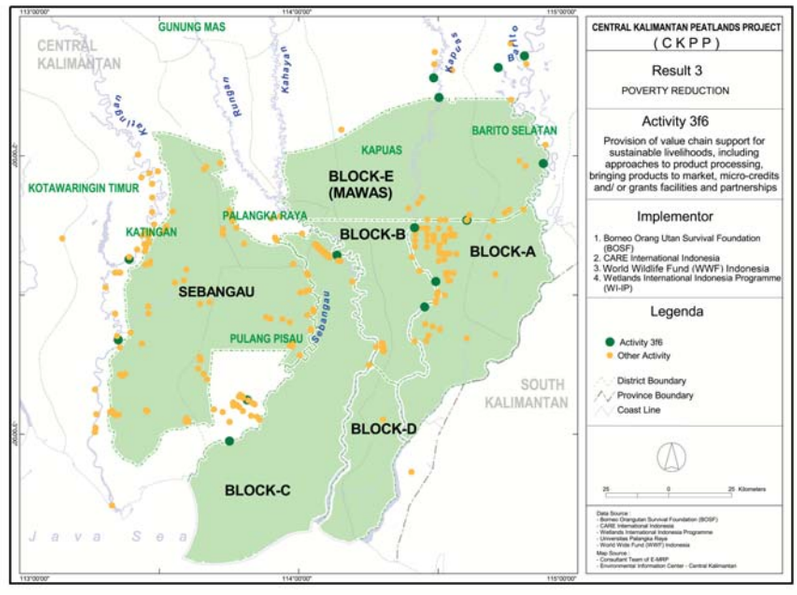
A fourth area of activity was improving the nutritional status of children under five and high-risk pregnant and breast-feeding women. When a community experiences shock due to, for example, the increased frequency of forest and land fires, smog, flooding, extreme drought, and food shortages, health issues become crucial. When there are food shortages, infants/toddlers and pregnant and breast-feeding women are the most vulnerable to nutritional scarcity.

CARE data for the period of July-December 2006 shows the low food security of the poor communities of Katingan Block (23%), Sebangau Block (35%), Tumbang Nusa-Gohong Block (10%), Timpah Block (20%), Mantangai Block (13%), and Barito Selatan Block (13%).

CKPP revitalised 39 integrated health service posts (POSYANDU) and trained 181 cadres from 25 villages within CKPP's working area. POSYANDUs are a community-based resource health effort, managed and held by, for, and together with, the community. These are the most appropriate local institution for managing nutrition and disease prevention.
In the space of a relatively short term programme CKPP was able to increase the nutritional status of 60% of high-risk pregnant and breast-feeding woman in ten villages, and 30% of the malnourished children under five in 17 villages. The nutritional status of pregnant and breast-feeding women was improved through *Sarana Belajar Ibu* (Learning Facility for Mothers) or COME (Centres for Mother's Education). Children under five were cared for through *Pos Gizi* (Nutrition Posts) or NERS (Nutrition and Education Rehabilitation Sessions). The activities were conducted by health cadres under the supervision of medical technicians (midwives and doctors) from local community health centres (PUSKESMAS). In a few villages water purification facilities were established.

A fifth activity was a response to the policy of the Central Kalimantan Provincial Government to 'Stop Smoke, Stop Fire, and Stop Disasters' (*Stop*

Figure 25.
Map: Provision of value chain support for sustainable livelihoods



Asap, Stop Kebakaran dan Stop Bencana), introduced in 2007. The community of Mantangai Tengah tested zero-burning peat agriculture on 25 hectares of land. These 'green' farmer groups worked with CKPP and the Agriculture Service of Kapuas District. CKPP provided tools, fruit seedlings, horticulture support and infrastructure for rice production, and the Agriculture Service of Kapuas District provided a compost cutter, Ciherang rice seedlings, training and an extension course.

The initiative took place between September 2007 and March 2008. Over that period 16 hectares of land provided 36 tons of unhusked rice (*gabah*), approximately 2.25 tons/hectare of land. A satisfying result was also obtained from demonstration plot activities testing vegetable and fruit planting, where the production levels obtained by the farmers was fairly good.

5.7.6. Conclusions and lessons

- At the start of the project, people saw sustainable agriculture (no burning of peat and agroforestry) as a threat to their incomes. This perception was reversed during the project.
- Working through community groups and supporting villages to create their own plans helped to empower people and gave them confidence and a feeling of ownership.
- Harvests from sustainable agriculture, without burning peat, appeared promising.
- Community based and community owned health programmes were successfully implemented.

Figure 26.
Map: Health and nutrition program area

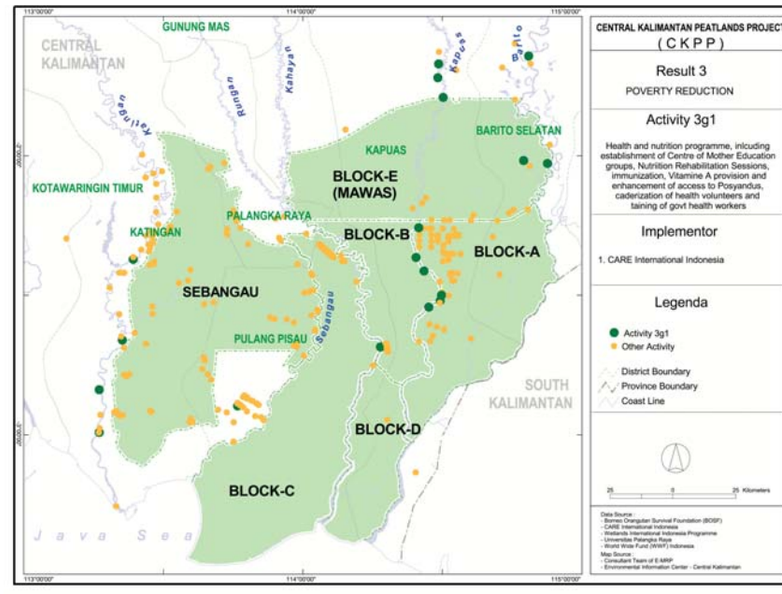
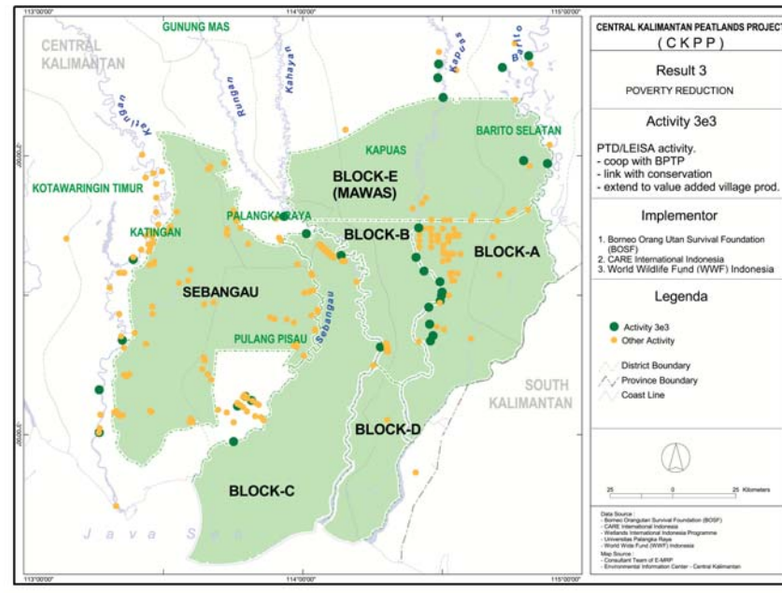


Figure 27.
Map: PTD/LEISA activity area



5.8. Involving communities, explaining the project

5.8.1. Awareness about reversing peatland loss: a real challenge

The communities that live in, benefit from, but also unintentionally degrade peatlands played a crucial role in the success of the project. They needed to accept the blockage of canals that they used to as transport routes. They also had to agree to raising water tables in peatland areas in order to prevent irreversible loss of the area. This was an enormous challenge: the story behind peatland loss and the potential long-term impacts is complex. The links between fires and floods and drainage canals was totally unclear to many. Daily needs and old habits are difficult to abandon for new and unknown agricultural practices. Through its comprehensive programme, CKPP conducted a wide range of awareness-raising and education sessions and activities targeting the communities living in the Sebangau area and the northern areas of the EMRP (Block E, Block A/B).

5.8.2. Dissemination of outreach materials

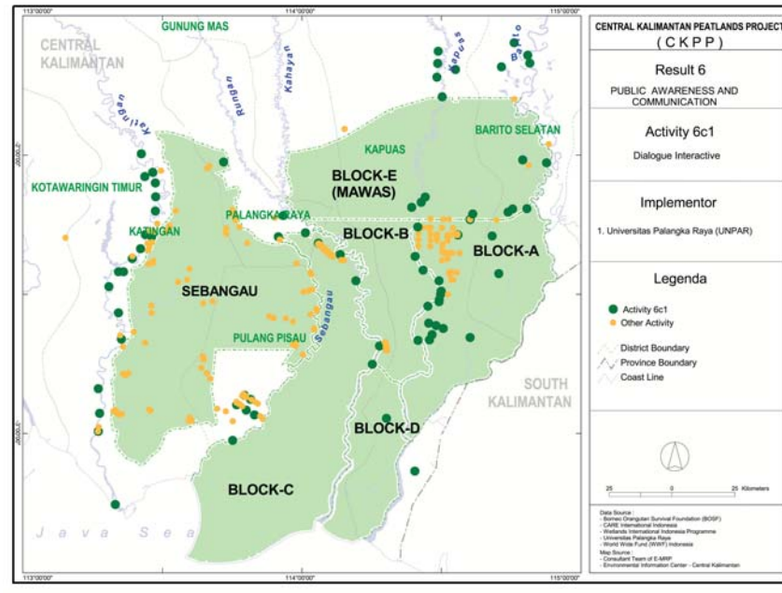
Leaflets for local people

Outreach materials designed specifically for local people were made in Bahasa Indonesia. The materials clearly explained the problems that the project intended to solve and how this would benefit local people. The materials were made with input from all the consortium partners and disseminated in the villages of the Sebangau area and the northern areas of the EMRP (Block E, Block A and B).

Leaflets for local authorities

For people working at the district level, the message had to be different. Their level of knowledge, as well as the challenges they faced, differed from those of local people. A leaflet was produced for this specific target group, introducing the project and explaining the activities, many of which needed proper explanation.

Figure 28.
Map: Public Awareness



Forbidden to use fire during dry season-banner from the Government

5.8.3. CKPP radio

In addition to the local outreach by leaflets, a community radio station, CKPP Radio (95.1 FM). was established to broadcast news about the project and peatland and environmental issues in general. The station was officially launched by the Rector of UNPAR on 28 June 2008 and continued beyond the completion of CKPP.

Using the tag line, 'Environmental radio for all (*Radio Lingkungan untuk semua*)' four volunteer broadcasters reach out to listeners within a radius of 50km from 7am to 11pm. In addition to playing music targeting young people, the station presents information on environmental issues, with a particular focus on peatlands. These pieces alternate with messages delivered by community leaders, environmental experts and

A volunteer broadcasters reach out to listeners to care more about the environment

government officials, such as the Governor of Central Kalimantan Province and the Rector of UNPAR. It also broadcast interviews with relevant experts followed by interactive question and answers sessions.

The existence of Radio CKPP 95.1 FM was warmly received by listeners, as shown by the response to its interactive sessions.

5.9. Putting the loss of tropical peatlands on the global agenda

5.9.1. Global attention for peatland restoration

CKPP's visbility considerably increased as a result of the publication of a document, '*Peat CO_2,: Assessment of CO_2 emission from drained peatlands in SE Asia*', launched during the 12th UNFCCC CoP in Nairobi, Kenya, in 2006. This document, based on research commissioned by CKPP, made the link between the loss of peatlands and climate change explicit for the first time. It went some way to quantifying the significance of tropical peatland destruction to global climate change. This in turn considerably increased attention paid to the project's activities. The document was published by Delft Hydraulics, in cooperation with Wetlands International and Alterra.

5.9.2. Outreach to global media

Despite causing some controversy and the reluctance of some parties to accept the findings of the report, it awakened the world to the importance of peatland preservation in controlling global climatic change. The *Peat CO_2* report also highlighted the global relevance of the project's work. This was reflected in the immense mass media coverage it received globally. As a result, the project received much international media attention, with visits from Al Jazeera, CNN and several national TV stations. Many other media have written about the issue of peatland loss and climate change, and the efforts to stop this disaster.

This wave of media attention put peatland destruction high on the agenda, with increased attention from governments, the private sector and donors and much interest in providing resources for activities aimed at restoring drained peatlands and maintaining relatively healthy peatlands.

Launched on 28 June 2008, the CKPP Radio will continue beyond the completion of CKPP

5.9.3. Working on global peat and climate policies

The significance of peatland loss in Southeast Asia to the global problem of climate change implies the need for a a global response. At present peatland emissions are not included within global climate policies meaning that there are few funds available to tackle this problem, which is frustrating efforts to continue and expand projects such as CKPP. While climate change is not the only problem caused by peatland loss, it does provide a large incentive for governments and donors to address this problem. As such, the CKPP has advocated inclusion of peatland emissions in the REDD schemes that are under development and has advocated inclusion of peatland emissions in national accounting for the UN-FCCC.

UN Climate Change Convention

The UNFCCC meetings were the focus of the project's global advocacy work. Teams from the project attended COP 12 in Nairobi (December 2006), the technical SBSTA meeting in June 2007 (Bonn), COP 13 in Bali (December 2007) and the Climate talks AWG meeting in Accra, Ghana (August 2008) and invested in meeting delegations before COP 14 in Poznan (December 2008). In Nairobi, Bonn and Bali, CPKK organised side events and press events to specifically show the potential for ending peatland loss in Southeast Asia.

Changing global climate policies takes some time, although small changes in the details of texts can have a huge impact. Thanks to the advocacy efforts, delegations in Bali decided to improve the text on REDD. As a result, soil degradation was included in the draft decision that was initially only related to forests. This decision and the Bali Roadmap (agenda for a new climate treaty) were subsequently approved in Bali, paving the way to include peatland restoration in activities that can be supported under REDD. While this is a very promising development, attention still needs to be focused on ensuring that peatlands are explicitly mentioned in the next new climate treaty (scheduled for 2009).

The Convention on Biological Diversity

A small CKPP team also attended COP 8 of the Convention on Biological Diversity in Bonn (May, 2008). Thanks to a side event on the work of the project, and to ongoing advocacy, a resolution on biodiversity and climate change was approved, which recognised the global relevance of peatlands for biodiversity and stressed the need to address this problem.

Ramsar Convention on Wetlands

CPKK also arranged a side event about peatland degradation at the Ramsar Convention on Wetlands, COP 10 in Korea in November 2008. A draft

resolution on wetlands and climate change, which explicitly highlighted the problem of peatland loss, was prepared. The outcomes of this convention were unclear at the time of writing.

5.10. Working with the Indonesian authorities

Support from national, provincial and district level authorities in Indonesia was crucial for the success of the project, as it is for protecting and restoring peatland areas facing similar problems. During the project, cooperation with local, provincial authorities was very good.

Provincial and local levels

The Provincial authorities, and especially the Governor, were very supportive partners of the project, particularly since the project was a way of implementing the Governor's Green Government Policy. At the district levels, most cooperation occurred during the implementation phase, particularly during the hydrology restoration works, the establishment of the fire brigades, the development of five-year village development plans, the improvement of public health facilities and the protection of the Sebangau National Park. Good communication with partners at the district and local levels were built through joint meetings and distributing awareness and information materials.

National level

Although most of the activities focused on field work at the provincial and local level, efforts were also made at the national level. The project raised awareness about peatland loss and its impact on global warming, the loss of potentially valuable lands and resources, and increased problems with floods and fires.

The CKPP showed how these problems could be reduced by improving policies for peatland management. In order to raise support for conservation, restoration and better planning of activities in peatland areas, information on peatland degradation and climate change and the CKPP approach towards peatland restoration was been presented, discussed and recommended at several meetings, including the preparatory meeting for

Marcel Silvius of WI gives an interview at the UNFCCC conference in Bali, 2007

WI Japan at the Ramsar Conference

Indonesian delegates to the COPs of the CBD, Ramsar and UNFCCC. In addition, communication also took place during national meetings on forestry and REDD.

This increased awareness may have contributed to the development of Presidential Instruction (Inpres) No. 2/2007, which followed Presidential Decree (Kepres) No. 80/1999 on the General Guidance for the Planning and Management of Peatlands Development area in Central Kalimantan. This 'Inpres', instructed relevant Ministers to take any necessary steps to speed up the rehabilitation and revitalisation of peatlands development areas in Central Kalimantan, including provision of funding from national and local budgets and other sources.

5.11. Science base: monitoring the impact of the project

Restoring the hydrology and vegetation cover of tropical peatlands is a very new activity. One major task of the project was to investigate, improve and document the methods.

5.11.1. Hydrological surveys and monitoring

For peatland conservation and rehabilitation to be successful, it is

Figure 30.

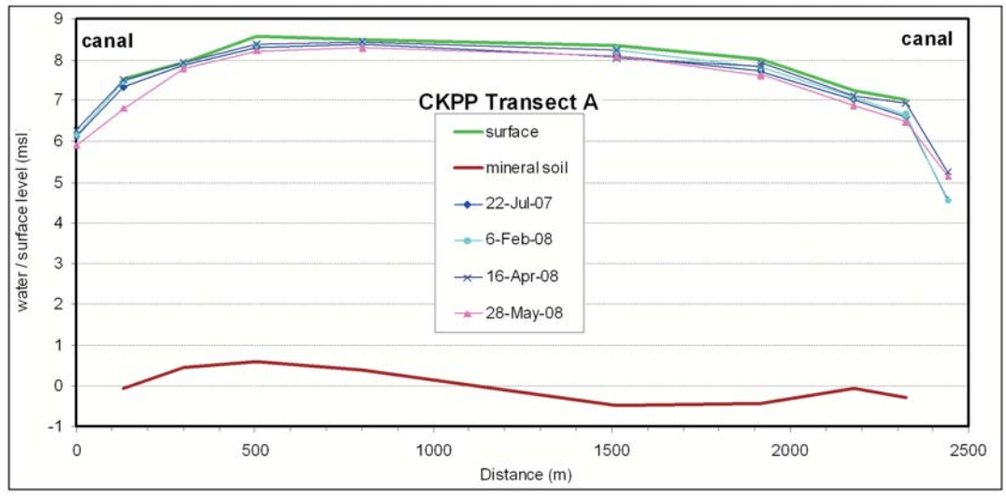
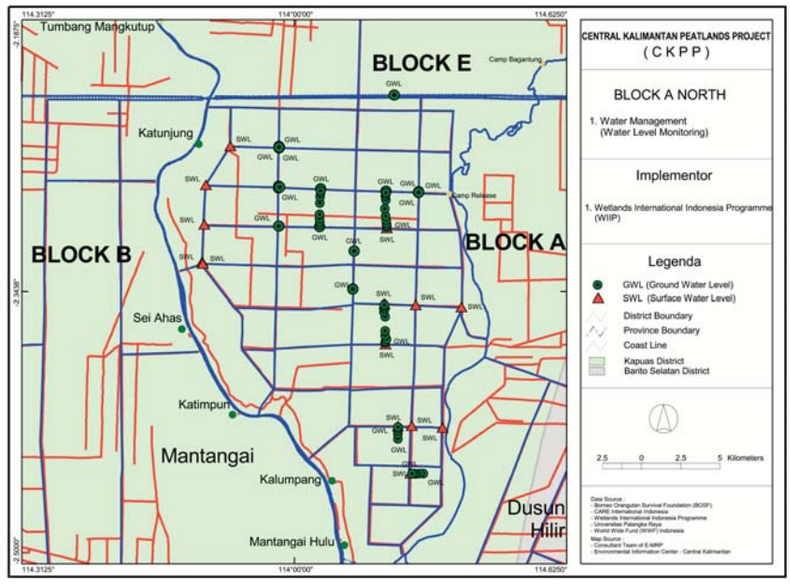


Figure 29.
Map: Water management in Block A North Area



necessary to understand the hydrological functioning of the peatlands and the impacts that drainage has had, as well as the expected impacts from interventions such as blocking canals. To this end, hydrological survey and monitoring activities were an important part of the CKPP project.

The Peat Soil and Drainage Mapping activity, undertaken with Deltares and Delft Hydraulics, carried out over 1,300 km of land-based surveys, improving the mapping of surface elevation, peat depth and land cover, canal dimensions, water depth and flow directions. The survey lines, as well as the resulting peat depth map, are shown in Figure 30. In addition, elevation and water depth were measured along some 40 cross-sections (26 in peatland) perpendicular to canals, to help quantify peat subsidence rates in relation to water depth (see Figure 30). All the results of the CKPP mapping project are available in the public domain, to help improve the available knowledge base that can contribute to rehabilitation and research projects in the EMRP area.

The results of the CKPP mapping project were later used in the EMRP Master Plan project to analyse and model the hydrological functioning of the EMRP peatlands, to assess the impacts of past and present drainage and those of present and future rehabilitation interventions. During the Master Plan project, CKPP staff carried out additional surveys and refined the water depth monitoring system implemented by CKPP in the North-western part of Block A (figure 30).

The figure above shows detailed elevation, peat depth, and selected groundwater depths from June 2007 to May 2008 (all in a relatively wet period, hence there are no very low water levels). Note how closely the water table follows the topography, indicating that water depth is mostly controlled by local rainfall, evapotranspiration and surface runoff, rather than by groundwater flow. This demonstrates the low hydraulic conductivity of the highly humified peat that is found in much of the area. This feature has the benefit that water depths are not as low as they would be in less humified peat. The disadvantage, however, is that a 'mini dome topography' has developed in just 10 years of drainage. All the peat above the water levels has already gone, indicating a huge subsidence of the peatsoil near canals.

This situation may complicate canal blocking: little is left of the drained, dry peatsoil. Canal blocks are needed for long-term stabilisation of peatland hydrology and to prevent further subsidence, but do not necessarily result in rapid peatland rewetting in the short term.

5.11.2. Using remote sensing as a tool

Measuring the elevation and topography of the area is crucial to assess the impacts of rewetting on preventing subsidence and to identify crucial locations for dams.

Laser Altimetry

A high-resolution Airborne Laser Scanner (ALS) mounted on a helicopter was used to measure the topography of the peatlands of Block E and A north and to generate a three-dimensional Digital Elevation Model (DEM). The flight altitude was approximately 500m above ground and recordings were made using between 66,000 and 100,000 laser pulses per second. These DEMs were used to obtain a Digital Surface Model (DSM) showing trees, bridges and houses and also a filtered-classified Digital Terrain Model (DTM) showing the topography of landscape without trees, bridges, houses, etc.

This ALS information was processed and analysed to obtain the topography of the peatlands with an elevation resolution of +/-15cm and x-, y- of 0.5m in the area. The ground elevation was referenced to the Palangka Raya airport at 82ft or approximately 25.0m.

The results of the laser scanning were presented in summary in section 3.1.5 of this document. As noted, this was the first time this technique has been used to accurately map the relative height differences in this peatland landscape, allowing analysis of the exact dome shape and slopes.

Radar

Tropical peatlands are notorious for persistent cloud cover and smoke from fires, which inhibits the use of traditional satellite sensors. Satellite radar sensors such as the European Space Agency's Envisat and ERS satellites and the Japanese JERS and ALOS satellites are able to produce reliable high-quality images of these areas because they are able to peer through the clouds, haze and smoke. SarVision and Wageningen University have developed specific expertise over the past decade on using new radar methods for tropical forest monitoring.

1. Monitoring forest cover change

To monitor forest cover change over large areas in a feasible way, a system using traditional satellite imagery (i.e. Landsat ETM+, ASTER) and ASAR APP radar imagery from the European Space Agency's Envisat satellite has been developed and implemented. SarVision's methodology uses a thoroughly tested computer programme to analyse changes in both the strength of the radar return signal and the orientation of radar wave within a small timeframe (every 35 days, which is the revisiting cycle of the satellite) and a large timeframe (one year). This is necessary to improve the accuracy of the changes and prevent any undue alarm from false readings.

More than 90 Envisat ASAR APP radar images of the CKPP area were collected between 2005 and 2007 and were systematically analysed to detect changes. Whenever available, Landsat ETM+ data was integrated. This data has been used to build a consistent series of maps showing changes in the forest cover (due to deforestation, fire damage, road building etc.) and other land and water characteristics.

This remote sensing work can make ground surveys and enforcement work in poorly accessible peatland areas much more efficient by directing teams to the areas of change. The results have also provided a critical input for REDD project development in the Block E (Mawas) area. Interaction and feedback from the ground teams, as well as follow-up action, is crucial to effective forest monitoring. During the CKPP project, innovative use of Google Earth was made to easily visualise and respond to the detected changes.

2. Monitoring peatland hydrology

To monitor hydrological changes in tropical peatland areas (e.g dehydration of swamp forest due to drainage, rewetting after canal blocking) over large areas in a feasible way, CKPP commissioned SarVision to develop an observation system using PALSAR radar imagery from the Japanese Space Agency's ALOS satellite. The use of radar satellite imagery is important as drainage impacts has strong spatial variations, depending on the distance from canals, peat depth and other factors. The Japanese JERS (1992-1998) and PALSAR (since 2006) radar is sensitive to soil moisture fluctuations, even under a forest canopy. No other satellites are capable of measuring this.

A methodology is under development to normalise the radar images which will enable analysis in a semi-automated fashion in accordance with local ground measurements. Wageningen University, SarVision and BOSF, are collaborating to set up a 23km long research bridge in undisturbed peatswamp forest for this purpose (this activity was not funded by CKPP). The surface parameters have been surveyed and automated instruments have been measuring rainfall and water level at hourly intervals since 2003. Comparable ground data is available from drained and disturbed peatland areas.

Preliminary research analysing over 40 JERS and PALSAR images demonstrates that the impact of canal blocking can be systematically measured over large areas. Quantitative comparison over time between excessively drained areas and intact and regenerating forests inside Block E (Mawas) shows that the radar signal for intact forest remains stable, while the signal for drained areas remains consistently lower. However, the radar signal for areas near canal blocking locations has increased significantly over time, indicating a rewetting of the area.

It is strongly recommended that a consistent, systematic satellite-ground monitoring program be fully implemented to keep track of the success of the rewetting and restoration activities over time.

5.12. Improving access to data about tropical peatlands

Information centre

One of the programmes of the CKPP was the establishment of an Information Centre for Tropical Peatland (ICTP) at UNPAR. The ICTP is managed collaboratively by the UNPAR Library. The establishment of

the ICTP at UNPAR supported the University's mission, which includes the development of science and technology on peatland and water catchments management.

The ICTP is mandated to compile, collect and manage every document related to peatlands research and management activities in Central Kalimantan, and to make these available through the Internet. In this way UNPAR can play a key role for individuals and institutions concerned with peatlands conservation and rehabilitation. UNPAR is also developing collaborative research with other institutions on the conservation, rehabilitation and wise use of peatlands.

The presence of the Information Centre at UNPAR is also important to the government of Central Kalimantan, since it will provide valuable scientific information from research activities and practical information on peatlands management, which is needed as the basis of development planning in the province. It is expected that UNPAR will continue to develop the Centre in the future.

5.13. Developing finance mechanisms: carbon and biodiversity values

Global carbon markets

The new awareness of the contribution that the degradation of forest carbon stocks makes to climate change has resulted in a strong international political commitment to addressing this issue, as laid down in the Bali Roadmap (which sets the agenda for a new UN climate treaty). This includes the possibility of payments for REDD. The post 2012 climate treaty is expected to provide opportunities for all countries to acquire carbon credits by reducing their emissions from forest degradation, which includes peatswamp forests and their soil carbon stocks.

Community involvement in managing carbon stocks

Carbon payments should take local social conditions into account; payments made solely for managing the physical situation are not a sustainable solution. CKPP's experience is that the key to peatswamp forest protection and peatland rehabilitation lies primarily with the local communities. Without appropriate community involvement and ownership over planning, well-intended projects may increase conflicts and the chance of failure. Without community involvement, there would be no chance of blocking canals and raising watertables without conflicts. Involving local communities in the emerging carbon market would also provide a substantial opportunity for poverty reduction and will increase the success of projects.

The Bio-rights approach (www.biorights.org) is an interesting method for involving local people. Bio-rights involves establishing business contracts that provide micro-credit for sustainable development in exchange for the conservation or rehabilitation of globally important biodiversity or environmental values. The business partners are 'the global community' (represented by a broker, e.g. a NGO or bank) and a local partner, e.g. a local community or a major community-based stakeholder group. The local (community) business partner pays interest on the micro-credit not in the form of money, but in terms of biodiversity conservation services, such as protecting and managing carbon stocks.

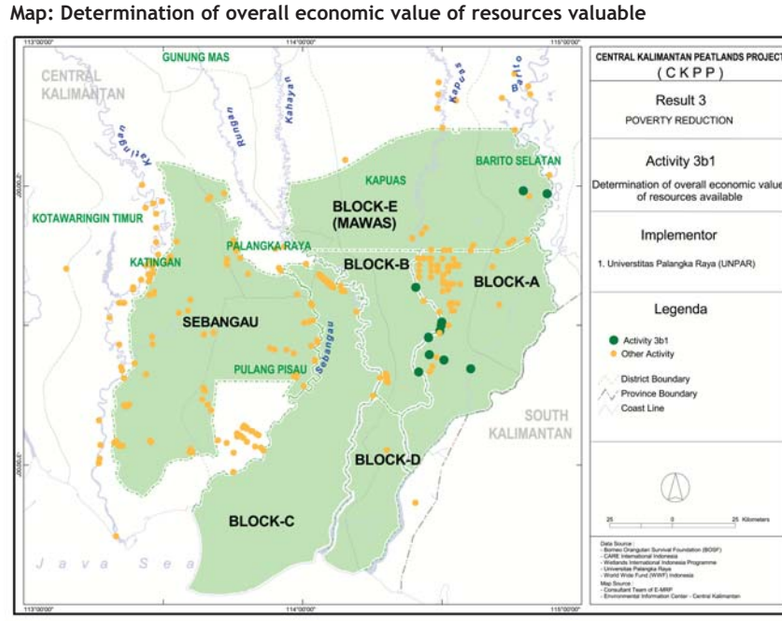
The Bio-rights approach removes the incentive for unsustainable development. The public, global, value of key biodiversity and wetland/peatland areas is transferred to local stakeholders as a direct economic benefit.

Bio-rights schemes are operational in the buffer zones of the Berbak National Park in Jambi, Sumatra, and are also used in many other community-based wetland restoration projects in Indonesia, such as the tsunami hit region of Aceh (involving sustainable coastal development and mangrove reforestation) and the Pemalang region in Java. The CKPP has done some capacity building as groundwork for using this approach in Central Kalimantan.

5.13.1. Voluntarily carbon market: The Global Peatland Fund

It is uncertain whether REDD schemes being developed under the UN Climate Treaty will include peat carbon stocks. Since we cannot wait to scale up restoration of degraded peatlands, CKPP has invested in the development of a Global Peatland Fund to attract private sector financing for peatland conservation and restoration, with the aim of channelling carbon funding via grants, payments and microcredit mechanisms to local stakeholder groups (government and communities). In this way, the fund aims to stimulate sustainable development that will conserve and restore endangered or degraded peatlands.

Figure 31.
Map: Determination of overall economic value of resources valuable



To generate a sustainable finance flow, it is essential that this be based on an accredited methodology for baseline development, monitoring and measuring. The resulting Verified Emissions Reductions (VERs) can then be put up for sale on the international voluntary carbon market, and the revenues used to support a local funding mechanism.

The potential carbon value of the Ex-Mega Rice Project area

With 1 million ha of heavily degraded peatlands, and assuming a moderate annual emission of 70 tonnes CO_2/ha and the potential to reduce this by 80% against a price of 5 Euro per ton, the potential revenue from successful peatland restoration in Central Kalimantan could theoretically reach over 300 million Euro per year.

Carbon financing requires long-term commitments from all stakeholders, embedded in policy and legislation. Buyers need sufficient guarantees that their investments in carbon storage are safe. Commitments need to be binding over periods that exceed the lifetimes of elected authorities. Such long-term commitments are also needed for carbon projects that are based on business deals with local communities. For instance, investment in reforesting community-owned buffer zones adjacent to protected areas requires contracts that are also binding on future generations. This poses considerable new policy and legislative challenges, as it is unpredictable what incentives or disincentives may arise in the future that may change the priorities of local stakeholders.

5.14. Economic valuation

Natural peatland habitats tended to be poor areas with low population densities. They can provide many environmental services which, when properly valued may exceed those obtained from habitat conversion. Habitat conversion almost inevitably leads to degradation of an area with a water table that is too high to support agriculture or other economic activities. Carbon and biodiversity values are also eroded.

The actual and potential values of peatlands in Central Kalimantan include:

- Revenues from sustainable forestry and plantations of native peat forest species (without drainage), from fisheries and the aquarium industry and tourism;
- Hydrological functions: a steady supply of freshwater for agriculture and other uses, as well as prevention of economic damage from floods and droughts and prevention of highly acidic run-off;
- Carbon storage functions: emerging new markets for reduced carbon emissions and carbon sequestration
- The economic costs associated with damage to ecosystem services can be substantial: for example, the damage that the 1997 Borneo fires caused to public health, timber, tourism, transport, agriculture, and other benefits derived from or linked to the forests is estimated at US$4.5 billion, in addition to the actual cost of fighting the fires

The CKPP invested in an economic valuation study of peatland areas in Central Kalimantan, carried out by the University of Palangka Raya in conjunction with experts of the Institute of Environmental Studies, Amsterdam in a study entitled: *The economic value of peatland resources within the Central Kalimantan Peatland Project in Indonesia*.

5.15. Donor Coordination for financing the project

As a result of CKPP's success and its international outreach and presence at international conventions; many countries, conservation foundations and private sector agencies have become interested in investing in peatland conservation and rehabilitation. Some may be motivated by the potential shown by CKPP's pilot projects to reduce carbon emissions through community-based peatland conservation and restoration. As such, CKPP might have become Indonesia's first REDD project had REDD existed when the project commenced.

Other donors may be more motivated by the biodiversity conservation potential of areas such as the Sebangau National Park and other relatively intact peatswamp forests (e.g. Block E), while others may be more interested in addressing poverty related issues in Central Kalimantan's peatlands. Overall the CKPP has shown that investment in the wise use and conservation of peatlands provides win-win-win-win options, as peatlands have multiple values in terms of biodiversity conservation, carbon storage and sequestration, water management and livelihoods development, and if we address one we can create benefits for all in a 'A win4all' scenario.

The interest and collaboration of the wider donor community needs to be coordinated to maximise the complementarity of investments and direct efforts to where they are needed most. To this end, CKPP facilitated high-level talks between the Governor of Central Kalimantan and the Minister of Development Cooperation in the Netherlands to promote international cooperation for the development of a Master Plan for the rehabilitation of the peatlands of Central Kalimantan. This started in 2007 and resulted in the Master Plan for the Conservation and Development of the EMRP area in Central Kalimantan, which provides guidance to local, provincial, national and international stakeholders, including the donor community. CKPP has also argued for development of a multi-donor trust fund, to ensure cohesion in planning, sustained financial support and to enhance donor coordination. Efforts were started to create a project secretariat under the umbrella of the provincial government to facilitate this coordination.

What the project delivered

6

6.1. Reducing peat subsidence by restoring the hydrology

In Central Kalimantan, the project, together with local communities, built 24 dams in large drainage canals and over 150 blocks in small drainage channels, restoring the hydrology of 10,000 ha in the Sebangau area and over 50,000 hectares of drained and degraded peatlands in the EMRP area. These interventions increased the water table by one, and often two, metres, greatly reducing peat decomposition and subsidence.

6.2. Reduced number of peat fires

Rewetting the areas made these peatlands far less fire prone and those fires that did occur were more rapidly detected and controlled by the teams of firefighters. Around 250,000 hectares of peatland now has improved security from fires and fire-fighting capacity has been improved in 25 villages.

The reduction in the number of fires is not measurable as this figure fluctuates from year to year. The long term effects will only be verifiable after a few years of both wet and dry weather.

6.3. Reduced carbon dioxide emissions

For every hectare of peat that is rewetted, annual emissions of peat-carbon are reduced to the order of around 70 tonnes of CO_2. In total we estimate a reduced emission of at least four million tonnes of carbon dioxide per year by reducing decomposition alone. Without these restoration activities, these emissions would have continued unabated for some decades until all the peat had disappeared.

6.4. Regreening the area

The project has reforested over 1,000 hectares of peatlands. Two years on, some tree seedlings are already a few metres high.

Farmers were persuaded to plant seedlings of valuable indigenous tree species that can live in waterlogged conditions. Regreening helps to store more water in the area (vegetation reduces surface runoff and consolidates water after rainfall). It reduces drainage and the risks of fires. Commercial crops help to increase local communities' income. Reforesting the rewetted peatswamps also leads to carbon sequestration. This sequestration will continue even after the forest reaches climax vegetation because carbon will be stored in the form of peat.

6.5. Success in improving health and incomes

Access to health facilities was improved in 17 villages and malnutrition was reduced. Also, local incomes were improving. Alternative farming (coupled with improved access to markets), planned conservation incentives and carbon services were paying off for local communities. Households participating in the CKPP programme were been able to stabilise their incomes by adopting more sustainable land management practices.

6.6. Creating alternative livelihoods

Changes to management of the area will help to sustain important natural resources such as fish, timber and other peatland products.

6.7. Increased respect for peatlands in Indonesia

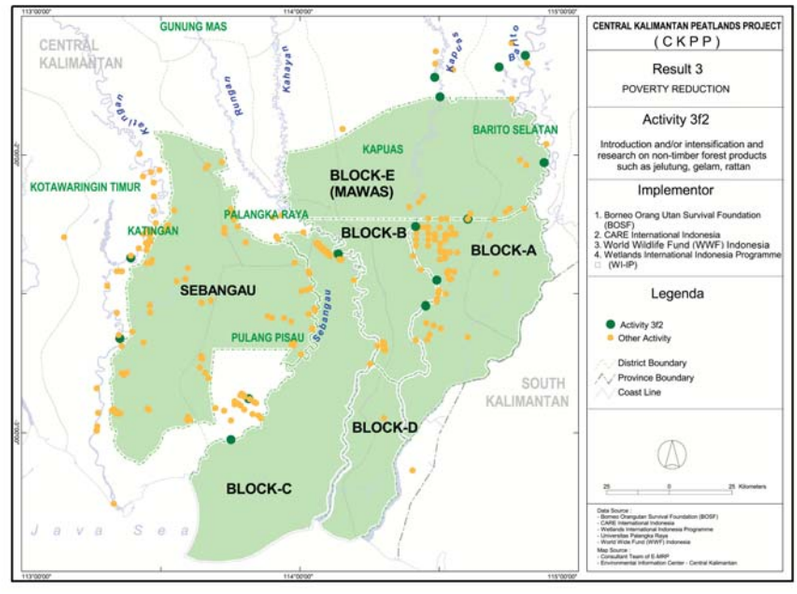
There is some evidence of renewed respect for the environment in the project area and in Indonesia at large. Illegal logging and peatland loss have been increasingly seen as major problems for the future of the country. There was a reduction of illegal sawmills in forest reserves and increasing political, public and financial support for peatland conservation. This was also evident in the actions of the Provincial Government, which initiated a Master Plan for peatlands rehabilitation and the President, who has issued a decree to drive peatland restoration.

6.8. Awareness at the global policy level

At the global level the consortium did a great deal to raise awareness about the peatland problems in Indonesia and Southeast Asia. Through attending important meetings and conventions, and attracting much media interest, the climate change impact of peatlands rose on the agenda of the Convention of Biological Diversity and of the UNFCCC.

Thanks to the advocacy efforts made by the project, the Convention on Biological Diversity acknowledged the alarming loss of peatlands and the impacts on climate change in the

Figure 32.
Map: Intensifications and research area on non-timber forest products



climate change resolution of the COP in Bonn, 2008.

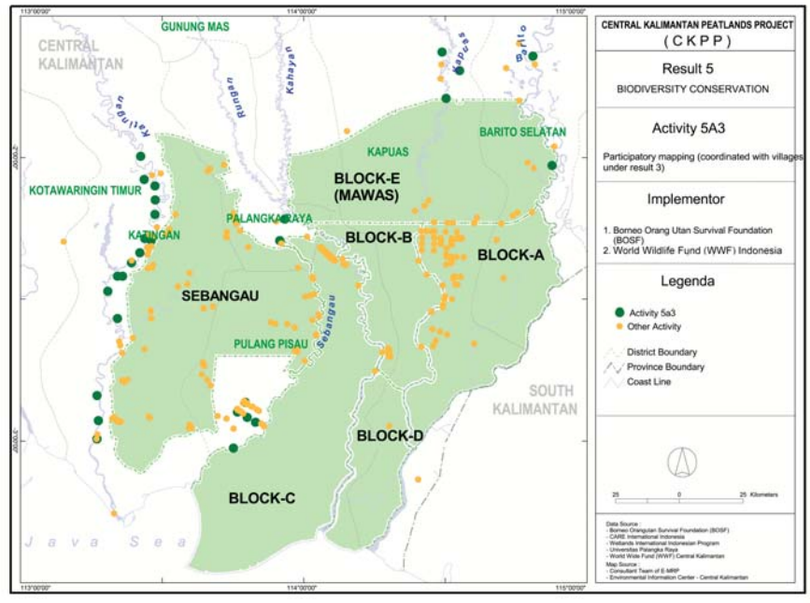
Also, in 2007, the UNFCCC summit in Bali agreed to address the loss of forests and their associated carbon stocks such as peat soils ('Decision on Reducing Emissions from Deforestation' and the inclusion of forests and associated carbon stocks in the Bali Roadmap). This decision is a good start. Now policies have to be developed so that developed countries can officially offset their own CO_2 emissions by investing in projects such as CKPP.

6.9. Reducing loss of an unique biodiversity

The project activities enhanced the status of the Sebangau National Park and of Block E, by restricting illegal logging and providing alternatives for local residents. This enhanced protection was also achieved through participation of local communities in defining the park boundaries and other aspects of planning biodiversity conservation. This helps to improve the long-term conservation of threatened species such as the Orangutan, especially through securing large areas of their peatswamp forest habitat.

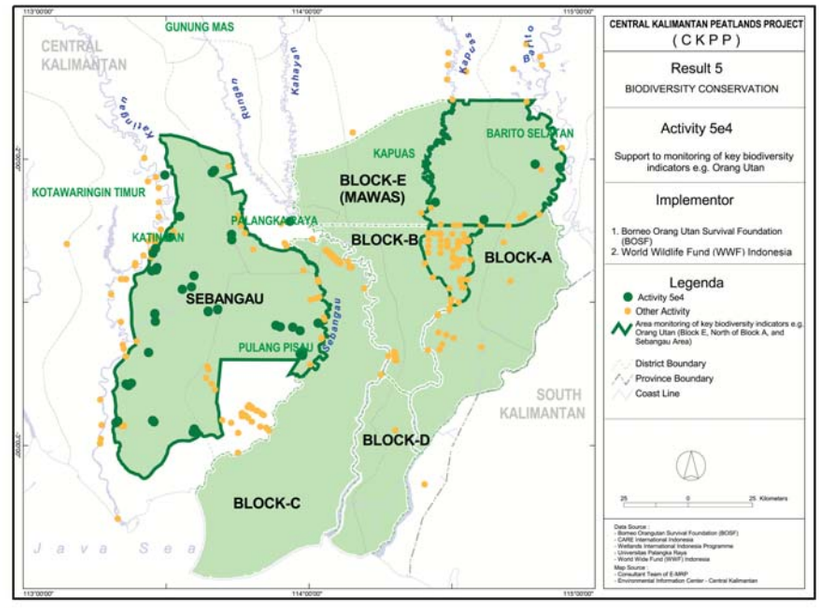
Orang utan

Figure 35.
Map: Community Participation in biodiversity conservation

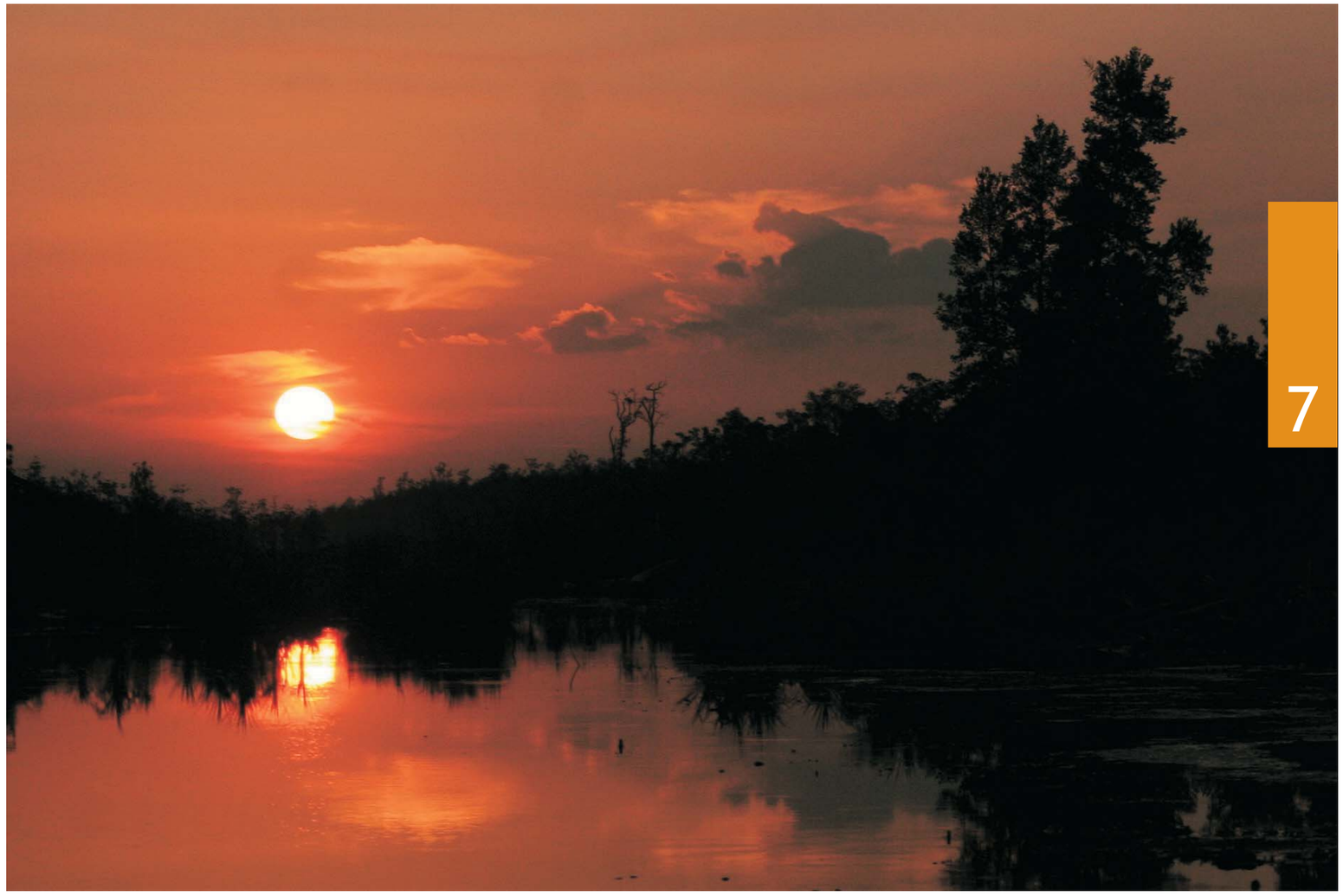


Orang utan

Figure 36.
Map: Monitoring area of Orang Utan



Recommendations for follow-up to CKPP and Masterplan



7

CKPP's activities between 2006 and 2008 in Central Kalimantan have resulted in some important outputs and lessons learnt in terms of fire prevention and control, hydrology restoration, improving livelihoods through sustainable means, reforestation, biodiversity conservation, communication and awareness raising, strengthening policy and attracting the interest of international donors.

These outcomes, described in more detail elsewhere in this report are the result of the collaboration of consortium partners and intensive facilitation from the governments of the province, districts, sub-districts and villages where CKPP worked. The project also greatly benefited from the guidance, support and constructive inputs from different parties, especially from the Provincial Programme Coordination Team (PPCT), established by the Central Kalimantan Provincial Government, and the International Advisory Group (IAG).

However, the successes of the CKPP are still relatively minor in comparison to the scale and intensity of problems and challenges of peatland exploitation in Central Kalimantan and other important peatland regions of Indonesia. The complex challenges indicate that there is a need for replication and expansion of activities from a geographic perspective, but also in terms of the types of activities and the target recipients.

However, the CKPP also experienced constraints and weaknesses, including the limited capacity, synergy and integration of activities between implementing parties and weak communication networks. Externally, it is recognised that there was the potential for coordination and facilitation through the PPCT, but the effectiveness of this mechanism was not optimised. These issues should be addressed in any follow-up initiative involving CKPP or any similar programmes that may be developed in the future.

The CKPP brokered the deal between the Netherlands Government and Indonesia to develop the Master Plan for the EMRP area. The completion of the Master Plan document for the more than one million hectares of the EMRP is an initial step and stimulant in the long process of rehabilitation and revitalisation of this troubled area. The document provides new hope for stakeholders related to the EMRP as it contains the joint results of much knowledge, experience and advanced technology.

As a Master Plan, the contents of the document are still relatively general and underline issues of policy guidance. The document needs to be considered as a dynamic or 'living' document that should be discussed, reviewed and revised in line with developments over time, the steadily improving science base, changes in national and international policy frameworks and in the local situation. Steps to be taken in the short term should include a strategic and detailed action plan, a redefinition and re-actualisation of an institutional implementation mechanism and a strengthening of the structure and financing system so that the Master Plan can be used and implemented effectively in the field.

In view of these matters, some recommendations to follow up on CKPP and the Master Plan are presented below:

7.1. EMRP Master Plan

7.1.1. Policy aspects

- The results of the Master Plan in relation to structure, management and use of the EMRP area should be integrated and synchronised with the ongoing revision of the spatial plan of Central Kalimantan Province. This will provide the Master Plan with increased legal authority;
- The Presidential Instruction No. 2 Year 2007 should be reviewed in relation to the improved knowledge base and identification of issues and options for conservation and sustainable development identified by the Master Plan and CKPP;
- Other provinces or important peatland regions in Indonesia should be encouraged to enter into a similar process of master planning combined with (CKPP-like) community-based action on the ground, involving all major stakeholder groups. This should involve sharing of lessons learned from CKPP and the EMRP Master Plan.

7.1.2. Strategies and detailed action plans

- Strategies and detailed action plans should be developed for sectoral and inter-sectoral peatland management (conservation, agriculture, transmigration, forestry, fisheries, health, tourism, etc).
- Governance: institutional structures need to be developed and enhanced so as to achieve an effective, efficient and economical management system. It is recommended that consideration be given to establishing an inter-sectoral peatland coordination body.

7.2. Central Kalimantan Peatlands Project

7.2.1. Policy Aspects

- Encourage government, private sector and communities to adopt and integrate the results and positive experiences of CKPP into policy and planning for the improved conservation and sustainable management and use of peatlands;
- Encourage government (national, provincial, district/city) to adopt and integrate the results and positive experiences of CKPP in the revitalisation and rehabilitation of the EMRP.

7.2.2. Activity governance

1. Central Kalimantan should be a demonstration site for the sustainable and wise use of peatlands in Indonesia.
   - CKPP should become a demonstration project and a source for learning about wise and sustainable cultivation practices for peatlands, and to promote up-scaling and replication of successful approaches elsewhere in Indonesia.
   - To do this effectively, the

governance of any follow-up to CKPP should be significantly enhanced through the establishment of a project governance Board, involving representatives of key stakeholders, including relevant government agencies, donors, the private sector, scientists and NGOs. This Board should be government-led. In addition, a project secretariat should be established in Palangka Raya to manage the project under the Board's supervision and guidance. The secretariat should ensure the effective coordination, integration and synchronisation of work plans and activities with government, donors and related stakeholders.

- The project should be supported by a Scientific and Technical Advisory Committee, involving local, national and international experts. This Advisory Committee should be shared as much as possible with other peatland and REDD projects to optimise synergies and complementarity of project investments.

2. Project Objectives, Approaches and Interventions
   - The objectives of CKPP remain relevant within the current conditions of Central Kalimantan. However, the project targets should become more SMART (specific, measurable, attainable, realistic and timely) in order to enhance the contribution towards the vision, mission, strategy and priorities of peatland management in Central Kalimantan, and also within the national and global context.
   - The pilot activities implemented by CKPP remain relevant and in line with the needs and priorities of Central Kalimantan. Further diversification will be useful, particularly with regard to emerging opportunities such as REDD, Bio-rights, biodiversity offset mechanisms and payment for environmental services, etc.
   - To enhance the demonstration value of CKPP, future activities should focus on a limited number of demonstration pilots with optimal integration of the strategic interventions. CKPP approaches and techniques should be further evaluated to enable optimisation of efficiency and cost effectiveness, as well as identification of potential complementary and alternative approaches.
   - The ways in which CKPP's interventions directly support implementation of the government approved and led EMRP Master Plan should be explicitly enhanced and acknowledged.
3. Capacity Building and Awareness
   - Capacity building and awareness raising should be continued and strengthened. Future peatland projects should incorporate components for both internal capacity building and extension to project implementers in the field (e.g. consortium members), as well as other relevant organisations (e.g. district and provincial government agencies, private sector and local community groups).
   - Internal capacity building should focus on: i) project management (communication, administration, reporting, documentation, monitoring and evaluation); ii) integration of planning and implementation of the various thematic interventions in the field, such as hydrology restoration, reforestation, fire prevention, Bio-rights and village planning; iii) improvement of the knowledge and conservation skills of field staff, through a shared extension service providing on-the-job advice and training and enabling field staff to place their activities on the ground within the broader perspective of provincial, national and international policies and planning.
   - Future priority areas of external capacity building should include: i) integration of peatland issues in spatial planning and policy; ii) enhancement of the knowledge base, procedures and mechanisms for sustainable peatland planning and management, iii) improvement of forest and peatland governance, involving promotion of wise use principles.
   - Strategies should be developed and implemented for global, national and local outreach and optimising CKPP's role as a demonstration project
4. Project Monitoring and Evaluation
   - Project monitoring should be improved, and involve developing a detailed monitoring protocol, regular independent monitoring and evaluation of approaches, field activities and outcomes, as well as establishment of specific monitoring systems for defining and measuring impacts. Regular project monitoring should be implemented by task groups under the Scientific and Technical Advisory Committee, augmented by annual independent monitoring and evaluation surveys.
   - A REDD methodology for reducing peat degradation related to emissions should be developed in the context of international developments in this regard, specific guidance should be sought from the Government of Indonesia and current and potential investors.
   - Local capacity should be developed for REDD methodology implementation, especially the monitoring of emissions and water levels in line with scientific and market requirements.
5. Donor Coordination and Sustainable Finance
   - The CKPP Board should include representatives of other major peatland projects to ensure coordination among donors, optimise synergies, avoid duplication and overlap and ensure that project plans relate appropriately to the local absorption capacity.
   - The CKPP Board should ensure the longevity of financial mechanisms to enhance the security for local stakeholders. Such mechanisms should make optimal use of innovative funding sources (carbon market, payments for environmental services, biodiversity offsets, Bio-rights etc) to support, strengthen and guarantee sustainable community-based environmental management in the future.

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