SmartWood
Practical conservation through certified forestry

Rainforest Alliance SmartWood Program
High Conservation Value Forest (HCVF) Assessment Report

for:

Serapung Unit

PT Arara Abadi, Asia Pulp & Paper / Sinar Mas Group

Date of Final Report: 4 February 2005
Date Draft Report Completed: 13 December 2004
Dates of Assessment: 1 to 12 November 2004

DISCLAIMER: This report is NOT for the purposes of Forest Stewardship Council (FSC) certification nor has it been reviewed or approved by the FSC in any manner. The presentation herein is based on the Rainforest Alliance SmartWood Program's adoption and use of some principles, models, or tools developed for the identification and assessment of HCVF, based on FSC definitions.

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ACRONYMS

AA	PT. Arara Abadi
AAC	Annual Allowable Cut
adat	Customary or Traditional Law
APL	*Areal dengan Penggunaan Lain* /Area of Other [non-forestry] Use
APP	Asia Pulp and Paper
CITES	Convention on International Trade in Endangered Species
CE	Critically Endangered Species
dbh	Diameter at Breast Height
dusun	Sub-village community unit
ES	Endangered Species
FMP	Forest Management Plan
FMU	Forest Management Unit
FSC	Forest Stewardship Council
GIS	Geographic Information Systems
GPS	Global Positioning System
HCV	High Conservation Value
HCVF	High Conservation Value Forest
HK	*Hutan Konservasi / Conservation Forest*
HPH	*Hak Pengusahan Hutan* / Production Forest Concession Right
HTI	*Hutan Tanaman Industri* / Industrial Timber Plantation
IBSAP	Indonesian Biodiversity Strategy and Action Plan 2003 – 2020
ILO	International Labor Organization
IUCN	The World Conservation Union
Kab.	*Kabupaten* / District or Regency
Kec.	*Kecamatan* / Sub-District
KK	*Kepala Keluarga* / Head of Family or Household
kuda kuda	Wood rail system for transporting logs out of peat swamp forest
MGI	PT Multi Gambut Industri, oil palm plantation adjacent to Pulau Muda concession
MHJ	PT. Mitra Hutan Jaya
MTH	Mixed tropical hardwoods
MAI	Mean annual increment
MoF	Ministry of Forestry
NCAP	National Conservation Plan for Indonesia
NTFP	Non-timber forest product(s)
PA	Protected Areas
P&C	Principles and Criteria
PSF	Peat Swamp Forest
PT.	*Persero Terbatas* / Limited Liability Company
RDB	Red Data Book
RKPH	*Rencana Karya Pengusahaan Hutan* / Forest Concession Master Management Plan
RKT	*Rencana Karya Tahunan* / Annual Workplan
SAP	Sustainability Action Plan of APP.
SFM	Sustainable Forest Management
Sg.	*Sungai* / River
SMG	Sinar Mas Group
SPA	PT. Satria Perkasa Agung
TNC	The Nature Conservancy
TPTI	*Tebang Pilih Tanam Indonesia* / Indonesian Selective Logging System
VS	Vulnerable species
WWF	World Wide Fund for Nature

(See Appendix 5 – Glossary for definition and/or usage of terms)

1. Introduction

This report presents the findings of an independent assessment of High Conservation Value Forests (HCVFs) in an industrial timber plantation (*Hutan Tanaman Industri, HTI*) in Riau Province, Sumatra, Indonesia. From November 1 to 12, 2004, the Rainforest Alliance's SmartWood program conducted an independent HCVF assessment of Asia Pulp and Paper's (APP) Serapung Resort I and Resort II, a 19,495 hectare forest management unit (FMU).[1] The Serapung FMU is one of APP's industrial timber plantations in Riau Province (Sumatra, Indonesia), managed by PT. Arara Abadi (AA), a subsidiary company of APP. The HCVF assessment was conducted by a team of specialists representing the SmartWood Program of the Rainforest Alliance.

APP requested this assessment as it was necessitated by company commitments made to customers and to export credit agencies, and as specified in forestry-related environmental covenants between APP and its creditors. SmartWood was selected as an independent conservation organization with expertise in forestry auditing and evaluation to undertake this HCVF assessment as well as the July 2004 HCVF assessment of APP's Pulau Muda District.

1.1 Purpose

The purpose of the present HCVF assessment was a) to identify the High Conservation Values (HCV) within the defined Forest Management Unit (FMU) of the Serapung Unit managed by PT Arara Abadi, a subsidiary of the Asia Pulp and Paper Company (APP), b) to propose a boundary delineation for High Conservation Value Forest (HCVF) within this FMU, and c) outline basic management and monitoring implications for maintenance of identified HCVFs.

This assessment did not evaluate nor verify APP legal compliance, the standard or quality of forest practices, or any aspect of APP forest management other than what is described herein.

1.2 Approach

The approach adopted by SmartWood for this assessment followed the methodology that was implemented in the SmartWood HCVF assessment of Pulau Muda District from July 19 to 31, 2004, described in the final report for that assessment, which has been publicly-available on the SmartWood website since early October 2004.

The present HCVF assessment also follows the guidance provided in the document prepared by Proforest and Rainforest Alliance, *Identifying, Managing, and Monitoring High Conservation Value Forests in Indonesia: A Toolkit for Forest Managers and other Stakeholders, Version 1, August 2003*, hereinafter referred to as the 'Indonesian HCVF Toolkit', 'HCVF Toolkit, or simply the 'Toolkit'.

The concept of High Conservation Value Forests was developed by the Forest Stewardship Council (FSC) in 1999. Central to the determination of HCVF within a forest management unit is the assessment and identification of High Conservation Values. The HCVF toolkit takes the FSC definitions of HCVs and describes a series of steps to conduct a systematic evaluation of the conservation values that exist in a forest area, and to establish a rationale for those values that are particularly significant and whose conservation is of critical importance. The Indonesian interpretation of the HCVF toolkit has been applied on other forest and palm oil concessions in Indonesia.

[1] Serapung Resorts I and II are managed as part of the Pulau Muda District, an FMU some 25 km upriver, assessed for HCVF by SmartWood in July 2004.

1.3 HCVF Assessment Team

SmartWood assembled a team of assessors with expertise in ecology and social sciences to conduct the HCVF assessment and delineation. The team's specialized scope covered habitat and species ecology in tropical forests, the socio-economics of village communities, Geographic Information Systems (GIS), and the application of independent forest certification methods.

The background experience and competencies of the team are summarized in the following bio-sketches, and table 1 indicates the HCVs that they focused on.

Table 1. Assessment Team Expertise and HCVF Assessment Focus

Name	Fields of Expertise	HCV Aspect
Jeff Hayward	Forest Management	Project Manager
Anthony Sebastian	Wildlife Ecologist	HCV 1
Mark Leighton	Forest Ecologist	HCV 2, 3 & 4
Chris Bennett	Social Scientist	HCV 4, 5 & 6
Martin Hardiono	GIS	GIS analysis & Mapping
Aisyah Sileuw	Social Scientist	HCV 4, 5, & 6

Jeff Hawyard, Msc.
Mr. Hayward is Asia Pacific Regional Manager, of the Rainforest Alliance SmartWood Certification Program, based in Jakarta, Indonesia. He has conducted over 20 forest management assessments, scopings, and/or audits and over 60 chain of custody assessments and/or audits.He has conducted silviculture and ecology research for the B.C. Ministry of Forests and UBC Alex Fraser Research Forest in Canada. In Oregon State, he worked for the federal government in the U.S. Bureau of Land Management in forest inventory and timber sale administration. For three years he worked with the U.S. Peace Corps as a community forester in Guatemala, providing technical extension services to an agroforestry and conservation of natural resources program. His private forestry consulting has been for the B.C. Ministry of Forests, the FSC and IIED. Publications include research on forest certification and forest silviculture.

Anthony Sebastian, BSc.
A wildlife ecologist by training, he is a natural resource management consultant with Aonyx Environmental, an international specialist consultancy based in Kuching, Malaysia. Mr. Sebastian has 13 years experience in species and habitat management in Southeast Asia, with specific experience with floodplain and tropical peat ecosystems. He has worked in almost all the remaining peat swamp forests on the Malay Peninsula and Borneo. He brings considerable wetland conservation and management experience, particularly from a protected area management planning perspective, to the team.

Mark Leighton, PhD.
Dr. Leighton is a tropical forest ecologist with 27 years of research experience in basic and applied rainforest ecology, mostly focused in Indonesia, and especially Kalimantan. For over 20 years he has taught courses in rainforest ecology, vertebrate ecology, and forest management systems while on the faculty at Harvard University. He has directed research programs that span tropical plant ecology, vertebrate ecology, plant-vertebrate ecological interactions, conservation biology, and financial and ecological appraisals of sustainable forest management systems. He founded the Gunung Palung Research Station in 1984, which has supported nearly 200 research publications by himself and his colleagues and students. He has advised policies for the

Indonesian Ministry of Forestry, numerous conservation initiatives and UNESCO and UNEP. His consulting work includes work on tropical landscape conservation planning, forest certification and the design of mixed function sustainable forestry enterprises that incorporate conservation objectives.

Chris Bennett, MSc.
Over the past 20 years, Mr. Bennett has worked mostly in Indonesia, but also in Laos and Malaysia, on forestry and agroforestry development and broader issues in natural resource management. In recent years, he has carried out policy and institutional analysis linked to broad-based dialogue through shared learning for good governance of decentralized natural resource management. This has included national policies and regulations, participative decision-making for land management and village-based co-management of public forestry land resources. Much of his policy analysis has been through consultancies for organizations such as the Harvard Institute for International Development (HIID), World Bank, United States Agency for International Development (USAID), U.K. Department for International Development (DfID), F.A.O., Centre for International Forestry Research (CIFOR), the Ford Foundation, SmartWood (Rainforest Alliance), The Nature Conservancy (TNC), and Birdlife International. An Adjunct Professor at the University of British Columbia with the Food and Resource Economics Centre, he teaches a course on rural development.

Martin Y. Hardiono, BSc.
Mr. Hardiono has been working in the field of GIS and Remote Sensing for the past 10 years mainly in conservation, which he has chosen as his field of interest for the past 15 years. He has intensive field experience in Indonesia, and also worked in Sabah, Cambodia and Lao PDR. He has worked as an independent consultant for almost 6 years since he left WWF Indonesia in 1999. He has worked for various conservation and research organization including The Nature Conservancy, World Wide Fund for Nature, the East-West Center, the Yale University field study in West Kalimantan and numerous Indonesian organizations. He contributed to the production of GIS overlays, maps, and spatial analysis of all HCVs.

Aisyah Sileuw, BSc.
Ms. Sileuw graduated from Bogor Agricultural University and was a SmartWood staff member and auditor for over two-years. She has ten years experience in certification issues, particularly focused on social and community aspects of forest management. She has participated in several SmartWood certification scoping evaluations and full assessments of forest management and chain of custody in Indonesia.

1.4 Report Availability, Layout, and Review

The entire written report will be made publicly available upon finalization, as agreed to by APP and SmartWood. Appendices will be at the end of this written report. Information stated as being part of the "Technical Annexes" will be available on the SmartWood website: www.smartwood.org

The format of the reporting is as follows:
1: *Introduction*
2: *Organisation and Landscape Context of the FMU*
3: *Assessment Methodology*
4: *Determination of the Presence and Location of HCVs*
5: *Delineation of HCVF(s).*
6: *Management and Monitoring Implications of the HCVF(s).*
Bibliography

Appendices include:
(1) Data Sources
(2) APP / SMG Contacts
(3) Interviewed Stakeholders
(4) Itinerary
(5) Glossary of Terms

Technical Annexes include:
(1) Assessment checklist
(2) C.V.s of the assessors and reviewer
(3) Peer reviewer report
(4) Photographs and maps
(5) Tables of village demographics, etc.

This report was peer reviewed by Dr. Steve Jennings (of ProForest) a tropical forest ecologist and principal architect of the HCVF Toolkit. The final report does not necessarily reflect the views of Dr. Jennings or ProForest.

2. Organisation and Landscape Context of the Forest Management Unit

2.1 Contact information

FMU Name: Serapung Resort (of the Pulau Muda Forest District)
FMU Manager: Kho Tjin Ho, Senior District Manager, PT Arara Abadi
FMU Contact: Arian Ardie, Director of Sustainability and Stakeholder Engagement, APP
Address: APP, c/o Plaza BII, Tower II, 19th Floor
Jl. M.H. Thamrin No. 51, Jakarta, Indonesia
Tel: +62-21-392-9266
Fax: +62-21-392-9531
E-mail: *arian_ardie@app.co.id*

2.2 FMU Description

2.2.1 Type and Period

The Serapung Forest Management Unit (FMU) is comprised of two concessions, PT. Satria Perkasa Agung (SPA or Serapung I) and PT. Mitra Hutan Jaya (MHJ or Serapung II). These operations are Industrial Timber Plantations (*Hutan Tanaman Industri, HTI*) that supply the PT Indah Kiat Pulp & Paper mill in Perawang, Riau Province. During the early 1980s, the FMU area was selectively harvested by an unrelated company under the Indonesian Selective Logging and Planting System or *TPTI*, approved by the Minister of Forestry. The present two HTI concessions were approved by the Head of Pelalawang District.[2] They are managed as a single entity by PT. Arara Abadi (AA) and cover a total area of 19,945 ha.

The current HTI licenses under AA management permit land clearing of the logged-over forest areas, the establishment of canals and drainage ditches, and the planting of *Acacia crassicarpa* for pulpwood production. Timber obtained from the land clearing is Mixed Tropical Hardwood (MTH), suppling PT Indah Kiat Pulp & Paper mill in Perawang, Riau Province. Small volumes of larger-diameter logs are supplied to plywood mills.

2.2.2 Location

FMU Serapung is located at the mouth of the Kampar river in Pelalawang District, Riau Province, Indonesia. Parallel with the north bank of the Kampar river, and approximately aligned east-west, the FMU's Serapung II connects with Serapung I close to the river mouth. Serapung I, joined at right angles to Serapung II, is approximately aligned north-south along the coast. For ease of spatial understanding, this assessment report refers to the two resorts as the east-west and north-south arms of the FMU. Each arm is separated from the riverbank and coast by narrow strips of agricultural and forest land. (See Figure 1).

[2] FMU Resort I license: *Keputusan Bupati Pelalawan No. 522.21/IUPHHKHT/I/2003/013 ttg Pemberian Hak Izin Usaha Pemanfaatan Hasil Hutan Kayu Hutan Tanaman Kepada PT. Satria Perkasa Agung seluas +/- 12,000 Hektar di Kabupaten Pelalawan, 29 January 2003*.

FMU Resort II license: *Keputusan Bupati Pelalawan No. 522.21/IUPHHKHT/I/2003/014 ttg Pemberian Hak Izin Usaha Pemanfaatan Hasil Hutan Kayu Hutan Tanaman Kepada PT. Mitra Hutan Jaya seluas +/- 10,000 Hektar di Kabupaten Pelalawan, 29 January 2003.*

At its closest point to the river, the east-west arm of the FMU extends 9.8km from 103° 54' E and 0° 36' N to 103° 5' E and 0° 28 N at its nearest point to the point of Tanjung Datuk at the mouth of the Kampar river. From this point the north-south arm of the FMU, varying in width from 5.2 to 10.3 km, extends 10.1 km north to 103° 0' E and 0° 36' N at its closest to the coast.

2.3 Forest Management System

2.3.1 Forest Land Classification

The FMU is primarily designated under the HTI licenses as production forest for clear-felling and replanting with industrial timber species. There are three other land uses mandated under all HTI licenses, depicted in figure 1, namely:

- *Kehidupan* (land management for local community livelihoods),
- *Unggulan* (forest management for high-quality local tree species)
- *Konservasi* (natural forest areas for conservation).

Table 2 summarizes the land use status in the FMU in September 2004, one month before the harvesting ceased in the FMU as agreed to between APP and SmartWood. Taking into account the October harvest of 667 ha, by the time harvesting stopped, about 11,200 ha or 60% of the total FMU area was still under natural forest cover. Half of this area is classed as production land use and half as *Kehidupan, Unggulan* and *Konservasi* areas. The konservasi area accounts for about 11%. Most of the remaining natural forests are severely to lightly degraded, as these areas had been accessed by illegal loggers, in the past, and currently using FMU canals to transport logs out of the concession without the manager's permission. As calculated by interpreting remote imagery, eight percent of the FMU is under smallholder agriculture, some preceding the date of the HTI license.

Table 2. Natural and Planted Forest Areas in FMU Serapung as of September 2004

Forest Land Use /2/		FMU Area		Totals	%
		Serapung 1	Serapung 2		
Production (*Produksi*)	Natural /4/	2,820 /3/	4,119	6,733	35
	Cleared	1,510	588	2,098	
	Planted	3,172	482	3,654	
Multipurpose (*Tanaman Kehidupan*)		381	419	800	7
Indigenous Trees (*Tanaman Unggulan*)		1,179	780	1,959	10
Conservation (*Konservasi*)		1,343	820	2,163	11
Infrastructure		163	132	294	2
Informal Smallholder Agriculture		836	751	1,587	8
	Total Natural	**5,723**	**6,138**	**11,861**	**61**
	Total Other	5,681	1,953	7,634	39
	TOTAL	**11,404**	**8,091**	**19,495**	**100**

Notes:
/1/ Source: Arara Abadi, Pulau Muda; data presented to the nearest whole number. In October, 667 ha of natural forest were harvested up to the cessation of logging activities when the HCVF assessment began, at which time therefore, 11,861 – 667 = 11,194 ha of natural forest cover remained.
/2/ Informal smallholder agriculture inside the FMU either began before or after the FMU licenses were given.
/3/ Includes 206 ha of flooded forest.
/4/ Shade = natural forest

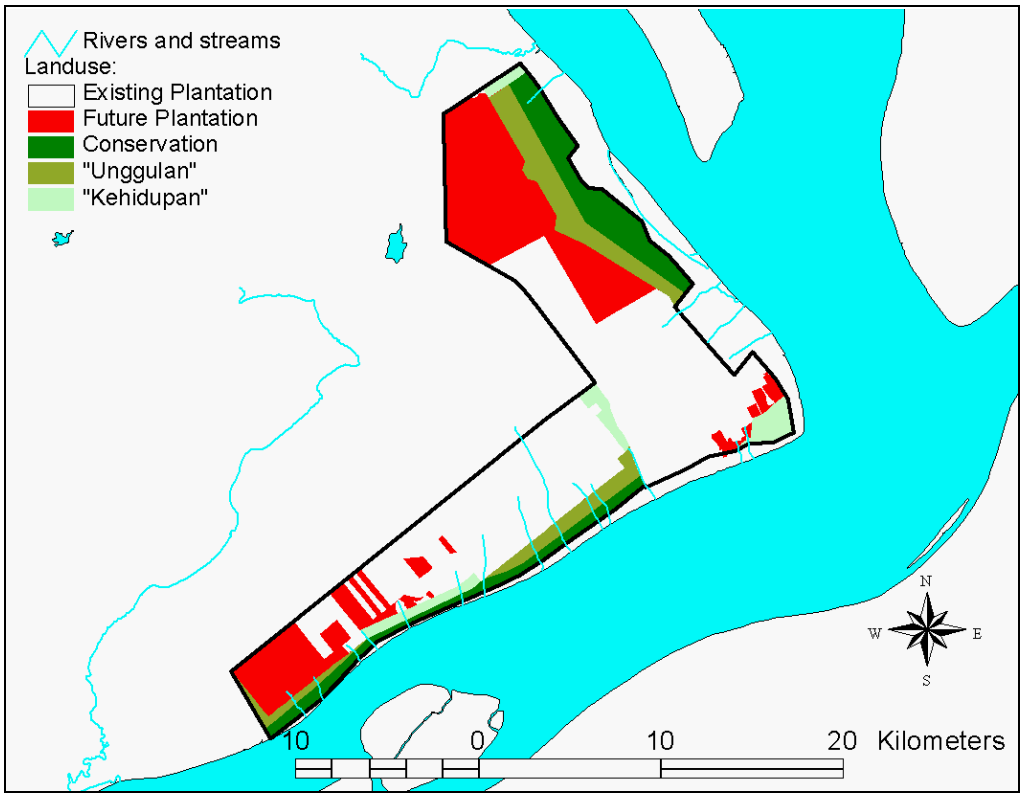
2.3.2 Land Use Objectives of the Forest Management System

The primary purpose of the FMU is to access wood fibre in the short-term and to provide AA with a land base for plantation development for the long-term. This land use occurs in the HTI-designated production or *Produksi* areas.

Plantation establishment begins with harvesting and transport of MTH logs of approximately 10-30cm DBH. These logs are manually hauled on wood rails to loading points alongside canals. From here they are towed in barges through a grid of minor and major canals to 1,000-ton capacity river barges that are then towed out the Kampar River, along the sea, back up the Siak River to a landing point from where they are trucked to the mill.

The cleared land base is used to plant fast-growing timber trees, the main species being *Acacia crassicarpa*. A six to seven-year growing cycle is assumed based upon estimated MAI of 25 $m^3 ha^{-1}$. The first harvest of planted acacia in FMU Serapung is expected in 2010. Plantation establishment has proceeded rapidly during 2004, progressing outward from the central base camp. Remaining uncleared forest slated for future plantaion is mostly in the far western and northern sections of the two resorts.

Figure 1. Serapung FMU Boundaries and Land Uses



As mentioned above, other HTI-designated forest land uses are for conservation (*Konservasi*), community livelihoods (*Kehidupan*) and high-quality local tree species (*Unggulan*). In the case of FMU Serapung, 2,163 Ha or 11% of the FMU area is designated for conservation.

There are three conservation areas established by the company:
- a small area inland from Tanjung Datuk point;
- a large strip in the top half of the north-south arm of the FMU; and,
- a narrow strip along the east-west arm of the FMU.

District staff indicated that these areas were delineated as strips running the edge of the resorts to buffer the concession from the coastal agriculturalists. This guideline did not extend to all such borders, as unbuffered forest remained in places. A narrower stip, with the same total conservation area, could have run the entire border.

Kehidupan areas are intended for development of local community livelihoods. These might range from forestry livelihoods such as non-timber forest product collection to food crop cultivation. To date, AA has no specific concepts or plans for development of these areas.

Unggulan area functions could be met by maintaining natural forest cover with minimal management interventions. To date, AA has no specific concepts or plans for development of these areas.

All remaining forest blocks in each of these three categories are now relatively open-access areas primarily or solely used by communities for unauthorized logging. This situation impacts upon the condition and conservation values contained within the forest.

Logging by groups from the surrounding villages is rampant within the Serapung FMU. Aerial inspections via the helicopter overflights revealed no areas that could be called primary forest within the concession. Because hand logging is selective, leaving behind a patchy canopy but a nearly continuous forest understory, these areas have been termed "less severely logged" in this report. These comprise 87% of the remaining 9,820 ha of natural forest in the FMU. Areas with relatively little remaining canopy cover were classified as "severely degraded" and comprise 13%. Secondary forest areas are located near the border with coastal agriculturalists and may include fallow scrub vegetation regenerating from previous agricultural clearing.

Communities brazenly use the canal system established by the company, in some cases manually reopening dammed canals to regulate waterflow and move logs. From observations and interviews, logging gangs use newly opened canal systems to systematically penetrate adjacent forest blocks with kuda-kuda "rail lines" to move logs to the canal bank by hand, then out to the coast via the canal system in long booms of two rows of logs tied end to end. Such unauthorized logging is restricted mostly to a small set of four commercial species above 30-40 cm dbh: Meranti bunga (*Shorea teysmanniana*), Suntai (*Palaquium burkii*), Punah (*Tetramerista glabra*) and Ramin (*Gonystylus bancanus*). Large trees of these species that were left in the residual stand seem to be due to stem/trunk defect. The dominant canopy emergent *Shorea uliginosa* (Meranti batu) is a heavy "sinker" log that is difficult to move along canals, and is seldom cut. The green-gray emergent crowns of the *Shorea uliginosa* become relatively more dominant in logged forests and easily categorize logged Tall PSF when seen during overflights.

The company has been unable to stop this unauthorized logging. There is poor police intervention and difficult political ramifications of aggressive enforcement with surrounding villages.

The concession area was previously logged via locomotive rail line system operated by a concessionaire until about 1995. The set of species taken was probably similar to the current hand logging, although Ramin, commanding extraordinarily high value, would have been a particular focus. Typically, this type of logging ignores forest areas with low densities of commercial trees, so logging is patchy. However, most natural forest areas within the FMU have then experienced two cycles of logging, with recent and current illegal logging by villagers throughout the concession. Company representatives suggested that devising a sustainably managed system for community logging might be the best use of these areas, although the conservation areas are legally not meant to be disturbed.

A final land use feature, worthy of separate consideration because of the way it fundamentally alters the hydrology of the area, is the network of major and minor canals and drainage ditches, of the existing canal system (see figure 2) that provides access to approximately 75% of the FMU land area. The primary function of the canals and associated infrastructure is to control (and reduce) water table depth at an optimum for both plantation growth, for management access into the plantations, and for transport of logs. Main canals are on average 12m wide and 3.5 - 4m deep, while secondary canals are on average 9m wide and 2 - 3m deep. Canals are usually blocked to conserve water once planting and early maintenance operations are completed, and the main transport route may be closed off temporarily with water-gates.

Figure 2. Canal system for the Serapung FMU

The tendency is for water to overflow canals downslope into the forests or agricultural lands bordering the *Acacia* planted areas inland. This flooding problem is mitigated by feeding downslope-running canals into a bordering canal running parallel with the coast, as occurs along the *Unggulan* forest area of the north-south arm of the FMU. Where there is no bordering canal, flooding occurs into the natural forest, causing death of trees. For example, *Kehidupan* forest in the southwest of the FMU has suffered canopy tree dieback, and adjacent plantations immediately on the west are too flooded to support plantation trees. The FMU canals do not threaten draining of the peat forest

dome during drought periods, as was a concern at Pulau Muda, because the peat dome is far inland from the FMU (50 km west, judging from our overflight). However, there remains the potential serious risk that acute dry periods might lead to drying out of the peat and even the canals, creating the conditions for wild fires.

2.4 Ecological Context

The Serapung FMU is an L- shaped block of PSF set about 2km back from the true left bank of the Kampar river at its mouth. The Kampar river features strongly in the ecology of the delta, of which the FMU is a part of, and therefore a brief description is provided below.

The Kampar River

The lower reaches of this great river exhibit an unusual character. The direction of flow in the Malacca Straits is northwards, and the Kampar emerges at Pulau Mendo, dividing either side of this island. The main water flow turns sharply left here, outflowing northwards either side of Pulau Serapung, and exiting into the Straits between the islands of P. Mendo and P. Rangsang. A separate channel (Selat Panjang, becoming Selat Bengkalis further north) continues north-westwards, separating the islands of P. Tebing Tinggi, P. Padang and P. Bengkalis from the mainland. This suggests that the original mouth of the Kampar river was further north between the islands of P. Bengkalis and P. Rupat.

This sharp left-turn of the Kampar can be attributed to the fact that the outer Riau islands are the tops of a northwest-southeast aligned geological ridge, creating a barrier to the spread of the Kampar delta. The resulting north-westwards flow formed the large, geologically different deltaic islands through the deposition of silt. The different formative origins of these islands (Tebing Tinggi, Padang, and Bengkalis) are evident by the formation of peat soils and lacustrine lakes on them.

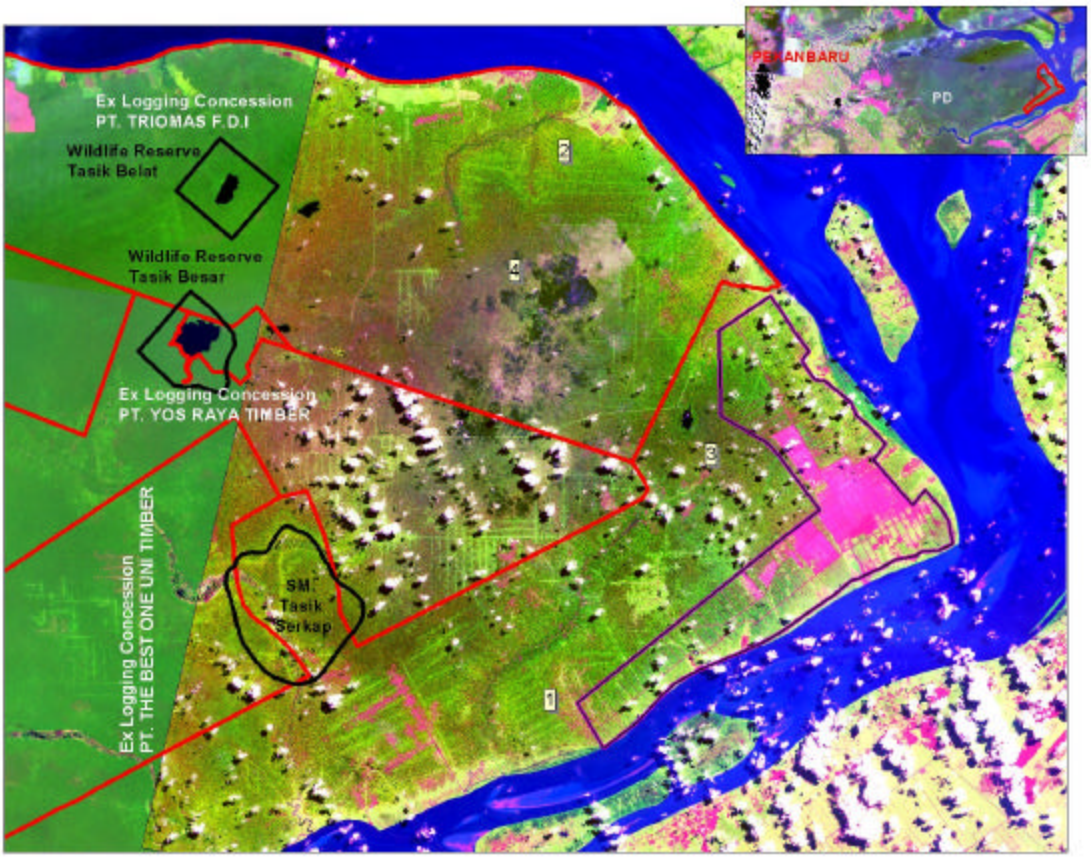
2.4.1 The surrounding landscape forest & its protected areas

The FMU is on the edge, along the southeast corner, of a large landscape-level contiguous forest, which we have termed the Danau Pulau Besar - Tasik Serkap landscape forest , after the names of two of its four small protected areas. Danau Pulau Besar - Tasik Serkap is one of the few remaining large continguous blocks of peat swamp forest (PSF) within what will be referred to in this report as the East-Central Sumatran PSF ecoregion (see section 2.4.2).

Figure 3 below is comprised of a SPOT 2A satellite photo taken July 19, 2004 (for the image to right of diagonal line) and a Landsate satellite photo taken on July 14, 2002 (for the image to the left of the diagonal line). There are three of the four nearby protected areas outlined in black and other forest concession boundaries indicated in red. As can be seen by the network of lighter lines in the SPOT image, most forest areas have been logged by either recent hand-logging (for example, point #1), or an earlier period of concession rail logging (faint long straight lines, at point #2). Primary Tall PSF remains in most central locations (#3 & 4, to right of lake). Lighter green areas in the image have been more severly degraded logged areas, whereas the darker green areas have been more lightly logged or, in some cases, primary forest.

In the upper right corner is a smaller scale landsat image covering from Pekanbaru in the east to Serapung FMU (outlined in red). The Short PSF habitat type, indicative of a peat dome, is shown (PD) where observed from helicopter transect.

Figure 3. Landscape Context for the Serapung FMU



Source: Rencana Tata Ruang Wilayah Propinsi Riau, Peraturan Daerah No 10, tahun 1994 tanggal 19 Augustus 1994 ; SPOT2A 19 July 2004

2.4.2 The Ecology of Peat Swamp Forests

The FMU is located in a coastal peatland where peat has been accumulating over marine sediments (Reiley, Ahmad-Shah & Brady, 1996). Peat soils are typically water-logged and extremely nutrient-poor. Their low pH (typically 3.5-4.5) inhibits vegetative decomposition by microorganisms, causing nett peat accumulation and correspondingly increasing peat depth over time. The soil profiles exposed in the drainage canals of the FMU clearly display un-decomposed limbs, twigs and roots that are characteristic of acidic, anaerobic peat. Large accumulations of peat act like a sponge, absorbing and holding water at a level about 50cm below the surface. In dry seasons the water table drops.

The nutrient-poor, and often waterlogged, peat soils present extreme physiological challenges to plants. Under normal rainfall conditions and short dry periods, the sponge action of peat keeps the water table high, however, in extreme dry seasons the water table falls and plants must be adapted to these drought conditions. Leaves are leathery and tough to resist desiccation and crowns are small relative to tree height and diameter.

In the setting of the Serapung FMU, where peat abuts a tidal river and/or coastline, the freshwater accumulated in the peat maintains the hydrostatic pressure necessary to repel tidal saltwater incursions into the inland peat soil profile. Therefore, maintaining peat

continuity and freshwater inputs percolating downslope from inland rainwater sources protects agricultural lands in the coastal belt.

The peat flora is comprised mostly of plants endemic to peat swamps, and this flora is the most restricted among tropical rainforest vegetation (Cannon & Leighton 2004; Rieley & Ahmad-Shah 1996). Nonetheless, the peat flora is species-rich in trees, and this diversity is mostly at the generic level, with most tree genera of nearby dry lowland forests contributing one or two endemic peat swamp species to the unique flora.

Due to periodic contiguity during the sea level drops associated with the recurrent ice ages over the last two million years, the extensive peat swamps of west and central coastal Borneo, east-central Sumatra and south peninsular Malaysia share many species. However, the species assemblages, or peat plant communities vary regionally. The Sumatran PSF are a distinctive forest type, and their biodiversity is characteristic of the habitat. The East-Central Sumatran peat swamp forests form a unique ecoregion representing the PSF along the eastern coast of Sumatra (Wikramanayake *et. al., 2001*; Jarvie *et. al.,* 2003a). Although few peat forest plant species endemic to Sumatra have been noted in the literature, the flora has not been sampled to identify rare endemics, (Rieley & Ahmad-Shah 1996), which are likely to occur. Because of barriers formed by river systems, and limited dispersal, species assemblages of peat swamp forest vary between the large landscape forest blocks within an ecoregion.

2.4.3 Habitats and Species

The tropical PSF of Southeast Asia exhibit a close correlation between forest structure and peat depth (Rieley & Ahmad-Shah 1996; Tie, 1990; Anderson, 1964; 1983). This relationship is based on three primary factors: Peat depth, Nutrient availability and Water-logging. Peat formations typically form domes, which rise from the levees of rivers, reaching their maximum depths towards the centre, or furthest from the rivers. Peat deposits are shallowest at the edges and deepest in the centers. Plant communities typically differ along these concentric gradients, forming distinct “bands” around a dome.

There are five habitats occurring in the landscape and described below —Tall PSF, Mixed PSF, Short PSF, Secondary Habitats, and Mangrove/Coastal Habitats. However Short PSF was not present within the FMU.

These habitats are relatively easy to distinguish on the ground and from the air both by stature and indicator species. However, this classification corresponds only roughly to other published studies. Each study of a PSF ecosystem has defined distinct habitats based on criteria of structure and floristics, but each classification is idiosyncratic to some degree (see the review of Reiley, Ahmad-Shah & Brady, 1996). The definition of these three PSF habitats that occur along a peat depth gradient follows established nomenclature in Rieley & Ahmad-Shah (1996).

Tall peat swamp forest (Tall PSF)
A rather uniform Tall PSF forms the dominant, nearly solely occurring habitat type of the FMU.

Peat depth ranges roughly from 2-8m, and is not permanently inundated. The continuous canopy is at 15-20m with scattered large trees (50-80 cm dbh). Emergent trees are most commonly the two *Shorea* spp. (*S. uliginosa* and *S. teysmanniana*), *Parastemon urophyllum*, and *Palaquium burkii* and whose coppery leaf undersides assist identification of this habitat from the air. Tree diversity is relatively high compared to Short PSF, but

low compared to Mixed PSF, which can more resemble species-rich and liana-rich lowland Mixed Dipterocarp Forest. *Campnosperma spp.* can become locally dominant and emergent, and are indicative of large scale clearing, burning or natural disturbance.

The Tall PSF at Serapung, as with the Pulau Muda FMU, appear to match that described from the nearby Kerumatan Wildlife Reserve by Momose & Shim amura (2002). Based on the data they present, however, we do not think their subdivision of the tall PSF at Kerumatan into subtypes was justified. The slight differences in relative abundances of different species in the single plots they enumerate at different distances from the river could easily fall within the normal range of variation for Tall SPF. SmartWood acknowledges that four days of field assessment and two over flights are inadequate to evaluate important variation for sub-structuring within this habitat or to detect rarer discrete peat forest habitats. However, the primary canals provided access to virtually all areas of the FMU, and bordering natural forest was inspected for floristics and walked to examine site conditions. The same set of characteristic Tall PSF tree species was present throughout the FMU.

Avifauna diversity is consistent with similarly structured PSF elsewhere in the region. Bird species can be broadly differentiated by their stratified utilization of the forest into canopy, middle storey, and understory species. Canopy species are typified by Scarlet Minivet *Pericrocotus flammeus*, Blue-crowned Hanging Parrot *Loriculus galgulus*, *Megalaima* barbets and the *Aceros* hornbills. Middle-storey species include Scarlet-rumped Trogon *Harpactes duvaucelii* and the *Malacopteron* Babblers. Understory species are typified by *Trichastoma* Babblers. Ground-living birds such as pheasants and pittas are less common, or entirely absent from pure PSF, but utilise river levees.

The large Sumatran mammals, Asian Elephant *Elephas maximus*, Sumatran Rhinoceros *Dicerorhinus sumatrensis* and Malayan Tapir *Tapirus indicus* are absent from these forests, but the Sumatran Tiger *Panthera tigris* is known to occur within this habitat type, likely in response to the abundance of large prey species. Sambar deer *Cervus unicolor* and Wild Pig *Sus scrofa* are common and these populations are expected to be more abundant along the interphase between pure PSF and the alluvial bench forests that form a band along the coast[3].

The extent of utilization of PSF by tiger prey species is key to the suitability of PSF as habitat for tigers. Franklin *et.al.* (1999) states that although dry lowland, montane and freshwater swamp forests form the primary habitat for tigers on Sumatra, they frequent PSF wherever they occur in proximity to forest types on mineral soils.

Primate diversity and sympatry is typically lower in PSF compared with dryland mixed dipterocarp and mixed PSF. Four monkeys were present in the FMU: the two macaques (*Macaca fascilularis* and *M. nemestrina*) and two colubines, the Banded Leaf Monkey *Presbytis femoralis* and Grizzled Leaf Monkey *Trachypithecus villosus*[4]. *P. femoralis* is widespread in PSF, but *T. villosus* is confined to the narrow bands of mangrove forests at the water's edge. The Agile Gibbon *Hylobates agilis* is also widespread, but confined to tall forests.

[3] The breadth of this band varies from narrow strips where peat soils reach the edge of rivers, particularly along the banks of the Kampar, to broad swathes extending inland along the raised levees of small river systems outflowing into the sea, e.g. along the Sg. Apong to the north of the FMU, which has a comparatively wide extent of deposited mineral soils extending a few kilometers into the PSF.

[4] formerly known as the Silvered Leaf Monkey *Presbytis cristata*

The Malayan Sun Bear *Arctos malayanus* is also present, occasionally encountered in PSF by locals and contract workers. The Clouded Leopard *Pardofelis nebulosa* is expected to be present, although surveys did not record the species.

Information on herpetofauna is lacking. Two species were recorded. A single Rough-necked Monitor *Varanus rudicollis*, a rare arboreal species restricted to the Malay Peninsula, eastern Sumatra and Borneo (Manthey & Grossmann, 1997), was seen (and photographed) in a canal. A single Asian Leaf Turtle *Cyclemys dentata* was caught in a canal and photographed. This species is evidently common in this habitat, and is opportunistically caught and eaten by locals[5].

Mixed Peat Swamp Forest (Mixed PSF)
Mixed PSF, typically found on alluvial deposits of mineral soil in terraces along rivers, is rare in the FMU.

Although the FMU boundaries are parallel and only a few km from the Kampar River, in most places the deeper peat (>2-3m) extends nearly to the margin of the river, apparently because the river current has been slowly eroding into its northern bank, and instead, the southern bank is accumulating sediment. In contrast, the coast along the eastern boundary of the north-south arm of the FMU is depositional, and sediment has been accreting over recent time. Therefore, non-peaty mineral soils are expected here, some with a shallow peat covering. The natural vegetation here would have been Mixed PSF on shallow peats overlying mineral soil terraces, with swamp forest in the lower lying tidal depressions. However, these have been mostly converted to agriculture in this coastal margin adjacent to the FMU. In the Mixed PSF, tree roots can reach mineral soils and the floristic composition is distinctive from Tall PSF, with many lowland forest elements (Rieley & Ahmad-Shah 1996; Momose & Shimamura 2002). Mixed PSF peat swamp forest is bordered abruptly by Tall PSF as peat depth increases rapidly away from the river. This habitat is classified under the WWF Ecoregions as Sumatran Freshwater Swamp Forests (IM0157).

Mixed PSF is regarded, together with lowland and montane forests, primary habitat for tigers on Sumatra (Franklin *et.al.*1999), although this may not have been the case in the past. These coastal mixed areas of peat swamp forest and alluvial bench forests are expected to support high densities (at least in the past) of Wild Pig *Sus scrofa* and Sambar Deer *Cervus unicolor*, as well as the smaller ungulates (*Tragulus* and *Muntiacus*), the main prey species for tigers. Ecological health of tiger habitat is closely related to prey availability and abundance (Karanth & Stith, 1999).
Primate species present are Agile Gibbon *Hylobates agilis*, Long-tailed Macaque *Macaca fascicularis*, Pig-tailed Macaque *M. nemestrina* and Banded Leaf Monkey *Presbytis femoralis*[6].

Clouded Leopard *Pardofelis nebulosa* and Malayan Sun Bear *Ursus malayanus* are reported as present by locals.

Eight species of birds of prey (Family Falconiformes) were recorded: Black Baza *Aviceda leuphotes*, Crested Serpent Eagle *Spilornis cheela*, Oriental Honey Buzzard *Pernis ptilorhyncus*, Changeable Hawk Eagle *Spizaetus cirrhatus*, Wallace's Hawk Eagle *S.*

[5] *C. dentata* is listed as Low Risk (near-threatened), primarily from habitat loss and wild capture for trade and food (IUCN, 2004; IUCN/SSC-TFTSG & ATTWG, 2000).
[6] Aimi & Bakar (1996; 1992) and Aimi *et.al.* (1986) provide a detailed treatments of the *Presbytis* group on Sumatra, and separate *P. melalophos* and *P. femoralis* geographically, with the latter distributed along the coastal habitats of central Sumatra, including the Riau PSF.

nanus, Japanese Sparrowhawk *Accipiter gularis*, Chinese Goshawk *A. soloensis* and Black-thighed Falconet *Microhierax fringillarius*. Four of these are migratory.

Three species of Hornbills (Bucerotidae) were recorded: Black Hornbill *Anthracoceros malayanus*, Wreathed Hornbill *Aceros undulatus* and Great Hornbill *Buceros buceros*. Seven Wreathed and 5 Great Hornbills were observed congregating on a fruiting tree along the PT Yos Canal on 7 November.

Short Peat Swamp Forest (Short PSF)
This habitat does not occur within the FMU.

Far to the northwest of the Danau Pulau Besar - Tasik Serkap landscape forest block, approximately 50km from the FMU, a large peat dome is present, recognized during the aerial overflight by its characteristic low-statured tree with reduced crowns. This habitat, referred to as Short PSF (Rieley & Ahmad-Shah 1996) features small-diameter poles with small crowns, reflecting restrictions imposed by the extreme nutrient limitation and periodic drought stress of these deep peat soils at the apex of the peat dome profile.

Secondary Habitats & Farmlands (Including *Acacia* Plantations)
The majority of these transitional vegetation types have been cleared for agriculture in the past, leaving secondary scrubland and herbaceous marshy lands, and only small areas of these habitats extend into the FMU.

The outer seaward boundary of the FMU extends along the former interphase between PSF and the transitional stages from alluvial bench forests on the levees to mangrove forests of varying widths and zonal representation (back mangrove and Nibong *Oncosperma* forests through to *Rhizophora* to sea-fronting accreting forests of *Sonneratia* and *Avicennia*, and salinity-influenced Nipa *Nypa fruticans* stands).

Wild pig *Sus scrofa* appear to be abundant in these areas, and the frequent spoor and droppings of Sambar Deer *Cervus unicolor* observed in remnant mangrove backswamps and coconut plantations suggest that this ungulate is common here as well. The presence of Bearded Pig *Sus barbatus* has not been confirmed, but its presence cannot be discounted. Long-tailed Macaques *Macaca fascicularis* were also observed in remnant patches of trees. Plantain Squirrel *Callosciurus notatus* appeared to be the most common squirrel seen and heard in secondary scrub forests and coconut plantations.

Typical birds in this habitat were Greater Coucal *Centropus sinensis*, Lesser Coucal *C. bengalensis*, Magpie Robin *Copsychus saularis*, Yellow-bellied Prinia *Prinia flaviventris*, Plain-throated Sunbird *Anthreptes malaccensis*, White-rumped Munia *Lonchura striata* and White-headed Munia *L. maja*.

The areas planted with *Acacia crassicarpa* support very few wildlife species. The only mammal recorded here was Pig-tailed Macaque, probably displaced animals or groups moving between remaining forest patches. Pigs will regularly use plantation areas, though none were observed. Birds recorded here are typical secondary scrub species as described above. Some species of birds of prey will include plantations areas within their hunting range, such as Changeable Hawk Eagle and Crested Serpent Eagle. During migration, birds of prey can be seen in almost every habitat, including plantations.

Mangroves, coastal waters and intertidal habitats
Although not present in any significance within the FMU (fingers of remnant, degraded back-mangrove forests extend slightly into the FMU in a few areas), this ecosystem is in close association with the FMU in terms of proximity.

Formerly a major representation of coastal mangrove forest and associated intertidal mudflats and sandflats was present here, leading this stretch of coastline to be proposed as a protected area[7].

The mangroves along the lower Kampar form part of the east Sumatran mangrove forests, classified under the WWF Ecoregions as Sunda Shelf Mangroves (IM1405). This area was identified as an important wetland site in Indonesia (Wibowo & Suyatno, 1997) and part of the range of the Milky Stork *Mycteria cinerea*, with six seen at the Kampar estuary in February 1999 (S. J. M. Blaber *in lit.* 1999). Lesser Adjutants *Leptoptilos javanicus* make occasional use of the area, including one seen during surveys and reports from locals.

The coastal wetlands of Riau are an important part of the East Asian-Australasian Migratory Flyway, the migratory route taken by shorebirds and waterbirds heading south from the northern winter (Wetlands International, 2003). 64 species of shorebirds are known from Indonesia, 45 of which occur on Sumatra (Yus Rusila Nor, 1994). The mouth of the Kampar has a well-defined coastline, without the typical inter-tidal mudflats upon which wintering shorebirds are dependent. Mid-channel sandflats and mudflats are present, but only during the very lowest tides, and do not support significant numbers of wintering waterbirds.

The Grizzled Leaf Monkey *Trachypithecus villosus* is confined to the narrow belt of remaining mangrove forests. The species may not persist in the long term. The coastal waters support a population of Irrawaddy Dolphins *Orcaella brevirostris*, present in the deeper channels throughout the year according to local fishermen. They have been two whale strandings: locals report unidentified whale (length: 15m, height: 1.8m, width: 3m) stranded at Desa Segamai in 2002 and a dead whale (unidentified) weighing 13.5tons washed up at Pulau Muda in 1996. (PT Satria Perkasa Agung, 1999).

The avifauna of the mangrove forest is typical, with four Kingfisher species, Chestnut-bellied Malkoha *Phaenicophaeus sumatranus*, Common Iora *Aegithina tiphia*, White-chested Babbler *Trichastoma rostratum*, Pied Triller *Lalage nigra* and Pied Fantail *Rhipidura javanica*. Two migratory species, Black-capped Kingfisher *Halcyon pileata* and Eye-browed Thrush *Turdus obscurus*[8], were seen in mangroves. A Dog-faced Water Snake *Cerberus rynchops* was seen in mangroves at Pulau Tugau.

2.4.4 Conservation Value for Globally Threatened Species

Table 3 summarises the globally significant species known to occur within the FMU. Definitions of the categories of threat according to IUCN are provided in Appendix 5.

Table 3. Globally-significant species occurring in the FMU

	CR	EN	VU	LOW RISK			TOTAL
				Nt	Cd	Dd	
Mammals	1		2	3		3	9
Birds			2	16			18
Reptiles & Amphibians				1			1
Total	1		4	20		3	***28***

Refer to Appendix 5, Glossary of Terms for definitions of criteria of threat.

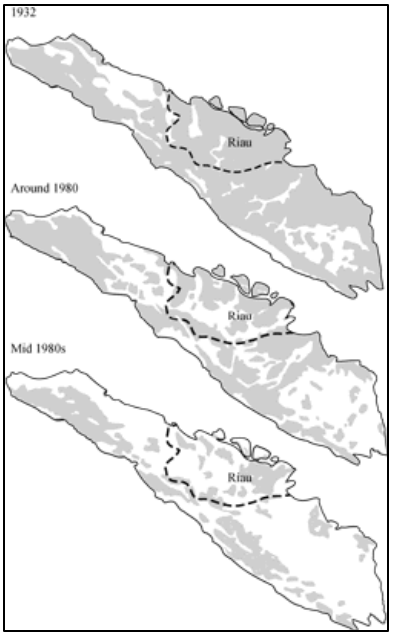
[7] Referred to as Bakau Muara Kampar (WCMC, 1997; Wibowo & Suyatno, 1997)

[8] A north-Asian species wintering in the Sumatran mountains above 1,000m (MacKinnon & Phillips, 1993), but recorded on the coast during passage.

2.5 Social and economic profile, impacts, and context of communities within the FMU and surrounding landscape

Like other major lowland river basins in eastern Sumatra, the peat forests of the Kampar river basin have a long history of natural forest disturbance, degradation and loss. Logging by licensed and unauthorized enterprises, and land clearing for small- and large-scale agriculture and for timber plantations as well as forest fires resulting from these development activities have inexorably eroded natural forest ecosystems and the livelihoods of those who depend upon them directly or indirectly for water resource and fire protection. Conflicting land claims among local communities, concessions and government have frustrated efforts to slow the pace of deforestation.

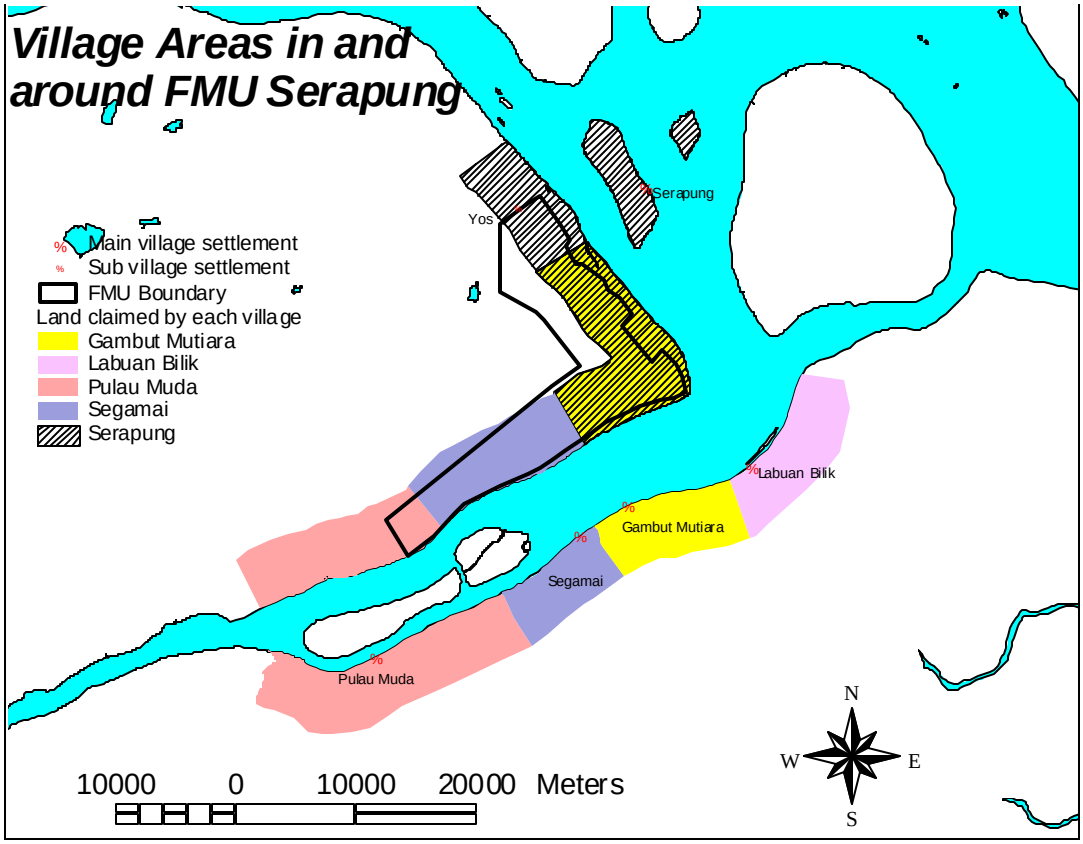
Deforestation in lowland forest areas in general in Riau province has been frequently reported by a wide range of authors and institutions (CEPF 2003; DtoE 2003; Jarvie *et al.* 2003a, b; MoFr 2003; Obidzinski 2004; Sijabat 2004; Suyanto *et al.* 2004). The root causes of deforestation, though arguably more intense in recent years, have been at work for many years in Riau, and the Kampar river basin, as elsewhere in Sumatra (see figure 4, Matthew & van Gelder 2002).



The landscape of which the FMU is a part, however, appears to have suffered lower levels of exploitation than in the neighbouring major river basins to the north and the south. Various factors may account for this such as remoteness from urban and agricultural development centers as well as higher-cost conditions for exploitation.

Four villages consider that the FMU is adjacent to or within their land area, from east to west, the villages of Pulau Muda, Segamai, Gambut Mutiara and Serapung. As can be seen in Figure 5, the main settlements of the first three are located on the south bank of the Kampar river; north and south riverbanks are separated by 5 km here in the lowest reaches of the river. None of these three villages have even small settlements on the north side of the Kampar river where the FMU is located, except for a handful of groups of a few simple farm dwellings along the coastal strip between the FMU and the river or the coast. The only settlement of any consequence on the FMU side of the river consists of 40 households along a locally-built canal running close and parallel to the north boundary of the most northern boundary of the FMU. Within the mainland area of Serapung village (its main settlement located off-shore on Serapung island), this community refers to itself as a sub-village or *dusun* although it is not yet formally established as such. Located in the work area of a previous logging company, PT. Yos, this settlement is referred to in the present report as Yos.

Figure 5. Villages (*desa*) and Settlements nearby the Serapung FMU



Inter-village relationships are complicated by uncertainty over village boundaries in and around the FMU. Until a few years ago, village land on the north side of the Kampar river and the east-facing coastal area was clearly divided between Pulau Muda and Serapung, respectively. In 2003, however, Segamai and Gambut Mutiara, once sub-villages or *dusuns* but having grown sufficiently, and now full villages, each claim land in the riverine and coastal strip alongside the river. The Pulau Muda – Segamai border has yet to be formally agreed upon. More problematic still are the Gambut Mutiara – Serapung claims. Serapung does not recognize any land control by Gambut Mutiara, that cites the creation of a new sub-district (Kecamatan) in its claim to authority over all land between Mata Koli river and the mouth of the Tugau river.

Traditionally, village land on either side of the river extends at least 5 km inland. Given that the riverine and coastal borders of the FMU are in places no more than a kilometer from the riverbanks and shore, overlapping claims of FMU and village communities have been inevitable.

All four villages are so-called *muara* river villages in contrast to upstream *pangkalan* villages that used to be important staging grounds for estate crop commodities such as coffee and rubber (Kuniyasu 2002). Historically, *muara* villages were poorer. The replacement of river transport with roads for most commodities, increased employment opportunities in downstream timber and oil palm plantations and above all greatly increased opportunities to sell timber from village forests, all have transformed this socioeconomic equation. In general, therefore, downstream *muara* villages have risen in economic importance relative to upstream *pangkalan* villages.

Even after losing the sub-village of Segamai Barat (to become Segamai village), Pulau Muda remains the most populous village community with 910 households (*Kepala Keluarga* or *KK*). Serapung village has 710 *KK* while the two new villages Segamai and Gambut Mutiara are much smaller with 303 and 330 *KK*, respectively.

Table 4 shows primary livelihood strategies. Farming has long been the primary livelihood for villagers (more than 75% of all *KK*), though periodically farming may not be the main source of cash income. The highest proportion of farmers is among the pioneer community of Yos with high subsistence reliance on farming until their coconut palms start to yield and supply local markets. Fishing ranks second as a livelihood in all communities except for Gambut Mutiara where livestock is second in importance. Though not in official village statistics, in Pulau Muda and Segamai up to 10% of households may be employed by either AA or the nearby MGI oil palm plantations.

Table 4. Livelihood Sources Reported by 5 Local Communities Accessing Natural Forest in FMU Serapung

Primary Livelihood	**Proportion of Local Community Households** (HH or *KK*)				
	Pulau Muda (*910 KK*)	**Segamai** (*303 KK*)	**Gambut Mutiara** (*330 KK*)	**Serapung** (*706 KK*)	**Yos** (*40 KK*)
Farming	80	90	75	75	100
Fishing	10	5	5	10	<1
Trade	2	< 1	4	5	<1
Livestock	1	< 2	15	8	<1
Craftsmen	<1	< 1	-	1	<1
Traditional healer, mid-wife	<1	<1	<1	<1	<1
State-employees	<1	< 1	1	< 1	<1

Notes:
/1/ From village statistics except for Yos for which data by interview only.
/2/ No reference to wood harvesting. Some households with one of the above primary livelihoods are also involved in logging either as labourers or managers of small-scale operatons. In recent years, wood harvesting income has become a primary source of livelihood for many farmers.
/3/ HH = household or *Kepala Keluarga = KK*

The data in the above table, derived from village statistics, make no mention of small-scale wood industry from logging to sawmilling, most of which are unauthorized by government forestry agencies and are referred to in this report as illegal or unauthorized logging.

Moving downstream towards the coast, smallholder coconut cultivation in *muara* villages from Pulau Mudah to Labuan Bilik and beyond, becomes more important as a farming system from the river's edge inland south to small areas of natural forest on the other side of which forest has been replaced with the MGI oil palm plantation. Traditional drainage systems that characterize peat swamp agriculture become more sophisticated, especially those managed by Bugis farmers who come originally from southern Sulawesi. In recent years, smallholder oil palm cultivation has begun to replace coconut at the margins. It is the preferred crop in Pulau Muda where the small amount of remaining inland natural forest on the south side of the Kampar river is coverted to agriculture. In all villages, fruit

trees are also cultivated; rambutan grows particularly well in the peat soils. Housegardens (*pekarangan*) are another common feature.

Table 5, compiled mostly from interviews, shows how important small-scale timber harvesting and sawmilling can be. As much as 70% of cash income has originated from logging and milling activities in the informal sector. This table is a reminder that livelihood strategies among villagers are typically diversified. Coconut farmers are not just coconut farmers. Households may include both farming and logging activities. Nowadays, all the commercial, informal logging in all four villages occurs on the north side of the river, in and around FMU Serapung.

Table 5. Livelihoods of Five Local Communities Adjacent to FMU Serapung

Primary Livelihood Sources	Range of Households
Farming (food crops, coconuts, sago, fruit trees)	70 – 99
Fishing (Kampar, tributaries and canals)	5 – 15
Wood (harvested from natural forest for timber and fuel)	15 – 70
Company employment (AA & MGI)	1 – 10
Trading (food, clothing, general purpose)	5 – 10
Traditional Medicine (healing, mid-wife)	<1 – 5
Civil Servants (teachers, health services, security)	<1

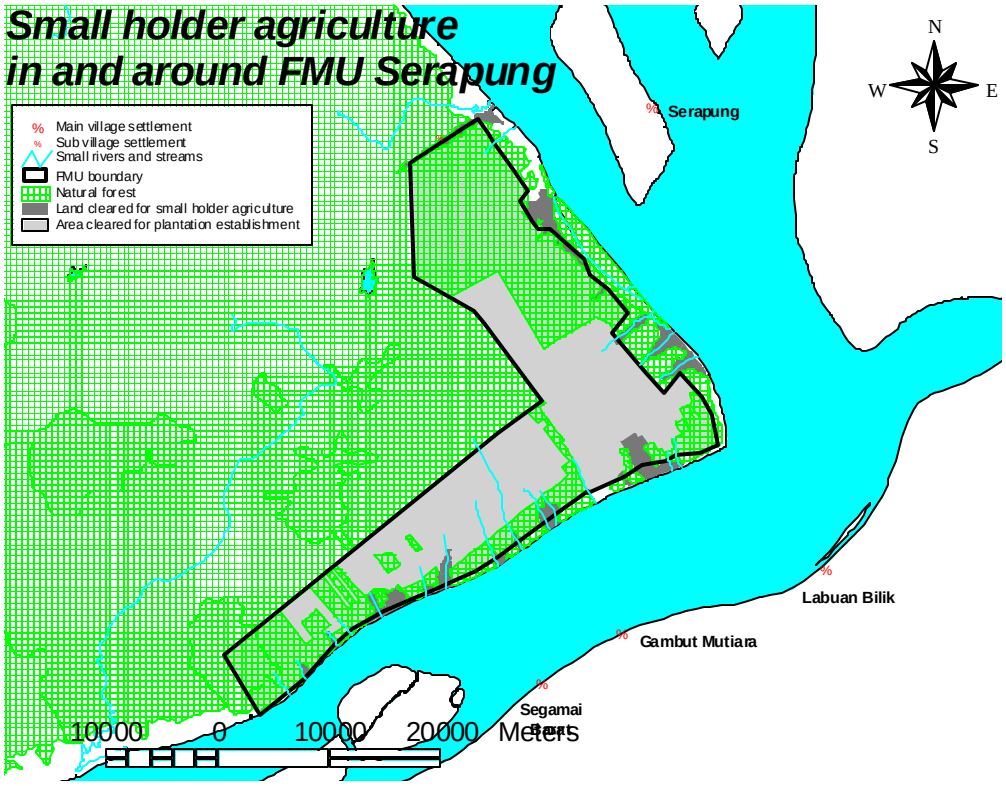
Notes:
/1/ Information for this table was obtained was village statistics and interviews with village executive and council as well as individual households in the villages of Serapung, Gambut Mutiara, Segamai, Pulau Muda and the informal sub-village or dusun of Serapung village known as Yos.
/2/ Households generally diversified, relying upon more than one of the above livelihoods. Some will adjust their portfolio of livelihood strategies seasonally.

The pattern of land use in forests on the north side of the river in the landscape where the FMU is located generally begins with timber extraction, in part using the old logging routes of past concession companies. Wood rails (*kuda kuda*) or canals are used for log transport to the Kampar river or east coast. Once the timber extraction potential has been exhausted, loggers move to other forest areas. Farmers move in, clear about a hectare of logged-over forest and first cultivate corn. After two or three harvests, they plant coconuts or abandon the area. Coconut cultivation sometimes fails because of the depredations of rhinoceros beetle (*Oryctes rhinoceros*). Thriving in rotting vegetation, these pests may be worse close to the land-clearing activities of the FMU where wood refuse is left to decay naturally (because of the government's zero-burn policy). There are only a few good-quality and sizeable coconut areas in the coastal agricultural area. Close to the river bank, clumps of sago palms are sometimes cultivated. There is no agricultural development in and around the inland side of the FMU, except for Yos in the north.

Figure 6 illustrates this agricultural land use pattern in and around the FMU. Note the small number of dwellings and the characteristic inverted "V" shape of long-established

smallholder agricutlural areas, some of which are fallow, few of which have more than a handful of dwellings. Interpretation of satellite imagery identified 35 separate smallholder areas, from 3 to 238 ha (on average, 54 Ha/site), in and around the FMU. This amounted to a total area of 1,877 ha, including a large area of fallow or abandoned land.

Figure 6. Smallholder Agricultural Land Use in and around Serapung FMU



Only about half (16) of the sites had dwellings, mostly simple huts for temporary living, with 1 to 36 dwellings per site. Corn would have been cultivated in most of the area. Coconut cultivation, the traditionally preferred end point of smallholder farming in the area, is nonetheless present over only a small area. The total area is a fraction of coconut areas in Pulau Muda, Segamai and Gambut Mutiara areas on the other (south) side of the river. Part of the reason may be the high incidence of coconut pest damage caused by the Oryctes beetle (see above). 10 of the 35 sites had coconuts, of which 6 had dwellings. Some dwellings might be hidden by coconut palms over 6 years old. There did not appear to be any coconut planting over 10 years old.

Oil palm cultivation is becoming more popular among farmers, in large part because of cost-effective opportunities to sell fresh palm bunches to oil palm processors connected to plantations such as MGI. Plans for a 100 ha oil palm plantation in the Yos area may herald an expansion of oil palm elsewhere around the FMU.

Sustainable natural forest uses by local communities, as referred to by Kuniyasu (Kuniyasu 2002), is not apparent, certainly not as far as timber harvesting is concerned. There are few hunters, fishermen, and gatherers of wild vegetables and medicinal plants who use the forest for its produce. Wild meat, vegetables and medicinals form only a small part of the diet of village communities with access to the forests in and around the

FMU. Detailed records of basic needs from natural forest sources illustrate this point for each of the five communities in tables in the technical annexes.

Although timber harvesting by local and outside communities is not sustainable, it is wrong to assume that all villagers are involved in and fully agree with such practices. Benefits from illegal logging are not widely shared among local communities and some rural livelihoods are damaged. For example, in Yos, many farmers' fields were flooded when illegal loggers linked the FMU's main north-south canal to their canal to transport logs to a coastal harbour.

With few exceptions, the five local communities with access to FMU forests do not perceive a major role for natural forest management in their scheme of income-earning. For these communities it would appear that the forest is not valued as forest per se (to be continuously managed or protected as a forest) but valued primarily for other purposes such as a source of timber at the lowest cost (regardless of whether or not the forest survives), or as a means to obtain land for agricultural development.

3. Assessment Methodology

The following sections describe the manner by which SmartWood applied the Indonesian HCVF toolkit to identify HCVs and delineate HCVF(s) in the FMU of Serapung.

3.1 Development of the Assessment Methodology

The current assessment of Serapung is the second HCVF assessment SmartWood has conducted for APP. The prior HCVF assessment was considered "Phase III" of an approach which had 3 phases – one for providing clarification to APP on the concept of HCVF, one for development of a methodology that would be applied to the HCVF assessments, and one for the implementation of the first HCVF assessment in Pulau Muda District. In overview, the Serapung assessment carried forth where Phase III left off, as described below.

Phase III: SmartWood began the pilot field HCVF assessment for the Pulau Muda district on 19 July and concluded the field work on 30 July 2004. Report writing took place between 02 and 23 August 2004, when the draft report was submitted to APP and the two independent peer reviewers. The report was also reviewed by Richard Donovan, SmartWood Director and Chief of Forestry, Rainforest Alliance. The report was revised to incorporate the comments from all reviewers and APP. After technical clarifications, the report was finalized by SmartWood. A publicly available version of the final report was published on the SmartWood website on October 10, 2004.

Serapung: SmartWood shared the results of the first HCVF assessment publicly and met briefly to discuss the results with WWF. After receiving feedback from WWF, and some others who read the HCVF assessment report, SmartWood agreed to undertake the assessment of Serapung. The significant comments received by reviewers of the report related mostly to the presentation of information, visually and graphically, so that it would be more readily grasped by the reader. We have made some improvements in this regard. There were no significant changes to the assessment checklist or other elements of the assessment process. The same team was used as before. SmartWood began the field HCVF assessment for Serapung on 1 Nov and concluded the field work on November 8. Report writing took place between November 10 and December 10, 2004. The draft report was submitted to APP and one independent peer reviewer on December 13, 2004. The report was finalized on February 4, 2005.

3.2 Defining High Conservation Values (HCV)

The FSC (2000) has established six definitions of High Conservation Values (HCVs). Components to determine the presence of these HCVs were developed by Proforest, through the development of a Global HCVF Toolkit framework and as interpreted by the Indonesian HCVF toolkit, which follows a format similar to the Global Toolkit. Identification of the presence of HCVs in the Serapung FMU was based on the definitions provided in the Indonesian HCVF toolkit. These six HCV definitions and their main components are:

HCV 1: *Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia)*;

HCV component threshold definitions:

1.1 Protected areas - All protected areas and proposed protected areas are considered HCVs.
1.2 Critically Endangered Species - Any species listed as critically endangered by IUCN or on Appendix I of CITES that is actually or potentially present within the FMU is an HCV.
1.3 Concentrations of Threatened or Endangered or Endemic species - A forest containing a concentration of threatened of endangered species or a concentration of endemic species, as recognised by national and international experts, is an HCV.
1.4 Critical Temporal Concentrations - A globally significant concentration of migratory species or a nationally significant temporary concentration or migration route is an HCV.

HCV 2: *Forest areas containing globally, regionally, or nationally significant large landscape level forests, contained within, or containing the management unit, where viable population of most if not all naturally occurring species exist in natural patterns or distribution and abundance.*

HCV component threshold definitions:

2.1 A FMU which is a large landscape forest is considered an HCV.
2.2 A FMU which is an integral part of a large landscape forest is considered an HCV.
2.3 A FMU which contains viable populations of most naturally occurring species is an HCV.

HCV 3: *Forest areas that are in or contain rare, threatened or endangered ecosystems.*

HCV component threshold definitions:

3.1 Where and FMU contains significant size of these rare, threatened, and endangered forest types and has been identified as a conservation priority area by an independent organization, then the forest types is an HCV. Rare, threatened or endangered ecosystems that are located outside the FMU that are impacted heavily by FMU activities is also an HCV.

HCV 4: *Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control)*

HCV component threshold definitions:

4.1 Where forests provide the only source of water for daily use to a community, this will be an HCV.
4.2 Forests that are protected, DAS Super-Prioritas and Prioritas, other significant DAS and Sub-DAS areas designated by relevant experts, as well as cloud forests, will be HCVs.
4.3 Any forest boundary that protects against large scale fire is an HCV.
4.4 Any forest that has a critical impact on the forest services that agriculture or aquaculture are dependent upon is an HCV.

HCV 5: *Forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health)*

HCV component threshold definitions:

If local communities obtain essential fuel, fodder, medicines, or building materials from the forest, without readily available alternatives, then the forest is an HCV. HCV5 applies only to basic needs.

HCV 6: *Forest areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance in cooperation with such local communities).*

HCV component threshold definitions:

If forest areas are critical to the traditional cultural identity of local communities, e.g., restricted-use and reserve forest, ancestral burial, spiritual, religious, and taboo sites, then the forest area will be HCV.

To assess and determine the presence of conservation values that would be considered HCV according to these definitions requires highly trained ecological and social experts; further consultation with relevant stakeholders (communities, government bodies, forest managers, scientists, and NGOs); access to baseline inventories, data sets, maps, and spatial imagery; and professional judgment based on field evaluation. The steps taken to perform these assessment tasks are described below.

3.3 HCV Identification and HCVF Delineation

3.3.1 Steps to implementation of field assessment, data collection, and analysis

Step 1. Preliminary Assessment and Preparation for Field Assessment

Preliminary assessment of spatial data and literature supported the decision to proceed with an HCVF assessment, as it was evident that some, and potentially all, HCVs were present.

- Recent satellite imagery was reviewed. It was evident that this landscape is one of a few remaining tracts of large landscape forests of the East-Central Sumatran peat swamp forests.
- The forest within the FMU, located at the south-east corner of the Danau Pulau Besar - Tasik Serkap landscape, is contiguous with forest in four small protected areas, and part of a large landscape of peat swamp forest, as shown by satellite imagery.
- GIS overlays of concessions already licensed by the government for conversion indicated that planned land use changes for the landscape will further reduce the area of contiguous forest.
- The preliminary HCVF assessments of the Riau PSF by WWF (Jarvie *et al*. 2003a, c) were evaluated and indicated the potential HCV presence in the natural forests within the FMU as related to other PSF areas.
- Literature research included consultation of indices and databases of endangered and threatened species, maps, government legislation, and definition of various PSF habitats within the East-Central Sumatran peat swamp forest ecoregion.

Step 2. Field Observations and Data Collection

The SmartWood HCVF assessment checklist identified information to be acquired from the company and other sources, and that from direct field observations. Due to the limitations of company ecological data, the assessment would rely greatly upon the expertise of the team to collect primary data.

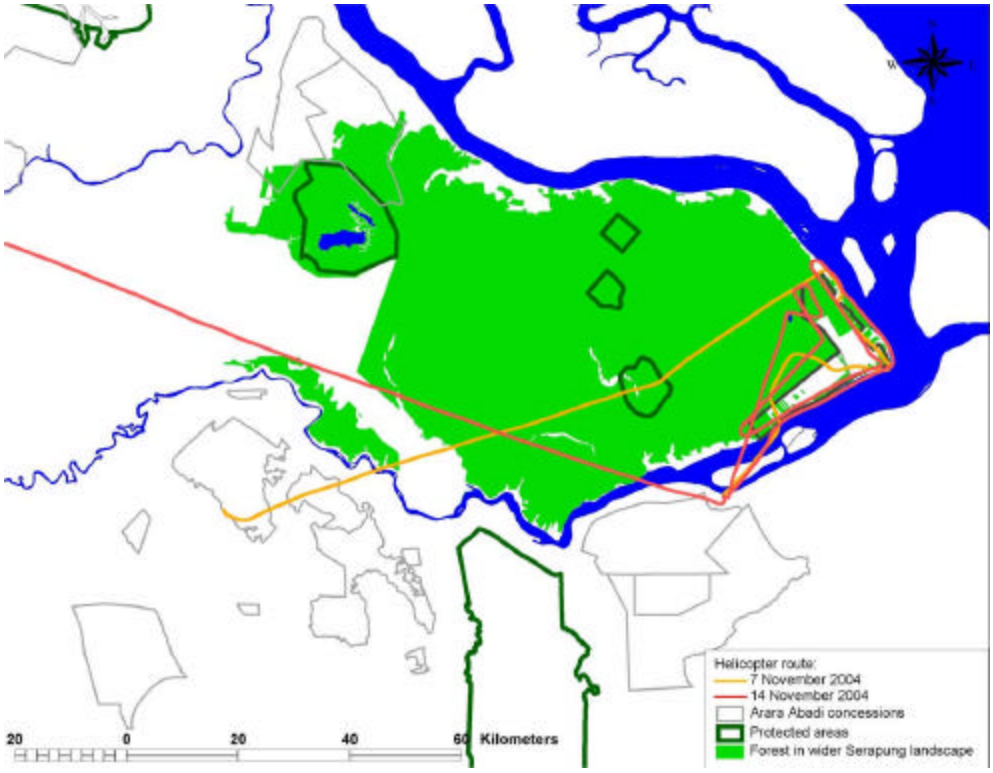
- Data were gathered through meetings with APP/SMG and AA staff and workers at their Jakarta, Perawang, and Pulau Muda District offices. Data were acquired firsthand by meeting with members of local communities.
- Observations, ground-truthing, and rapid survey of conservation values were conducted for species, ecosystems, forest services and community resource uses (basic needs and cultural). These were obtained through field visits to locations within and surrounding the FMU on foot, motorbike, speedboat, and small boats.
- Baseline spatial information on forest cover and landscape features was obtained from remote-sensing imagery (SPOT2A, May 2004 and Landsat7, August 2002).
- Vegetation and habitat mapping of the FMU was not available, and thus required primary data from aerial reconnaissance and preliminary ground-truthing

? Species inventory baselines were developed through anecdotal information, available literature on the Kerumutan Wildlife Reserve, and from the company AMDAL reports. [Data were sparse and/or inaccurate, requiring primary data gathering at accessible locations.]

? Background information on species and conservation status was gathered from literature searches and documents provided by APP, from interviews with local people and staff / workforce [although turnover of the largely immigrant workforce meant few sources of reliable local knowledge], and from conservation organizations. In addition, the wildlife expert at KSDA, and the botanist with Dinas Kehutanan in Pekanbaru were interviewed to review species distributions and conservation plans for the landscape forest that includes the FMU.

? 2 helicopter aerial surveys of the concession and landscape (See Figure 7 for a map of the flight path.)

Figure 7. Helicopter aerial survey route



Step 3. Data analysis to determine potential HCV areas

The data analysis instrumental for the determination of HCV areas required significant professional expertise from the ecologists and social scientists working in the forest and villages. The comparative analysis of different key data sources is outlined here to support the rationale for HCV identification presented in section 4.

Habitat

? Evaluation of topographic maps to determine soil and hydrological conditions to assist in defining habitat distinctions.

? Analysis of recent satellite images to delineate remaining forest areas and their contiguity or condition within the FMU.

- Comparison of natural forest types sampled at a few locations to characterize structure, indicator plant species, species diversity and abiotic conditions within the FMU.
- Analyzing timber crusiing data using vernacular tree to evaluate habitat distinctions, and comparing these with new samples gathered at at other locations. (Botanical names had been established during HCVF assessment and the nearby Pulau Muda FMU.)
- Collecting leaf samples to verify botanical names and document uniqueness of tree morphospecies in tree disversity plots; consultation with botanical references, published studies and colleagues to verify identities of peat swamp species.
- Classification of forests and riparian areas into habitat types defined by vegetative structure and floristics, and combinations of peat depth and drainage.
- Observations of vertebrates to establish indicative representation of faunal communities in relation to vegetation types or habitats.
- Mapping habitats within the FMU through direct observations from helicopter overflights and photographic analysis with computerized enhancement.
- Reviewing ecological data collected in August 2004 from the nearby Pulau Muda FMU.
- Analysis of satellite imagery of the larger area of the Kampar estuary to determine potential hotspots and habitats of significance to migratory waterbird and raptor species

Species

- Analysis of available information and published sources to establish a baseline for the FMU.
- Evaluation of globally significant species in terms of habitat requirements and ecological behaviour through published sources of ecological knowledge on these species.
- Analysis of habitat requirements provided the first layer for each target species, which was then correlated with presence of preferred habitats within the FMU, and ground-truthed where possible.
- Consultation with individuals and institutions for reference information on vertebrate species.
- Evaluation of responses from tiger experts from questionaire developed to evaluate the importance of the FMU as critical habitat for landscape level tiger population

Social

- Data on the importance of FMU forest areas to local community values primarily relied upon interviews with various village groups (e.g., village executive and council, hunters, fishermen, traditional mid-wives (*bidan kampung*), healers (*dukun*) and *tiger shamans*, to fill out data sheets on the significance of FMU forests as sources of basic needs or as areas of cultural value.
- Social data included estimates of livelihood production trends, alternatives and sustainability.
- Watershed, river, well and canal observations were used to determine whether there were HCVs related to water resource protection.

3.3.2 Mapping the extent of identified HCVs

The occurrence and distribution of all identified HCVs were mapped using GIS. The use of GIS was necessary to take data collected from hundreds of locations within the FMU and place them on a map. However, the specific location of a particular value (e.g., endangered species) does not immediately translate to a hard HCV boundary on a map. Rather, the team had to interpret species and habitat information to best estimate the real world occurrence and extent of the forest in which the HCV was present. For example, the HCV boundaries for species were delineated based on presence and extent of their identified or predicted preferred habitats, both inside and outside the FMU. Some HCVs were more straightforward to map, such as protected areas within the concession or cultural sites that village elders could describe.

Once the team had classified and ascribed where the HCVs occur within the FMU, a spatial GIS overlay for each HCV definition was produced. Since this would enable putting one GIS layer on top of the other, the technology could facilitate further review and understanding of the final HCVF area.

Overlays represent approximate locations of HCV boundaries and are therefore indicative not prescriptive. Actual demarcation on the ground would be guided by the mapped borders and be subject to ground-truthing but is not expected to deviate markedly from the indicated borders.

3.3.3 Delineating the HCVF Boundary

The final step in the process was to analyze whether the HCV areas mapped in the multiple overlays should concide with the areas delineated as the HCVF boundary.

The team analyzed interacting and other contributing factors and conditions to delineate the HCVF boundary with respect to whether the forest area could be expected to maintain the identified HCVs. The team produced a decision support matrix of criteria to guide final decisions as to whether a particular forest area would qualify as HCVF (and included in Technical Annexes).

The following basic precepts underscore important considerations used in this judgment process:

- Each HCVF area is a viable and functional ecosystem unit itself or has the realistic possibility of future management practice allowing it to become a functional unit.

- Contiguity is paramount in identifying HCVFs. Single large areas of habitat, or mosaics of different habitats, are of higher value and priority than a series of smaller, isolated forest areas.

- Each HCVF protects a significant portion of overall biological diversity and/or safeguards significant local community dependence on forests in the FMU.

- Each HCVF assumes company and local community commitment to effective management, resources and appropriate research to ensure optimal short- and long-term conservation while providing opportunities and knowledge for future improvements within the FMU.

The HCVF (s) arising from the integration of the HCV assessments were indicated on a single HCVF map of Serapung.

3.3.4 Application of the Precautionary Approach

The FSC (2000) recognizes the Precautionary Principle (PP) for decision-making processes about HCVs in the absence of adequate scientific knowledge on the consequences of human impact on forest areas. FSC Principle 9 states that "decisions regarding high value conservation forests shall always be considered in the context of a precautionary approach". The definition of the precautionary approach used by the FSC was ratified during the FSC General Assembly in June 1999. The term is defined as: "Tool for the implementation of the precautionary principle. The term 'principle' is defined as: An essential rule or element; in FSC's case, of forest stewardship.

While there are multiple definitions of the PP in circulation, probably the most widely accepted is from the Rio Declaration, "In order to protect the environment the Precautionary Approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

The IUCN has launched an evaluation into the application, effectiveness, and controversy surrounding the PP in natural resource management, and Cooney (2003) indicates that "considerable ambiguity remains regarding the meaning and context of the precautionary principle … [its] meaning and application are unclear in situations where sources of risk are complex and multiple, which is frequently the case in the context of natural resource management and conservation"

The clearest guidance in the Indonesian HCVF Toolkit on the precautionary approach is with respect to *managing* HCVF. The guidance itself comes from the FSC: "Planning, management activities and monitoring of the attributes that make a forest management unit a HCVF should be designed, based on existing scientific and indigenous/traditional knowledge, to ensure that these attributes do not come under threat of significant reduction or loss of the attribute and that any threat of reduction or loss is detected long before the reduction becomes irreversible. Where a threat has been identified, early preventive action, including halting existing action, should be taken to avoid or minimise such a threat despite lack of full scientific certainty as to causes and effects of the threat" (FSC Principle 9 Advisory Panel, 2000).

For the *identification* of HCVF, the toolkit states that "where doubt exists as to whether an attribute, or collection of attributes, are sufficient to signify HCVs, then the forest manager will treat these attributes as HCVs, until information proves otherwise."

Given the current limited state of knowledge about biodiversity attributes in tropical PSF, a presumptive interpretation of the precautionary principle might conclude that all such forests hold HCV and hence all should be assigned HCVF status. SmartWood has found through its experience in conducting certification assessments in Indonesia that many stakeholders, especially forest managers, perceive the FSC HCVF definitions to imply that all natural forest in Indonesia is HCVF. While the Toolkit does not state this, the present assessment team felt it was important to emphasise herein that the use of a precautionary approach does not begin with a foregone conclusion, but works to fill knowledge gaps wherever possible.

There are two kinds of knowledge gaps surrounding an HCVF assessment, which would probably be similar to others in Indonesia. First, the lack of available baseline inventory data on flora, fauna, human uses, etc. as well as the limited time or resources to conduct comprehensive biodiversity surveys. Second, the lack of scientific knowledge on Sumtran PSF *per se*.

This HCVF identification process applied by SmartWood aimed to introduce as much measurable, observable and objective data analysis through the field assessment and consultation to close the first kind of knowledge gap and require less 'fallback' on the PP when making decisions concerning the presence of HCVs. Nevertheless, there were situations in determining the presence, or extent of the areas considered as HCVs, where the combined knowledge of the team and other expert sources were not sufficient to make a completely informed decision and a precautionary approach was invoked.

4. Determination of High Conservation Values in the Serapung FMU

This section covers the treatment of the observed ecological and social conservation values within the FMU, including their relationship to the surrounding landscape forests, according to the assessment criteria. The assessment team used an Assessment Checklist in the field to determine that each of the guiding assessment criteria was evaluated in order to assess presence or identification of particular values as being HCVs.

For each of the six HCV definitions and their components, findings are provided to describe and analyze the conservation values, and what makes them high conservation values for the FMU within the wider ecological landscape. HCVs and their components are explained within the context of the site and rationale is given for the forest area delineated which pertains to these HCVs.

4.1 High Conservation Value 1

Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered spe cies, refugia).

Four sub-categories (components) have been set to assess the presence of such forest areas, and each are treated separately below.

4.1.1 HCV 1.1 Protected Areas

Definition

The Indonesian HCVF Toolkit states that all protected areas and proposed protected areas are considered HCVs.

HCV1.1 relates to legally constituted protected areas[9] within the country, and how they contribute to conservation of biological diversity in the context of forest management. The objective of this HCV as "gazetted or proposed protected areas within, adjacent or in the immediate vicinity of the FMU are identified as HCVs and protected from any potential impact of FMU operations".

Any protected area within the FMU automatically qualifies as a HCV. Protected areas immediately adjacent to the FMU, in the immediate vicinity or having physical and ecological connection with the FMU are HCVs. Those forests or habitats within the FMU that contribute to protecting the values for which a protected area was established, are given due consideration as HCVs.

HCV 1.1 Site Context

Four wildlife reserves (*Suaka Margasatwa*) totaling 37,000 ha lie due west of the FMU[10]. All are centered on lakes within this large block of continuous PSF, and none are adjacent to the FMU. According to Riau KSDA sources, the Bupati has approved a proposal to greatly expand Danau Pulau Besar, the largest reserve, and the one furthest from the FMU. Although it makes sense that a large contiguous area of this landscape forest be

[9] Protected areas are defined as areas legally gazetted under national laws, and include those equivalent to IUCN categories I-V. Areas proposed for protected area status by the relevant statutory body, but not yet gazetted, are also included.

[10] Suaka Margasatwa Danau Pulau Besar (28,237ha), Suaka Margas atwa Tasik Belat (2,529ha), Suaka Margasatwa Tasiuk Besar / Tasik Metas (3,200ha), Suaka Margasatwa Tasik Serkap / Tasik Sarang Burung (6,900ha).

preserved for conservation, given it is one of a limited number of forest blocks in this PSF ecoregion and might harbour one of a limited number of viable tiger populations (Tilson *et.al.*, 1994), there are no active proposals to create this large conservation area. While KSDA officials stated they would support such a large conservation area, this would be dependent upon active government and/or NGO partners to propose and implement this.

The coastline between the estuaries of the Kampar and Siak (Pulau Tadi) was included in the first regional review of the protected area system conducted by the IUCN in 1986. This site was named Bakau Muara Kampar, and comprised 700 km^2 (IUCN, 1986). This was a proposed protected area under the IUCN Category IV. This proposed PA constituted 200 km^2 of mangrove forest and 500 km^2 of peat swamp forests. This site was included in the Indonesian Wetland Database (Wibowo & Suyatno, 1997) but subsequently removed (Wibowo & Suyatno, 1998).

Although still referred to in some papers and reports, this site was never officially proposed for gazettement under Indonesian law, and subsequently been excluded from un-official plans for proposals for sites to be included under the national protected area system. The mangrove forests have largely been converted into farmlands and estate monocultures, and the peat swamp forests have been severely degraded by previous and continuing timber extraction. It is unlikely that this area would qualify as a protected area in the future, under any of the IUCN criteria.

The Indonesian Important Bird Area (IBA) Directory (Holmes & Rombang, 2001) identifies the area between the Siak and Kampar rivers as an IBA, listed as Site No. 15: Hutan Rawa Gambut Siak-Kampar, covering 550,000ha. The global IBA programme aims to identify, document and conserve a network of globally important areas for the conservation of birds and their habitats using standard, internationally-agreed criteria, through national and local level consultations involving NGOs, experts and government agencies [11]. The premise is that since birds are excellent indicators of overall biodiversity, these areas will be important for other fauna and flora.

The boundary of this IBA excludes the coastal zone, thus not covering the FMU. However, the five species of threatened birds listed under this IBA (Storm's Stork, Lesser Adjutant, Wallace's Hawk-Eagle, Large Green Pigeon & Hook-billed Bulbul) are likely to be all present within the FMU.

While any areas of forest within the FMU potentially contribute to the size and conservation value of the overall IBA, its contribution to protected areas within this IBA is minimal.

HCV 1.1 Rationale for Boundary Delineation
This HCV was not identified or considered to be present, within the FMU and no boundary was delineated for the HCV.

[11] The objectives of the Asian IBA programme are (Birdlife International, 2004):
1. To provide a basis for the development of national conservation strategies and protected areas programmes;
2. To highlight areas which should be safeguarded through wise land-use planning, national policies and regulations, and the grant-giving and lending programmes of international banks and development agencies;
3. To provide a focus for the conservation efforts of civil society including national and regional NGO networks;
4. To highlight sites which are threatened or inadequately protected so that urgent remedial measures can be taken;
5. To guide the implementation of global conservation conventions and migratory bird agreements.

4.1.2 HCV 1.2 Critically Endangered Species

Definition

The Indonesian HCVF Toolkit states that any species listed as critically endangered by IUCN or on Appendix I of CITES that is actually or potentially present within the FMU is an HCV.

HCV 1.2 relates to critically endangered[12] species known to occur within the FMU, their habitat requirements and ensuring their continued existence and viability is not compromised by operations. The objective of this HCV is that critically endangered species dependent upon, or using, the FMU are identified and their ecological requirements protected and managed.

HCV 1.2 Site Context

The assessment the team has reason to believe there is tiger presence in the general area, possibly utilizing forest in the FMU, as based on anecdotal evidence from locals. The details of these findings are summarized below.

Interviews

The likely presence of tiger in Serapung was supported by numerous reports from the local populace and contract workers within the FMU. Interviews with 21 groups of respondents were recorded. Respondent groups were from three categories:

- ***Contract workers*** of the company, working along the canals and within the forest of the FMU. This group varied from tree-cutters and machine operators to boat drivers and company management staff.

- ***Illegal Loggers*** - Local community members involved in independent, unauthorized timber extraction within the FMU. Respondents interviewed ranged from logging camps within the forest, boat drivers to those met in the villages.

- ***Farmers*** - Local community members involved in farming on lands outside the FMU boundary, including permanently-settled individuals at Desa PT Yos, located on the northern boundary of the FMU.

Six respondent groups said yes to the presence of tigers within the FMU boundaries, and fifteen respondent groups said yes to the presence of tigers outside the FMU boundaries. These reports would require further investigation to confirm actual tiger presence. See Table 6 below regarding respondent remarks.

Table 6. Responses of interviews concerning tiger presence in Serapung

	RESPONDENTS	REMARKS
Direct sightings of tigers	2	Both of two tigers traveling together, one sighting inside and one outside (at forest edge farm) the FMU.
Heard calls of tigers	2	Both from PT Yos, from their houses at night
Seen tiger spoor (foot prints)	7	2 from within FMU, 5 from outside FMU at forest edge and farms.
Related story of tiger attack on contract worker	8	Stories vary considerably, but consistent in that the worker had caught a tiger cub in a canal and ate it, and was subsequently killed

[12] Refer to Appendix 5 for IUCN Red List Categories

along canal		by a tiger.
Never heard of tigers in the area	2	

Information from local communities suggest that the area of forest at the true left bank of the Kampar river was a spiritual forest in the past, and named Tanjung Datuk [13] because tigers were frequently seen there. It is unknown whether this patch of forest, now isolated from the remaining coastal strip further north of the FMU, is still used by tigers. In any case, given its degraded state and isolation, it is unlikely to contribute significantly to potential viable habitat to a tiger population.

Direct surveys

No positive field evidence was obtained during the field assessment. Foot transects were conducted at seven locations (detailed in Table 7 below), covering 11.4km. No physical signs of tigers were found.

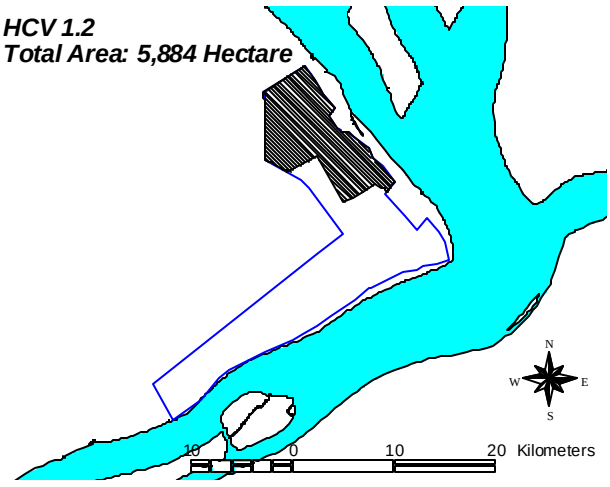
Table 7. Wildlife survey transects during HCVF assessment at Serapung

	TRANSECT LOCATION	EST. DIST / km
Inside FMU	Primer Canal I: East Secondary Canal 11.5km	1.1
	Primer CanalI: East secondary Canal 14km	1.2
	Primer Canal III: East secondary canal 8.5km	1.0
	Primer Canal III between 7 & 8.5km	1.5
	Primer Canal II: south secondary canal 5.5km	1.4
Outside FMU	Northern boundary Canal (PT Yos Seraya)	4.0
	Sg. Tugau to coconut farm	1.2
	TOTAL	**11.4**

The Tiger is listed as Endangered globally (IUCN, 2004), but the Sumatran sub-species of the Tiger *Panthera tigris sumatrae*, endemic to the island of Sumatra, is listed as critically endangered (IUCN, 2004). Any species listed as critically endangered is automatically an HCV.

HCV 1.2 Rationale for Boundary Delineation

Although the tiger is an HCV in its own right, its distribution in the area, and extent of its usage of forest within the FMU cannot be determined at the present. The field assessment found no direct evidence of tiger presence within the FMU.



Given this situation, it is not possible to delineate an HCVF boundary that fulfills the conservation requirements of a tiger population. More specific information is required to enable accurate and appropriate HCVF boundary delineation.

[13] The word *Datuk* in the Malay language means grand-father. Its usage has many other meanings as well, but always inferring an element of reverence or respect. Superstition forbids calling the tiger by name (Harimau), and tigers are usually referred to as *Datuk* instead.

Until a study is commissioned to obtain this information, an indicative HCVF boundary has been delineated.

This boundary should be treated as a defined target area to be covered by the study within the FMU. The study however, will cover a larger area to obtain comparative data to enable accurate decisions to be made with regards the defined forest area within the FMU.

This is a precautionary approach and should be understood by the reader to be part of a process for which a more conclusive, thorough boundary – which could very well modify the initerim boundary – is to be expected. Following the completion of the study, this indicative boundary will be revised by SmartWood appropriately into a final HCVF boundary.

Through the course of the team's field observations, no other species fulfilling the criteria for HCV1.2 were identified (i.e. no white-wing ducks or Storm's stork were observed, as was the case in the Pulau Muda assessment, and no suitable habitat found within the FMU). No CITES appendix 1 species were identified.

Rationale & Justification for this Approach

- The tiger is a HCV of the highest degree in Indonesia and globally. The most recent estimate of the tiger population size on Sumatra is between 400-500 animals (Seidensticker, *et.al.*, 1999). The IUCN Cat Specialist Group, using only mature breeding individuals, estimates the population at below 250 animals, with no single population much larger than 50 mature breeding individuals (IUCN, 2004). This means that the species is facing immediate danger of extinction, particularly given recent estimates suggest that these animals are divided into 26 isolated (i.e. disjunct) populations (Tilson, *et.al*, 1994).

- Results of the *Sumatran Tiger Population and Habitat Viability Analysis (PHVA) Workshop* estimate that 400 (out of 500) are within six protected areas, and the remaining 100 are spread thinly in un-protected areas which will be soon lost to agriculture (Jackson & Kemf, 1996; Ministry of Forestry, 1992). The *Indonesian Tiger Conservation Strategy* (Ministry of Forestry, 1992) emphasizes the need for conservation measures outside protected areas, and particularly in Production Forests. Given adequate prey bases and low poaching pressure, tigers have a high possibility of persistence outside protected areas (Karanth & Stith, 1999).

- If a population is present within the area, including the FMU, there is a potential for a conflict situation to develop between people and tigers as large-scale forest conversion takes place. Tigers (and elephants) are a principle source of conflict in much of Asia (McDougal, 1987; Nowell and Jackson, 1996) and the same is true in Sumatra (Tilson & Nyhus, 1998). There is concern that on Sumatra, forestry practices have not taken human-wildlife conflict in consideration (Nyhus & Tilson, *in press*). Lessons must be learnt from the extinction of the Javan tiger, where extermination of problem tigers as core wildlife habitat diminished played an important role in the demise and eventual extinction of the Javan tiger in the 1980s (Hoogerwerf, 1970; Seidensticker, 1987).

- If present, an appropriate HCVF boundary will serve both the conservation needs of the tiger and the avoidance of a conflict situation. Plantations, production forests, and other managed forest systems, offer additional opportunities to expand habitat

available for biological diversity beyond the boundaries of core protected areas (MacKinnon, *et.al.*, 1986; Sayer, 1991).

- If confirmed not to be present within the FMU, or the FMU does not constitute an integral portion of the habitat and range of the tiger population, then this HCVF will not exist within the FMU.

HCV 1.2 Rationale for Exclusions (if applicable)

The remaining forests at the cape (Tanjung Datuk) have been excluded from this indicative HCVF boundary because it is separated from the northern block by a large area of open secondary scrubland and planted areas of *Acacia*. Although this area is also potential habitat for tigers, its isolation from the existing contiguous block of forest to the north would diminish its value for tigers. In addition, only a small portion of this area consists of PSF in a relatively less degraded state, the majority of the patch seriously degraded and dying from extended inundation from flooding caused by canals draining into the forest.

4.1.3 HCV 1.3 Concentrations of threatened or endangered or endemic species

Definition

The Indonesian HCVF Toolkit states that a forest containing a concentration of threatened or endangered species or a concentration of endemic species, as recognised by national and international experts, is an HCV. The HCV relates to areas which support concentrations of significant species. This implies a comparison between such areas, or habitat types, and other habitats present. These HCVs will be areas of exceptional importance to more than one globally significant species.

HCV 1.3 Site Context

Globally threatened and endemic species undoubtedly occur within the forests areas of the FMU. Table 8 below lists those that have been recorded either directly or from local sources of information.

Table 8. IUCN Status of Species Potentially Occurring at FMU

SPECIES	STATUS	DESCRIPTION
Sumatran Tiger *Panthera tigris*	**CR**	Critically endangered and facing imminent extinction on Sumatra. Remaining distribution related to habitat and prey availability. Primarily occurs in lowland, montane and freshwater swamp forests, but frequently occurs in PSF where contiguous with primary habitats (Franklin *et.al.* 1999). **No direct observations or sign by team during surveys, but locals indicate they are present. Categorised by assessment team as probable presence in the general area, and possibly present within FMU as well.**
Pig-tailed Macaque *Macaca nemestrina*	**VU**	While this species is not uncommon in Sumatra, this predominantly ground-living social primate is listed as vulnerable due to the threat to its lowland forest habitat. Groups require large areas of forests, and landscape fragmentation has compromised the viability of populations throughout southeast Asia. **Five sightings of single animals and groups in PSF and along canals in recently-cleared forests within the FMU, and one sighting in *Acacia* planting.**
Clouded Leopard *Pardofelis nebulosa*	**VU**	A large, shy primarily arboreal cat of southeast Asian forests. Populations are threatened by deforestation and fragmentation of suitable areas of habitat. One foot-print was observed on a canal bund along the western boundary of the FMU. **Locals in PT Yos report seeing a very long-tailed large cat (harimau) in the trees in kempas forest to the north of the FMU. Description fits this species, and it**

SPECIES	STATUS	DESCRIPTION
Milky Stork *Mycteria cinerea*	**VU**	**is likely to extend into the FMU.** The global population is estimated at just over 6,000 individuals (Birdlife International, 2002). More than half the world's population is found in the coastal swamps and mangroves along the east coast of Sumatra, with smaller numbers on Java and Sulawesi. Two other small populations are known: along the west coast of the Malay Peninsula and at Tonle Sap in Cambodia. Sumatra is the main stronghold for this stork. **Not recorded during surveys, but six observed at Tanjung Datuk in 1999 (S. J. M. Blaber *in litt.* 1999).**
Lesser Adjutant *Leptoptilos javanicus*	**VU**	A large stork of coastal mudflats and mangroves, extending up large rivers. Known to nest colonially in tall trees deep within PSF in Malaysia. Virtually no significant tracts of PSF remain close to the Sg. Kampar along its southern bank. **The species may still breed in the area. One bird observed soaring inland from Pulau Tugau, and another further upstream of the Kampar at P. Ketam.**
Wallace's Hawk Eagle *Spizeatus nanus*	**VU**	An extreme lowland specialist (Wells, 1985). Widespread conversion of lowland forest has constricted the distribution of this species, and it is today most commonly recorded in PSF (Sebastian, 2002). **Five sightings at different locations in the FMU (and photographed).**

No areas within the FMU were found to support significant concentrations of threatened or endemic species that warrant assignment of high conservation value to them.

HCV 1.3 Rationale for Boundary Delineation
This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.1.4 HCV 1.4 Critical Temporal Concentrations

Definition
The Indonesia HCVF Toolkit states that a globally significant concentration of migratory species or a nationally significant temporary concentration or migration route is an HCV.

This HCV relates to values involving the temporal usage of specific locations or habitat types by significant numbers of species or individuals of a species, and which are critical to their continued survival. The objective is that areas which play a crucial role in the life-cycles (i.e., breeding, migration) of certain species are identified as HCVs.

HCV 1.4 Site Context
The location of the FMU along the coastal wetlands along the Malacca Straits places it within two recognized migratory flyways [14]: The East Asian – Australasian Flyway, used by migratory waterbirds and the East Asian Flyway, used by migratory birds of prey (raptors). The two groups are treated separately below.

Waterbirds – The Malacca straits is situated within a globally significant migratory flyway, and also serves as important wintering quarters for migratory shorebirds. 64 species of shorebirds are known from Indonesia, 45 of which occur on Sumatra (Yus Rusila Nor, 1994). The majority of these pass through the straits during autumn (southward) and spring (northward) migrations. The extensive coastal wetlands of the

[14] Flyways are broad pathways taken by groups of migratory birds during their annual movements. These mass movements of birds of many species and families follow the flyways first during autumn migration, heading south to escape the northern winter and then back north (spring migration).

Malay Peninsula and Sumatra also support large numbers of these waterbirds over the northern winter.

The five most important sites for waterbirds in the Malacca Straits are Krabi bay, Thailand, Matang Mangrove forest reserve, Malaysia, and Sembilang, Tanjung Koyan and Way Kambas NP on Sumatra. (Birdlife International, 2003).

The FMU and its immediate surroundings do not support any critical temporal concentrations of migratory waterbirds.

Raptors – The Malay peninsula is the southernmost point of the Asian mainland, and thus forms a concentration point for land-based migratory birds such as birds of prey. A major pathway for these raptors is across the straits of Malacca from southwestern Peninsular Malaysia to eastern and southeastern Sumatra (Zalles & Bildstein, 2000). Indonesia is at the southern end of the East Asian flyway (McClure, 1998), and receives 39 species of migratory raptors.

Raptor migration is poorly studied in Indonesia, with only one watch site (Bengkalis island) in eastern Sumatra (Zalles & Bildstein, 2000). Data from Peninsular Malaysia and Singapore show the most numerous species crossing the straits of Malacca are Black Baza *Aviceda leuphotes*, Oriental Honey-Buzzard *Pernis ptilorhyncus*, Grey-faced Buzzard *Butastur indicus*, Japanese Sparrowhawk *Accipiter gularis* and Chinese Goshawk *A. soloensis* (Zalles & Bildstein, 2000).

Movement patterns over the Riau islands are unknown, but the migration front is expected to spread across all these islands and the coastal areas. Survey data during the assessment is in Table 9 below.

Table 9. Observations of raptor migration made during HCVF Assessment Serapung

DATE	TIME	OBSERVATIONS
3 Nov	1332	1 *P. ptilorhyncus* flying south along true left bank of the Kampar river
	1540	1 *Accipiter gularis* heading south crossing Kampar at Pulau Muda, est. 16km from mouth of river.
4 Nov	1300	6 *Aviceda leuphotes* flying northwest on true left bank of the Kampar
	1318	1 *P. ptilorhyncus* flying south, heading for the Kampar
	1455	1 *Aviceda leuphotes* circling over forest on edge of Kampar river
5 Nov	0948	1 *P. ptilorhyncus* heading south at mouth of the Kampar
	1057	1 *P. ptilorhyncus* heading south over forest on true left bank of the Kampar
6 Nov	0855	1 *Accipiter gularis* crossing channel from Pulau Serapung to Pulau Tugau, westerly direction
	0913	2 *Accipiter gularis* crossing same channel
7 Nov	0853	1 *P. ptilorhyncus* and 1 *Accipiter soloensis* soaring over canal 4km inland from coast, est. 25km north of the Kampar.

The data indicate migration takes place over the FMU. However, the numbers are small and there is no evidence of concentrations of migratory raptors in the general area.

HCV 1.4 Rationale for Boundary Delineation

This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.2 High Conservation Value 2

Forest areas containing globally, regionally, or nationally significant large landscape level forests, contained within, or containing the management unit, where viable population of most if not all naturally occurring species exist in natural patterns or distribution and abundance.

Three sub-categories (components) have been set to assess the presence of such forest areas, and these are treated separately below.

4.2.1 HCV 2.1 The FMU is a large, landscape-level forest

Definition

The Indonesian HCVF Toolkit states that a FMU which is a large landscape forest is considered an HCV.

For the island of Sumatra a large landscape level forest on its own would need to be greater than 50,000ha.

HCV 2.1 Site Context

The FMU includes two blocks of degraded natural forest, each separated from the other by *Acacia* plantations, but both connected to the Danau Pulau Besar-Tasik Serkap landscape. Each of these natural forest blocks is less than 7,000ha in area and smaller than the area threshold.

HCV 2.1 Rationale for Boundary Delineation

This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.2.2 HCV 2.2 The FMU is an integral part of a large landscape-level forest

Definition

The Indonesian HCVF Toolkit states that a FMU which is an integral part of a large landscape forest is considered an HCV.

HCV2.2 relates to areas that critically enhance the conservation functions of a landscape-level forest that is outside, adjacent, or contains the FMU. The forests of the FMU must be contiguous with forests of this larger landscape so that dispersal is possible within the forested block.

In addition, the objective of this HCV should be that the forests of the FMU contribute to maintaining the conservation of one of a limited set of ecosystem replicates within the ecoregion, so that loss of this landscape forest or its decline in size and integrity would increase the risk of species extinction.

HCV 2.2 Site Context

Although the FMU is not itself a large landscape level forest, it is connected to one of a limited number of such landscapes remaining that represent the diversity of habitats and species of the East-Central Sumatran Peat Swamp ecoregion (Reiley & Ahmad-Shah 1996; Jarvie *et al.* 2003a).

The accompanying table 10 shows that the Danau Pulau Besar - Tasik Serkap landscape forest, as we have termed it, comprises the second largest continuous block of this landscape in the ecoregion. A total of 211,000 ha of this is classified as protection forest,

including four small wildlife reserves of 37,000 ha. The aerial overflight on a transect running west of the FMU indicated that much of the landscape level forest is Tall PSF, with areas of Short PSF. A large area around and between the nature reserves appeared to be primary forest with adjacent areas of lightly hand logged Tall PSF.

Table 10. Contribution of the Serapung FMU to the Forest Landscape

	Area (x 1000 ha)	
I. Forested Blocks of the East-Central Sumatran Peat Swamp Forest Ecoregion		**protected areas**
A. Kerumatan	439	(Kerumatan = 96k)
B. Danau Pulau Besar - Tasik Serkap	**425**	(4 protected areas, totaling 37k)
C. Berbak (Jambi/S. Sumatra)	355	(Berbak = 163k)
D. Giam Siak Kecil - Bukit Batu	314	(2 protected areas, totalling 108k)
E. Senepis	205	(proposed protection area of 50k))
F. Libo	147	(3 separate patches, none protected)
II. Forest of the Tasik Serkap Forest Landscape (based on 8/2002 & 7/2004 images)		
Total Landscape Level Forest Block*	425	(excluding converted forests and lakes within the block)
1. Other	15	(zoned for oil plam plantation)
2. Production Forests (HTI & HPH)	199	
3. Protection Forest	211	
a. 4 wildlife reserves	37	(suaka margasatwa, under MoF management)
b. hutan lindung	174	(protection forest, under Dinas Kehutanan management)
III. Natural Forests of the Serapung FMU	9.28	
A. Severely Degraded (Heavily logged)	1.13	(some areas also degraded by flooding or agriculture)
1. Tall PSF	1.09	
3. Mixed PSF	0.04	(tiny area in far northernmost corner)
B. Degraded (Lightly logged)	8.05	(both prior concession & recent illegal logging)
1. Tall PSF	8.05	of Protected Forest Block
3. Mixed PSF	0	
Serapung FMU Forest as % of Landscape Forest	2.2%	
Serapung FMU Forest as % of Protection Forest	4.2%	

* 7/14/02 & 8/15/02 landsat images, minus an estimated area of 63,000 hectares of APRIL concession since converted.

Source: SPOT 2A image, Timber_estate_2003_48n.shp, Palmoil_plantation_2002_48n.shp, Logging_concession_2002_48n.shp, Rtrwp_riau_1994_48n.shp, Rtrwp_riau_draft_2015_48n.shp

The contribution of the Serapung FMU to this large landscape forest is very minimal. The FMU sits on the far eastern border of block and is not necessary to link important conservation areas. The contribution of its natural forests (9,280 ha) to the existing

protected forests (including Hutan Lindung, which may be reallocated at the district level for production forest or plantation; e.g., a RAPP concession) within the block (211,000 ha) would only be 4.2%. Perhaps more important, the natural forest within the FMU is nearly all degraded to severely degraded. Samples of tree species composition observed from diverse locations within the FMU indicated that this Tall PSF was relatively homogenous, with no areas of unusual species composition indicating separate habitat subtypes, and it appears to be redundant with the large areas of Tall PSF to the west.

HCV 2.2 Rationale for Boundary Delineation
This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

The rationale for this is that the natural forest areas within the FMU do not contribute to the conservation value or integrity of the large landscape level forest.

- These natural forest areas are small and do not contribute added area critical to the landscape level forest.
- The FMU is located peripherally at the margin of the large intact forest block, and so unimportant for contiguity.
- The natural forest vegetation type within the FMU is almost entirely Tall PSF, by all indications redundant with the dominant vegetation of the large landscape level forest to the west.
- All areas within the FMU have been logged, some very severely, compared to the primary forest and lightly logged large areas of Tall PSF to the west, and outside, of the FMU

HCV 2.2 Rationale for Exclusions (if applicable)
Not applicable, as HCV not present.

4.2.3 HCV 2.3 The FMU maintains viable populations of most naturally occurring species

Definition
The Indonesian HCVF Toolkit states that a FMU which contains viable populations of most naturally occurring species is an HCV.

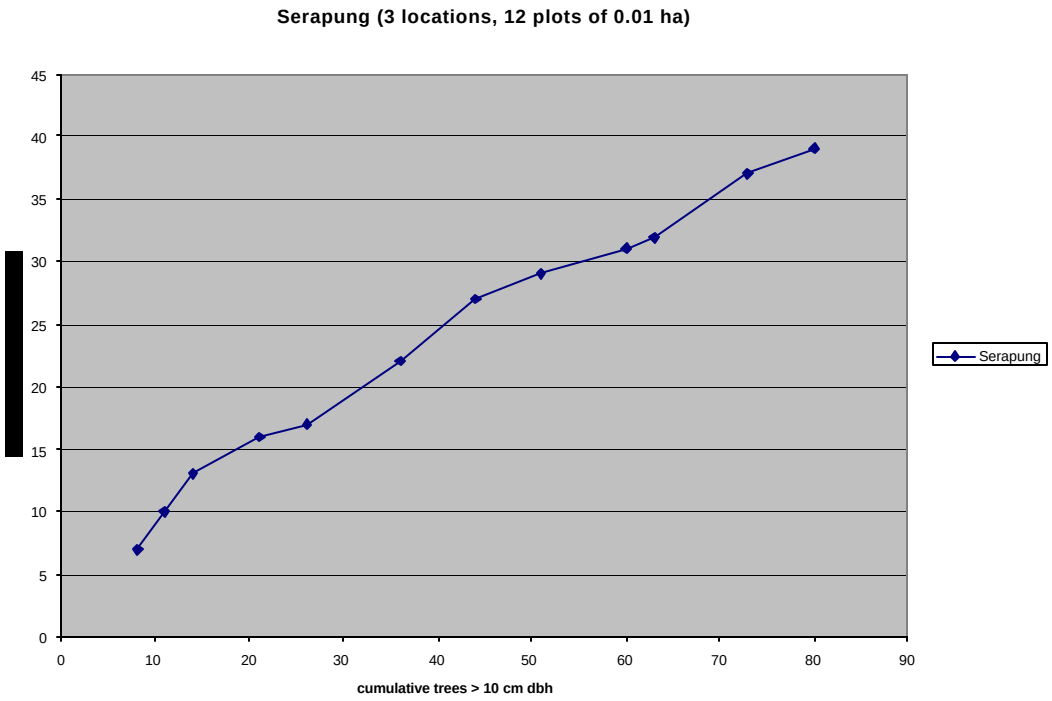
HCV2.3 relates to the importance of FMU areas in maintaining viable populations. To be HCVs, the area must critically contribute habitat or resources that lower the risk of extinction. The distribution of species among habitats and total area of each habitat within the larger forested landscape must be considered in determining whether areas within the FMU are HCV because they are needed to maintain viable populations.

HCV 2.3 Site Context
The natural forest of the FMU is nearly all Tall PSF degraded by logging. The area is small relative to the adjacent large areas of Tall PSF to the west, which might comprise at least 300,000 ha (75%) of the contiguous the Danau Pulau Besar - Tasik Serkap landscape forest abutting to the FMU. Therefore the FMU would only contribute an additional 3% to this habitat, and is not critical in providing additional area to maintain viable populations within this forest block. Even very rare plant and animal species would maintain viable populations in contiguous blocks of this habitat on the order of 50,000 ha.

These conclusions were reached from noting the species composition of the more dominant trees (25-50 cm dbh) throughout the FMU in the residual stands of the remaining Tall PSF. In addition, three widely separated areas were selected for plot

samples to measure tree species richness (trees > 10 cm dbh). Twelve plots of 10m x 10m (0.01 ha) were sampled (5, 5 & 2 from each of the locations). Most species could be identified to at least family or genus.

Figure 8. Species area curve for trees (>10 cm dbh) in the residual logged Tall PSF within the FMU.



This small sample showed a mix of species similar to Tall PSF sampled in Pulau Muda District, and as previously reported from research in Kerumutan Wildlife Sanctuary. Larger comparative samples would need to substantiate that it is typical Tall PSF. Thirty-nine tree species were represented among the 80 individuals within the plots. Figure 8 indicates the typical case that the species-area curves at any one location (the first two sets of five plots in the graph) begin to level off as more redundancy is encountered as sample area increases. However, new species are encountered at a high rate when a location several km away is sampled within this same habitat. We do not know of any other species-area curves measuring tree species richness from this ecoregion. However, from comparisons elsewhere (Cannon & Leighton 2004), this diversity is not unusual for Southeast Asian Tall PSF.

Viable populations of species would be poorly maintained by the limited areas of degraded habitat within the FMU, but more than adequately by the large blocks of this habitat to the west of the FMU, centered on the existing protected areas.

HCV 2.3 Rationale for Boundary Delineation

This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.3 High Conservation Value 3

Forest areas that are in or contain rare, threatened or endangered ecosystems

4.3.1 HCV 3.1 Forest areas that are in, or contain rare, threatened or endangered ecosystems

Definition

The Indonesian HCVF Toolkit states that where a FMU contains a significant area of these rare, threatened, and endangered forest types and has been identified as a conservation priority area by an independent organization, then the forest type is an HCV. Any rare, threatened or endangered ecosystems that are located outside the FMU that are impacted heavily by FMU activities is also an HCV.

The Indonesian HCVF Toolkit guidance relates HCV3.1 to rare, threatened or endangered ecosystems that have been identified within national conservation plans. The Toolkit provides further guidance as "there may be cases where conservation plans do not reflect current forest condition, threats, and trends. Experts should be consulted to identify if there are gaps in these plans and if the FMU should be considered critical to the protection of the ecosystem type." Thus, the present assessment would consider as HCV areas within the FMU that are rare, threatened, or endangered ecosystems for the ecoregion or nation based on expert judgment, especially if the available national conservation plans had overlooked ecosystems that were poorly represented in protected areas in the ecoregion.

HCV 3.1 Site Context

- The National Conservation Plan for Indonesia (Vol 3D- Riau Province, MoF 1995) defines a 500,000 ha block for a proposed Danau Belat Besar – Linau (BBL) Wildlife Reserve (Suaka Margasatwa) that includes most of the landscape between the Siak and Kampar rivers. However, the rough-drawn proposed boundaries are set back 10 km from the river and coastal margins, and therefore, the FMU would lie outside these boundaries. According to interviews with KSDA staff in Pekanbaru, no further steps had been taken to implement this proposal.
- The Sumatra section of the Indonesian Biodiversity Strategy and Action Plan 2003-2020 includes this proposed BBL wildlife reserve for conserving the Siak-Kampar peat swamp forest ecosystem (pg. 24). Note that the map on pg. 9 erroneously shows the coastal strip between the Siak and Kampar rivers, which encompasses the Serapung FMU, as a "conservation area," presumably because it was listed in the 1997 Indonesian wetland plan, before its removal in subsequent editions.

Therefore, the FMU is adjacent to but outside the BBL proposed wildlife reserve. Our overflight of portions of this 500,000 ha area indicated that it contained diverse peat swamp forest habitats, including large areas of primary and lightly logged tall peat swamp forest. The FMU contains roughly 9,200 ha of severely degraded and degraded Tall PSF and 50-100 ha of severely degraded Mixed PSF. Both are trivial in size and of poor condition compared to adjacent areas outside the FMU. The FMU does not contain a rare, threatened or endangered ecosystem, thus it does not contain HCV 3.1.

HCV 3.1 Rationale for Boundary Delineation

This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.4 High Conservation Value 4

Forest areas that provide basic services of nature in critical situations (e.g. watershed protection and erosion control)

Four sub-categories (components) have been set to assess the presence of such forest areas, and each are treated separately below. Spatial and temporal considerations are important in determining HCV 4 and its components. Although HCV 5 and 6 assessment regards the north side of the FMU as part of the entire village communities of four villages separated by coastal waters or the Kampar river (except for the Yos community established on the FMU side of the river), the social scope for assessment of critical dependence related to 4.1, 4.3 and 4.4 is taken to be farmed areas only on the northern FMU side of the river. These areas have no significant geographic connection with other areas in the same villages on the south side of the Kampar river. Their agricultural significance is likely to increase over time.

4.4.1 HCV 4.1 Unique sources of water for daily use

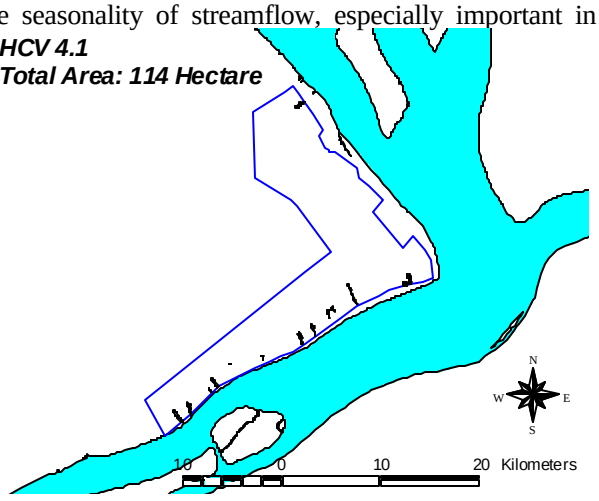
Definition

The Indonesian HCVF Toolkit states that where forests provide the only source of water for daily use to a community, this will be an HCV.

HCV 4.1 Site Context

Most water sources for drinking and other the daily needs of people living adjacent to the FMU is provided by numerous small streamlets that issue from the forests of the FMU and run downslope into the river or ocean. Shallow wells (1-3 metres deep) and rain water are also sourced but cannot sustain daily water needs. People may prefer to use rainwater during wet seasons, but during dry seasons, it is expected that these streams provide critical water sources. Although a small proportion of villagers maintain agricultural plots and houses in this zone adjacent to the FMU, these streams nonetheless provide critical sources when they are there, and are not substitutable by hauling water from other sources. The trajectory has been for these lands to become increasingly converted to agriculture over the last few years, with increasingly more households supported in this zone. This need for water is therefore expected to increase.

The forests upstream moderate the seasonality of streamflow, especially important in prolonging water availability during dry seasons. However, we would expect that forests also help mitigate damage from flooding from nearby canals during wet seasons.



HCV 4.1 Rationale for Boundary Delineation

HCV 4.1 was designated for any natural forests remaining within 100 m either side of streams.

This width along small streams is not based on case studies comparing how different widths of forest greenbelts moderate streamflow. Because of the small size of these streams, all of which flow under closed forest canopy, 100m seems a reasonably conservative, albeit arbitrary, width.

The forest patches so designated were identified from aerial photographs and from the SPOT satellite image.

HCV 4.1 Rationale for Exclusions (if applicable)

Anomalous forest fragments extending less than 100 m from the streams, which are generally small, highly degraded remnants, were excluded because these cannot be reasonably monitored and protected as HCVF.

4.4.2 HCV 4.2 Forests with critical impact on water catchments, and controlling erosion

Definition

The Indonesian HCVF Toolkit states that forests that are protected, DAS Super-Prioritas and Prioritas, other significant DAS and Sub-DAS areas designated by relevant experts, as well as cloud forests, will be HCV4.2. This HCV relates to the critical role forest areas may play in protecting water catchments, downstream water quality, and preventing erosion.

HCV 4.2 Site Context

The FMU does not contain important designated water catchments. The DAS priorities identified for the area where the concession is situated are production forest, which would include HTI.

HCV 4.2 Rationale for Boundary Delineation

This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.4.3 HCV 4.3 Forest providing a barrier to the spread of fire

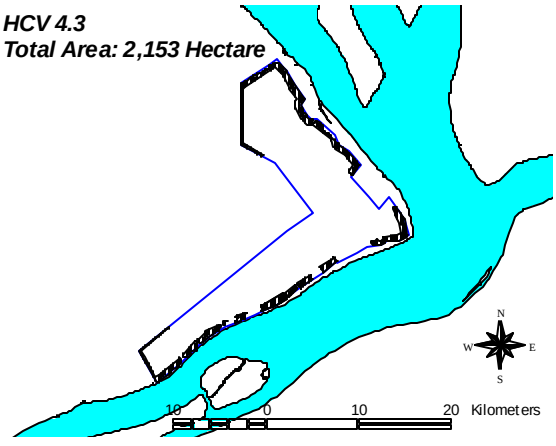
Definition

The Indonesian HCVF Toolkit states that any forest boundary that protects against large scale fire is an HCV.

HCV4.3 relates to the critical role forest areas may play as a buffer to the spread of forest fires especially in PSFs where the consequences of fire can cause irreversible damage.

HCV 4.3 Site Context

Any fire poses a threat to nearby agricultural lands and natural forest outside of the FMU. A 12 ha fire recently burned within the cleared area of the FMU, demonstrating the danger posed by the woody slash and dried top layers of peat following forest clearing operations. Of course, perhaps the most likely fire damage will occur from fires set in agricultural zones, so the forest buffer from agricultual areas should be wider in appreciation of this greater risk, and because the forest greenbelt will suffer damaged edges on both sides. These forest edges will suffer blowdowns and other sources of higher tree mortality, narrowing the effective width of the forest that might impede fire.



HCV 4.3 Rationale for Boundary Delineation

A 500m buffer is proposed inside the FMU border wherever there is natural forest bordering lands designated for agricultural use. This effectively applies to the southern

and eastern borders of the concession.

The 500 m width serves two functions: it allows a reasonable response time for fire control measures, and a buffer of green, wettish vegetation to suppress fires from either side. On the inland western and northern sides of the FMU, a 200 m belt has been designated as HCV 4.3, in keeping with the fact that the FMU borders natural forest there. Although it seems reasonable to have these distinctively different widths in these contexts, there is no scientific data suggesting what effective forest greenbelts for fire control might be in peat swamp forests. These widths are therefore reasonable approximations.

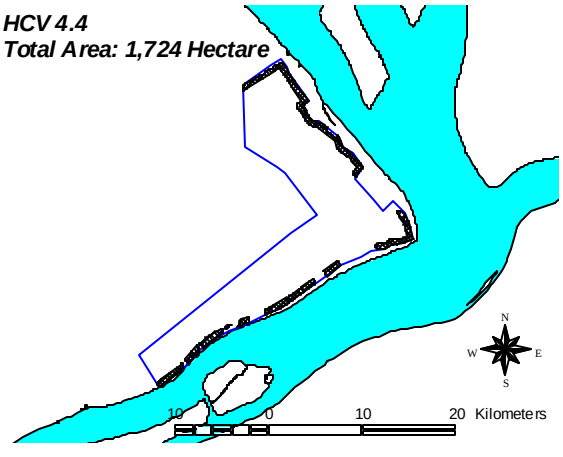
HCV 4.3 Rationale for Exclusions (if applicable)
Where clearing has left narrow belts of natural forest isolated by strips cleared up to the boundaries, any such isolated strips < 500 m in length are thought to have limited value for fire control, and have been excluded as HCV4.3.

4.4.4 HCV 4.4 Forests with critical impact on forest services that agriculture, aquaculture, or fisheries are dependent upon

Definition
The Indonesian HCVF Toolkit states that any forest that has a critical impact on the forest services that agriculture or aquaculture is dependent upon are an HCV4.4. Similar to HCV4.2, the assessment is whether any forest areas are critically responsible for water quality and supply, albeit focused on agriculture or acquaculture.

HCV 4.4 Site Context
FMU natural forest areas are critical to maintaining water resource services in downstream agricultural areas along the riverine and coastal land strips between the FMU and the estuary waters. Forests bordering streams upslope from the coastal and riverine agricultual zones will moderate water supply into the agricultural peat soils. These forests help prevent flooding into agricultural areas from upslope canals during wet seasons, and supply sustained water laterally into the peat during the dry season. Especially important is the function of upslope forest and the peat profile in maintaining hydrostatic pressure of fresh groundwater throughout the agricultural soil zone, and the groundwater recharge function to maintain this. This prevents saltwater incursions into agricultural peat soils in this tidal environment.

Natural forest buffers are also important to prevent pests from entering the agricultural areas, and lowering pest damage from *Erictys (*rhinoceros beetle) that attacks coconut palms. While this may seem bizarre, it is an ecologically sound environmental service of forest greenbelts separating cleared plantation areas from the scattered smallholder coconut orchards. Breeding in rotting, woody vegetation from forest clearing activities in the FMU, these beetles can recognize the silhouette of coconut palms up to 500 metres away. The beetles attack the growing coconut



meristem. They take refuge within and can reach high densities in the dead slash piles left behind from forest clearing operations, creating a negative externality for coconut farming.

HCV 4.4 Rationale for Boundary Delineation
HCV 4.4 was designated for any natural forest extending within 500 m of the FMU borders adjacent to the downslope agricultural zones.

These encompass all areas on the river and seaward sides, given that the trajectory of agricultural use indicates that all land might be cleared and planted in the future. No research has established the rate or lateral water flow through peat, so the 500 m width is considered reasonable and prudent to safeguard potential potential lateral water flows downstream from FMU forest into adjacent agricultural areas. The need for such a buffer is assumed for forest areas outside the FMU but adjacent to the agricultural areas where farming is expected to spread.

The 500 metre buffer for water resource protection should be adequate to act as a barrier to the rhinoceros beetle.

HCV 4.4 Rationale for Exclusions (if applicable)
Previous clearing would render some forest areas unsuitable in their present condition to be designated for this function in some sections of the FMU boundaries.

4.5 High Conservation Value 5
Meeting Basic Needs of Local Communities

Definition
The Indonesian HCVF Toolkit states that if local communities obtain essential fuel, fodder, medicines, or building materials from the forest, without readily available alternatives, then the forest is an HCV. HCV5 applies only to basic needs.

In this HCVF assessment, SmartWood has applied a threshold at greater than a quarter (25%) of a local community (generally households) must be dependent on the FMU forests in this way. Local communities may include sub-groups within village areas that form a distinct community of their own.

HCV 5 Site Context
The four villages and sub-village Yos comprise the social units that were used for the assessment of HCV 5. Agricultural and forest land along the riverine and coastal strips that are outside the FMU were considered as part of each of the five local community units for assessment. Farmers in these lands rarely live permanently in these areas, staying only for planting and harvest seasons, returning to the main settlements when they can. Significant numbers of farmers, however, came from other, more distant villages. These villages could not be visited in the time available and were therefore not included in the HCV 5 assessment.

Four village communities and one sub-group within a village (and individuals from several other villages) harvest products from the forest. Some of these products are basic needs, e.g., wood for house construction, vegetables, wild game and medicinal plants. With the exception of timber and fuel wood in Yos, less than 25% of basic needs come from natural forest sources. In those two cases, wood for house construction and as a source of cash income, harvesting is not organized with sustainability in mind; indeed such harvesting is sometimes part of a strategy to clear forest for agricultural use.

In some other cases where individual products only came from forest sources, e.g., palas leaves for vegetable use and food-wrappings, and some medicinals, no one ever expressed a desire to protect the forest habitat that harboured these products if the alternative was to replace the forest with farmland. Even the loss of forest sources for wood elicited regret but no serious concern, and certainly no reason for conserving forest areas rather than converting them to agriculture.

Detailed records of each of the five communities' basic needs sourced from natural forests in and around the FMU, as well as from all other important sources are listed in tables in the technical annex. A second series of tables in the technical annex qualifies the score for reliance on FMU forest sources for basic needs by considering extraction sustainability, readily available and affordable alternatives and production trends.

Table 11 shows the highest reliance recorded for FMU natural forest sources of basic needs. A score of 2 (more than 25% reliance) or more is what this assessment is using as a pre-requisite for HCV 5. HCV 5 can then only apply if extraction is likely to be sustainable, there are no readily available and affordable alternatives and production is not declining over time (unless because of forest loss). Only the Yos community scored at least 1 (except for carbohydrate needs that were zero, equivalent to less than 10% reliance) for all basic needs.

Table 11. HCV 5 Status of Most Significant Basic Needs Obtained from Natural Forest in FMU Serapung

Most Significant Basic Needs		**Highest Ranking of Basic Need from Forest**	*Harvesting Sustainability S1, s0/1, s0*	*Readily Available Alternatives r1, r0/1, r0*	*Five Year Production Trends*	**Derived HCV Status** [-/+]
(1)		(2)	(3)	(4)	(5)	(6)
Carbohydrates		0	s1	r1	stable	[-]
Protein	Fish	1	s1	r1	stable	[-]
	Meat	1	s1	r1	stable	[-]
Vegetables and Fruits		1	s1	r1	stable	[-]
Medicinal Plants		1	s1	r1	stable	[-]
Construction & other materials	Timber	4	s0/1	r0	declining	[-]
	Rattan	1	s0/1	r1	stable	[-]
Fuelwood		4	s0/1	r0	stable	[-]
Cash Income	Timber	4	s0	r1	declining	[-]

Note:
/1/ Data from tables in Technical Annexes.
/2/ Minimum threshold for HCV 5 status is basic needs' ranking of 2 (more than 25% of a given basic need from FMU natural forest sources), harvesting sustainability of 1, uncertain readily available alternative r 0/1 and stable production trend (unless caused by forest loss)
/3/ 1 = yes, 0/1 = uncertain, 0 = no

In summary, there are no HCV 5 values assigned to any area within FMU Serapung.

HCV 5 Rationale for Boundary Delineation
This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.6 High Conservation Value 6
Forest Areas of Critical Value to Traditional Culture

Definition
The Indonesian HCVF Toolkit states that if forest areas are critical to the traditional cultural identity of local communities, e.g., restricted-use and reserve forest, ancestral burial, spiritual, religious, and taboo sites, then the forest area will be HCV.

The Indonesian Toolkit does not set a threshold for what would determine a 'critical cultural value'. SmartWood has applied a threshold within this report that to qualify as HCV 6, at least 50% of a defined group (may be village/sub-village) or defined sub-group (may be ethnic or tribal, etc.) consider candidate forest areas as having critical cultural value.

HCV 6 Site Context
The four villages and sub-village Yos comprise the social units that were used for the assessment of HCV 6. Agricultural and forest land along the riverine and coastal strips that are outside the FMU were considered as part of each of the five local community units for assessment. Farmers in these lands rarely live permanently in these areas, staying only for planting and harvest seasons, returning to the main settlements when they can. Many farmers, however, came from other, more distant villages. These villages could not be visited in the time available and were therefore not included in the HCV 6 assessment.

Only one potential candidate site for HCV 6 was found. During interviews with Kampar river village communities that identified parts of the FMU and surrounding land on the north bank of the river as coming within village jurisdictions, there was wide awareness of the spiritual attributes of Tanjung Datuk point at the mouth of the river. Formed by strong tidal and other river currents, the point is where coastline and northern riverbank meet abruptly at right angles.

The point, its forest and the waters near it had a sinister reputation not unlike that of Tanjung Bebayang about 20 km upriver, designated as HCV 6 and part of the Pulau Muda HCVF. Many respondents spoke of boats being lost in whirlpools just beyond the point, and frequent sitings of tiger by the edge of the river. In the Melayu language, the term Datuk can be used as an indication of respect and also as a euphemism for "tiger" … "which upon hearing its real name might be invited to appear"). The whirlpools are probably created by strong interactions between the tidal and other river currents that converge at and around the point. Frequent tiger sightings might be explained by the fact that the point is where boats come closest to the river bank when turning at right angles to enter or exit the river.

Unlike Tj. Bebayang, however, Tj. Datuk no longer inspires either the awe or dread that has kept most loggers away. The degraded state of the forest and the assertion of all respondents who had something to say about Tj. Datuk, made it clear that the spiritual value of the area is very much a thing of the past. There was no significant constituency (and less than even a 15% or 25% of a group or sub-group) to revive the system of taboos

that once existed. Further, there was no indication that there would be serious resistance to any efforts to develop Tj. Datuk agriculturally or to replace its forest with other uses.

HCV 6 Rationale for Boundary Delineation
This HCV was not identified or considered to be present within the FMU and no boundary was delineated for the HCV.

4.7 HCV areas identified in the FMU

HCV area identification is summarized in Table 12.

Table 12. Forest Areas with HCVs Identified in the FMU

	Total (Ha.)	% of FMU Natural Forest	% of HCVF Area	% of overlap with other HCVs
HCV 1.2	5,884	63%	60%	15%
HCV 4.1	114	1%	1%	61%
HCV 4.3	2,153	23%	22%	94%
HCV 4.4	1,724	18%	17%	100%

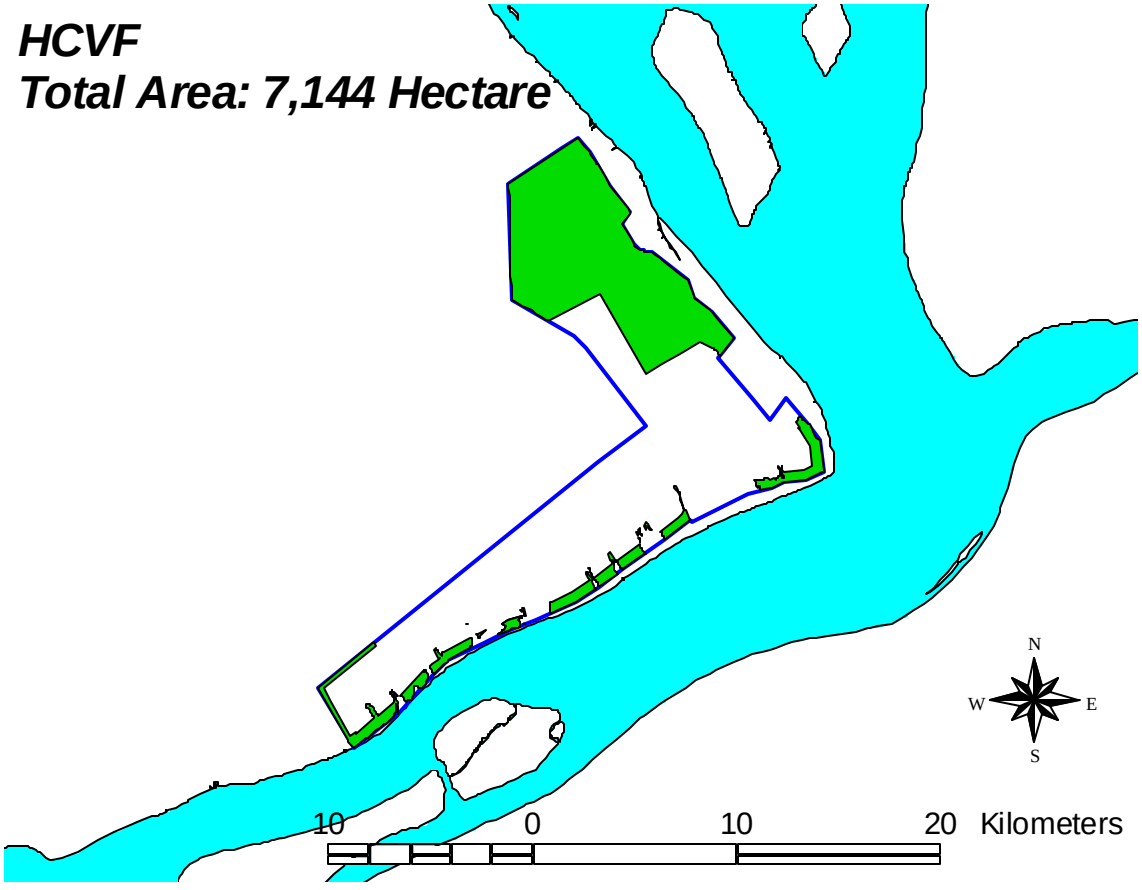
5. Indicative HCVF Boundary for Serapung District

This section takes forward the process of identifying and delineating HCV areas in the previous section to demonstration of where the indicative HCVF boundary and area that it encompasses should be for the Serapung District.

Following the delineation of HCV boundaries through the GIS mapping process, a composite overlay of all identified HCVs and components was produced. The overlays permitted a single HCVF layer with defined areas indicated on a map of the FMU. The HCVF boundary is best represented according to the dominant forest blocks that are described below.

Figure 9 is to be considered the indicative HCVF map for the Serapung Unit as of November 12, 2004, and depicts one major forest block and numerous 'buffer' strips around the edges of the concession area.

Figure 9. Indicative HCVF Boundary for Serapung FMU



The HCVFs defined within the FMU can be broadly divided into the following areas:

Block 1
The entire northern part of the Serapung I concession block, from its northern boundary along the PT Yos canal following the western boundary of the FMU to where the 2004 cutting plan boundary (Petak nos. 248 & 247), then following the Primer Canal I to Petak nos. 186, 185 & 184. The eastern alignment of this block follows the eastern boundary of the FMU, including the

Kawasan Lindung and Tanaman Unggulan exclusions. In short, Block I includes all the remaining (un-cut) forest areas in the northern portion, according to the Arara Abadi Peta Kerja for Serapung I.

HCV 1.2 – This indicative HCVF boundary and area covers that designated area which is believed to be used and of significance for tigers. A supplemental study on the presence and utilization of FMU forests by tigers would be necessary for SmartWood to modify and improve upon the delineation of this boundary.

Buffer Areas along the FMU boundary

HCV 4.1 – HCV 4.1 was designated for any natural forests remaining within 100 m to either side of watercourses.

HCV 4.3 – A 500m buffer is proposed inside the FMU border wherever there is natural forest bordering lands used by communities for agriculture. This effectively applies to the southern and eastern borders of the concession. A 200m fire buffer is proposed on the inside of the FMU border where there is a non-agricultural interface between natural forest within the FMU and natural forest outside the FMU.

HCV 4.4 – HCV 4.4 was designated for any natural forest extending within 500 m of the FMU borders adjacent to the downslope agricultural zones.

These encompass all areas on the river and seaward sides, given that the trajectory of agricultural use indicates that all land might be cleared and planted in the future.

Table 13 represents the area delineated as HCVF corresponding to each of the current FMU land use classifications.

Table 13. HCVF area compared to FMU land use

FMU Landuse	HCVF Area (ha)	% of FMU Landuse	Remaining Natural Forest (Ha)	Total Area
Kehidupan	375.2	44.6%	630.8	1,006.1
Konservasi	2,003.0	88.8%	1,946.8	3,949.8
Produksi	3,512.4	23.8%	5,026.1	8,538.5
Unggulan	1,251.8	69.0%	1,762.4	3,014.2
Totals	7,142.4		9,366.2	16,508.6

6. HCVF Management, Monitoring and Research Implications

The scope of the SmartWood HCVF assessment of Serapung was to identify HCVs and delineate the HCVF areas. Detailed management and monitoring guidelines will have to be developed by the company, in consultation with stakeholders, on the basis of the identified HCVs and preliminary delineation of HCVF. This chapter outlines some important management (6.1), monitoring (6.2) and research (6.3) implications of the HCVF assessment.

Management Implications related to HCV 1.2 are dealt with first (6.1.1), followed in 6.1.2 by comments on the management of HCV 4.1, 4.3 and 4.4. Given the major impact of social factors on ecological integrity of the HCVF, a third theme of community relations is covered in the next sub-section (6.1.3). Sub-section 6.1.4 deals with land status issues and the need to get them properly clarified and formalized.

The Monitoring section focuses on internal and external monitoring, the need for a lessons-learned approach and organizational changes required.

Much of the section on research focuses on survey of the Sumtran tiger.

6.1 Management Implications

6.1.1 Indicative HCVF boundary delineation for HCV 1.2

In the specific case of the Sumatran Tiger as HCV 1.2, the approach taken by this assessment to delineate an indicative HCVF boundary for the identified HCV, subject to further information gathering and analysis. This approach places certain requirements upon the management of the FMU and its operations. The nature of these requirements and their implications are treated below.

Operations within the designated forest block.
The current harvesting moratorium within Serapung I (SPA) should remain in effect until the commissioning and completion of the supplemental study. All other activities that would cause harm or impact to remaining natural forest, e.g. canal building, camp building, etc., should cease. Only limited and routine maintenance and/or monitoring patrols should be accessing the block. In short, this block of forest should be kept in its current state until a decision is made on its HCVF status based on the supplemental study.

Illegal logging activity
During the field assessment, illegal logging and movement of logs out of the block from both (north and south) ends by local people, was on-going. It is recognized that the Forest Manager has little control over this activity at present, and requests to the police to enforce the law have not lead to prosecution. It is understood that swift action against illegal loggers taken by AA would likely lead to a breakdown in relationships with many villagers along the river that engage in illegal logging. Yet, it is important that illegal logging is curtailed for the duration of the supplemental study until a final HCVF boundary is delineated, or in the case that the block is found not to be an HCVF, company operations resume. The company should provide tighter security and apply more persuasive pressure on the police immediately, with better engagement for future reduction in illegal logging.

Community engagement
Placing the responsibility of halting timber harvesting by locals from the area can be seen as both a challenge and an opportunity. The challenge would be for the company to achieve cessation of illegal logging. This may not be achievable in the immediate short term, but the

effort has to be initiated. Allocation of appropriate resources (personnel trained in community dialogue and negotiations, manpower to patrol, etc) is seen to be a key factor towards achieving this objective. The best approach would be to combine enforcement measures with community engagement.

On the other hand, the opportunity that is laid before the company is an avenue to actively engage the local communities with a goal that is not conversion of forest lands. The reasons for this cessation of company operations (i.e. to assess, and potentially exclude this forest from conversion, as a contribution to conserving an animal on the verge of extinction) in this block is a demonstration of commitment to the (environmental) sustainability of its operations. The local communities are being asked to do likewise. It is noted that this approach has its difficulties, and its success will depend on the ability of the company to present itself as a responsible and professional outfit.

In the case of an HCVF boundary delineated

If HCV1.2 is found to be present within the indicative HCVF block, and an HCVF boundary is drawn on the ground, the forest manager will face a different set of management challenges. HCVFs protecting intrinsic biological diversity require relatively simple management, revolving around basic protection measures against illegal activities (e.g. logging, poaching) and ensuring water management of the overall FMU does not compromise habitat integrity. However, when an HCVF is protecting large, predatory, wide-ranging and highly-prized mammals such as tigers, management needs are more complicated. More robust management should be designed and incorporated into the FMP. Some examples of such measures are indicated below.

- Poaching alone can eliminate tigers from an area, especially when the population (and habitat) is small. If poaching is not prevented, it negates the very purpose of preserving habitat.

- Effective measures are required to avoid potential human-tiger conflict situations, particularly with company workers working in close proximity to the HCVFs.

- Illegal logging has to be completely stopped within the HCVF area, and a strategy needs to be worked out to address this matter.

6.1.2 HCV 4.1, 4.3 & 4.4

HCVF areas that protect HCV 4.1, 4.3 and 4.4 are essentially buffer strips of forest for water resource protection and fire barriers, ranging from 100 to 500 metres that are obviously vulnerable to border effects, most acute for the narrowest strips. Observations from helicopter over-flights of forest buffer strips in other timber plantations illustrated major forest degradation and loss from border effects. Where the only reason for an HCVF area is HCV 4 (hence not a biodiversity rationale *per se*), and border effects are a clear risk, there should be enrichment planting using appropriate local species for restoration.

6.1.3 Collaboration between the Company and Village Communities

FMU Serapung is surrounded on all sides by threats to conservation of its natural forests and water resource management, primarily from unauthorized logging and agricultural encroachment, both of which are likely to increase. While these deforestation pressures are not always driven by local people, attitudes of adjacent village communities to the company and its operations are a critical determinant of cost-effective and sustained forest conservation. Typically viewed as a threat to be contained, a management problem that grows with the size of natural forest area set aside for conservation, local communities are unquestionably a necessary part of the solution and potential allies against more destructive outside forces. Across Indonesia, the alternative of using crude force to exclude local people from forestry resources

has, in the long term, left everyone as losers, including the environment. At present, if one considers village communities at large rather than their formal representatives alone, current company-village relations are distant at best.

There are compelling HCVF management reasons to improve engagement with people living in intimate contact with FMU areas -- creating the right incentives and avoiding the wrong ones -- in ways which are consistent with the company's new community relations' approach. A number of management issues need to be factored in for protection of HCVs 1 and 4. Most are applicable to HCVF management in general.

6.1.3.1 Inter-village Boundary Issues

Long term development of community relations with local communities adjacent to the FMU (referred to in this section as "local communities") will be seriously handicapped unless disagreement over inter-village boundaries is settled. The company must know with which village governments it should engage for management of a given area outside the FMU. Unclear village authority will only invite outside loggers and farmers to do as they please.

Amicable agreement is more likely between Pulau Muda and Segamai than between Serapung and Gambut Mutiara where claims hugely overlap. Formal agreement, approved by Pelalawang District is essential. Obviously, this is not an area where the company has right or capacity to intervene. Strictly impartial support of a fair and proper process would be appropriate. Even this could backfire if willfully misconstrued by critics of the company. Or a village aggrieved by what it perceives as an unfair boundary resolution, may find it easier to blame the company than pursue its case with its more distant District government. Sensitive to these issues and aware of the importance of setting clear village boundaries, the company should be able to appropriately encourage the process. For example, the company might request timely resolution of the problem so that it knows which village communities it should formally work with.

In the short term, however, a great deal more can be done to forge better relations with local communities and thereby increase the likelihood that HCVF areas will be successfully conserved.

6.1.3.2 Community - Company Collaboration to Reduce Illegal Logging and Agricultural Encroachment (and Ensure Tiger Protection)

HCVF management for HCVs 4 and 1 will be most readily achieved in the demarcation of boundaries, and most difficult to achieve in terms of keeping human impacts within acceptable limits. Even before village boundaries are formally settled, the company can take important steps towards laying the foundation for long term conservation of HCVF areas. This will include different approaches to community engagement. Conventional reliance on village leaders alone should be avoided because of the importance to sub-groups of certain HCVs who may not be part of village government mainstream, e.g., the informal sub-village of Yos in Serapung village. Community relations should be given a higher planning and operational profile within the company. Other institutions such as NGOs and local government agencies may have to be brought into the process. And nothing can be lastingly achieved unless the social capital of mutual trust is seen as a sine qua non of community-company collaboration.

What follows are seven strategic management steps to guide efforts at improving community relations to minimize threats to the ecological integrity of HCVF areas and keep these within manageable limits. Although the steps outlined below are in sequence, in practice the process should be seen as a progressive series of feedback loops as implementation experience leads to appropriate changes. For example, having identified target communities, while working with them it may become evident that further division or merging makes more sense. Over time, experience will necessitate management adaptations, in particular the relationship between

Pelalawang and the FMU, and within the FMU Serapung. Each of the seven steps should be informed by one of the key outcomes of monitoring and evaluation.

1. **Company Organisation**. *What organizational changes must be made?* The importance of a dedicated unit in the company at FMU, Pelalawang and Jakarta levels for HCVF management, fully integrated into the company's organization structure (with sufficient human and financial resources), is noted as a general management implication in this assessment. The social dimension of HCVF management will require the following:

   - ✍ The HCVF Management Unit should have a distinct Social Section that is an equal partner among other sections of the HCVF Unit,
   - ✍ The Social Section should be involved in decision-making about claims and be kept fully informed of claims' processes.
   - ✍ Oversight (but not day-to-day management decisions) of the FMU-level Social Section should be the responsibility of the Pelalawang HCVF Management Unit.
   - ✍ The Community Development Division of the Company at Pelalawang should develop strategic guidelines for community relations related to HCVF management.

2. **Identification of Communities and Potential Partner Groups.** *Who and where are the communities?* There are various levels of community units that should be taken into account when deciding with whom to engage.

   - ✍ Engagement with villages adjacent to or overlapping with the FMU is an obvious starting point (currently handicapped by uncertainty over which villages have other authority over which areas), namely, Pulau Muda, Segamai, Gambut Mutiara and Serapung; Segamai's proposal to offer land access to Labuan Bilik may require adding this village. To obtain village-wide acceptance of HCVF areas, however, a wider range of village people must be included, above all those with access to land in and around the FMU, e.g., Yos sub-village as well as smaller groups of corn and coconut smallholders farming along the coastal and riverine land strips (distinguishing between fallow and abandoned areas), of river and canal fishermen, occasional hunters, healers and spiritual leaders such as tiger shamans in the northern part of the north-south arm. Some of these groups may have an ethnic character, e.g., Buginese coconut farmers in the river Tugau area. Like it or not, illegal loggers are a social group that must be engaged with, particularly if they are largely made up of local people.
   - ✍ First attempts should be made to identify representatives of the above groups, in the case of villages, the executive, elected council and respected elders (*Tokoh masyarakat*), or an informal leader such as in Yos sub-village. To avoid elite capture of the engagement process, it is important to identify other social groups and institutions in the village, that should be a part of subsequent engagement processes. For some groups, such as scattered pioneer farmers (generally in small numbers), representation may not exist at all and initially individual contacts will have to be made.
   - ✍ Another identification feature is recognition that some groups may be future allies of HCVF protection, e.g., farmers in Yos whose livelihoods are destroyed

by flooding caused when illegal loggers connect their small canal to the main north-south canal of the FMU. Tiger shamans could be co-opted to increase understanding of, and conservation interest in, tiger protection.

3. **Mutual Trust.** *How can trust -- the foundation for lasting collaboration -- between the company and local communities be nurtured?* Without the social capital of mutual trust, community relations must remain in the realm of ad hoc and reactive responses to problems that often invite more of the same kinds of problem. The so-called "trajectory of trust" (*mutual understanding ✍ mutual respect ✍ mutual trust*) is a participative process for very different institutions to find common interests, culminating in the starting point of collaborative initiatives.

   - ✍ First, there should be a stakeholder analysis. The interests of both company and communities are estimated, comprising expectations and concerns (hopes and fears), differentiating between interests that are declared and hidden.

   - ✍ In an environment in which company and the specific community feel comfortable in (probably not in the AA office or the Village Head's office), the company introduces its intention to demarcate and manage HCVF areas. All parties agree to the need for a better understanding of the implications of this intention, focusing on their interests (expectations and concerns). No agreements or promises are sought at this stage, only dialogue towards mutual understanding. As is well known and documented world-wide for conflict resolution, it is critical to emphasise interests and to avoid creating a platform for promoting (intransigent) positions.

   - ✍ Proper facilitation is key. A third party, such as an NGO or other institution in which both company and community have confidence, is more likely to succeed at moderating the process.

   - ✍ With mutual understanding that each party has legitimate (if not always legal) and essential livelihood concerns and that both are willing to seek accommodation with each other rather than to perpetuate the *status quo*, mutual respect is fostered.

   - ✍ Transforming mutual respect into mutual trust requires the realization that both company and community can gain and some early concrete demonstrations of good faith. Increased transparency is an example, e.g., sharing map information with communities of land use in and outside the FMU and villages admitting to development plans such as the placing of 100 households for oil palm development close to the northern border of the FMU.

4. **Better Boundaries.** *How can boundaries between the FMU and community areas be mutually acceptable and respected?* Once there is sufficient mutual trust, one of the first collaborative activities between the company and relevant communities should be participative mapping to demarcate the HCVF boundaries identified in the present HCVF assessment. The process itself can build further trust. As the saying goes, "Good fences make good neighbours". Participative mapping, however, if not done properly can erode trust and create disputes over land control. Across Indonesia, there are examples of miserable failures (some of them the fault of international agencies) and impressive successes.

   - ✍ The company should learn from the Network of Village Mappers or JKPP (*Jaringan Kerja Pemetaan Partisipatif*) and NGOs with wide and successful

experience, e.g., Pancur Kasih in West Kalimantan, Watala in Lampung, and Warsi in Jambi. Other useful information sources are DfID's Multi-stakeholder Forestry Programme (MFP) and the Ford Foundation that have supported participative mapping initiatives across Indonesia.

- ✍ HCVF boundary demarcation through participative mapping should be fully aware of the current land claims' situation. Indeed, it may be possible to find solutions to some land claims through participative mapping processes.

- ✍ Among the social groups that are important to participative demarcation of HCVF boundaries are tiger shamans (for HCV 1), upstream pioneer farmers (for HCV 4.1), and coconut farmers (for HCV 4.3 and 4.2).

5. **Entry Points for Company-Community HCVF Management.** *Where to start?* It probably does not make sense to start on all fronts at once. Ideally, AA should start where the task is easiest yet important. The sub-village of Yos fits these criteria for the following reasons:

   - ✍ Although not yet formally established as a sub-village, Yos is inside a village area which is not contested by other villages (Segamai claims land only as far north as the Tugau estuary, far to the south of Yos).

   - ✍ Yos is the only sizeable settlement (40 households) adjacent to the FMU, with a respected though informal leader.

   - ✍ It is adjacent to FMU areas currently assigned for all the HCVs in the Serapung HCVF, namely, HCV 1, 4.1, 4.3 & 4.4.

   - ✍ Allies. There are potential community allies for HCVF protection, e.g., tiger shaman and smallholder farmers whose coconut and vegetable plots are threatened by floods caused by illegal loggers (a pan-FMU problem) that connect the main north-south FMU canal with their smaller canal to transport illegally-harvested logs.

   - ✍ Threats. Illegal loggers, who include some who live in Yos, are well represented -- an acid test for the idea that two major long term stakeholders in the future of FMU forests -- the company and local farmers -- can engage with and persuade illegal loggers to leave. Perhaps some orderly, small-scale and reduced-impact selective logging system might be developed in forest classified as *Kehidupan* or *Unggulan*, with benefits accruing not only to loggers (approved by the community) but to the community at large through a co-managed fund, in exchange for a cessation of logging elsewhere.

   - ✍ Threats. The head of Serapung village, without consultation with the Yos community, has apparently approved the request of an outside investor to locate 100 migrant families to work a 100 ha oil palm plantation within the Yos area. The increased demand for wood and potential labour supply for illegal logging activities are a challenge that is likely to recur elsewhere in agricultural land adjacent to the FMU.

6. **Enhancing Efficiency and Effectiveness.** *Can community relations processes for HCVF management be made more efficient and effective?* During the early stages of managing the social aspects of HCVF protection, more time and resources will be required than in

the kind of community development connected with FMU Serapung. Nonetheless, there are a number of efficiency and effectiveness measures that should be pursued, e.g.,

- ✍ Ensuring effective representation within specific communities, ensuring the voices of typical silent but numerous groups are heard, e.g., women, the landless poor, traditional leaders.

- ✍ *Kehidupan* and *Unggulan* areas could be sustainably managed, without threatening HCVF functions, providing either timber or non-timber revenues to local communities (the alternative may be logging and re-logging by illegal loggers).

- ✍ Focus on benefits with wide reach rather than benefits that are easily captured by the elite or create social jealousy, e.g., high-yielding crop planting material rather than processing equipment, village meeting place rather than village government offices, or primary health care and school facilities. Any village development funds related to HCVF to be management transparently and audited. As far as possible connect the flow of benefits with verifiable conservation progress, monitoring outcomes together with the community.

- ✍ Explore the possibility of employing people from Yos to help persuade other communities of the benefits of collaborative management of HCVF areas.

- ✍ The company should work towards the establishment of an association of village communities surrounding FMU Serapung in alliance with the company to reduce HCVF threats and sustain direct and indirect benefits. Understandably, there might be concern that such an alliance might backfire and result in unrealistic, even extortionary demands. Certainly the risk is there, but mitigated by the kind of participative and trust-building measures mentioned above, and small in comparison with the failure to provide a more effective defense against future waves of illegal loggers, oil palm plantations and other development activities.

7. **Monitoring, Evaluation and Responses.** *How can monitoring be effective and responses timely?* M&E for the social aspects of HCVF management generally apply to other aspects and are dealt with in Section 6.2, below.

6.2 Monitoring Regime

- ✍ Periodic monitoring should have internal and external components.
  - ? Clearly, internal monitoring by the HCVF Unit is important for timely management responses.
  - ? A separate agency within the company should evaluate progress annually before the arrival of the independent auditors.
  - ? Quarterly remote-sensing data of forest cover should be sent to the independent auditors.
  - ? The company should set up a periodically-updated website showing key monitoring parameters such as natural forest cover and HCVF boundaries.

- ✍ The emphasis on monitoring should be outcome-based, rather than an administrative exercise of checking on reporting and documentary procedures.
  - ? Monitoring should be able to track the indicators of success and similarly capture failure.
  - ? Protocols for management responses need to be developed.

- Annually, a lessons-learned exercise should be conducted. Lessons means, "*what we thought we knew but experience proved otherwise*".
  - Lessons-learned processes involve (i) identification, (ii) learning and (iii) remembering.
  - As more APP FMU's establish HCVFs, it will be helpful to institute shared-learning processes among FMUs.

- Monitoring of tigers within the FMU will be required.
  - To enable relevant and usable data to emerge from monitoring, a programme should be designed and implemented. This should include the establishment and training of a team to implement this programme.
  - External assistance and collaboration may be the way forward, possibly forming partnerships with organisations or local NGOs who have the capacity either to train or to undertake monitoring on behalf of the company.

6.3 Research and Development

- There should be support for research that systematically compares across FMUs different incentives and disincentives for local communities to help safeguard HCVFs. This may be outsourced but there should be company competence to oversee and interpret such work and to use the results to modify management decisions.

- Supplemental study to determine the contribution of the area designated as an indicative HCVF to the survival and long-term viability of a tiger population in the area.

Objective:	To evaluate the contribution of the defined area of forest within the Serapung unit towards maintenance of a tiger population in the wider area.
Study Area:	The coastal strip between Tanjung Datuk at the mouth of the Kampar river to the next river channel entering the sea, at Pulau Tadi (Refer map), extending 10km inland from the coast. Contained within this study area is a 5,884ha block of forest within the FMU.
Implementation:	The study will be conducted by an independent specialist team, lead by a recognized expert in tiger ecology and rapid survey techniques.
Scope of Work:	Determine the estimated size of this tiger population Evaluate the habitat utilization and distribution of the population within the study area. Evaluate the population's comparative utilization of different habitat types: peat swamp forest, coastal alluvial bench forests, secondary habitats and farmlands. Taking into account current and future land use of the wider area, determine the long term viability of this population, and the area (and primary habitats) required to support it. Determine if the defined forest block within the FMU constitutes an integral part of the area and habitat required to support the tiger population in the long term.
Outputs:	A report detailing the findings of the study
Timeframe:	3 – 6 months
Budget:	To be developed with identified specialist team.

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Appendix 1. List of Spatial Data & Imagery Sources

Asia Pulp and Paper Co. Ltd

1. Hasil sementara verifikasi klaim dan okupasi areal PT Arara Abadi & Group. To SmartWood from Sugianto, *Tim Penyelesaian Klaim Areal*, PT Arara Abadi, Perawang.

IMAGES

2. Spot image of Pulau Muda and surrounding areas. Dated 19 July 2004. Reference No. #. Electronic file *SPOT2A.tiff*.

GIS Data

3. Pulau Muda Baseline Information in Arc View Shapefile and AutoCAD format. Reference files:
    a. Bagunan_air.dxf
    b. Mhjknl021004.dxf
    c. mhjls011104.shp
    d. mhjnopp011104.shp
    e. mhjpp011104.shp
    f. mhjppanno.shp
    g. mhjsm011104.shp
    h. psrpknl021203.dxf
    i. spsm011104.shp
    j. srpannopp.shp
    k. srpklm011104.shp
    l. srpls011104.shp
    m. srpmhjhp01104.shp
    n. srppp011104.shp
    o. srpsg011104.shp
    p. srpsl191104.shp
    q. srptf011104.shp
    r. srptftex0111.shp

Ministry of Forestry

4. Table of conservation sites in Riau. Undated. Ministry of Forestry website: *http://www.dephut.go.id/*[. , downloaded on 15 July 2004. Electronic file *ConservationAreaRiau_2004*.

IMAGES

5. Peta Penutupan Lahan pada Area hutan Lindung dan Kawasan Konservasi, Propinsi Riau, Skala 1:4000,000. Undated. Ministry of Forestry website: *http://www.dephut.go.id/*[. , downloaded on [. 2003. Electronic file *riau*.

SarVision, Wageningan University

IMAGES

6. Spot image of South East Asia. Dated 15 February 2002. To Chris Bennett from Dirk Hoekman 2003. Electronic file *1998_VVY_FullResolution*.

7. Spot image of South East Asia. Dated 15 February 2002. To Chris Bennett from Dirk Hoekman 2003. Electronic file *1998_VVY_FullResolution*.

WWF Indonesia

IMAGES

8. Landsat MSS. Dated 14 May 1973.
9. Landsat MSS. Dated 15 July 1985.
10. Landsat MSS. Dated 17 July 1985
11. Landsat TM. Dated 15 September 1993
12. Landsat ETM 7. Dated 5 March, 2001
13. Landsat ETM 7. Dated 15 August, 2002

GIS Data

14. Various data on Riau in Arc View Shapefile and Arc View grid files. Reference files:
    a. Protectedareas_dinhut_poly_48n.shp
    b. Timber_estate_2003_48n.shp
    c. Palmoil_plantation_2002_48n.shp
    d. Logging_concession_2002_48n.shp
    e. Rtrwp_riau_1994_48n. shp
    f. Rtrwp_riau_draft_2015_48n.shp
    g. Riau_90 (digital elevation model)
    h. Administrative_boundary_2001_poly_48n.shp
    i. Base_poly_48n.shp
    j. Landcover_riau_2002_48n.shp

Appendix 2. APP / SMG Contact List

	Name	Division, Section	Office Location	Date(s) met. Remarks
1	Michael Black	Deputy CEO Asia Pulp & Paper	**Jakarta**	12 Nov
2	Arian Ardie	Dir. Stakeholder Engagement & Sustainability	Jakarta	1 Nov
3	David Nicoll	Forestry	Jakarta	2 & 12 Nov
4	Alias Abdul Jalil	Conservation and Environment	**Perawang**	8 Nov
5	Tan Kee Chong	Plantation Specialist	Perawang	8 Nov
6	John Casey	Community Development	Perawang	7 & 12 Nov
7	Priyageng SP	PSD Deputy Head	Perawang	8 Nov
8	Diding K	FAM Section	Perawang	8 Nov
9	Erwan Effendi	FAM Section	Perawang	8 Nov
10	Francis Phillips	Vice Director	**Pulau Muda**	3-7 Nov
11	Edy Joko Kusworo	KaSie Administrasi	Pulau Muda	“
12	Yulianto	PTS Serapung	Pulau Muda	“
13	Eri Tandra	PTS Sipil	Pulau Muda	“
	Marhalim	PSS, Humas ComDev	Pulau Muda	“
14	Pasau	PLD	Pulau Muda	“
15	Hadi	TUK	Pulau Muda	“
16	Ali	Ka Resort Serapung	Pulau Muda	2-7 Nov
17	Razali	PMR	Pulau Muda	“
18	Roy Adam	PLD Pulau Muda	Pulau Muda	“
19	Hermawan Iskandar	Kasubdistrik	Pulau Muda	“
20	Mawan	Foreman, Surya Alam Lestari	**FMU Serapung**	4 Nov
21	Heri Sanotoso	SMG	**Pekanbaru**	“

Appendix 3. Contact List of Interviewed Stakeholders & Resource Persons

	Name	Location, Title	Date(s) met. Remarks
1	Jamalis	**Serapung**, Village Head	4 & 5 Nov
2	Zaujar K	Serapung, Village Secretary	4 & 5 Nov
3	Zainal	Serapung, highly respected person (Tokoh Masyarakat)	4 & 5 Nov
4	Roslawati	Serapung traditional midwife	6 Nov
5	Abu Zahir	Serapung, farmer	6 Nov
6	Hasan	Serapung, farmer	6 Nov
7	Zainal	Serapung, farmer	6 Nov
8	Kahat	Serapung, farmer	6 Nov
9	[.	**Yos**, Wife of "sub-village" Head Pak Kamil	6 & 7 Nov
10	Aten	Yos, farmer and forest hunter	6 Nov
11	Lobe	Yos, farmer and forest harvester	7 Nov
12	Anuar		7 Nov
13	Saharuddin	Yos, farmer and forest harvester	7 Nov
14	Symasudin	Yos, farmer and forest harvester	7 Nov
15	Samin	Yos, farmer and forest harvester	7 Nov
16	Naga	Yos, farmer and forest harvester	7 Nov
17	Man	Yos, farmer and forest harvester	7 Nov
18	Isbuan	Yos, farmer and forest harvester	7 Nov
19	Anto	Yos	7 Nov.
20	Johari	Yos.	7 Nov.
21	[.	Yos, Wife of tiger shaman, Pak Ibrahim	7 Nov
22	Khaidir	**Labuhan Bilik**, Village head	4 Nov
23	Latif	Labuhan Bilik , Village Council (Badan Perwakilan Desa) member	4 Nov
24	Armin	**Gambut Mutiara**, Village Head	4 & 5 Nov
25	Arifin	Gambut Mutiara, Market Head	4 & 5 Nov
26	Dedy	Gambut Mutiara, businessman	5 Nov
27	Sami	Gambut Mutiara, farmer	5 Nov
28	Jamil	Gambut Mutiara, farmer	5 Nov
29	Maisum	Gambut Mutiara, traditional midwife	5 Nov
30	Sariyati	Gambut Mutiara, traditional midwife	5 Nov
31	Armin	**Segamai**, Village Head & traditional healer	3 Nov
32	Dedi	Segamai, Village Secretary	3 Nov
33	Arifin	Segamai, Market Head	3 Nov
34	Sudirman	Segamai, Market Area Head (RT)	4 & 6 Nov
35	Bujang	Segamai, forest harvester	4 & 6 Nov
36	Amri	Segamai	4 Nov

37	Anasruddin	**Pulau Muda**, Village Head	4, 6, 7 Nov
38	Muhamad Nasir	Pulau Muda, Head of Peoples' Association	
39	Bapak Darwis	Pulau Muda, Village Secretary	7 Nov
40	[.	Pekanbaru, NGO [Yayasan Hakiki]	8 Nov (meeting cancelled)
41	Rully Syumanda	**Pekanbaru**, Kaliptra	1 Nov (phone call)
42	Arif Budiman	Riau Elephant Conservation Program WWF Pekanbaru Office	8 Nov
43	Samsida	Communication Unit WWF Pekanbaru Office	8 Nov
44	Yuyu Arlan	WWF Save the Sumatran Tiger Project WWF Pekanbaru Office	8 Nov
45	Sudirno	Pekanbaru, Deputy Head, Provincial Forestry Service (Dinas Kehutanan)	8 Nov
46	Fardizal Labay	Pekanbaru, Head of Division for Forestry Development (Pengembangan Kehutanan), Provincial Forestry Service (Dinas Kehutanan)	8 Nov
47	Frederic Suli	Provincial Forestry Service (Dinas Kehutanan), Head of Sub-Section for Forest Planting (Hutan Tanaman)	8 Nov
48	[.	Pekanbaru, BKSDA	8 Nov
49	Rachmat	**Jambi**, Warsi	1 Nov (phone call)
50	Nonette Royo	**Jakarta**, MFP (DfID)	1 Nov (phone call)
51	KSDA	Village Head, Pulau Muda	8 Nov
52	Jonoruddin	Hunter, Pulau Muda	8 Nov
53	Sulaimi	Penyuluh Pertanian Lapanagan, Desa Teluk Meranti	8 Nov
54	Neil Franklin	Director – Indonesia Program The Tiger Foundation - Sumatran Tiger Trust	By email
55	Ron Tilson	Director of Conservation, Minnesota Zoo AZA Tiger SPP Coordinator	By email
56	Jim Sanderson	Conservation International	By email

Notes:
/1/ [.= name not given

Appendix 4. Itinerary

Date	Sites & Travel	Specific Activities /a/
1st Mon	SmartWood Office, **Jakarta** **Pulau Muda** District office, AA, Kab. Pelawang.	Meeting of SmartWood (SW) Task Manager Jeff Hayward and Consultants Mark Leighton (ML, Tropical Forest Ecologist), Anthony Sebastian (AS, Wildlife Ecologist), Martin Hardiono (MH, GIS Specialist) and Chris Bennett (CB, Social Scientist). Social assistant, Aisyah Octavia (AO), starts collecting secondary basic data on villages. (AO traveled to Pulau Muda on 31st October).
2nd Tue	Jakarta to **Pekanbaru** flight (one hour) Pekanbaru to **Sodek** (45 minutes) Sodek to **FMU Serapung** to Pulau Muda base camp (MH, ML & AS) Pulau Muda to/from Sodek (CB, 30 minutes) **Pulau Muda** District Office **Pulau Muda** District Office	Team takes commercial flight from Jakarta to Pekanbaru, Riau. Joined by APP's Forestry Technical Advisor, David Nicoll, then fly by helicopter to AA's HTI camp at Sodek. MH, ML and AS conduct one hour helicopter fly-over survey of FMU Serapung -- photos/video and other observations of habitats and site characteristics -- landing at Pulau Muda District offices. Helicopter returns to Sodek to bring CB and David Nicoll to the Pulau Muda District base camp In the afternoon, the full SW team meets with AA staff to agree on work agenda during the HCVF assessment of FMU Serapung In the morning, AO, continues data and other information collection.
3rd Wed	SW team: 1.25 hour river journey from Pulau Muda District Base Camp on the south side of the river Kampar to **FMU Serapung** harbour on the north side. MH, ML & AS then travel along the internal canal system. Canals visited in Petak 311 and 147, Primary canals I and II in Serapung I and Primary canal II in Serapung II (East-West, E-W, and North-South, N-S, arms of the L-shaped FMU).	MH, ML and AS: Overall orientation and preliminary observations of FMU Serapung. AS: recording of wildlife and ground-truthing of information gained from helicopter fly-over. ML: classifying vegetation types by structure, disturbance and floristics; ground truthing from helicopter overflight
	AO & CB: 20 minutes river journey from FMU Serapung harbour to **Segamai** village settlement on the south side of the Kampar river. AO & CB: 20 minutes river journey from Segamai to **Gambut Mutiara** village settlement on the south side of the Kampar river.	AO and CB: Socioeconomic work begins in the village settlements of Segamai and Gambut Mutiara on the south side of the Kamapr river. Introductory meeting with Village Headman and Secretary of Segamai Village. CB: Motorbike travel 20 minutes inland for introductory meeting with Village Headman and Secretary of Segamai Village. AO: Interview village midwife.

4th Thu	MH, ML & AS: Pulau Muda to **FMU Serapung**, Canal 1 and Canal 2 at secondary canal 9.5km and 5.5km respectively. Serapung II – canal primer II.	AS: Transect along secondary canal off Primer II, wildlife observations. Recording of wildlife and habitat. AS: Boat survey of Primer Canal I of Serapung II. ML: Classifying vegetation types by structure, disturbance and floristics along remaining canals. Vegetation plot samples of tree species identity, species richness and structure along Primer II. Discuss timber cruising data with Planning Dept. staff, and obtain photocopies of cruing data in selected areas.
	AO & CB: 1.5 hour river journey to **Serapung** village settlement on Serapung island at the mouth of the Kampar river. 30 minutes to **Labuhan Bilik** village settlement, then on to **Gambut Mutiara**, **Segamai** and **Pulau Muda** village settlements all on the south side of river Kampar.	AO & CB: Introductory and preparatory meetings with village representatives to arrange for questionnaire interviews on subsequent days as well as to gather basic village information: Serapung (Village head and Secretary), Labuan Bilik (Village Head and BPD representative, data indicates village not relevant for questionnaire), Gambut Mutiara (Son of Village Head), Segamai (Head of RT Pasar) and Pulau Muda (Village Head).
5th Fri	MH, ML & AS: Pulau Muda District base camp to **FMU Serapung**. MH: Secondary canal off Primer I AS: Canal Primer II and I for wildlife conservation and secondary canal in Tanjung Datuk Block	ML: Examine condition of forest in SE corner of concession, then conduct floristic samples and plot samples in Tall PSF along canal Primer I; examine active illegal logging operations there MH: Interviews about tigers with contractor and people from Serapung village AS: transect along secondary canal off Primer I, wildlife observations AS: interviews with illegal loggers from Serapung (three people) to ascertain presence of tigers
	AO & CB: Pulau Muda District base camp to **Gambut Mutiara** village settlement CB: Gambut Mutiara to **Segamai** to forest areas on the north side of the river adjacent to the FMU, claimed by Segamai. Return to Gambut Mutiara, then AO & CB: Gambut Mutiara to Segamai, on to **Pulau Muda**.	AO & CB: Village meeting to fill in the questionnaires. Village head introduces meeting then leaves. Also talk with people coming from various other villages (because this was the weekly market day). Observations of Sago cultivation, unauthorized small-scale log collection and inter-village boundaries, traveling from border with Gambut Mutiara/Serapung (overlapping claim) to the east and Pulau Muda to the West. Pulau Muda village meeting for questionnaire postponed

6th Sat	MH, ML, CB, AS: Pulau Muda District base camp to **FMU Serapung**. ML visits sites inside the FMU. MH, AS & CB travel 30 minutes east, around Tanjung Datuk point and head north to **Parid Ramli**. MH & CB to the agricultural area of the Ramli canal on the coastal strip the west of the N-S arm of FMU Serapung. AS visits **tidal flats** of Kampar river. Returns later to pick up MH & CB, then head another 20 minutes upriver to the informal and so-called "**PT Yos sub-village"** or *Dusun* of Serapung village. Pick up ML from the FMU Serapung harbour and return north to the mouth of **Tugau** river.	ML: Collect floristic data and plot samples of structure and species diversity in 3rd area of Tall PSF habitat. Analyze cruising data to check habitat consistancy in different areas of concession. AS: General survey of tidal and coastal waters for migratory birds and marine mammals. Surveyed exposed sandbar below Pulau Tiga, opposite Serapung island. Attempted to survey tidal flats opposite Serapung camp jetty, but the tide was not low enough. AS: wildlife observations and interviews for tigers along PT Yos Seraya canal from jetty to 1.4km
	AO: Pulau Muda District base camp to **Serapung** village settlement on Serapung island. Then to **Segamai** village settlement. CB & MH: **Parid Ramli** and "**PT Yos sub-village"** ML, AS & CB: **Tugau** river and inland coconut area	AO: Village meetings in Serapung and Segamai to fill in the questionnaires. Slow-going across the mangrove mid flats to the parid Ramli agricultural area. No respondents found. Area abandoned, probably because of acute coconut pest attack. Interview recent settlers in the new "PT Yos" settlement about agricultural and forestry strategies, relations with the FMU and with illegal loggers; the latter's canal works lead to evidently destructive flooding of coconut gardens. Visit coconut area established by Bugis farmers but none present (probably already heading homeward (*mudik*) to celebrate the imminent end of the fasting month.
7th Sun	AS & CB: Pulau Muda District base camp to sub-village **"PT Yos" sub-village**	AS: transect from jetty along boundary canal, distance 4km. Wildlife observations, interviews with locals for tigers and observations / photographing the drainage ditch breaching the main canal into the PT Yos canal, dug by illegal loggers to remove logs.
	CB: "**PT Yos" sub-village** AO: Pulau Muda District base camp to/from **Pulau Muda** village settlement	CB: Informal, trail-side village meeting to fill in questionnaire. AO: Village meeting to fill in questionnaire.
	SW Team: **Pulau Muda** base camp	Wrap-up meeting between AA and SW team
	MH, ML, AS & CB: Pulau Muda District base camp helicopter fly-over of **FMU Serapung** survey. SW Team: Pulau Muda District base camp, helicopter flight to AA/APP/Indah Kiat **Perawang**	AS & ML: Aerial survey of concession by helicopter, confirmation of potential HCV boundaries and re-affirmation of ground-findings. Obtain comprehensive digital photographs of different forsted areas within and abutting concession. Stay over night at Perawang.

8th Mon	AA Office, **Perawang** SW team by road to Pekanbaru for various meetings before departure to **Jakarta** in afternoon.	SW team meets with Pak Alias Djalil, Conservation Director, and his staff. AS: discussions with Survey & planning staff, Pak Irwan, who was assigned to data gathering on migratory raptors prior to the arrival of the SW team. ML & AS: discussions with Dr. Pang on hydrology
	Pekanbaru	AO & CB: Meeting with AA staff, Hari Santosa. AO & CB: Meeting with Dinas Kehutanan. AO: Meeting with NGO ML & MH: Meeting with KSDA, Riau. Discuss government and NGO conservation and development plans for forest landscape block that includes Serapung. Compare flotistics of PSF and leaf samples with Pak Jono from Dinas Kehutanan technical staff. AS: Meeting with WWF, Riau. Discussions on tiger conservation with Pak Arif Budiman (Riau Elephant Conservation programme), Pak Yuyu Arlan (Tiger conservation programme) and Ibu Samsida (Communications officer).
	Pekanbaru to **Jakarta**	Afternoon commercial flight back to Jakarta.

Notes:
12 November: SW presentation of preliminary findings to APP.

/a/ Team members referred to as follows in the above itinerary: Aisyah Octavia (AO), Mark Leighton (ML), Anthony Sebastian (AS) and Chris Bennett (CB).

Appendix 5. Glossary of Terms

***Areal Kehidupan* / Livelihoods Area**
According to Minister of Forestry Decree No.70 of 1995, around 5% of the HTI FMU area with non-timber yields of value for local communities.

***Areal Konservasi* / Conservation Area**
According to Minister of Forestry Decree No.70 of 1995, conservation areas are where there is peat, water absorption area, riparian zone, beach zone, next to lake or reservoir, around spring and around mangrove areas.

***Areal Produksi* / Production Area**
According to Minister of Forestry Decree No.70 of 1995, production areas that can be cleared for the establishment of industrial timber plantations.

***Areal Unggulan* / High-quality Local Species Area**
According to Minister of Forestry Decree No.70 of 1995, around 10% of the HTI FMU area is mandated for management of local species of high market value.

Alternatives
In the context of livelihood sources, refers to alternatives that are readily available at a low marginal cost, e.g., market beef instead of deer meat.

Baseline Mapping
Mapping parameters that include: topography, vegetation types and their distribution, and land use and vegetation cover of the surrounding areas. Graphical presentation of all available baseline information forms the basis for planning of surveys, plotting of HCVs, creation of overlays and delineation of HCVFs. Pre-requisite for conducting an HCVF assessment.

Baseline Inventory and Mapping
An inventory of the habitat and species in the FMU. It should cover the following parameters:
- Inventory of species occurring within the FMU: plants, mammals, birds, herpetofauna (reptiles & amphibians) and fish;
- Reports & other literature on gazetted protected areas in the immediate vicinity;
- Ecological literature on species of conservation significance locally, nationally, regionally and globally;
- Reports and other literature on the status of habitats, forest types and vegetation communities of conservation significance locally, nationally, regionally and globally;
- Mapping of: topography, soils, vegetation types and their distribution, and land use and vegetation cover of the surrounding areas.

A baseline inventory and mapping is a pre-requisite for conducting an HCVF assessment.

Contiguity Principle
The application of this principle to HCVF delineation endeavours to minimize boundary lengths, keeping forest blocks as compact as possible. Small tracts of forest should be avoided, reducing fragmentation and edge effects to HCVFs. Where gazetted protected areas occur adjacent to, or close to the FMU, HCVFs should maintain contiguity with these protected areas. Wherever possible, forest corridors should be maintained between HCVFs, their size and shape reflecting the needs of the animal and plant species which use them. Contiguity should also be maximized with other protection forests within forest estates, such as riverine buffers, catchments, steep slopes and buffer strips.

Critical temporal concentrations

Defined by the Indonesian HCVF Toolkit as habitats or locations which have important concentrations of species only at certain times or at certain phases of their life-history, including critical breeding sites and migratory routes or bottlenecks (latitudinal as well as altitudinal). These may be represented by:

? Concentrations of migratory birds;
? Animals such as bearded pig following Dipterocarp masting events;
? Fruit bats, bees and pigeons follow flowering and fruiting patterns of trees;
? Elephant migration between different forest blocks;
? Fish migrating to spawning grounds.

Critically Endangered Species

According to IUCN, a taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of =90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   (a) direct observation
   (b) an index of abundance appropriate to the taxon
   (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   (d) actual or potential levels of exploitation
   (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of =80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of =80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of =80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 100 km^2, and estimates indicating at least two of a–c:
   a. Severely fragmented or known to exist at only a single location.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.
   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 10 km^2, and estimates indicating at least two of a–c:
   a. Severely fragmented or known to exist at only a single location.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat

(iv) number of locations or subpopulations
(v) number of mature individuals.

c. Extreme fluctuations in any of the following:
(i) extent of occurrence
(ii) area of occupancy
(iii) number of locations or subpopulations
(iv) number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):
a. Population structure in the form of one of the following:
(i) no subpopulation estimated to contain more than 50 mature individuals, OR
(ii) at least 90% of mature individuals in one subpopulation.
b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

Data Deficient (DD) Species

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution is lacking. Data Deficient is therefore not a category of threat or Lower Risk. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and threatened status. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

Degraded forest

Forest no longer in its natural state, its structure being modified by human activity or natural conditions, *either directly, e.g., high-impact logging, or indirectly, e.g., flooding of forests caused by downstream obstruction to rivers by infrastructure development.* The majority of its floristic composition is retained, but opening of the canopy has resulted in colonization, or regeneration, of light-loving species. Depending on proximity to sources of colonization, scrub species (mammals and birds) may or may not occur.

> Also considered is the AMEC definition derived from World Bank, "This is a forest that has been essentially modified by human activity and has reduced the habitat's ability to maintain viable populations of native species. These forests may also be under current threat from local people involved in illegal activities which will continue to degrade the forest structure and its associated hydrology and thereby its habitat values for the conservation of fauna and flora and sustainable livelihood of local people. Degraded forests have been essentially modified through previous logging, indicated by evidence of railway lines and large openings, fires, or extensive networks of canals in peat areas."

Ecoregion

A geographically disctinct area of land that is characterized by a disctinctive climate, ecological, features, and plant and animal communities.

Endangered Species

According to the IUCN, a taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of =70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   (a) direct observation
   (b) an index of abundance appropriate to the taxon
   (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   (d) actual or potential levels of exploitation
   (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of =50% over the last 10 years or three generations, whichever is the longer**,** where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of =50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of =50% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 5000 km^2, and estimates indicating at least two of a–c:
   a. Severely fragmented or known to exist at no more than five locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.
   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 500 km^2, and estimates indicating at least two of a–c:
   a. Severely fragmented or known to exist at no more than five locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.
   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

C. Population size estimated to number fewer than 2500 mature individuals and either:

1. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):
   a. Population structure in the form of one of the following:
      (i) no subpopulation estimated to contain more than 250 mature individuals, OR
      (ii) at least 95% of mature individuals in one subpopulation.
   b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

Forest
Unless otherwise indicated all references to "forest" in the report assume natural forest (regardless of its quality). Plantation forest areas are specified as such.

FMU
The Forest Management Unit of Pulau Muda District I located south of the Kampar river in Kabupatens Pelalawang, Indragiri Hilir and Indragiri Hulu. It does not include the Serapung forest management area.

Forest Fragmentation
In the context of forests, refers to discontinuity in the forest landscape compromising functioning of the corridor affect, resulting in forest landscape dysfunction and related threats to habitat integrity and species survival. The usage of this term here is not applied to canopy fragmentation.

HCV
High Conservation Value as determined by identifiable biodiversity components. HCVs are distinct from lower conservation values which may still be worthy of protection as well as other site aspects of no significant conservation value.

HCV 1
Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia).

HCV2
Forest areas containing globally, regionally, or nationally significant large landscape level forests, contained within, or containing the management unit, where viable population of most if not all naturally occurring species exist in natural patterns or distribution and abundance.

HCV3
Forest areas that are in or contain rare, threatened or endangered ecosystems.

HCV4
Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control).

HCV5
Forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health).

HCV6
Forest areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance in cooperation with such local communities).

HCVF
High Conservation Value Forest area determined according to the presence of one or more high conservation values within areas of conservation value.

***Kawasan Lindung / Protection* Area**
According to Presidential Decree No.32 of 1990, Protection Areas.

Keystone species
Species providing ecological functions (e.g., seed dispersal, pollination, key food resources) necessary for preventing the local extinction of other species in the community.

Landscape Forest
Large blocks of forest covering more than 50,000 ha that are (a) continuous enough to allow dispersal of plant and animal populations and (b) are mostly in primary or lightly disturbed condition.

Local Community
A village (*Desa*), sub-village (*Dusun*) or other social sub-group unit within the village or from another village (e.g, fishermen, rattan gatherers), whose area of livelihood development overlaps partly or entirely the FMU's natural forest area or is adjacent to it. Local communities may be recently or long-established. The social unit of community may apply to settlements downstream that are impacted by human forest disturbance, e.g., canal digging, or settlements close to smoke sources from fire mismanagement.

Lightly degraded forest
In the Pulau Muda FMU this term is applied to lightly selectively logged forest which has increased the frequency of gaps, but retains high biodiversity conservation value. If protected from fire, natural processes of ecological succession and regrowth will return this forest towards primary forest conservation value.

Lower Risk (LR) Species
A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

- **Conservation Dependent (cd).** Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
- **Near Threatened (nt).** Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
- **Least Concern (lc).** Taxa which do not qualify for Conservation Dependent or Near Threatened.

Non-forested land
Land that has been entirely cleared of its former vegetation, or has been colonized by secondary forest species, e.g. monotypic stands of *Macaranga* and other pioneer species. Faunal composition entirely open country scrub species.

Overlap
Refers to ecological as well as physical characteristics. For species, this would apply to those whose ranges extend across the Protected Area (PA) and the FMU. For habitats, this applies to vegetation communities which occur in both the PA and the FMU, and are of significant conservation concern or priority on national, regional or global scales.

Peat Swamp Forest (PSF)

Forests growing on surface peat, of variable structure and floristic composition depending on edaphic (soil) and drainage factors. Those at the Pulau Muda FMU are coastal peat swamp forests on peat deposits that have accumulated over marine sediments. The peat layer comprised of partially or nearly undecomposed plant litter, including fallen leaves, twigs, limbs and roots, may be a surface layer or many meters deep. Peat is highly acidic (pH 3.5-4.5), which inhibits its decomposition by microorganisms and inhibits essential mineral nutrient availability for plants. Peat swamp plant species are mostly endemic to this nutrient-poor, drought-prone habitat. Three major types of PSF occur in the Pulau Muda FMU, namely, Short PSF, Tall PSF and Mixed PSF.

Precautionary Principle
Ethical principle that if the consequences of an action, especially the use of technology, are unknown but are judged by some scientists to have a high risk of being negative from an ethical point of view, then it is better *not to carry out the action* rather than risk the uncertain, but possibly very negative, consequences (Wikipedia 2004, *http://en.wikipedia.org/wiki/Precautionary_principle* , 18 July 2004).

Primary forest
Forest in its natural state, unmodified by human activity (i.e., with negligible impact from human gathering activities, including the rare cutting of isolated timber trees). This refers to forest structure, and not to its fauna, or its size. Hunting may have removed certain species (e.g. large mammals), but the forest stand remain undisturbed.

> Also considered is the AMEC definition derived from World Bank, "This forest is relatively intact 'natural forest' and essentially unmodified by human activity. The forest shows no signs of fire, logging in the form of infrastructure such as railways or canals. Local people may be present in sufficient low numbers or under take activities that leave the forest in near-natural condition. The forest does not have adjacent activities that in the near future might essentially modify the natural forest cover, or leave the forest in other than near-natural condition. Some of these primary forest areas are critical habitats if they occur in existing 'protected areas' and or in areas that are being proposed for Protection Forest status under provincial land use planning legislation."

Severely degraded forest
Forest drastically altered in composition and structure, as a result of human activity or natural events, e.g. fire. The forest no longer retains natural structure and most of its fauna has been reduced to pioneer and secondary forest species. In the Pulau Muda FMU this is heavily logged forest that often has also burned, or forest that has established after agricultural clearing. It has negligible conservation of biodiversity value, but if protected from further disturbance, could help serve as a forested corridor lending continuity between forested block, or serve as a buffer zone forest helping to protect HCVF.

> Also considered is the AMEC definition derived from World Bank, "This is a forest that has been irreversibly modified by human activity and has reduced the habitat's ability to maintain viable populations of native species. These forests are also under current and increased threat from local people and their associated illegal activities that will continue to degrade the forest structure to a point where it loses habitat values for the conservation of fauna and flora and sustainable livelihood of local people. Severely degraded forests have been impacted by previous repeated logging activities which are indicated by the presence of railway lines or canals, repeated fires as evidenced by fire scars, vines, shrubs and grasslands."

Traditional
Of long-established social or economic practices reflected in social norms and institutions. In the context of HCV, taken to apply to practices that have been established for at least one generation or approximately 25 years.

Umbrella Species
Species occurring at low density whose habitat needs in terms of area and diversity encompass areas sufficient to maintain viable populations of other species.

Vulnerable Species

According to the IUCN, a taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of =50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   (a) direct observation
   (b) an index of abundance appropriate to the taxon
   (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   (d) actual or potential levels of exploitation
   (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of =30% over the last 10 years or three generations, whichever is the longer**,** where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible**,** based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of =30%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of =30% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 20,000 km^2, and estimates indicating at least two of a–c:
   a. Severely fragmented or known to exist at no more than 10 locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.
   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 2000 km^2, and estimates indicating at least two of a–c:
   a. Severely fragmented or known to exist at no more than 10 locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.
   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

C. Population size estimated to number fewer than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a–b):
   a. Population structure in the form of one of the following:
      (i) no subpopulation estimated to contain more than 1000 mature individuals, OR
      (ii) all mature individuals are in one subpopulation.
   b. Extreme fluctuations in number of mature individuals.

D. Population very small or restricted in the form of either of the following:
1. Population size estimated to number fewer than 1000 mature individuals.

2. Population with a very restricted area of occupancy (typically less than 20 km^2) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.