The Rimba Raya Biodiversity Reserve Project

REDD: Avoided (Planned) Deforestation in Central Kalimantan (Borneo) Indonesia

Project Design Document (PDD)

Submitted for validation according to: by:

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Dedication

All of us, as participants in the world's developed economies, are living in a period of abundance and mass consumption unequaled in the course of human history. To us, the abundance of our lives has become so much the expected norm that we think it is simply the way things are and will always be. But in fact, it has never been an historical reality, nor is it inevitable or even probable for the future generations of this planet.

This is not a political issue. It is undoubtedly an economic issue; but even further to its core, this is a moral issue.

We, the current custodians of this planet, have stood on the broad shoulders of our parents and grandparents and have harvested the fruits of their labor. Now, in a shameful frenzy to satisfy our insatiable appetite for mass consumerism, we are climbing up the backs of our children and short selling their futures. Our legacy and their inheritance is that we have left them environmentally bankrupt and financially enslaved.

The recent financial crisis is only a microcosm of the broader reality that everything we consume is highly leveraged, with the real total cost of ownership being far greater than its current price reflects. By paying only for the extraction cost of our non-renewable natural resources and not their full replacement costs, we are borrowing from our children's futures to subsidize the cost of the goods and services we consume today.

In this Environmental Ponzi Scheme, in which we are the perpetrators and our children are the victims, the consequences of the sudden hard stop that must inevitably follow will dramatically alter the way we live on this planet. It will not only have dire environmental consequences, but also far reaching socio-economic consequences.

The cause and the solutions of this environmental crisis are the same as the recent economic debacle, albeit in the reverse. Whereas most asset classes have been overvalued for decades, Environmental Assets have been grossly undervalued, leading to over exploitation and relatively little commitment to investment in environmental technology or infrastructure. Understanding this not only offers us the chance to mitigate the consequences of our unbridled actions, but also to profit from what is arguably the single greatest economic opportunity of the next century.

We have exceeded the Earth's "Carrying Capacity", its ability to regenerate what we consume. We currently consume at a rate of 1.5 times the earth's capacity to absorb our waste and regenerate the resources we've consumed. By the year 2050, when our population reaches 9 billion people, we will need the equivalent of two Earths to support our insatiable demand for natural resources. Clearly, we are past the point of peak production and on a decline that can only lead to chronic and systemic shortages in food, water and other life giving natural resources.

And while there is now finally much talk about carbon emissions, there is still little discussion of our total ecological footprint, which far exceeds our carbon footprint. Just since the inception of this project some three years ago, the world has lost 45 million hectares (110 million acres) of forest, an area one and a half times the size of Norway. Most of this was tropical bio-diverse forests whose real value is incalculable – slashed and burned for things like palm oil for the production of packaged cakes, cookies, candy and crackers and cleared for cattle grazing for the production of fast food hamburgers. For these frivolous things we have stolen from our children's future and for the first time in modern history we have condemned the next generation to a lower standard of living than our own.

InfiniteEARTH created the Rimba Raya Biodiversity Reserve because we simply cannot afford to wait for political compromise on the future of this planet.

Regardless of your position on Climate Change, one relentless truth stands unchallenged…every minute of every day an area of bio-diverse tropical forest the size of five soccer fields is destroyed and lost forever. That is an area the size of Belgium every year.

The consequences of deforestation are irrefutable and go far beyond carbon and climate change. If we do not act now, with all of the tools available to us, we will lose the battle to save the world's few remaining and fragmented tropical forests.

InfiniteEARTH's Rimba Raya project was founded on two basic principles:

1. **The developing world's right to exploit their natural resources cannot be marginalized.** To do so is to economically enslave those we purport to liberate. We, the consumers in the developed economies, must accept responsibility for providing an alternative land-use for this resource if we are serious about its conservation. That is the essence of REDD - to give value to ecosystems services that, for too long, have been undervalued and gone unpaid.

2. **Carbon Neutral and Sustainable are simply not enough.** These are words we would never use to describe our products, our companies' brands or stock prices, let alone to describe the state of the planet or the vision we have for our children's futures. And yet, they are often tendered as acceptable benchmarks of success in the race to save the planet. The future generations of this planet deserve more than just a sustainable future.

The solution for addressing these two seemingly dichotomous demands is remarkably simple. We must price natural resources based on their fully burdened replacement cost. The promise of REDD is exactly that – to remove the unsustainable "subsidies" that we currently enjoy on environmental services.

In August 2010, InfiniteEARTH and its partners delivered the industry's first internationally recognized REDD methodology. Though this is but a modest step in the long journey to saving the world's diminishing tropical rain forests, the successful double validation of this methodology gives the world a powerful new tool that allows us to shift into action…before its' too late.

For too long the issue of REDD has languished exclusively in the halls of academic debate and in the mire of party politics. As such, throughout this long and difficult process, we at InfiniteEARTH have felt the burden of doing more and with greater urgency. To that end, we have now taken this issue and placed it in the arena where it belongs – on the ground - where theoretical science becomes real and produces meaningful results while we "learn by doing".

Finally, the real monetary value of the world's forests has begun to be recognized and paid for. With the sale and purchase of each REDD credit from this project, collectively we have made the commitment that no more will we ask our children to sacrifice their futures to pay for our current indulgences.

We are now no longer limited to the cynical choice of economic growth versus environmental sustainability. With the successful verification of InfiniteEARTH's Rimba Raya project, we have provided the world with a new economic paradigm and tangible example that we can, in fact, grow our economies and do so sustainably.

The success of the Rimba Raya project has been InfiniteEARTH's ability to build a global cross-sector coalition between nonprofit, community, international finance and global commerce and to synthesize them all into a new "private-sector-for-profit conservation model".

In doing so, together we have begun to deliver on the promise of long-term economic and environmental sustainability for all stakeholders, including forest-dependent indigenous and local communities.

Today, we stand proudly with our global coalition partners who have shown exceptional courage and leadership on this issue.

The Rimba Raya Project is dedicated to all the children of this fragile planet from whom we have taken so much.

Todd Lemons – Chairman & CEO
InfiniteEARTH

"We do not inherit the Earth from our ancestors; we borrow it from our children"

– Native American Proverb

Acknowledgements

With Special Recognition and Thanks to:

The Indonesian People and Government

Just four years ago Indonesia was named the world's third largest emitter. Today, InfiniteEARTH and Indonesia stand poised to deliver the world's first 100 mega-tonne REDD project. We are grateful for the commitment to REDD that President Susilo has shown.

and

Orangutan Foundation International

Dr. Biruté Mary Galdikas Founder

for her unparalleled 40 year commitment to forest conservation in the Tanjung Puting National Park and the eastern buffer zone to the park that now comprises the Rimba Raya Biodiversity Reserve. The world is deeply indebted for your invaluable work.

and

Gazprom Marketing & Trading

for their forward purchase of credits very early in the project development process and for their ongoing commitment to providing a viable market for the project's REDD credits. Their leadership and support has been a crucial component of the project's success.

and

Clinton Climate Initiative-Forestry, S.E. Asia

for their generous support in the validation process of the Methodology and validation of the project by both the VCS and CCB Standards, under the Norad grant to CCI-Forestry (GLO-4244, INS09/010).

and

The People and Government of Norway

for setting an example to the other developed economies of the world. Their $1 Billion USD commitment to Indonesia tangibly demonstrates their recognition that we can no longer borrow from our children's futures and that we must pay the full replacement costs of our non-renewable natural resources TODAY.

"The power of imagination makes us infinite"

- Naturalist & Conservationist John Muir

2010 International Year of Biodiversity

INTERNATIONAL YEAR OF FORESTS • 2011

Project Profile Highlights

Project Owner	PT Rimba Raya Conservation
Project Developer	Infinite-Earth, Ltd.
NGO Partner & Project Beneficiary	Orangutan Foundation International
Host Country	Indonesia
Region	Kalimantan (Island of Borneo)
Province	Central Kalimantan
Regency	Seruyan
Forest Type	High Conservation Value Tropical Peat Swamp Forest
Total Project Zone (Project Management Area)	91,215 ha
Total Area at Risk of Deforestation	91,215 ha
Project Area (Carbon Accounting Area)	47,237 ha
30-year Carbon Emissions Avoided in the Carbon Accouting Area	104,886,254t CO_2e
Total Carbon Stocks in Project Management Area	>350 million t CO_2e
Project Start Date by Project Developer	November 2008
Primary Deforestation Driver	Planned Deforestation (Palm Oil) support by government policy
REDD Standards	CCB & VCS
Endangered, Threatened & Vulnerable Mammals in Project Zone	29 including the Endangered Bornean Orangutan
Endangered, Threatened & Vulnerable Species (All) in Project Zone	94+
Communities in Project Area and Project Zone	0 in Project Area. 14 in Project Zone

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GLOSSARY OF ACRONYMS

AB 32 Assembly Bill 32: California's Global Warming Solutions Act
AEP: American Electric Power
CARB: California Air Resources Board
CER: Certified Emission Reduction
CCAR: California Climate Action Registry
CCB: Climate, Community, and Biodiversity Alliance
CCB: Climate, Community, and Biodiversity Standards
CCX: Chicago Climate Exchange
CCFE: Chicago Climate Futures Exchange
CFTC: Commodities Futures Trading Commission
CDM Clean Development Mechanism
CFC Chlorofluorocarbons
CFI Carbon Financial Instrument
CO_2 Carbon dioxide
CO_2e: X amount of (solid organic) carbon x 3.67 = CO_2 equivalent
DEFRA: Department for Environment, Food and Rural Affairs (UK)
ECCM: Edinburgh Center for Carbon Management
ECIS: European Carbon Investor Services
ECX: European Climate Exchange
ERT: Environmental Resources Trust
EU ETS: European Union Emission Trading Scheme
ERU: Emission Reduction Unit
GHG: Greenhouse Gas
GWP: Global warming potential
IIED: International Institute for Environment and Development's
JI: Joint Implementation
KWh: kilowatt hour
LULUCF: Land Use, Land Use Change and Forestry
$MtCO_2e$: Millions of tonnes of carbon dioxide equivalent
NGAC: New South Wales Greenhouse Abatement Certificate
NGO: Non- governmental Organization
NOx: Nitrogen oxide
N2O: Nitrous oxide
NSW GGAS: New South Wales Greenhouse Gas Abatement Scheme
OTC: Over-the-counter market
PG&E: Pacific Gas & Electric (California & other western states)
REC: Renewable energy credit
RGGI: Regional Greenhouse Gas Initiative (11 Eastern United States + California)
SO2: Sulfur dioxide
tCO_2e: Ton of carbon dioxide equivalent (1 tonne of solid organic carbon x 3.67 = 1 tonne of CO_2 equivalent)
TREC: Tradable renewable energy credit
VER: Verified Emission Reduction
VCS: Voluntary Carbon Standard
VCU: Voluntary Carbon Unit
WBCSD: World Business Council for Sustainable Development
WRCAI: Western Regional Climate Action Initiative
WRI: World Resources Institute
WWF: World Wildlife Fund

GLOSSARY OF PROJECT SPECIFIC TERMS

Carbon Accounting Area – From VCS terminology, this is referred to as the Project Area in CCB Standards. The Carbon Accounting Area is the section of the Rimba Raya forest concession that is managed for carbon credits, comprising 47,237 ha of the 91,215 Rimba Raya concession.

Leakage (InfiniteEARTH Definition) - Any increase in greenhouse gas emissions that occurs outside a project's boundary and within Central Kalimantan, is measurable and directly attributable to project activities, and involves the harvesting of Protected Forest and Protected Areas.

Physical Buffer – A defined section of forest located on the perimeter of a national park whose presence acts as a barrier against the encroachment of oil palm plantation, logging or other illegal activities into the park. The InfiniteEARTH Rimba Raya Reserve will fund a reserve-wide network of permanent guard posts, community-based patrols, and a fire brigade, further strengthening Rimba Raya's role as a Physical Buffer.

Project Area – The 47,237 ha within the Rimba Raya concession that is being audited for avoided Greenhouse Gas (GHG) emissions. The Project Area is comprised of land that would convert to oil palm estates but for the intervention of InfiniteEARTH.

Project Zone – This includes the full 91,215 ha of the Rimba Raya concession. The Project Zone seeks to account for communities whose economies are affected by activities within the Rimba Raya concession and extend climate and biodiversity management well beyond Project Area boundaries.

Positive Leakage – An increase in the carbon stores of neighboring forests as a consequence of project activities.

Project Management Area – From VCS terminology, this is referred to as the Project Zone in CCB Standards.

Social Buffer – The consequences of engagement with local communities, government and NGOs as stakeholders in resource management and conservation of forest around a national park. The provision of social services and creation of employment incentivizes stakeholders to support forest preservation and oppose the harvesting of forest. This acts as an additional societal barrier to the incursion of illegal activities into the nearby national park.

EXECUTIVE SUMMARY

Every minute of every day in Indonesia, an area of biodiverse forest the size of five football fields is slashed and burned for conversion to oil palm plantation. Annually, this primary driver of deforestation destroys more than 25,000 square kilometers of forestland – an area roughly the size of Belgium – in a wasteful cycle that is responsible for Indonesia's ranking as the world's third largest emitter of greenhouse gases despite being a non-industrialized nation whose economy accounts for less than 1% of global GDP (World Bank and IMF Global Rankings - 2008). This wanton destruction of forests is fueling an environmental catastrophe that reaches far beyond the borders of Indonesia. The Rimba Raya project aims to stem the tide of destruction that threatens global climate stability.

The Rimba Raya Biodiversity Reserve is a beautiful and storied expanse of tropical peat swamp forest on the southern coast of Borneo in Central Kalimantan province, Indonesia, covering 91,215 hectares of land along the eastern flank of world-renowned Tanjung Puting National Park. Without the Rimba Raya project, this area would be lost to planned oil palm development. The habitat protected by the Park and the Reserve is home to dozens of endangered species, including the Bornean orangutan. Along the eastern edge of the Reserve, 14 impoverished communities face looming economic forces that threaten to appropriate land that has been their home for generations.

The Rimba Raya project represents an innovation in the field of conservation via "Reducing Emissions from Deforestation and Degradation" (REDD). REDD is quickly emerging as the most promising new tool for addressing the rampant deforestation responsible for some 20% of annual global greenhouse gas emissions. But mature standards, methods, and technologies are still years away, and critical forests are disappearing at an alarming rate. While the sector struggles with growing pains, hoping to incorporate into the international market system just a small fraction of the value that forests have to offer if allowed to remain standing, other industries race to destroy the world's remaining forests for short-term profit.

- **The Guinness Book of World Records ranks Indonesia as having the highest rate of deforestation in the world, with the amount of forest lost equivalent to 300 soccer fields each hour. This world record estimates Indonesia's deforestation rate at 1.8 million hectares (2 percent of its forests) per year between 2000 and 2005.**

- **The World Bank has predicted that in Kalimantan there will be no lowland rainforests left outside protected areas by 2010 if current destruction rates continue.**

- **According to Forest Watch Indonesia, Central Kalimantan's forests are being converted into oil palm plantations at the fastest rate in the country. The rate has increased more than 400 times to 461,992 hectares per year in 2007 from 1,163 hectares per year in 1991.**

- **According to Wetlands International, the annual deforestation rate of Central Kalimantan peatlands was 5.4% between 2002 and 2005.**

- **Satellite studies show that about 56% (more than 29,000 km^2) of *protected* lowland forests in Kalimantan were cut down between 1985 and 2001.**

While much attention is focused on clean energy sources, none of these efforts address the primary drivers to deforestation in Indonesia, the destruction of biodiverse tropical rain forest for the production of monoculture edible palm oil used primarily in the production of snack foods. The Rimba Raya project offers an immediate solution by targeting for protection a forest which functions as a buffer region to the embattled Tanjung Puting National Park, home of the world-famous Camp Leakey Orangutan Research Center. Most importantly, the project recognizes Indonesia's right to develop and accepts responsibility for creating an economically viable and competitive alternate land-use for this resource.

The Rimba Raya Biodiversity Reserve Project adopts an integrated approach to greenhouse gas emissions reductions that emphasizes both rural development and orangutan habitat conservation. For too long, the world has accepted the view that development and conservation are diametrically opposed. As a result, little effort has been made to balance development needs of local communities with the imperatives of global conservation. InfiniteEARTH, the Project Proponent of Rimba Raya, believes that the two must co-exist for either to succeed.

Beyond Carbon. Beyond Sustainability.

"Neutral" and "Sustainable" are words we would never use to describe our commitment to the future we envision for our children, and yet they are frequently tendered as acceptable benchmarks for success in the race to save the planet. InfiniteEARTH believes that we owe our children and the future generations of this planet much more than a merely "sustainable" future.

InfiniteEARTH was founded on one basic belief: **"Carbon Neutral and Sustainable are simply not enough."** This belief is the cornerstone of the Rimba Raya Biodiversity Reserve and the guiding principle by which all project activities will be implemented. From this guiding principle, we have created six essential mandates, which separate the Rimba Raya Biodiversity Reserve Project from all other REDD projects.

1. **Double Offset.** The Project will be designed to conserve twice as much carbon as it sells through its registry of carbon credits, thereby ensuring that we make positive improvements that go Beyond Carbon Neutral and Beyond Sustainability.

2. **Protection in Perpetuity.** Project Proponents will form a non-profit foundation and, with a percentage of annual profits, will fund an endowment sufficient to protect the project area in perpetuity, well beyond the official 30-year project life.

3. **Social Programs to meet UN Millenium Goals**. Project Social Programs are designed to achieve the eight UN Millenium development Goals within the project area by 2015.

4. **Conservation of Endangered Wildlife and Habitat.** The Project Area must provide habitat for at least one major endangered species. The Rimba Raya Biodiversity Reserve houses more than six major endangered species of mammals and literally hundreds of threatened and endangered species of flora and fauna.

5. **Positive Leakage via Protection of a National Park.** Ideally, the Project Area should be adjacent to a National Park, thereby creating significant positive leakage by providing a physical and social barrier to the park.

6. **Partnership with a local Conservation Group (NGO).** Projects will be designed to sustainably fund the work of an established and respected conservation group (such as Orangutan Foundation International) for their ongoing conservation work.

This project is intended to become the model in for-profit national park conservation. By acquiring land-use rights for border forests surrounding protected areas, project proponents can create a self-sustaining park system whereby commercial carbon sales fund the management of physical and social buffer zones (Figure 1). This model can deliver economic benefits that reach far beyond mere subsistence-level income opportunities for the constituent communities, while simultaneously casting a protective net around Indonesia's national parks, which house some of the world's highest stores of biodiversity.

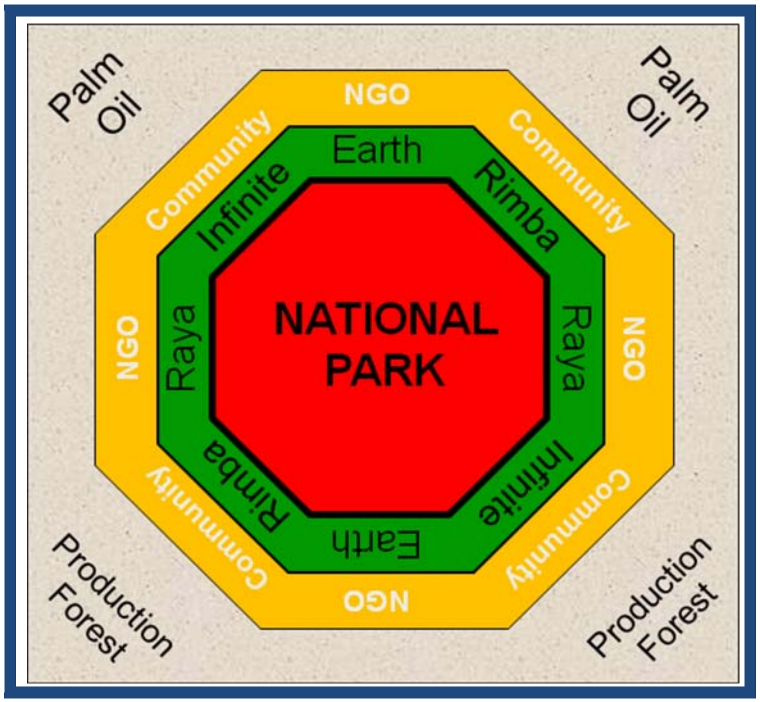


Figure 1. The Rimba Raya physical and social buffer model.

- Through a **revenue-share program**, the Management Authority of the National Park would be commercially subsidized, as are the local communities, the Regency, the Province, and the National Department of Forestry.
- Carbon sales fund a Reserve-wide network of permanent guard posts, community-based patrols and fire brigades, thereby creating a **"physical buffer"** to the Park.
- By engaging NGOs and local communities in the conservation process and by providing employment opportunities, the InfiniteEARTH plan creates a **"social buffer"** to the park.

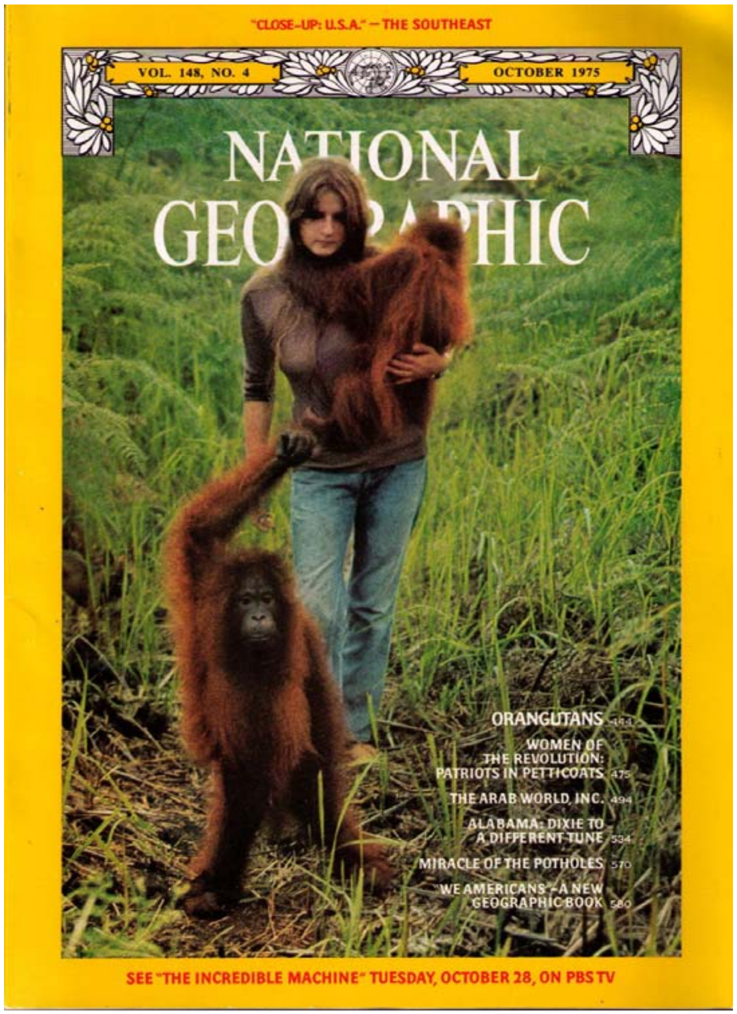
In partnership with the Orangutan Foundation International

InfiniteEARTH's primary objective is to form an alliance between conservation, community, and commerce to preserve **High Conservation Value Forests** that are habitats for endangered species. In keeping with that objective, InfiniteEARTH has partnered with **The Orangutan Foundation International** and its founder, **Dr. Biruté Mary Galdikas**, for its Rimba Raya project in Central Kalimantan (Indonesian Borneo). InfiniteEARTH will leverage OFI's and Dr. Galdikas' forty year history of grass-roots forest and orangutan conservation in Central Kalimantan.

In 1971, Biruté Mary Galdikas, was chosen as one of the three female protégés of world famous anthropologist, Dr. Louis Leakey. Her mission was to go to Borneo to research the "last arboreal great ape left on Earth", the endangered orangutan. Biruté Galdikas, along with Dian Fossey and Jane Goodall would form the famed trio known as "Leakey's Angels".

From the abandoned forester's hut where she first landed, she has built the world famous Camp Leakey Research Center and later co-founded the Orangutan Foundation International

Rehabilitation Center (OFI), home to over 300 injured or orphaned Orangutans. In 1997, Dr. Galdikas was awarded the **"Kalpataru Prize for Environmental Leadership"** by the Indonesian government and is the only foreigner to ever have won the award. For 2008, she has been nominated to receive the **"Satya Lencana Pembangunan Prize for Leadership in Social Development"**.



InfiniteEARTH has drafted this Project Design Document to meet the requirements of the Climate, Community and Biodiversity Project Design Standards, Second Edition (CCB Standards). The CCB Standards serve as a qualitative screen to identify those REDD projects that subscribe to the highest ethical and ecological ideals. The Rimba Raya project is seeking Gold-level certification under these standards. InfiniteEARTH will concurrently apply for certification under the Voluntary Carbon Standard (VCS), a global carbon accounting standard including a formal validation and verification program for voluntary greenhouse gas offsets.

REDD projects that seek certification under CCB Standards must show substantial climate benefits from avoided emissions, and also demonstrate that the rights and needs of local communities have been addressed and important biodiversity conservation will be achieved by project activities. The Rimba Raya project has been designed to balance all three of these concerns.

- **In July 2008, Yale University published an Environmental Performance Index that ranked Indonesia 102nd out of 149 countries because of its high rate of deforestation. Indonesia has produced 85 percent of its emissions through deforestation.**

- **A study by Greenomics Indonesia reports that ~18.4 million hectares of managed forest concessions have been occupied illegally, mostly by plantation and mining companies that have been granted unauthorized permits by local government officials.**

- **According to Wetlands International, oil palm plantations in Kalimantan expanded by 11.5 per cent to nearly a million hectares between 2002 and 2003.**

Climate. With recent redistricting in Central Kalimantan province and a concerted push for economic development on the part of the newly created Seruyan District, oil palm has already reached (and encroached) the border of Tanjung Puting National Park. The Rimba Raya Project Area, for years host to periodic incursions by illegal logging operations, has now been targeted for clearance, drainage, and conversion to oil palm plantation. Such a process would oxidize peat deposits underlying most of these lands and release millions of tonnes of carbon dioxide into the atmosphere over the life of the plantations.

InfiniteEARTH has successfully intervened in this process, establishing the Rimba Raya Biodiversity Reserve to block any further encroachment by palm oil companies. In an effort to protect the Project Management Zone and safeguard anticipated climate benefits, the Reserve will construct a network of guard posts and fire towers, develop a fire response and prevention plan, hire and train a dedicated corps of guards and firefighters, and implement a comprehensive ecosystem restoration program to rehabilitate degraded portions of the Project Area.

The Baseline Scenario used the methodology developed by Winrock International to estimate net CO2 emissions avoided from preventing planned deforestation and conversion to oil palm in Rimba Raya.

For a Project Area covering only 47,237 hectares of the total 91,215-hectare Project Management Zone, 32.5 million tonnes CO_2e over the first ten years of the project, and approximately 3.5 million tonnes CO_2e per year over the project.

Over the 30-year life of the project, avoided emissions amount to 104.9 million tonnes CO_2e.

Community. An initial social survey of communities in the Project Zone paints a picture of nearly 2000 indigenous families living in villages and hamlets. In these communities, poverty is defined by the quality of materials used to build the family hut and by livelihoods eked out from fishing nearby rivers – which are in decline owing to flooding, sedimentation and pollution caused by conversion of upstream forests into plantations and to degradation caused by the communities themselves.

The Rimba Raya project envisions the development of a social buffer to complement the physical buffer created by the Reserve. InfiniteEARTH believes that only by addressing the root causes of deforestation – poverty, hunger, disease, lack of adequate shelter, and exclusion – will sustainable protection of the Reserve and adjacent National Park be achieved.

To that end, and with full collaboration from the impacted communities, project proponents will implement a slate of social programs linked to the United Nations Millennium Development Goals for Indonesia.

The first stage in the development of the Rimba Raya social buffer will focus on basic needs, from clean water and improved health care to increased agricultural yields and new employment opportunities. A second stage will focus on developing options and choice, with programs targeting early childhood education and development, capacity building, and micro-credit. At all times, community members will be given a stake in the project and a role in its design and implementation.

Biodiversity. A preliminary assessment of High Conservation Values in the contiguous habitat inside the Park and the Reserve identifies dozens of species of threatened, endangered, restricted-range, or otherwise protected species of animals and plants that will benefit from project activities. The social and physical buffer under development by the Rimba Raya project, includes a comprehensive program to protect and rehabilitate critical exosystems, which will allow these species to thrive in a time of increasing external pressures and diminishing habitat.

To implement the project's biodiversity programs, InfiniteEARTH has teamed with Orangutan Foundation International (OFI), an organization whose founder, Dr. Biruté Mary Galdikas, has fought for 40 years to protect the forests of Tanjung Puting National Park, rescue threatened orangutans, rehabilitate them, and reintroduce them into the wild. Initial plans call for the construction of orangutan release stations and feeding platforms inside the Reserve, the release of 300 rehabilitated orangutans, and the development of a tracking study in conjunction with a global outreach and education campaign. Additionally, InfiniteEARTH and OFI field teams and conservation managers will strengthen and expand protection of Rimba Raya Reserve which provides habitat for hundreds of species of flora and fauna.

Summary Comments

This Project Design Document is necessarily a technical document, but the subdued tone and copious detail should not distract the reader from the real and very imminent threat menacing a forest of unparalleled importance. InfiniteEARTH hopes that the methods and data contained herein will serve others who are fighting to protect the world's remaining forests during this period of innovation, and experimentation.

InfiniteEARTH is committed to the creation of something enduring and extraordinary in the Rimba Raya Biodiversity Reserve. Project proponents believe that the market mechanisms originally conceived by the UN Panel on Climate Change are the only viable model for saving the world's remaining ancient biodiverse forests. Capitalism and conservation can coexist peacefully and equitably. All stakeholders – including local communities, the host country, project investors, and the wildlife that depend on these forests – can share in the compound benefits generated from the commercialization of the invaluable ecosystem services that Rimba Raya forests provide.

"If we lose the battle against tropical deforestation, we lose the battle against climate change"

- Charles, Prince of Wales

GENERAL SECTION

G1. Original Conditions in the Project Area

General Information

G1.1. Project Location and Basic Physical Parameters

The location of the project and basic physical parameters (hydrology, geology, soil, climate).

Location of the Project

The Rimba Raya project is located in the Seruyan District in the province of Central Kalimantan, Indonesia (Figure 2). The district capital, Kuala Pembuang, is located on the Seruyan River at the Java Sea coast about 12 km southeast of Rimba Raya. The provincial capital, Palangkaraya, lies approximately 200 km to the northeast.

The project is bounded by Tanjung Puting National Park (TPNP) to the west, the Java Sea to the south, and the Seruyan River to the east. To the north, a political line extends from the northeast corner of TPNP to the Seruyan River. The eastern border of Rimba Raya coincides with the Seruyan River for almost 100 km. Locating the concession borders from TPNP to the Seruyan River includes several habitat types, such as a small amount of lowland Dipterocarp, *kerangas* (heath), peat swamp, and riverine forests, which provides a strong conservation rational for the border location.

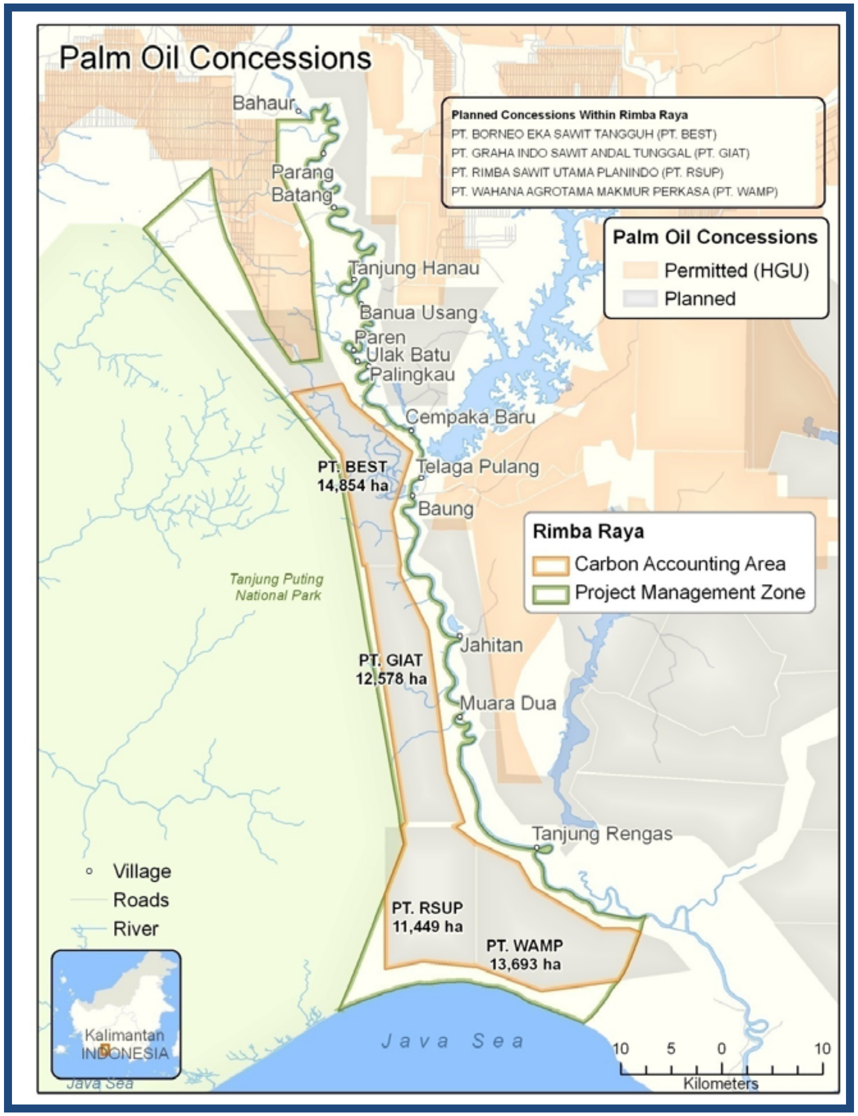


Figure 2. Project location and boundaries in relation to Tanjung Puting National Park and proposed palm oil concessions.

In 1996, the border of Tanjung Putting National Park (TPNP) was set comprising 396,000ha[1]. Each province and district is required to conduct ten-year spatial plans and the 2003 plan for Central Kalimantan indicated a different, smaller border. The Minister of Forestry agreed to this revision to the border of the Park in 2005[2]. The GIS file for the 2005 TPNP boundary was obtained from government sources and is used in project development and mapping for Rimba Raya.

TPNP harbors a substantial population of Bornean orangutans among other endangered wildlife and the adjacent Rimba Raya area provides additional critical orangutan habitat. Orangutan nests were frequently spotted during the biomass surveys.
In the Rimba Raya concession during the 1980s and 1990s, two timber concessions selectively logged the area, PT BinaSamaktha[3] in the northeast portion and PT MulungBasidi[4]in the southeast and the companies stopped operations in 1998 and 2000, respectively. Since then much of the easily accessed forest has been illegally logged by nearby villagers.

In 2004, five oil palm estates were formally proposed to the Bupati and the Governor that partially occupy the ex-timber concessions adjacent to the Park. All five of these proposed estates have received the initial stage of oil palm permits from the Seruyan Bupati with the northern most estate having been granted the estate license (HGU – Indonesian acronym). The odd notch-shaped northern part of the Project Zone is due to the area being excised because of the northern most oil palm estate now being operational.

The Carbon Accounting Area coincides exactly with the borders of the proposed oil palm estates to ensure additionality, except in the north where the Rimba Raya project area was reduced to avoid any impacts from canals in the operational palm oil estate. As required by the approved methodology, the Carbon Accounting border was relocated three km south of the estate borders.

Hydrology

Watersheds in the Project Zone were delineated using the HydroSHEDS data set (http://hydrosheds.cr.usgs.gov/). The majority of the Project Area and Zone fall within the Seruyan watershed, which flows along the eastern side of the Project Area to the south (Figure 3). The Seruyan watershed itself covers approximately 13,144 km^2. Other watersheds in or near the Project Zone are small and near the coastline, with headwaters less than 10 km from the sea.

Geology

Surface geology of the Project Zone is dominated by depositional substrates of very recent origin compared to much of Kalimantan. These swamp and river deposits are characteristic of coastal Kalimantan formations including Rimba Raya.

[1] Minister of Forestry's SK No. 687/Kpts-II/1996
[2] Minister of Forestry's SK No.292/MENHUT-VII/2005 Tanggal 13 Mei 2005
[3] SK HPH No. 33/KPTS/Um/I/1978 tanggal 8 Januari 1978 seluas ± 50.000 Ha
[4] SK HPH No. 26/KPTS/Um/I/1980 tanggal 14 Januari 1980 seluas ± 98.000 Ha)

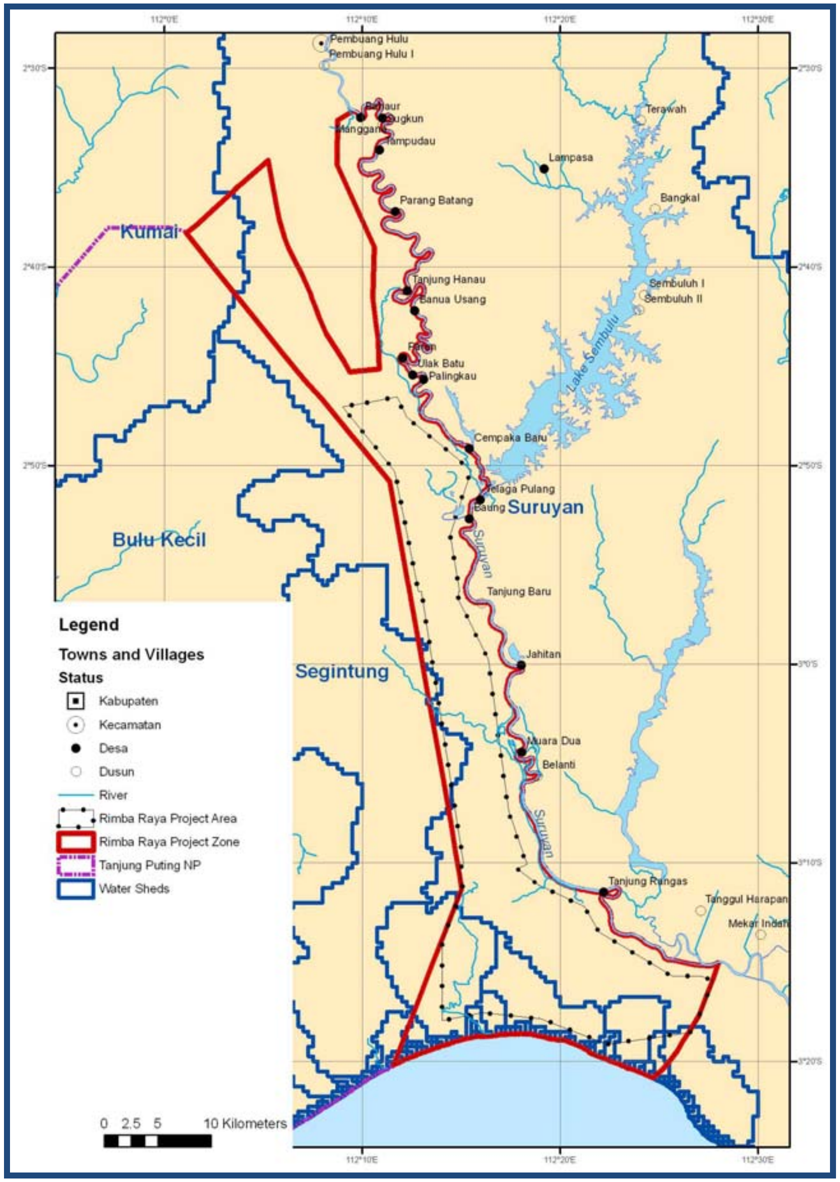


Figure 3. Watersheds in the Rimba Raya Project Zone and vicinity.

Major elements depicted in Figure 4 are described below. To produce this map, scanned copies of Geology sheets number 1512 & 1513 (Geological Research and Development Centre 1994) were rectified independently to Landsat 5 orthorectified imagery (path 119 row 62 02/07/1989) to correct a number of major geographic errors. The two sheets were independently digitized and combined, and were found to be inconsistent for many attributes, but are represented as is. Surface geology classes TQd and QTp are probably interchangeable in this area, judging from Landsat imagery, but not interchangeable over the full extent of the sheets (not shown). Class Qs in the northern part of the Project Zone is probably made up from a combination of classes Qau and Qas shown separately in the south. An improved version of the geology can be reconstructed from Landsat and some limited field work in the future.

***(i) Deltic Deposits* - *Qad*.** Holocene. Coarse- to fine-grained sands, silts, and mud. Loose quartz sands, bright brown, locally containing marine organic matter. Silt and mud are bright grey, sometimes bedded, containing organic matter, and deposited underneath coarse-grained sands. This unit is found only in the Pembuang River mouth area, suggesting a progressing delta sequence influenced by wave activity. This unit occasionally mixes with other surface deposits.

***(i) Deltic Deposits* - *Qad*.** Holocene. Coarse- to fine-grained sands, silts, and mud. This unit is found only in the Pembuang River mouth area to the north and outside the project area.

***(ii) Undifferentiated Clastic Deposits – Qau*.** Holocene. Sands, silt, clay, mud, and peat. Unbedded coarse- to fine-grained sands, bright brown in color, mainly composed of quartz, feldspar, and biotite, but locally containing conglomerates. Silts are unconsolidated, bright grey in color, and unbedded. Grey clay and mud are very elastic, and the peat is dark brown. In many places this unit is very similar to the other superficial desposits.

***(iii) River Deposits – Qas*.** Holocene. Cobble/pebble, sand, silt, clay, and mud containing debris of terrestrial organic matter. Cobble/pebble and sand mostly unconsolidated, composed of rock fragments (sandstone/coal/quartz) and organic matter. Silt/clay and mud found mostly in the river mouth area, mixed with tiny plant matter. Lineaments orientated semi-parallel to the main river course indicate the influence of the river flooding.

***(iv) Swamp Deposits – Qs*.** Quaternary. Peats, kaolinitic clay, silt with intercalation of sand, and plant remains.

***(v) Pembuang Formation – QTp*.** Late Pleistocene. Carbonaceous sandstone, conglomerate, siltstone, claystone, and peat. Coarse- to medium-grained sandstone mostly composed of quartz, K Feldspar, biotite, and carbon-rich matter. Polimicteous conglomerate, chiefly composed of quartz, calcite and sandstone. Semi-consolidated sandstone ranging from fine- to medium-grained size. Grey siltstone and claystone showing well bedded structures. Brown peat attends to 50 cm thick. The C14 dating of the uppermost part of the formation indicates an age of c. 45,000 years (Late Pleistocene). This formation was deposited in the progressing delta environment, and included at least three periods of stratigraphic sequence. A type location is suggested in the right corner bank of the Pembuang River upstream and close/opposite to Kampung Jahitan, or 03 01' S 112 17' E.

***(vi) Dahor – TQd*.** Middle Miocene-Plio Plistocene. Conglomerate, sandstone, and alternation of claystone-containing lignite layer with paralic environment, thickness up to approximately 500 m, no fossil; can be correlated with the Dahor formation in Palangkaraya quadrangle.

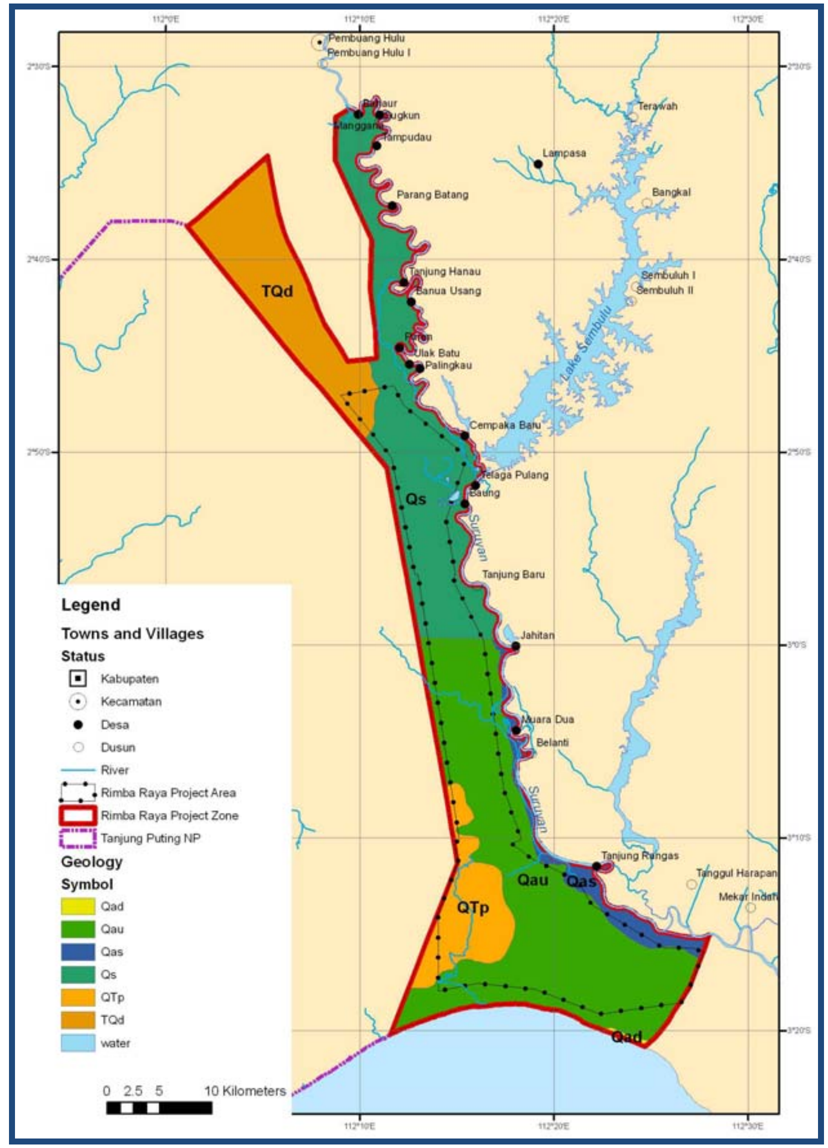


Figure 4. Surface geology of the Project Zone.

Soil

A soil map for the Project Zone was produced using the Soil Resource Exploration Map (Pontianak MA49, Centre for Soil and Agroclimate Research, Bogor, Indonesia) at a scale of 1:1,000,000 (Figure 5). This map depicts Soil Mapping Units (SMU), which represent an area with recognizable landform wherein similar soil types are likely to be found.

Associated soil types in each mapping unit are summarized in Table 1. The great groups and general descriptions are derived from Soil Taxonomy (Soil Survey, USDA 1999). Co-dominant soil types derived from peat (SMU 3) and riverine alluvium (SMU 20) underly the Project Zone. Coarser-textured sediment-derived soils are also found in the north (SMU 52; possibly associated with kerangas vegetation on poorly draining psamments with sub-surface hardpan) and the east (SMU 61).

The soil map shows general agreement with the geological map, and RePPProT land systems. The map was first rectified using Landsat 5 orthorectified imagery (path 119 row 62 02/07/1989) to adjust for major geographic errors. The resulting image shows vastly improved alignment with the Seruyan River and coastline. The image was then on-screen digitized over the Project Zone boundaries. Remaining differences are likely accounted for by residual geographic inaccuracies and the fact that the base map was produced at a scale of 1:1,000,000. Further improvements could be made based on Landsat interpretation or other imagery, but ultimately, field surveys may be required. There are no known alternative soil maps available for this region.

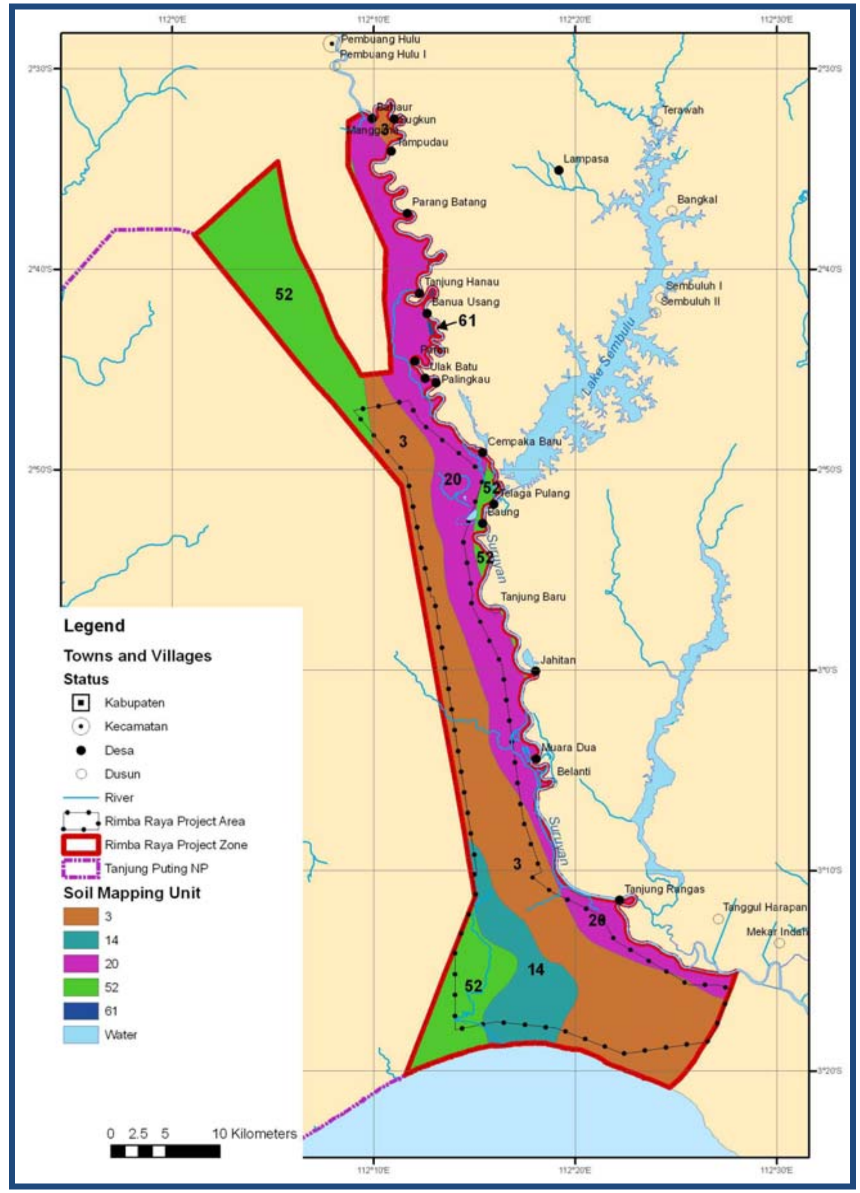


Figure 5. Soil Mapping Units in the Project Zone (see Table 1 for dominant soils in each soil mapping unit).

Table 1. Soil Types associated with each Soil Mapping Unit					
Soil Mapping Unit	**Dominant Soils**	**General Description**	**Parent Material**	**Sub-landform**	**Relief**
3	Haplohemist, Sulfihemists	Moderately decomposed peat soils some of which are sulphic	Organic	Peat Dome	Flat
14	Endoaquepts, Sulfaquents	Saturated Inceptisols and Saturated Sulphic Entisols	Aluvium	Delta or Estuary	Flat
20	Endoaquepts, Dystrudepts	Saturated Inceptisols and Acidic Inceptisols	Aluvium	Aluvial Flood Plane	Flat
52	Quartzipsam-ments, Durorthods	Quartzic Entisols and Spodosols with a Cemented Hardpan	Sediment	Terraces	Flat - Rolling
61	Haplorthods, Palehumults	Freedraining Spodosols and Humus rich Ultisols	Sediment	Terraces	Flat - Rolling

Climate

Rainfall in the Project Zone is approximately 2500 – 2700 mm per year (WorldClim v1.4 http://www.worldclim.org/). The Project Zone falls into two agro-climatic zones: B1 and C1 (Figure 6). Zone B1 has long-term averages of 7 – 9 months per year > 200 mm of precipitation per month and < 2 months per year with < 100 mm per month. C1 has 5 – 6 months at > 200 mm of precipitation per month and < 2 months of < 100 mm per month (Oldeman *et al.* 1980).

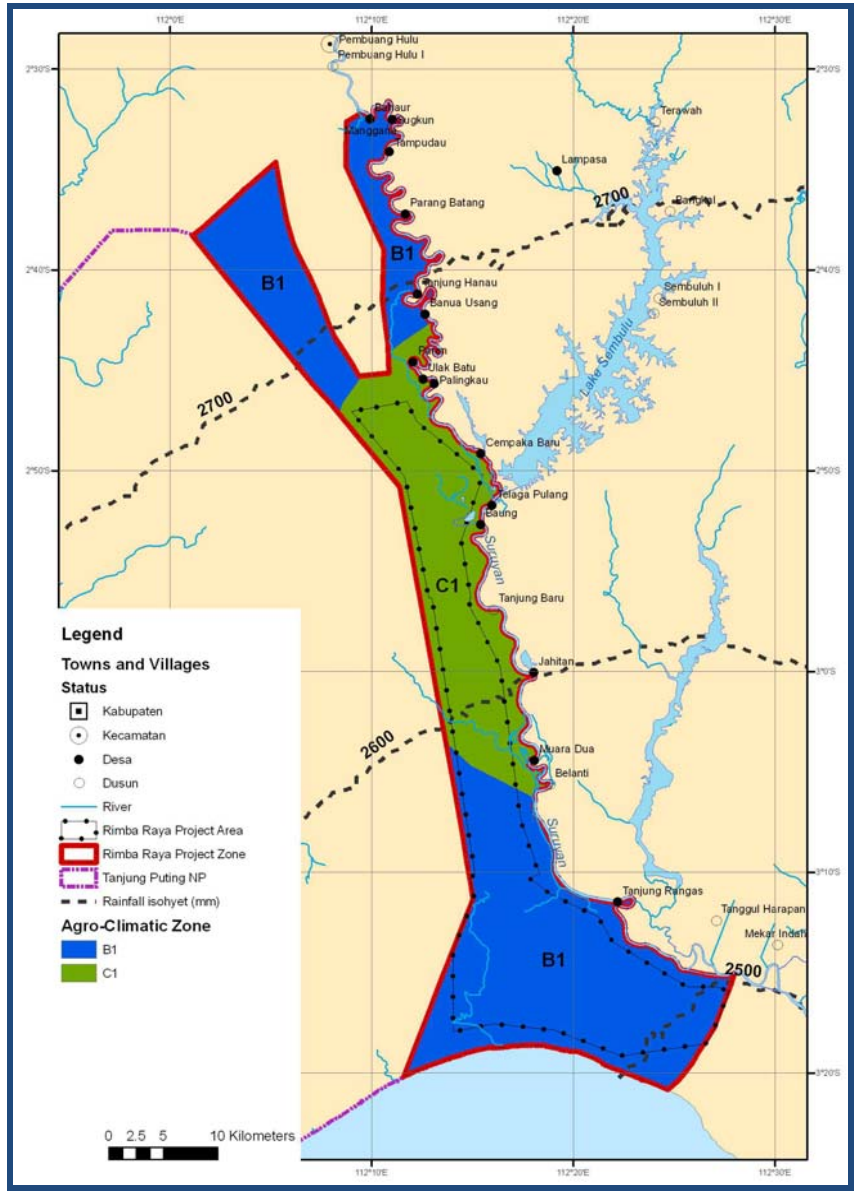


Figure 6. Agro-Climate Zones in the Project Zone (rainfall isohyets shown at 100 mm intervals).

G1.2. Types and Condition of Project Area Vegetation

The types and condition of vegetation within the project area.

General description

The Project Area is adjacent to Tanjung Puting National Park and shares most of the vegetation types occurring there, but in different relative proportions. An extremely rich variety of natural wet and dry land vegetation types are represented, often forming a fine-scale complex mosaic. From southern coastal areas to the low Pleistocene terraces of the north, these natural vegetation types include: mangrove and tidal/brackish water swamps near the coast line; marshy, grass-dominated wetlands; riparian and freshwater swamp forest associated with the Seruyan River and its many tributaries; peat swamp forest developing on peatlands of various depths (up to and greater than 5 meters deep), kerangas (heath) vegetation of various forms (tall to stunted) on sandy soils; and lowland mixed dipterocarp forest on mineral soils (Susilo 1997; MacKinnon et al. 1996; OFI 2008; Stanley & Salim 2008; Bolick 2010).

Vegetation diversity is enriched by a wide range of anthropogenic disturbance, including: selective logging and burning, and natural vegetation conversion to agriculture. These influences have produced a mosaic of disturbance types overlaying natural vegetation types, including: alang-alang grasslands, actively managed agricultural areas associated with settlements on the Seruyan River, post-fire shrubland and secondary forest, and regenerating logged forest.

Major vegetation classes

Prior to field surveys in the Project Area, Stanley & Salim 2008 described and mapped broad vegetation types in Rimba Raya based on a review of existing data and analysis of recent satellite imagery. Six broad vegetation classes were identified: (i) mixed freshwater swamp, (ii) peat swamp forest, (iii) lowland dipterocarp forest, (iv) kerangas forest, (v) marshy swamps, and (vi) anthropogenic disturbance types:

i. Mixed freshwater swamp. Freshwater swamp is an ecological and functionally important vegetation type on Borneo, with a natural variety of structural and compositional forms that co-vary with local terrain features, proximity to rivers, frequency and duration of flooding, and soil type. Freshwater swamp forms occur throughout Tanjung Puting, and in the Project Area with limited distribution adjacent to major rivers and their tributaries. Freshwater swamp is said to have been the natural vegetation cover of approximately 7% of Kalimantan (MacKinnon & Artha, cited in MacKinnon et al. 1996), although the vast majority of this swamp type has been converted to wetland rice cultivation. It is therefore considered an extremely endangered ecosystem by most conservation organizations (e.g., Wikramanayake et al. 2002).

Freshwater swamps develop where periodic flooding causes water logging on soils. Soils are much less acidic than peat swamps (with which freshwater swamps may occur in close association), and they are among the most nutrient-rich topical soils due to frequent deposition of silt and organic matter. Forests tend to be very productive in terms of tree growth, litter fall, and leaf and fruit production, with high natural rates of disturbance and canopy turnover due to frequent tree falls and gap formation. Where inundation is frequent but temporary, freshwater swamps can have tall stature (c. 35 m) and standing biomass; where inundation is frequent and prolonged, forests can be stunted and dominated by only a few tree species. Compositionally, freshwater swamps share many species in common with lowland dipterocarp forest, but in general they are far less species-rich (though exceptionally diverse examples have been documented). The most abundant tree species in this vegetation type are members of the following genera: *Alstonia*, *Campnosperma*, *Dyera*, *Koompassia*, *Litsea*, *Neesia*, *Saraca* and *Syzygium*.

The distribution of freshwater swamps in the Project Area has not been mapped for Rimba Raya, reflecting the limitations of remote sensing in capturing the fine-scale pattern of its natural distribution. The vegetation type no doubt occurs in close association with rivers, and future efforts to conduct ground-based vegetation mapping will assist with mapping this type.

ii. Peat swamp forest. Peat swamp is the dominant forest type in the Project Area, with compositional and structural variation depending on peat depth and hydrology. Peat swamp is widely distributed throughout northern, western and southern Borneo in coastal and lowland areas. However, forested peat swamps have declined markedly in extent over the past several decades due to wild fires and conversion to non-forest uses, including small scale and industrial oil palm estates (Wikramanayake et al. 2002). In Indonesia, a small proportion of remaining peatland ecosystems has formal protected status. A Presidential Decree issued in 1990 declared all peat lands > 300 cm deep as protected areas unsuitable for development, yet this is rarely enforced.

According to maps produced by Wetlands International (Wayunto et al. 2004), peat depth in the project area ranges from 50-100cm, but maps of peat depth based on RePPProT land systems (RePPProT 1989) show deeper peat layers ranging from 50-200 cm in the MDW land system covering ca. 60% of the Project Area. Field surveys of Rimba Raya show that peat depths exceed 400-600 cm in project area peatlands, which dominate major drainages of the Seruyan River. Much of these peat areas remain in forest cover that varies in level of degradation from lightly disturbed to heavily degraded by fire and logging. The largest peat swamp forest block in Rimba Raya covers the center third of the Project Area is contiguous with extensive forests in the adjacent national park.

Dominant species of conservation concern in peat swamps, and which are confirmed or very likely present in the Project Area, include the endangered dipterocarps *Shorea teysmanniana*, *S. uliginosa* and *S. platycarpa*; the protected species *Gonystylus bancanus* (CITES Annex II); and *Dyera costulata*, which is also protected by the Government of Indonesia and severely overharvested throughout its range.

iii. Lowland mixed dipterocarp forest. Lowland mixed dipterocarp forest is the richest and tallest stature lowland forest type on Borneo, with canopy height ranging from 35-50 m, emergent trees to > 60 m, and aboveground biomass values ranging from ca. 300-600 Mg (metric tons) per ha, which is on average 60% higher than that of the Amazon (Slik et al. 2009; Paoli et al. 2008). The floristic composition of mixed dipterocarp forest, which occurs on mineral soils, differs from all forms of swamp forest described above, though many genera are shared in common.

Lowland mixed dipterocarp forest occurs in parts of the greater TPNP landscape (Susilo 1997), intergrading with kerangas forest on sandy soils and peat swamp forest in low-lying drainages. This forest type is prevalent where mineral soils occur on the north-eastern side of Tanjung Puting, bordering Rimba Raya. This high ground area, which marks the division of the Kumai and Seruyan watersheds, represents the southernmost extent of low foothills that descend from the northern interior of the province down to the Java Sea. In the Project Area, lowland mixed dipterocarp forest is restricted to the far northwest and is contiguous with similar forest in northeastern Tanjung Puting.

iv. Kerangas forest. Kerangas forest, sometimes referred to as heath forest, is a distinctive Sundaland forest type developing on nutrient-poor, often waterlogged sandy soils. Kerangas is extremely variable in structure and composition depending on soil and climatic conditions, with tall kerangas producing a maximum canopy height of 35-40 m, and severely stunted kerangas reaching a canopy of less than 5 m. All forms share in common a surface organic layer (10 to over 100 cm); a predominance of trees with small, thick, nutrient-poor leaves; tall narrow crowns; and a relatively uniform canopy with few if any emergent trees (except in examples of tall kerangas).

Kerangas supports lower plant and animal diversity than lowland forests on well-drained soils, but harbors a large number of endemic plants, especially understory and epiphytic woody or herbaceous species. Common woody plants include *Vaccinium lauriflorum*, *Rhodomyrtus tomentosus*, *Tristianopsis whiteana*, *Gymnostoma nobile*, *Shorea retusa*, *Hopea kerangasensis*, *Hopea dryobalanoides*, *Swintonia glauca*, *Combretocarpus rotundatus*, *Cratoxylum glaucum*, and a rich assemblage of species in the genus *Syzygium*.

Many plant species have specialized adaptations to the low nutrient conditions typical of kerangas, including the epiphytic myrmecophytes (ant plants) *Myrmecodia* and *Hydnophytum*, the carnivorous pitcher plants (*Nepenthes*), sundews (*Drosera*), and bladderworts (*Utricularia*), and understory and epiphytic orchids including the protected black orchid (*Coelogyne pandurata*). In comparison to other forest types on Borneo, kerangas forests contain a relatively high density of plants of Australasian origin, including the families Myrtaceae and Casuarinaceae, and gymnosperms of the southern hemisphere, including Agathis, Podocarpus and Dacrydium.

Kerangas vegetation occurs in the northern and southern parts of the Project Area, on sandy terraces, which intergrade with peat swamps and also with mixed dipterocarp forest on mineral soils in the northwest. Most of these kerangas areas have been burned and tall forest has been replaced by sparse scrub vegetation on open sand.

v. Marshy swamp. A dominant and widespread vegetation type throughout the Project Area is marshy swamp. These periodically inundated grasslands with no forest cover are variously represented on Ministry of Forestry and other government maps as open swamp, seasonal lake, and unproductive wetlands.

In the Project Area, marshy swamp occurs in three major blocks: one in association with flood plains of the Seruyan River, extending from the southeastern boundary of Rimba Raya northward up to and beyond Muara Dua village; and the other two along the major drainages to the Seruyan along the Sigintung and Baung Rivers. Along these interior rivers, marshy swamps are contiguous with intact peat swamp forest. The extent to which the current distribution of these open swamps is natural, manmade, or a combination of both is not well understood.

vi. Disturbance classes. The Project Zone has experienced a variety of disturbance histories, ranging from low intensity selective logging, intensive logging, fires, small-scale agriculture by subsistence farmers, and forest conversion to oil palm in the north. Historical and on-going anthropogenic disturbance has modified natural vegetation to varying degrees such that vegetation classes described above are occur over a range of disturbance classes.

Vegetation and Land Cover Assessment

A land cover assessment of the Rimba Raya Project Area was conducted January 2010 in order to provide baseline data for the project and to support the carbon assessment. A classification scheme of 18 land use / land cover types was developed for Rimba Raya based on Ministry of Forestry classification and expanded to include more detailed and accurate types specific to the Project Area. Annex 1 includes the full report for the land cover assessment, conducted by Bolick (2010).

Land cover mapping was accomplished following a two-part approach including remote sensing image classification techniques followed by image interpretation in GIS. In the first phase, pixel-based image classification was conducted to make use of spectral information in Landsat7 ETM+ bands that are sensitive to vegetation. The results of this classification provided important verification of broad land cover types such as forest, shrub and herb cover. In the second phase, land cover was interpreted and digitized using classified and full band Landsat data in a GIS. Interpretation was therefore able to incorporate key ancillary data including aerial photos, field survey data and other GIS data compiled for Rimba Raya, which substantially improved the classification.

The resulting 18 classes from the land cover assessment, were grouped into 13 classes for the carbon assessment to reflect broad vegetation classes identified by Stanley and Salim (2008), while preserving classification detail that strongly affects above-ground biomass and carbon estimates (e.g. forest type and level of degradation). Vegetation classes are described in Table 2 and shown in Figure 7.

Table 2. Rimba Raya Land Use/Land Cover Classes	
Class Name	**Description**
Lowland forest	Lowland mixed dipterocarp forest on mineral soils. This is a "dry land" or non-swamp forest type and is found only in the northwestern portion of the PMZ where there are elevation gains of ca. 30-40 meters asl.
Lowland forest (lightly degraded)	Lowland mixed dipterocarp forest on mineral soils with some apparent logging damage, adjacent to lowland forest. Note that the term "degraded" is used rather than the Ministry of Forestry term "secondary" which implies forest succession from clear-cutting.
Lowland forest (highly degraded)	Lowland mixed dipterocarp forest on mineral soils with heavy damage from logging and fire. Occurs in the northwestern portion of the PMZ between lowland forest and low, sparse vegetation cover associated with burning and land clearing adjacent to WSSL palm oil plantation.
Peat shrubland	Formerly peat swamp forests, these areas were deforested by fire in the last ten years. Seasonally wet areas characterized by shrubby regrowth and scattered remnant trees.
Kerangas forest	Heath and scrub forest on sandy soils. Isolated patches in peat swamp forest along the western border of RR, including survey transect 7. More prevalent in the south, where air photos show loose canopies of even height, lacking the broad leaves of peat swamp and lowland forest. Visually distinct on satellite imagery(e.g. smooth in texture) but not recognized in Ministry of Forestry mapping which classifies this type with swamp or dry forest depending on location. Relatively rare type, highly susceptible to fire and conversion to open sand scrub.
Open kerangas scrub (locally "padang")	Open sandy soils with patches of scrub forest or thin scrubby vegetation. In West Kalimantan and Sarawak, these areas are known as kerangas, but in Rimba Raya are locally named "padang". These are former heath or kerangas forests that have burned. Bright white sand may be apparent on imagery, or not depending on whether herb cover is present. These areas are often underlain with a hardpan and may be flooded during the wet season. Presence of standing water has confused some previous land cover interpretations of the area (e.g. Ministry of Forestry mapped some areas in the south as "swamp"). These ancient beach areas may intergrade with peatland areas in Rimba Raya, as in the northwestern part of the PMZ.
Cultivated land with shrubs	Repeatedly burned cultivation land, locally "ladang", often abandoned after several years of cultivation. Active cultivation land may appear bright green on imagery from post-fire herbaceous growth. Old ladang often has woody shrubs and scattered trees.
Oil palm plantation	In the Rimba Raya vicinity, all plantation agriculture is oil palm plantation and is currently confined to the WSSL concession in the north, with some recent expansion into the PMZ.
Low, sparse vegetation cover	Areas with sparse grass or herb cover or bare ground, usually associated with recent, severe or frequent burning in areas of human activity. Most of these areas have been cleared by fire but are interpreted to be outside cultivation lands.
Seasonally inundated wetlands	Locally "danau" or seasonal lake, most of these areas were formerly peat swamp forests that have been logged and burned. Where these are adjacent to rivers, flooding may be semi-permanent. Most are sedge-dominated.
Open water	Deep water with no vegetation, especially on or near the Seruyan River and lower reaches of the Baung River

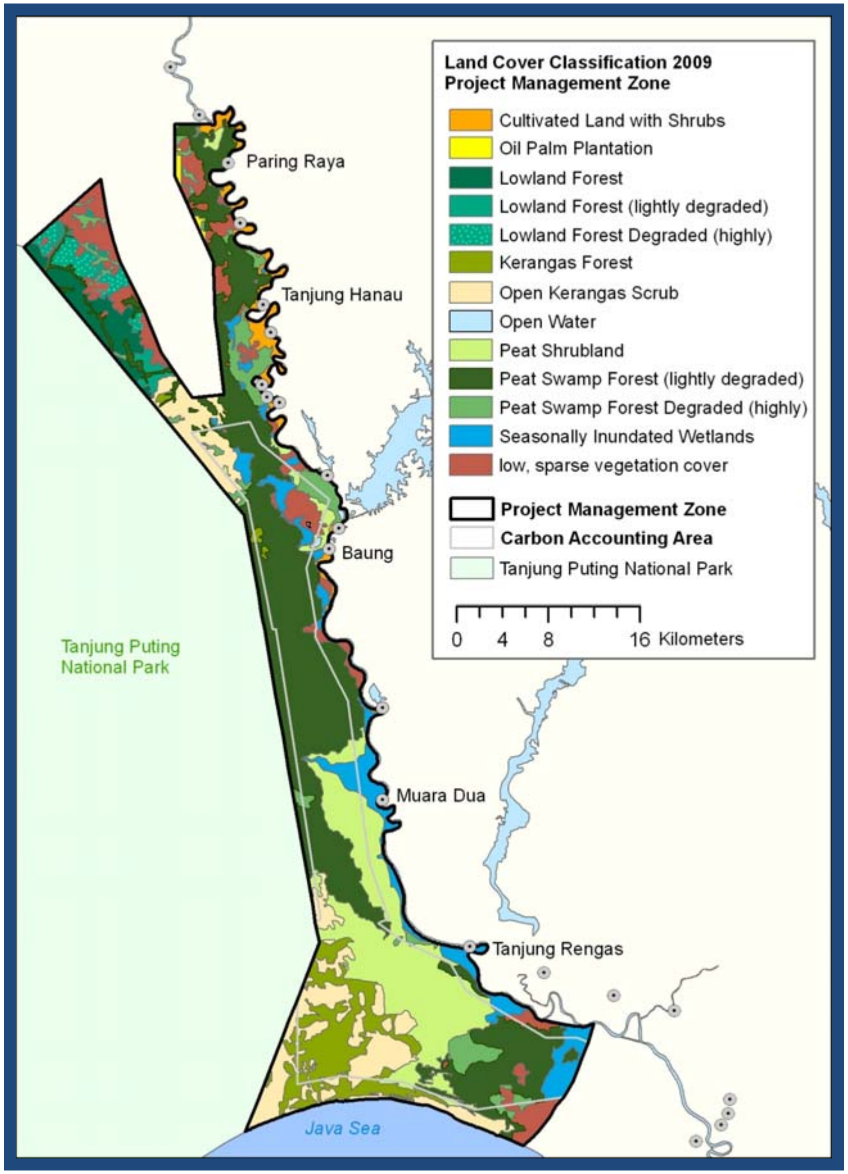


Figure 7. Rimba Raya Project Area Vegetation and Land Cover

G1.3. Boundaries of the Project Area and Project Zone

The boundaries of the project area and project zone and their relation to the National Park and nearby communities

Project Area and Project Zone

The Rimba Raya site is comprised of a 47,237 ha Project Area within a 91,215 ha Project Zone (Figure 8). The Project Area is defined by the boundaries of four planned but undeveloped palm oil concessions and represents the carbon project boundary. In VCS terminology, the Project Area is referred to as the Carbon Accounting Area.

The Project Zone is defined by geographic and political boundaries and represents the area of project influence, especially with reference to communities potentially affected by the project as well as climate and biodiversity management concerns extending beyond Project Area borders. In VCS terminology the Project Zone is referred to as the Project Management Zone. Tanjung Puting National Park on the west, the Java Sea on the south, and the Seruyan River on the east form the boundaries of the Project Zone. Wana Sawit Subur Lestari (WSSL, ex-KUCC), an active palm oil concession, has been excised from and forms the northern boundary of the Project Zone.

These boundaries, their delineation and relation to current land use and land management are described in this section.

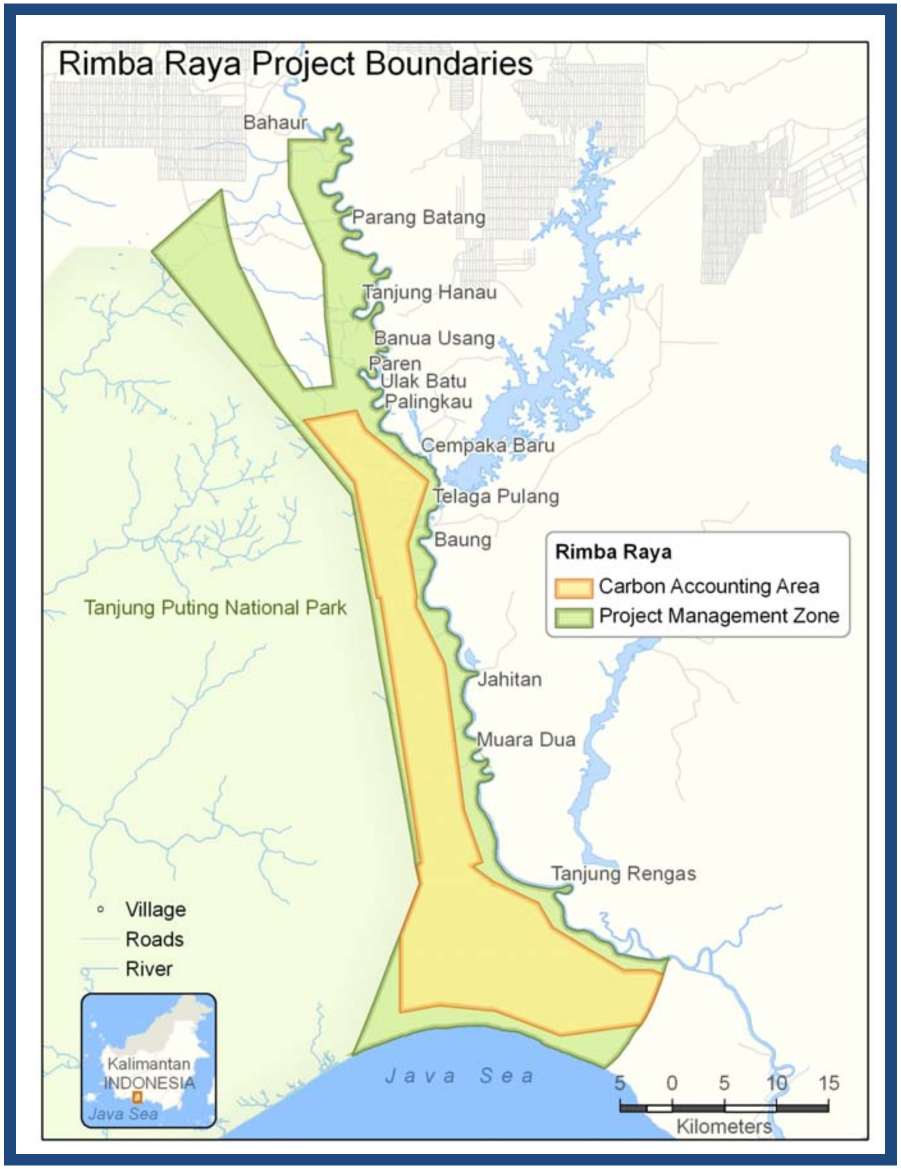


Figure 8. Rimba Raya Project Area and Project Zone Boundaries

Tanjung Puting National Park and Rimba Raya Border

Tanjung Puting National Park (TPNP) bounds Rimba Raya to the west**.** The Rimba Raya Area Verification is based on park borders delineated in the 2003 provincial plan, which was approaching finalization in 2005. This marks more than seven decades of a somewhat convoluted history of the expansion and contraction of Tanjung Puting borders. Brend (2005) summarizes much of the following history:

There were originally two conservation areas in what today is considered Tanjung Puting National Park: Kotawaringin Wildlife Reserve in Kabupaten Kotawaringin Barat, and Sampit Wildlife Reserve in what is now Kabupaten Seruyan. These were gazetted in 1936 and 1937, respectively, by the Colonial Government and were combined in 1978 with the name Tanjung Puting Wildlife Reserve and a total area of 305,000 ha. This area was then designated as a candidate national park by decree of the Minister of Forestry in May 1984. In December 1984, a decree from the Director General PHPA authorized the working territory of the Tanjung Puting National Park to cover the area of the former Wildlife Reserve, amounting to 300,040 ha. In 1990 an act was passed that defined the legal status of national parks for the first time. The forest surrounding the new National Park were originally State Forest Land, later designated as Production Forest (Hutan Produksi or HP) by the Department of Forestry, and worked as active logging concessions.

In 1996, the expired logging concessions on the western side were incorporated into the newly designated Tanjung Puting National Park by the Minister of Forestry's SK No. 687/Kpts-II/1996 dated 25 October 1996. The land between the eastern border of TPNP and the Seruyan River remained in production forest (HP designation) but were accroding to the Tanjung Puting National Park Management Plan (MoF 1994) proposed as park extensions and managed buffer zones.

In a 1997 paper, the head of the National Park referred to the Park's eastern boundaries as having been "cut," most likely meaning a simple trail was cleared through the forest. More recently, the eastern boundaries, in the new Kabupaten of Seruyan, were mapped and apparently marked in the field with temporary poles. This temporary boundary ('trayek batas semantara') has been approved by the multi-agency Boundary Delineation Committee as incorporated in the map annexed to the Decision Letter (SK) of the Bupati Seruyan No. 29/Thn 2003 dated 27 September 2003. (Note, one of the pre-conditions for full gazettement, is having a temporary boundary marked first).

In June 2004, Orangutan Foundation International (OFI) became aware of plans for four palm-oil plantations to be established down the eastern edge of the park. On 18 February 2005, the Minster of Forestry released letter no. S.79/Menhut-VII/2005, specifically mentioning the palm-oil companies which "overlap with TPNP and/or the area of production forest which acts as a buffer zone to the national park." Three months later, on 13 May 2005, the Minister of Forestry wrote letter No. S.292/Menhut-VII/2005 stating that the border of TNTP in the northern part of the park would be changed, granting approval for conversion of the area into the four palm oil plantations mentioned in the 18 February letter, and adding two additional oil plantations to the south along the Java Sea.

The borders of these planned oil palm estates are shown in the map on the preceding page (Figure 8) and form the Project Area.

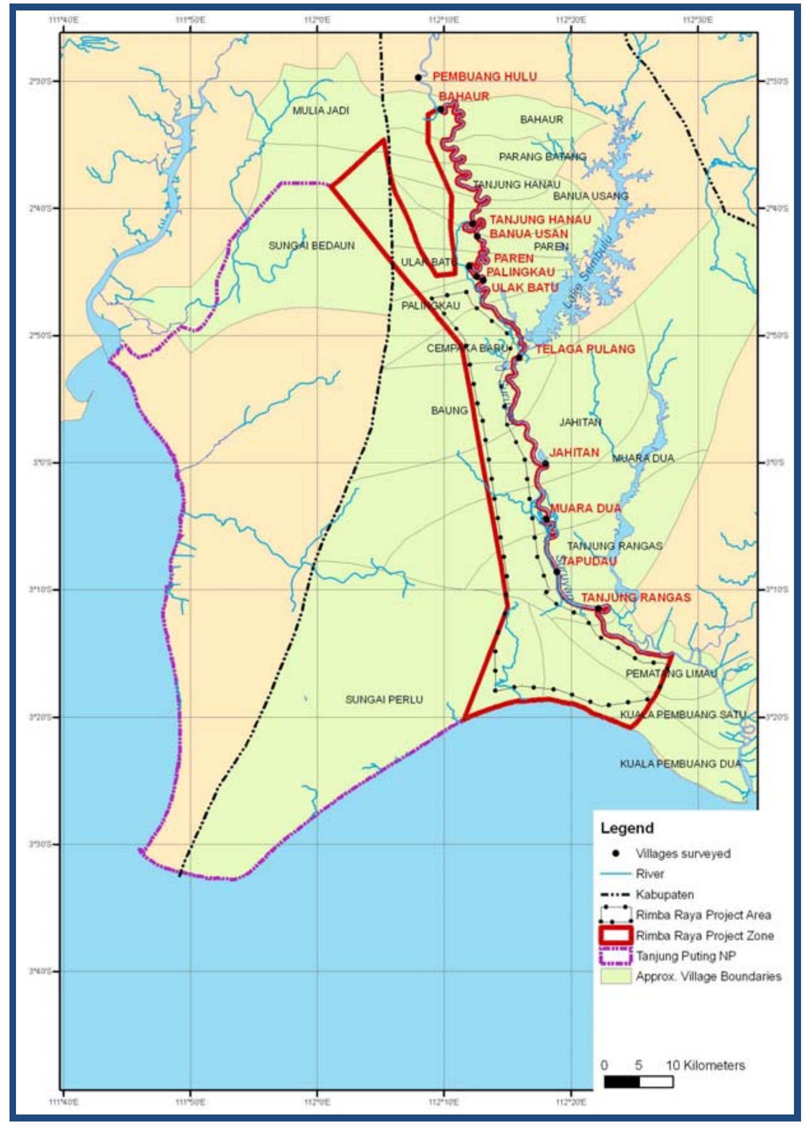


Figure 9. Project Area, Project Zone, Tanjung Puting National Park, and villages (*desa*) surveyed during the December 2008 Daemeter social survey (labeled in red).

Delineation of the Project Zone. To ensure the inclusion of all communities that potentially derive some form of livelihood from the area, the Project Zone will comprise the 47,237 ha Project Area plus an additional 43,978 ha of surrounding lands including all 14 communities on the Seruyan River within the potential sphere of influence of the project. Land inside Tanjung Puting National Park, to the west of the Project Area, has been excluded from the Project Zone. Recent community surveys indicate that the national park was previously used for logging but is no longer used for this purpose as a result of recent improvements in law enforcement. Additionally, land use for purposes other than logging would likely be met in forests located closer to the communities, inside the Project Area but outside the national park.

The Project Zone extends west to the border of Tanjung Puting National Park, south to the Java Sea, east to the Seruyan River and north to the land surrounding KUCC oil palm plantation. This broad delineation extends management and co-benefits of the Reserve as far as the major geographic and administrative boundaries that have historically constrained land use activities in the Rimba Raya region. To the north, the Project Zone extends more than 25 kilometers beyond the Project Area to forests and communities surrounding KUCC plantation in order to extend climate, community and biodiversity benefits to a threatened park border, at-risk lowland and peat swamp forest, and six communities that lie far beyond Project Area boundaries. This inclusive delineation of the Project Zone promotes comprehensive community planning in the Seruyan and prevents the formation of marginalized frontiers between important geographic boundaries.

Communities in the Project Zone. The Rimba Raya Project Zone is designed to include communities affected by activities within the Rimba Raya Project Area. In the context of CCB Standards, 'communities' are defined as all groups of people, including Indigenous peoples, migratory, and other local groups who live within or adjacent to the Project Area, as well as any groups that regularly visit the area and derive income, livelihood, or cultural values from the area. Using this definition, we can imagine communities located outside the Project Area, but potentially affected by the project, to include:

1. Communities with land rights in the Project Area. These include villages along the Seruyan River, which forms the eastern border of the project.

2. Communities in which certain individuals travel some distance into the Project Area to log, hunt or collect forest products.

A social survey was undertaken in December 2008 in order to gather basic information about land rights and land use in and around the project area. This information, together with land cover/land use mapping supports inferences about which communities may have rights to and/or use land in the project zone. Both are discussed below to provide context for delineating Project Area and Project Zone boundaries. Descriptions of community characteristics and land use are detailed in sections G.1.5 and G.1.6.

Communities with land rights in the Project Area. In the most general sense, land belonging to communities in or near the Project Area could include all land in villages (*desa)* that border the Project Area. Looking at the map in Figure 9, this approach would unnecessarily include areas up to 20 km from the Project

Area border (e.g. Desa Muara Dua), following administrative lines rather than current land use and land rights. For this reason, land use and rights patterns were examined to determine a more accurate project zone.

During the December 2008 social survey, all surveyed communities were located within the Project Area, along the west bank of the Seruyan River. Four of these communities also have *pemukiman* (small settlements) on the east bank and are identified with the larger communities directly across the river. These include Telaga Pulang, Baung, Jahitan and Muara Dua.

Community livelihoods in the Project Area derive mainly from fishing. In the past, many communities planted dry rice and vegetables and collected rubber from rubber gardens. In the past three years, however, monthly flooding has limited their livelihood activities to fishing and palm sugar production (from the tree *Arenga pinnata*). Therefore, available data suggest communities in the Project Area are not currently heavily dependent on their land (i.e., land which they possess the right to use). The majority of communities is Muslim, and therefore generally hunts a smaller set of animals and, in these areas, at lower intensity. Communities surveyed claim that they do not hunt, focusing instead on fishing. Community reliance on forests is limited to fire wood and, at times, logging. Communities claim that logging is no longer part of their livelihood activities, largely due to lack of valuable timber and recent crackdowns on illegal logging (with several local officials jailed). Communities do, however, still obtain wood from the east side of the river, which is designated as Production Forest under central government classification. It was emphasized during site visits that local livelihoods are very compromised by recent flooding and people with sufficient means are moving out of the area. Those who must remain are barely surviving and live under extremely difficult, unhygienic conditions.

Based on available data from initial site visits, cultural values linked to the Project Area and its surroundings appear to be very low or nonexistent. For Muslim communities, local areas of cultural importance include mosques and graveyards (which are not considered sacred as they often are in the Dayak communities of Kalimantan). All ethnic Dayaks encountered were Muslim. A very small number of Christians reside in the area (less that 1% in Desa Telaga Pulang) and no churches were encountered.

It is expected that any villages located close to the Project Zone on the east side of the river have experienced similar flooding and meet their livelihood needs in a similar manner to those in the Project Zone. Even if communities to the east were still planting rice or other crops, it is highly unlikely that farmers would travel the distance across the river, as there are few areas suitable for planting. Nevertheless, it is possible that communities on the east side of the river have rights to some land inside the Project Area. It is also possible that occasional forays into the forest in the Project Area occur, but this too seems unlikely, given that (i) they are Muslim and hunt at very low levels (in some cases not at all), and (ii) current land cover indicates there is greater availability of forest on the east side of the river for harvesting of non-traditional forest products.

Based on the foregoing information, all communities on the Seruyan River from Bahaur, near the northeastern boundary of the KUCC oil palm plantation south to Tanjung Rengas, in the vicinity of the southernmost proposed oil palm plantations, will be included in the Rimba Raya Project Zone. This conservatively includes all residents who may have access to the Project Area, regardless of their minimal expected use of the area, given that they reside on the Seruyan River. This river, forming the eastern boundary of the Project Zone, provides the only access to Rimba Raya, which remains roadless.

Distant communities using the Project Area. Communities situated at some distance from the Project Area are most likely to use the Project Area for illegal logging, especially in the southern portion of Rimba Raya and Tanjung Puting National Park, where illegal logging is reported to be ongoing. For example, one coastal community inside the National Park and west of Rimba Raya, Segintong Luar, was established specifically as a logging community in the 1990s. Further surveys in the project vicinity will be conducted, and any community determined to rely heavily for its livelihood on illegal logging in the Project Area will be included in the Project Zone. Other uses of the Project Area (e.g. hunting and collection of other non-traditional forest products) are thought to be minimal based on data collected during recent social surveys.

Delineation of the Project Zone. To ensure the inclusion of all communities that potentially derive some form of livelihood from the area, the Project Zone will comprise the 47,237 ha Project Area plus an additional 43,978 ha of surrounding lands including all 14 communities on the Seruyan River within the potential sphere of influence of the project. Land inside Tanjung Puting National Park, to the west of the Project Area, has been excluded from the Project Zone. Recent community surveys indicate that the national park was previously used for logging but is no longer used for this purpose as a result of recent improvements in law enforcement. Additionally, land use for purposes other than logging would likely be met in forests located closer to the communities, inside the Project Area but outside the national park.

The Project Zone extends west to the border of Tanjung Puting National Park, south to the Java Sea, east to the Seruyan River and north to the land surrounding KUCC oil palm plantation. This broad delineation extends management and co-benefits of the Reserve as far as the major geographic and administrative boundaries that have historically constrained land use activities in the Rimba Raya region. To the north, the Project Zone extends more than 25 kilometers beyond the Project Area to forests and communities surrounding KUCC plantation in order to extend climate, community and biodiversity benefits to a threatened park border, at-risk lowland and peat swamp forest, and six communities that lie far beyond Project Area boundaries. This inclusive delineation of the Project Zone promotes comprehensive community planning in the Seruyan and prevents the formation of marginalized frontiers between important geographic boundaries.

"The price of anything is the amount of life you exchange for it"

- Naturalist and Philosopher Henry David Thoureau

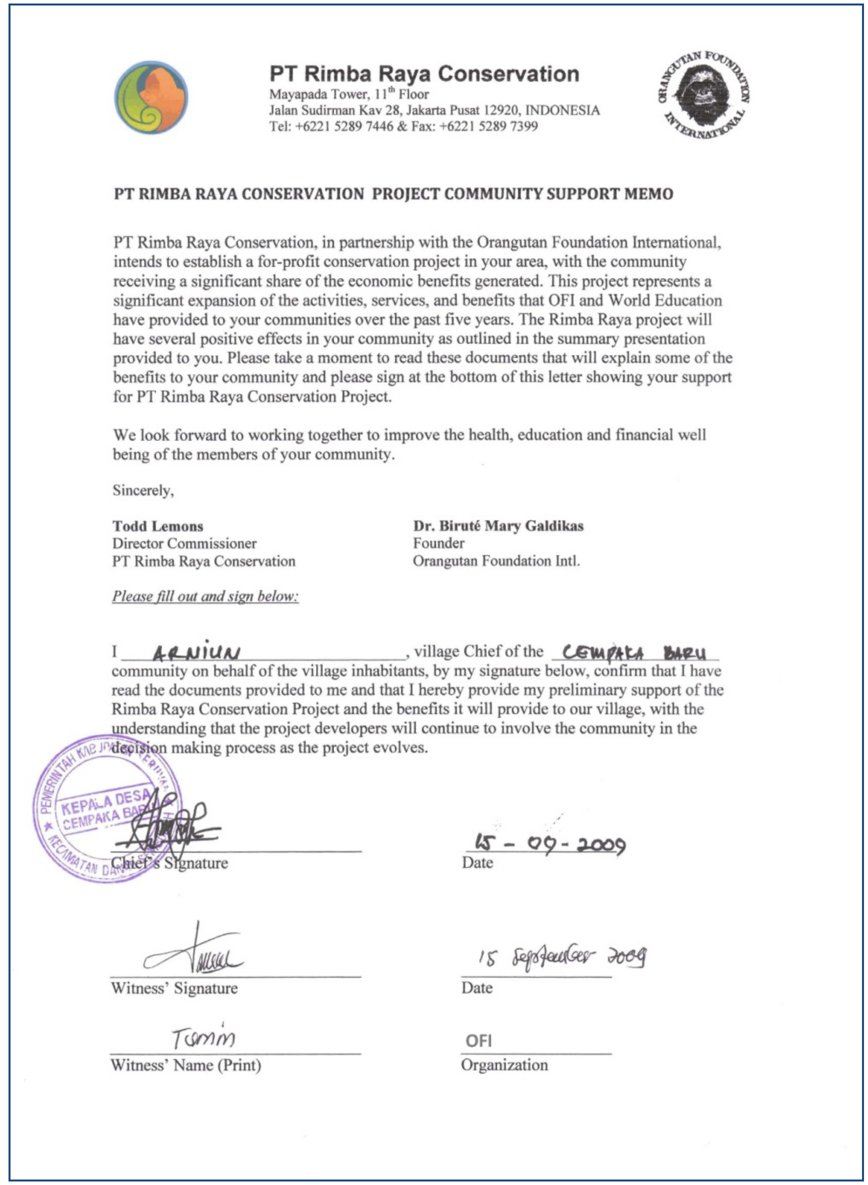
Community Approval

Village heads in Project Zone communities were consulted during several social surveys, and all gave their approval at that time and since then one such evidence is their signatures on the "**PT RIMBA RAYA CONSERVATION PROJECT COMMUNITY SUPPORT MEMO"** (see English version sample in Figure 10).

For a complete copy set or both the English and Bahasa Indonesia versions of the Community Support Memos, please see Annex 2.

Communities have been engaged on numerous dates ending recently with the **CCB Public Comment period** which closed **Sept 30, 2010** (see G 3.8 and G 3.9)

A discussion of local property rights is elaborated upon in section G1.



PT Rimba Raya Conservation
Mayapada Tower, 11th Floor
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Tel: +6221 5289 7446 & Fax: +6221 5289 7399

PT RIMBA RAYA CONSERVATION PROJECT COMMUNITY SUPPORT MEMO

PT Rimba Raya Conservation, in partnership with the Orangutan Foundation International, intends to establish a for-profit conservation project in your area, with the community receiving a significant share of the economic benefits generated. This project represents a significant expansion of the activities, services, and benefits that OFI and World Education have provided to your communities over the past five years. The Rimba Raya project will have several positive effects in your community as outlined in the summary presentation provided to you. Please take a moment to read these documents that will explain some of the benefits to your community and please sign at the bottom of this letter showing your support for PT Rimba Raya Conservation Project.

We look forward to working together to improve the health, education and financial well being of the members of your community.

Sincerely,

Todd Lemons Director Commissioner PT Rimba Raya Conservation	**Dr. Biruté Mary Galdikas** Founder Orangutan Foundation Intl.

Please fill out and sign below:

I ARNIUN, village Chief of the CEMPAKA BARU community on behalf of the village inhabitants, by my signature below, confirm that I have read the documents provided to me and that I hereby provide my preliminary support of the Rimba Raya Conservation Project and the benefits it will provide to our village, with the understanding that the project developers will continue to involve the community in the decision making process as the project evolves.

KEPALA DESA CEMPAKA BARU

Chief's Signature	15 - 09 - 2009 Date
Witness' Signature	15 September 2009 Date
Tomm Witness' Name (Print)	OFI Organization

Figure 10. Community Support Memo signed by Chiefs of the Villages within the Project Zone.

G1.4. Current Carbon Stocks within the Project Area

Current carbon stocks within the project area, using stratification by land-use or vegetation type and methods of carbon calculation (such as biomass plots, formulae, default values) from the Intergovernmental Panel on Climate Change's 2006 Guidelines for National GHG Inventories for Agriculture, Forestry and Other Land Use (IPCC 2006 GL for AFOLU) or a more robust and detailed methodology.

Carbon stocks in Rimba Raya are primarily comprised of below-ground peat and above-ground tree biomass. These carbon pools were quantified for the Carbon Accounting Area, consisting of 47,237 ha. Stratification of the project area and methods of carbon calculation are briefly described below and detailed in the Baseline Report (Annex 3) and project methodology[5].

Total carbon stocks were calculated by strata (land cover type and peat depth and distribution) using guidance and tools provided by the project methodology and the IPCC 2003 Good Practice Guidance (GPG) for Land Use, Land-Use Change and Forestry (LULUCF). Peat and aboveground tree biomass were included in carbon stock change calculations, while aboveground non-tree biomass, litter, and deadwood were conservatively excluded. Carbon stocks and baseline GHG emissions were estimated based on equations provided in the methodology. Project-specific data from field surveys, high resolution aerial image acquisition, and remote sensing and G.I.S. analysis were used whenever appropriate and were supplemented by recommended default data values from IPCC and peer-reviewed science.

Stratification by Landcover Type

Mapped land cover classes represent vegetation type (e.g. peat swamp forest, kerangas forest, peat shrubland) and level of anthropogenic disturbance in peat swamp forest (e.g. lightly degraded, highly degraded), both of which are expected to affect carbon stocks in aboveground biomass. Landcover classification and mapping for Rimba Raya was conducted to improve regional landcover maps by the Indonesian Ministry of Forestry. Methods and results are briefly described below and detailed in the Landcover Report and Landcover Accuracy Assessment (Annex 1).

Land cover mapping was accomplished following a two-part approach including automated image classification followed by manual image interpretation in GIS. In the first phase, pixel-based image classification was conducted to make use of spectral information in Landsat7 ETM+ bands that are sensitive to vegetation. The results of this classification provided important verification of broad land cover types such as forest and no-forest vegetative cover and bare soil. In the second phase, land cover was interpreted and digitized using classified and original Landsat data in a GIS. Interpretation was therefore able to incorporate key ancillary data including aerial photos, survey data and other GIS data compiled for Rimba Raya, which improved the classification.

Results of landcover classification (Table 3 and Figure 11) show that the Carbon Accounting Area is predominated by lightly degraded peat swamp forest (40.5%) and peat shrublands (25.6%) with some kerangas forest (10.2%) and open kerangas scrub (11.4%).

[5] The methodology for this project follows the Approved VCS Baseline and Monitoring Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, Version 1.0 accessed September 30, 2010 at http://www.v-c-s.org/VM0004.html

Biomass Survey

In order to quantify biomass associated with landcover types, a combination of ground and aerial surveys were conducted. Survey transect locations are shown in Figure 11. Survey methods and results are briefly described below and detailed in the Carbon Assessment Survey Report (Annex 4).

Two 8-person teams of trained and experienced field staff conducted the ground survey. A total of 16,000 meters of transect were marked and surveyed with biomass data recorded across 36 plots representing 9 hectares of forest. Biomass measurements included tree diameter, tree height and tree crown measurements.

Table 3. Land Cover Classification and Extent in the Project Carbon Accounting Area		
Land Cover Description	**Extent (Ha)**	**% Total**
Peat Swamp Forest (lightly degraded)	19,028	40.4
Peat swamp forest (highly degraded_	1,734	3.7
Peat Shrubland (<20% tree cover)	12,147	25.6
Kerangas Forest	4,810	10.2
Kerangas Open Scrub	5,429	11.4
Low sparse vegetation cover	1,342	2.9
Seasonally Inundated Wetlands	2,704	5.8
Open Water	43	0.1
Grand Total:	**47,237**	**100.0**

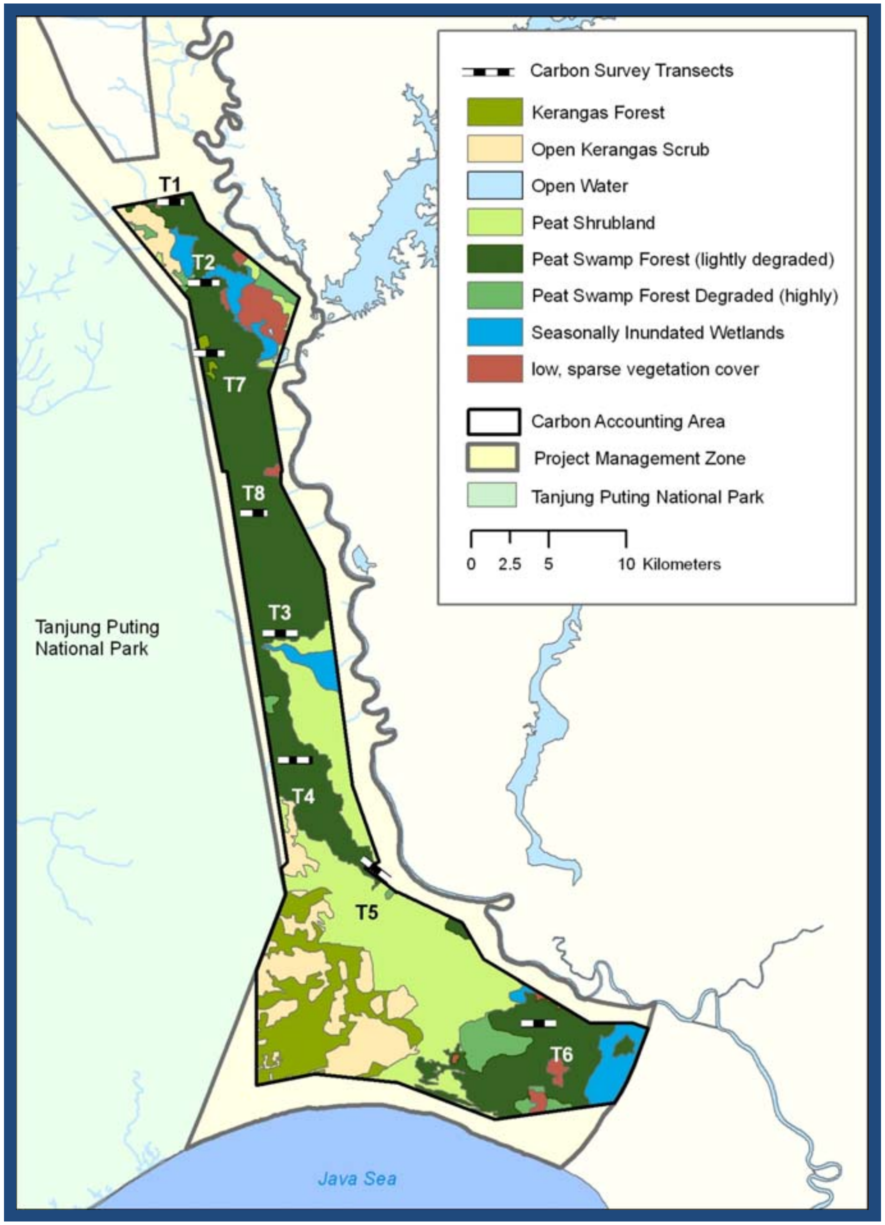

Figure 11. Land cover classification in the Carbon Accounting Area with transect locations for biomass and peat surveys.

Survey results indicate that despite the history of selective-hand logging in the area, forest biomass is moderately high and relatively consistent across major forest blocks in Rimba Raya.

During the ground surveys, aerial surveys were also conducted. A total of 3,382 photos were taken over the Rimba Raya concession. Photos with high cloud cover were excluded and remaining photos were ortho-rectified and georeferenced as described in the baseline report. One-hectare plots were installed in the center of each photo and tree crowns were identified and measured in order to estimate above ground tree biomass. Example aerial photos with plots and tree-crown delineations are shown below for lightly degraded peat swamp forest (Figure 12) and kerangas forest/open scrub (Figure 13). Biomass by landcover class for Rimba Raya based on ground and aerial survey analysis is shown in Table 4.

Table 4. Biomass of Land Cover types

Land Cover Description	Biomass in trees > 10 cm DBH (t d.m. ha-1)
Peat Swamp Forest (lightly degraded)	206
Peat swamp forest (highly degraded)	128
Peat Shrubland (<20% tree cover)	49
Kerangas Forest	86
Kerangas Open Scrub	58
Low sparse vegetation cover	10
Seasonally Inundated Wetlands	14

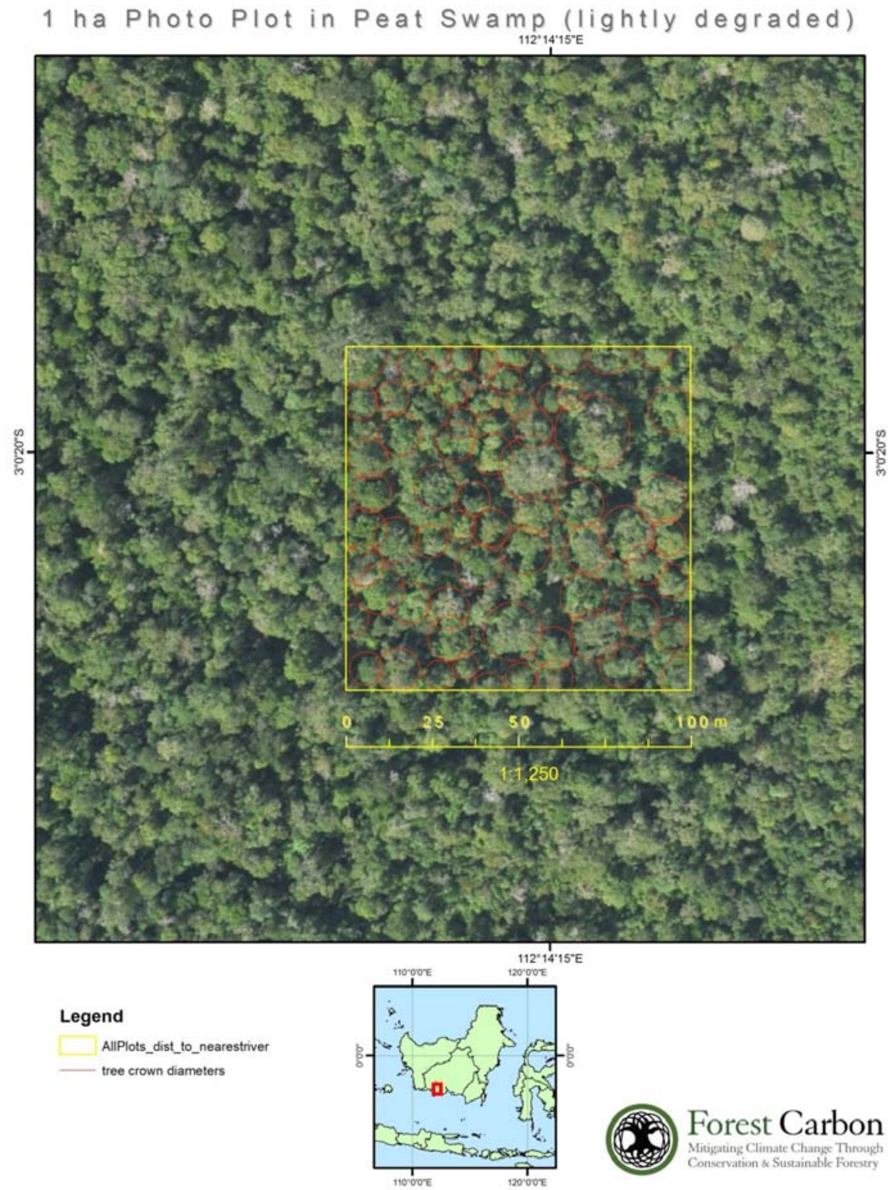

Figure 12. 1ha aerial photo plot in Peat Swamp Forest (lightly degraded).

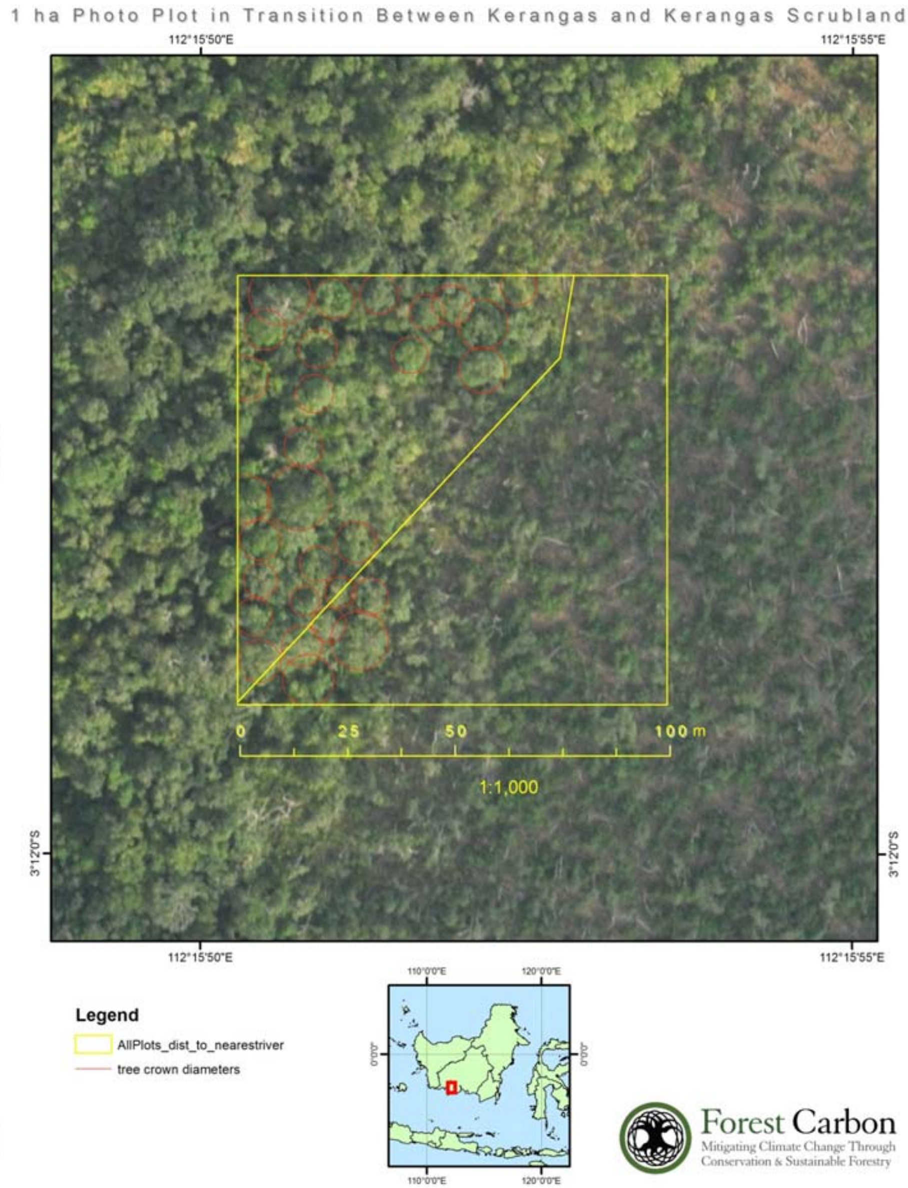

Figure 13. 1ha aerial photo plot in Kerangas Forest (upper left) and Open Kerangas Scrub (lower right).

Peat Distribution

The principal factor controlling carbon content in peat forests is the depth of the peat, with type of peat layer and bulk density as secondary factors. The majority of peat swamps in Indonesia are deeper than 1 m, and sometimes more than 15 m in depth (Rieley et al. 1997). Hooijer estimates 42% of the peat land areas in Indonesia are over two meters thick, accounting for most of the country's peat and carbon deposits (Hooijer et al. 2006).

The most comprehensive peat assessment to date for Indonesia was conducted by Wetlands International using both primary and secondary data sources (Wayunto et al. 2004). A series of maps were produced that show peat depth and type for each province and district. These data show shallow peats distributed throughout the Rimba Raya Carbon Accounting Area. Wetlands International data was ground-truthed by an in situ peat depth assessment conducted by Forest Carbon and OFI.

Peat Depth Survey

Peat depth was measured at 100-meter intervals along all survey transects. Methods and results are briefly described below and detailed in two Carbon Assessment Survey Reports (Annex 4). A total of 16 km of transect were marked and surveyed with peat depth measured in 160 locations. Average depth of each transect is shown in Figure 14 together with Wetlands peat mapping.

Unexpectedly, peats were moderately deep across all survey transects. 67% of peat depth measurements exceeded the reach of the peat probe at ca. 5 meters and average depth overall was 4.5 meters in peat areas.

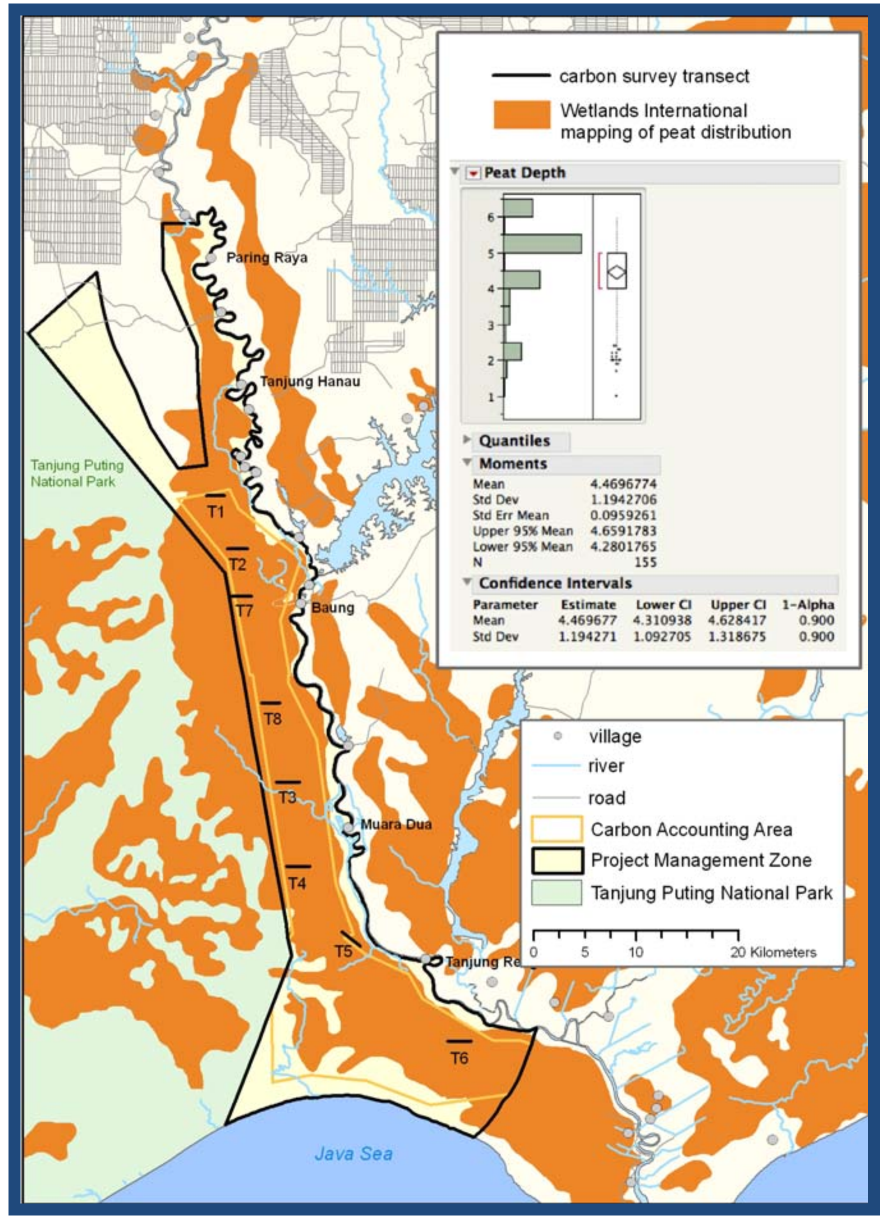

Figure 14. Peat map for Rimba Raya and Tanjung Puting National Park from Wetlands International with ground survey measurements recorded on carbon assessment survey transects.

Actual peat depths measured in the Rimba Raya Carbon Accounting Area exceed Wetlands International estimates for the area and likely contain an average carbon content of 2,500t C/ha (associated with two-four meter Hemist/Fibrist peats). This far exceeds the calculated carbon loss under the baseline, which assumes a maximum 1 meter peat loss through burning and subsidence under a business as usual scenario.

Combined Above and Belowground Carbon Estimates

Stock changes for above and below ground carbon were assessed under the baseline scenario (described in G.2 and the baseline report) in order to determine the amount of carbon emissions avoided by the project.

The baseline analysis, which takes a necessarily conservative approach, shows that protection of Rimba Raya carbon stocks over the 30-year life of the project equate to an estimated 104,886,254 t CO2e avoided.

Many additional "inherent buffers" in the baseline are seen as offsetting other uncertainties (confidence deduction offset) associated with this emerging science. The following lists all areas in which the methodology and project proponents have built in conservativeness in its baseline calculations and in leakage estimates. The following list shows conservative approaches on high impact parameters that affect the baseline calculationsgreater than 5%.

Conservative Assumptions/Parameters of the methodology

1. Net peat drainage to establish the land use change in the baseline scenario would not exceed one meter in depth regardless of average drainage canal depths.
2. Carbon stocks in dead wood and litter are excluded.
3. Future biomass accumulation in the project area can be ignored if desired; it is conservative to do so.
4. When estimating the biomass of timber removed (based on a minimum diameter threshold) when land is cleared in the baseline case, it is conservative to assume that the biomass of the entire aboveground component (leaves, branches, etc.) of each harvested tree is removed with the logs extracted, leaving no slash behind to burn, because a fraction of the extracted biomass is stored as long-lived wood products.
5. The upper uncertainty bound was used to estimate carbon accumulation on the baseline land use (palm oil plantation).
6. The lower uncertainty bound was used to estimate carbon stocks in the project case.
7. The depth of peat burned (estimated conservatively) is subtracted from the depth of peat drained (estimated conservatively) when estimating baseline peat drainage emissions to avoid double counting of emissions.
8. Areas outside the project boundary may be impacted by drainage activities or burning activities inside the project

boundary in the baseline case, but these areas are conservatively ignored from baseline calculations.

9. In the baseline, the burn depth is set equal to the drainage depth minus a critical threshold value of 40 cm above the drainage depth. If this exceeds 34 cm, then the maximum burn depth is conservatively capped at 34 cm, which is the average of measurements from Couwenberg et al. 2009. If drainage depth is less than 40 cm, then fire emissions are conservatively excluded from calculations.
10. Emission factors for peat combustion at the lower temperature are assumed in the baseline scenario because this results in lower overall GHG emissions (CO_2 + CH_4 reported as CO_2 equivalents) and is therefore conservative.
11. All monitored emissions from biomass damaged and extracted during illegal logging are assumed to occur immediately in the year that logging is detected.
12. Carbon storage in wood products is ignored in the project case.
13. All monitored logging gaps larger than the predetermined minimum gap size are assumed to be from commercial logging and not by natural treefall. This is conservative because it overestimates the number of trees logged in the project case.
14. The distance of impact of new logging canals should they occur in the project, is conservatively defined (i.e. upper bound for the likely distance of impact) for both large and small canals in consultation with peat experts.
15. The measurement where the water table is lowest adjacent to any new logging canals in the project, is the assumed depth to which peat is drained across the entire area of impact. This is conservative, because lower drainage depths translate into higher CO_2 emissions in the project case.
16. If no field measurements are available of carbon stocks in a given stratum after burning in the project case, then the CO_2 emission factor is conservatively estimated as the CO_2 equivalent of the mean baseline aboveground carbon stock of the stratum in which fire was detected. This is conservative.
17. Emission factors for peat combustion at the higher temperature are assumed for peat burning the project case, because this results in higher overall GHG emissions and thus a conservative project scenario.
18. Above-ground biomass estimates did not include biomass below 20 cm in diameter.

G1.5. Description of Project Zone Communities

G1.5. A description of communities located in the project zone, including basic socio-economic and cultural information that describes the social, economic and cultural diversity within communities (wealth, gender, age, ethnicity etc.), identifies specific groups such as Indigenous Peoples and describes any community characteristics.

In December 2008, a socioeconomic and cultural survey was conducted by Daemeter Consulting to identify and describe communities present in and near the Rimba Raya Project Area.

Methodology

The methodology used for collecting data included individual interview and small group discussion. The village head, deputy village head, village secretary, Chairman of BPD (Badan Perwakilan Desa, Village Representative Body), informal leaders, elders, youth, and women leaders represented the target contacts, as these individuals and groups have the greatest access to village-specific information. In some cases, members of these groups were interviewed individually, allowing for the repetition of certain questions to gauge consistency across interviewees. In other cases, the small group format facilitated discussions, allowing for the collaborative elaboration and refinement of information as it pertained to a specific village.

The interviews addressed topics as described in the CCB Standards with the goal of collecting relevant data and information, but they were otherwise unstructured, emphasizing topics of interested to interviewees.

Overview

Fourteen villages (*desa*) were identified, from just south of Tanjung Hanau down to Kuala Pembuang, the capital of Seruyan District (southeast of the Project Area). Administratively, these 14 villages fall under the same district (*Kabupaten* Seruyan), but three different subdistricts (*kecamatan*). The villages and their subdistricts are: Bahaur, Paring Raya, Parang Batang, and Tanjung Hanau located in Hanau Subdistrict; Banua Usang, Paren, Ulak Batu, Palingkau, Cempaka Baru, and Telaga Pulang located in Danau Sembuluh Subdistrict; and Baung, Jahitan, Muara Dua and Tanjung Rengas located in Seruyan Hilir Subdistrict. Table 5 provides population data for the villages visited.

Most community members residing in the 14 villages surveyed, rely on the Seruyan River for their basic needs, cash income, and transportation. Before the 1990s, forests provided for the communities' basic needs and cash income. Villagers cleared forests to make their *ladang* and plant rice and rubber. They also logged the forests and sold logs to markets in Baung, Telaga Pulang, and Segintong Luar. However, after the operations of Hutan Lestari, conducted by the Ministry of Forestry in the late 1990s to control illegal activities within state forests, logging became the least favored livelihood option for villagers. There were (and still are) some illegal logging cases resulting in elite village officials or their family members being jailed.

Villagers' access to forests has become even more restricted with recent oil palm plantation development. In the villages surveyed, it was common to hear complaints of oil palm companies operating in a manner that caused land tenure disputes. This form of conflict reportedly never occurred in the past, when land use issues were resolved by visiting villages and asking for permission to operate in the area. Only a few companies have had the good will to resolve such conflicts by negotiating with the villagers directly, some even asking for facilitation by the government. A number of palm oil companies still use the 'New Order approach', arranging for the police's special task force or the military to support them in negotiations with villagers, a posture that is inevitably (and often intentionally) intimidating.

Table 5. Population data for villages in the Rimba Raya Project Area						
No.	**Village**	**No. of Families**	**No. of People**	**No. of Women**	**No. of Men**	**Predominant Tribe**
1	Bahaur	-	1700	-	-	Dayak Kahayan
2	Paring Raya	20	-	-	-	Dayak Kahayan
3	Parang Batang	-	206	-	-	Dayak Keninjal & Bangkul
4	Tanjung Hanau	127	511	281	230	Banjar
5	Banua Usang	215	642	-	-	Dayak Pante & Banjar
6	Paren	113	227	113	114	Dayak Pante & Banjar
7	Ulak Batu	70	181	89	92	Dayak Nadju & Banjar
8	Palingkau	43	168	77	91	Dayak Nadju & Banjar
9	Cempaka Baru	133	566	216	250	Dayak & Banjar
10	Telaga Pulang	411	2313	1008	1305	Banjar & Dayak
11	Baung	250	2015	992	1223	Banjar & Dayak
12	Jahitan	133	477	208	269	Dayak & Banjar
13	Muara Dua	140	523	236	287	Banjar & Dayak
14	Tanjung Rengas	320	1406	641	765	Banjar & Dayak
	Totals:	**1,975**	**10,935**	**3,861**	**4,626**	

From the villages visited, most of the villagers – who typically belong to Dayak and Banjar tribes – earn their living from fishing. Seeing this, the Seruyan District government developed a program to help the communities improve the productivity and sustainability of fish populations in the river by adopting a *keramba* (aquaculture) system. However, it is reported that in the last five years the Seruyan River has experienced far more frequent flooding than in previous periods. In the past, flooding occurred predictably once each year and could be anticipated. Recently, they have experienced monthly flooding, and some communities remain flooded for up to three months at a time. Only a few of the communities have healthcare facilities.

Villagers from communities without healthcare facilities go to other communities for treatment. At one point, there were a number of midwives assigned to each village, but due to the extremely challenging living conditions (unhealthy environment, lack of clean water, etc.) only a few midwives have stayed.

In terms of education, village elders did not attend school or, if they did, attended only through elementary school. On average, each village has one elementary school building that is poorly maintained. One exception is the elementary school in Paren village, which was renovated recently. The younger generations now receive education through high school, but schoolchildren must move to Telaga Pulang or Pembuang Hulu to attend. Some teenagers return to their villages after completing high school to help their parents. Others work with oil palm companies or become boat operators. Still others do not return to their villages, instead migrating to towns and cities for other employment opportunities.

Due to the extreme poverty in the area, many villagers leave their communities to look for work elsewhere. At the same time, many migrants have started coming to the area to work with oil palm companies operating on land near these communities. A number of village officials cited these changing population trends as the principal complicating factor in conducting an accurate census of the population.

The migrant workers have become a controversial issue with villagers, who feel that they are reducing local employment opportunities. All officials interviewed said that the oil palm companies prefer to use their own workers rather than train locals to work for them. Another common complaint is that oil palm companies use community land, but the compensation paid does not meet the communities' expectations.

Life seems difficult for most of the villagers in the Project Zone. Their access to forests is limited by the expansion of oil palm plantations. They cannot fish when the river is flooded, a condition that is occurring with increasing frequency. They cannot compete with migrant workers if they wish to work for the oil palm companies. They cannot afford the day-to-day cost of living, which is significantly more expensive than in other places in Indonesia (e.g., gasoline and kerosene are priced three times higher here than in cities). They are typically last to know what is happening in the area. In effect, they are being driven from their land.

Survey Results

1. Bahaur Village. Administratively, Bahaur village is under the Hanau Subdistrict, located in the Seruyan District. Bahaur is an old village, established prior to Indonesian Independence in 1945. The village, located within 40 minutes of Pembuang Hulu, can be reached via speedboat. It has only one sub-village (*dusun*), named Manggana. The word *Bahaur* comes from the Pembuang Hulu language, in which it means "*banyak hanau*" (a lot of palm trees, referring to the palm *Arenga pinnata*). Historically, and through to the present day, the palm has had significant economic value for the Bahaur people, especially women, who process the palm water into brown sugar. At present the price of brown sugar is IDR 15,000/kg when sold locally. The population is predominantly Dayak Kahayan, with Islam as the dominant religion.

Reportedly comprising 21,000 hectares, the village has categorized its land into the following land uses: settlement, swidden agriculture, and graveyard. Most land is privately owned by families, with the exception of a plantation planted with *jelutung* (*Dyera costulata*) and rubber that belongs to the village (200 ha). This land was distributed to 100 families, each given two hectares, by the Indonesian government. The families are only authorized to manage the piece of land that they were given and they do not have ownership rights to the land. These 200 ha are not concentrated in one area, but rather scattered throughout the village. This plantation development is part of the National Reforestation Program that was managed under the Seruyan District's DAK-DR (*Dana Anggaran Kabupaten-Dana*

Reboisasi, the District Budget from the Department of Forestry's Reforestation Fund).
Reportedly, there are no conflicts among villagers. They are said to respect each other, and respect the boundaries of each other's property. They know which *ladang* (swidden area) belongs to whom without the use of physical marks on the ground. When conflicts arise, they prefer using discussion in lieu of confrontation to resolve them. At present, the ownership of land is registered through *Surat Kepemilikan Tanah* (*SKT*), issued by the Village Head. However not all villagers have used this SKT to claim their land officially.

Most of the villagers have multiple sources of income, but the main source at present is from fishing. In the past, they also collected rattan and used forested areas for their needs. Since oil palm licenses were issued from Seruyan District and plantations developed on nearby land, however, the villagers claim that all the forests are gone. According to the village secretary, there is a potential conflict brewing with the oil palm license holder PT. Wana Sawit Timur. The company has yet to visit the village to discuss the license area or other issues of oil palm operation. Villagers generally meet their basic needs through a cash-based economy, purchasing carbohydrates, vitamins, minerals, some protein, and medicines. They meet their protein needs largely through fishing.

Both formal and informal institutions are present in the village. Formal institutions are managed through government structures, typically comprising a village head, village secretary, other staff of the village office, and a BPD (*Badan Perwakilan Desa*, Village Representative Body). Bahaur does not have a village office. Currently the administration operates out of the village head's house. Informal institutions include a women's group (e.g., *PKK, Program Kesejahteraan Keluarga*, Family Welfare Program), a weekly Islam study group, a youth group, and a farmer group. To organize meetings, Bahaur uses written invitations delivered a day in advance. The villagers prefer to have something in writing to inform them, although the verbal communication system still functions.

Villagers apply national and Islamic laws to regulate most aspects of their lives. Historically, they used Islamic law, which provides men twice the proportion that women receive, to determine inheritance. Yet they have modified this law and today sons and daughters receive equal portions. They have a local term, "cut fish" (*potong ikan*), meaning equal division among children.

There appears to be an equal division between villagers who support oil palm plantation development and those who support forest conservation. Some believe that oil palm can bring a new source of income for them, improving their livelihoods, while others are confident that forests contribute most to their livelihoods, providing protection from natural disasters like flooding and erosion. To them, forests provide fuel wood and construction materials, and help maintain the rivers, which they rely on for water and fish. In accordance with these different stances, some villagers are prepared to release land for any oil palm plantation development scheme that may arrive, while others will not sell rights to their land and hope for a program that will protect the remaining forests.

The local system of land ownership is quite simple and clear amongst locals, only running into complications of the system with the arrival of outside interests. Locally people respect each other's property and land rights. They know the boundaries of each other's land without it being physically demarcated. Each of the villagers know which ladang (*swidden area*) belongs to whom without having the physical marks on the ground. They use natural features such as ditches and big trees to mark the land boundaries. Until recently they did not have a written, official form of documentation to verify land ownership. Now some villages and individuals have started to use land ownership certificates (*Surat Kepemilikan Tanah-SKT*) issued and signed by the village head (*Kepala Desa*).

It's quite clear that there's no such 'clear customary land ownership' that affect (or to be referred by) tenurial system of surrounding communities of Rimba Raya Area.

2. Paring Raya. Paring Raya is a new village established by people originating from Bahaur village. The settlement, about a 15-minute boat ride south of Bahaur, was legalized in July 2008. Only 20 families reside in this village.

3. Parang Batang*.* This village, established in 1913, is inhabited by 206 families. Administratively, it is under the Hanau Subdistrict. Information on the number of men and women residing in the village was not available during the survey. The village has one *dusun* (Kahoe) located on the west side of Seruyan River. Most of the villagers are Dayak Keninjal and Bangkul (90%), with the remaining 10% from Java, Banjar, or other ethnic backgrounds. Everyone in the community is Muslim, and they speak the language Pembuang as well as Indonesian.

Most of the villagers earn their living by fishing (75%), while others do so by tapping rubber and collecting *jelutung* (25%), which can provide them with cash income of approximately IDR 47,000/day. During the rainy season, this second group rarely taps rubber, shifting over to fishing instead. In regard to basic needs, carbohydrates, non-fish protein, vitamins, minerals, and medicines are all purchased from markets. The villagers still depend on local natural resources for water, fuel wood, wood for construction materials, and protein (fish). They do not use the forest for cultural or religious purposes.

Few villagers (approx. 10%) have registered their private, individually owned land to receive a SKT from the village head. In addition to private land, the village also has a 500 ha communal forest that villagers utilize for wood.

In December 2008, the village received funding from the Agriculture Service Office (District level) through a program called PUAP (*Program Usaha Agribusiness dan Peternakan*, Agri- and Livestock Business Program). There are two farmer groups that manage this agricultural program.

4. Tanjung Hanau*.* Tanjung Hanau village lies on the border between the Hanau and Danau Sembuluh Subdistricts, but falls under the administration of the Hanau Subdistrict. From Pembuang Hulu (heading downstream on the Seruyan River) it can be reached within 3 hours by long boat. Alternatively, it can be reached in 5 hours heading upstream from Kuala Pembuang, the capital of Seruyan District. The village consists of 127 families and 511 people (281 women and 230 men). Of these, 130 women and 192 men are considered to be of working age. Ethnically, the villagers are mostly Banjar and speak both Banjar and Indonesian. They are all Muslim.

Most of the villagers earn their living through fishing and rubber tapping. The oil palm companies periodically offer the communities one-off employment opportunities (for land clearing and planting) with a wage of IDR 47,000/day. For the past two years villagers have not been able to work on the land for *ladang* or rubber because of the routine flooding of the Seruyan River.

Village land is owned individually, with most ownership rights lacking formal documentation. In addition to the individual land, Tanjung Hanau also has 25 square kilometres of communal forest on the east side of Seruyan River. Use of this forest has not been institutionalized, although local villagers are permitted to source timber at a subsistence level. To date, no illegal logging has been reported in this forest.

A few NGOs, including WALHI and Sawit Watch, have made short visits to this village. According to the respondent, their visit was intended to document any conflicts between communities and oil palm companies. They also carried out some advocacy work, attempting to organize villagers against oil palm encroachment. However, the community organizing activity did not yield solid results as it was undertaken over a short period of time. World Education has also worked in this village, conducting community organizing activities. For financial reasons, however, the activities have stopped, and WE is currently focusing on the 5 of 12 villages along the Seruyan River included in their initial work plan.

5. Banua Usang*.* Banua Usang comes under the administration of the Danau Sembuluh Subdistrict. It consists of 215 families totalling 642 people. Most of the villagers are Dayak Pante, a sub-group of Dayak that converted to Islam generations ago. They speak Banjar and Indonesian. Most are fishermen, as their forest was converted to oil palm some time ago. For the past two years they have been unable to clear forest for *ladang* because they must compete with the oil palm plantation for this land. They now depend on alternatives to meet their basic needs, including carbohydrates, protein (non-fish), vitamins, minerals, and medicines. They still rely on local natural resources for protein (fish), water, wood for construction materials, and fuel wood. They do not have cultural practices tied to the forest.

The village has one farmer group, called Bina Sejahtera, with 100 members. This group receives funding from PUAP (*Program Usaha Agribisnis dan Peternakan*), which was introduced by the Agriculture Service Office from Seruyan District. Additionally, the farmer group has received the DAK-DR assistance for planting 100 ha of rubber and *jelutung* on land provided by the program. The planted area is not concentrated in one location.

The village does not have a land use plan, but is interested in having an organization facilitate the process of developing such a plan. WALHI and Sawit Watch made a brief visit to this village to document conflicts between villagers and oil palm companies. As part of a program put together by these two organizations, the chairman of BPD (*Badan Perwakilan Desa*, Village Representative Body) was invited to a meeting where he exchanged and shared his experiences with oil palm companies with other villagers from different islands. The intent was for him to learn how to undertake advocacy work to lobby against oil palm development.

6. Paren*.* Administratively, this village belongs to the Danau Sembuluh Subdistrict. The size of the village is about 15,000 hectares, including the villagers' *ladang* and rubber plantations and the village itself. The village has 227 people (113 women and 114 men) comprising 116 families. Sixty percent of the total population is of working age. The villagers are mostly Muslim and ethnically Dayak Pante (95%) and Banjar (5%). Most speak Pembuang and Indonesian.

Similar to the other villages along Seruyan River, land is owned individually in the village, but there is also a 500 ha communal forest used to meet the villagers' subsistence needs for timber.
The village has organized villagers into two farmer groups (Sepakat and Bahandep).

7. Ulak Batu. Ulak Batu used to be part of Telaga Pulang village. The name Ulak Batu was chosen by an official from the Bangkal Subdistrict in 1965 because he thought that Ulak Batu had enough people to become a separate village. It is now under Danau Sembuluh Subdistrict administration. The village borders Paren village to the north, with Sembuluh to the east, Palingkau to the south and the Project Area to the west.

The population is 181 people, comprising 89 women and 92 men in roughly 70 families. Most of the villagers are of Dayak Nadju and Banjar descent, and the vast majority are Muslim. They speak Pembuang, Banjar, and Indonesian.

Before the 1990s, the villagers practiced logging and therefore relied on the forest as their source of cash income. Beginning in the late 1990s with the Ministry of Forestry operation to combat illegal logging, however, it has been difficult for them to find cash income. They initially shifted to fishing, but they now face difficulty with seasonal uncertainty, flooding, and the degradation of the Seruyan River. It is therefore difficult for them to meet their basic needs.

8. Palingkau. Palingkau was established in 1977, and it is currently under Danau Sembuluh Subdistrict administration. It is inhabited by 168 people, 77 women and 91 men, in 43 families. Most of the villagers are Dayak Nadju or Banjar, and all are Muslim. They speak Pembuang, Banjar, and Indonesian.

The village borders Ulak Batu village to the north, Sembuluh to the east, Cempaka Baru to the south and the Project Area to the west.
Ninety percent of the families earn their living from fishing in the Seruyan River. The fish they catch include *baung*, *jelawat*, *haruan*, *biyawan*, *tapah*, and *kemancung*. In addition to fishing in the Seruyan River, they also make some "*keramba*" for aquaculture. Farmed species include *bakut*, *jelawat, toman*, *baung* and *haruan*.

9. Cempaka Baru. Cempaka Baru is one of the villages under the administration of the Danau Sembuluh Subdistrict. It contains one *dusun* (subvillage), also called Cempaka Baru, with two hamlets (RTs). The village was established in 1963. Prior to being named Cempaka Baru, it was called Danau Pepundak. The population consists of 566 people in 133 families. Approximately 360 of the villagers are of working age. Three quarters of the total population are Dayak, and the other quarter is Banjar. All of the villagers are Muslim. Of the 133 families, 70 are considered "poor" – a term locally defined as families whose house roofing is made of leaves or whose daily income is less than IDR 30,000.

The village has formal (village governance) and informal (women's group/PKK, youth group/Karang Taruna) institutions, although the informal institutions are no longer active. The village also has a cooperative bank, and all members of the cooperative can deposit money and borrow from the bank.
To meet their basic needs, the villagers depend on rivers for protein (fish) and on the forest for construction material and fuel wood. They did not indicate which forest they utilize.

Most people from Cempaka Baru do not possess a land certificate for their property. Only 5% have a Surat Keterangan

Tanah (SKT) signed by the village head. Swidden agriculture areas and rubber gardens are owned individually, not communally. Individuals know the boundaries of their properties without relying on clear physical markers. They use natural features such as rivers and large trees to mark the boundaries. So far, there have been no conflicts among the villagers over land boundaries. In addition to individual property, there is also communal forest land owned by the village. The village has not established formal regulations for its utilization, but only villagers from Cempaka Baru are permitted to use it. The village also has a land use plan that divides the village land into settlements, agricultural areas, plantations, fisheries, graveyards, and public facilities.

In general, community members would like to have a development program without sacrificing their remaining forested lands. They prefer to have a program that can protect their forests while at the same time generating income to improve their welfare.

10. Telaga Pulang*.* Administratively, Telaga Pulang is within the Danau Sembuluh Subdistrict. It has two sub-villages on either side of the Seruyan River, with a total of 6 hamlets. The population is 2,313 people, consisting of 1,305 men and 1,008 women in 411 families. There are 1,754 people considered to be of working age. Almost all residents are Muslim, with only one percent of families reported to be Christian. Ethnically, the villagers are Banjar (50%), Dayak (45%), and other (5%).

Fifty-five percent of families earn their living from fishing and farming, while the other 45% work for private companies (including oil palm) operating near the village. Daily income from fishing is around IDR 45,000. Fifty percent of the families are considered poor because they earn less than IDR 30,000/day and have roofs made of leaves on their houses.

The land in the village is owned privately by individuals. Only 20% of the families have registered their land with the village and received official documents in the form of SKT. About 5% of the village's total area is communal forest land. The village has yet to set up a separate body to manage this land. The villagers do not use forests for cultural or religious purposes. Basic needs met by local natural resources include protein (fish), water for bathing, drinking, and washing, fuel wood, and wood for construction. Other necessities, such as carbohydrates, vitamins, minerals, and medicines, are purchased.
The village also has a cooperative bank called *Koperasi Pare Itah* which the members can use to save and borrow money.

11. Baung*.* The village of Baung is located in the Seruyan Hilir Subdistrict. It has one sub-village with the same name and three hamlets (RT). Two are located along the riverbank while the third is farther south and inhabited by only three families. The total population is 2,015 people, comprising 992 women and 1223 men in 250 families. 1,631 people are considered to be of working age. Ethnically, almost 90% of the families are Banjar, 9% Dayak, and 1% Javanese.
Of the 250 families, 100 are considered poor either because their daily income is less than IDR 20,000 or because their houses are in very poor condition. These poor families receive direct cash assistance under a BLT program from the government. Farming and fishing are the principal sources of income for 70% of the villagers, while the remaining 30% work for the oil palm company. On average, farmers and fishermen can earn IDR 35,000/day. The farmers tap rubber, *jelutung* (*Dyera costulata*), and *gembor* (raw material used for mosquito repellent).

To meet their basic needs, villagers rely heavily on cash purchases from markets in the Seruyan District or other nearby villages. Natural resources used to meet basic needs include river water for drinking, bathing, and washing, fish for protein, and fuel wood from the remaining forests.

There are three economic institutions in the village, the Koperasi Usaha Mandiri (an oil palm-plasma cooperative that is not active yet), the Mekar Sari Farmer Group (a World Education-facilitated group focusing on agricultural activities), and Subur Mandiri Farmer Group (a Forestry Service Office program for planting rubber (*Hevea braziliensis*) and *jelutung* (*Dyera costulata*)).

The village has a land use plan that separates the land according to functions, including the following categories: settlement (housing), village office facility, agricultural land, plantation, fishery, and public facilities (e.g. school and medical center).

Each individual has private land for farming or settling. No one has official documentation to prove ownership, but there is consensus on property boundaries. Land conflicts among villagers have yet to occur, although there have been some conflicts with individuals from the neighboring village.
Seventy percent of the total area of the village is reported to be forest land, which makes it communal property.

12. Jahitan. Jahitan is another village under the administration of the Seruyan Hilir Subdistrict. This village was established far before Indonesian independence in 1945. It consists of only 1 *dusun* with 2 hamlets on either side of the Seruyan River. The population totals 477 people, including 269 men and 208 women in 133 families. There are 335 individuals of working age. Most of the villagers are Dayak (95%), with some Banjar (4%) and Javanese (1%). All are Muslim.

Sixty percents of the families work for the oil palm plantation belonging to PT. Gawe Bahandep Sawit Mekar, while the other 40% are farmers and fishermen. This latter group earns IDR 35,000/day on average. Of the 133 families, only 11 are considered poor and receive BLT (*Bantuan Langsung Tunai*, Cash Direct Aid) from the government.

The villagers meet their carbohydrate, vitamin, mineral, and medicinal needs by cash purchases in markets or neighboring villages. They still depend on local natural resources to meet basic needs for water, protein, construction materials, and fuel wood. They do not have any cultural relations to the forest.

Jahitan has one formal institution, the village government (village head, village representative body, village secretary and other officials). The only informal institution identified was the farmer group, Mardi Rukun, which is facilitated by the Forestry Service Office for planting rubber and *jelutung*.

The village has developed a land use system that divides the village area into the following functions: housing, agricultural, fishery, plantation, public facilities, village office, and graveyard. Seventy percent of the families have registered their land with the village head to obtain their SKT. The village still has a lot of forested land, which is considered communal property. Regulations for using these forests have yet to be developed, but in principle every individual in the village has access to it.

13. Muara Dua. Muara Dua is also under Seruyan Hilir Subdistrict administration. It has 3 *dusun* (Muara Dua, Belanti, and Tempudan) located on either side of Seruyan River. The population is 523 people, comprising 287 men and 236 women in 140 families. The number of people of working age is 419. Ethnically the villagers are Banjar (60%) and Dayak (40%), and all are Muslim. All of them earn their living by fishing and farming, with cash income approximating IDR 40,000/day. Of the 140 families, 36 are considered poor as they earn less than IDR 20,000/day. These poor families receive Cash Direct Aid from the government.

Muara Dua villagers still depend on local natural resources to meet basic needs: fish for protein, water, wood for construction materials and fuel. They purchase other basic needs, such as carbohydrates, vitamins, minerals, non-fish protein, and medicines.

Land is owned individually and communally. Individual ownership is not registered with the village head, although landowners know the boundaries of their properties. Reportedly, there have been no conflicts between villagers and outside parties. No companies operate in the village. However, in 2008 word reached the village that the Seruyan District government had plans for part of the village land to be allocated for oil palm plantation development. At present, the oil palm company with a license for the area, PT. Ahmad Saleh, has yet to commence its operations on the ground. Similar to other villages in Seruyan Hilir Subdistrict, Muara Dua has not developed any institutions for managing the village forests, but each individual may use this communal land.

There are two farmer groups, Harapan Makmur (25 members) and Setia Karya (15 members). One is facilitated by World Education and the other by the Forestry Service Office at the District level.

14. Tanjung Rengas*.* Tanjung Rengas is the southern-most village in the Seruyan Hilir Subdistrict, and includes one *dusun* with six hamlets located on the west side of Seruyan River. It is inhabited by 1,406 people, consisting of 765 men and 641 women in 320 families. The number of working age people is 985. Ethnically the population is 50% Dayak and 50% Banjar.

Seventy percent of the villagers earn their living from fishing, 20% from farming and 10% from working for companies. The average income from fishing or farming is IDR 30,000/day. Of the 320 families, 70% reportedly live in poverty, which they define as having an income of less than IDR 25,000/day, owning no land, or living in a house with a palm roof.

Similar to other nearby communities, villagers here meet their basic needs for carbohydrates, vitamins, minerals, and medicines through cash purchases and depend on local natural resources for water, construction materials, and fuel wood. The villagers do not have cultural ties to the forests.

Land is owned individually, but most of the land has not been registered with the village. Only 5% of the families have obtained a SKT signed by the village head. There is communal forest land available for use by the villagers. Officially, any individual who wants to use the land must report to the village head to apply for a SKT, but no sanctions are applied for failure to do so. The village has delineated village land into the following use categories: housing, office, agricultural use, plantation, fishery, public facilities, and graveyard. There are five farmer groups, each with 20-50 members.

G1.6. Current Land Use, Property Rights, and Conflicts

A description of current land use and customary and legal property rights including community property in the project zone, identifying any ongoing or unresolved conflicts or disputes and identifying and describing any disputes over land tenure that were resolved during the last ten years (see also G5).

Land Use and Property Rights

The local system of land ownership is quite simple and clear among locals, only engendering complications with the arrival of outside interests. Locally, villagers respect each other's property and land rights. They know the location of boundaries without resorting to physical demarcation. Until recently, they did not have an official, written form of documentation to verify land ownership. Some villages and individuals have now started to use land ownership certificates (*Surat Kepemilikan Tanah*) issued and signed by the village head.

Most villages have a land use plan for land within their village (*desa*) boundaries. A typical village land classification scheme creates the following categories: housing, agriculture (used for planting rubber (*Hevea braziliensis*, *Dyera costulata*, or other species that contribute to their livelihoods), public facilities (such as health clinics and schools), fisheries, and graveyards.
Some communities have accepted the expansion of oil palm plantations into the area, while others have fought it. One common complaint is that communities are not informed about the existence of oil palm plantations in their vicinity, but they are willing to try planting oil palm to see whether this species can contribute significantly to their welfare.

When asked what kinds of programs they would like to see in their communities, most villagers stated that they were open to any program that would improve their welfare and capacity to face future challenges. They emphasized that they wished to be informed early in the process, before the program commenced.

Conflicts

The survey of communities in the Project Zone conducted by Daemeter Consulting suggests that very few conflicts over property rights existed in the area until the arrival of oil palm plantations. Since then, however, protracted social conflicts have been relatively common, particularly during the early phase of plantation development. During this phase, oil palm companies often seize disputed land first and worry about the legal and economic consequences later, as compensation typically does not have to be paid until after the plantation has commenced operations. Local communities, by contrast, must bear the social and environmental costs from the earliest phase of plantation development. The following is a detailed chronological record of a typical conflict, as yet unresolved, between Project Zone community members and an oil palm company:

- 1997. During the high season for logging, several members of Tanjung Hanau village dug a channel to be used for transporting logs. The channel, called Tatah Pambakal, was located on farm land previously cleared by the village head, near Natai Pambakal. In addition to transporting logs, the channel was also used for fishing and transportation.
- 2000-2006. Several members of Tanjung Hanau village used land near Natai Pambakal for farming, planting crops as well as fruit and rubber trees.
- 2006-2007. PT. Kharisma Unggul Centraltama Cemerlang begins survey activities in an area of roughly 19,500 ha,

entering portions of Natai Pambakal without consent from the owners.

- 2006-2008. Community members with farmland in Natai Pambakal try to arrange for land certificates (SKT) at the office of the village head, making five separate attempts over two years, but he fails to respond.
- February 2007. PT. Kharisma becomes PT.Wana Sawit Subur Lestari and continues development activities in an area of 14,200 ha based on Decision No. 20 of 2007 by the Bupati of Seruyan Regency. PT.WSSL is a subsidiary of BEST Group (Borneo Eka Sawit Tangguh). The company begins planting palms in Natai Pambakal, which is now officially located in block Q 28 of PT. WSSL's concession.
- Late 2007. The area in Natai Pambakal claimed by community members is estimated at 43 hectares. Out of this total, PT. WSSL plants oil palm on 35 hectares by end of 2007, including on land previously planted with rubber trees with help from World Education using resources from the Reforestation Fund granted by the Indonesian government.
- July 2008. PT. WSSL pays a local representative, nominally acting on behalf of one of the community members, Rp. 10,000,000 as compensation for 10 ha of land. The receipt and statement letter are signed by the representative, the Tanjung Hanau village head, the Hanau Subdistrict head, and the acting general manager of PT. WSSL.
- Sept. 2008. PT. WSSL attempts offers to pay for land belonging to another community member. When the community member attempts to negotiate the price, the company threatens to have the village head, the Subdistrict head, and the local representative revoke recognition of his right to the land. The community member acquiesces and the company pays him Rp. 14,847,237 for 11 ha of land.
- Community members send a letter to the company with copies to the Seruyan Regency, the Seruyan House of Representatives, the chief of the Hanau police, the Hanau Subdistrict head, and local media, stating that the land in dispute belongs to them and that the company must remove the palm trees already planted there.
- Oct. – Nov. 2008. The company fails to respond to the letter, and instead continues planting trees on the disputed land, this time with the help of policemen armed with guns.
- Dec. 2008. A second letter is sent to the company with copies to the chief of the Pembuang Hulu police precinct, the Pembuang Hulu Subdistrict head, and the head of Tanjung Hanau village.
- January 1, 2009. Fifteen members of Tanjung Hanau village remove oil palm trees from disputed land for which compensation has not been settled.
- January 2, 2009. Company management, guarded by four policemen and one member of the Indonesian military, meet with villagers and demand that they stop removing oil palm trees. The company issues a response letter claiming that compensation has already been made for the disputed land and threatening to file a report against community members in the event of further vandalism to company property.

A full list of the conflicts identified during the survey is included in Table 6 below.

Table 6. Historical Community Conflict and Resolution Status with Deforestation Agent			
Village	**Conflict Type**	**Start Date**	**Resolution Status**
Banua Usang	900 hectares overlapped with PT. Sawit Mas Nugraha Persada's license area.	2002	No mutually satisfactory resolution was obtained.
	Village land overlapped with PT. Karisma Unggul's license area but the size of the area is not clear		
	Village land overlapped with PT. Rim Capital's license area, but the size of the area is not clear		
Parang Batang	2000 ha of village land overlap with license area of PT. Wana Sawit Timur	2005	The Head of Hanau Subdistrict is mediating, but it has yet to be resolved.
Paren	450 ha overlap with PT. Wana Sawit Timur's license area	2005	No mutually satisfactory resolution was obtained.
	Conflict with the villagers of Banua Usang following the operation of PT. Rim Capital. The land of a villager in Paren borrowed by a villager in Banua Usang was surrendered to PT. Rim Capital. The size is not clear.	2006	
	200 ha overlap with PT. Rim Capital's license area	2007	
Ulak Batu	250 ha of village overlapping with PT. Wana Sawit Timur's license area.	2005	No mutually satisfactory resolution was obtained.
Telaga Pulang	Compensation of the land surrendered by villagers to PT. Mega Ika Kansa	2006	Resolution was achieved in 2008, but with dissatisfaction by the villagers as the compensation was decided unilaterally by the company
Baung	Compensation issues over land surrendered to PT. Mega Ika Kansa	2005	Resolved, with company unilaterally deciding to pay IDR 500,000/ha for individual land and IDR 200,000/ha for communal land. Villagers dissatisfied with the result.
	A family in Telaga Pulang borrowed land from a family in Baung village. The borrower surrendered the land to an oil palm company (PT. Mega Ika Kansa).	2006	No mutually satisfactory resolution was obtained.
Tanjung Rengas	Conflict with village following operations of PT. Sarana Titian Permata	2005	Resolved, with company paying compensation and building a school for the village

G1.7. Description of Project Zone Biodiversity

A description of current biodiversity within the project zone (diversity of species and ecosystems) and threats to that biodiversity, using appropriate methodologies, substantiated where possible with appropriate reference material.

For the validation phase, Daemeter Consulting conducted a desktop study of biodiversity in the Rimba Raya project area based on extensive information available on the adjacent Tanjung Puting National Park. Phase II of the biodiversity assessment, to be conducted before verification, will involve extensive on-site evaluation of habitat status and confirmation of species present. For a full description of the planned assessment, see Section B3.3, below.

Current Biodiversity

The Project Area abuts TPNP for the full extent of the park's c. 90 km eastern border. As there is no natural boundary between the two, the Project Area is likely to support a similar diversity of flora and fauna as the park. As with TPNP, vegetation is predominantly low-lying swamp forest (peat and freshwater) with dry land areas of kerangas (various forms), riverine and limited extent of mixed dipterocarp forest (see Section G1.2).

Plants. Initial research indicates that plant species diversity in the project area is extremely high, and many elements of the flora are rare, threatened or protected species. Comprehensive and systematic floristic surveys have not yet been conducted in either Tanjung Puting National Park or the project area. For this reason, there were limited primary data available for direct reference to assemble and evaluate a list of plant species present in the project area. However, a semi-structured botanical survey was conducted inside the project area by a group of researchers from the Agricultural Institute of Bogor (Santosa et al. 2008), combining limited field identification with translation of local names into Latin binomials. These floristic data, which should be treated as preliminary, were in turn supplemented based on (i) likely vegetation types in the project area (see Section G1.2); (ii) species associated with these vegetation types on Kalimantan and considered potentially present in the project area, based on Daemeter's field botanical experience on the island and reference to secondary literature (Ashton 1982; Anderson 1972; Mansur 2002; Ng & Ibrahim 2001); and (iii) reference to plant records from other sources deemed reliable. The resulting list (see Annex 5) is no doubt far from complete, but it is nevertheless a conservative, sound compilation of reliable data upon which to build.

Throughout the course of research, emphasis was placed on woody plants. This choice overlooks most orchid and carnivorous plant diversity, both of which are likely to be extremely high in the Project Area given the predominance of peat swamp and kerangas vegetation types. No attempt has been made to indicate species confirmed or potentially present in the different vegetation types of the project area (i.e., peat, kerangas, freshwater swamp, riparian forest, mixed dipterocarp forest), pending field verification of these types and their condition.

To maximize conservation relevance of this partial list, effort was concentrated on evaluating records and data for the Dipterocarpaceae and other plant families (e.g., Sapotaceae) known to predominate the IUCN list of threatened plants in Indonesia, as well as the Government of Indonesia list of protected species. Among the 180 plant taxa listed (mostly woody plants), 45 are considered threatened by IUCN. Of these, 25 species are Critically Endangered (CR), 14 are Endangered (EN) and six are Vulnerable (VU). CR species are heavily dominated by canopy trees in the genus Shorea and to a lesser extent Dipterocarpus, both of which are overexploited for timber production throughout their range, and have suffered extensive habitat loss due to conversion to non-forest uses. The medium size canopy tree *Shorea balangeran*, common in nearby TPNP, is considered among the most highly threatened dipterocarps on Borneo due to severe over-harvesting throughout its range, where it naturally forms high density stands that make it a target for commercial logging operations. The species is likely present in the project area as well.

At least 15 species potentially present in the project area are protected by GOI. These include medium to tall timber tree species restricted to peat swamp and wet kerangas forest, such as *Palaquium leiocarpum* and *Ganua motleyana* in the Sapotaceae, and *Dyera costulata* (jelutung) in the Apocynaceae, as well as the ground dwelling pitcher plan *Nepenthes ampullaria*. Also considered potentially present in limited areas of mixed dipterocarp forest in the project area, especially along flood plains of slow moving rivers, is Bornean Ironwood (*Eusideroxylon zwageri*), as well as the illipe nut tree *Shorea seminis*.

Mammals. Swamp forests are known to support lower diversity and densities of mammals than Borneo's lowland dipterocarp forests (MacKinnon et al 1996), yet many of Borneo's iconic species, as well as species of conservation concern, are present in the area (e.g. orangutan and proboscis monkey). TPNP is an important refuge for many mammal species, especially those that do not thrive in disturbed habitats (e.g. agile gibbon). Protection of forests in the Rimba Raya project area will expand this refuge, hopefully reducing pressure on the park, which has already suffered extensive degradation through illegal logging, fire and agricultural encroachment.

The Rimba Raya project area likely hosts some 122 mammal species (c. 54% of the c. 227 mammal species thought to occur across the island). Many of these are confirmed present in the neighboring TPNP, while others are deemed likely or potentially present (e.g. unrecorded in or near the project area, but likely or potentially present based on known habitat and geographic range, or, were once confirmed present, but are now potentially locally extinct – e.g. banteng, *Bos javanicus*). Annex 6 provides a complete species list of mammals confirmed, likely or potentially present in the Rimba Raya project area.

Species of particular conservation concern are those listed as Endangered by IUCN. These include the Orangutan (*Pongo pygmaeus*), Agile gibbon (*Hylobates agilis*), Proboscis monkey (*Nasals larvatus*), Pangolin (*Manis javanica*), Banteng (*Bos javanicus*), Otter civet (*Cynogale bennettii)*, Hairy-nosed otter (*Lutra sumatrana)*, and Borneo bay cat (*Catopuma badia*).

Cetacea (whales, dolphins, porpoises) and Sirenia (dugong) are not included in the attached mammal species list. Little is known about the presence of these aquatic species and their use of local rivers, although the dugong (*Dugong dugon*) and Irrawaddy dolphin (*Orcaella brevirostris*) are reported to occur in rivers and coastal waters of TPNP (Siliow 1997, MacKinnon 1996). These species are therefore considered possibly present in the Seruyan River and its estuary.

Bats are diverse (96 species in Borneo; ca. 40% of the island's terrestrial mammals) and perform valuable ecological services such as pest control, pollination and seed dispersal (Hutson et al. 2001). Despite this, species losses are predicted to exceed 40 % by 2100 in the Southeast Asia region (Lane et al. 2006). Forest bats of the families Rhinolophidae and Hipposideridae, as well as vespertilionids of the subfamilies Kerivoulinae and Murininae (38% of Borneo's bats) are particularly vulnerable to habitat disturbance (Struebig et al. 2008), and flying-foxes (*Pteropus* spp.) are subject to overhunting (Struebig et al. 2009).

Borneo is one of the most important areas in Southeast Asia for bat diversity with more species recorded than any other island. A fifth of these species are IUCN Red Listed as Vulnerable (7 spp) or Near Threatened (13 spp) (IUCN 2008), and a further 7% (7 spp) are Data Deficient. Since the Rimba Raya area is characterised by oligotrophic forests, the area likely supports lower bat diversity than limestone areas elsewhere on Borneo. However, some 45 species (47% of the Borneo list) are likely to be present, a third of which are IUCN Red Listed, and 13 of which have restricted ranges or are endemic to Borneo. Like Tanjung Puting, the area should be a particularly important stronghold for 'Vulnerable' forest-roosting species such as *Hipposideros ridleyi, Murina aenea* and *Murina rozendaali*, which are typical of old growth forest, roosting in tree cavities or under the bark of old trees. Peatswamp and peat forests are also priority roosting habitats for large flying-foxes (*Pteropus vampyrus*), a species that is suffering massive declines throughout its range due to overhunting and habitat loss.

Much of our knowledge of Borneo's bats comes from research in Sabah. The ecology, diversity and distributions of bats in Kalimantan is relatively unknown, and our knowledge of bat diversity in oligotrophic forests is very poor. Further research is a priority, as such forests are likely to be important strongholds for forest-roosting species that are rapidly declining from forest loss throughout Borneo. In addition to further documenting diversity over the island, research should be focused on the conservation threats bats face, and should include quantifying prey consumption by large colonies of insectivorous bats to advocate their protection in agricultural areas; describing roost types available to forest bats so that mitigation strategies can be developed by timber companies; and identifying areas where intensive *Pteropus* hunting is taking place so that intervention can be best placed (Struebig et al. 2009).

Birds. Some 361 bird species may reasonably be expected to occur in the Rimba Raya project area based on current knowledge regarding distribution and habitat preferences. The list includes 223 species (61.8%) that have previously been recorded in TPNP (bin Jalan & Galdikas 1986; Nash & Nash 1987).

Based on habitat preferences, some 232 bird species may be expected to occur in intact forest habitats, including *kerangas*, peat swamp, freshwater swamp forest, dipterocarp and riparian forest associations; 174 species may occur in anthropogenically disturbed forest habitats such as secondary forest, *tembawang*, small forest patches and coastal fringing forests and woodlands; 97 species may occur in converted habitats including *ladang*, regrowth scrub, *sawit*, grasslands and other cleared areas; and at least 127 species may occur in freshwater non-forest wetland habitats, including swamps and rivers, and in coastal marine habitats. A suite of additional coastal and oceanic seabirds may be sighted along the coast but were not included in the initial survey.

Of these species, 156 are of national and/or international conservation significance. Eighty species are listed by the IUCN as Threatened or Near-threatened with global extinction, including the Endangered Storm's Stork (*Ciconia stormi*), and eight are listed as Vulnerable. Eighty-three species are protected under Indonesian law and 48 species are listed under CITES Annex 7 (Peregrine Falcon *Falco peregrinus*, Helmeted Hornbill *Buceros vigil*) or II.

Of nine globally Threatened taxa that may occur, the following seven have been recorded inside TPNP:

1. Storm's Stork (Endangered). Endemic to the Sunda sub-region, where less than 1,000 birds remain in the forested swamps of Borneo, Sumatra and the Malay Peninsula. In Kalimantan both species occupy habitat along the Mahakam River and in scattered localities near the south coast including near Bandjarmasin, along the Negaro River and in TPNP (bin Jalan & Galdikas 1986; Nash & Nash 1987; Budiono et al. 2006; BirdLife International 2001). Importantly, Storm's Stork is believed to breed in TPNP.

2. Lesser Adjutant (*Leptoptilos javanicus*) (Vulnerable). Formerly common in wetlands throughout Southeast Asia, habitat loss, hunting and disturbance have resulted in a dwindling and fragmented global population of less than 5,000 birds (BirdLife International 2001). Most closely associated with coastal mangroves and associated mudflats. Lesser Adjutant is believed to breed in TPNP.

3. Black Partridge (Vulnerable). The ecology of this scarce and inconspicuous Sundaic endemic is poorly known, though it apparently inhabits lowland and hill forest, including peatswamp (BirdLife International 2001; Madge & McGowan 2002). Recorded breeding in *kerangas* in TPNP (Nash & Nash 1987).

4. Crestless Fireback (Vulnerable). A scarce pheasant of lowland forests in Borneo, Sumatra and the Malay Peninsula. Few recent records from Borneo, with most restricted to the south and west (BirdLife International 2001). Recorded in TPNP (bin Jalan & Galdikas 1986; BirdLife International 2001).

5. Large Green-pigeon (Vulnerable). A patchily distributed inhabitant of primary and logged lowland Sundaic forests (BirdLife International 2001). Extensive habitat clearance and hunting pressure have led to heavy declines in a global population that is currently estimated at less than 20,000 birds. As a large-fruited fig specialist it is likely not to depend heavily on *kerangas* or other low productivity forests. It has been recorded on multiple occasions in TPNP (bin Jalan & Galdikas 1986; Nash & Nash 1987; BirdLife International 2001) and is likely also to occur in surrounding areas.

6. Blue-headed Pitta (Vulnerable). Endemic to Borneo where it is patchily distributed though locally fairly common in appropriate habitat within lowland and hill forests up to 600 m asl. The core habitat is primary and regenerating selectively logged forest near rivers and streams, where it prefers flatter terrain such as floodplains and alluvial terraces (Lambert 1992; Lambert and Woodcock 1996; BirdLife International 2001). The Blue-headed Pitta is particularly sensitive to logging. Unlike many other pitta species it has not been recorded in degraded habitats such as plantations and scrub, and it

may only occur in logged forests that are adjacent to primary forest which acts as a source of dispersing birds (Lambert and Woodcock 1996; BirdLife International 2001). Moreover, while the recent high rates of deforestation have depleted populations of all lowland biota, those Bornean endemics preferring accessible and ecologically sensitive level riverine forest are likely to be placed under even higher pressure. This species is reported to occur in TPNP (BirdLife International 2001).

7. Hook-billed Bulbul (Vulnerable). Endemic to Borneo, Sumatra and Bangka Island where it is a specialist resident of low productivity forests such as *kerangas* and peatswamp (Sheldon 1987; Dutson et al. 1991; BirdLife International 2001). It is reportedly common in inland forest areas in TPNP, including swamp forest, *kerangas* and fire-padang scrub (Nash & Nash 1987).

Borneo's southern coastal forests and wetlands (including 'Lake of a Thousand Birds' in Tanjung Puting National Park and Lake Sembuluh on the east side of the Seruyan River) host a variety of bird species that are entirely or largely restricted to these parts of the island. These include two species of woodpecker (Sunda Pygmy Woodpecker, Common Flameback), two kingfishers (Ruddy and Collared Kingifshers), at least three species of waterbird (Purple Swamphen, Common and Dusky Moorhens), and a suite of resident and migratory passerines (Mangrove Whistler, Asian Glossy Starling, Great Tit, Brown and Long-tailed Shrikes, Copper-throated Sunbird and Crimson-breasted and Scarlet-headed Flowerpeckers).

In addition to the large number of IUCN-threatened bird species residing in the area, TPNP also supports breeding colonies of wetland birds that are known to breed in few or no other places in Borneo, including a number of Threatened birds. Species in this category include Storms' Stork, Lesser Adjutant and a variety of egrets and herons (bin Jalan and Galdikas 1986).

Further research on birds in the estate is highly desirable due to a combination of factors:

- The distribution and ecology of Bornean birds are still poorly understood. Importantly, there are still gaps in our knowledge of the bird community structure in TPNP and surrounding areas. The most extensive list to date was compiled over a single period between May and September in 1986 (Nash and Nash 1987). While this work provides a good background survey of the local avifauna, it does not constitute a complete inventory of all bird species present. In particular, a number of endemic and conservationally significant taxa may remain undetected (e.g. Wallace's Hawk Eagle *Spizaetus nanus*, Bonaparte's Nightjar *Caprimulgus concretus*).
- The high biodiversity values present in Bornean lowland forests.
- The high rate of loss of Bornean lowland forests in recent decades, including the destruction and degradation of habitat within protected as well as production landscapes. As a result, there is an emerging consensus that maintaining Indonesia's biodiversity will rely on conservation efforts within production landscapes (e.g. Meijaard et al. 2005).
- The high number of bird (and other) species of international and national conservation significance present within TPNP, situated immediately to the west of the forest management unit, many of which may also occur in adjacent areas.

- The loss or degradation of ~40% of forest originally existing within TPNP, particularly from illegal logging and forest fires (Environmantal Investigation Agency 1999; Greenpeace 2004). These losses highlight the importance of adjacent areas in firming the ongoing viability of resident bird populations. Of more than 32,000 ha of Oil Palm estate situated immediately to the east of TPNP, some 75% still supports intact or only lightly degraded forest (Stanley 2008). This area thus offers excellent opportunities for bolstering the viability of animal populations utilizing TPNP and surrounding areas.

Taken together, these factors indicate that an on-the-ground biodiversity survey will be of great value in: characterizing the biodiversity values present within the oil palm license areas in or near the project area; identifying areas and habitats important in maintaining the viability of local, regional and in some cases global populations of species of concern; and developing sustainable management of High Conservation Values present within the project area and biodiversity in the broader sense, the protection of which is a central feature of the CCB standard.

Reptiles and Amphibians. Borneo is one of the richest islands on the Sunda Shelf for reptiles and amphibians (MacKinnon et al 1996). Although understudied, especially when compared to plants, mammals and birds, Borneo is known to have approximately 166 species of snakes, 3 species of crocodile, 104 species of lizard, at least 15 species of turtles and tortoises, and 183 species of amphibians (MacKinnon et al 1996, Iskandar 2000). To our knowledge, Tanjung Puting National Park's TPNP herptofauna has never been surveyed. Fifteen species of herptofauna have been confirmed present in TPNP, but this list clearly does not represent the full suite of herptofauna likely present in the park and Rimba Raya project area. Annex 8 presents an incomplete list of reptiles that have been identified as confirmed or possibly present in the Rimba Raya project area.
Of particular concern is the False Ghavial (*Tomistoma schlegelii*) (EN under IUCN), which has been hunted to extinction in most of Borneo but is still present in TPNP and may be present as well in the Seruyan River running along the eastern edge of the Rimba Raya project area. The Estuarine Crocodile (*Crocodylus porosus*) is also present in TPNP. Although listed as lower risk on IUCN, this species has also suffered severe overhunting and is listed in CITES Annex II and protected by Indonesian law. While conducting social surveys in the Rimba Raya project area, the Daemeter social team reported villager claims that crocodiles still exist in the Seruyan River and its tributaries.

The Malayan giant turtle (*Orlitia borneensis*) and Asian giant tortoise (*Manouria emys)* are two Endangered (IUCN) reptiles that are also confirmed present in TPNP, and also likely present in the Rimba Raya project area. The Painted river terrapin (*Callagur borneoensis*) has not been confirmed present in the park, but is a Critically Endangered (IUCN) species that should be considered if faunal surveys are undertaken.

Management of these species, as well as other herptofauna, will need to focus on protecting wetland areas and undisturbed forests (preferred habitats for Bornean herptofauna), reducing hunting, and maintaining water quality in rivers and wetlands. Hunting pressure on crocodiles and turtles tends to be particularly severe, with crocodiles seen as a threat to human safety and their skin a valuable commodity, while turtles are a preferred food. Sedimentation, nutrient loading, and destructive fishing practices (e.g. cyanide) also have negative implication on distribution and viability of water/river dependent species.

Threats to Biodiversity from Oil Palm

Studies of biodiversity make up less than 1% of the literature on oil palm (Turner et al. 2008), but enough is known to conclude that short-term impacts are severe and long-term impacts likely to be catastrophic for native wildlife populations. There is tremendous overlap between oil palm growing areas and priority regions for biodiversity conservation. In this paper, the threats to biodiversity arising from plantation development in Central Kalimantan, Indonesian Borneo, are inferred from 23 studies across taxa. Since most studies have been undertaken in the Sundaland biogeographic region (principally in Sumatra, Borneo and peninsular Malaysia), such inference is reliable and appropriate.

Direct impact of conversion. Conservation management in oil palm plantations requires an understanding of the levels of biodiversity plantations can support relative to prior, or alternative, land-cover. In much of Central Kalimantan oil palm plantations have directly replaced natural forest (Potter 2009); thus comparisons of biodiversity levels to undisturbed or disturbed forests are appropriate.

Species vary in their dependence of habitat features and hence their sensitivity to environmental change. Some groups may respond positively to landscape change (i.e. they thrive in plantations), and others may become locally extinct. The net response can be determined according to taxonomic group or over all species studied, and depends upon the extent to which natural habitat features are replicated. Oil palm monoculture as a potential habitat contrasts greatly with that provided by natural forest: plantations have a much less complex structure, with a uniform tree age structure, lower canopy, sparse undergrowth, less stable microclimate and greater human disturbance, and are cleared and replanted on a 25-30 year rotation (Corley and Tinker, 2003).

Annex 9 reviews the findings of the 23 studies available that have compared animal diversity in oil palm plantations to that of forest. Summaries by taxonomic group are as follows:

Plants. The loss of virtually all major components of forest vegetation during conversion is perhaps the most intuitively obvious impact of plantations; it lays the foundation for impacts on faunal groups, yet it has received little comment in the oil palm literature. Intensive agricultural management precludes regeneration of native vegetation, which results in forest trees, lianas, epiphytic orchids, and indigenous palms being completely absent from most plantations. In Jambi, Sumatra, more species of pteridophytes (i.e. non-flowering plants such as mosses and ferns) were found present in oil palm plantation plots than in old growth dipterocarp forest, but few forest specialists persisted in oil palm and the most dominant species were typical of regrowth on disturbed or burnt ground or along roadsides (Danielsen et al. 2009). Species composition, abundance, and use of substrate were markedly different to natural communities in forest.

Mammals. Studies of small mammals, bats and medium/large mammals in Jambi, Sumatra illustrate another notable decline in biodiversity levels in oil palm plantations. Only 25% of bat species from native forests were retained in oil palm plantations, and most squirrels, tree shrews and primates were absent (Danielsen & Heegaard 1995). Other studies in Sumatra revealed that 88% of the medium to large mammals found in logged forest were absent in the surrounding oil palm plantations (Maddox et al. 2007), and small mammal species richness declined by 40% (Scott et al. 2004). Generalist primates such as macaques are frequently seen foraging along forest/oil palm boundaries, and high profile species such as orangutans and elephants are sometimes reported raiding plantations when they are present in neighbouring forest. Since their presence depends on proximity to neighbouring forest and access to the plantation, they are not permanent inhabitants. Wild pigs (*Sus scrofa*) have been recorded in unusually high numbers in forests bordering oil palm plantations (Ickes et al. 2001; Maddox et al. 2007). Since their food requirements are saturated by an abundance of palm fruits, they dominate the large mammal community. Generalist predators such as leopard cats (*Prionailurus bengalensis*) may also become locally abundant in oil palm landscapes. This is likely a response to high prey densities – for example rats such as *Rattus tiomanicus* can reach densities of 600 per ha in plantations (Rajaratnam et al 2007). Nonetheless, high-profile specialist predators such as clouded leopards (*Neofelis nebulosa*) have been reported as absent in plantations in Sumatra (Maddox et al. 2007).

Birds. The impoverishment of an oil palm plantation's avifauna compared to that of forest is consistently noted, with the proportion of forest species surviving in plantations reported as between 10 and 38% (Aratrakorn et al. 2006; Danielsen & Heegaard 1995). Moreover bird species in oil palm are significantly more widespread and are of lower conservation status than those in forest, and the losses of species are not random with respect to guild; in a study in Thailand, all forest woodpeckers, barbets and most of the babblers were absent from plantations, and there was a greater tendency for larger species such as hornbills to become locally extinct (Aratrakorn et al. 2006). For many plantations an exception to this trend would be the barn owl (*Tyto alba*), which is frequently introduced or encouraged in plantations as a natural form of pest control for rat pests (Corley and Tinker, 2003).

Reptiles. There are few data available from Southeast Asia, but a study of a landscape mosaic in the Dominican Republic suggested that neotropical lizards were quite resilient in oil palm plantations with 83% of the forest fauna represented (Glor et al 2001). In Sumatra, populations of snakes such as blood pythons (*Python brongersmai*) and short-tailed pythons (*P. curtus*) have increased with anthropogenic habitat modification, especially the establishment of oil palm plantations (Shine et al 1999). Again, this is likely due to a local abundance of key prey species such as rats.

Invertebrates. Invertebrates exhibit more variation in their response to conversion of forest to oil palm than vertebrates. Of 16 independent comparisons of invertebrate diversity in forest and oil palm plantations, nine revealed declines in species richness (i.e. the number of species) in plantations. In Sabah, beetle diversity was much lower in plantations of oil palm than in those of Acacia, or logged or undisturbed forest (Chung et al. 2000). An open canopy and minimal forest vegetation and leaf litter were typical features of plantations and were linked to falls in diversity of beetle guilds. Beetles showed a shift in trophic structure across a disturbance gradient, moving from predator dominated communities within forests, to a simple community in oil palm with a much higher proportion of fungivores and sporophages. In Ghana, the scarab beetle community in oil palm was dominated by invasive savanna species, which were recorded in superabundance (Davis & Philips 2001), whereas in Sabah, ant communities were dominated by the invasive crazy ant *Anoplolepis gracilipes* (Brühl 2001). In fact, 40% of the ant species found in oil palm plantations in Sabah were alien invasives, and the community was likened to those in heavily disturbed urban areas. In studies of ants, bees and moths, comparisons between oil palm and forest revealed an increase in species richness of certain components of invertebrate communities. For example, one study of bees found more species in oil palm than in forest, but might have underestimated species richness in forest because the canopy was not sampled (Liow et al. 2001). Indeed, further examination of community structure revealed that oil palm plantations typically exhibited much lower bee abundance than undisturbed forest, and honey bees (Apidae) were notably absent, with important implications for forest regeneration.

Overall trends across taxa. The 23 studies reviewed in Annex 9 have formed the basis of a meta-analysis to reveal trends in biodiversity following conversion of forest to oil palm (Danielsen et al. 2009; Fitzherbert et al. 2008). For each comparison, species are classified as forest-specialists or otherwise, according to independent assessments. Changes to communities are quantified for each taxonomic group and then as a mean effect size.

Across all studies (i.e. pooling vertebrates and invertebrates) a mean of only 15% of forest species are evident in oil palm. In other words, 85% of natural forest species are lost in conversion to oil palm. For vertebrates, the total number of species in plantations is less than half (38%) that of natural forest, and only 22% of the vertebrate species found in forests are found in plantations. Species richness of birds, lizards and mammals is always lower in oil palm plantations than in forest. Community similarity between plantations and forest is notably poor (29%), and on average, plantations are more dominated by fewer species than forest (mean evenness 0.8).

The mean response of invertebrates is not as clear. On average, oil palm plantations and forest sites have similar numbers of invertebrate species (i.e. mean total invertebrates species richness does not differ significantly between plantations and forests; 89%; Figure 15). However, only 31% of invertebrate species found in forests are also found in plantations, with a similarity in community composition of just 21%. Again, on average, oil palm invertebrate communities are dominated by a few species (mean evenness 0.7).

In summary, converting forest to oil palm leads to a significantly impoverished wildlife community. Most forest species are lost and replaced by smaller numbers of largely non-forest species resulting in simpler, species-poor communities. The species lost tend to include taxa that rely on habitat features not found in plantations (such as dead wood, or large trees for cavity-dwelling species), those with the most specialized diets, those with the smallest range sizes and those of highest conservation concern (Chey et al. 2006; Peh et al. 2006; Danielsen and Heegaard 1995). Plantation assemblages are typically dominated by a few abundant generalist non-forest species that include alien invasives and pests. While any conversion of natural forest is inevitably damaging to biodiversity, studies that have compared several land-cover types reveal that oil palm plantations support even fewer forest species than plantations of other tree commodity products such as rubber, cocoa and *Acacia*, (Fitzherbert et al. 2008).

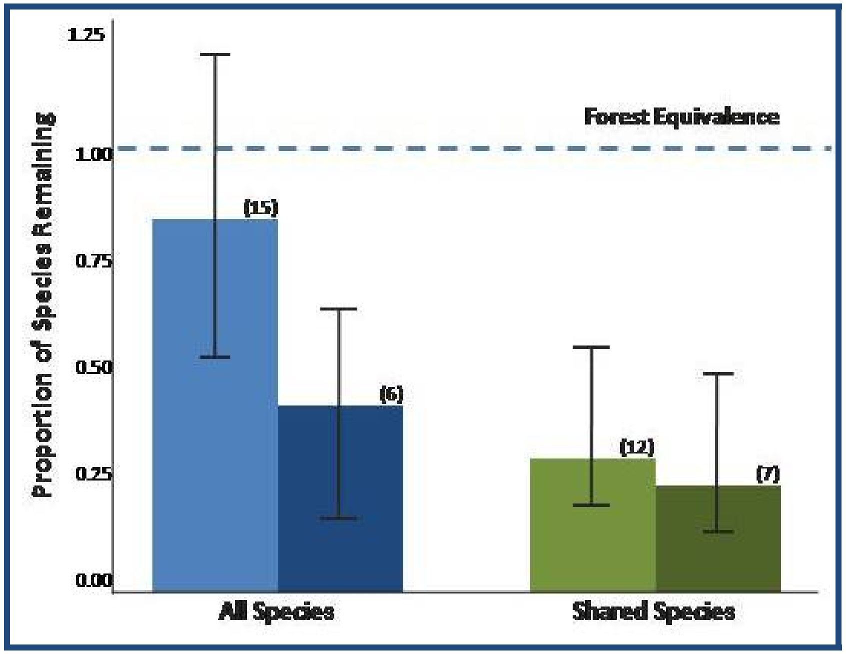

Figure 15. The impact of replacing forest with oil palm on the number of animal species (i.e. species richness). Bars represent the mean number of animal species recorded in oil palm as a proportion of those recorded in forest, and all species recorded in oil palm and only those present in both oil palm and forest ("shared species"). Data are presented as mean proportions and confidence limits for invertebrates (light grey) and for mammals, birds, and reptiles combined (dark grey). Meta-analysis sample sizes are provided in parentheses. The figure is reproduced from Danielsen et al. (2009), where the analysis is described in full.

Caveats. A substantial proportion of the current literature suffers from several common methodological shortcomings (see Danielsen et al. 2009; Fitzherbert et al. 2008). The most obvious is that it is typically more difficult to detect species in a structurally complex forest compared to the more open structure of an oil palm plantation. Another is that sampling in oil palm near to forest borders is likely to result in inflated species richness because of transient species from the forest being recorded. It is also likely that a time lag exists between habitat loss and extinction so that species recorded in oil palm plantations cannot ultimately persist in the long-term. The net effect of these shortcomings, in addition to non-standardized analytical procedures and reporting biases, is that the biodiversity value of oil palm plantations is likely to be overestimated. The impact of converting forest to oil palm is probably even more damaging to biodiversity than is currently considered. There is clearly a need for more research. While the current literature reveals massive threats to above-ground terrestrial biodiversity from oil palm, there is virtually no reliable data available that documents threats to below-ground diversity, or freshwater and even marine communities that may be downstream of plantations.

Indirect threats through forest fragmentation. In Southeast Asia, oil palm agriculture is becoming a significant driver of forest fragmentation, a process that describes the conversion of formerly continuous habitat into smaller, more isolated patches. Given that oil palm and other tree crops are unsuitable habitats for most forest species, plantations may act as barriers to animal movements (Struebig et al 2008; Maddox et al. 2007). Smaller forest fragments surrounded by oil palm in Malaysia support a lower diversity of butterflies (Benedick et al. 2006), ants (Brühl 2001) and bats (Struebig et al. 2008). The implication of this is that retaining remnants of natural forest in concessions may increase the biodiversity value of plantations, but most benefits will only result from retaining larger patches. Edge effects in forests are likely to exacerbate this situation. Increased vulnerability to wind, desiccation and fire might be negligible in tall-growth mature plantations, but this is yet to be examined. Increased tree sapling mortality in forests where densities of wild pigs are elevated could have more far-reaching implications for forest regeneration, resulting in forest fragments degrading over time together with the wildlife they support.

Impacts of management practices. There is the potential for a range of additional factors arising from oil palm management practices to threaten biodiversity, but these have so far not been rigorously assessed.

Initial forest clearance. Replacing forest with oil palm plantations, especially on peat soils, contributes substantially to greenhouse gas emissions and thus to climate change, a growing global threat to biodiversity (Danielsen et al 2009). Locally, seeds and sedentary animals are killed by fire used to clear forest or spread accidentally from plantations.

Water pollution. Although the high sediment loads in streams that follow land clearance apparently return to baseline levels once a plantation is established (Corley and Tinker 2001), this requires constant monitoring that may be lacking in remote plantations. Water pollutants from plantations and on-site mills, such as POME (palm oil mill effluent), fertilizers and pesticides, are likely to impact aquatic wildlife severely. However, where POME is treated before discharge, such impacts are likely to be negligible, and pesticide use is relatively low for oil palm compared to other tree crops because of widespread use of integrated pest management (IPM) and leguminous cover crops.

Access. Development of any agricultural land, including oil palm plantations, facilitates access to neighbouring forests, increasing the likelihood of human-wildlife conflict and hunting rates. This is likely to further exacerbate threats to vulnerable species, particularly mammals such as orangutans (*Pongo pygmaeus*), flying foxes (*Pteropus* spp) and pangolins (*Manis javanica*). Increased access to forests also increases vulnerability to illegal logging, compromising biodiversity through greater habitat loss.

Biodiversity-friendly plantations? It is unlikely that oil palm management practices could be improved enough to significantly increase the biodiversity value of plantations. This is because the main cause of massive biodiversity losses in oil palm areas is reduction in habitat complexity, and there are only limited opportunities to improve that whilst maintaining agricultural productivity. Retaining epiphytes or undergrowth in plantations only marginally increases the number of bird and butterfly species, and planting non-native plants such as *Euphorbia heterophylla* to attract beneficial insects does not significantly improve the biodiversity value (Koh, 2008). Of much greater biodiversity value is the protection of forest fragments and corridors within plantations, including riverside buffers and remnants on slopes. However, tens of thousands of hectares of forest are typically required to avert the extinction of many species (Falcy and Estades, 2007), meaning that avoiding oil palm development on forested land in the first place will always be the best option for biodiversity.

Other threats to biodiversity

Additional threats to biodiversity in the Project Zone include forest degradation from illegal logging, human-induced fires, and a broad range of 'edge effects' associated with plantations, including unsustainable hunting by resident worker populations and capture of songbirds for the commercial pet trade. Each is described below in order of declining severity.

***Logging*.** The most important direct threat to biodiversity resulting from illegal logging in the Project Zone includes degradation of forest habitat, on which a large portion of resident biodiversity depends. Biodiversity in areas adjacent to concentrations of illegal logging in the south are especially at risk. Indirect impacts of illegal logging include hunting for subsistence and commercial purposes by loggers and increased risk of fires associated with temporary human shelters (especially in peat areas).

***Fires*.** Fires in the Project Zone are concentrated in two clusters, one in the south and another in the north (see Section G1.8.4). Historically, fires have been a major cause of forest loss in peat and mineral soil areas, and remain a current threat especially in seasonally inundated grassland areas in the south (see Section G 1.2). Direct negative impacts of fire include total destruction of natural habitat, with the potential for long-term continuous degradation – especially on peat areas due to cyclical fires.

***Hunting*.** Preliminary data from the social survey indicate that, on the whole, hunting by local communities occurs at low levels and is limited primarily to deer. No evidence was found for trapping of songbirds or other wildlife by local communities for the local or outside commercial pet trade. Available data therefore suggest that threats to biodiversity in the Project Zone arising from hunting and/or trapping are much less severe than threats posed by oil palm, logging, or fires.

G1.8. Project Zone High Conservation Value Evaluation

An evaluation of whether the project zone includes any of the following High Conservation Values (HCVs) and a description of the qualifying attributes:

This section requires an assessment of High Conservation Values (HCV) present in the Project Zone and a description of their qualifying attributes. It distinguishes six categories of HCV denoted as G1.8.1-1.8.6, which correspond to HCVs 1-6, respectively, of the Global HCV Toolkit (ProForest 2003) and the HCV Resource Network (www.hcvnetwork.org). A national interpretation (Toolkit) based on the Global Toolkit was developed for Indonesia in 2003, and revised in 2008. For this section, the description of HCVs present in the Project Zone follows the definitions and criteria outlined in the revised Toolkit for Indonesia, as summarized in Table 7 below.

The following discussion of HCVs should be considered a preliminary identification, or *HCV pre-assessment*, based on a combination of: (i) rapid appraisal social surveys; (ii) a variety of secondary data sources including land cover maps, on-line spatial data sets (e.g. hotspot fire records), satellite imagery, ecosystem maps, and published and unpublished data sources; and (iii) expert opinion. Of the 13 values and sub-values defined in the Toolkit for Indonesia, 10 are deemed present in the Project Zone, one is potentially present and two are deemed absent. A summary of findings is presented below in Table 8.

Table 7. High Conservation Values and sub-values, revised HCV Toolkit for Indonesia (2008)		
HCV Value	**Sub**	**Description**
HCV 1 Areas with Important Levels of Biodiversity	1.1	Areas that Contain or Provide Biodiversity Support Function to Protection or Conservation Areas
	1.2	Critically Endangered Species
	1.3	Areas that Contain Habitat for Viable Populations of Endangered, Restricted Range or Protected Species
	1.4	Areas that Contain Habitat of Temporary Use by Species or Congregations of Species
HCV 2 Natural Landscapes & Dynamics	2.1	Large Natural Landscapes with Capacity to Maintain Natural Ecological Processes and Dynamics
	2.2	Areas that Contain Two or More Contiguous Ecosystems
	2.3	Areas that Contain Representative Populations of Most Naturally Occurring Species
HCV 3 Rare or Endangered Ecosystems	3	Rare or Endangered Ecosystems
HCV 4 Environmental Services	4.1	Areas or Ecosystems Important for the Provision of Water and Prevention of Floods for Downstream Communities
	4.2	Areas Important for the Prevention of Erosion and Sedimentation
	4.3	Areas that Function as Natural Barriers to the Spread of Forest or Ground Fire
HCV 5 Basic Needs	5	Natural Areas Important for Meeting the Basic Needs of Local People
HCV 6 Cultural Identity	6	Areas Critical for Maintaining the Cultural Identity of Local Communities

Table 8. Preliminary evaluation of High Conservation Values in the Rimba Raya Project Zone			
HCV	**HCV Title**	**Findings**	
		Present	**Not Present or Unlikely**
1.1	Areas that Contain or Provide Biodiversity Support Function to Protection or Conservation Areas	Present	
1.2	Critically Endangered Species	Present	
1.3	Areas that Contain Habitat for Viable Populations of Endangered, Restricted Range or Protected Species	Present	
1.4	Areas that Contain Critical Habitat of Temporary Use by Species or Congregations of Species	Present	
2.1	Large Landscapes with Capacity to Maintain Natural Ecological Processes and Dynamics		*Not Likely Present*
2.2	Areas that Contain Two or More Contiguous Ecosystems	Present	
2.3	Areas that Contain Populations of Most Naturally Occurring Species	Present	
3	Rare or Endangered Ecosystems	Present	
4.1	Areas or Ecosystems Important for the Provision of Water and the Prevention of Floods for Downstream Communities	Present	
4.2	Areas Important for the Prevention of Erosion and Sedimentation		Not Present
4.3	Areas that Function as Natural Barriers to the Spread of Destructive Fire	Present	
5	Natural Areas Critical for Meeting the Basic Needs of Local People	Present	
6	*Areas Critical for Maintaining the Cultural Identity of Local Communities*	*Potentially Present*	

G1.8.1. Significant Concentrations of Biodiversity Values

Globally, regionally or nationally significant concentrations of biodiversity values;

The Indonesian Toolkit distinguishes four sub-values of HCV 1, corresponding approximately to G1.8.1.a, b, c, and d, below:

HCV 1.1 Areas that contain or provide biodiversity support function to protected areas

HCV 1.2 Areas that contain one or more individuals of Critically Endangered species

HCV 1.3 Areas with habitat for viable populations of one or more endangered, restricted- range, or protected species

HCV 1.4 Areas that contain habitat of temporary use by species or congregations

The potential presence of each sub-value of HCV 1 in the Project Zone is discussed in turn.

a. HCV 1.1 biodiversity support to protected areas

HCV 1.1 draws attention to areas that contain or provide biodiversity support function to protection or conservation areas in or near the assessment area (in this case the Project Zone) to ensure that management actions are taken to maintain or enhance the function of such areas. HCV 1.1 in the revised Toolkit includes areas officially protected by the Government of Indonesia, as well as those designated by local communities to conserve local biodiversity.

The key question for evaluating HCV 1.1 in the Indonesian context is:

- Does the assessment area contain a protection or conservation area designated to conserve biodiversity, or does it provide a biodiversity support function to such an area in the surrounding landscape?

Definitions	
HCV	High Conservation Value species (ie, threatened under IUCN listing, CITES App I or II, protected by Indonesian law, or restricted range (RR)- endemic to Borneo considered RR in this case.)
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
I & II	Indicates species listed under CITES Annex I or II
IUCN	World Conservation Union
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
LR/nt	Lower Risk: Near Threatened
GoI	Government of Indonesia
P	Species protected under Indonesian law
B	Endemic to Borneo
TNTP	Tanjung Putting National Park
X	Presence previously confirmed in the park
blank	Likely present in the park based on distribution and habitat needs.
?	Possibly present in the park based on distribution and habitat needs.

HCV 1.1 is considered present in the Project Zone. The Rimba Raya Project Area is adjacent to and contiguous with the eastern boundary of Tanjung Puting National Park, a protected area of well-known biodiversity conservation importance. The Project Zone provides vital biodiversity support function as a buffer zone of Tanjung Puting, by expanding the effective area of lowland forest cover in the greater Tanjung Puting landscape by 14% (OFI 2008). This buffer zone function expands available habitat for orangutans and a wide variety of threatened or protected plant and animal species in the national park, as described more fully under sections G1.8.1.b-d below.

The Project Zone also contains legally mandated protection zones along riparian-zone floodplains of the Seruyan River and its numerous tributaries, as well as buffer zones associated with undiscovered wetland areas potentially present within the freshwater/peat swamp mosaic of habitats in the Project Zone. These protected areas are delineated by the government primarily for the protection of water supplies and prevention of floods, but they also provide an important de facto biodiversity support function for aquatic wildlife, including amphibians, reptiles, fish, crustaceans, and birds (see section G 1.8.1.d below for discussion of Sembuluh Lake, lying just outside the Project Zone to the east).

b. HCV 1.2 critically endangered species

The aim of HCV 1.2 is to identify critically endangered (CR) species and sub-species that occur in or near the management unit (MU) and that may suffer negative off-site impacts from operational activities.

Birds and Mammals

No HCV 1.2 birds or mammals are thought to be present in the Project Zone. The CR Sumatran rhino (*Dicerorhinus sumatrensis*), once present in nearby Tanjung Puting National Park (TPNP), is now extinct in the region.

Plants

Twenty-five HCV 1.2 plants were identified as likely present in the Rimba Raya Project Zone (see Table 9 below). All are in the Dipterocarpaceae family: five in the genus *Dipterocarpus*, one in the genus *Dryobalanops*, four in the genus *Hopea*, and 15 in the genus *Shorea*. Distribution of these species is restricted to mature lowland rainforest in its various forms (freshwater swamp forest, peat swamp forest and lowland dipterocarp forest) and all are considered CR due primarily to habitat loss. Proposed HCV 1.2 management will, therefore, be done in parallel with HCV 1.3 and 3 (see below), where the requirement is to maintain and manage sufficient habitat to ensure long-term population viability.

Table 9. Critically Endangered High Conservation Value (HCV) Plant Species Inside Project Area					
Genus / Species	**Family**	**IUCN**	**CITES**	**GoI**	**TPNP**
Dipterocarpus coriaceus	Dipterocarpaceae	CR		P	
Dipterocarpus elongatus	Dipterocarpaceae	CR		P	
Dipterocarpus eurhynchus	Dipterocarpaceae	CR		P	
Dipterocarpus gracilis	Dipterocarpaceae	CR		P	
Dipterocarpus kunstleri	Dipterocarpaceae	CR		P	
Dryobalanops fusca	Dipterocarpaceae	CR			
Hopea beccariana	Dipterocarpaceae	CR			
Hopea sangal	Dipterocarpaceae	CR			
Hopea semicuneata	Dipterocarpaceae	CR			
Shorea balangeran	Dipterocarpaceae	CR			
Shorea gibossa	Dipterocarpaceae	CR			
Shorea induplicata	Dipterocarpaceae	CR			
Shorea johorensis	Dipterocarpaceae	CR			
Shorea lamellata	Dipterocarpaceae	CR			
Shorea longiflora	Dipterocarpaceae	CR			
Shorea longisperma	Dipterocarpaceae	CR			
Shorea palembanica	Dipterocarpaceae	CR			
Shorea platycarpa	Dipterocarpaceae	CR			
Shorea ricehetia	Dipterocarpaceae	CR			
Shorea rugosa	Dipterocarpaceae	CR			
Shorea sagittata	Dipterocarpaceae	CR			
Shorea seminis	Dipterocarpaceae	CR		P	

Herptofauna

Only one HCV 1.2 species of herptofauna was identified as potentially present in the Project Zone, the CR Painted river terrapin (*Callagur borneoensis*). This species is known to inhabit the tidal portions of rivers and estuarine mangrove areas and feed on fruit, leaves, and clams. Females nest on sand beaches along riverbanks and coastal beaches. The distribution of the terrapin on Borneo is unclear. Using the precautionary principle, it is therefore noted here. This species will be further investigated during the HCV full assessment. As the project aims to prevent further degradation of the Seruyan River and its tributaries through stabilizing land use and potentially replanting some areas to restore riparian zone and flood plain buffers, these successful conservation actions will have a positive net impact on this HCV, if present.

c. endangered species

HCV 1.3 aims to identify areas where viable populations of endangered, restricted range, or protected species are known or likely to occur, and to ensure that management action is taken to conserve sufficient habitat for continued viability of the population. In the assessment of this HCV, populations of species confirmed or likely present are assumed to be viable until credibly proven otherwise, through population modeling, analysis of habitat extent and condition, or exhaustive field surveys. HCV 1.3 species also includes viable populations of CR species listed above under HCV 1.2 (Section G1.8.1b).

Birds

Of the 361 bird species expected to occur in the Rimba Raya Project Zone, 110 (30%) are considered to be HCV 1.3 (see Table 10 below). Of these, 82 have been confirmed in the neighboring TNTP, including the IUCN Endangered Storm's stork (*Ciconia stormi*), eight IUCN Vulnerable species, two CITES Annex I listed species (Helmeted hornbill and Peregrine falcon), 46 CITES Annex II species, 83 species protected by the Government of Indonesia, one restricted-range species (Javan white-eye), and four species endemic to Borneo.

Nearby TPNP also supports breeding colonies of wetland birds that are known to breed in few or no other places in Borneo, including a number of Threatened birds. Species in this category include Storms' Stork, Lesser Adjutant, and a variety of egrets and herons. Storm's Stork (Endangered) is of particular concern. Endemic to the Sunda sub-region, less than 1,000 birds remain in the forested swamps of Borneo, Sumatra, and the Malay Peninsula.

Of the 110 HCV 1.3 species, 38 (35%) are thought to are thought to depend solely on natural forest, while another 34 (31%) use natural forest as well as disturbed forests. Nineteen species are known to use converted, non-forest lands, but only 3 of these exist solely in non-forested areas. Thirty-nine species are wetland and/or coastal species. Thus, the spatial distribution of HCV 1.3 birds in the Project Zone encompasses, at a minimum, all remaining forests and non-forested wetlands.

Mammals

Fifty-five HCV 1.3 mammal species are potentially present in the Project Zone (see Table 11 below). Of these, eight are listed by IUCN as Endangered and 21 as Vulnerable, six are listed by CITES on Annex I and 18 on Annex II, 24 species are protected by the Government of Indonesia, and 15 are endemic to Borneo.

Species of particular conservation concern are those listed as Endangered by IUCN. These include the Orangutan (*Pongo pygmaeus*), Agile gibbon (*Hylobates agilis*), Proboscis monkey (*Nasals larvatus*), Pangolin (*Manis javanica*), Banteng (*Bos javanicus*), Otter civet (*Cynogale bennettii)*, Hairy-nosed otter (*Lutra sumatrana)* and Borneo bay cat (*Catopuma badia*). All except the pangolin rely on forested habitats, with the agile gibbon dependent on mature or primary forest. Only the orangutan and pangolin are known to enter and use gardens and plantation.

As with birds, many HCV 1.3 mammals are dependent on natural forest habitats. Thirty-four HCV 1.3 mammals are dependant on forest, and seven of these rely on primary forest. While the remaining 21 species use forest, they are also known to use or exist in non-forested areas (e.g. *ladang* agriculture, scrub, short secondary forest regrowth), usually when such areas are in close proximity to forests.

Plants

Twenty-four HCV 1.3 plant species were identified as likely present in the Project Zone. Most common among these are members of the Dipterocarpaceae (18 of 24 species), including six species listed as Vulnerable by IUCN, 14 listed as Endangered by IUCN, and six species protected under Indonesian law. These species are mainly concentrated in peat and mixed freshwater swamp ecosystems of the Project Zone, but at least 14 species also occur in the area of lowland dipterocarp forest in the north. All of these species, especially dipterocarps, are largely or totally dependent on natural forest for pollination by outbreeding, seed predator avoidance, seedling recruitment, and growth.

Herpetofauna

Seventeen HCV 1.3 reptiles are identified as likely or potentially present in the Project Zone, seven of which have been confirmed in neighboring TPTN (see Table 12 below). Of these, five are listed as Endangered by IUCN: False Ghavial (*Tomistoma schlegelii*), Malayan giant turtle (*Orlitia borneensis*), Asian brown tortoise (*Manouria emys*), Black-breast leaf turtle (*Geoemyda spengleri*), and Spiny turtle (*Heosemys spinosa)*.

Of particular concern is the False Ghavial, which has been hunted to extinction in most of Borneo but is still present in TPNP. The species may still be present in the Seruyan River along the eastern border of the Project Area. The Estuarine Crocodile (*Crocodylus porosus*) is also present in TPNP. Although listed as lower risk on IUCN, this species has suffered severe over-hunting and is listed in CITES Annex II and protected by Indonesian law. Villagers in the Project Area claim that crocodiles still exist in the Seruyan River and its tributaries.

Table 10. Endangered High Conservation Value (HCV) Bird Species Inside Project Area					
Scientific Name	**Common Name**	**IUCN**	**CITES**	**GoI**	**TPNP**
Melanoperdix nigra	Black Partridge	VU			X
Caprimulgus concretus	Bonaparte's Nightjar	VU	II		
Spizaetus nanus	Wallace's Hawk Eagle	VU	II	P	
Ciconia stormi	**Storm's Stork**	**EN**			**X**
Leptoptilos javanicus	Lesser Adjutant	VU		P	X
Pitta baudii	Blue-headed Pitta	VU		P	X

Table 11. Endangered High Conservation Value (HCV) Mammal Species Inside Project Area						
Scientific Name	**Common Name**	**IUCN**	**CITES**	**GoI**	**End.**	**TPNP**
Bos javanicus	Banteng (tembadau)	EN		x		locally extinct?
Catopuma badia	Borneo Bay cat	EN	App II	x	B	x
Cynogale bennettii	Otter-civet	EN	App II	x		
Hylobates albibarbis	Bornean White-bearded Gibbon, Bornean Agile Gibbon	EN	App I			x
Lutra sumatrana	Hairy-nosed otter	EN	App II			x
Manis javanica	Sunda pangolin	EN	App II	x		x
Nasalis larvatus	Proboscis monkey	EN	App I	x	B	x
Pongo pygmaeus	Bornean Orangutan	EN	App I	x		x

Table 12. <u>Endangered</u> High Conservation Value (HCV) Reptile Species Inside the Project Area					
Scientific Name	**Common Name**	**IUCN**	**CITES**	**GoI**	**TPNP**
Orlitia borneensis	**Bornean Terrapin, Malayan Giant Turtle**	**EN**	**App II**	**x**	**x**
Manouria emys	**Asian Brown Tortoise, Asian Giant Tortoise**	**EN**	**App II**		**x**
Callagur borneoensis	**Painted Terrapin**	**CR**			
Amyda cartilaginea	Asiatic Soft-shell Turtle	VU			
Dogania subplana	Malaysian Soft-shell Turtle	LC			
Pelodiscus sinensis	Chinese Soft-shell Turtle	VU			
Geoemyda spengleri	**Black-breast Leaf Turtle**	**EN**			
Heosemys spinosa	**Spiny Turtle, Sunburst Turtle**	**EN**			
Siebenrockiella crassicollis	White Cheek Terrapin	VU			
Manouria emys	**Brown Giant Tortoise, Asian Giant Tortoise**	**EN**	**App II**		
Cuora amboinensis	Asian Box Turtle	VU	**App II**		
Tomistoma schlegelii	**False Ghavial**	**EN**	**App I**	**x**	**x**

d. areas that support significant concentrations of a species during any time in their lifecycle (e.g. migrations, feeding grounds, breeding areas).

The purpose of HCV 1.4 is to identify and maintain habitat features within a landscape where temporary congregations of wildlife occur during key stages of the life cycle, such as for periodic feeding, reproduction, shelter, or refuge from disturbance. The management goal of HCV 1.4 is to maintain the function and accessibility of such areas to resident wildlife.

The Toolkit for Indonesia lists the following examples of key habitats under HCV 1.4:

- Caves for bats or swiftlets
- Lakes or other open water bodies for resident or migrant water birds
- Grassy banks along slow moving rivers for breeding
- Salt licks

- Areas with known high concentrations of fruit availability, especially figs, for frugivorous vertebrates
- Dead or standing trees used for nesting by birds and other vertebrates
- Ecotones or ecoclines across which animals move, sometimes in large numbers, to forage in different habitats where food is available at different times

The key question for identifying HCV 1.4 in the Project Zone is:

- Does the Project Zone contain or is it likely to contain one or more keystone habitat(s) of temporary use by species or congregations of species?

On the basis of available data, and with reference to the revised Toolkit, the following attributes of HCV 1.4 are deemed present in the Project Zone: (i) lakes or open water bodies for resident or migrant birds, (ii) grassy banks along slow moving rivers, and (iii) ecotones across which animals moves to track seasonal availability of fruit. They are discussed in turn below.

Lakes or open water bodies

The western edge of Lake Sembuluh, situated east of the Project Area but included within the eastern edge of the Project Zone, is very likely to function as HCV 1.4, providing vital wetland habitat for concentrations of migratory and resident wetland bird species. Nearby Tanjung Puting National Park and Lake Sembuluh are situated along the East Asian-Australasian Flyway (EAAF), which holds the highest number of wader populations of any global flyway, with more than 35 species of Arctic-breeding migratory wader traversing this route to reach regular non-breeding grounds in the tropics and as far south as Australia and New Zealand. A full description of Lake Sembuluh and its potential importance for bird conservation is provided in Annex

Some 62 bird species from 11 families that use inland or sub-coastal wetlands may reasonably be expected to occur in the vicinity of Lake Sembuluh as regular migrants or aseasonal non-breeding visitors (vagrants excluded). Species include 31 'shorebirds' or 'waders' (Charadriidae, Scolopacidae, Glareolidae), 10 herons, egrets, and bitterns (Ardeidae), six ducks (Anatidae), six rails and crakes (Rallidae), three gulls and terns (Laridae), two kingfishers (Alcedinidae, Halcyonidae), and four migratory passerines (Sylviidae, Passeridae). Twenty species are protected under Indonesian law, including all gulls and terns and most egrets and herons. Four species are listed by the IUCN as Near Threatened – the Band-bellied Crake (*Porzana paykullii*) and three Palearctic waders: Black-tailed Godwit (*Limosa limosa*), Eurasian Curlew (*Numenius arquata*), and Asian Dowitcher (*Limnodromus semipalmatus*). None are listed as globally threatened. Sixteen have been recorded previously at nearby Tanjung Puting.

While some of these species are 'migrants' in the truest sense, travelling annually along the EAAF, many others move about in a more nomadic pattern between islands or throughout the wider Sundaic region. Some of these species are considered likely to arrive and breed in the area.

Grassy banks along slow-moving rivers

Grassy banks along slow-moving rivers or standing water bodies can be important breeding habitat for birds and reptiles (especially crocodiles, see Section G1.8.1.c above), as well as feeding grounds for a number of vertebrates. Such areas are likely to be widely distributed throughout the Project Zone, along the Seruyan River and its tributaries, in as-yet undiscovered wetland areas within intact areas of the freshwater/peat swamp mosaic of habitats throughout the Project Zone, and along the shores of Lake Sembuluh.

Ecotones across which animals move to track seasonal availability of fruit

The revised Toolkit draws attention to zones of transition between ecosystem types as areas of special importance for maintaining habitat connectivity to ensure that the migratory movements of locally nomadic frugivorous species remain intact. This is because broadly different ecosystem types often show asynchronous phenological patterns of fruiting, and therefore enable frugivorous vertebrates to maintain a positive energy balance by moving among different habitat types. Examples of such taxa include orangutans, gibbons, and bearded pigs, among others. Ecosystem transitions identified as important in the Toolkit, and which are present in the Project Zone, include transitions between:

- Swamp and non-swamp forest
- Kerangas and non-kerangas
- Wetland and non-wetland areas

An indicative map of transitions between these ecosystem types can be inferred from the distribution of vegetation types (see Figure 7 in Section G 1.2, above). This map will be revised once a refined version of ecosystem types in the Project Zone is available.

G1.8.2. Significant Large Landscape-Level Areas

Globally, regionally or nationally significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance;

This HCV is equivalent to HCV 2 under the Global Toolkit and the revised HCV Toolkit for Indonesia. Under the revised Toolkit, three sub-values are distinguished:

HCV 2.1 Large landscapes with capacity to maintain natural ecological dynamics
HCV 2.2 Areas that contain two or more contiguous ecosystems
HCV 2.3 Areas with representative populations of most naturally occurring species

The potential presence of each HCV in the Project Zone is discussed in turn.

HCV 2.1

HCV 2.1 aims to identify large, relatively intact landscapes with a capacity to maintain natural ecological processes and dynamics. HCV 2.1 seeks to ensure that management action is taken to protect the interior and buffer zones of such landscapes.

The Toolkit defines this HCV as forest blocks with cores of >20,000 in size after delineating ('subtracting') a 3-km buffer along the margin of the forest block.

Roughly 36% (144,000 ha) of TPNP and 60% (59,960 ha) of the Project Area were classified as non-forest in 2005, leaving an estimated combined total of c. 288,000 ha of forest, in various forms, across the TPNP-Project Area landscape. Though large in total extent, landscape forest cover is rather fragmented, reflecting (i) deforestation along the Sekonyer, Air Besar, and Air Kecil rivers and tributaries within TPNP, as well as the Seruyan River and its tributaries on the eastern border the Project Area; (ii) replacement of forest by grasslands and marshy swamps within TPNP as a result of widespread fires triggered by logging and small scale agricultural conversion; (iii) coastal deforestation extending northward into TPNP and the Project Area; and (iv) large scale forest conversion to oil palm in the northeast and northern sections of TPNP and the Project Area, respectively.

This has created at least four major blocks of forest, illustrated in Figure 16. The first and largest block (Block 1) is situated in the north of TPNP and comprises an intact mosaic of freshwater swamp, peat swamp, lowland MDF, and kerangas. Block 2 is situated south of Block 1 within TPNP, and is delineated by bands of deforestation along the Air Besar River to the north and Air Kecil River to the south. This block centers on a major peat swamp dome, inter-digitated with various forms of freshwater swamp and possibly tall kerangas. Block 3 is situated south of Block 2 within TPNP, separated from it by an arc of deforestation along the Air Kecil River to the north. This block extends southward into the open wetland areas of southern TPNP and southeastward for c. 20 km along the northern edge of these wetlands, terminating at the western boundary of the Project Area. Block 4 is situated in the central portion of the Project Area, extending westward into TPNP and northward for nearly 30 km. This block is largest and most intact in the south, where it centers on a peat swamp forest spanning the border of TPNP and the Project area, and grades northward into a long narrow arm of forest classifed as MDF, but which is also likely to support various forms of kerangas.

The most recent available map for landscape forest cover of the Project Zone and nearby TPNP are those produced by OFI based on interpretation of Landsat 7 imagery from late 2005 (Figure 16).

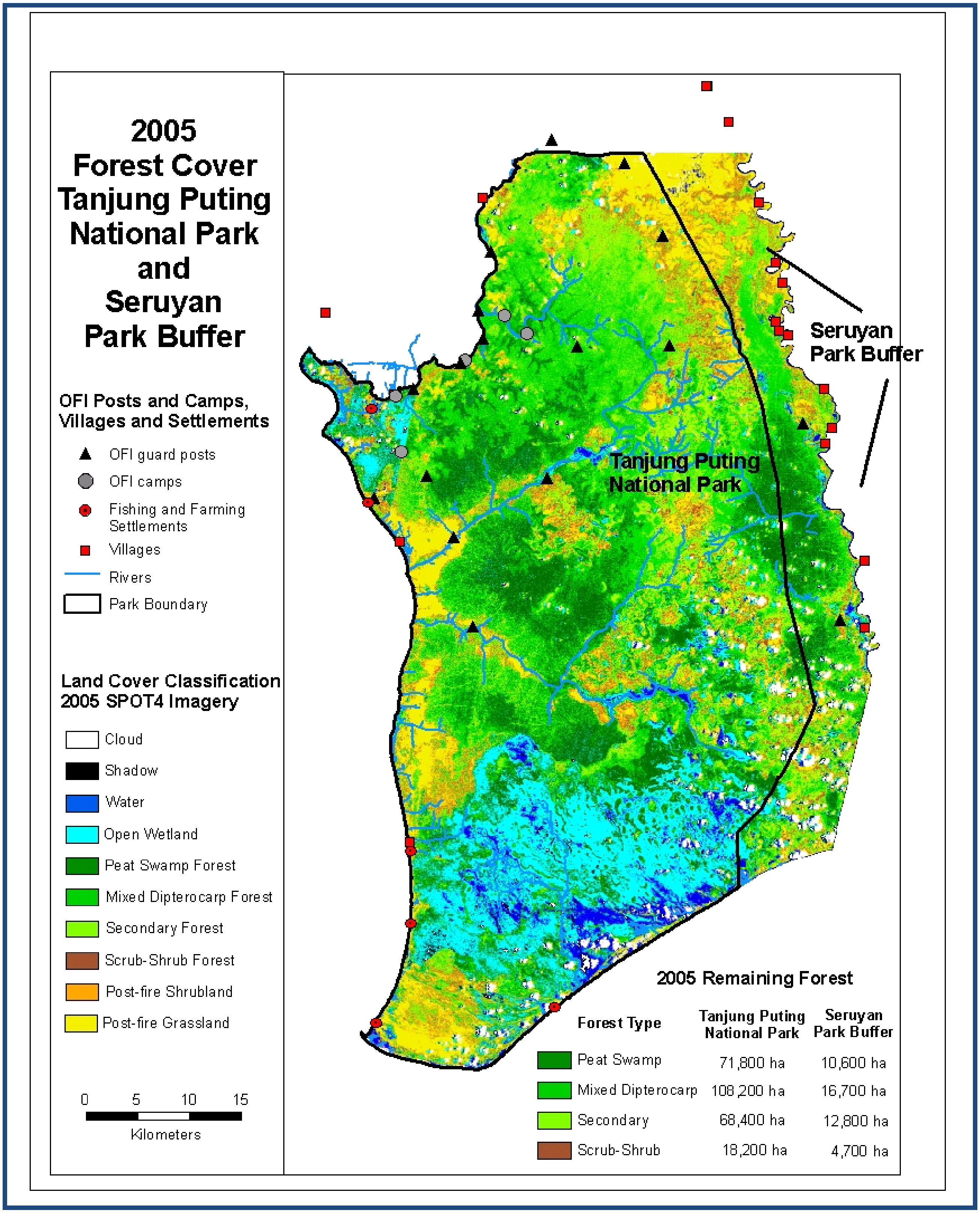

Figure 16. 2005 forest cover map of TPNP and Project Area. The combined total area of TPNP (c. 400,000 ha) and the adjacent Project Zone (c. 91,215 ha) is approximately 491,215 ha.

It is possible that a degree of permeable connectivity remains functional among one or more of these blocks, especially for taxa that are capable of utilizing a mosaic of regenerating secondary or disturbed primary forests as 'connecting habitat'. However, neither the landscape mosaic of fragments, nor one or more of the individual fragments themselves, qualifies as HCV 2.1 under the landscape definition. This reflects their size, shape and relative isolation caused by the surrounding (predominantly) non-forest matrix. While Block 4 in the Project Area is vital to long term biodiversity conservation (especially the orangutan) and maintenance of HCVs 1 and 3 (see Sections G 1.8.1 and 1.8.3 above), its long narrow shape means the block does not quality as HCV 2.1.

HCV 2.2

HCV 2.2 aims to identify and maintain ecotones and ecoclines that connect different ecotypes (ecosystem classes), especially where they occur in large forest landscapes. Such transitional environments are important not only for their maintenance of key ecosystem functions by ensuring continued movement of species and flux of materials and energy across boundaries, but also as centres of biodiversity in their own right.

In the case of TPNP and the Project Zone, maintenance of ecotones can be especially important for long-term population viability of mobile, locally nomadic frugivorous vertebrates that forage among multiple habitat types tracking seasonal availability of fruit. Broadly different ecosystem types often show asynchronous phenological patterns of fruiting, and therefore enable specialist frugivores, such as hornbills and gibbons, to maintain a positive energy balance by moving among different habitat types. Examples of such taxa likely or confirmed present in the Project Zone and nearby TPNP include orangutans, gibbons, bearded pigs, pigeons, and fruit bats.

Ecosystem transitions listed under HCV 2.2 in the Toolkit include wetlands and non-wetlands, swamp and non-swamps, kerangas and non-kerangas, karst and non-karst forest, and elevational gradients that encompass transitions between lowland, sub-montane, and/or montane forest. With reference to the vegetation description under section G 1.2, three HCV 2.2 ecosystem transitions are present in the Project Zone, and are discussed in turn below:

- Wetland and non-wetlands
- Swamps and non-swamps
- Kerangas and non-kerangas

Wetland and non-wetland. The most notable wetland to non-wetland transition in the Project Zone is that which occurs along the western edge of Lake Sembuluh.

Swamps and non-swamps. The swamp to non-swamp transitions are centered on three kinds of swamp: (i) periodically inundated grasslands or marshes; (ii) freshwater or riparian swamps; and (iii) peat swamps. Based on best available vegetation mapping for the Project Zone, transitions from marshy swamps to other natural vegetation types occur in two major concentrations, one near Telagapulang in the middle of the Project Zone, and the other in the south. In both cases, marshes grade into intact peat swamps. Precise location of transitions from freshwater or riparian swamps to other natural ecosystems cannot be mapped at present but occur in association with the Seruyan River and its major tributaries. Transitions among peat and non-peat areas are limited mainly to continuous boundaries with marshes, as mentioned above.

Kerangas and non-kerangas. As with transitions from freshwater or riparian swamp to other ecosystems, kerangas to non-kerangas transitions cannot be mapped at present, though they are likely to be common in parts of the north (see Section G 1.2).

HCV 2.3

HCV 2.3 aims to identify landscapes with representative populations of most naturally occurring species in the study region and with a capacity to maintain such populations in the long term.

As described under Section G1.7 on biodiversity in the Project Zone and under Sections G1.8.1 and 1.8.2 on endangered species and regional forest cover in the Project Zone and nearby TPNP, the Project Zone is an important part of a large landscape mosaic of diverse natural and anthropogenic ecosystem types. This mosaic covers c. 500,000 ha of terrestrial and aquatic ecosystems, including: (i) c. 266,000 ha of natural forest, representing at least five major terrestrial ecosystem types; (ii) numerous ecotonal transitions among contrasting terrestrial ecosystem; (iii) a complex network of rivers and associated riparian environments draining nutrient poor sandy soils or peat swamps, which produce so-called 'black water rivers' with distinctive aquatic fauna; and (iv) a large black water lake system (Lake Sembuluh).

Combined, this area is confirmed or likely to support some of the largest populations of threatened and protected species known from the area of study – especially the orangutan – including a total of 361 species of birds, 167 species of mammals (including 45 species of bats), and at least 180 species of free-standing large woody plants (note this excludes orchids, pitcher plants, lianas, epiphytes and understory herbs). Species lists are provided in Annexes 5 – 9.

On the basis of these data, HCV 2.3 is considered present in the Project Zone and in nearby TPNP, to which it makes vital contributions of intact lowland habitat to support landscape-level populations of most naturally occurring species.

G1.8.3. Threatened or Rare Ecosystems

Threatened or rare ecosystems;

The precautionary approach for identification of HCV 3 ecosystems throughout Indonesia makes use of a national land system classification and mapping program carried out by the Government of Indonesia during the 1980s and early 90s, called the Regional Physical Planning Programme for Transmigration (RePPProT). The RePPProT program described and mapped 414 land systems throughout Indonesia at a scale of 1:250000. These land systems are classifications of land forms based on specific associations between lithology, climate, hydrology, topography, soils, geographic location, and organisms – factors that are also known to affect the distribution of natural ecosystems. Within limitations of the data, these land systems can be used as proxies for broad ecosystem typing.

The revised Toolkit for Indonesia includes a table for Kalimantan (Table 8.3.1 in the revised Toolkit) that lists each land system, corresponding ecosystem types associated with it, and conservation status of these ecosystems as rare or endangered, based on expert input and reference to other conservation priority setting schemes commonly used in Indonesia (e.g. the WWF Global 200 Ecoregions).

If a land system present in an assessment area (i.e., the Project Zone) is defined as rare or endangered with reference to the precautionary approach defined in the Toolkit, then all remaining natural ecosystems on the ground – within such land systems – are defined as HCV 3. (Note: the precautionary approach for identifying HCV 3 is necessarily more conservative than the analytical approach, meaning that in some parts of Indonesia, a given ecosystem will be more likely to be classified as HCV 3 using the former than the latter.)

Eight land systems are present in the Project Zone, and they are shown in Figure 17, below. These land systems, their associated ecosystems, and HCV 3 status are summarized in Table 13.

All of these land systems are considered HCV 3, rare or endangered ecosystems, following the precautionary approach outlined in the revised Toolkit.

Table 13. A summary of HCV 3 ecosystems present in the Project Zone

Land System	Associated ecosystems	Rarity Status	Endangered Status
MDW	Shallow peat < 2 m depth	-	Endangered
SGT	Kerangas of various forms & medium extensive areas of lowland MDF	-	Endangered
BWN	Kerangas in various forms & limited areas of lowland MDF	-	Endangered
KHY	Riparian & alluvium forest	-	Endangered
SBG	Riparian & alluvium forest	-	Endangered
SRM	Shallow peat < 1 m depth	-	Endangered
PTG	Beach forest and other vegetation	Rare	Endangered
KLR	Grass & reed swamps	Rare	Endangered

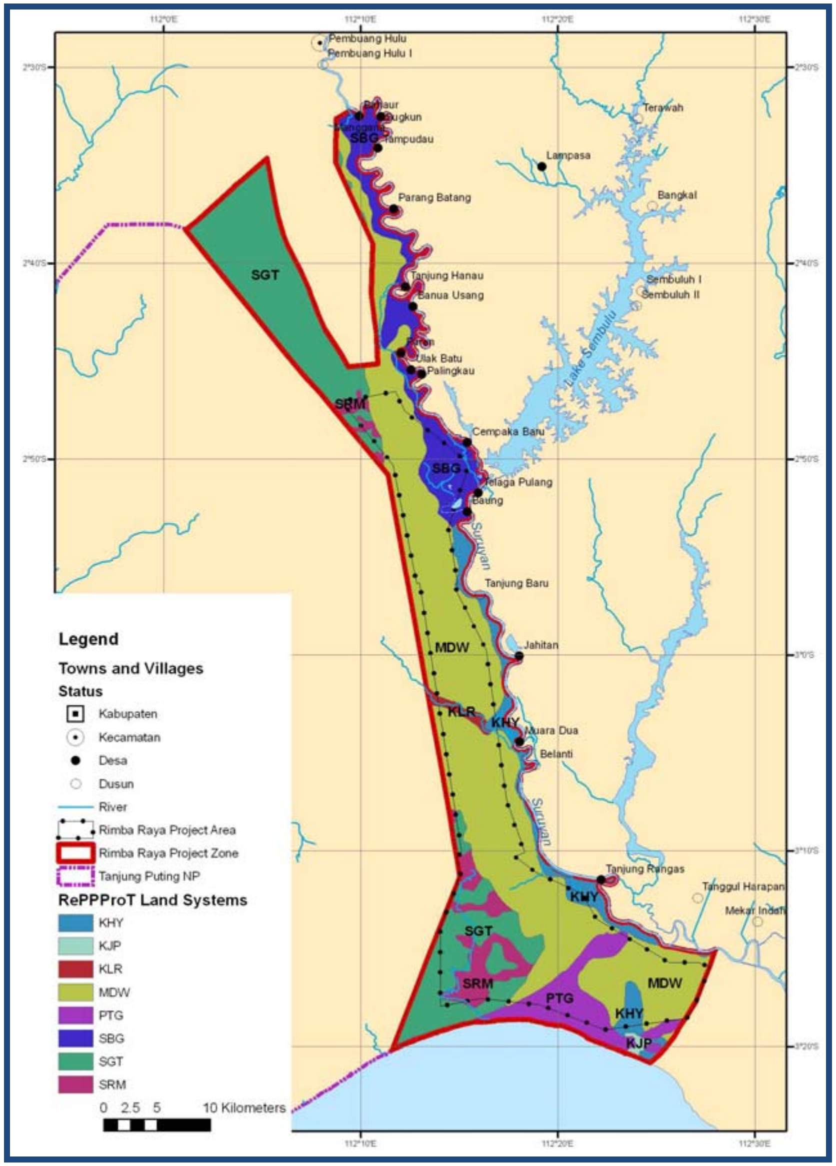

Figure 17. Land Class systems in the Project Zone.

G1.8.4. Areas Providing Critical Ecosystem Services

Areas that provide critical ecosystem services (e.g., hydrological services, erosion control, fire control);

This HCV is equivalent to HCV 4 under the Global Toolkit and the revised HCV Toolkit for Indonesia. Under the revised Toolkit, three sub-values are distinguished:

HCV 4.1 Areas or ecosystems important for provision of water and prevention of flood
HCV 4.2 Areas important for the prevention of erosion and sedimentation
HCV 4.3 Areas that function as a natural break to the spread of forest or ground fire

The potential presence of each HCV in the Project Zone is discussed in turn.

<u>HCV 4.1</u>

HCV 4.1 draws attention to areas or ecosystems that are important for the provision of clean water and prevention of flood for downstream communities and aims to ensure management action is taken to maintain provision of these services.

The revised Toolkit defines *areas* important for the provision of clean water as watersheds and riparian zones that feed into rivers on which communities depend for water and related services, such as protein from fishing. Evaluation of HCV 4.1 is thus a two-step process: first, the identification of areas or ecosystems known to have a direct impact on river function in the assessment area; and second, an evaluation of community dependence on such rivers as a source of clean water and their vulnerability to floods if upstream areas are degraded.

Step 1. The Toolkit defines *ecosystems* important for provision of water and prevention of floods as:

- Cloud forest
- Ridge line forest
- Riparian or flood plain forest
- Karst forest
- Peat forest or peat land
- Freshwater swamp forest
- Mangrove forest
- Marsh or other wetland vegetation
- Lakes or other open water bodies

Of these nine ecosystem types listed in the Toolkit, six are present in the Project Zone: (i) riparian or flood plain forest, (ii) peat forest or peat land, (iii) freshwater swamp forest, (iv) marsh or wetland vegetation (natural and manmade), and (v) lakes or other open water bodies.

Step 2. Results of social surveys in the Project Zone (see sections G1.5, G1.8.5 & G2.4) indicate that: (i) local communities are fundamentally dependent on the Seruyan river and its tributaries for the provision of water, protein (fish), and transportation within the Project Zone; and (ii) communities are extremely vulnerable to floods, which are becoming more frequent and severe as upstream forests are degraded by logging and fires and replaced by grassland and in the north converted to oil palm plantations following clear-cutting and drainage of peat swamps.

The expansion of oil palm plantations into northern sections of the Project Zone deserves special mention. Plantations have effectively transformed the ecological function of this area from a 'natural sponge', which dampened hydrological impacts of intense rainstorms by absorbing and slowly releasing rain water, to a compacted, rapidly draining source of storm water runoff.

One could argue, in a strict sense, that communities are no longer dependent on upstream ecosystems of the Project Zone for prevention of floods, since floods are reported to be frequent and severe, implying that, in fact, ecosystems no longer function to prevent floods. Such reasoning would be inconsistent, however, with the spirit of HCV, since it is clear that continued degradation of these upstream ecosystems will make a bad situation worse. Very large areas of intact peat swamp forest remain in the Project Zone (c. 27,700 ha; see Section G1.2), and conversion of these areas to oil palm would severely worsen the frequency and duration of floods suffered by downstream communities.

Any and all intact and regenerating peat swamp forest, riparian or flood plain forest, and natural grass land or marshy swamps play a vital role in the provision of clean water and prevention of worsening floods. These areas are considered HCV 4.1 ecosystems in the Project Zone.

HCV 4.2

HCV 4.2 aims to identify areas with high erosion risk that must be managed carefully to prevent soil erosion or sedimentation of rivers or open water bodies.

In the revised Toolkit, HCV 4.2 areas are defined as areas with estimated soil Erosion Risk Potential of > 180 t/ha/yr. The procedure recommended for evaluating HCV 4.2 is a simplification of the Universal Soil Loss Evaluation (USLE), where land cover types and soil management are ignored (i.e., a worst-case scenario). An indicative map of HCV 4.2 areas for Kalimantan prepared by Tropenbos is provided with the revised Toolkit as a Digital Annex. According to this map, HCV 4.2 is not present in the Project Zone (see Figure 18 below). This finding also accords well with the occurrence of soil types in the Project Zone (see Section G 1.1), topography, and inferred erosion risk.

Continued degradation of peat swamp forest in the Project Zone, especially in the form of drainage canal construction and conversion to oil palm, will have negative impacts on water quality through increased sedimentation. This, however, is more appropriately treated in HCV 4.1, where peat swamp forests have been identified as an HCV 4.1 ecosystem vital for watershed protection and provision of clean water.

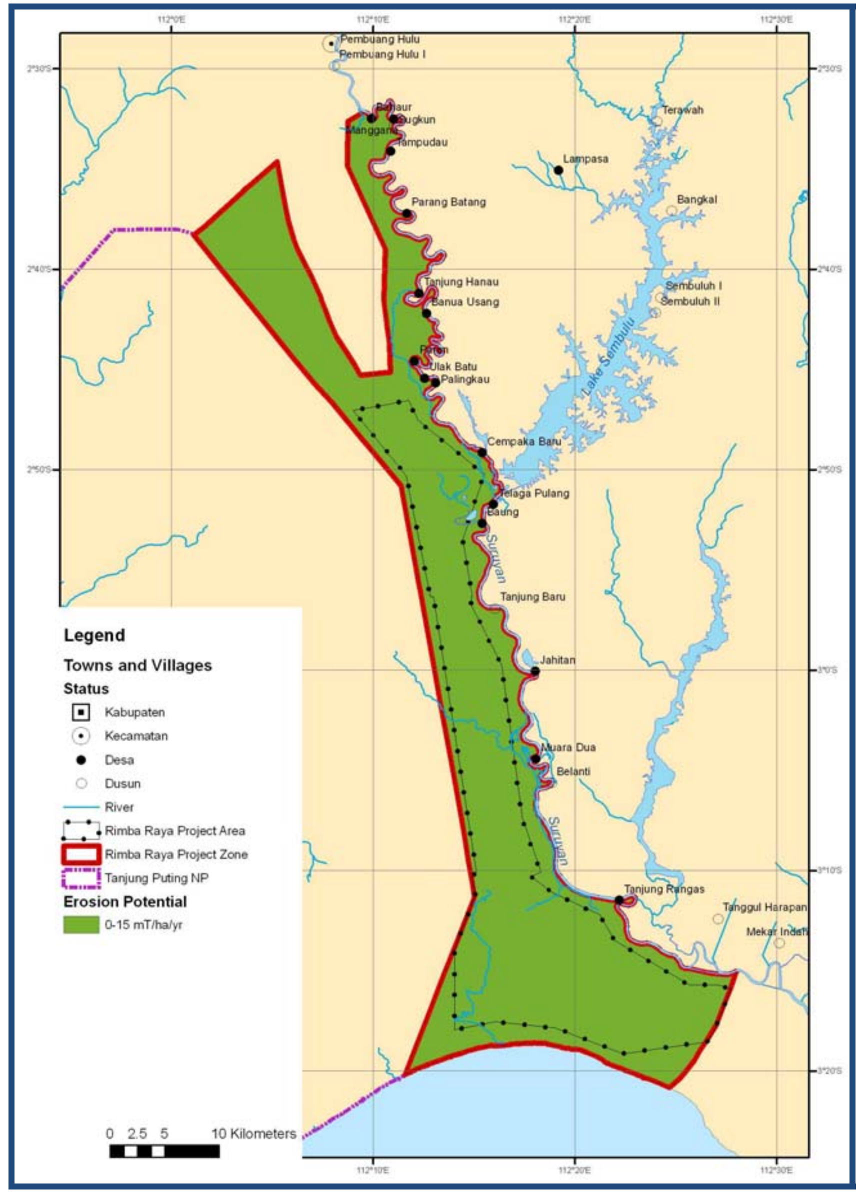

Figure 18. Erosion Potential in the Project Zone

HCV 4.3

HCV 4.3 aims to identify and maintain areas that serve as natural firebreaks, protecting vulnerable areas from known current or historical sources of fire.

The key question for evaluating the potential presence of HCV 4.3 in the Project Zone is:

- Does the effective license area contain areas that function as a natural barrier to the spread of forest or ground fire?

Intact primary tropical forests are thought to offer a degree of protection against the spread of forest fires, with damage typically limited only to the understory stratum of forest. Everwet or waterlogged forest types, such as primary peat swamp or freshwater swamp forests, have a further natural resistance to fire, as long as surface substrates, especially in the case of peat lands, remain waterlogged. Primary forests damaged by a range of human activities – especially logging and swamp drainage – can, however, transform naturally resistant primary forests into highly combustible areas, especially during a prolonged dry season.

While fires can be caused by natural sources, such as lightning, the vast majority of forest fires in the tropics are caused by humans. In remote Kalimantan, traditional swidden fallow agricultural systems are the dominant form of agriculture. Fire is an essential part of site preparation for both clearing land and temporarily increasing soil fertility for one or two planting cycles. Smallholder land clearance using fire is often cited as a major source of forest fires, but other sources include hunters burning neighbouring grasslands to drive game, fisherman burning wetlands during the dry season to increase their catch later in the wet season, and irresponsible industrial agricultural or forestry corporations using fire for large-scale land clearance. The likelihood of forest fires increases substantially during periods of draught, such as during El Niño and La Niña years, which over the past 20 years have occurred in 1986-1987, 1991-1992, 1993, 1994, 1997-1998, 2002-2003, 2004-2005 and 2006-2007.

Table 14. Summary of fire detection in the Project Zone 1997-2006 ATSR World Fire Atlas Data

Year	Number of fires detected	% of total
1997	57	75
2002	3	4
2004	2	3
2006	14	18
Total	**76**	**100**

Severely degraded lowland forests and drained peat swamps are the areas most severely affected by fires in Kalimantan and Sumatra, with large quantities of highly combustible materials available to burn. Degraded but un-drained peat swamp forest can also be highly combustible if severe, temporary drops in the water table occur due to draught. Another source of combustible material is surface coal deposits, which once on fire may continue to burn underground until the coal substrate is exhausted.

HCV 4.3 in the revised Toolkit draws attention to natural ecosystems that function to prevent or impede the spread of fire, or in other words, areas that functions as buffers between potential sources of combustion and potentially highly combustible stock.

To evaluate the potential occurrence of HCV 4.3 areas in the Project Zone and nearby TPNP, the history of fires in and nearby the Project Zone was examined using the 1995-2007 ATSR World Fire Atlas. This database uses remote sensing data from the ERS-2 ATSR-2 (http://earth.esa.int/ers/eeo9/earth_esa.html) to detect the presence of fires at night. The data provided are considered to underestimate the total number of large fires but are consistent over time and space, and thus allow comparison across studies.

Using these data, fires were detected almost exclusively between the months of August and December, and only during years that coincided with El Niño droughts, such as in 1997, 2002, 2004 and 2006 (Table 14). Fires were most severe in number and extent during 1997, which also coincided with the longest drought since World Fire Atlas data compilation began.

Two concentrations of fire in the Project Area were detected, one in the south near Tanjung Rengas, in association with what appears to be a grassland swamp of unknown origins (i.e., natural or anthropogenic), and the other in the north, in association with an established oil palm estate on shallow peat (Figure 19). The absence of fires in non-El Niño years suggests that fires are accidental, rather than part of a deliberate policy to clear land within the Project Zone.

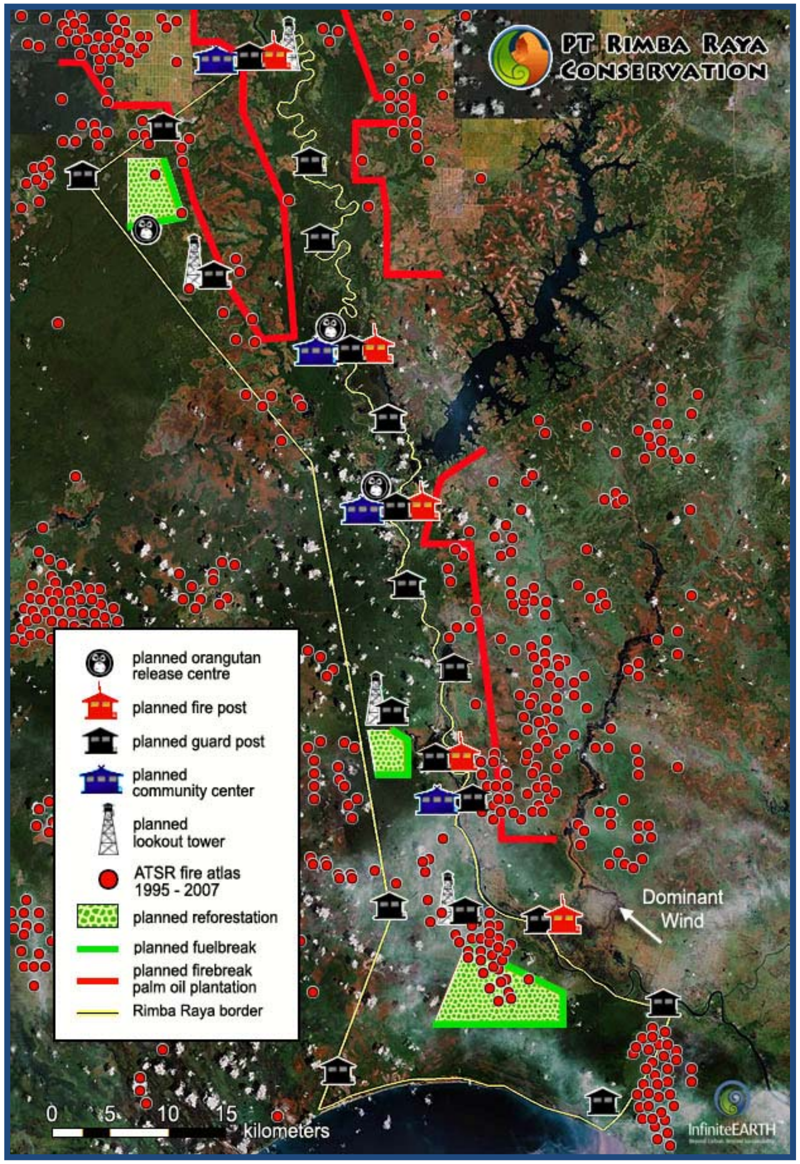

Figure 19. Fires detected by ATSR 1995-2007 in the Project Area.

Within the Project Area and neighbouring TPNP, there are many areas of peat swamp forest and other vegetation types growing on medium and deep peat substrates. These areas support some large blocks of intact forest, as well as vegetation in various stages of degradation, and show a history of fire susceptibility.

The risk of future fire in these areas is increased further by continued forest degradation by logging, or draining of peatlands for agricultural purposes, with severe impacts on peat ecology and thusfire risk both on- and off-site. The spatial extent of peat areas affected by drainage, and thus having an increased susceptibility to fire, depends on local area hydrology, in particular dome structure if a dome is present. Inside the Project Area it is likely that only drainage canals constructed in areas on the western bank of the Seruyan River would be relevant.

Some of the more intact peat swamp forest areas appear to be among the least fire prone ecosystems in the Project Area. Such forests potentially function as a barrier to spread of fire, especially in the central portion of the Project Area, which also functions as a vital channel of connectivity between the Project Area and the greater TPNP landscape.

G1.8.5. Areas Fundamental for meeting the basic needs of local communities

Areas that are fundamental for meeting the basic needs of local communities (e.g., for essential food, fuel, fodder, medicines or building materials without readily available alternatives)

HCV 5 aims to identify natural areas (terrestrial and aquatic) that are important to local communities for the provision of basic needs (e.g., food, water and building materials), in situations where such needs cannot be met with readily available alternatives. The management goal of HCV 5 is to ensure continued provision of such basic needs through collaborative management of the areas or through substituting forest/river-derived basic need with alternatives, provided such alternatives will be available into the foreseeable future even without support were the project to end.

The Indonesian Toolkit defines basic needs as carbohydrates, protein, water, vitamins & minerals, medicine, fuel, building materials and fodder. Key questions to assess the presence of HCV 5 in the Project Zone are:

- Do communities living within the Project Zone use forests or other natural ecosystem types, including rivers, for meeting basic needs?
- Where are such forest-derived resources located in relation to the communities?
- If the entire landscape or some areas within it were converted or degraded, would the availability of important forest resources be impacted? If so, do the communities have alternatives for meeting these needs?

Based on preliminary field visits in each of the villages, communities in the Project Area are dependent on natural forest and rivers to obtain a number of basic needs. These include water, protein (fish), timber for building materials, and fuel wood. The Seruyan River is the most important source for meeting basic needs for water, including for drinking, washing, and sanitation purposes. The Seruyan is also vital for local transport. All communities appear to depend very heavily on the Seruyan for protein derived from fish. Upstream tributaries are also used. Communities did not report depending on forest for hunting as an alternative source of animal derived protein – due in part to religious prohibitions – suggesting rivers are vital in this regard. Based on available data, communities appear to derive timber for local consumption (building) from communal forest areas on the east side of the Seruyan, which is outside the Project Area but inside the Project Zone. Fuel wood is derived from nearby forests, usually of a disturbed nature (e.g., regenerating secondary forests).

Market alternatives are available for fish-derived protein, building materials, and fuel wood, but these appear to be far beyond the reach of most community members. This conclusion is based on reports that communities already have trouble affording market purchases to meet other basic needs, such as carbohydrates, vitamins & minerals and non-fish protein.

G1.8.6. Areas Critical for Traditional Cultural Identity

Areas that are critical for the traditional cultural identity of communities (e.g., areas of cultural, ecological, economic or religious significance identified in collaboration with the communities).

HCV 6 draws attention to areas that are important for maintaining local cultural identity, such as burial sites, sacred sites, or locations where forest products are obtained for ritual or ceremonial purposes. Management of HCV 6 aims to maintain or enhance the function of these areas by implementing a management plan developed in collaboration with local communities. At a minimum, this requires delineating and protecting such areas from damage.

Key questions in assessing the presence of HCV 6 in the Project Area include:

- Are there areas of cultural significance to communities?
- How are these areas used (e.g., worship, sacred place) and at what frequency?
- Where are these areas located?

In the Project Area, most of the communities are Dayak ethnicity, but converted from animism or Christianity to Islam in recent past. Unlike Dayak communities elsewhere in Kalimantan, who generally follow Christianity, communities in the Project Area were considered unlikely to have religious rituals dependent on forests, as this is prohibited by Islamic teachings. Preliminary field surveys confirmed this, as no communities reported the presence of sacred forest locations for worship or other cultural ceremonies. As mentioned above, some communities do, however, assert customary rights over nearby communal forest areas east of the Seruyan, outside the Project Area but inside the Project Zone. If such forests also hold cultural importance to communities, then such areas might be considered HCV 6.

HCV6 is considered unlikely to present in most communities of the Project Area, but this will require more intensive interview-based data collection.

G2. Baseline Projections

G2.1. Most Likely 'Without Project' Land-Use Scenario

This section describes the most likely land-use scenario in the absence of the project following IPCC 2008 Guidance for AFOLU, describes the range of potential land-use scenarios and associated drivers of GHG emissions and justifies why the land-use scenario selected is most likely.

Land Use and Land Planning in the Project Area

In 1996, the Tanjung Puting National Park border was set (shown as red line in Figure 20) and comprised 396,000ha6. Each province and district in Indonesia is required to conduct ten-year spatial plans and the 2003 plan for Central Kalimantan indicated a different, smaller border (light green area in Figure 20). This revision to the border of the Park was agreed to by the Minister of Forestry in 2005[6].

In the buffer area east of the park in what is now the Rimba Raya concession two timber concessions selectively logged the area during the 1980s and 1990s, PT Bina Samaktha[7] in the northeast portion and PT Mulung Basidi[8] in the southeast. The companies stopped operations in 1998 and 2000, respectively. Since then some of the easily accessed forest has been illegally selectively logged by nearby villagers.

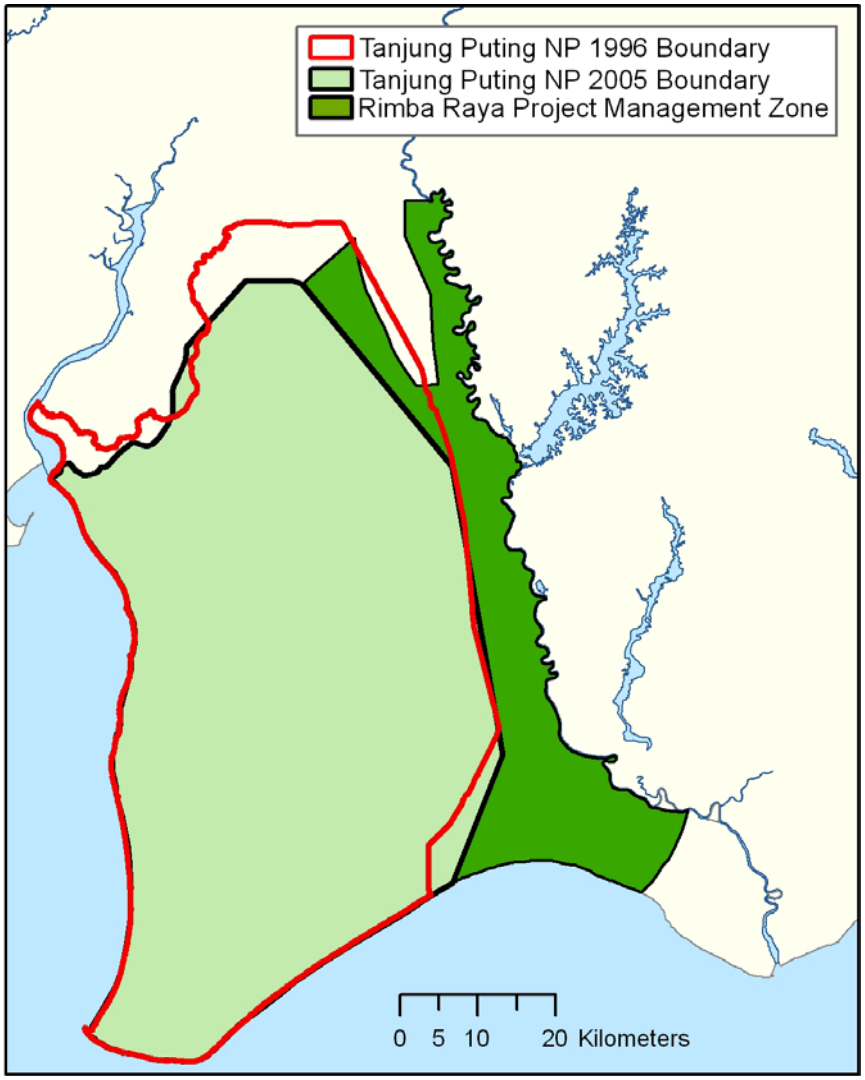

Figure 20. Tanjung Puting National Park Boundaries 1996 (shown as red outline) 2005 (shown as light green area) and the Rimba Raya concession boundary (shown as dark green area).

[6] Minister of Forestry's SK No.292/MENHUT-VII/2005 Tanggal 13 Mei 2005
[7] SK HPH No. 33/KPTS/Um/I/1978 tanggal 8 Januari 1978 seluas ± 50.000 Ha
[8] SK HPH No. 26/KPTS/Um/I/1980 tanggal 14 Januari 1980 seluas ± 98.000 Ha)

In 2004, five oil palm estates were formally proposed to the Bupati and the Governor that partially occupy the ex-timber concessions adjacent to the Park (Figure 21). All five of these proposed estates have received the initial stage of oil palm permits from the Seruyan Bupati with the northernmost estate also being granted the estate license (HGU – Indonesian acronym).

Following HGU designation, the northernmost estate was rapidly converted to oil palm plantation. This concession, managed by PT Kharisma Unngul Centratama) became operational in 2007.

InfiniteEARTH has obtained copies of official government letters requesting the conversion or Rimba Raya to five individual estates. The original copies and translations of these letters are included in Annex 10.

This series of events strongly suggests that conversion of the remaining four palm oil concessions, is the most likely baseline or "business as usual scenario" for the Project. And the Rimba Raya Project Area is based on the boundaries of the four planned but as yet undeveloped oil palm concessions (Figure 22). The Carbon Accounting Area boundary, which covers an area of 47,237 ha, is coincident with proposed concession boundaries except in the north where it has been reduced to exclude an area of potential hydrological impact within 3 km of the developed KUCC plantation.

Field surveys, government records research and spatial analysis were conducted to further investigate and document this scenario and also used to test alternative scenarios, both of which are discussed in the following sections.

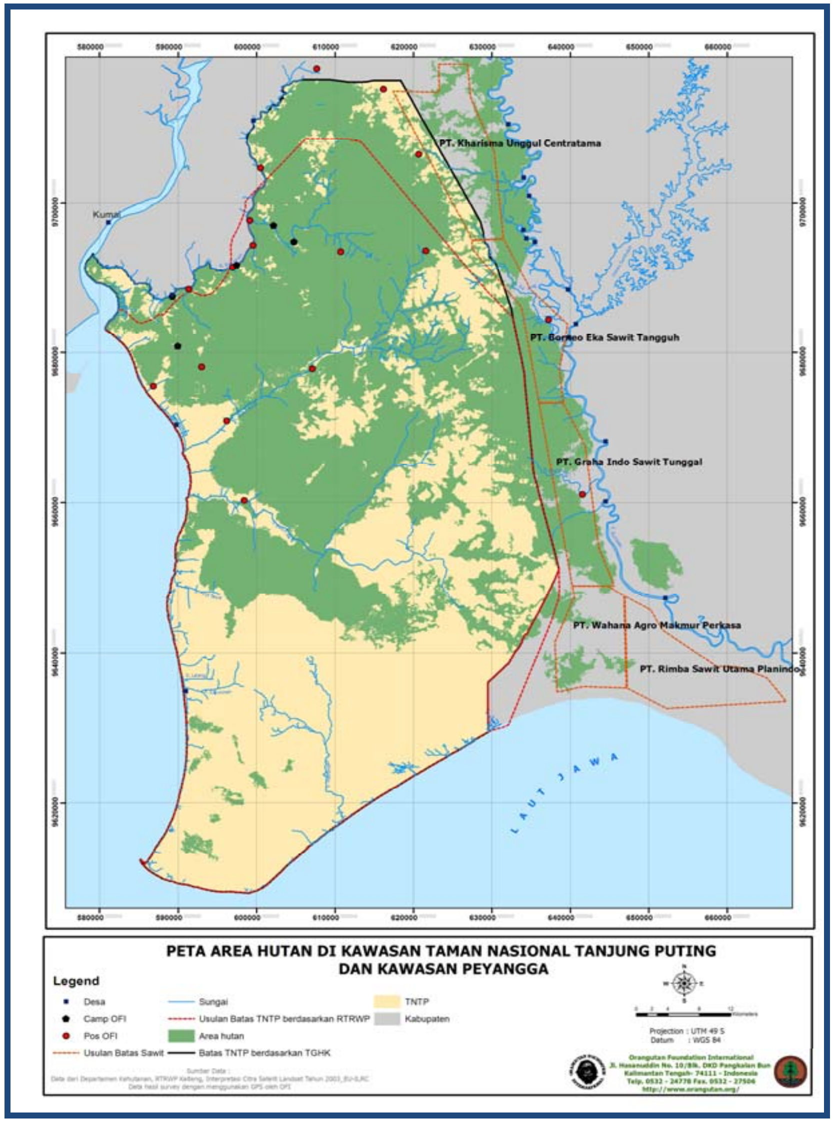

Figure 21. Outline of five original proposed oil palm concessions in the Project Area, the 1996 TPNP border (shown in black) and the new park border (shown in red) revised as a result of illegal infringement by the palm oil estate to the north of the park.

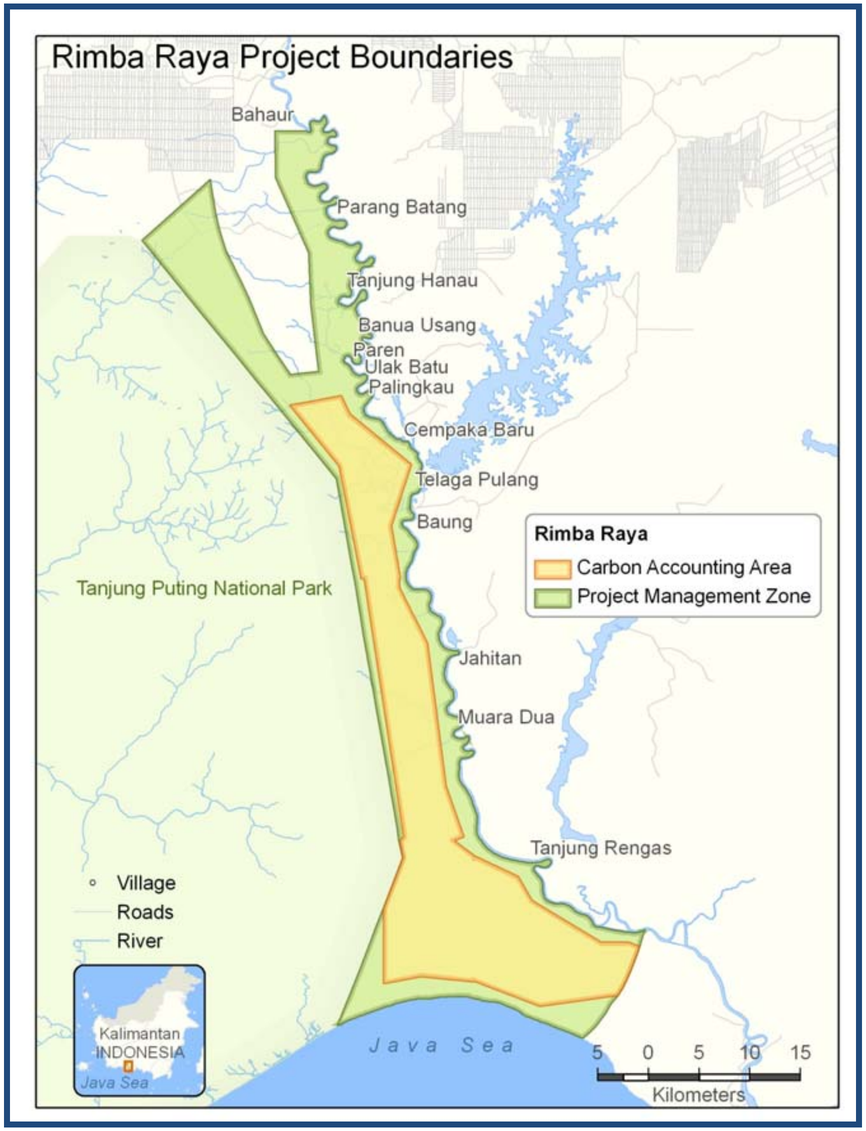

Figure 22. Rimba Raya Project Area (Carbon Accounting Area) in yellow.

Planned Deforestation

The underlying assumption of planned deforestation is that the State is able to guide and control deforestation through spatial and land use planning that allocates specific forest areas for conversion. An investigation of planned deforestation was carried out for Rimba Raya and found to support the baseline scenario of conversion to palm oil. Spatial plans at the district, province, and national government levels are summarized below.

The Central Kalimantan Land Use Planning Agency (BAPPEDA) developed a spatial plan in 2003 that was signed into law[9]. The Rimba Raya area was allocated mostly as production forest with a thin strip of conversion forest allocated for community development along the Seruyan River. (Figure 22) The land use classes in the 2003 Spatial Plan located in the Rimba Raya area concur with the earlier MoF National Spatial Plan (TGHK 1982).

Despite having a legal spatial plan in 2003, the province began developing a new spatial plan in 2006, mainly to synchronize the huge demand from oil palm developers with a spatial plan that allows for extensive conversion of production forest. Figure 23 below, compares the new draft provincial plan (RTRWP) with the MoF National Plan (TGHK) with conversion forest represented by a pink color. From Figure 24 it is obvious that the draft 2006 provincial plan seeks to convert a massive swath of production forest; practically one third of the province would be in oil palm estates. In fact, the province is planning to deforest over 2.6M ha of forest, based on their draft plan, including the Rimba Raya area.

[9] Peraturan Daerah No. 8 Tahun 2003

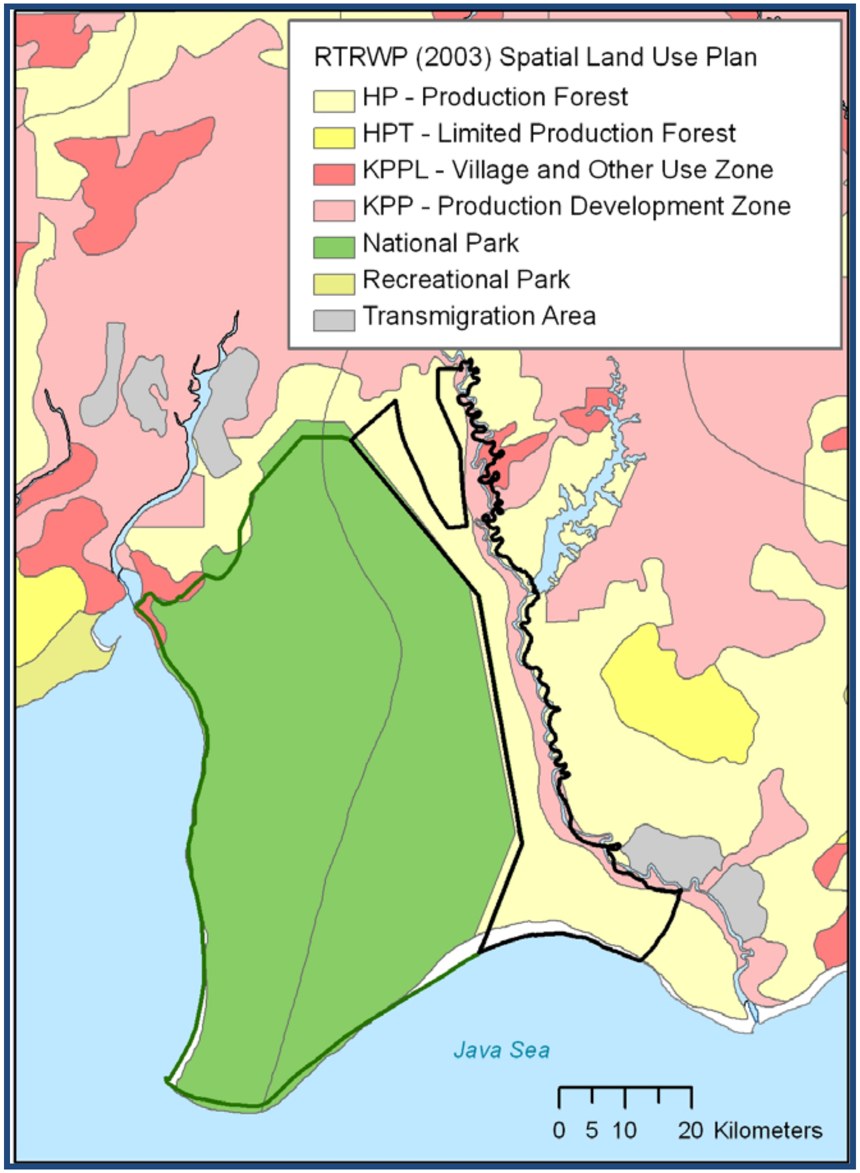

Figure 23. Provincial Spatial Land Use Plan 2003.

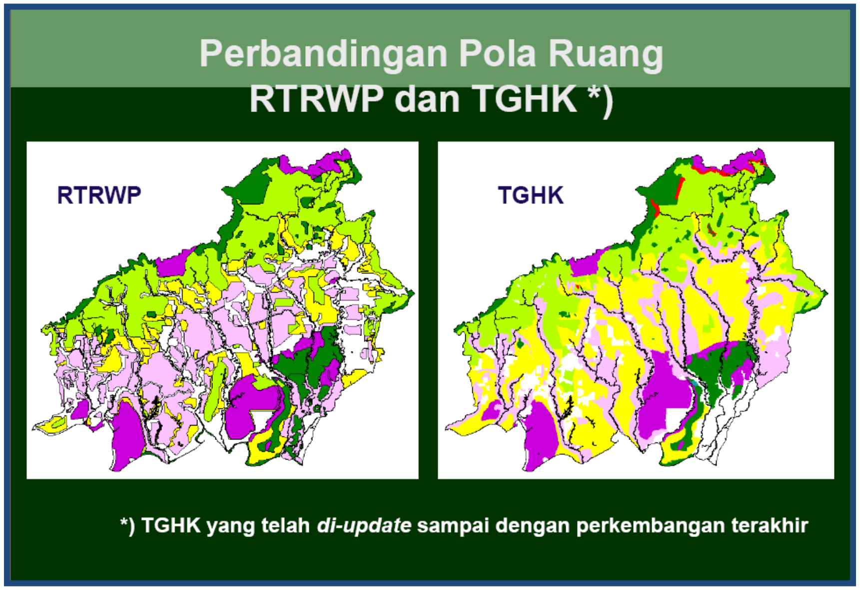

Figure 24. Comparison of the new draft provincial plan (RTRWP) with the MoF National Plan (TGHK) . Conversion forest represented by a pink color.

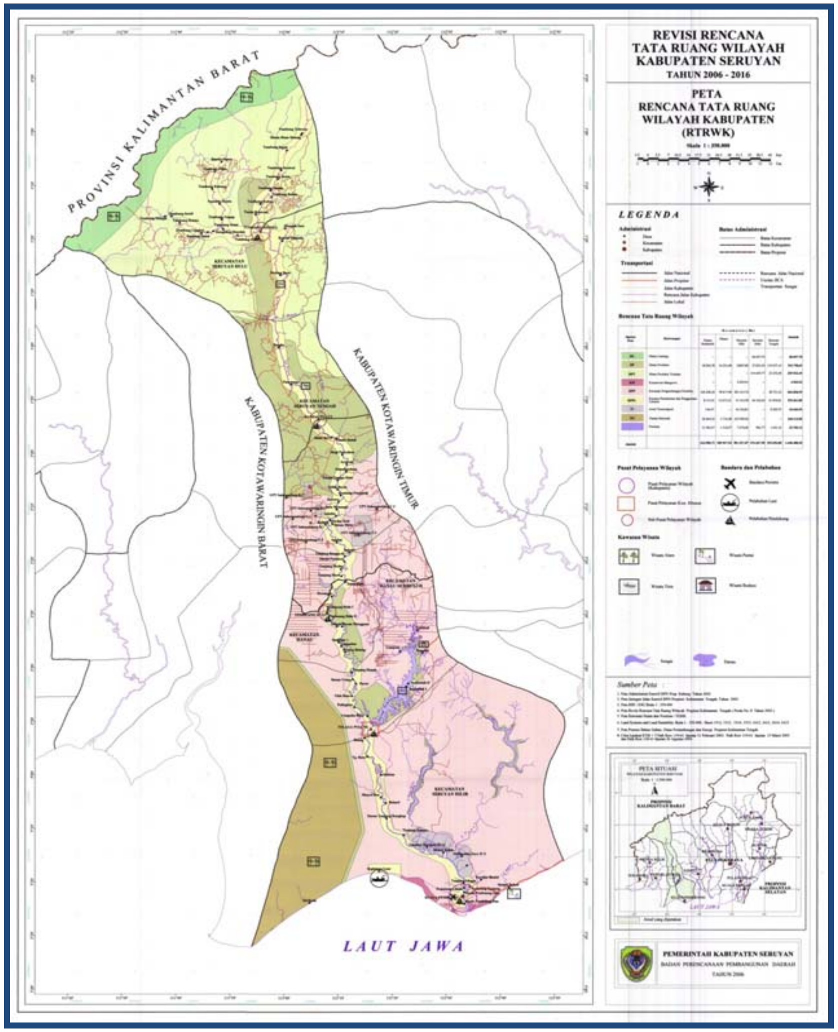

Figure 25. Seruyan Regency Spatial Plan (2006-2016). Colors: pink – conversion forest, yellow – conversion for community use, yellow/green – production forest, light green – limited production forest, dark green – protection forest. Black arrow indicates location of Rimba Raya concession and red arrow shows location of planned CPO harbor.

Regency plans are consistent with provincial plans in showing redesignation of production forest to conversion forest. The current draft spatial plan for Seruyan District has allocated almost 40% of the district including the Rimba Raya area as conversion forest (Figure 25).

Moreover, similar district plans throughout the province are providing impetus for larger scale land use redesignation to accommodate the regional expansion of oil palm plantations. Figure 26 shows an overlay of oil palm estates, where they have been allowed to operate in regards to the Ministry ofForestry (MoF) spatial plan. It should be noted that MoF planning takes precedent over provincial spatial plans unless they have been approved by BAPPLAN (Spatial Planning Agency of MoF).

Table 15 examines the overlap between oil palm estates and the MoF Spatial Plan. Oil palm estates now occupy nearly 800,000ha of production forest and another 800,000ha of estates have entered the approval process. In order to legally operate on production forest, each estate must obtain a Ministerial Decree (*surat pelapasan*) that relinquishes this area from the permanent forest estate. Given the number of oil palm estates and the high demand for further conversion, it becomes obvious why the province is seeking to change the land use status.

Table 15. Extent of Overlap w/ Oil Palm Estates			
MoF Spatial Plan (TGHK) Land Use Classes	**With Operating Permit (ha)**	**Proposed (ha)**	**Total (ha)**
Agricultural & other uses (APL)	22,220	2,612	24,832
Protected Forest (HL)	0	3,819	3,819
Production Forest (HP)	799,450	804,441	1,603,891
Limited Production Forest (HPT)	43,366	99,199	142,565
Conversion Forest (HPK)	366,295	582,796	949,091
Protected Areas (HSA-W)	5,045	1,140	6,185
Wetlands	30	707	737
Grand Total	**1,236,407**	**1,494,715**	**2,731,122**

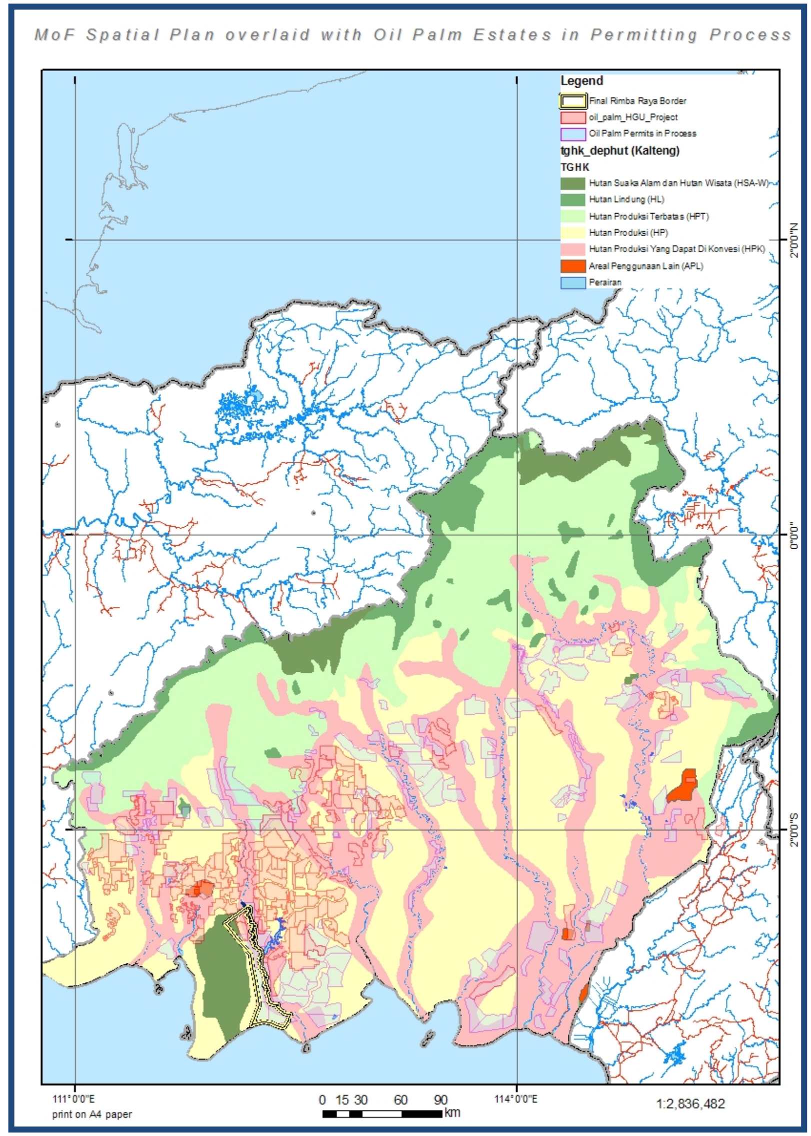

Figure 26. Central Kalimantan spatial plan (TGHK) and overlap with oil palm estates in operation (red) and planned (blue). Production Forest is shown in yellow; conversion forest in pink.

Supporting Documentation

1. During a December 2006 public hearing on Tanjung Puting National Park and provincial government plans, the head of the Central Kalimantan Forestry Office presented a map showing the five oil palm estate borders adjacent to the park, which comprise the Rimba Raya Project Area (Figure 21).

2. The Surayan Bupati has issued location permits for all four oil palm estates. Copies of these permits were obtained for PT Eka Sawit and PT Graha Indosawit (Annex 10)

3. The Minister of Forestry has set a precedent of issuing decrees allowing the conversion of production forest and specifically issued a decree allowing the conversion of production forest in the buffer zone of TPNP for the establishment of PT Kharisma Unggu Centraultama, (Annex 10).

4. The Central Kalimantan Governor has sent a letter to the Minister requesting that the four planned four estates in the Rimba Raya Project area be changed from production forest to conversion status (No. 525/358/Ek tanggal 5 Maret 2005, copy of letter not available, but specifically mentioned in presentation by Provincial Forestry Head).

5. Response from the Minister to letter No. 525 where he is in basic agreement with the conversion but requested that the Governor swap forest areas that were formally classified for conversion to production (Annex 10).

6. In February 2009, the Joint Spatial Planning Team appointed to resolve the conflict between the 2006 Provincial Spatial Plan and the MoF spatial plan, presented their conclusions which included a recommendation that the status of Production Forest areas that already possess an '*ijin lokasi*' should be changed to Conversion Forest. This includes all four planned oil palm estates in Rimba Raya.

7. During a March 2009 field visit to Rimba Raya, a newly dug canal and road were observed connecting the PT Kharisma oil palm estate with the Seruyan River in the vicinity of Tanjung Hanua village Installing these canals is common practice in oil palm estates to provide access to the estate, and allow for drainage of the peat swamp. Such infrastructure development facilitates expansion of transportion corridors and ancillary land clearing, and its location at the southern end of the operational PT. KUCC plantation and close to a Seruyan village indicates a drive for plantation development southward from KUCC.

Baseline analysis: Landcover

In order to assess existing conditions in the project area and gain a better understanding of baseline scenario impacts, field suveys and analysis were conducted. Landcover analysis and overlay of planned palm oil concessions shows that the four remaining estates are comprised of the following land cover classes and sizes (Table 16).

Table 16. Size and land cover classification for four proposed concessions

Land Cover Classes	Borneo Eka Sawit Tangguh	Graha Indo Sawit Andal	Rimba Sawit Utama Planindo	Wahana Agrotama Makmur Perkasa	Grand Total (ha)
Peat Swamp Forest (lightly degraded)	5,718	8,302	97	4,911	**19,028**
Peat Swamp Forest Degraded (highly)	427	97	27	1,183	**1,734**
Peat Shrubland (<20% Tree Cover)	314	3,265	3,104	5,464	**12,147**
Kerangas Forest	142	0	4,494	174	**4,810**
Kerangas Open Scrub	774	328	3,959	368	**5,429**
Low, sparse vegetation cover	944	33	0	365	**1,342**
Seasonally Inundated Wetlands	924	552	0	1,228	**2,704**
TOTAL	**9,286**	**12,577**	**11,681**	**13,693**	**47,237**

Existing Conditions: Field Surveys of Peat and Biomass

Overview

Forest Carbon consultants and Orangutan Foundation International (OFI) conducted a field survey June 22 – July 4, 2009 on behalf of InfiniteEARTH to support the Rimba Raya carbon assessment. Two 8-person field teams, including experienced forest surveyors, OFI staff and local residents familiar with Rimba Raya forests conducted the first survey. A follow-on carbon survey was conducted by Ms. Leslie Bolick with a five-person field team from Orangutan Foundation International (OFI) July 17 – September 1, 2009. In the combined surveys, a total of 16,000 meters of transects were marked and surveyed with peat depth measured in 160 locations and tree biomass data recorded in 36 plots representing 9 hectares of forest. *For a complete report on the Carbon Assessment Surveys, see Annex 4.*

DBH measurements of subplot trees

Survey results indicate that despite the history of selective-hand logging in the area, forest biomass is moderately high and relatively consistent across major forest blocks in Rimba Raya.

Unexpectedly, peats were moderately deep across all survey transects. Most peat measurements exceeded the reach of the peat probe at 5 meters. Actual maximum peat depth remains unknown, but using the limits of the peat probe as actual depth, peat averages 4.47m deep over the project area based on 155 survey locations.

Measuring peat depth

All survey data were entered into an Excel spreadsheet using data quality control procedures, and provided to InfiniteEARTH, Forest Carbon and Orangutan Foundation International (OFI). These data provide the first detailed ground information on the condition and characteristics of forest and peat in Rimba Raya, which were used in carbon stock assessments and will provide information for other ecological analyses conducted by project participants.

Field Work Areas and Transect Locations

Field survey areas were distributed north to south and located to cover a broad geographic area representing forest types throughout Rimba Raya (Figure 27). Inititally, six transects were used to organize survey points, plots and subplots. Available land cover maps and satellite imagery of the area were reviewed in order to locate transects in forest across a variety of hydrologic conditions and levels of disturbance.

Field teams staged field work out of OFI monitoring posts and temporary camps near transects. Transects 1 and 2 were surveyed by combined teams at the start of the fieldwork. Following completion of these surveys, separate teams moved south to survey Transects 3 and 4 (Central Team) and Transects 5 and 6 (Southern Team). From overnight camps, teams navigated to the transect start to cut and mark the centerline.

On 4 of the original 6 transects, the transect center was used as the start point to provide an efficient means of accomplishing multi-day surveys from centrally-located camps or site access points. At these sites (T2, T3, T4, T6), transect layout proceeded in two parts: 1-1.25 km to the East and 1-1.25 km to the West. At the other sites (T1 and T5), forest conditions relative to site entry points required transect layout from the endpoints.

Northern transects 1 and 2 were located in the vicinity of Baung River and OFI's Post Sitiung. Central transects 3 and 4 were located in the interior of Rimba Raya from Muara Dua village on the Seruyan River accessed by the Sigintung River and "Tatah J". Southern transects 5 and 6 were located in Rimba Raya in the vicinity of Tanjung Rengas village on the Seruyan.

Transect and Plot Layout

The survey was designed to orient all transects east-west to facilitate accuracy and consistency in layout. All transects follow this east-west orientation except Transect 5 which follows the orientation of the relatively narrow forest patch. Transects were 2.0 - 2.25 km in length oriented on a bearing of 90° - 270°. Transect 5 was oriented on a bearing of 310° - 130° to traverse the existing forest patch. Transect centerlines were marked every 10 meters with poles and flagging which provided orientation for survey plots.

Along the transects, tree counts for volume estimates were recorded every 50 meters and peat depth was measured every 100 meters. Biomass plots 250m x 10m (¼ hectare), were located at 250 meter intervals on the transect. Tree diameter, tree height and tree canopy measurements were recorded in biomass plots for large trees (> 20 cm dbh) across the entire plot and within two nested subplots (50 x 10m) for small trees (10-20 cm dbh). A total of 12.75 km of transect were surveyed including 131 sample locations for peat depth, 262 sample locations for tree volume and 28 biomass plots representing 7 hectares of detailed tree surveys.

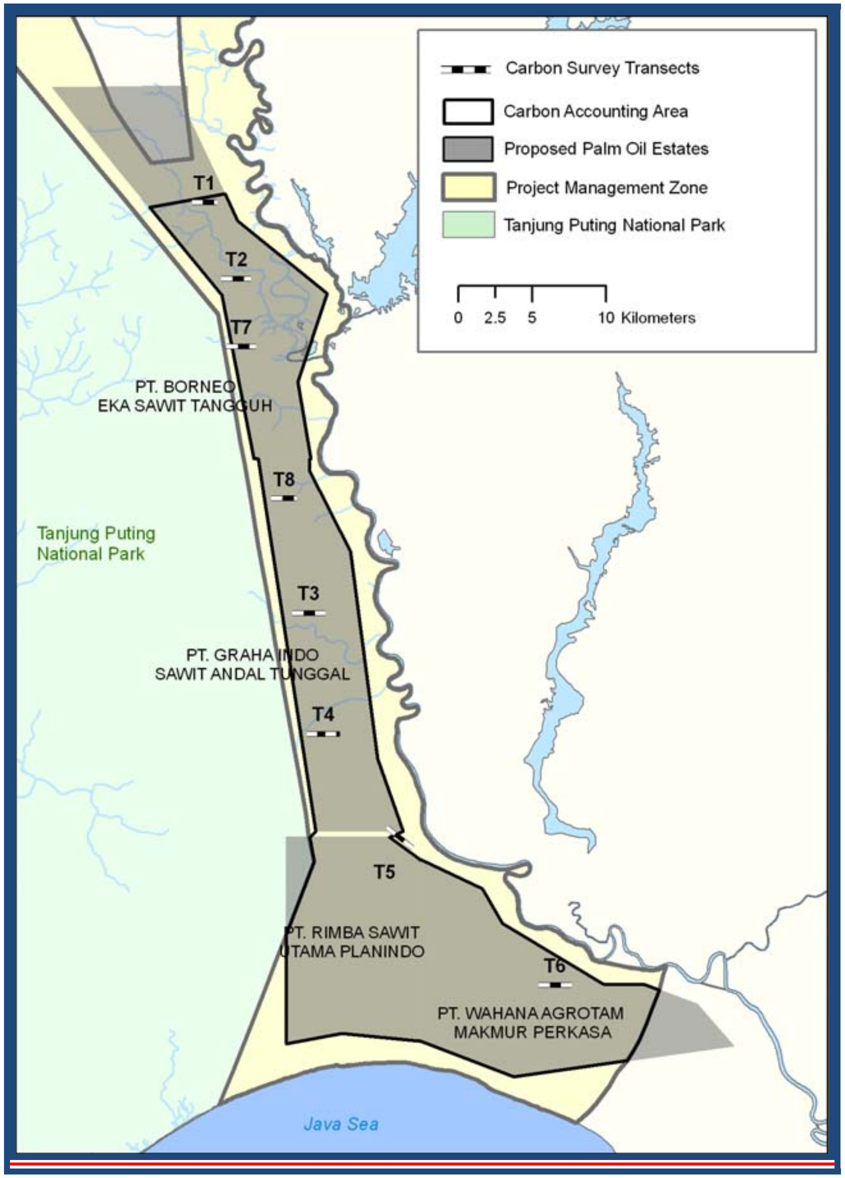

Figure 27. Map showing location of carbon survey transects (total length 16 km) used for peat depth and ground-based tree biomass assessments. These plots are permanently fixed and marked in situ.

Ms. Leslie Bolick, in partnership with Dr. Biruté Galdikas and Dr. Suwido Limin and with the assistance of Orangutan Foundation International (OFI) field staff, conducted a second carbon survey in the proposed Rimba Raya restoration concession July 17 – September 1, 2009.

The survey was conducted following protocols used in the carbon assessment fieldwork carried out by Forest Carbon Consultants and Orangutan Foundation International for Infinite Earth June 22 – July 4, 2009. The objective of the new survey (transects T7 and T8) was to augment the original dataset (transects T1-T6) by targeting previously unsurveyed areas in Rimba Raya's core forest.

New transects T7 and T8 were located to better represent the central northern interior of Rimba Raya where the largest and most inaccessible forest blocks are located. Transect T7 was located in an area that appeared to be a different forest type based on visual interpretation of satellite imagery. Transect T8 was located in an area that appeared to be dense swamp forest at some distance from logging rails which are prevalent throughout the study area. Together, these eight transects provide a broadly distributed representation of forest in Rimba Raya's Carbon Accounting Area.

Palm Oil Canal Depth Survey

A field survey was conducted in order to assess the canal depth and drainage practices of the KUCC oil palm estate. Drainage depth is an important component in the methodology for the purpose of calculating the baseline.

The KUCC concession lies at the northern extent of Rimba Raya and is situated approximately 10-20 meters higher in elevation than the project area. Topography grades east to the Seruyan River and south to the deep peats of Rimba Raya's carbon accounting area. In low-lying areas, especially along rivers draining to the Seruyan, a network of drainage canals has been cut through peat swamps where oil palm has been planted. These areas were the focus of the field survey aimed at systematically measuring drainage canal depths.

Survey target locations were established by interpreting peat drainage areas on 10-meter resolution SPOT5 satellite imagery. Seventy-five target locations were identified, entered into Garmin GeoXT GPS units and mapped on hardcopy field maps. Two two-person survey teams spent five days during August 9-18 traversing plantation roads on motorbike to reach target locations. Some target locations were situated in a mosaic of high ground areas (non-peat) and some were unreachable, as newly cut roads could not be accessed. Areas of newly cut peat that had not yet been planted in oil palm were excluded from the survey.

A total of 50 locations distributed throughout KUCC peatlands were surveyed. Teams used centimeter measuring tapes and wooden stakes to measure canal depth below-water and above-water to the natural land grade. Team members divided tasks of measuring water depth, siting land grade and recording measurements in a field notebook. Care was taken to accurately site original land grade, which was often situated below road grade by at least 0.5 meters so that canal depths were not over-estimated.

Measuring primary drainage canal depth

Results showed that canal depth in the KUCC peatland areas already planted in oil palm were 1.44 meters averaging all primary, secondary and tertiary drainages. The four primary drainages measured were all >2 meters deep (average 2.23 meters). These data exclude newly opened areas of deeper peat, which had not yet been planted in oil palm. Three of these areas were visited during an initial survey, and new drainage canals were measured at >3 meters deep (average 3.40 meters).

At KUCC, canal depths of 1.4 to 3.4 meters are necessary to sufficiently lower the water table for planting and maintaining young oil palm. To the south, in Rimba Raya, it is expected that drainage requirements could exceed those of KUCC given that there is no high ground and all deep peats, measured at >4 meters throughout the project zone as documented in the carbon assessment survey.

Given the deep peat and the correspondingly deep drainage canals, it can reasonably be extrapolated that peat subsidence would exceed 1.5 meters (in the without-project scenario) based on the calculations for subsidence within the methodology. However, the methodology, as it is currently written, places a maximum cap of 1-meter subsidence, regardless of on-the-ground conditions at the project site. The survey, nonetheless, serves to provide empirical evidence that the baseline calculations are conservative by a margin of perhaps 50% and that the full 1-meter subsidence allowance in the methodology should be used in the case of the Rimba Raya carbon accounting area.

Given the deep peat and the correspondingly deep drainage canals, it can reasonably be extrapolated that peat subsidence would exceed 1.5 meters (in the without project scenario) based on the general calculations for subsidence within the methodology and based on other scientific data readily available.

However, the methodology, as it is currently written, places a maximum cap of 1-meter subsidence, regardless of actual conditions in the project site.

The survey, nonetheless, serves to validate with solid imperical evidence that the baseline calculations are conservative by a margin of perhaps 50% and that the full 1-meter subsidence allowance in the methodology should be used in the case of the Rimba Raya carbon accounting area.

Measuring secondary drainage canal depth

Identification of Baseline Scenario using CDM Tool

Project proponents must provide documentation and supporting data that leads toward the conclusion that emissions reductions from this project are, in fact, additional to what would have happened otherwise. This section uses the latest approved VCS version of the CDM additionality tool[10] as a guide to clearly demonstrate that the reductions in emissions resulting from this project are additional to the most likely business-as-usual scenario.

[10] Approved VCS Tool VT0001 Version 1.0 "*Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities*"

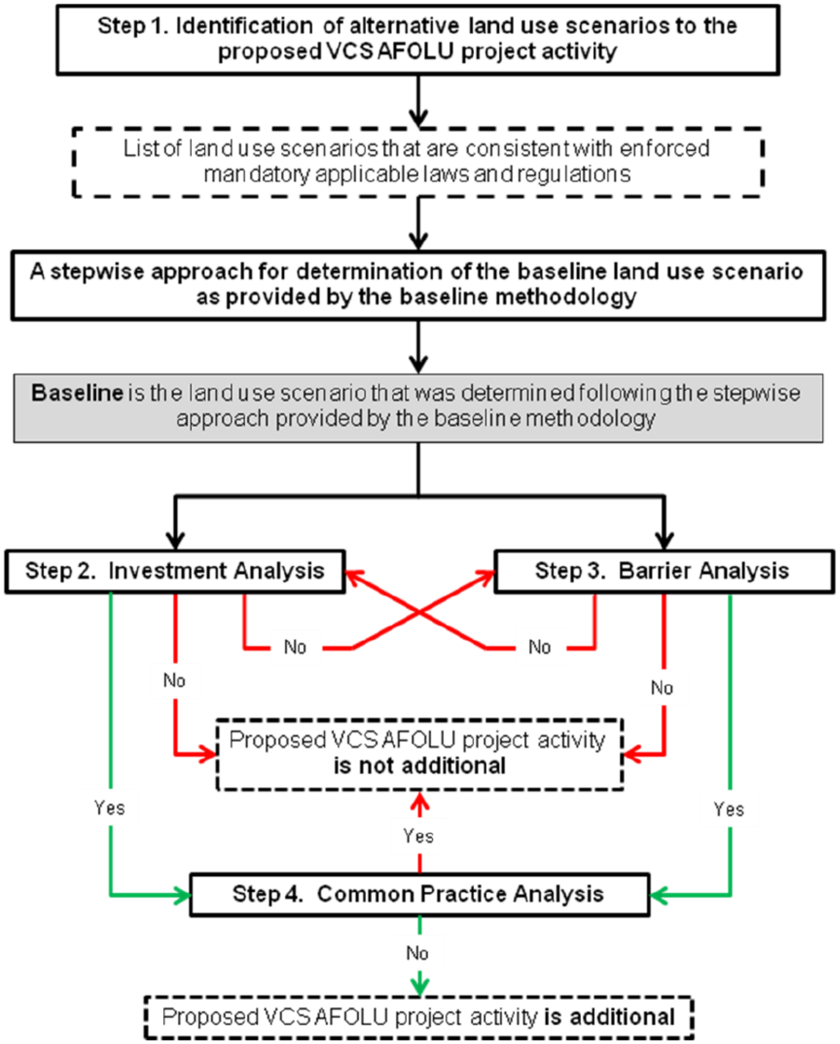

Figure 28. Step-wise approach toward determining project additionality

Step 0: Preliminary Screening Based on Starting Date

The project starting date is 2008; thus, it meets the criteria for VCS that projects have to start after 2002.

Step 1: Identification of Alternative Land Use Scenarios

Sub-step 1a: Identify of Alternative Land Use Scenarios

Six potential land use scenarios were identified in addition to the proposed project activity and are listed below:

1. **Conversion to palm oil estates:** The project lands are zoned on provincial and district spatial plans for conversion and the acquisition process for obtaining four oil palm estate licenses has begun for the project site.
2. **Conversion to pulp plantations:** Indonesia's two largest pulp and paper companies, APP and APRIL over the last several years have been expanding their holdings into Kalimantan. Large, industrial pulp plantations are consistent with the provincial government's strategy to provide sustained tax and employment benefits.
3. **Conversion to agriculture:** Project site is deforested and industrial scale planting of crops takes place (e.g. rice, pineapple, aloe vera, etc.).
4. **Status Quo:** Project site remains zoned as production forest with continued illegal logging taking place.
5. **Protection in the absence of carbon financing:** The project site is added into Tanjung Puting NP or gains protection under a different status.
6. **Conservation/protection with carbon financing:** project site is conserved as intact peat swamp forest with funding

from carbon financing. Illegal logging no longer significant.

Sub-step 1b: Consistency of credible land use scenarios with enforced mandatory laws and regulations.

The first criteria in the step-wise test of additionality is to examine whether each alternative is consistent with the enforced applicable laws and regulations at the appropriate levels of government.

Alternative 1 above is currently not consistent with the legislated MoF National Spatial Plan that shows the project site as "Production Forest", which cannot be converted to agricultural use without the Ministry of Forestry's approval and release. However, throughout Indonesia, the vast majority of conversions have been authorized at the local and provincial levels and the 2006 provincial and district land-use plans allocate the project site for conversion (Figure 21). Both plans are currently going through a harmonization process at the national level (*process padustrasi*). There is ample evidence that the Minister has approved the conversion of "production forests" to oil palm concessions.

Additionally, the Wetlands International Peat Atlas for Indonesia suggests that the Rimba Raya area is situated on shallow peats, mostly less than two meters deep. Therefore, the Presidential Decree classifying peat swamps over three meters deep as protection forest has not and would not be in effect[11]. In summary, alternatives 1 – 3 would be in compliance with applicable laws and regulations and in particular with common historical practice.

[11] Presidential Decree 32/1990

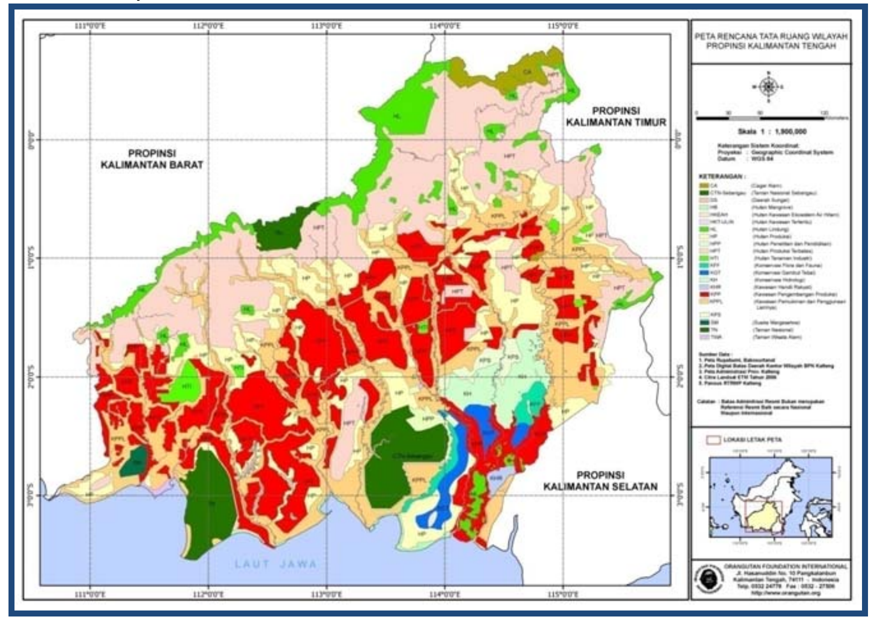

Figure 29. 2006 Provincial Land-Use Plan showing all of Rimba Raya as gazetted for conversion (red).

Alternative scenario 4 is in full compliance with current laws and regulations, the status quo being that at the national level, the area could continue to be logged and the status quo at the local and provincial level that the area could be logged initially, prior to clearing for palm oil.

Alternatives 5 and 6 would require that the current spatial plans and the draft plans be changed from production forestry to a conservation status. Indonesia has a poor record of being able to defend its National Parks. Tanjung Puting, in particular, has suffered at the lands of commercial scale illegal logging and the deforestation agent has encroached into the park boundaries by illegally expanding their concessions beyond their borders.

Another method consistent with the laws and regulations for conserving the forest in the project site is to apply for a Restoration Ecosystem Concession (IUPHHK) to the Minister of Forestry. This type of concession is designed for production forest lands that have been repeatedly logged, but still possess significant conservation values. In fact, the project proponent has solicited the MoF for such a concession[12].

Sub-step 1c: Selection of baseline scenario

From the assessment above, **all six scenarios are feasible** under the relevant Indonesian laws and regulations.

Step 2: Investment Analysis

Conducted barriers analysis instead, as allowed in "*Approved VCS Tool VT0001 Version 1.0: "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities"*

"Barrier analysis maybe performed instead of or as an extension of investment analysis" (pg 6).

Step 3: Barrier analysis

Barriers can take various forms such as institutional, technological, ecological, cultural, and sociological. This section identifies if barriers are in place and what type of barrier it is for each alternative scenario.

[12] Proposal available upon request to Infinite Earth

Sub-step 3a. Identify barriers that would prevent the implementation of the type of proposed project activity

Sub-step 3a. Show that the identified barriers would not prevent the implementation of at least one of the alternative land use scenarios (except the proposed project activity):

For superior clarity, sub-steps 3a & 3b are best reviewed jointly. Both criteria have been applied to each barrier identified.

Barriers to Alternative Scenario #1 (conversion to palm oil plantations)

There are no barriers to alternative scenario #1. Rather, there are several incentives for this land use scenario, all of which would prevent the implementation of the proposed project activities, summarized below:

- Indonesia is the world's largest producer of palm oil, with Malaysia close behind it. Together they account for 87 percent of global production[13]. Indonesia's palm oil production has been steadily growing, primarily for export. In 2006, of the estimated 14-16 million tons produced, some 11 million tons were exported, according to the Indonesian Palm Oil Producers Association (Gapki)[14]. An estimated 19.5 million tons of palm oil are expected to be produced in Indonesia in 2009[15].

[13] US Department of Agriculture Commodity Intelligence Report, 31 December 2007.
[14] Indonesia's palm oil production expected to rise in 2006. Xinhua, 06 March, 2006
[15] The Jakarta Post, Feb. 13, 2009. Government to allow peatland plantations.

- Indonesia currently has an estimated 5.5 million hectares of palm oil plantations, and the area under cultivation through the development of an additional 6.1 million hectares in Kalimantan, Papua and other provinces[16]. Table 17 lists the amount of land available for oil palm by province with Central Kalimantan possessing the third most extensive area.

Table 17. Extent of area (ha) suitable for the development of oil palm (source: Hasibuan 2006).

Province	Area (ha)
Nanggroe Aceh Darussalam	384,871
North Sumatera	37,000
West Sumatera	355,814
Riau	2,563,156
Jambi	1,818,118
South Sumatera	1,483,959
Bangka Belitung	593,038
Bengkulu	208,794
Lampung	336,872
Banten	63,742
West Jawa	224,708
West Kalimantan	1,681,186
Central Kalimantan	3,610,819
South Kalimantan	1,162,959
East Kalimantan	4,700,333
Central Sulawesi	256,238
South Sulawesi	192,370
Southeast Sulawesi	10,264
Papua	6,331,128
TOTAL	26,015,372

- While about three quarters of Indonesia's production comes from Sumatra, the provinces with the greatest potential for continued growth are Kalimantan and Irian Jaya, due to the relative availability of land for conversion to plantations. According to the Indonesian Chamber of Commerce, in 2006 East and Central Kalimantan together accounted for over 30 percent of the remaining land area in Indonesia suitable for conversion to oil palm plantations10. This has resulted in an increasing area within Central Kalimantan that supports industrial oil palm, going from no formal plantations in 1967 to 200-300,000 ha of planted area in 2002. The Indonesian Chamber of Commerce reports that palm oil area in Central Kalimantan grew from 240,000 hectares in 2003 to nearly 270,000 hectares in 2005.
- In July 2008, the Central Kalimantan government reported 2,847,720 ha of proposed oil palm plantations in the region, by 186 companies, with investments on the order of US$25M planned[17]
- Specifically, regarding the Rimba Raya site, the only technical/financial barrier that could exist is the lack of a CPO processing facility nearby. However, a processing plant is now under construction at the district capital of Kuala Pembuang less than 20 km away.

Barriers to Alternative Scenario #2 (conversion to pulp/paper plantation)

The barriers analysis applied to oil palm is also relevant for establishing a pulp and paper tree plantation. As already mentioned, over the last several years, there has been a rapid expansion of the holdings of the two largest Indonesian pulp and paper companies. APP purchased PT Finnantara and PT Surya Hutani Jaya II, a 180,000ha pulp tree plantation in East

[16] Guerin, B. A who's who of Indonesian biofuel. Asian Times, 22 May 2007.

[17] http://www.kalteng.go.id/INDO/Kebun_investor.htm

Kalimantan. APRIL acquired PT Adindo, a 219,000 ha plantation in East Kalimantan. The most common species planted on peat swamps for production of pulp is *Acacia crassicarpa*.

One barrier that a pulp company would have to overcome is with transporting the logs or chips to a pulp mill, the closest being located in Banjarmasin in South Kalimantan, 300 km away. Currently, there isn't a road system that connects the Rimba Raya area with the main road to Banjarmasin. However, one possible solution would be to use barges towed up the Seruyan River with the logs being chipped at the log pond. From the log pond, the chips could be shipped by barge to the pulp mill.

There are institutional barriers to this scenario. The northern section of Rimba Raya already has an active oil palm estate and the remaining area has permits that recognize their preliminary borders. Therefore, there would be an institutional barrier in place, given the provisional commitment from local government to the oil palm developers. Additionally, pulp plantations haven't been established in this area and are not the prevailing practice.

This barrier would have prevented the proposed project activities.

Barriers to Alternative Scenario #3 (conversion to agriculture that is not palm oil):
There appear to be barriers due to local ecological conditions: The project area is not suitable for agricultural development other than palm oil due to its presence on peat. The failed Mega Rice Project was halted in the late 1990s in Central Kalimantan after it was drained due to the realization that areas of deep peat were unsuitable for agriculture other than palm oil.

Barriers due to prevailing practice: growing crops other than palm oil is not a common land use within the project region.

Barriers to Alternative Scenario #4 (Status Quo)
There appear to be institutional barriers: Though the project land was zoned as production forest in the past, in 2006 individual permits were issued by the district governments to develop at least 4 palm oil concessions in the project area. One concession is already active. Central Kalimantan's 2006 Spatial Plan (RTRWP), currently undergoing approval by the Indonesian government, shows the entire carbon accounting boundary area zoned for agricultural development, thereby supporting the notion that the project region was re-designated from production forest to development land, likely because much of the valuable timber in the region has already been extracted. Therefore, continued classification as production forest faces institutional barriers because local and provincial government plans seek to convert the forest.

This barrier would have prevented the proposed project activities.

Barriers to Alternative Scenario #5 (conservation in the absence of carbon financing):
There appear to be institutional barriers: the conservation forest scenario faces institutional barriers because conserving this area would go against the ground swell of government support for increased oil palm tax and employment benefits. Additionally, given Indonesia's government debt and budget restrictions, allocating additional funds to protect this area and without the support of provincial authorities would be exceptionally difficult.

Barriers to Alternative Scenario #6 (proposed project activity):
Investment barriers: There is currently no formal national or international capital market for this type of activity. A key intent of the project is to demonstrate the viability of harnessing carbon finance for the purpose of strengthening the case for conservation.

Institutional barriers: The project activity faces no institutional barriers given that Indonesia has taken a leadership position in the development of a regulatory framework to support REDD.
Barriers due to prevailing practice: No project activity of this type is currently operational in the region.

Technological barriers: Fire is the most significant threat to the project area. The project proponent's partner, OFI, has had a long history in providing for forest conservation protection inside Tanjung Puting National Park around Camp Leakey including the construction and staffing of 20 permanent guard posts.

Sub-step 3b. Elimination of land use scenarios that are prevented by the identified barriers

The land use scenarios identified in Sub-step 1b that are prevented by at least one of the barriers listed in Sub-step 2a include:

Scenario #2: Conversion to pulp plantations

Scenario #3: Conversion to agriculture

Scenario #4: Status Quo

Scenario #5: Conservation in the absence of carbon financing

Scenario #6: Conservation with carbon financing (proposed project activity)

Thus the only remaining plausible land use scenario is: **Scenario #1: Conversion to oil palm plantations**

Sub-step 3c. Determination of baseline scenario (if allowed by the barrier analysis)

The decision tree under Sub-step 2c in the combined tool was applied:

- Is forest protection without being registered as a voluntary project activity included in the list of land use scenarios that are not prevented by any barrier? Decision: **No**

- If no, then: Does the list contain only one land use scenario? Decision: **YES**

- If yes, then **the remaining land-use (Conversion to Palm Oil) is the baseline scenario**.

STEP 4: Common practice analysis

Conservation activities such as Rimba Raya are not common in the region. One other conservation project, the Mawas Conservation Project, is carrying out conservation activities in southeastern Central Kalimantan, but this project is not fully operational due to implementation challenges. Although the investment analysis was not necessary to determine the most likely baseline scenario, additional evidence demonstrating that the project lands are under threat of conversion to plantations is summarized below. It should be noted that government documents are not publically available. While copies of some permits were obtained, it wasn't possible to get copies of all outstanding permits in the Rimba Raya area.

Supporting Documentation

1. During a public hearing on TPNP and provincial government plans, the head of the Central Kalimantan Forestry Office in a presentation made in December of 2006, presented a map showing the oil palm estate borders.

2. Additional Supporting Government Documents (Annex 4)
    a. In 2004 The Surayan Bupati has issued location permits for all 4 oil estates with copies being obtained for PT EkaSawit

    b. On January 18, 2005 The Central Kalimantan Governor has sent a letter (522.2/073/EK) as a follow up to (525 not in our possession) to the Minister of Forestry requesting that the planned four other estates in the Rimba Raya area be changed from production forest to conversion status

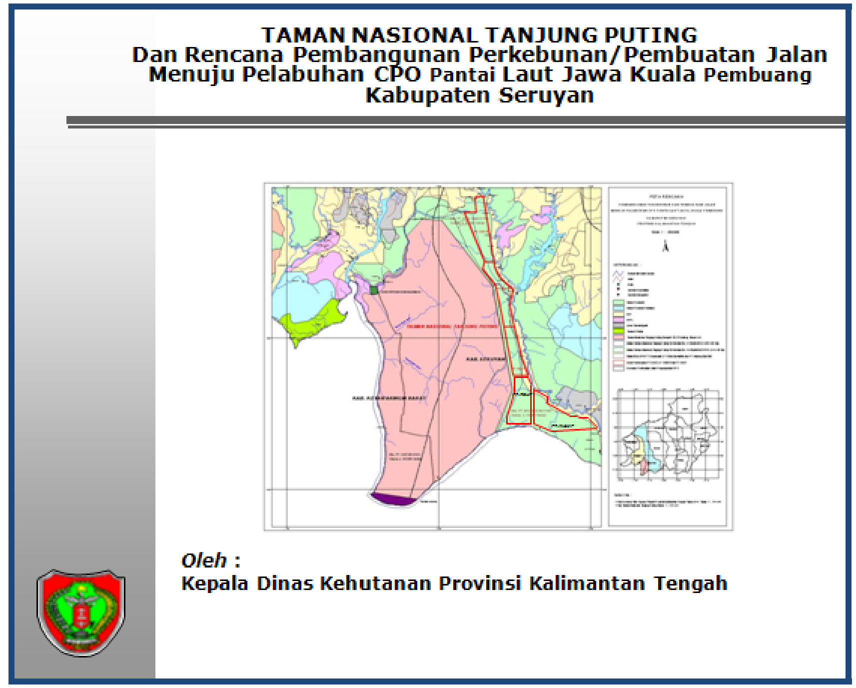

Figure 30. Map of TPNP (in pink) and planned oil palm estates (red outline) presented by Provincial Forestry Office Head.

    c. On May 13, 2005 the Minister in response to letter No. 525(July 2004) from the Governor that he is in basic agreement with the conversion but request the Governor to swap forest areas that were formally classified for conversion to production

    d. In 2006 the Minister of Forestry has set a precedent of issuing decrees allowing the conversion of production forest and specifically issued a decree allowing the conversion of production forest in the buffer zone of TPNP for the establishment of PT Kharisma Unggu Centraultama,

3. In February 2009, the Joint Spatial Planning Team appointed to resolve the conflict between the 2006 Provincial Spatial Plan and the MoF spatial plan presented their conclusions, which included a recommendation that for Production Forest areas that already possess an '*ijinlokasi*' the status should be changed to Conversion Forest. This includes all four planned oil estates in Rimba Raya.

1. During a recent field trip to Rimba Raya, a newly dug canal and road was observed connecting the PT Kharisma oil palm estate with the Seruyan River. Installing these canals is common practice in oil palm estates to provide access to the estate, and allow for drainage of the peat swamp, and undoubtedly more will be dug further south.

Figure 31. Photograph of recently dug canal and road from Seruyan River to PT Kharisma oil palm estate (coordinates: 2.68 degrees South, 112.204 degrees East)

G2.2. Documentation of Project 'Additionality'

This section documents that project benefits would not have occurred in the absence of the project, explains how existing laws or regulations would likely affect land use and justifies that project benefits are truly 'additional' and would be unlikely to occur without the project.

The basis for "additionality" in the project area is "Avoiding Planned Deforestation" where government land-use planning policy specifically targets the project zone for conversion from a "forest" classification to a "non-forest classification for industrial agriculture exploitation" (principally oil palm).

Under the VCS *Guidelines for AFOLU Projects*, "Planned Deforestation" can encompass a wide variety of activities such as: national resettlement programs from non-forested to forested regions; plans to convert well-managed community-owned forests to other non-forest uses; planned forest conversion for urban, rural, and infrastructure development; and in the case applicable to Rimba Raya, ***national land plans to reduce the forest estate and convert it to industrial-scale production of commodities such as soybeans, pulpwood12, and oil palm***. Other forms of planned deforestation could include decisions by individual landowners or community groups, whose land is legally zoned for agriculture, to convert their forest(s) to crop production or biofuel plantations. According to the VCS-Guidance for AFOLU Projects, these ***planned deforestation activities would be outlined in land planning or management documents, and could therefore be readily verified under the VCS***. Such is the case for Rimba Raya.

In Rimba Raya, the majority of the project zone (total project management area) has been proposed by the provincial government to be gazetted for conversion to non-forest agricultural industrial estates. In response, oil palm concessionaires applied for and were granted 5 concession areas, which comprise the entire project area (carbon accounting area) by the local regency and the Provincial government.

<u>Overview: The Threat of Palm Oil to Indonesian Forests</u>

To provide the appropriate context for a discussion of project 'additionality', it is useful first to review the relationship between oil palm development and forest management at the national, provincial and local levels.

Indonesia is the world's largest producer of crude palm oil (19.5 million tons per year) and production is centered in Central Kalimantan, which has the world's highest rate of deforestation (3.5-5% forest loss per year).

National Perspective.

Indonesia is currently the world's largest crude palm oil (CPO) producer, and the country is expected to produce 19.5 million tons this year. The Agriculture Ministry has stated that oil palm is the country's main driver of economic growth, indicating that it intends to issue a decree this year opening millions of additional hectares of peatland for oil palm development (Simamora 2009b).

At the same time, Indonesia has an average annual rate of deforestation of 2%, one of the highest in the world, with Central Kalimantan deforestation rates that are double national figures and top global rates at 3.5-5%. Oil palm companies prefer to establish plantations on forested land, first logging valuable timber, and then using logging revenues to fund their operations.

Often, companies will exploit discrepancies in the land classification and permitting processes between national and local governments to obtain additional land. A recent study by Greenomics Indonesia showed that about 18.4 million hectares of forest concession areas had been occupied illegally, mostly by plantation and mining companies that were granted permits by regents (Simamora 2008). The study warned that deforestation would increase if the government failed to resolve overlapping permits from government agencies.

Provincial Perspective. The relationship between oil palm plantation development and deforestation is having devastating effects on natural resources at the provincial level. According to a study by Forest Watch Indonesia last year, Central Kalimantan's forests are being converted into oil palm plantations at the fastest rate in the country. In a recent 16-year period, the rate of forest to plantation conversion surged more than 400 times, from 1,163 hectares per year in 1991 to 461,992 hectares per year in 2007 (Simamora, 2009a). The study also found that 14 percent of 3 million hectares of peat land in the province had already been converted to oil palm plantations (Simamora 2009a). This represented a 5.42% annual loss of peatland forests between 2002 and 2005 (Langner et al. 2006).

Taken together, these statistics paint a grim picture of the reality on the ground. Still more worrying is the sense that these trends are accelerating. The Ministry of Forestry indicated recently that it has received a mounting number of requests from local administrations for permits to convert Indonesia's dwindling forests into plantations, mostly due to uncertainty surrounding the spatial planning law (Simamora, 2009a).

Ministry senior official Soenaryo said the most controversial proposal had come from Central Kalimantan despite conflict with the spatial planning law. Central Kalimantan has asked to convert about 2.5 million hectares of forest. “We know Central Kalimantan has violated the law, but they justify their demand for the central government's approval for the forest conversion under a regional ordinance and other regulations,” he said (Simamora, 2009a)

In Central Kalimantan 461,992 hectares of forest were converted to plantation in 2007 - a rate 400 times greater than forest to plantation conversion in 1991 (Simamora 2009a).

A recent study found that the annual deforestation rate for peat soil areas of Central Kalimantan between 2002 and 2005 was 5.42% (Langner et al. 2006).

Protected areas are not exempt from this assault, as they contain some of the most highly valuable timber resources still remaining, making them a target for exploitation. Although protection laws are in place throughout Borneo, these are often inadequate or unenforced. One satellite study shows that more than 56 percent (>29,000 km^2) of *protected* lowland forests in Kalimantan were cut down between 1985 and 2001 (Curran et al. 2004).

Focusing on one protected area, Gunung Palung National Park, West Kalimantan, the study shows that 38 percent of lowlands inside the park, and more than 70 percent of lowlands in the surrounding 10-km park buffer were deforested from 1988 to 2002. Furthermore, deforestation inside the park rapidly accelerated after forests in the park buffer were lost (9.5% annual rate of deforesation after 1999).

In the Gunung Palung park buffer, after valuable timber was removed, forests were clear-felled for conversion to oil palm plantation (concessions and plantations comprise 70% of the park buffer). This pattern of conversion from abandoned logging concession to oil palm plantation is characteristic of current land change in Kalimantan.

From the 1970's, Kalimantan land use and management was dominated by the federal timber industry. However, overexploitation has caused a rapid decline in this industry (94% reduction in active federal logging concessions between 1970 and 2004) (Curran et al. 2004). Most former logging concessions, abandoned and unmanaged by the federal government are open for reclassification to agriculture and industrial use. This paves the way for oil palm plantation development through allocation of concessions by the provincial government.

The recent shift from federal to provincial land management has expanded considerably since decentralization laws were passed in 1999. While local and national governments are working to resolve inconsistency and conflict regarding land management, the process has engendered a feeling of empowerment at the level of local government that has catalyzed de facto decentralization (Rhee et al. 2004).

In Kalimantan, more than 56% of *protected* lowland forests were cut down between 1988 and 2001

In Gunung Palung National Park, West Kalimantan > 70% of the 10-km park buffer was deforested from 1988 to 2002. Loss of the park buffer caused a rapid acceleration in annual rate of deforestation (9.5% after 1999) *inside the park,* which lost 38% of its lowland forests.

In Central Kalimantan, the provincial government has proposed extensive land reclassification from federally-managed "HP" lands (*Hutan Produksi*/Production Forest) to provincially-managed "KPP" lands (Forest Conversion Land) in order to release and convert most lowland areas to oil palm plantations. Of particular concern to forest watchers is a 2-million-hectare oil palm project funded by China and supported by the Indonesian government (Simamora 2009a) that may be driving plans for rapid conversion of Central Kalimantan forest.

The official 2006 Provincial Government Land-Use Change Plan Map (Figure 29) clearly demonstrates the provincial government's intent to convert a significant portion of the province's entire land mass to palm oil. The areas in red are still classified as "Forest" by the Central government but under the provincial plan would be re-classified as "Non-Forest" Agricultural use, paving the way for their destruction and conversion to palm oil.

"Things alter for the worse spontaneously, if they be not altered for the better designedly"

- Philosopher & Statesman Sir Francis Bacon

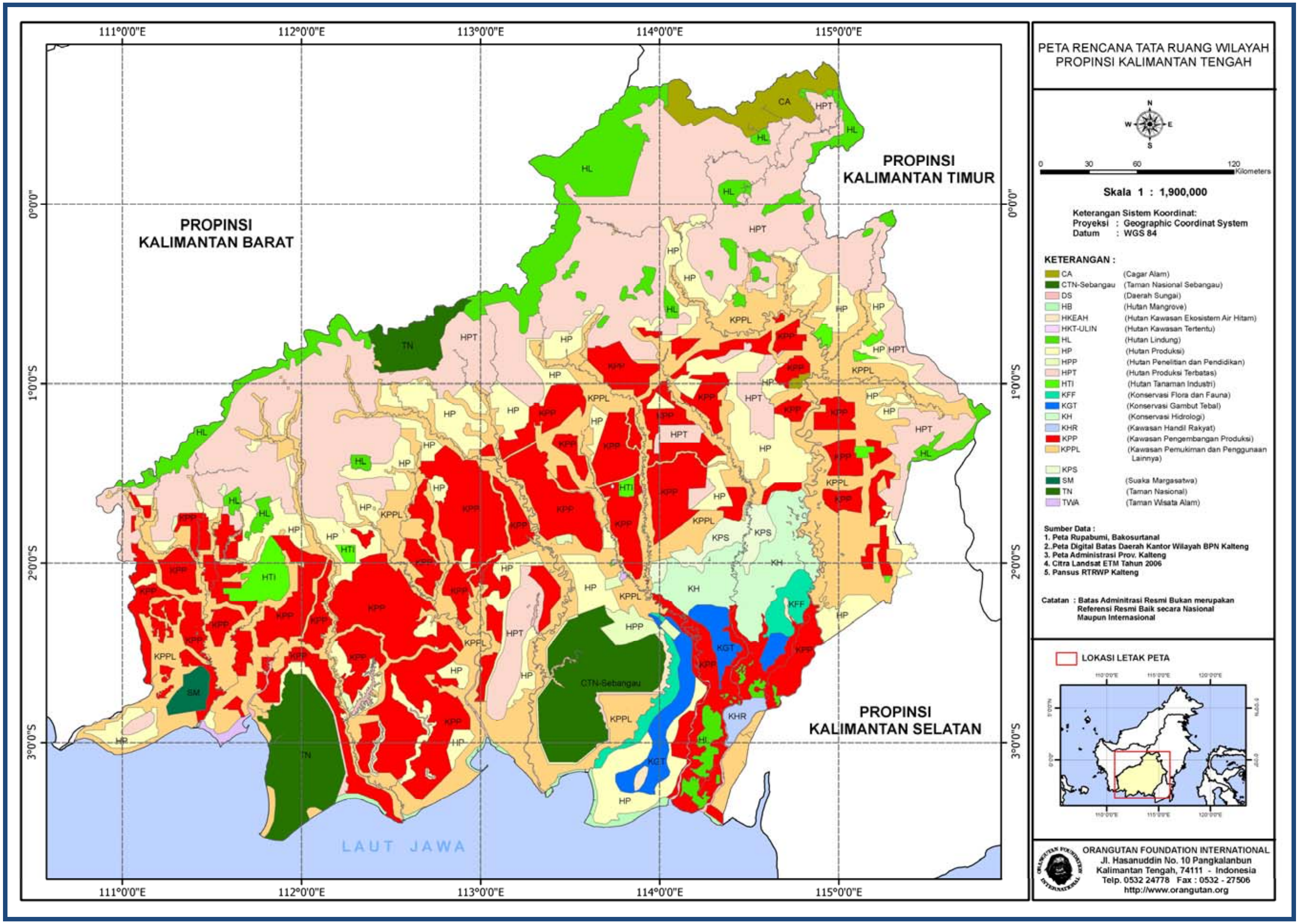

Figure 32. Provincial Government Land-Use Change Plan Map (2008) with areas in red representing lands classified as "Forests" to be gazetted for conversion to "Non-Forest" Agricultural use (Palm Oil).

Local Perspective. Tanjung Puting National Park, located near growth centers for palm oil in Central Kalimantan faces an immediate threat of deforestation and degradation from expanding plantations. Most of the forests in the surrounding region have already been logged, making the park and its forest buffer (the Rimba Raya project) particularly vulnerable to accelerated rates of deforestation.

OFI has been fighting encroachment by oil palm companies into TPNP and the surrounding buffer, including the Project Area, since 2004. A brief chronology of the major incidents in this struggle follows:

- 1990. The Government of Indonesia passes an act defining the legal status of national parks for the first time. The forest surrounding the new National Park is designated State Forest Land, later reclassified as Production Forest and subsequently worked as active logging concessions.
- 1996. The Minister of Forestry's SK No. 687/Kpts-II/1996, dated 25 October 1996, incorporates the expired logging concessions on the western side of the National Park into the newly designated Tanjung Puting National Park. The land between the eastern border of TPNP and the Seruyan River (current Project Zone) remains Production Forest.
- 2004. OFI first becomes aware of plans to establish four oil palm plantations along the eastern edge of the park (current Project Area). During a location survey of northern TPNP, they find an extension of the PT. Wanasawit plantation inside the park borders. They also discover the PT. KUCC plantation clearing land that has not yet been approved for conversion.
- February 2005. The Minster of Forestry issues letter no. S.79/Menhut-VII/2005, specifically mentioning the four palm oil companies which "overlap with TPNP and/or the area of production forest which acts as a buffer zone to the national park", indicating the concession licenses must be revoked.
- May 2005. The Minster of Forestry issues letter No. S.292/Menhut-VII/2005, stating that the northern border of TPNP will be altered, excising over 30,000 hectares from the park. In addition, the letter approves conversion of the area into the four palm oil plantations mentioned in the February letter and adds two additional concessions to the south. The letter refers to the 2003 Provincial Spatial Plan (RTRWP) for Central Kalimantan for the first time.
- Late 2005/early 2006. During fieldwork, OFI records boundary markers and cut lines made by PT. KUCC extending at least 1 km further inside the park than approved plantation borders.
- March 2006. USAID (through an IDCP grant to OFI) funds the first of a series of stakeholder meetings to discuss land use and land management in the TPNP region.
- May 2006. The Provincial legislature visits Tanjung Puting, noting that the province was preparing a new (2006) RTRWP, and would accept comments/alterations to the 2003 RTRWP.
- March 2007. Definitive boundaries for KUCC plantation are demarcated in the field and GIS data released to OFI.
- June 2008. OFI obtains Provincial Spatial Plan data (Figure 32 above) demonstrating the government's intent to modify the TPNP boundary, significantly reducing its area, and convert the eastern park buffer area to nonforest Agricultural Use for oil palm plantation development. Remote sensing and GIS analysis showed that >3000 ha of the park had already been converted to oil palm (Figure 33 below).
- November 2008. InfiniteEARTH partners with OFI to expand guard post staff and strengthen patrols in the TPNP buffer region (Rimba Raya Project Zone) to control unpermitted deforestation and pursue the Rimba Raya REDD project to prevent park buffer conversion to oil palm.

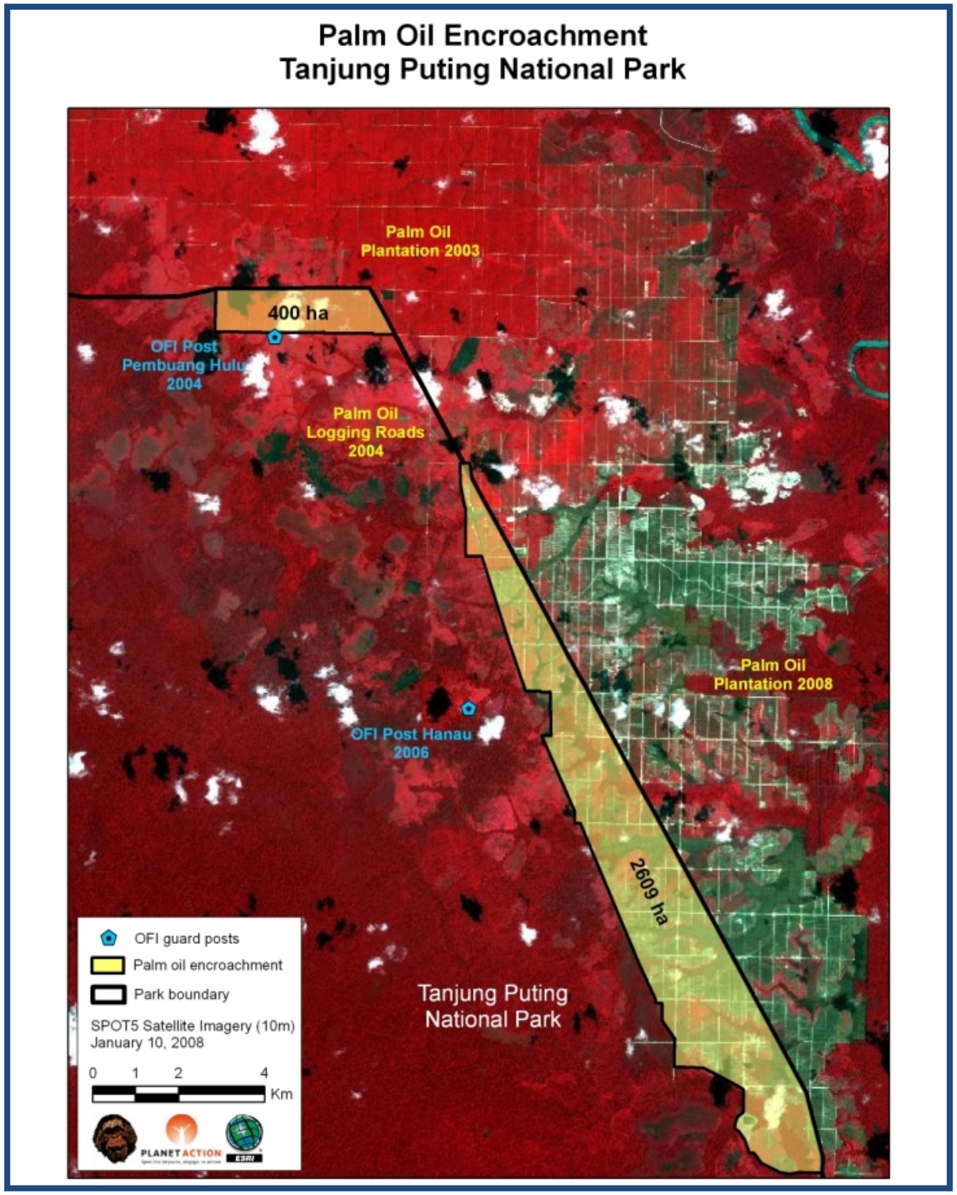

Figure 33. Palm oil encroachment on Tanjung Puting National Park, based on January 2008 SPOT5 satellite imagery.

Analysis of Regional Palm Oil Expansion Using Satellite Imagery

In order to quantify the threat of deforestation in the project region, a remote sensing and GIS analysis was conducted to assess the extent and rate of deforestation and land conversion to oil palm. For the purpose of this analysis, a study region was delineated to include ~464,000 hectares north and east of TPNP including the Rimba Raya Project Zone. Note that this analysis includes land inside and outside planned concession boundaries; concession conversion rate is presented below in Section G2.3. Interpretation and delineation of plantation boundaries was conducted using annual Landsat ETM+ image scenes (30 meter resolution) in ENVI image analysis software and ArcGIS. Results are summarized in the map (Figure 33) and Tables below.

Palm oil plantation development in the TPNP / Rimba Raya region began before 2000 (Figure 34), at which time there were approximately 61,330 ha of palm oil, representing 13.2% of the analysis study area (Table 18). By 2003, oil palm plantation area had increased slightly to 64,280 ha, representing 13.9% of the study area. After 2003, oil palm expanded significantly. In total, during the 2000 – 2008 study period, 102,518 ha of new palm oil were developed, representing a 167.2% increase over the land area of palm oil in 2000. As of 2008, there were 163,850 ha of palm oil comprising 35.3% of the study area.

Land cover rate of conversion to palm oil was not significant between 2000 and 2003. Compared to plantation extent in the previous year, there was small change in 2001 and 2003 and no change in 2002. Between 2000 and 2003, a total of 2,949 ha of new palm oil were developed representing a conversion rate of 983 ha per year (0.21% average annual rate of conversion in the study area) (Table 19).

Table 18. 2000-2008 Palm Oil Extent of Conversion in Study Area			
Year	hectares of palm oil in study area	% change in palm oil area	% of study area in palm oil
2000	61,332		**13.2%**
2003	64,280	4.8% increase in area since 2000	**13.9%**
2008	**163,850**	**167.2% increase in area since 2000**	**35.3%**

Table 19. 2000 – 2008 Palm Oil Rate of Conversion in Study Area			
Time Period	Hectares of NEW Palm Oil	Average Annual Increase in Palm Oil Area	Average annual rate of land cover conversion to palm oil
2000-2003	2,949	983 ha/yr	0.21%
2003-2008	**99,566**	**19,913 ha/yr**	**4.29%**

Between 2003 and 2008 there was rapid and extensive expansion of palm oil plantations in the study area. Between 2003 and 2007, 82,773 ha of new plantations were developed, indicating an expansion rate of 20,693 ha per year (Table 20). This represents a 21-fold increase in the annual rate of palm oil conversion compared to the 2000 – 2003 period. By 2008 another 16,796 ha of palm oil were developed. On average in the 2003 – 2008 period, palm oil developed at a rate of 19,913 ha per year (8.95% average annual rate of conversion in the study area).

These analyses suggest that Tanjung Puting and Rimba Raya are under serious threat of immediate and extensive encroachment and conversion given rapidly expanding oil palm plantations in the region.

Table 20. 2000 – 2008 Change in Plantation Extent			
Year	Hectares of Palm Oil in Study Area	Change from Previous Period	Annual Change
2000	61,332		
2001	62,648	1,316	1,316
2002	62,648	-	0
2003	64,280	1,633	1,633
2007	**147,053**	**82,773**	**20,693**
2008	**163,850**	**16,796**	**16,796**

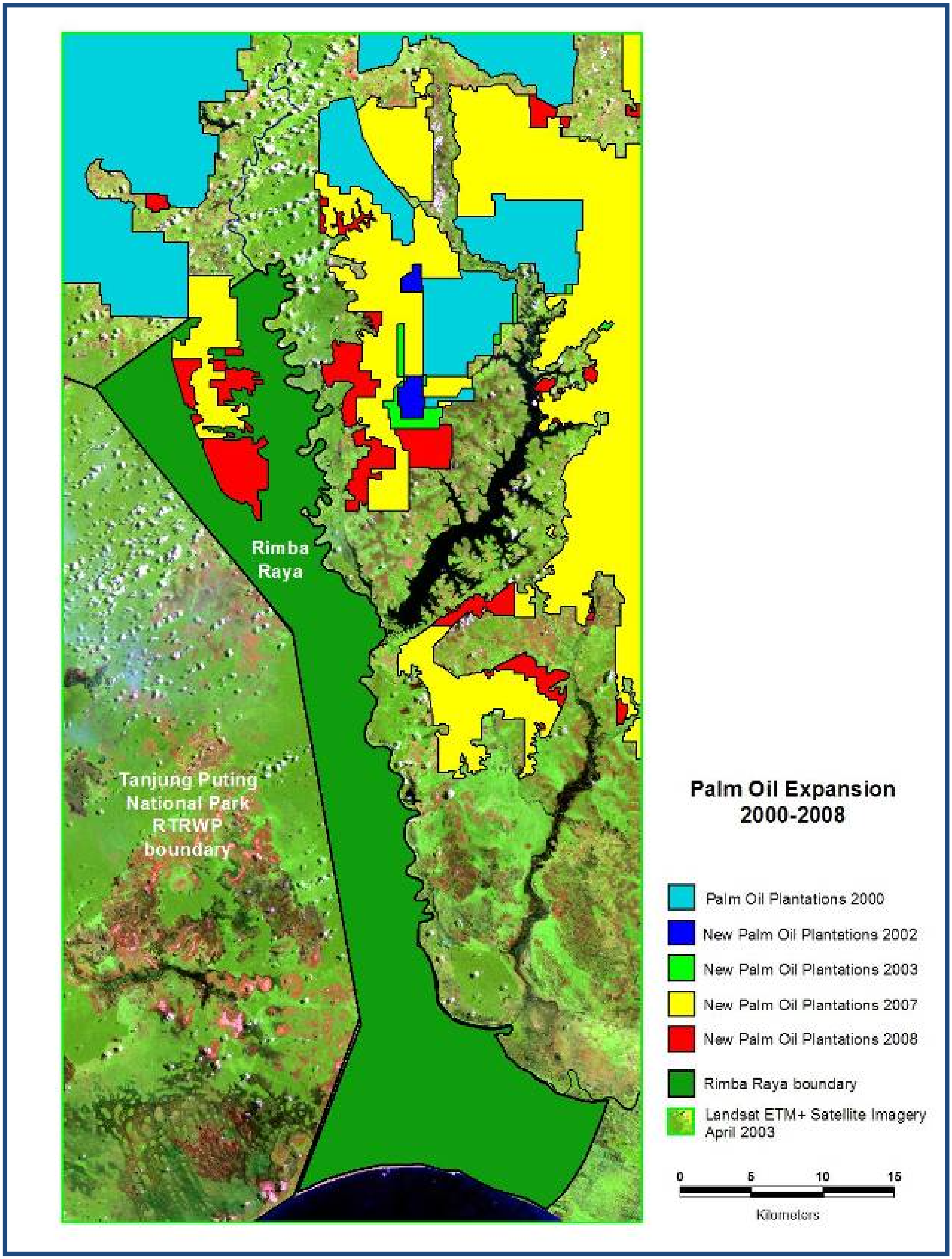

Figure 34. Expansion of Palm Oil Inside and around the Rimba Raya Project Zone.

Provincial Government Targets Rimba Raya for Conversion of Forest Lands to Oil Palm

The basis for "additionality" in the project area is "Avoiding Planned Deforestation" where government land-use planning policy specifically targets the project zone for conversion from a "forest" classification to a "non-forest classification for industrial agriculture exploitation" (principally oil palm). Under the VCS *Guidelines for AFOLU Projects*, "Planned Deforestation" can encompass a wide variety of activities such as: national resettlement programs from non-forested to forested regions; plans to convert well-managed community-owned forests to other non-forest uses; planned forest conversion for urban, rural, and infrastructure development; and in the case applicable to Rimba Raya, ***national land plans to reduce the forest estate and convert it to industrial-scale production of commodities such as soybeans, pulpwood12, and oil palm***. Other forms of planned deforestation could include decisions by individual landowners or community groups, whose land is legally zoned for agriculture, to convert their forest(s) to crop production or biofuel plantations. According to the VCS-Guidance for AFOLU Projects, these ***planned deforestation activities would be outlined in land planning or management documents, and could therefore be readily verified under the VCS***. Such is the case for Rimba Raya.

In Rimba Raya, the majority of the project zone (total project management area) has been proposed by the provincial government to be gazetted for conversion to non-forest agricultural industrial estates. In response, oil palm concessionaires applied for and were granted 5 concession areas, which comprise the entire project area (carbon accounting area) by the local regency (Bupati) and the provincial government (Governor).

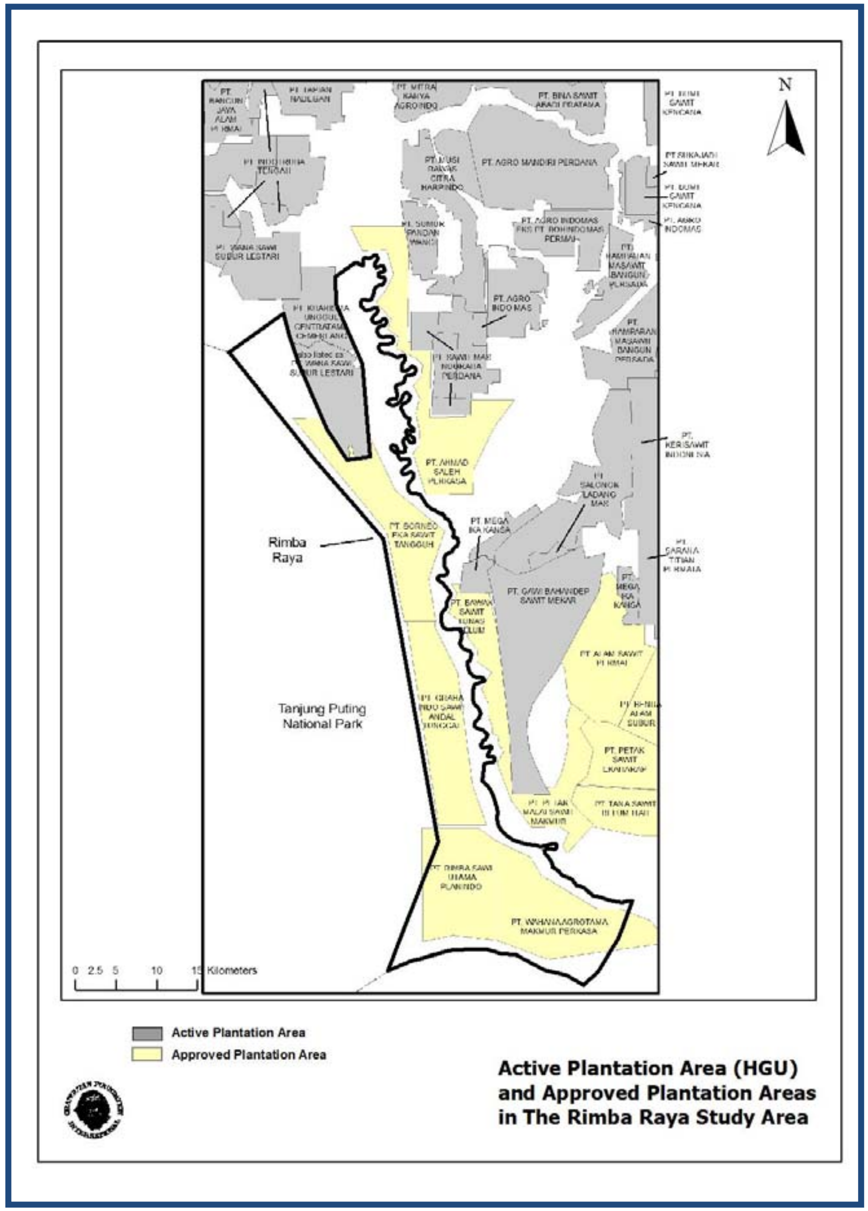

Figure 35. Map showing Project Zone boundaries with surrounding active and approved palm oil concessions.

G2.3. Estimated Carbon Stock Changes for 'Without Project' Reference Scenario

Calculate the estimated carbon stock changes associated with the 'without project' reference scenario described above. This requires estimation of carbon stocks for each of the land-use classes of concern and a definition of the carbon pools included, among the classes defined in the IPCC 2006 GL for AFOLU. The timeframe for this analysis can be either the project lifetime (see G3) or the project GHG accounting period, whichever is more appropriate. Estimate the net change in the emissions of non-CO_2 GHG emissions such as CH4 and N2O in the 'without project' scenario. Non-CO_2 gases must be included if they are likely to account for more than 5% (in terms of CO_2-equivalent) of the project's overall GHG impact over each monitoring period. Projects whose activities are designed to avoid GHG emissions (such as those reducing emissions from deforestation and forest degradation (REDD), avoiding conversion of non-forest land, or certain improved forest management projects) must include an analysis of the relevant drivers and rates of deforestation and/or degradation and a description and justification of the approaches, assumptions and data used to perform this analysis. Regional-level estimates can be used at the project's planning stage as long as there is a commitment to evaluate locally-specific carbon stocks and to develop a project-specific spatial analysis of deforestation and/or degradation using an appropriately robust and detailed carbon accounting methodology before the start of the project.

Applicability of Existing Methodology

The sections outlined below for estimating baseline CO_2e emissions follow the methodology originally developed by Winrock International for the Mawas Conservation Project and approved by VCS for application in Rimba Raya and other tropical peat swamp forests titled: ***Baseline and Monitoring Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, Version 1.0***(accessed September 30, 2010 at http://www.v-c-s.org/VM0004.html)

The Rimba Raya project meets the applicability conditions outlined in the methodology as follows:

A. The Rimba Raya project prevents land use change on tropical peat swamp forests.
B. Baseline approach (c) is the most appropriate choice for determination of the baseline scenario (changes in carbon stocks in the project boundary are calculated based on the most likely land use at the time the project starts)
C. The project avoids complete conversion of peat swamp forests to another known land use (palm oil plantations).
D. The project prevents planned land use conversion in known, discrete parcels of peatland.
E. The project avoids land use change that would be caused by corporate or governmental entities (plantation companies, national forestry departments, etc.) and not by community groups, community-based organizations, or individual households.
F. Peat drainage in the project area would not exceed 1 meter in depth.
G. Carbon stocks in dead wood and litter can be expected to further decrease (or increase less) in the absence of the project activity during the time frame that coincides with the crediting period of the project activity.
H. The parcels of peat swamp forest to be converted to another land use do not contain human settlements

(towns, villages, etc.) or human activities such as agriculture, grazing or fuelwood collection.

I. The biomass of vegetation within the project boundary at the start of the project is at steady-state or increasing due to recovery from past disturbance, and so monitoring project GHG removals by vegetation can be conservatively neglected if desired.

J. The volume of trees extracted for lumber per hectare prior to land conversion is assumed to be equivalent to the total volume (or biomass) of all trees above the minimum size class sold in the local timber market.

Baseline CO_2e emissions from planned palm oil concessions

Overview of calculations. The boundaries of the proposed oil palm plantations were used as the Carbon Accounting Area (CAA)and its area was estimated to be 47,237 ha. Because the CAA overlaps exactly with the proposed oil palm plantations additionality can be easily demonstrated for the entire CAA.
The baseline methodology outlines three main steps for estimating baseline net avoided GHG emissions:

(1) Stratification and sampling;
(2) Estimation of GHG emissions from changes in aboveground biomass; and
(3) Estimation of GHG emissions from peat; and

Stratification of the project area into land cover strata is explained in Section 4. Below, the calculations for estimating the area of conversion and greenhouse gas (GHG) emissions from changes in aboveground biomass and emissions from peat are summarized, followed by summary tables showing total emissions avoided over a 30-year life-of-project scenario. Baseline calculations for the first ten years were the focus of the analysis. These are estimates only; in the project scenario the baseline will need to be re-assessed every ten years to incorporate new data sources, policy changes, etc. and thus minimal attention should be given to the baseline estimates beyond the 10 year window.

Calculating emissions from aboveground biomass involves four components:

(1) emissions from timber;
(2) emission from burning remaining aboveground biomass;
(3) sequestration by replacement vegetation (palm oil); and
(4) emissions from harvest rotations. As palm oil plantations operate on a 25-30 year timeframe, emissions from harvest rotations were not considered in this analysis.
(5) Estimation of GHG emissions from Market Leakage, which are taken as a one-time automatic deduction against the baseline emissions for Timber Extraction.

Calculating emissions from peat involves two components: (1) emissions from drainage and (2) emissions from burning for site preparation. Calculations are summarized below and can be found in the associated Excel spreadsheet titled: **Baseline Calculations for Rimba Raya_2011.05.15_Final.xls**.

Project start date

InfiniteEARTH dates the start of project actitives from November, 2008, which is when a letter from the Bupati of the Seruyan District was signed recommending that the Rimba Raya Concession be awarded to RT Rimba Raya (see section G5.1.) and when Infinite-Earth began officially funding operations for conservation efforts in the project area. From this point forward, the remaining four palm oil concessions no longer had the authority to commence operations.

Annual Area of Conversion. To gain a transparent and conservative estimate of the annual rate of conversion expected for Rimba Raya concessions, formerly held by PT. BEST, a satellite image-based GIS analysis was conducted. Eleven of 15 existing PT BEST concession areas were examined by overlaying concession boundaries on Landsat imagery, to delineate plantation boundaries in each year from 2003 to 2009.

Three of the estates in this study were already developed by 2003 and one remained undeveloped in 2009 (Figure 36). The remaining seven estates were developed 2003-2009 (Figure 37). All concessions examined are within 100 km of the project and are located on single Landsat ETM+ scene at path-row 119-62. Image dates were: April 2003, August 2004, March 2005, May 2007, January 2008, and February 2009.

Results show that the average area under conversion during this period was 6,114 ha/year (Table 21). Inter-annual variation is due to concessions being in various stages of the 3-4 year conversion process in any given year. For example, in 2005, development on PT. Wanasawit was stalled and PT. Bangun Jaya Alam already completed, so overall plantation area increased by only 2,123 ha that year. In 2006, after obtaining licenses for 3 adjacent estates under the company name PT. Hamparan Masawit Bangun Persada, development increased dramatically to 7,948 ha/yr and peaked in 2008 at 11,569 ha/yr when all 6 estates were being planted concurrently.

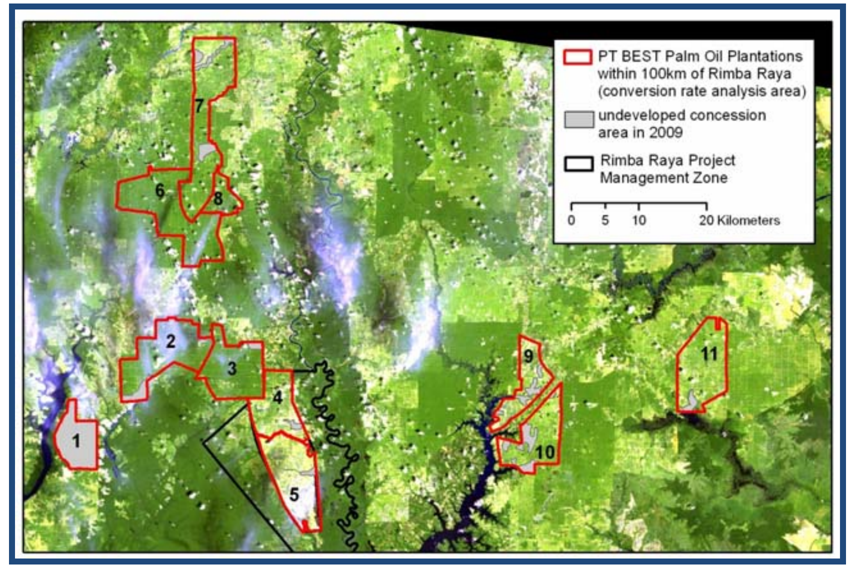

Figure 36. PT BEST palm oil plantations within 100km of Rimba Raya. These 11 concessions were analyzed for rate of conversion to plantation (See Table below for estate names).

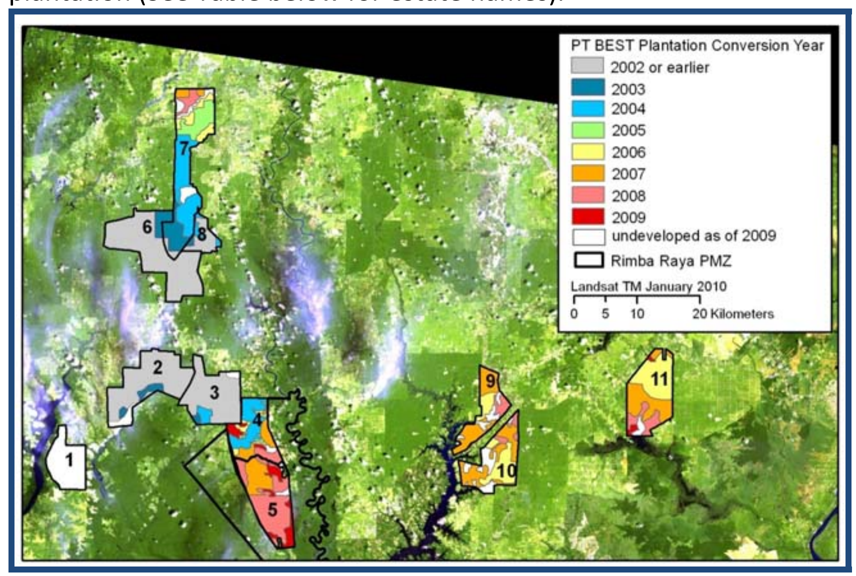

Figure 37. PT BEST plantation conversion year for 11 estates within 100km of Rimba Raya. (See Table below for estate names).

Table 21. Annual Area of Conversion by Estate											
Historical Area of New Conversion by the Baseline Agent of Deforestation											
Map #	**Estate Name**	**already converted in 2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**remaining undeveloped in 2009**	**Grand Total**
1	**PT. WANA SAWIT SUBUR LESTARI SK74 north**	0								4486.6	**4486.6**
2	**PT. WANA SAWIT SUBUR LESTARI SK74 south**	7663.9	501.3							670.4	**8835.5**
3	**PT. WANA SAWIT SUBUR LESTARI SK73**	6402.4	150.4	507.7						229.6	**7290.1**
4	**PT. WANASAWIT SUBUR LESTARI kucc north**	0		2432.2	250	486.4	1166.3	619.8	570.5	183.1	**5708.3**
5	**PT. WANASAWIT SUBUR LESTARI kucc south**	0					1866.1	4729.3	1347.6	217.6	**8160.6**
6	**PT. BANGUN JAYA ALAM PERMAI south**	10049.5	774.3								**10823.8**
7	**PT. BANGUN JAYA ALAM PERMAI north**	356.5	1595	4141	1873.6	1172.4	447.5	652		1119.6	**11357.5**
8	**PT. BANGUN JAYA ALAM PERMAI east**	1532.2	120.3	463.3							**2115.9**
9	**PT. HAMPARAN MASAWIT BANGUN PERSADA north**	0				766.1	2599.7	553		719.2	**4638.1**
10	**PT. HAMPARAN MASAWIT BANGUN PERSADA south**	0				2123.2	2577.4	526.2		1414.9	**6641.7**
11	**PT. HAMPARAN MASAWIT BANGUN PERSADA east**	0				3399.9	2912.3	1194.7	276.2	351.8	**8134.9**
Grand Total	**Total conversion by calendar year**	**26004.4**	**3141.3**	**7544.2**	**2123.6**	**7948**	**11569.2**	**8275.1**	**2194.3**		**78193**
	average conversion (ha/yr) 2003-2009										**6113.7**

By concession, 74.1% of the estate areas were developed to oil palm within the first two years, representing an average annual conversion rate of 2030.2 ha/yr in Year 1 and 2868.3 ha/yr in Year 2 (Table 22). By Year 3, these estates were 88% built out and nearly completed (94% built) by Year 4.

It is expected that former concessions comprising RimbaRaya were slated to begin focused development in 2009 as the three large concessions to the east comprising PT. Hamparan Masawit Bangun Persada, were already developed and KUCC north and south were nearing completion. (Note the other four concessions not included in this quantitative analysis are two fully developed estates 50km to the north and two undeveloped estates (with no surrounding infrastructure) 135 km to the southeast.

Table 22. Area of Conversion by Plantation Year

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	total 2009
KUCC N	2431.2	250.0	486.4	1166.3	619.8	570.5	5525.2
KUCCC S	1866.1	4729.3	1347.6	BUILT	BUILT	BUILT	7943.0
BANGUN north	1595.0	4141.0	1873.6	1172.4	447.5	652.0	10238.0
HAMP north	766.1	2599.7	553.0	BUILT	BUILT	BUILT	3918.9
HAMP south	2123.2	2577.4	526.2	BUILT	BUILT	BUILT	5226.8
HAMP east	3399.9	2912.3	1194.7	276.2	BUILT	BUILT	7783.1
Average ha/yr	2030.2	2868.3	996.9	435.8	177.9	203.8	
Average % developed	31.2%	74.1%	88.0%	94.0%	97.2%	100%	
sd	12.7	16.8	17.5	8.8	4.3	0	
se	5.2	6.8	7.1	3.6	1.8	0	
uncertainty	22	11.5	10	5.6	3.5	1.7	
lowest expected rate	18.4%	57.3%	70.6%	85.3%	92.4%	100%	

Note that proposed concessions for Rimba Raya are 75% larger than previously developed concessions (avg 11,809 ha compared to avg 6,746 ha). Rapid build-out on relatively small concessions limits conversion rate analysis based on annual area of conversion. In order to extend this analysis to future scenarios, the cumulative proportion of build-out is applied to Rimba Raya concessions, shown the table below.

Table 23. Average Percent Area Developed applied to Rimba Raya Concessions

AVERAGE						
	yr1	yr2	yr3	yr4	yr5	yr6
RR1	2884.6	6878.9	8176.9	8740.8	8984.6	9286.0
RR2	3906.9	9316.8	11074.9	11838.6	12168.7	12577.0
RR3	3628.6	8653.1	10285.9	10995.2	11301.8	11681.0
RR4	4253.6	10143.6	12057.6	12889.1	13248.5	13693.0
total	14673.7	34992.4	41595.3	44463.8	45703.6	47237.0

There is a moderate amount of variation and uncertainty associated with average annual conversion shown in 22, so to incorporate this uncertainty for a conservative estimate of development rate, the low expected average % development (18.4% in year 1, 57.3% in year 2 etc) was applied to RR concessions to quantify minimum expected rate of development shown in the following Table.

Table 24. Minimum expected Conversion Rate for Rimba Raya Concessions

LOW	yr1	yr2	yr3	yr4	yr5	yr6
RR1	1707.2	5322.3	6553.2	7923.0	8583.1	9286.0
RR2	2312.2	7208.6	8875.7	10731.0	11624.9	12577.0
RR3	2147.5	6695.0	8243.4	9966.5	10796.8	11681.0
RR4	2517.4	7848.2	9663.3	11683.2	12656.4	13693.0
total	8684.2	27074.1	33335.7	40303.8	43661.2	47237.0

This scenario accounts for the uncertainty around the mean proportion of area converted. From these data its evident the rate of development is not linear, peaking around year 2 then tapering close to build-out. However, applying a linear deforestation rate is conservative and makes baseline calculations more straightforward and transparent. By delaying expected plantation development in the south (concessions 3 and 4) by one year and by applying a linear rate of conversion of 2,800 ha per year, the baseline scenario shows a 6-year build-out scenario similar to that of the expected rate under the maximum level of uncertainty (Table 22). This rate of deforestation, **2,800 ha per year** is used to estimate baseline CO_2 emissions.

Table 25. Baseline Scenario Oil Palm conversion and Deforestation Rate

BASELINE	yr1	yr2	yr3	yr4	yr5	yr6
RR1	2800.0	5600.0	8400.0	9286.0	9286.0	9286.0
RR2	2800.0	5600.0	8400.0	11200.0	12577.0	12577.0
RR3		2800.0	5600.0	8400.0	11200.0	11681.0
RR4		2800.0	5600.0	8400.0	11200.0	13693.0
TOTAL	5600.0	16800.0	28000.0	37286.0	44263.0	47237.0

Emissions from aboveground biomass.

Mean carbon stocks in aboveground biomass are expressed as the sum of biomass in the tree and non-tree components:

[illegible] (17)

where:

[illegible]

[illegible]

[illegible]

Estimations of these components are summarized below and described in detail in the Baseline Report.

Tree biomass

The methodology provides three alternatives for measuring aboveground tree biomass. Given the large extent and inaccessibility of Rimba Raya's peat swamp forests, the Aerial Image Method (AIM) was selected as recommended in the methodology. Methods applied are based on Brown et al. (2005) and Slaymaker (2003) and the original technical work was conducted by Forest Carbon. AIM steps and deviations are summarized belowand described in more detail in the Baseline Report. Also see methodological pathways diagram and data parameters table at the end of this section.

AIM Step 1. Tree biomass surveys were conducted in permanent plots on eight transects distributed throughout the Carbon Accounting Area. Measurements were made of tree diameter (D), tree height (H) and tree crown area (A). Field protocols followed standard forestry procedures and are described in the carbon survey SOP (Annex 3). Field methods were identical to those prescribed in the methodology except for slight differences in measurements of tree height (calculated from distance to stem and angles to base and top of tree – deviation in eq.26) and crown area (measured at 2 points rather than 4 - deviation in eq. 23). These deviations did not affect biomass estimates as neither parameter was used in the selected biomass model.

AIM Step 2. Allometric relationships were created to relate Tree Biomass to some combination of Tree Height (H) and /or Tree Crown Area (A) from ground plot data. All equation types were tested using all data and species-specific models were constructed using 16 of the most common species. Results of regression analysis showed that tree species diversity and variation in allometries limited the explanatory power of a single site-specific regression model (R2 = 0.379) . Broadbent et al (2008) conducted a similar exercise but for a larger dataset in the neotropics for the purpose of applying a site-specific regression model to aerial image data. The Broadbent model represents a good alternative to site-specific model and was applied as a deviation in AIM Step 2. In order to account for possible over-estimation of biomass, the results were then calibrated to match biomass estimated from ground-plot data. Results of biomass estimation were reduced over landcover classes by 22.85%, ensuring a conservative estimate.

"The Supreme Reality of Our Time is the Vulnerability of our Planet"

\- John F. Kennedy

AIM Step 3. Aerial photography was flown of the project area to collect high resolution imagery in systematically spaced transects over Rimba Raya concession. A total of 3,380 photographs were taken over Rimba Raya, each one covering approximately 120 ha, with a focus on the carbon accounting area. Photos were ortho-rectified in preparation for tree crown assessment.

AIM Step 4. ArcGIS software was used to view and analyze aerial imagery. 2D aerial image files were processed since only tree crown (not tree height) was used in biomass estimation modelling as allowed by the methodology.

AIM Step 5. Virtual plots were established on images in a stratified random manner. 1ha square plots were systematically installed at the center of each photo to avoid any effects from lens distortion.

The sampling framework followed methodology requirements as follows:

Sample size was established by conducting a pilot study with n=20 plots for each land cover strata and calculating biomass variance. A 10% sample error with a 90% Confidence Interval was applied to generate the number of plots needed in each strata. A total of 364 aerial plots were analyzed for biomass estimation.

Plot size was sufficiently large to minimize between-plot variation in biomass for the number of sample plots established. The CDM Tool suggests plot sizes of at least 100-1000 m2 (depending on stand density) to adequately capture biomass variation, and subsequently reduce sample size. Aerial plot size at Rimba Raya was 10,000 m^2, so each plot is expected to be highly representative of the vegetation within its boundaries.

Plot location followed a stratified random design with all Carbon Accounting Area land cover classes represented. Plots centers are located at the center point of aerial images as recommended by the Methodology.

Stratification was performed based on available land cover mapping (e.g. Ministry of Forestry and Orangutan Foundation International) and satellite imagery (e.g. Landsat and ALOS 2008). Initial stratification included all major forest blocks and transects were located throughout these blocks to maximize sample size for ground measurements including tree DBH, crown diameter and peat depth. Final stratification was performed based on improved data and supplementary sampling (e.g. 2009 Landsat imagery and aerial image and ground reference data).

Accuracy assessment was performed on final stratification and a confusion matrix generated as required by the Methodology. An overall classification accuracy of 81.3% was obtained. The predominant class by area, lightly degraded peat swamp forest covering 30,445 ha or 33.5% of Rimba Raya, was mapped with 90.0% accuracy. A weighted kappa coefficient of 0.78 indicated there is good agreement between all map classes interpreted from satellite imagery and aerial photo data. This stratification was used in the final sample design for aerial plot locations.

AIM Step 6. For each plot, tree crown areas were digitized using standard and customized tools in ArcGIS software. Code was written to run in ARCGIS that allowed the GIS operator to click with the mouse on three different points of the outline of each visible tree crown and the software would automatically create a circle polygon using the averaged radius from the three points.

AIM Step 7. Tree biomass was estimated using the Broadbent et al. (2008) regression equation (deviation in eq. 28 and eq. 30) using tree crown areas digitized in virtual plots. Nadir photographs or imagery cannot record all tree crowns in the plots since some crowns will be obscured from view, therefore remotely sensed biomass estimates will under-represent the true biomass present. This issue was addressed in a recent study (Broadbent, Asner, Pena-Carlos, Palace, & Soriano, 2008) that linked biomass estimates from Quickbird imagery with biomass measured in ground plots. The results showed a discrepancy between 30-50% between remotely sensed biomass estimates and ground plots. However, Broadbent et al (2008) were able to construct correction equations relating crown exposure class and the amount of obscured biomass and showed that the relationship was linear ($r2 = 0.65$, $p < 0.001$). Application of the Broadbent regression equation is expected to provide a more accurate estimation of tree biomass.

AIM Step 8. Above ground biomass was calculated per plot.

AIM Step 9. Mean biomass was calculated for each stratum by averaging across plots in a stratum (column 1 in Table 16). In order to account for possible overestimation, biomass estimates were then reduced by 28.5% to match biomass estimates from field plots (column 2 in Table 23). Biomass was converted to carbon in subsequent baseline spreadsheet calculations.

Results of tree biomass estimation are given in Table 25 below. Only in the strata classed as deforested does the sample error exceed the recommended 10% (at a 90% level of confidence). The stratum with the highest biomass has a very low sample error due to the large number of plots installed.

Table 26. Statistics for the estimate of biomass by strata

Estimated Tree Biomass	**Broadbent et al. 2008 Formula**	**Calibrated to Ground-based Biomass Estimates**
Land Cover/Land Use Classes	**Mean (tdm/ha)**	**Mean (tdm/ha)**
Peat Swamp Forest - lightly degraded	267	**206**
Peat Swamp Forest Degraded (highly)	166	**128**
Peat Shrubland (<20% Tree Cover)	63	**49**
Kerangas Forest	112	**86**
Kerangas Open Scrub	75	**58**
Low, Sparse vegetation cover	13	**10**
Seasonally Inundated Wetlands	18	**14**

Non-tree biomass

According to the methodology, non-tree biomass includes trees smaller than the minimum tree size measured in the tree biomass pool, and all other non-herbaceous (woody) live vegetation. At Rimba Raya, non-tree biomass is dominated by tree saplings 5-10 cm DBH. All trees of this size class were measured in 150 small plots (78.5m2) on 30 transects totalling 15 km in the carbon survey area. Biomass was calculated for each transect by applying the Chave et al. (2005) regression equation:

$$AGB = \rho \times \exp(-1.499 + 2.148 \ln D) + 0.207 (\ln D)^2 – 0.0281 (\ln D)^3)$$

Results showed that in peat swamp forest, average estimated non-tree biomass is 7,965.74 t.d.m/ha representing 3.72% of total aboveground (tree + non-tree) biomass. In transitional kerangas forest, non-tree biomass is 6,644.88 t.d.m/ha representing 5.60% of total aboveground biomass. Based on this study, non-tree biomass contributes <0.5% to total GHG emissions (all biomass burning represents 7.1% of total GHG emissions). Given the level of effort required to carry out this intensive sampling across Rimba Raya and pursuant to guidelines in the “Tool for testing significance ofof GHG emissions in A/R CDM project activities” (Version 01), it was determined that non-tree biomass would be excluded from mean carbon stock assessment.

Estimation of GHG Emissions from changes in Aboveground Biomass

Calculations for carbon stock change in aboveground biomass are explained in full in methodology section 8.1and are 1) the sum of carbon stock changes due to timber extraction prior to land clearing, 2) biomass burning of the remaining vegetationand 3) re-growth of replacement vegetation (palm oil). Each of these components are presented below. Note that since palm oil plantations operate on a 25-30 year timeframe, emissions from harvest rotations were conservatively excluded from calculations.

$$\Delta C_{BSL,AB,t} = E_{timber,t} + E_{BiomassBurn,t} - R_{growth,t} + E_{harvest,t} \qquad (3)$$

where:

$\Delta C_{BSL,AB,t}$	sum of carbon stock changes in aboveground biomass under the baseline scenario in stratum i at time t; t CO_2-e
$E_{timber,t}$	sum of carbon stock changes in aboveground biomass due to timber extraction prior to land clearing in stratum i at time t; t CO_2-e
$E_{BiomassBurn,t}$	sum of carbon stock changes in aboveground biomass due to biomass burning for stratum i at time t under the baseline scenario; t CO_2-e
$R_{growth,t}$	sum of carbon stock changes in aboveground biomass due to biomass growth of living vegetation on the future land-use for stratum i at time t; t CO_2-e
$E_{harvest,t}$	sum of carbon stock changes in aboveground biomass due to harvest activities at rotation on baseline future land-use for stratum i at time t; t CO_2-e

Emissions from timber

The biomass of timber extracted under the baseline scenario was estimated by implementing the steps outlined in section 8.1.1 in the methodology. Per applicability condition J of this methodology, in the baseline scenario the project land is assumed to be logged for timber prior to land clearing. Emissions from timber extraction are calculated as:

(eq. 4)

$$E_{timber,t} = \left(C^{extracted}_{BSL,i,t} - C^{longterm\ wood}_{BSL,i,t}\right) \cdot \frac{44}{12}$$

and

$$C^{extracted}_{BSL,i,t} = B^{logged}_{BSL,i,t} \cdot CF \cdot A^{logged}_{BSL,i,t} \qquad (5)$$

$$C^{longterm\ wood}_{BSL,i,t} = C^{extracted}_{BSL,i,t} \cdot p \qquad (6)$$

where:

$C^{extracted}_{BSL,i,t}$	carbon stocks from trees extracted under the baseline scenario in stratum i at time t; t C
$C^{longterm\ wood}_{BSL,i,t}$	carbon stocks moving into long-term wood products under the baseline scenario for stratum i at time t; t C
$B^{logged}_{BSL,i,t}$	timber biomass logged under the baseline scenario for stratum i at time t; t d.m. ha^{-1}
CF	= carbon fraction of dry matter (0.5 t C / t biomass); dimensionless
$A^{logged}_{BSL,i,t}$	= Area of land logged under the baseline scenario for stratum i, in time t; ha
p	= percent of harvest industrial roundwood going into long term wood products

Estimation of area cleared and logged

The annual area of clearing was estimated to be 2,800 ha/year based on the land conversion rate assessment presented in section 4.2.2 above. This annual rate of clearing was applied to land cover types classed as forest to estimate area logged. The assumption has been made that forest conversion will happen relatively sequentially with clearing of the four concessions beginning in Years 1-4 and continuing at a rate of 2,800 ha yr-1 for a total clearing of 47,237 ha. Because there are multiple land cover types within each concession, area-weighted carbon stocks were used in the calculations.

Estimation of biomass logged

All tree species above the minimum diameter threshold were assumed to be harvested. It is conservative to assume a larger proportion of trees extracted before the remaining trees are burned, because some of the carbon in the extracted timber is stored as long-term wood products. The minimum diameter that would have been harvested under the baseline scenario was assumed to be 30 cm. This threshold is based on market survey information collected by BOSF on common practice in the region.

Biomass in the commercial component of tree species logged was estimated based on Mawas plot data. The total biomass of trees larger than the 30 cm threshold was estimated based on aerial imagery sampling plots. Based on measurements of 93 logging gaps in the Mawas project region, **36%** of the total aboveground biomass per tree is assumed to be extracted as timber (Table 27).

Estimation of proportion of wood products

For the purpose of estimating long-term wood products, "long-lived" is assumed to be >5 years. In the project region, the proportion of harvested wood that goes into long-term wood products was obtained using FAO (1995) data for Indonesia cited in Winjum et al. (1998)[18]:

- Table 4 of this study gives a net production of industrial roundwood (IR) of 12 Tg C in 1990.
- Table 5 gives a value of 3 Tg of wood going into long-term wood products (use >5 yr; definition of long-term according to FAO definition)
- Thus, the percent of harvest logs (IR produced for all of Indonesia) going into long-term wood products is 3/12= **25%**. The remainder (short-term use <5 yr) is assumed to be oxidized in the base year.
- It was further assumed that the efficiency of milling and the proportion going into long term wood products has not changed and will not change over the next 30 years
- Wood waste generated at each stage of the conversion of timber to products was assumed to be decomposed in the year of harvest; none of the wood waste is used for cogeneration.

Wood products are therefore assumed to account for **25%** of the extracted timber (Table 27).

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[18] FAO 1995. FAO Yearbook: Forest products. FAO For. Serv. No. 28, FAO, Rome, 422 p

Timber Emissions Calculations

Table 27. Calculations of CO2 emissions from timber extraction for each land cover stratum in the Rimba Raya project boundary. An area-weighted average of all land cover types was used in the final calculations.

Substratum	**Total Biomass in trees >10 cm diameter (t d.m. ha^{-1})**	**Biomass Extracted as Merchantable Timber >30cm (% total biomass) 36%**	**Carbon extracted as timber (t C ha^{-1})**	**Carbon Carbon Preserved as Solid Wood Products as a % yield of log 25%**	**Net Carbon Extracted (t C ha-^{1})**	**Area Weighted CO_2 emissions (t CO_2 ha^{-1})**
Peat Forest (lightly degraded)	206	74.16	37.08	9.27	27.81	92.74
Peat Swamp Forest Degraded (highly)	128	46.08	23.04	5.76	17.28	4.30
Peat Shrubland (<20% Tree Cover)	49	NA	NA	NA	NA	NA
Kerangas Forest	86	30.96	15.48	3.87	11.61	0.96
Kerangas Open Scrub	58	NA	NA	NA	NA	NA
Low, sparse vegetation cover	10	NA	NA	NA	NA	NA
Seasonally Inundated Wetlands	14	NA	NA	NA	NA	NA
Open Water	0	NA	NA	NA	NA	NA

Emissions from biomass burning for land clearing

The carbon stocks remaining in the aboveground biomass pool that are left to burn after timber extraction was estimated by implementing the steps outlined in section 8.1.2 in the methodology. Per applicability condition C it is assumed in the baseline scenario that all remaining biomass that is not harvested as timber would be cleared by fire to prepare the site for new land use activity. GHG emissions from biomass burning are estimated as:

$$E_{B,BiomassBurn,i,t} = E_{B,BiomassBurn,CO2,i,t} + E_{B,BiomassBurn,N2O,i,t} + E_{B,BiomassBurn,CH4,i,t} \qquad (12)$$

and

$$E_{B,BiomassBurn,CO2,i,t} = (C_{B,i,t} \cdot PBB_{B,i} \cdot CE) \cdot \frac{44}{12} \qquad (13)$$

The carbon extracted as timber was subtracted from total aboveground carbon stocks, and the remainder was assumed to burn (proportion burned or PBBB,it = 1) with a combustion efficiency of 0.5 (IPCC default) as per the methodology.

Emissions of non-CO2 gases are given by:

$$E_{B,BiomassBurn,N2O,i,t} = E_{B,BiomassBurn,CO2,i,t} \cdot \frac{12}{44} \cdot (N/C\ ratio) \cdot ER_{N2O} \cdot \frac{44}{28} \cdot GWP_{N2O} \qquad (15)$$

and

$$E_{B,BiomassBurn,CH4,i,t} = E_{B,BiomassBurn,CO2,i,t} \cdot \frac{12}{44} \cdot ER_{CH4} \cdot \frac{16}{12} \cdot GWP_{CH4} \qquad (16)$$

N/C Ratio, Emission Ratios and Global Warming Potential used default values prescribed by the methodology:

$N:C_{ratio}$	nitrogen-carbon ratio (IPCC default = 0.01); dimensionless
ER_{N2O}	emission ratio for N_2O (IPCC default value = 0.007); t CO_2-e (t C)$^{-1}$
ER_{CH4}	emission ratio for CH_4 (IPCC default value = 0.012); t CO_2-e (t C)$^{-1}$
GWP_{N2O}	Global Warming Potential for N_2O (= 310 for the first commitment period); t CO_2-e (t N_2O)$^{-1}$
GWP_{CH4}	Global Warming Potential for CH_4 (= 21 for the first commitment period); t CO_2-e (t CH_4)$^{-1}$

GHG removals from oil palm sequestration

In the baseline scenario, a new land use (palm oil plantation) is established after merchantable trees are harvested and the remaining biomass is cleared with fire. To remain conservative, the baseline calculations must account for the removal of CO_2 that occurs due to biomass growth of living trees on the future land use, as per the methodology section 8.1.3. This biomass growth is estimated as:

$$R_{B\_BSL,it} = R_{ARB,it} \cdot A_{it}^{plant} \cdot \frac{44}{12} \quad (43)$$

To estimate $R_{ARB,it}$, growth curves for palm oil were constructed from literature data. Equations 43-46 from the approved methodology were used to estimate the accumulation of biomass carbon on the future plantation sites. Biomass data used to formulate a non-linear growth curve are cited in Cannell (1982) but reported originally in Ng et al. (1968). In Malaysia, one or two palms of average size were sampled from each high-yielding, fertilized stand on marine clay with fine sandy loams. Stand values were obtained by multiplying mean values by the number of palms per hectare (palms ha-1 = 148 at all age classes).

Dry biomass values for stem wood and bark were combined with values for branches, fruit and foliage to compute a total aboveground biomass value. The use of these data is conservative because oil palm would likely have lower growth rates on peat soils than on high-yielding, fertilized stands on mineral soils. Equation 44 of the proposed methodology requires the use of four parameters to calibrate the non-linear growth function. Model parameters for the oil palm growth function are as follows, and modelled growth curve and data points used to fit the curve are shown in Figure 38.

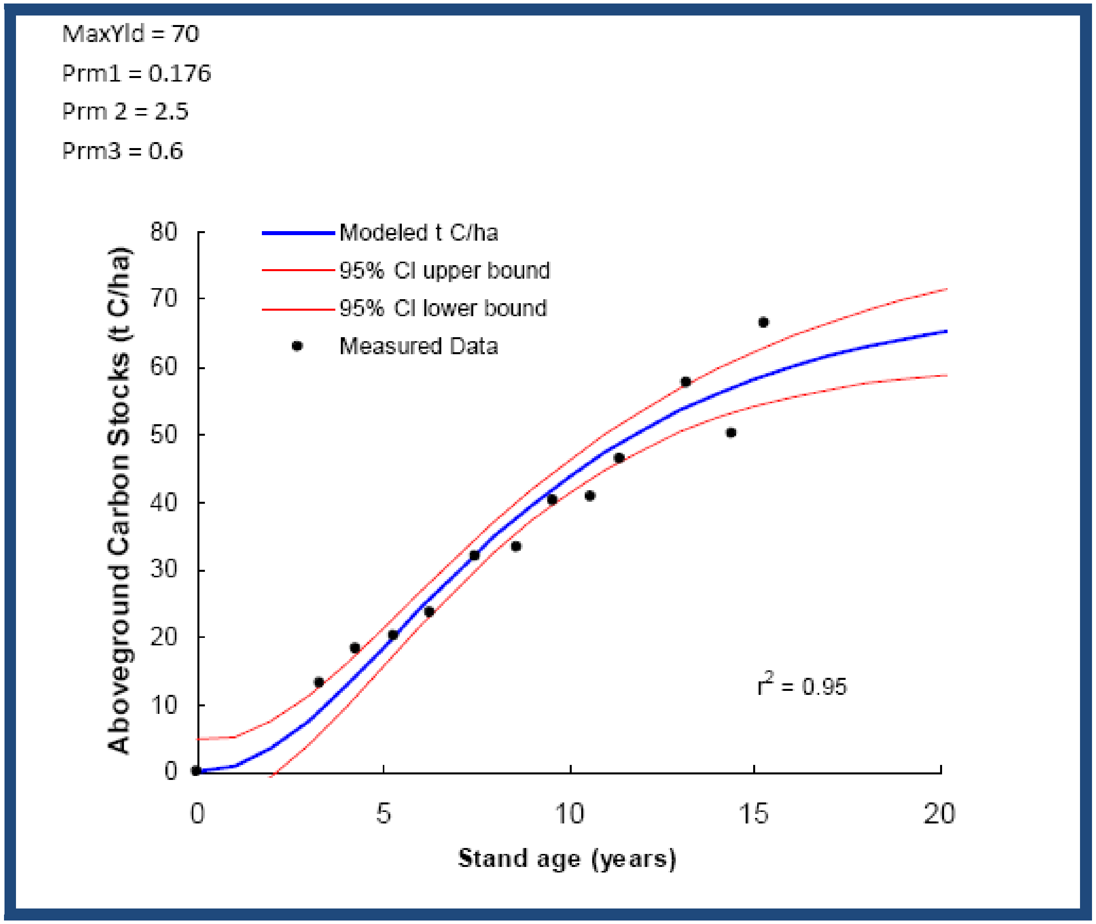

Figure 38. Modeled growth curve for oil palm (source: Ng et al. 1968).

A 90% CI was constructed for the regression model (95%CI shown in Figure 24) and used to calculate uncertainty across palm oil cohorts and years in the baseline scenario. Uncertainty is low overall in the palm oil growth parameter (<4% over the 30-year project life) but exceeds the 10% precision target in years 3-8. Baseline palm oil carbon accumulation associated with these years is low, especially compared to other carbon pools such that the project meets the allowable uncertainty under this methodology of +/- 10% CREDD, at the 90% confidence level. (methodology p.98). However, in order to build in conservativeness, estimated carbon accumulation associated with palm oil growth has been increased in years 3-8 to account for the maximum expected uncertainty.

To estimate $A^{planted}$, it is assumed that the concession areas would have been drained, cleared and burned one year prior to planting. Based on satellite image analysis of palm oil conversion rate by PT. BEST, the agent of deforestation, planting was assumed to occur at 2,800 ha yr^{-1}, for a total of six age "cohorts" of trees across the four concessions.

GHG Emissions from Peat

In addition to aboveground changes in carbon stocks, baseline emissions also include emissions from peat and are estimated as:

$$E_{B,i,t} = E_{B,Drainage} + E_{B,PeatBurn} \quad (56)$$

Peat drainage

GHG emissions from peat drainage resulting from baseline land clearing are estimated as:

$$E_{B,drainage} = A_{B,drain,i,t} \times ME_{B,i,t} \quad (57)$$

and:

$$ME_{B,i,t} = f(D_{B,drain,i,t}) \quad (58)$$

where:

$E_{B,drainage,i,t}$ — CO_2 emissions from peat drainage under the baseline scenario in stratum i at time t; t CO_2-e

$A_{B,drain,i,t}$ — area of drainage impact under the baseline scenario in stratum i, time t; ha

$ME_{B,i,t}$ — mean CO_2 emissions from drained peat in stratum i, time t; t CO_2 ha^{-1}

$D_{B,drain,i,t}$ — average depth of peat drainage or average depth to water table under the baseline scenario in stratum i, time t; cm

Depth of peat drainage ($D_{B,drain,it}$)

To be conservative, it is assumed that areas outside the proposed plantation boundaries would be unaffected by drainage under the baseline scenario. For this analysis, it is assumed that all peat areas within the project area are undrained and that palm oil plantations maintain a constant drainage depth **restricted to 100 cm** below the surface (conservative value required by the methodology). This is based on data from Hooijer et al. (2006)[19] who derived a minimum estimate of 0.80 m, a likely estimate of 0.95 m and a maximum estimate of 1.1 m based on peat depths more shallow than those found in the project site.

Time dimension of peat drainage

Equation 58 from the methodology (shown above), relating CO2 emissions to drainage depth is assumed to be applicable throughout the life of the project as long as there is a peat supply available to undergo oxidation. Because peat depth in the project exceeds 1.5 meters in depth, the time dimension of peat drainage can be disregarded as per the methodology (section 8.2.1.2) since emissions from drainage would continue for more than 30 years.

Area of peat drainage($A_{B,drainage,it}$)

It is widely recognized that forests are not homogenous and coastal Bornean peatlands may include mosaic patches of non-peat soils in close proximity to or mixed with peat. This variation in soil type is often reflected in tree species composition, such as patches of kerangas forest, which are mixed with peat swamp forest species in Rimba Raya. Therefore, to be conservative, all areas that may not meet the peat requirement based on land cover classification, were excluded from belowground biomass estimation in the baseline accounting.

Within the peat areas accounted, the annual area drained was estimated to be 2,800 ha/year based on the land conversion rate assessment presented in section 4.2.2. As per the methodology, once drained, emissions continue in subsequent years for the life of the project in the case of Rimba Raya, such that emissions are cumulative as new areas are cleared over time.

Mean CO2 emissions from drained peat ($ME_{B,dd,it}$)

Drainage depth is linked to CO2 emissions (in t CO2 ha-1 yr-1) using a regression relationship derived primarily from long-term monitoring of peat subsidence in drained peatlands combined with peat carbon content and bulk density analysis[20]. This method filters the

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[19] Hooijer, A., M. Silvius, H. Wösten, S. Page. 2006. PEAT-CO2, Assessment of CO2 emissions from drained peatlands in SE Asia. Delft Hydraulics report Q3943 (2006).

[20] relation provided in Hooijer et al. (2006).

contribution of peat compaction from the total subsidence rate, and the remainder is attributed to CO2 emission[21][22] Long-term monitoring of peat subsidence produces the most accurate and reliable data, but yields only few measurement points. For lack of a large enough population of observations, a linear relation between drainage depth and CO2 emission was fitted through the data, though the actual relation is known to be non-linear. Based on data from Couwenberg et al. (2009), mean CO2 emissions from drained peat were applied as:

$$ME_{B,DD,it} = 1.33*D_{B,drain,it}$$

In the drainage depth range most common in southeast Asian peatlands, the relation is supported by results from numerous gas emission monitoring studies in peatlands. The mean CO2 emissions factor used in this analysis is considered conservative with ranges cited in Couwenberg et al. (2009), from 0.90 g CO2/cm to 5.0 g CO2cm.

Methane (CH4) fluxes from peat were not accounted for because research to date indicates that CH4 fluxes in tropical peatlands are negligible compared to CO2 fluxes[23].

Peat burning

After peat drainage occurs, the upper layer of peat is assumed to be intentionally burned along with aboveground biomass when the land is cleared with fire to prepare the site for new land use. GHG emissions from peat burning are estimated as:

$$E_{[illegible]} \quad E_{[illegible]} + E_{[illegible]} \qquad (60)$$

and:

$$E_{[illegible]} \quad \frac{M_{[illegible]} * EF_{[illegible]}}{10^{[illegible]}} \qquad (61)$$

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[21] Furukawa, Y., K. Inubushi, M. Ali, A.M. Itang, H. Tsuruta. 2005. Effect of changing groundwater levels caused by land use changes on greenhouse gas fluxes from tropical peat lands. Nutrient Cycling in Agroecosystems 71: 81-91.

[22] Hadi, A, K. Inubushi, Y. Furukawa, E. Purnorno, M. Rasmadi, H. Tsuruta. 2005. Greenhouse gas emissions from tropical peatlands of Kalimantan, Indonesia. Nutrient Cycling in Agroecosystems 71: 73-80.

[23] Jauhiainen, J., A. Jaya, T. Inoue, J. Heikkinen, P. J. Martikainen and H. Vasander. 2005. Carbon fluxes from a tropical peat swamp forest floor. Global Change Biology 11, 1788-1797.

In accordance with the methodology, and as presented in Couwenberg et al. (2009), it was conservatively assumed that the average depth of peat burned for initial land clearing **is 0.34m**.

The area of peat burned in the baseline scenario is **2,800 ha/yr** as described in the conversion rate analysis section 4.2.2.

The default value for peat bulk density **0.14 g/cm^3** was used in baseline calculations.

Peat bulk density was surveyed and assessed to be 0.1505 g/cm^3 based on test results from the University of Palangkaraya survey of the project area (see Peat Survey Report). This survey was conducted for the single belowground strata defined for the project and met the uncertainty requirements of the methodology (n=48, sd = 0.0584, uncertainty = 9.234%). However, an additional survey of peat bulk density will be carried out to better represent potential variation in aboveground strata.

Emission factors for peat combustion at lower temperatures (480 °C) taken from Muraleedharan (2000) were assumed for ex ante baseline estimates as required by the methodology, as this results in lower overall GHG emissions and thus a conservative baseline. These were **185,000** g CO2 per ton of peat and **5,785** g CH4 per ton of peat[24]

[24] Muraleedharan, T.R., M. Radojevic, A. Waugh, A. Caruana. 2000. Emissions from the combustion of peat: an experimental study. Atmospheric Environment 34: 3033-3035.

Ex Post Actual Net GHG Emissions Avoided

GHG emissions from the baseline scenario that are not prevented within the project boundary in the project case (C_{PRJ}), such as logging, fire, or other land use changes that lead to an increase in emissions must be subtracted from the baseline scenario in annual carbon accounting. The calculations are performed annually according to the monitoring plan.

$$C_{ACTUAL} \quad C_{BSL} \quad C_{PRJ} \tag{88}$$

where

C_{ACTUAL}	actual net greenhouse gas emissions avoided; t CO_2-e.
C_{BSL}	sum of peat emissions and carbon stock changes in aboveground biomass under the baseline scenario; t CO_2-e
C_{PRJ}	sum of emissions that occur within the project boundary ; t CO_2-

Market Leakage

A deduction against the biomass of timber extracted under the baseline scenario must be estimated for Market Leakage by implementing steps outlined in Section 10.1 in the methodology:

USection 10.1 of the Methodology

When REDD project activities result in reductions in wood harvest, it is likely that production could shift to other areas of the country to compensate for the reduction. Therefore, in cases where the project area would be harvested for commercial timber before clearing the site for a new land use, market effects leakage must be estimated as the baseline emissions from logging multiplied by a leakage factor:

$$LK_{MarketEffects} = \sum_{t=1}^{t^*} \sum_{i=1}^{m_{LK}} LK_{ME,it} \tag{66}$$

$$LK_{ME,it} = LF_{ME,i} * C_{B,XBT,it} \tag{67}$$

The amount of leakage is determined by where harvesting would likely be displaced to. If in the forests to which displacement would occur a lower proportion of biomass in commercial species is in merchantable material than in the project area, then more trees will need to be cut to supply the same volume and thus higher emissions should be expected. In contrast, if a higher proportion of biomass of commercial species is merchantable in the displacement forest than in the project forest, then a smaller area would need to be harvested and lower emissions would result.

Each project thus shall calculate within each stratum the proportion of total biomass in commercial species that is merchantable (*PMPi*). Merchantable biomass per stratum is conservatively defined as the total volume (converted to biomass) of all commercially valuable trees within a stratum that are above the minimum size class sold in the local timber market (see Applicability Condition J). *PMPi*is therefore equal to the merchantable biomass as a proportion of total aboveground tree biomass for stratum *I* within the project boundaries. *PMPi*shall then be compared to the mean proportion of total biomass that is merchantable for each forest type (*PMLFT*) to which displacement is likely to occur.

The following deduction factors ($LF_{ME,i}$) shall be used:

PML_{FT} is equal (±0.15) to PMP_i	$LF_{ME,i}$ =	0.4
PML_{FT} is > 0.15 less than PMP_i	$LF_{ME,i}$ =	0.7
PML_{FT} is >0.15 greater than PMP_i	$LF_{ME,i}$ =	0.2

Where:

PML_{FT} = Mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type; dimensionless

PMP_i = Merchantable biomass as a proportion of total aboveground tree biomass for stratum i within the project boundaries; dimensionless

$LF_{ME,i}$ = Leakage factor for stratum i market-effects calculations; dimensionless

Instead of applying the default market leakage discounts, project proponents may opt to estimate the project‘s market leakage effects across the entire country and/or use analysis(es) from other similar projects to justify a different market leakage value. A description of the market leakage assessment, including steps for determining where leakage is likely to occur (i.e., to which forest types leakage is likely to occur) and what the carbon stocks of those lands are, shall be outlined in the PDD. The outcome of this assessment conducted at first VCU issuance (whether using default discounts or project specific analysis(es)) shall be subject to the VCS double approval process. Market leakage assessments conducted at validation stage and at verification other than the first VCU issuance are not required to undergo the double approval process.

The next step is to estimate the emissions associated with the displaced logging activity – this is based on the total volume that would have been logged in the project area in the baseline scenario. The emission due to the displaced logging has two components: the biomass carbon of the extracted timber and the biomass carbon in the forest damaged in the process of timber extraction:

$$C_{B,XBT,it} = \left(\left[V_{B,it} * \phi_i * CF\right] + \left[V_{B,it} * LDF\right]\right) * \frac{44}{12} \qquad \textbf{(68)}$$

Where:

$C_{B,XBT,it}$ = Carbon emission due to displaced timber harvests in the baseline scenario in stratum i at time t; t CO_2-e

$V_{B,it}$ = Volume to be extracted under the baseline scenario in stratum i at time t; m^3

ϕ_i = volume-weighted average wood density; t d.m. m^{-3} merchantable volume

CF = carbon fraction of dry matter (0.5 t C / t biomass); dimensionless

LDF = Logging damage factor; t C m^{-3} (default 0.37 t C m^{-3})

i = 1, 2, 3, ..., m_{BL} baseline strata

t = 1, 2, 3, ..., t^* years elapsed since the projected start of the REDD project activity

The total volume to be extracted under the baseline scenario in stratum *i* at time *t* (*VB,it*) can be estimated by multiplying the plot-level volume per stratum (*MVB,it* see Eq. 34) by the area cleared or logged in stratum *I* at time *t* (A cleared ,it or A logged B,it).

The logging damage factor (*LDF*) is a representation of the quantity of emissions that will ultimately arise per unit of extracted timber (m3). These emissions arise from the non-commercial portion of the felled tree (the branches and stump) and trees incidentally killed during tree felling. The default value given here comes from the slope of the regression equation between carbon damaged and volume extracted based on 534 logging gaps measured by Winrock International in Bolivia, Belize, Mexico, the Republic of Congo, Brazil, and Indonesia.

Though project proponents have made a defensible econometrics argument that neither Activity Shifting nor Market Leakage can occur with a finite non-renewable resource (peat lands) in the PD, both have been accounted for in Baseline calculations in accordance with the methodology.

In order to demonstrate the conservativeness of the methodology and these calculations, the econometrics argument against the existence of both Activity Shifting and Market Leakage is annexed herein as Annex 11.

Quantifying GHG emission reductions and removal enhancements for the GHG project

Total gross baseline emissions

Table 28 below summarizes the gross GHG emissions avoided by preventing the establishment of palm oil plantations in the project area. This summary table is broken down by component and shows that peat drainage is overwhelmingly the most significant source of GHG emissions associated with palm oil development.

Under the VCS, the baseline must be reassessed after ten years. Therefore, the baseline emissions in the first ten years should be the focus of attention; estimates beyond the 10-year window are subject to change as new policy measures are instituted and new data become available.

Total Gross Baseline emissions after leakage deductions are **2,462,212 t CO_2e** in year one, **40,660,403 t CO_2e** over the first ten years and **131,107,818 t CO_2e** for the 30 year life of the project.

Table 28. Total Gross GHG emissions avoided due to project activities.

Yr of Project	Em. from timber (t CO_2e)	Em. from biomass burning (t CO_2e)	Growth of oil palm (t CO_2e)	Em. from peat burning (t CO_2e)	Em. from peat drainage (t CO_2e)	Total Gross CO2e Baseline emissions (t CO_2e)	Market Leakage Deductions (t $C0_2$e)	Total Gross Emissions after Market Leakage Deduction (t CO_2e)	Total Gross Cumulative CO2e emissions (t CO_2e)
1	558,684	557,304	0.00	764,128	582,096	2,462,212	0	2,462,212	2,462,212
2	942,209	932,655	0.00	1,269,325	1,708,385	4,852,575	(1,198,394)	3,654,181	6,116,393
3	691,873	932,655	(65,314)	1,269,325	2,785,138	5,613,677	(2,021,067)	3,592,611	9,709,003
4	62,147	749,749	(161,729)	1,018,935	3,939,956	5,609,057	(1,484,087)	4,124,970	13,833,973
5	0	517,836	(301,696)	700,845	4,578,892	5,495,876	(133,306)	5,362,569	19,196,543
6	0	222,239	(467,616)	368,692	4,915,015	5,038,330	0	5,038,330	24,234,873
7	0	0	(635,119)	0	4,915,015	4,279,896	0	4,279,896	28,514,769
8	0	0	(776,046)	0	4,915,015	4,138,969	0	4,138,969	32,653,738
9	0	0	(888,679)	0	4,915,015	4,026,336	0	4,026,336	36,680,074
10	0	0	(934,685)	0	4,915,015	3,980,330	**0**	**3,980,330**	**40,660,403**

11	0	0	(928,570)	0	4,915,015	3,986,445	0	3,986,445	44,646,849
12	0	0	(886,764)	0	4,915,015	4,028,251	0	4,028,251	48,675,099
13	0	0	(823,155)	0	4,915,015	4,091,860	0	4,091,860	52,766,959
14	0	0	(748,225)	0	4,915,015	4,166,790	0	4,166,790	56,933,749
15	0	0	(669,362)	0	4,915,015	4,245,653	0	4,245,653	61,179,402
16	0	0	(591,475)	0	4,915,015	4,323,540	0	4,323,540	65,502,941
17	0	0	(517,618)	0	4,915,015	4,397,397	0	4,397,397	69,900,338
18	0	0	(449,513)	0	4,915,015	4,465,502	0	4,465,502	74,365,840
19	0	0	(387,968)	0	4,915,015	4,527,047	0	4,527,047	78,892,887
20	0	0	(333,183)	0	4,915,015	4,581,832	0	4,581,832	83,474,719
21	0	0	(284,974)	0	4,915,015	4,630,041	0	4,630,041	88,104,760
22	0	0	(242,933)	0	4,915,015	4,672,082	0	4,672,082	92,776,842
23	0	0	(206,529)	0	4,915,015	4,708,486	0	4,708,486	97,485,328
24	0	0	(175,186)	0	4,915,015	4,739,829	0	4,739,829	102,225,157
25	0	0	(148,324)	0	4,915,015	4,766,691	0	4,766,691	106,991,848
26	0	0	(125,387)	0	4,915,015	4,789,628	0	4,789,628	111,781,476
27	0	0	(105,861)	0	4,915,015	4,809,154	0	4,809,154	116,590,630
28	0	0	(89,281)	0	4,915,015	4,825,734	0	4,825,734	121,416,364
29	0	0	(75,231)	0	4,915,015	4,839,784	0	4,839,784	126,256,148
30	0	0	(63,345)	0	4,915,015	4,851,670	0	4,851,670	**131,107,818**
Totals	**2,254,913**	**3,912,438**	**(12,083,770)**	**5,391,249**	**136,469,842**	**135,944,672**	**(4,836,855)**		

Total net baseline emissions

In accordance with the methodology, an uncertainty assessment was conducted for all parameters where required and is specified for all parameters in section 10 of this document. Typically the uncertainty confidence deduction was zero (default value used or uncertainty quantified to be <10%). In rare cases, where uncertainty could not be calculated or exceeded 10%, parameter estimates were adjusted to conservatively include this uncertainty. This built-in confidence deduction was developed by parameter so that carbon pool estimates were conservative and further confidence deductions were not warranted in calculated summary emissions.

Section 24.3 of the methodology

The allowable uncertainty under this methodology is +/- 10% of CREDD,t at the 90% confidence level. Where this precision level is met, then no deduction should result for uncertainty. Where uncertainty exceeds 10% of CREDD,t at the 90% confidence level then the deduction shall be equal to the amount that the uncertainty exceeds the allowable level.

The adjusted value for CREDD,t to account for uncertainty shall be calculated as:

$$Adjusted\_C_{REDD,t} = C_{REDD,t} * \frac{(100 \quad C_{REDD\_ERROR,t} \quad 10)}{100} \qquad \textbf{(131)}$$

Where:

$C_{REDD,t}$	Net anthropogenic greenhouse emission reductions at time t; t CO_2-e
$C_{REDD\_ERROR,t}$	Total uncertainty for REDD project activity; %
$Adjusted\_C_{REDD,t}$	Adjusted value for $C_{REDD,t}$ to account for uncertainty; t CO_2-e

Additionally, according to VCS requirements, a Non-Permanence Risk Assessment was conducted.

Assessing a **20% Risk Buffer** resulted in a total deduction of **-26,221,564 t CO_2e.**

The net baseline emissions are therefore calculated as **1,969,770 t CO_2e** for year one, **32,528,323 t CO_2e** for the first ten years and **104,886,254t CO_2e** for the 30 year life of the project. (Table29).

Table 29. Total Buffers deducted from Baseline Emissions

Risk Buffers			Cumulative CO_2e After All Buffers (Final Baseline)
Non- Permanance Risk Buffer	Overall Project Uncertainty Deduction	Total Annual Buffers	
-20%	0%	0	
(492,442)	0	(492,442)	1,969,770
(730,836)	0	(730,836)	4,893,114
(718,522)	0	(718,522)	7,767,203
(824,994)	0	(824,994)	11,067,179
(1,072,514)	0	(1,072,514)	15,357,234
(1,007,666)	0	(1,007,666)	19,387,898
(855,979)	0	(855,979)	22,811,815
(827,794)	0	(827,794)	26,122,990
(805,267)	0	(805,267)	29,344,059
(796,066)	0	(796,066)	**32,528,323**
(797,289)	0	(797,289)	35,717,479
(805,650)	0	(805,650)	38,940,080
(818,372)	0	(818,372)	42,213,567
(833,358)	0	(833,358)	45,546,999
(849,131)	0	(849,131)	48,943,521
(864,708)	0	(864,708)	52,402,353
(879,479)	0	(879,479)	55,920,270
(893,100)	0	(893,100)	59,492,672
(905,409)	0	(905,409)	63,114,309
(916,366)	0	(916,366)	66,779,775
(926,008)	0	(926,008)	70,483,808
(934,416)	0	(934,416)	74,221,474
(941,697)	0	(941,697)	77,988,262
(947,966)	0	(947,966)	81,780,125
(953,338)	0	(953,338)	85,593,479
(957,926)	0	(957,926)	89,425,181
(961,831)	0	(961,831)	93,272,504
(965,147)	0	(965,147)	97,133,091
(967,957)	0	(967,957)	101,004,918
(970,334)	0	(970,334)	**104,886,254**
(26,221,564)		**(26,221,564)**	

Baseline Calculation Methodological Pathways and Parameters

Methodological pathways for baseline calculations (Figure 39) are taken from the conceptual diagram in the VCS methodology.

There were deviations in the Aerial Image Method (AIM) steps of the baseline calculations, which are detailed in Figure 29. Briefly, equations 23, 24 and 25 reflect a deviation in tree height and crown area field measurements, neither of which was used in direct biomass estimation. Tree biomass was estimated using the Broadbent et al. (2008) regression equation (deviation in eq. 28 and 30) using tree crown areas digitized in virtual plots. This model performed better than the allometric model using site-specific data. Biomass estimates were then adjusted downward to match ground-based biomass estimates, which are lower than IPCC default values for tropical moist forest.

The deviation in AIM steps had a negligible effect on baseline calculations since methods used are consistent with prescribed methods. The method used produced lower biomass estimates than the IPCC defaults for moist tropical forest, so any effect may be considered conservative. Further, all aboveground biomass contributes <3% to total carbon stocks in Rimba Raya's peat-dominated area.

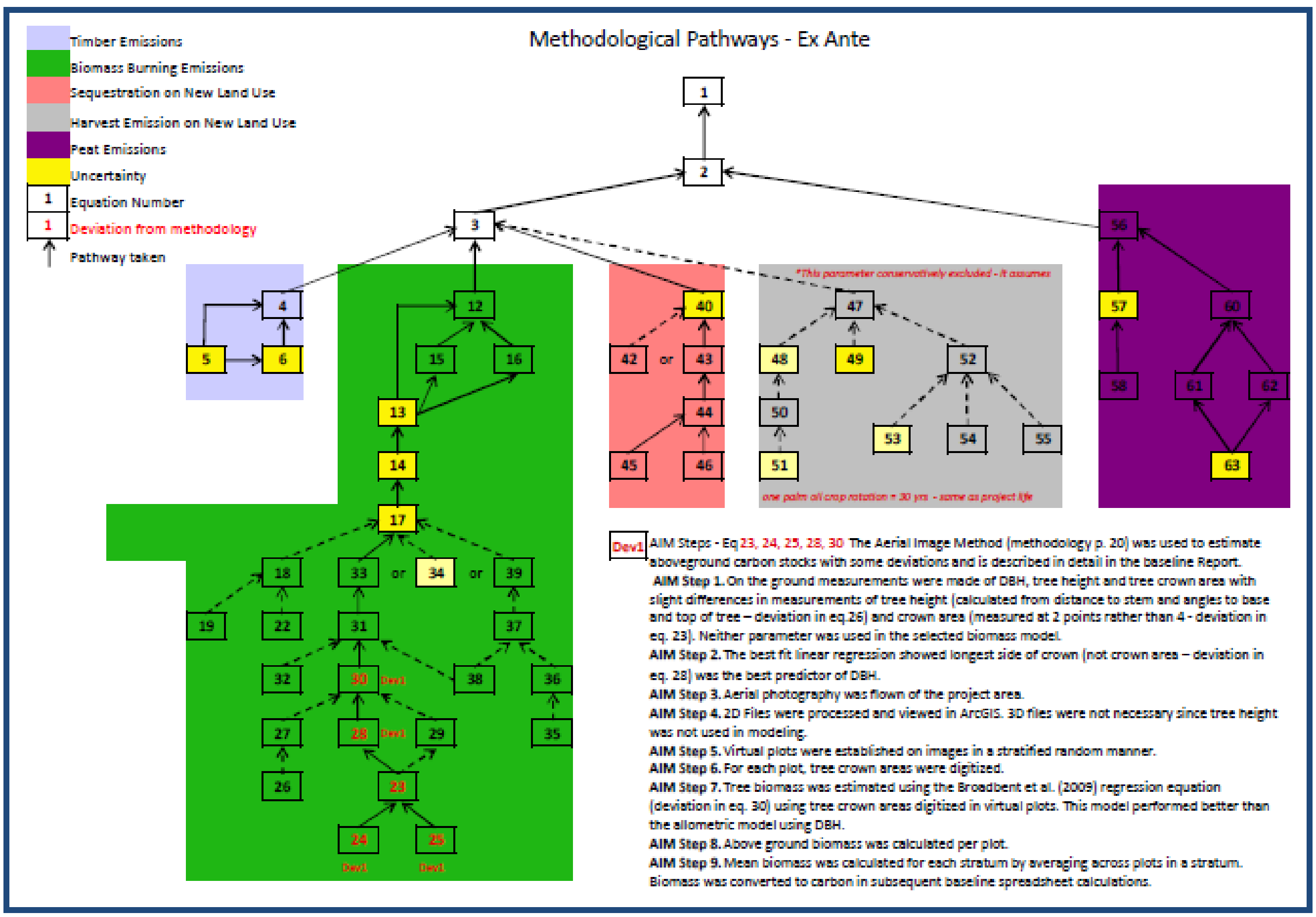


Figure 39. Conceptual diagram of baseline equations and methodological pathways used to calculate Baseline (Ex Ante) GHG emissions

Specific data collected for calculatingbaseline (ex ante) actual net avoided GHG emissions are summarized in Table 30. These data/parameter tables expand on those in the methodology to include value used, assumptions and decisions, uncertainty estimate and deviation information.

Uncertainty estimation was conducted in accordance with the methodology and is presented in the parameter table below. Note that since this methodology is only applicable to projects where deforestation is planned and projected to occur within 10 years of the project start date (Applicability Condition D), **uncertainty in deforestation rate is assumed to be zero** (methodology p. 53). To demonstrate the most likely deforestation rate scenario, an analysis of recent palm oil conversion by the agent of deforestation was conducted. These GIS-based calculations are estimated to be > 90% accurate. GIS-based parameters for ex ante calculations fall into one of two cases, which are referenced in the parameter table:

- Case 1. Area cleared, logged or planted (2,800 ha/yr): These parameters are based on the actual rate of clearing by the deforestation agent, determined from analysis of Landsat data. Landsat is the primary tool for mapping tropical deforestation (Defries et al. 2005) and has been validated against high resolution imagery to be 92-97.5% accurate (NASA accessed January 15, 2011 http://www.glcf.umd.edu/data/paraguay/description.shtml).

- Case 2. Area drained: Drainage area is based on stratification of peat/non-peat which derives from landcover stratification where non-peat types (Kerangas Forest and Open Kerangas Scrub) were differentiated from all other types with 92% producer's accuracy and 98.5% user's accuracy.

Table 30. Data/Parameters Needed for Estimation of Ex Ante GHG Emissions

Data/parameter 1:	CF
Data unit:	Dimensionless
Used in equations:	5, 30, 34, 36, 67
Description:	Carbon fraction of dry matter
Source of data and reference:	IPCC default value = 0.50
Measurement procedures: (if any)	n/a
Value used:	0.50
Comment:	used in multiple spreadsheets in biomass => carbon calculations
Assumptions and Decisions:	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 2:	$A_{B,it}^{logged}$
Data unit:	Ha
Used in equations:	5
Description:	Area of land logged under the baseline scenario for stratum i, in time t
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or

	controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	n/a
Value used:	Rate 2,800 ha/yr (stratum i, time t)
Comment:	Used in Timber Extraction spreadsheet
Assumptions and Decisions	The area logged was assumed to be the area cleared in all landcover types classified as forest. The expected annual rate of conversion was determined by analyzing historical rate of conversion by the baseline agent.
Uncertainty estimate:	Required. Zero. Case 1 described above.
Deviation from Methodology:	None

Data/parameter 3:	P
Data unit:	Dimensionless
Used in equations:	6, 49
Description:	percent of harvest industrial roundwood going into long term wood products
Source of data and reference:	Industry standard value: FAO 1995. FAO Yearbook: Forest products. FAO For. Serv. No. 28, FAO, Rome, 422 p.
Measurement procedures: (if any)	n/a
Value used:	0.25
Comment:	Used in Timber Extraction spreadsheet
Assumptions and Decisions	In the project region, the proportion of harvested wood that goes into long-term wood products was obtained using FAO data for Indonesia cited in Winjum et al. (1998)
Uncertainty estimate:	Required. Zero. Conservative Value. Industry standard dataset (FAO 1995) and report (Winjum et al. (1998) calculated with 90% Confidence Interval.
Deviation from Methodology:	None

Data/parameter 4:	*AP*
Data unit:	m^2
Used in equations:	32, 38
Description:	Plot Area
Source of data and reference:	Aerial plot measurement
Measurement procedures: (if any)	Digitized on aerial photographs using GIS measure tool
Value used:	10,000
Comment:	parameter created but not used
Assumptions and Decisions	eq 38 not used since allometric method not selected as allowed by the methodology p. 20; eq 32 not used because different AIM Step calculations were made.
Uncertainty estimate:	Not required.
Deviation from Methodology:	Deviation AIM Steps

Data/parameter 5:	*BEF*
Data unit:	Dimensionless
Used in equations:	8, 34
Description:	Biomass expansion factor for conversion of biomass of merchantable volume to above-ground biomass
Source of data and reference:	Literature Values
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	eq 34 not used (since BEF method not selected as allowed by the methodology p. 20; eq 8 not used because different AIM Step calculations were made.
Uncertainty estimate:	n/a
Deviation from Methodology:	Deviation AIM Steps

Data/parameter 6:	Φ_i
Data unit:	g cm^3
Used in equations:	8, 34, 51, 68
Description:	Volume-weighted average wood density
Source of data and reference:	Literature Value: Reyes, Brown, Chapman and Lugo (1992) mean wood density for tropical Asia represented by 428 species, SE = 0.007
Measurement procedures: (if any)	n/a
Value used:	0.57 (SD = 0.145)
Comment:	Used in Biomass Burning Spreadsheet
Assumptions and Decisions	eq 68 used for leakage calculation; eq 34 not used (since BEF method not selected as allowed by the methodology p. 20; eq 8 not used because different AIM Step calculations were made.
Uncertainty estimate:	90% CI/mean* 100 = 2.03%
Deviation from Methodology:	None

Data/parameter 7:	$PBB_{B,it}$
Data unit:	Dimensionless
Used in equations:	13
Description:	average proportion of *CB,AC,it* burnt under the baseline scenario in stratum *i*, time *t*
Source of data and reference:	methodology p. 16
Measurement procedures: (if any)	n/a
Value used:	1
Comment:	Used in Biomass Burning -BL E51
Assumptions and Decisions	As per the methodology p. 16 "because the land is being cleared for another land use in the baseline scenario, all of the biomass that is not extracted as timber is assumed to be burned and therefore this methodology the proportion burned in the baseline $PBB_{B,it}$ is assumed to be equal to 1."
Uncertainty estimate:	n/a

Deviation from Methodology:	none

Data/parameter 8:	*CE*
Data unit:	Dimensionless
Used in equations:	13, 53
Description:	Average biomass combustion efficiency
Source of data and reference:	IPCC default =0.50
Measurement procedures: (if any)	n/a
Value used:	0.50
Comment:	Used in Biomass Burning spreadsheet
Assumptions and Decisions	
Uncertainty estimate:	Required. Zero. Default value used.
Deviation from methodology:	None.

Data/parameter 9:	$A_{cleared\ B\ it}$
Data unit:	Ha
Used in equations:	14, 72, 74, 76
Description:	Area cleared under the baseline scenario for stratum *i,* in time *t*
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	GIS overlay analysis
Value used:	Rate 2,800 ha/yr (stratum i, time t)
Comment:	Used in Timber Extraction spreadsheet
Assumptions and Decisions	The expected annual rate of conversion was determined by analyzing historical rate of conversion by the baseline agent.
Uncertainty estimate:	Required. Zero. Case 1 described above.
Deviation from Methodology:	None

Data/parameter 10:	*N/C ratio*
Data unit:	Dimensionless
Used in equations:	15, 54
Description:	Nitrogen-carbon ratio
Source of data and reference:	IPCC default =0.01
Measurement procedures: (if any)	n/a
Value used:	0.01
Comment:	used in Biomass Burning spreadsheet
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 11:	$ER_{N2\ O}$
Data unit:	t CO2-e (t C)-1
Used in equations:	16, 55

Description:	Emission ratio for N2O
Source of data and reference:	IPCC default value =0.007
Measurement procedures: (if any)	n/a
Value used:	0.007
Comment:	see Biomass Burning spreadsheet
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 12:	ER_{CH4}
Data unit:	t CO2-e (t C)-1
Used in equations:	16, 55
Description:	Emission ratio for CH4
Source of data and reference:	IPCC default value = 0.012
Measurement procedures: (if any)	n/a
Value used:	0.012
Comment:	see Biomass Burning spreadsheet
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 13:	$GWP_{N\ 2O}$
Data unit:	t CO2-e (t N2O)-1
Used in equations:	15, 54
Description:	Global Warming Potential for N2O
Source of data and reference:	Methodology =310 for the first commitment period
Measurement procedures: (if any)	n/a
Value used:	310
Comment:	see Biomass Burning spreadsheet
Assumptions and Decisions	Used in eq 15. Eq 54 not calculated – as palm oil plantations operate on a 25-30 year timeframe, emissions from harvest rotations were not considered in baseline estimation. This is conservative.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 14:	GWP_{CH4}
Data unit:	t CO2-e (t CH4)-1
Used in equations:	16, 55
Description:	Global Warming Potential for CH4
Source of data and reference:	Methodology =21 for the first commitment period
Measurement procedures: (if any)	n/a
Value used:	21
Any comment:	see Biomass Burning spreadsheet
Assumptions and Decisions	Used in eq 16. Eq 55 not calculated – as palm oil plantations operate on a 25-30 year timeframe, emissions from harvest rotations were not

	considered in baseline estimation. This is conservative.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 15:	$A_{sampleframe}$
Data unit:	m^2
Used in equations:	20
Description:	Area of one sampling frame
Source of data and reference:	Field Measurement
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	non-tree biomass accounts for < 0.5% of total GHG emissions and was conservatively excluded from biomass estimation.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None.

Data/parameter 16:	*CFnon-tree*
Data unit:	Dimensionless
Used in equations:	19
Description:	Carbon fraction of dominant non-tree vegetation species
Source of data and reference:	Field measurement or literature values
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	non-tree biomass accounts for < 0.5% of total GHG emissions and was conservatively excluded from biomass estimation.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None.

Data/parameter 17:	*MCAG,nontree_sample,sf,,it*
Data unit:	Kg. d.m.
Used in equations:	19
Description:	Carbon stock in above ground non-tree vegetation in sample plot *sf* in stratum *i* at time *t* from sampling frame method
Source of data and reference:	Field measurement.
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	non-tree biomass accounts for < 0.5% of total GHG emissions and was conservatively excluded from biomass estimation.

Uncertainty estimate:	Not required.
Deviation from Methodology:	None.

Data/parameter 18:	*CFq*
Data unit:	t C t-1 d.m.
Used in equations:	21
Description:	Carbon fraction of biomass for species q
Source of data and reference:	Field measurement or literature values
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	non-tree biomass accounts for < 0.5% of total GHG emissions and was conservatively excluded from biomass estimation.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None.

Data/parameter 19:	*fq(vegetation parameters)*
Data unit:	t. d.m. individual-1
Used in equations:	21
Description:	Allometric equation for species *q* linking parameters such as stem count, diameter of crown, height, or others to above-ground biomass of an individual
Source of data and reference:	Field measurement or literature values
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	non-tree biomass accounts for < 0.5% of total GHG emissions and was conservatively excluded from biomass estimation.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None.

Data/parameter 20:	Ar_i
Data unit:	Ha.
Used in equations:	22
Description:	Total area of all non-tree allometric method sample plots in stratum *i*
Source of data and reference:	Field Measurement
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	non-tree biomass accounts for < 0.5% of total GHG emissions and was conservatively excluded from biomass estimation.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None.

Data/parameter 21:	$MC_{AG\_nontree\_allometric,i,r,t}$
Data unit:	t C
Used in equations:	22
Description:	Aboveground biomass carbon stock in nontree vegetation in sample plot *r* of stratum *i* at time *t* from non-tree allometric sample plots
Source of data and reference:	Field measurement.
Measurement procedures: (if any)	n/a
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	non-tree biomass accounts for < 0.5% of total GHG emissions and was conservatively excluded from biomass estimation.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None.

Data/parameter 22:	*angle*
Data unit:	Degrees
Used in equations:	24, 25, 26
Description:	angle formed between observer's eye and end of farthest observable canopy branch facing each of eight compass directions or one of two vantage points (24, 25). Angle formed between observer's eye and top of tree (26)
Source of data and reference:	Field Measurement.
Measurement procedures: (if any)	Clinometer used to position observer directly below canopy edge (angle = 90 and cos angle = 1) for crown dimension measurement (see Field SOP) (similar to 24, 25) and to top and bottom of tree (similar to 26)
Value used:	See Carbon Survey Report data
Comment:	Parameter not used
Assumptions and Decisions	tree height tested but not used in allometric equation as allowed by the methodology AIM Step 2
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 23:	*Dist*
Data unit:	Cm
Used in equations:	24, 25
Description:	distance from observer to end of first canopy branch facing each of eight compass directions or from one of two vantage points
Source of data and reference:	Field Measurement.
Measurement procedures: (if any)	Laser distance measurer used to measure tree distance from single vantage point to the tree stem (see Field SOP)
Value used:	See Carbon Survey Report data
Comment:	Parameter not used

Assumptions and Decisions	tree height tested but not used in allometric equation as allowed by the methodology AIM Step 2
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 24:	*Dbh*
Data unit:	Cm
Used in equations:	24, 25
Description:	diameter at breast height of tree
Source of data and reference:	Field Measurement.
Measurement procedures: (if any)	measured using DBH tape and standard forest survey procedures (see Field SOP)
Value used:	See Carbon Survey Report data
Comment:	
Assumptions and Decisions	Not used in eq 24,25. DBH was used in allometric equation by Chave et al. (2005) to estimate aboveground biomass from survey plots to test/validate biomass estimation equations.
Uncertainty estimate:	Not required.
Deviation from Methodology:	Deviation AIM Step 1.

Data/parameter 25:	H_{eye}
Data unit:	Meters
Used in equations:	26
Description:	height from ground to observer's eye
Source of data and reference:	Field Measurement.
Measurement procedures: (if any)	Clinometer used to measure angle to top and bottom of tree rather than H_{eye} (see Field SOP)
Value used:	See Carbon Survey Report data
Comment:	Parameter not used
Assumptions and Decisions	Note: tree height tested but not used in allometric equation as allowed by the methodology AIM Step 2
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 26:	H_{tree}
Data unit:	Meters
Used in equations:	26, 27, 29
Description:	height of tree
Source of data and reference:	Calculation from field data.
Measurement procedures: (if any)	n/a
Value used:	See Carbon Survey Report data
Comment:	Parameter not used
Assumptions and Decisions	Note: tree height tested but not used in allometric equation as allowed by the methodology AIM Step 2
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 27:	$MV_{B,AG\_timber,it}$
Data unit:	m3 ha-1
Used in equations:	34, 76
Description:	Mean merchantable volume under the baseline scenario in stratum i at time *t*
Source of data and reference:	Field Measurement.
Measurement procedures: (if any)	
Value used:	n/a
Comment:	Parameter not used
Assumptions and Decisions	eq 34 not used since BEF method not selected as allowed by the methodology p. 20; Parameter B_{logged} used in place of $MV_{B,AG_tree,it}$in eq 76 leakage
Uncertainty estimate:	n/a
Deviation from Methodology:	None

Data/parameter 28:	$A_{it}^{planted}$
Data unit:	Ha
Used in equations:	40
Description:	area of biomass growth on future land use in the baseline scenario in stratum *i* at time *t*
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	GIS analysis
Value used:	Rate 2,800 ha/yr
Comment:	Based on historical rate of plantation conversion by the baseline agent. See discussion Baseline Report. For values see oil palm regrowth worksheet. Annual area of planting cohorts A-F shown in columns E, I, M, Q, U, Y.
Assumptions and Decisions	Strata based on concession boundaries. Time based on staggered concession development and planting north to south.
Uncertainty estimate:	Required. Zero. Case 1 described above.
Deviation from Methodology:	None

Data/parameter 29:	*Slp*
Data unit:	t C ha-1 yr-1
Used in equations:	42
Description:	slope of regression line of biomass accumulation function
Source of data and reference:	Calculated based on field measurements
Measurement procedures: (if any)	
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	Non-linear function used to fit data on palm oil growth, therefore Slp parameter and eq 42 not used as allowed by the methodology p.28

Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 30:	*B*
Data unit:	t C ha-1
Used in equations:	41
Description:	intercept of regression line
Source of data and reference:	Calculated based on field measurements
Measurement procedures: (if any)	
Comment:	
Value used:	Parameter not used
Assumptions and Decisions	Non-linear function used to fit data on palm oil growth, therefore Slp parameter and eq 42 not used as allowed by the methodology p.28
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 31:	age_{peak}
Data unit:	Years
Used in equations:	45
Description:	age of stand at peak production
Source of data and reference:	literature values : Data reported in Cannell M.G. R. 1982. World Forest Biomass and Primary Production Data. Academic Press. London. 391 pp.
Measurement procedures: (if any)	n/a
Value used:	14
Comment:	See discussion Baseline Report Oil Palm Growth Model Data
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 32:	$A^{cleared}_{BH\ it}$
Data unit:	Ha
Used in equations:	48, 53
Description:	Area cleared at harvest *H* under the baseline scenario for stratum *i*, in time *t*
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	
Value used:	Parameter not used
Comment:	
Assumptions and Decisions	Eq 48 not calculated – as palm oil plantations operate on a 25-30 year timeframe, emissions from harvest rotations $E_{harvest}$ were not considered in baseline estimation. This is conservative.

Uncertainty estimate:	n/a
Deviation from Methodology:	None

Data/parameter 33:	*PBH*
Data unit:	Dimensionless
Used in equations:	48
Description:	average proportion of aboveground carbon stock removed during harvest *H* under the baseline scenario for stratum *i*, time t
Source of data and reference:	Field measurements or literature data
Measurement procedures: (if any)	
Value used:	Parameter not used
Comment:	
Assumptions and Decisions	Eq 48 not calculated – as palm oil plantations operate on a 25-30 year timeframe, emissions from harvest rotations $E_{harvest}$ were not considered in baseline estimation. This is conservative.
Uncertainty estimate:	n/a
Deviation from Methodology:	None

Data/parameter 34:	$PBB_{BH,it}$
Data unit:	Dimensionless
Used in equations:	53
Description:	average proportion of remaining aboveground carbon stocks burnt at harvest H under the baseline scenario in stratum *i*, time *t*
Source of data and reference:	
Measurement procedures: (if any)	
Value used:	
Comment:	Parameter not used
Assumptions and Decisions	Eq 48 not calculated – as palm oil plantations operate on a 25-30 year timeframe, emissions from harvest rotations $E_{harvest}$ were not considered in baseline estimation. This is conservative.
Uncertainty estimate:	n/a
Deviation from Methodology:	None

Data/parameter 35:	$D_{B,,drain,it}$
Data unit:	Cm
Used in equations:	58
Description:	average depth of peat drainage or average depth to water table under the baseline scenario in stratum *i*, time *t*
Source of data and reference:	Methodology default value = 100 cm
Measurement procedures: (if any)	
Value used:	100
Comment:	See Peat Drainage spreadsheet
Assumptions and Decisions	Note that peat depth across the project area is greater than the peat depth lost via subsidence and

	burning in the baseline scenario over the project life, therefore the net peat drainage depth of no more than 1 meter is used - Condition F of the methodology.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 36:	$A_{B,drain,it}$
Data unit:	Ha
Used in equations:	57
Description:	area of drainage impact under the baseline scenario in stratum *i*, time *t*
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	
Value used:	See Peat Drainage spreadsheet
Comment:	
Assumptions and Decisions	Strata comprised of concession boundaries and land cover (all types except kerangas forest and kerangas scrub which overlay sandy soil). Note peat drainage emissions are cumulative, expanding to cover the full extent of concessions, then continuing over the life of the project.
Uncertainty estimate:	Required. Zero. Case 2 described above.
Deviation from Methodology:	None

Data/parameter 37:	D_{peat}
Data unit:	Meters
Used in equations:	59
Description:	average depth of peat in project area
Source of data and reference:	Field Measurements
Measurement procedures: (if any)	Measured using peat probe at 159 sample points on 8 transects across project site (see Field SOP).
Value used:	4.3
Comment:	See Carbon Survey Report
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 38:	$D_{B,burn,it}$
Data unit:	cm
Used in equations:	63
Description:	depth of peat burned under the baseline scenario in stratum *i* at time *t*;
Source of data and reference:	Literature value: Couwenberg et al. (2009) cited in the methodology p. 36
Measurement procedures: (if any)	

Value used:	34cm
Comment:	
Assumptions and Decisions	According to the methodology p. 37 “The depth of peat burned shall be assumed to be equal to the drainage depth, minus a critical threshold of 40 cm above the drainage depth. If the difference between drainage depth and the critical threshold exceeds 34 cm, then the maximum burn depth of 34 cm shall be applied.” Since drainage depth for the baseline is 100cm, a burn depth of 34 cm is used.
Uncertainty estimate:	Required. Zero. Default value used.
Deviation from Methodology:	None

Data/parameter 39:	$A_{B,burn,it}$
Data unit:	Ha
Used in equations:	63
Description:	area of peat burned under the baseline scenario in stratum *i* at time *t*;
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	
Value used:	See Peat Burning spreadsheet
Comment:	
Assumptions and Decisions	Strata comprised of concession boundaries and land cover (all types except kerangas forest and kerangas scrub which overlay sandy soil). Note burning is a one-time event occurring during years 1-8 of staggered concession development. Estimated rate of burning = rate of deforestation and clearing.
Uncertainty estimate:	Required. Zero. Case 1 described above.
Deviation from Methodology:	None

Data/parameter 40:	BD_i
Data unit:	g cm-3 = t m-3
Used in equations:	63
Description:	Bulk density of peat in stratum I (g cm3 = t m3)
Source of data and reference:	Default value
Measurement procedures: (if any)	
Value used:	0.14
Comment:	see Peat Burning spreadsheet
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 41:	EF_{CO2}
Data unit:	g CO2 (t peat)-1

Used in equations:	61
Description:	CO_2 emissions from the combustion of peat
Source of data and reference:	Literature value. Muraleedharan et al. (2000) cited in the methodology p. 38
Measurement procedures: (if any)	
Value used:	185,000
Comment:	Peat Burning spreadsheet
Assumptions and Decisions	As per the methodology, the emission factors for peat combustion at the lower temperatures were assumed in the ex ante baseline estimates, as this results in lower overall GHG emissions (CO_2 + CH_4 reported as CO_2 equivalents) and thus a conservative baseline scenario.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 42:	EF_{CH4}
Data unit:	g CH_4 (t peat)-1
Used in equations:	62
Description:	CH_4 emissions from the combustion of peat
Source of data and reference:	Literature value
Measurement procedures: (if any)	
Value used:	5,785 g/ton peat
Comment:	Peat Burning – BL worksheet cell E6
Assumptions and Decisions	As per the methodology, the emission factors for peat combustion at the lower temperatures were assumed in the ex ante baseline estimates, as this results in lower overall GHG emissions (CO_2 + CH_4 reported as CO_2 equivalents) and thus a conservative baseline scenario.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 43:	*LDF*
Data unit:	t C m-3
Used in equations:	68
Description:	Logging Damage Factor for calculating the biomass of dead wood created during logging operations per cubic meter extracted
Source of data and reference:	Default value of 0.37 t C m-3 from 534 logging gaps measured by Winrock International in Bolivia, Belize, Mexico, the Republic of Congo, Brazil and Indonesia may be used for tropical broadleaf forests.
Measurement procedures: (if any)	
Value used:	0.37
Comment:	
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 44:	PML_{FT}
Data unit:	%
Used in equations:	Unnumbered eq methodology page 41
Description:	Mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type to which displacement of logging activities is likely to occur.
Source of data and reference:	GIS data from landcover/forest maps published by Ministry of Forestry. All forest types in which commercial logging could take place within PT Best concessions were considered.
Measurement procedures: (if any)	
Value used:	< 0.20
Comment:	
Assumptions and Decisions:	There is minimal remaining forest in PT BEST concessions outside Rimba Raya, therefore a relative value of < 0.20 was sufficient for determining that PML_{FT} is > 0.15 less than PMP_i (methodology p. 41) and therefore the highest market leakage deduction factor is selected and applied. This results in the most conservative (largest) deduction from the baseline estimate for market leakage as a result of Rimba Raya's comparatively high timber volume being removed from PT BEST concession's timber potential.
Uncertainty estimate:	n/a
Deviation from Methodology:	None

Data/parameter 45:	$V_{B,it}$
Data unit:	m^3
Used in equations:	68
Description:	Volume of timber projected to be extracted from within the project boundary during the baseline in stratum *i* at time *t*
Source of data and reference:	Source of data same as biomass logged parameter.
Measurement procedures: (if any)	
Value used:	Embedded in equation 68, see biomass burning spreadsheet
Comment:	Note that this volume does not include logging slash left onsite. Extracted volumes reported are gross volumes removed.
Assumptions and Decisions:	Biomass logged was already derived for RR based on Mawas field data and is the same as the first term of the CB,XBT,it equation. By setting this term equal to Biomass logged, V B, it is derived and used directly in eq. 68.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 46:	PMP_i
Data unit:	%
Used in equations:	Unnumbered eq. p. 41
Description:	Merchantable biomass as a proportion of total aboveground tree biomass for stratum *i* within the project boundaries
Source of data and reference:	unpublished data from Mawas, Winrock 2008
Measurement procedures: (if any)	
Value used:	Mean 0.36, SD 0.169
Comment:	Same as B logged (Biomass Extracted as Merchantable Timber >30cm in Timber Extraction spreadsheet)
Assumptions and Decisions:	Mawas data provides complete dataset applicable to Rimba Raya project site. Average proportion of merchantable timber across 93 logging gaps
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 47:	$HistHa_i$
Data unit:	Ha
Used in equations:	72
Description:	Average annual area of deforestation by the baseline agent of the planned deforestation in stratum *i* for the 5-10 years prior to project implementation
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	GIS analysis
Value used:	6113.7
Comment:	See discussion Baseline Report
Assumptions and Decisions:	
Uncertainty estimate:	Required. Zero. Case 1 described above.
Deviation from Methodology:	None

Data/parameter 48:	$A_{defLK,it}$
Data unit:	Ha
Used in equations:	73
Description:	The total area of deforestation by the baseline agent of the planned deforestation in stratum *i* at time *t*
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	GIS analysis of satellite imagery
Value used:	Not calculated as of year 1 (no leakage)
Comment:	Legal records will include government permits to

	deforest including concession licenses. Ex-ante, project proponents shall determine and justify the likelihood of leakage based on characteristics of the baseline agent. To be calculated if activity shifting leakage is detected. See Monitoring plan discussion.
Assumptions and Decisions	
Uncertainty estimate:	N/A year 1
Deviation from Methodology:	None

Leakage Calculation Methodological Pathways and Parameters

Methodological pathways for leakage monitoring (Figure 40) are taken from the conceptual diagram in the VCS methodology. Specific data collected for accounting leakage GHG emissions are summarized in Table 31 below. These data/parameter tables expand on those in the methodology to include value used, assumptions and decisions, uncertainty estimate and deviation information. There were no deviations in leakage monitoring pathways.

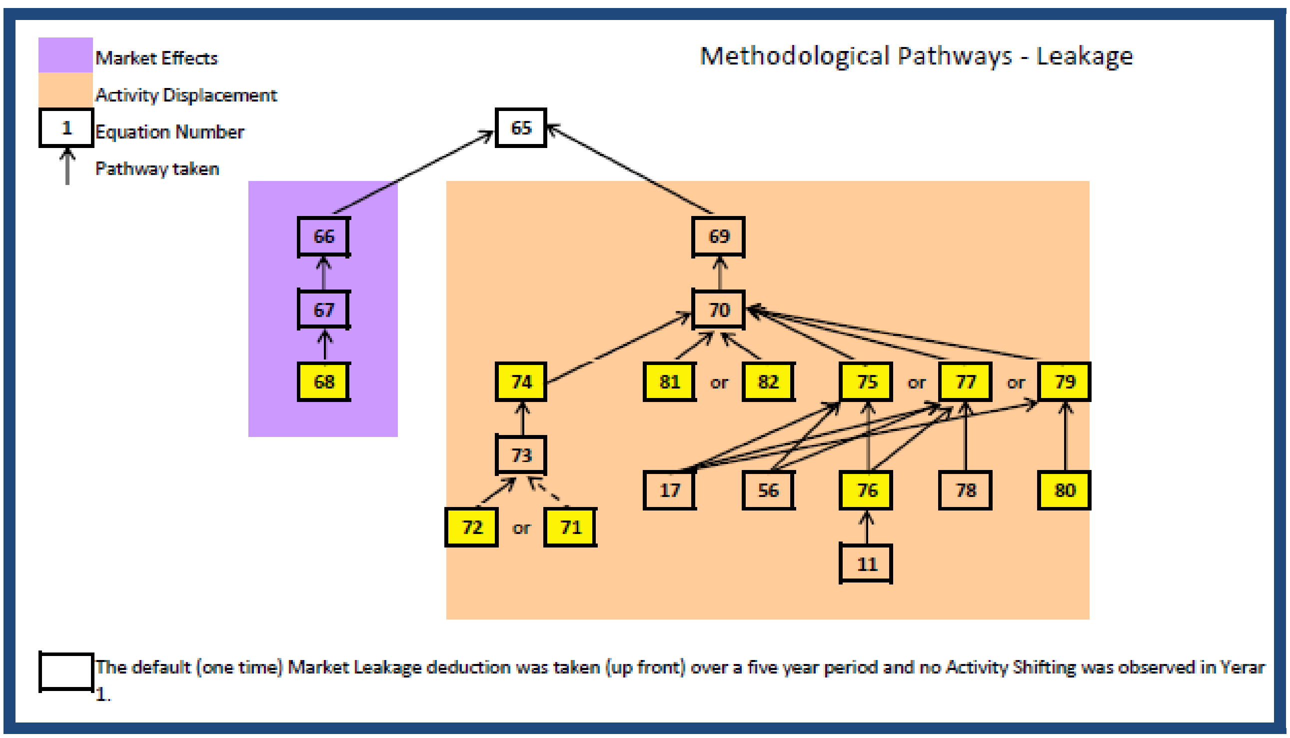


Figure 40. Methodological pathways used to calculate leakage GHG emissions avoided. Pathways included in one-time market leakage calculations and annual project leakage monitoring are shown as solid line arrows. Pathways not included are shown as dotted line arrows.

Equations that include at least one parameter for which uncertainty estimation is required are shown in yellow boxes. Uncertainty estimation was conducted in accordance with the methodology and is presented in the parameter table below. Note that since this methodology is only applicable to projects where deforestation is planned and projected to occur within 10 years of the project start date (Applicability Condition D), **uncertainty in deforestation rate is assumed to be zero** (methodology p. 53). To demonstrate the most likely deforestation rate scenario, an analysis of recent palm oil conversion by the agent of deforestation was conducted. These GIS-based calculations are estimated to be > 90% accurate as described below. GIS-based parameters for ex ante calculations fall into one of two cases, which are referenced in the parameter table:

- Case 1. Area cleared, logged or planted (2,800 ha/yr): These parameters are based on the actual rate of clearing by the deforestation agent, determined from analysis of Landsat data. Landsat is the primary tool for mapping tropical deforestation (Defries et al. 2005) and has been validated against high resolution imagery to be 92-97.5% accurate (NASA accessed January 15, 2011 http://www.glcf.umd.edu/data/paraguay/description.shtml).

- Case 2. Area drained: Drainage area is based on stratification of peat/non-peat which derives from landcover stratification where non-peat types (Kerangas Forest and Open Kerangas Scrub) were differentiated from all other types with 92% producer's accuracy and 98.5% user's accuracy.

Table 31. Data collected and archived for leakage GHG emissions avoided

Data/parameter 1	$A_{cleared\ B,it}$
Data unit:	Ha
Used in equations:	73
Description:	Average annual area of deforestation by the baseline agent of deforestation for the 5 years prior to project implementation
Source of data and reference:	GPS coordinates and/or remote sensing data and or/legal parcel records
Measurement procedures: (if any)	
Value used:	Rate 2,800 ha/yr (stratum i, time t)
Comment:	See baseline parameters 2, 9
Assumptions and Decisions	The expected annual rate of conversion was determined by analyzing historical rate of conversion by the baseline agent.
Uncertainty estimate:	Required. Zero. Case 1 described above.
Deviation from Methodology:	None

Data/parameter 2:	$A_{defLK,\ t}$
Data unit:	Ha
Used in equations:	74
Description:	The total area of deforestation by the baseline agent of the planned deforestation at time *t*
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	
Value used:	
Comment:	Legal records will include government permits to

	deforest including concession licenses
Assumptions and Decisions	
Uncertainty estimate:	Required. Zero. No area of deforestation (leakage) was observed.
Deviation from Methodology:	None

Data/parameter 3:	*WoPA*
Data unit:	Ha
Used in equations:	71
Description:	Total (cumulative) area of forest cleared by the baseline agent of planned deforestation in stratum *i* at time *t*
Source of data and reference:	Analysis of remote sensing data and/pr legal records and /or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	
Value used:	
Comment:	
Assumptions and Decisions	
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 4:	*HistHa*
Data unit:	Ha
Used in equations:	72
Description:	Average annual area of deforestation by the baseline agent of deforestation for the 5 years prior to project implementation
Source of data and reference:	Analysis of remote sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation
Measurement procedures: (if any)	
Value used:	6113.7
Comment:	Same as baseline parameter 47. See discussion on deforestation rate section 4.2
Assumptions and Decisions	
Uncertainty estimate:	Required. Zero. Case 1 described above.
Deviation from Methodology:	None

Data/parameter 5:	PMP_i
Data unit:	%
Used in equations:	Unnumbered Eq. p. 41
Description:	Merchantable biomass as a proportion of total aboveground tree biomass for stratum *i* within the project boundaries
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)

Measurement procedures: (if any)	
Value used:	Mean 0.36, SD 0.169
Comment:	Same as B logged (Biomass Extracted as Merchantable Timber >30cm in Timber Extraction spreadsheet
Assumptions and Decisions	Mawas data provides complete dataset applicable to Rimba Raya project site. Average proportion of merchantable timber across 93 logging gaps
Uncertainty estimate:	Mean = 0.36, SE = 0.0176, n=93. Uncertainty (90%CI/mean*100) = 8.04%
Deviation from Methodology:	None

Monitoring Calculation Methodological Pathways and Parameters

Methodological pathways for monitoring **(Figure 41)** are taken from the conceptual diagram in the VCS Methodology. Specific data collected for monitoring project (ex post) GHG emissions are summarized in Table 32. These data/parameter tables expand on those in the methodology to include value used, assumptions and decisions, uncertainty estimate and deviation information. There were no deviations in monitoring methods pathways.

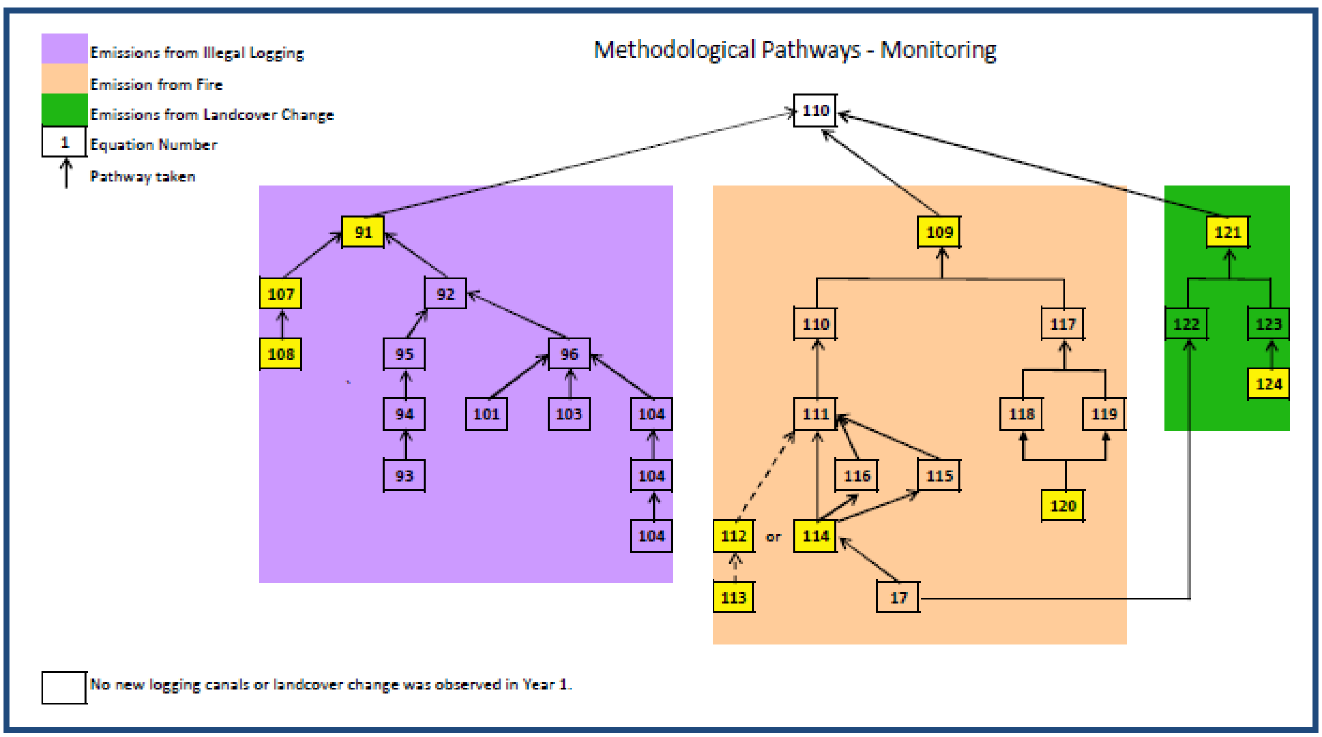


Figure 41. Methodological pathways used to calculate ex post net actual GHG emissions avoided. Pathways included in annual monitoring are shown as solid line arrows. Equations that include at least one parameter for which uncertainty estimation is required are shown in yellow boxes. Uncertainty estimation was conducted in accordance with the methodology and is presented in the parameter table below. Note that all pathways are implemented only as required each year. For example, equations 107 and 108, logging emissions associated with peat drainage, were not used in year 1 because there were no new logging canals.

Table 32. Data collected and archived for *ex post* net actual GHG emissions avoided

Data/parameter 1:	*N gapsP, it*
Data unit:	dimensionless
Used in equations:	91
Description:	number of logging gaps detected in stratum *i*, time t in the project area
Source of data and reference:	Field data – see field survey report, Yappi 2010
Measurement procedures: (if any)	
Value used:	40 (year 1)
Comment:	
Assumptions and Decisions:	Logging gaps were found by directed searches to areas of known logging activity based on community surveys.
Uncertainty estimate:	Not required.
Deviation from Methodology:	None

Data/parameter 2:	*L* log , tr, tk
Data unit:	m
Used in equations:	93,97
Description:	length of log extracted from timber tree tr in stratum i, gap k, measured as the distance from stump to base of crown, less the length of any pieces of bole left on site
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of groundmeasurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 3:	*D bottom, tr, ik*
Data unit:	Cm
Used in equations:	93
Description:	Diameter at the stump end of log extracted from timber tree *tr* in stratum *i*, gap *k*
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	

Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 4:	*D top, tr, ik*
Data unit:	Cm
Used in equations:	93, 97
Description:	diameter at the crown end of log extracted from timber tree *tr* in stratum *i*, gap *k*
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 5:	ϕ_i
Data unit:	t m-3
Used in equations:	94
Description:	Wood density[52] of extracted log in stratum *i*
Source of data and reference:	Literature Value: Reyes, Brown, Chapman and Lugo (1992) mean wood density for tropical Asia represented by 428 species, SE = 0.007
Measurement procedures: (if any)	
Value used:	0.57 (SD = 0.145)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	90%CI/mean* 100 = 2.03%
Deviation from Methodology:	None

Data/parameter 6:	*CF*
Data unit:	dimensionless
Used in equations:	100
Description:	Carbon fraction of dry matter (extracted log)

Source of data and reference:	IPCC default = 0.50 used in Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	n/a
Value used:	0.50
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 7:	$D_{s,tr,ik}$
Data unit:	Cm
Used in equations:	97
Description:	Diameter of the stump of the logged timber tree *tr* in stratum *i*, gap *k*
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 8:	$H_{tr,ik}$
Data unit:	M
Used in equations:	98
Description:	Height of tree *tr* in stratum *i*, gap *k*
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 9:	$D_{pce\text{-}b,tr,\ ik}$
Data unit:	Cm
Used in equations:	100
Description:	Diameter of bottom end of piece *pce* left from timber tree *tr* in stratum *i*, gap *k*
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 10:	$L_{pce,tr,ik}$
Data unit:	m
Used in equations:	100
Description:	Length of piece *pce* left from timber tree *tr* in stratum *i*, gap *k*
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps shall be completed at the beginning of the project or over the life of the project."
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 11:	$D_{pce\text{-}t,tr,ik}$
Data unit:	Cm
Used in equations:	100
Description:	Diameter of top end of piece *pce* left from timber tree *tr* in stratum *i*, gap *k*: cm
Source of data and reference:	Field measurements from Mawas logging gap assessment (Winrock 2008)
Measurement procedures: (if any)	
Value used:	See logging gap spreadsheet (Winrock 2008)
Comment:	
Assumptions and Decisions:	Mawas logging gap data is applicable to Rimba Raya and is used as allowed by the methodology p. 71 "An initial set of ground measurements in logging gaps

	shall be completed at the beginning of the project or over the life of the project.”
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 12:	$D_{logging\ drain,it}$
Data unit:	Cm
Used in equations:	108
Description:	Average depth of peat drainage or average depth to water table in drained area of stratum *i*, time *t* during the dry season
Source of data and reference:	Field measurements
Measurement procedures: (if any)	
Value used:	No new logging canals detected (year 1)
Comment:	
Assumptions and Decisions:	
Uncertainty estimate:	Required (n/a year 1)
Deviation from Methodology:	None

Data/parameter 13:	$A_{logging\ peatimpact,it}$
Data unit:	Ha
Used in equations:	107
Description:	Area of drainage impact in stratum *i*, time *t*
Source of data and reference:	Calculated in GIS
Measurement procedures: (if any)	
Value used:	No new logging canals detected (year 1)
Comment:	
Assumptions and Decisions:	
Uncertainty estimate:	Required (n/a year 1)
Deviation from Methodology:	None

Data/parameter 14:	*CE*
Data unit:	Dimensionless
Used in equations:	112
Description:	Average biomass combustion efficiency
Source of data and reference:	IPCC default =0.50
Measurement procedures: (if any)	
Value used:	0.50
Comment:	Same as baseline data/parameter 8
Assumptions and Decisions:	
Uncertainty estimate:	Required. Zero. Default value used.
Deviation from methodology:	None

Data/parameter 15:	$MC_{burned\ P,AG,it}$
Data unit:	t C ha^{-1}

Used in equations:	113
Description:	Estimated aboveground carbon stock after burning under the project case for stratum *i*, time *t*
Source of data and reference:	Field measurements
Measurement procedures: (if any)	
Value used:	n/a (not measured)
Comment:	
Assumptions and Decisions:	According to the methodology p. 81 "If no field measurements are available of carbon stocks after burning, then the CO2 emission factor for biomass burning should be conservatively estimated as the CO2 equivalent of the mean baseline aboveground carbon stock of the stratum in which fire was detected."
Uncertainty estimate:	Required (for field measurement) n/a year 1
Deviation from Methodology:	None

Data/parameter 16:	*N/Cratio*
Data unit:	Dimensionless
Used in equations:	115
Description:	Nitrogen-carbon ratio
Source of data and reference:	IPCC default=0.01
Measurement procedures: (if any)	
Value used:	0.01
Comment:	See Monitoring ABG Biomass Burn2010 worksheet
Assumptions and Decisions:	
Uncertainty estimate:	Not required
Deviation from methodology:	None

Data/parameter 17:	ER_{N20}
Data unit:	t CO_2-e (t C)$^{-1}$
Used in equations:	115
Description:	Emission ratio for N_2O
Source of data and reference:	IPCC default value=0.007
Measurement procedures: (if any)	
Value used:	0.007
Comment:	See Monitoring ABG Biomass Burn2010 worksheet
Assumptions and Decisions:	
Uncertainty estimate:	Not required
Deviation from methodology:	None

Data/parameter 18:	ER_{CH4}
Data unit:	t CO_2-e (t C)$^{-1}$
Used in equations:	116
Description:	Emission ratio for CH_4
Source of data and reference:	IPCC default value =0.012
Measurement procedures: (if any)	
Value used:	0.012

Comment:	See Monitoring ABG Biomass Burn2010 worksheet
Assumptions and Decisions:	
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 19:	GWP_{N2O}
Data unit:	t CO_2-e (t N_2O)$^{-1}$
Used in equations:	115
Description:	Global Warming Potential for N_2O
Source of data and reference:	Methodology = 310 for the first commitment period
Measurement procedures: (if any)	
Value used:	310
Comment:	See Monitoring ABG Biomass Burn 2010 worksheet
Assumptions and Decisions:	
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 20:	GWP_{CH4}
Data unit:	t CO_2-e (t CH4)$^{-1}$
Used in equations:	116,119
Description:	Global Warming Potential for CH_4
Source of data and reference:	Methodology = 21 for the first commitment period
Measurement procedures: (if any)	
Value used:	21
Comment:	See Monitoring ABG Biomass Burn2010 worksheet
Assumptions and Decisions	
Uncertainty estimate:	Not required
Deviation from Methodology:	None
IE comment	

Data/parameter 21:	$A_{p,burn,it}$
Data unit:	Ha
Used in equations:	109
Description:	Area burned in stratum *i*, time *t* in the project area
Source of data and reference:	Field measurements or using high resolution digital aerial imagery
Measurement procedures: (if any)	GIS analysis of satellite imagery and ground-truth data
Value used:	array
Comment:	See Monitoring ABG Biomass Burn2010 worksheet
Assumptions and Decisions	
Uncertainty estimate:	Required. Zero. Burn areas were assessed using MODIS fire data that has been validated to be 92-98% accurate for a tropical site in Thailand (Tanpipat et al. 2009). MODIS-based burn mapping was further improved by interpreting Landsat imagery which is widely used as a calibration image in mapping burn

	scars and deforestation (e.g. Tung Chu 2010) and also confirmed by ground surveys.
Deviation from Methodology:	None

Data/parameter 22:	$D_{P,burn,it}$
Data unit:	Meters
Used in equations:	120
Description:	Depth of peat burned under the project scenario in stratum *i* at time *t*:
Source of data and reference:	Methodology default value
Measurement procedures: (if any)	
Any comment:	
Value used:	0.34 m
Assumptions and Decisions	
Uncertainty estimate:	Required (for field measurement). n/a Year 1 literature value used.
Deviation from Methodology:	None

Data/parameter 23:	BD_i
Data unit:	g cm-3 = t m-3
Used in equations:	120
Description:	Bulk density of peat in stratum *i*
Source of data and reference:	Default value
Measurement procedures: (if any)	
Value used:	0.14
Comment:	
Assumptions and Decisions	
Uncertainty estimate:	Not required
Deviation from methodology:	None

Data/parameter 24:	EF_{CO2}
Data unit:	g CO_2 (t peat)$^{-1}$
Used in equations:	118
Description:	CO_2 emissions from the combustion of peat
Source of data and reference:	Literature value: Muraleedharan et al. (2000) cited in Methodology p. 38
Measurement procedures: (if any)	
Value used:	185,000
Comment:	Monitoring Peat Burn 2010 worksheet
Assumptions and Decisions	
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 25:	EF_{CH4}
Data unit:	g CH_4 (t peat)$^{-1}$
Used in equations:	119
Description:	CH_4 emission from the combustion of peat
Source of data and reference:	Literature value: Muraleedharan et al. (2000) cited

	in Methodology p. 38
Measurement procedures: (if any)	
Value used:	5,785
Comment:	Monitoring Peat Burn 2010 worksheet
Assumptions and Decisions	
Uncertainty estimate:	Not required
Deviation from Methodology:	None

Data/parameter 26:	$A_{P, LCC, it}$
Data unit:	Ha
Used in equations:	121
Description:	Area that underwent land cover change in stratum *i*, monitoring year *t*:
Source of data and reference:	High resolution digital aerial imagery or field measurements
Measurement procedures: (if any)	GIS and satellite image analysis
Value used:	
Comment:	No land cover change Year 1 (that was not accounted in logging or burning assessment)
Assumptions and Decisions	
Uncertainty estimate:	Required (n/a Year 1)
Deviation from Methodology:	None

Data/parameter 27:	$A^{LCCn}_{peatimpact,it}$
Data unit:	Ha
Used in equations:	121
Description:	Area of drainage impact due to land cover change in stratum *i*, monitoring year *t*
Source of data and reference:	Calculated in GIS
Measurement procedures: (if any)	
Value used:	
Comment:	No drainage associated with land cover change Year 1
Assumptions and Decisions	
Uncertainty estimate:	Required (n/a Year 1)
Deviation from Methodology:	None

Data/parameter 28:	$D^{LCC}_{drain,it}$
Data unit:	Cm
Used in equations:	124
Description:	Average depth of peat drainage or average depth to water table in the deforested area under the project scenario in stratum *i*, time *t*
Source of data and reference:	Field measurements or estimated from literature values if measurements not available
Measurement procedures: (if any)	
Value used:	

Comment:	No drainage associated with land cover change Year 1
Assumptions and Decisions	
Uncertainty estimate:	Required (n/a Year 1)
Deviation from Methodology:	None

G2.4. 'Without Project' Scenario Effects on Project Zone Communities

Describe how the 'without project' reference scenario would affect communities in the project zone, including the impact of likely changes in water, soil and other locally important ecosystem services.

Palm Oil and communities in Indonesia

The damaging impact of oil palm plantations on the environment in Souteast Asia is already well documented, including forest destruction, fires, the loss of orangutan habitat, pollution and sedimentation of rivers, and the oxidation of peatlands leading to massive carbon dioxide emissions. But the impact of oil palm impact extends far beyond environmental damage, harming the very communities it purports to help through usurpation of community land, conflict that sometimes leads to violence, and the perverse diminishment of economic opportunity.

Legally, once land has been identified by a company wanting to develop a new plantation, the local communities and indigenous peoples must be consulted about the development and appropriate levels of compensation. An environmental impact assessment (EIA) must also be carried out before a land use permit is granted. Evidence suggests, however, that this process is rarely adhered to on the ground. Many communities report that they are not consulted at the appropriate stages of the permitting process and only discover that their land has been allocated for palm oil when the bulldozers arrive to clear their ancestral territories. When community consultations do take place, these are often flawed, and palm oil companies do not permit communities to influence decisions on oil palm plantation development. Companies also frequently fail to explain to communities that the land they relinquish will not be returned to them at the end of the HGU (allocated land use) period, but will instead devolve to the State.

The rapid expansion of oil palm plantations in Indonesia leads to hundreds of disputes and conflicts over land involving demonstrations, land occupations, displaced persons, arrests, beatings, torture, and deaths. As of January 2008, Sawit Watch, an Indonesian NGO, has monitored 513 active conflicts between companies and communities in the oil palm plantation sector in Indonesia. These conflicts involve 135 companies from 23 groups, both private and state-owned.

Sawit Watch believes that 1,000 communities may be involved in oil palm-related conflicts in Indonesia. Information collated by the Consortium for Agrarian Reform (KPA) from media sources and by member organizations in 19 provinces shows that between mid-1998 and early 2002:

- At least 479 local people and activists defending community rights were tortured in 41 conflicts.
- At least 12 were killed in 14 conflicts.
- At least 134 were shot in 21 cases.
- At least 25 were abducted in seven cases.
- At least 936 were arrested in 77 cases.
- At least 284 houses or huts were burned down or destroyed in 25 cases.
- No less than 307,954 hectares of peasants' land was affected by crop damage, destruction and burning.
- No less than 1,901 peasants and activists were threatened in 157 cases.

The debate around the expansion of the oil palm industry is sometimes framed in terms of trade-offs between the crop's environmental impacts and the need for economic development, but few local people appear to benefit. Revenues are of course being generated from palm oil. The price of crude palm oil has risen steadily over the past few years, with the exception of the current economic crisis. However, many of the villagers who have given up their land to become smallholders or to work on plantations find that their situation has not improved. Reports published over the last 10 years have consistently shown that the conditions of smallholders and laborers working on or linked to large plantations are often very poor.

When oil palm companies seek to acquire land and permits to expand their operations, they not only hold out the promise of smallholdings, but also claim to provide employment for local communities and indigenous peoples. The promise of employment is a central argument used to convince communities to accept conversion of their land to oil palm plantations. In reality, the opportunities created are short-lived. Once the plantation has been established, many of the full-time contracted positions are replaced with casual jobs at lower wages offering fewer protections. Plantation managers often hire migrant workers for these jobs, further disenfranchising indigenous people. While the minimum wage often does not meet the government's own standards for a decent livelihood, plantation wages, even for contracted workers, are frequently at or below the minimum wage.

Observers comment that many local people have little choice but to work as casual laborers on oil palm estates. Though they may well be underpaid, transformation of their land to oil palm monoculture leaves them few employment options.

The lack of community land rights, corruption in permit allocations, and irregularities in community consultations only accelerate the expansion of oil palm plantations in Indonesia. The clearing of forests also results in the loss of subsistence resources such as bush-meat, forest fruit, forest vegetables, medicinal plants, roofing, building materials, firewood, and materials for traditional crafts. Community agro-forestry plots may also be lost, and communities bear the brunt of externalities such as fires (set to clear the plantations), floods (which are reported to follow plantation establishment), and a loss of access to clean water.

'Without-project' effects on communities within Project Zone

Oil palm plantation expansion is a cornerstone of the development program that the Seruyan District has implemented since 2000 in an effort to increase the region's income. Forest areas near TPNP (including the Project Area) have been licensed to more than eight oil palm companies, and thus far four have begun plantation development activities. Some of these companies have been operating since 2005 (based on the license area issued by the Seruyan District Head) in upstream villages inside the Project Zone, including Bahaur, Paren, Parang Batang, Tanjung Hanau, Ulak Batu and Palingkau. Without the Rimba Raya project, the other four are likely to commence development in the near future.

Oil palm development, if conducted in accordance with current laws, would see companies working in partnership with local communities to develop land with the expectation of strengthening the local economy and eventually improving the welfare of local communities. To date, however, the process of land acquisition by oil palm companies in the Project Zone has created conflict over land rights where none existed before (see Section G1.6 above). Compensation for land has been decided unilaterally by oil palm companies, and communities complain that they have been treated unfairly. Companies often clear land and plant oil palm prior to receiving consent from the owner and signing a formal lease agreement. The current situation is unlikely to change without first reaching a peak of collective protests and/or violence on the part of the communities, with reprisals from plantation owners, as seen in other parts of Indonesia.

Beyond these conflicts over land rights and compensation, forest conversion by oil palm companies – the 'without project' scenario – will likely diminish the region's capacity to deliver environmental services on which Project Zone communities rely. The replacement of robust ecosystems with monoculture plantations like oil palm inevitably reduces water retention and increases runoff and flooding. Recent and persistent flooding in the Project Zone is attributable to the conversion of land for oil palm plantations to the north of the Project Area.

The pollution of rivers with chemicals used to fertilize the soil is another inevitable consequence of plantation development. Two communities in the Project Zone (Bahaur and Tanjung Hanau) already claim that they cannot use river water for drinking since the arrival of oil palm plantations. In the Lake Sembuluh region, community members report that bathing in the water makes their skin itch, blaming the effluent being deposited in the lake by the nearby oil palm processing plant.

These problems are likely to multiply with further development of oil palm plantations in the area. Oil palm development creates a local "Catch 22": conversion leaves communities landless; in turn, community members obtain temporary work clearing land, planting, and harvesting oil palm, but after the initial push to develop a plantation, regular employment is usually unavailable; community members then turn to fishing, but increased flooding and pollution diminish the Seruyan's capacity to support this livelihood.

Project Zone communities have already experienced the negative environmental impacts of oil palm with only limited plantation development. Continued development is likely to increase the stress on these impoverished communities. Under such conditions, poverty levels are likely to rise further, provoking collective protests and demonstrations by the communities with possible violent repercussions, as has happened in other parts of Indonesia with similar patterns of oil palm development.

G2.5. 'Without Project' Scenario Effects on Project Zone Biodiversity

Describe how the 'without project' reference scenario would affect biodiversity in the project zone (e.g., habitat availability, landscape connectivity and threatened species).

Palm Oil and Habitat Loss

Around 40 per cent of Indonesia's legal timber supply results from land clearance for conversion to plantations. At $2,100/per hectare, timber generates an attractive cash source to subsidize plantation development. In the past burning was widely used to clear land of remaining timber stands. The forest fires of 1997/98 devastated over 5 million hectares of forest. Although aggravated by years of exploitative logging and the El Niño effect, satellite imagery confirms that the majority of these fires were triggered by palm-oil companies using uncontrolled burning to clear land.

Orangutans inhabit lowland dipterocarp, freshwater and peat-swamp forests, the same forests targeted for conversion to oil palm plantation. In the decade between 1992 and 2003, orangutan habitat declined by more than 5.5 million hectares, while the plantation area across Borneo and Sumatra increased by almost 4.7 million hectares. It has been estimated that the fires of 1997/98 alone were responsible for the loss of one-third of Borneo's orangutan population – a massive step back in the conservation effort to save this species from extinction.

The Bornean Orangutan is found in the Indonesian provinces of West, Central and East Kalimantan, and the Malaysian states of Sabah and Sarawak. Extensive fieldwork and improved survey techniques over the past decade have revealed that there may be higher numbers of orangutan on Borneo than previously thought, and the population is estimated to stand at around 47,237 individuals. During this time, however, the rate of deforestation has escalated. Forests across the Bornean orangutan's entire range are under pressure from illegal logging and conversion to oil-palm plantations, and habitat fragmentation is a significant issue across the island.

Experts have identified a number of key habitat areas that are crucial for the continued existence of orangutan in the wild. Within Central Kalimantan, two-thirds of the priority areas can be considered at risk of conversion. Recent habitat analysis revealed that in 2002, the total area of orangutan habitat remaining in Kalimantan was about 8.5 million hectares, divided into 306 distinct habitat units. To compound the problem of fragmentation, the majority of the forest is now classified as degraded.

Degraded forests support a lower density of orangutans than primary forests. Furthermore, degradation makes these forests more likely to be reclassified as 'conversion forest' – destined to be clear cut and converted to oil-palm plantations. Considering Borneo's deforestation rate of 1.3million hectares per year, the outlook for the Bornean orangutan is not favorable.

<u>'Without-project' effects on biodiversity within the Project Zone</u>

Tanjung Puting National Park (TPNP) is world-renowned for its orangutan population. With a population of 5,000 individuals, representing 10% of the global orangutan population, the Park makes an essential contribution to the protection and continued survival of the Bornean orangutan. Rimba Raya is an important part of greater Tanjung Puting National Park, and its large forest blocks adjacent to the park augment TPNP orangutan populations by an estimated 14%. Additionally, Rimba Raya's mosaic of terrestrial and aquatic ecosystems house hundreds of species of flora and fauna and provide habitat for many rare and endangered species. A recent study of the Project Management Zone documented high biodiversity including 361 species of birds, 122 species of mammals, and 180 species of trees and woody plants likely to be present in the project area.

Orangutan populations and most of Rimba Raya's biodiversity would be lost with conversion to palm oil, the most likely 'without-project' scenario. The park's northern border already consists of palm-oil plantations and there has been a history of encroachment and other negative impacts by plantations on the park. In December 2002 as much as 30,000 tonnes of palm-oil mill effluent leaked into the Sekonyer River after settling ponds at the Wana Sawit oil palm plantation ruptured. This damaged the aquatic ecosystem threatening endangered freshwater fish species and polluting the water resource on which local people depend. In May 2003, Wana Sawit planted oil palm on up to 380 hectares of once-forested land inside the park's border. In June 2004, a series of roads up to 10km long were discovered leading from this area further into the park, facilitating illegal logging and extensive degradation of the protected forests.

In 2004 NGOs uncovered plans by three other plantation companies to expand their operations. Examination and satellite analysis of these plans revealed that over 17,000 hectares of park land, nearly all of the supposed 'buffer zone' along the Eastern border, would be lost if the proposed expansion took place. Without the Rimba Raya project, this expansion of palm oil plantations encroaching the park would undoubtedly proceed according to plan.

Under the most likely 'without project' scenario, severe negative impacts on biodiversity in the project zone can be expected. Under this scenario, the vast majority of the Project Area is converted to oil palm. Such a large expansion of oil palm would lead to remaining forests being heavily exploited and very few, if any, natural forests remaining. As has been experienced in other areas in Kalimantan and Southeast Asia, this scenario would likely isolate patches of remaining forest, eliminating existing connectivity with the national park and between remnant patches of forest. Such a large-scale conversion to oil palm would leave very limited habitat for threatened species, and would lead to their local extinction. Only a small percentage of native wildlife can persist in such an environment, able to live in (e.g. mice, rats, pangolin), use, or pass through (e.g. pigs and deer) oil palm plantations. Seed banks of threatened plants would also be lost through such large-scale conversion to monoculture.

Even a less severe (though less likely) 'without project' scenario, under which a smaller portion of the Project Area is converted to oil palm (it is unforeseeable that none of it would) and the remaining land left to current land use patterns, would prove harmful to biodiversity. Under this scenario, some landscape connectivity would remain, albeit through secondary and degraded forests as they continue to be exploited for timber and grow increasingly susceptible to fire through human disturbance. Fire, through anthropogenic causes, has had a strong influence on the landscape in the Tanjung Puting National Park. This pattern of human-induced fire has also occurred in the Project Zone, and is likely to increase with a rise in disturbed forests and human presence, both of which will occur without the Rimba Raya project. Although this scenario is preferable to the more severe 'without project' scenario, allowing for greater levels of biodiversity to persist, it is still far from optimal as there is a guaranteed reduction in biodiversity, especially to threatened, forest-dependent species and large-bodied mammal species.

"Leave this earth a better place than when you arrived"

- Author, Sidney Sheldon

G3. Project Design and Goals

G3.1. Summary of Project Climate, Community, and Biodiversity Objectives

Provide a summary of the project's major climate, community and biodiversity objectives.

The Rimba Raya project represents a new model in for-profit conservation. The project was designed to attract conventional private sector funding, successfully compete with commercial interests for the project area's natural resources, and attract a high caliber of NGO and private-sector management.

In selecting the project area, InfiniteEARTH and OFI have set out to save a vast swath of peat swamp forest flanking the entire ca. 90 km eastern boundary of Tanjung Puting National Park from imminent deforestation at the hands of palm oil concessionaires. The overarching goal of the project is to utilize funds from the sale of carbon credits generated by the Rimba Raya project to engage the surrounding communities in park-wide conservation efforts, thereby creating a physical and social buffer to the park and providing effective protection to significant carbon stocks and the park's unique biodiversity.

TPNP, situated on the southern coast of Borneo, has natural borders to the west and south along the Java Sea. While there are a number of communities inside the park along its western coast, OFI has been active in engaging and integrating them sustainably into the park's management. The park's northern border has been the subject of disputes for a number of years, but OFI has been relatively successful in working with communities there to prevent illegal logging and to limit pollution from nearby gold mining operations.

Along TPNP's eastern border, however, OFI has met with little success in defending the park. The combination of impoverished communities and valuable timber in the past and the resurgent economics of the palm oil industry have created clear financial incentives for the exploitation of this land to the detriment of the park and surrounding communities. Palm oil companies have pushed into the Rimba Raya project area and have even made illegal inroads into the park proper. For years there has been serious discussion of reclassifying portions of the park along this eastern boundary for conversion to palm oil plantations, setting a dangerous precedent with ominous consequences for the park's carbon stocks and biodiversity.

The Rimba Raya project's climate objectives are two-fold. First, to stop encroachment by palm oil plantations in the project area itself, thereby avoiding over 130 million tonnes of carbon dioxide-equivalent emissions over the life of the project. Second, to create a physical barrier between the palm oil plantations and Tanjung Puting National Park, thereby safeguarding the park's carbon stocks in a demonstrable model of positive leakage.

With respect to biodiversity, the project objectives are also two-fold. The first is to expand the contiguous habitat of the national park eastward all the way to the Seruyan River, a natural and defensible boundary. The current border, which falls between the park and the Rimba Raya Reserve, is both artificial and ecologically arbitrary, and consequently has been subject to controversy and breach. The practical extension of the park will alleviate much of the external pressure that has driven habitat loss, thereby benefiting all of the park's flora and fauna. The second overarching biodiversity objective is to support the work that OFI and Dr. Biruté Galdikas have carried out for decades, with a number of project activities aimed at extending OFI's conservation, rehabilitation, and environmental education programs.

Beyond extending a physical buffer along the eastern border of TPNP, the project envisions the creation of a social buffer to alleviate external pressures on the park and project area. By actively engaging the communities within the project zone, InfiniteEARTH hopes to build on the work that World Education has initiated over the past few years, improving access to health care, education, and other government services, and working with households to ensure food security. In addition, all members of project-zone communities will have access to employment and capacity-building opportunities with the project itself, and they will benefit from the protection of ecosystem services that will result naturally from project activities.

The Rimba Raya project, if successful, will serve as a for-profit model for the integrated protection of national parks that do not have sufficient resources to ensure the integrity of their own borders. The final project objective is to disseminate information about this model globally via an interactive education program focusing on new research and conservation work by OFI and Dr. Galdikas.

G3.2. Description of Major Project Activities

Describe each project activity with expected climate, community and biodiversity impacts and its relevance to achieving the project's objectives.

Establishment of Rimba Raya Reserve

The primary project activity will be the establishment of the Rimba Raya Reserve, a privately-funded protected area comprising 91,215 ha of peat swamp, lowland and kerangas forest along the eastern boundary of Tanjung Puting National Park. The management plan envisions the creation of a series of guard towers, a fire response plan and fire brigade, and a comprehensive monitoring system. These measures will help ensure the permanence of Project Area carbon stocks and biodiversity and the territorial integrity of TPNP. In addition, project proponents will fund significant enrichment and rehabilitation work inside the Project Area, increasing carbon stocks and habitat available for biodiversity.

Guard post network. OFI has been instrumental in funding and building a small network of guard posts along the perimeter of Tanjung Puting over the past two decades, with the bulk of these posts located along the park boundaries to the north and west. The Rimba Raya project will extend this network of guard posts to create comprehensive observation and communication coverage along the eastern side of the park and project area.

A Guard Post and Fire Tower in the Rimba Raya Biodiversity Reserve, built by OFI & Infinite-Earth.

The current budget calls for the construction of four guard posts per year for the first five years of the project, for a total of 20 guard posts. During the first year of operations, 35 guards will be hired, equipped, and provided with GIS and patrol training. The network of guards and guard posts will allow for comprehensive protection of the Project Area against illegal logging, poaching, and encroachment by oil palm plantations.

Fire Plan. In past years, largely due to the practices of palm oil plantations within the Project Zone, fires have periodically swept through the Project Area and the park during dry periods. The Rimba Raya project will create a fire response system, including training and equipping a fire brigade and developing a fire response plan for the reserve in conjunction with guard towers and stations. The Fire Plan will include an institutional component addressing capital, personnel, and organizational elements and an assessment of the Project Area to develop procedures and training around fire prevention, response, and rehabilitation.

To ensure the permanence of the project, the budget calls for the construction of five fire towers across the Project Area, the hiring and training of a six-person Fire Brigade, and the purchase of state-of-the-art fire response technology – including airboats, swamp buggies, and water cannons – specifically designed for swamp forests and tested in swampland regions such as the Florida Everglades National Park in the southeastern United States. Airboats have been used effectively to create fire breaks in tall grasses in a matter of minutes. Airboats and swamp buggies equipped with 1700 gmp water cannons will provide immediate access to virtually any environment within the Reserve and can cut forest loss by 75% compared to conventional, manual suppression techniques.

Figure 42. This innovative, amphibious emergency vehicle combines the versatility of an airboat with full fire-fighting, EMS, and rescue capabilities.

InfiniteEARTH is committed to protecting the concession of PT. Rimba Raya, and has contracted Marc Nicolas, an internationally-recognized expert experienced in peat swamp fire prevention and suppression, to develop and implement a fire plan for Rimba Raya. The document examines the current conditions of the concession and its degraded peat swamp forest at high fire risk.

The technical aspects of fire prevention, pre-suppression, suppression and post-suppression are explained in detail. Fire prevention includes cooperative agreements, prevention infrastructures and fire information system. Fire pre-suppression covers pre-attack planning, fire management organization, standard operating procedures, task forces (crews, equipment and training), awareness campaigns and patrols. Fire suppression includes fire command system, mobilization, firefighting and rescue operations. Fire post-suppression covers identification of burnt areas, damage assessment and rehabilitation. *See the complete fire plan in Annex 12.*

***Monitoring Plan*.** To further ensure permanence, a comprehensive Monitoring Plan has been developed to ensure the collection and analysis of relevant climate, community, and biodiversity data. Combining ground truthing observations, advanced remote sensing, and periodic aerial flyovers, the monitoring plan will track key indicators to ensure the integrity of the reserve's carbon stocks and biodiversity and to allow project proponents to adapt the reserve management plan to changing conditions. *See the complete Monitoring Plan in Annex 13.*

***Enrichment and Rehabilitation*.** The project proponents have committed to undertaking significant enrichment and rehabilitation work inside the Project Area. Degraded forested areas, totaling approximately 30,000 hectares, have been divided into 40 blocks based on the cycle of tree growth in swamp forest (See figure 44, below). Each year, the project proponents will carry out enrichment activity in four blocks, planting seedlings of native dipterocarp and other appropriate tree species in areas with an insufficient inventory of young trees.

In addition, non-forested areas (including shrubland, grassland, and deforested areas), totaling approximately 25,000 hectares, have been divided into 60 blocks based on proximity to contiguous intact forest. Each year, project proponents will carry out significant rehabilitation work, planting native species such as jabon, binuang, and makaranga that thrive in exposed and degraded conditions. By the conclusion of the project, significant stretches of forest will have been restored to their natural state, increasing carbon stocks in the Project Area and providing additional habitat, thereby strengthening the physical buffer protecting TPNP.

Soil Enrichment with Biochar.

The following is reproduced from data mined from The Biochar Fund (www.biocharfund.org), a pioneer in the development of biochar technology for rural applications.

Current practises

Some 300 to 500 million subsistence farmers in the tropics rely on a land-use technique known as "shifting cultivation", which involves "slash-and-burn" practises. A patch of pristine rainforest is cleared to make available land to grow crops. However, during the clearing, the standing biomass is burned, releasing large amounts of emissions. Tropical deforestation is responsible for an estimated 20 percent of global greenhouse gas emissions. Reducing it is therefor a priority to tackle climate change. What is *more, deforestation leads to the loss of unique biodiversity and of valuable ecosystem services.*

A "cycle of unsustainability"

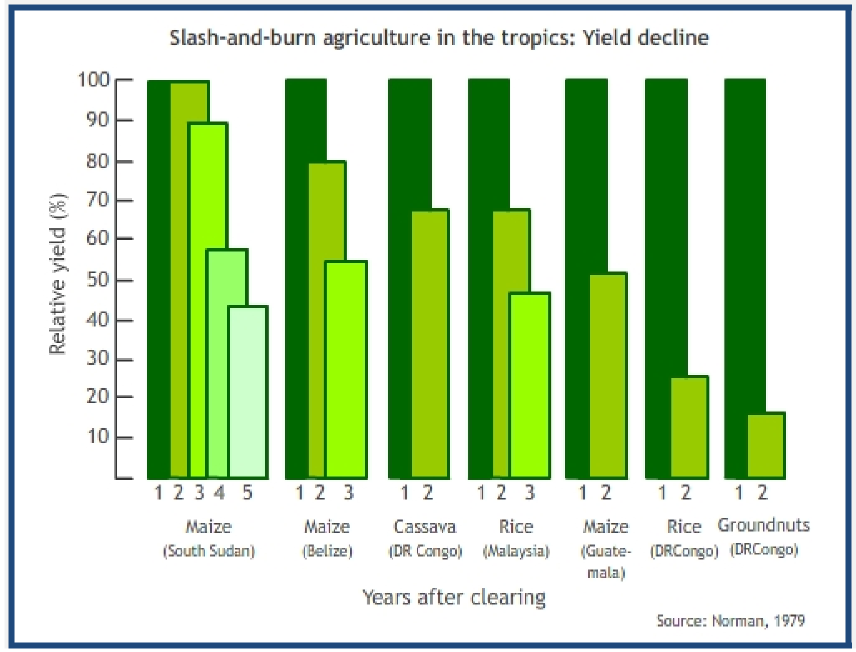
In principle there is nothing inherently wrong about slash-and-burn based agriculture. Forest communities across the tropics have been practising the technique for millennia, allowing the forests to regenerate. But with modern population growth and the pressures on land resources that result from it, the practise has become unsustainable. Fallow periods are shortened and soils are not allowed to replenish themselves.

The key problem related to slash-and-burn farming is the rapid loss of soil nutrients. Once a forest has been cleared, there is no canopy any longer to protect soils from heavy tropical precipitation. The small amounts of nutrients contained in these already poor soils get quickly washed away after one rainy season, while the remainder leaches over the following years. A rich diversity of decomposers empties the soil further. Cleared of vegetation, the exposed surface is also easily eroded. What is left is a nutrient poor soil in which not much grows. Adding fertilizers is largely futile, because these too get washed away. Moreover, their benefits are small compared with the high costs. Subsistence farmers in these parts of the world do not have access to fertilizers, and would not be able to buy them.

Even though the bare, poor soils are located in a humid climate, they do not retain water easily. This limited water retention capacity, felt during drier periods, further limits productive agriculture.

Another major problem encountered in the humid tropics is the high acidity of the soils. The land that is made available through slash-and-burn mainly consists of acidic ferralsols (oxisols) and acrisols. These soils are characterized by a pH which is strongly (5.5-4.5) to extremely acid (<4.5), a low cation exchange capacity and a low base saturation. This limits the type of crops that can be grown and generally results in very low productivity. Making soils less acidic requires access to inputs like agricultural lime - which is often unavailable for subsistence farmers at the forest frontier.

Because of these two factors - rapid nutrient loss and high soil acidicity - farmers are forced to search for new land after only a few years. Typically, crop yields decline dramatically after 2 to 3 years, making the land useless. Farmers cannot produce any surplus, and are forced to slash-and-burn further in order to survive.



This destructive land-use cycle leads to a tragic situation of endemic poverty and chronic food insecurity. The farmers we work with belong to the world's absolute poorest people.

Reversing the cycle

The Biochar Fund helps reverse this cycle by introducing a sustainable land use practise based on restoring soil health in such a way that land becomes permanently productive. This allows farmers to grow more food, end hunger and phase out slash-and-burn.

Biochar is a type of charcoal with specific properties obtained from pyrolysing biomass. Instead of burning standing biomass from cleared forest, the resource is charred (in practise, only the vegetation of secondary forests that have sprung up on fallow plots is charred; in a later stage, field residues from biochar based agriculture become the feedstock). Fine particles of this porous biochar are added to the nutrient poor soils to remediate their problems.

The two pillars that make biochar revolutionary are the extremely high affinity of nutrients to biochar (adsorption) and the extremely high persistence of biochar (stability).

Nutrient Affinity

All organic matter added to soil significantly improves various soil functions, not the least the retention of several nutrients that are essential to plant growth. What is special about biochar is that it is much more effective in retaining most nutrients and keeping them available to plants than other organic matter such as common leaf litter, compost or manures. Interestingly, this is also true for phosphorus which is not at all retained by 'normal' soil organic matter.

Persistence

It is undisputed that biochar is much more persistent in soil than any other form of organic matter that is commonly applied to soil. Therefore, all associated benefits with respect to nutrient retention and soil fertility are longer lasting than with alternative management.

Extensive research and trials show that biochar amendments result in measurable improvements of all the key parameters that make soils productive:

1. *Biochar increases the cation exchange capacity (CEC) in soils.*
2. *Biochar enhances soil microbial functions. The porous structure of char forms a safe haven for microbes that make nutrients available to crops.*
3. *Biochar improves the nutrient retention capacity of soils by preventing leaching and erosion; this allows farmers to use organic and inorganic fertilizers in a cost-effective manner.*
4. *Biochar improves the water retention capacity of soils; the porous structure of the material holds water and prevents the moisture from evaporating.*
5. *Biochar increases the pH of acidic soils; depending on the soil, the effect can be similar to that of lime additions.*

Crop trials with biochar amendments combined with organic and inorganic fertilizers in highly weathered, acidic tropical soils have shown impressive yield increases that can be sustained over years. In some cases productivity showed an 840% increase compared with non-amended soils and with soils that only received fertilizers.

By making soils fertile, biochar helps reverse an unproductive, destructive land-use cycle. This has wide-ranging social and environmental benefits: food insecure rural communties get rooted on productive soils, where they can grow more food and biomass that can be further sequestered. This firmly enhances their livelihoods and contributes to ending hunger in a structural manner. The improved productivity also reduces the need to clear biodiversity-rich forests, and limits the carbon emissions that go with this.

The improved soils not only yield more food, they also yield more residual biomass from the crops. This large biomass resource becomes the feedstock to produce more biochar, which can be continuously added to the soil. What is more, when the biomass is used in advanced pyrolysis systems, it yields electricity from the syngas. This makes it possible for rural communities to gain access to efficient, renewable and affordable energy services. Because the energy is generated from locally available field residues that are converted in clean pyrolysis facilities, communities are no longer forced to burn wood fuels. Primitive biomass use is responsible for both large amounts of greenhouse gas emissions as well as serious health problems. By coupling biochar production to modern energy production, these problems can be effectively solved.

The Biochar Fund conducts its own biochar trials in selected, difficult locations amongst extremely poor rural communities at the forest frontier. Current test sites are located in the Democratic Republic of Congo and in Southern Cameroon. Research findings constantly inform and improve the development of biochar strategies suited for implementation by rural communities. The goal is to expand optimised biochar systems to as many slash-and-burn farmers as possible.

A stable carbon sink

The long persistence of biochar in soil makes it a prime candidate for the mitigation of climate change as a potential sink for atmospheric carbon dioxide. When biochar is stored in soils, it constitutes a stable, manageable and measurable carbon sink. Research into ancient terra preta soils (Amazonian Dark Earths) has shown that charcoal remains unaltered in soils for thousands of years. Modern biochar is equally inert and oxidizes only over very long periods of time.

Nutrient poor tropical soils can store large amounts of biochar ranging from tens to hundreds of tonnes C per hectare while improving soil health. As such they can become permanent carbon sinks that help mitigate climate change in a major way. Another key advantage of biochar systems in the tropics is that they help slow deforestation and its large associated emissions. Finally, when biochar is produced in efficient pyrolysis systems, it can offer modern, carbon-negative electricity from syngas to people currently without access to efficient energy services. This prevents communities from using biomass in a primitive, climate-destructive way, as is the norm today. Thus, biochar systems can play a key role in mitigating climate change in three potential ways:

1. *biochar soils are stable carbon sinks that can be built up over time and remove CO2 from the atmosphere; soils can accumulate hundreds of tonnes of C while improving soil functions*
2. *biochar systems halt slash-and-burn agriculture, and thus slow deforestation and the large emissions that go with this*

3. *biochar produced in efficient pyrolysis plants offers clean, renewable electricity that eliminates the emissions from burning biomass in a primitive way*

Terrestrial carbon sequestration is recognised both by the International Panel on Climate Change (IPCC) as well as by the European Union as a viable method to reduce emissions. However, this technique to offset carbon emissions has not been taken up in the Kyoto Protocol (and its Clean Development Mechanism). Scientists, NGOs and conservation groups are therefor advocating its inclusion in a post-Kyoto agreement.

The Biochar Fund's aim is to connect poor farmers in the tropics who implement the carbon sequestration technique to voluntary carbon markets, until the system is recognised in the post-Kyoto framework.

Importantly, biochar amended soils have also shown to reduce nitrous oxide (N_2O) emissions from agriculture considerably. N_2O is a greenhouse gas 300 times more potent than CO_2 and is mainly associated with the use of nitrogen fertilizers. Since the Biochar Fund makes available nitrogen fertilizers to poor farmers, the simultaneous implementation of biochar amendments offsets much of the associated N_2O emissions from the very start.

Reducing deforestation through biochar

There are several proposals aimed at reducing or avoiding deforestation in the tropics. However, these are "top-down", bureaucratic (government to government) schemes that present major economic and social risks to the communities at the forest margins. When the real costs of these proposals are taken into account, they prove to be very costly.

Biochar on the contracy offers a "bottom-up" and cost-effective approach that results in multiple, concrete benefits for the communities involved. In contrast with other proposals, biochar systems are managed by the subsistence farmers themselves, who are guaranteed the carbon credits. – ***Biochar Fund.***

Indigenous Species, Cash Crop, Community-based Agro-forestry Program. As part of its reforestation effort, Rimba Raya will launch a community-based, cash crop agro-forestry project based on multi-story/multi-crop plantations of native species cash crops, including fruit, nut, spice, and rubber trees and jelutong, inter-planted with rare species (such as ramin and meranti) in a matrix of secondary forest regrowth.

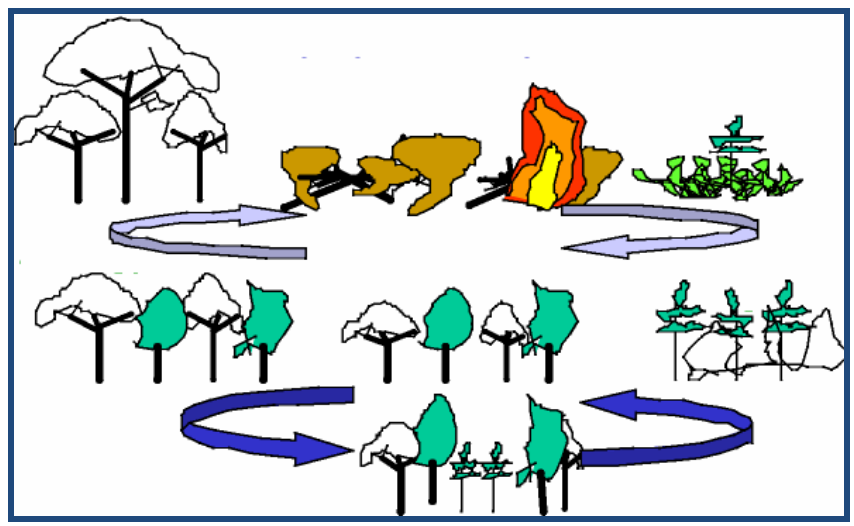


Figure 43. Gap rejuvenation rubber agroforestry "si sipan" - *ICRAF - World Agroforestry Centre.*

While rubber plantations may seem counter-intuitive to conservation and biodiversity, they are the most benign of all industrial crops, having no change on soil chemistry and therefore supporting the growth of other native species. Additionally, rubber tree plantations are a viable orangutan habitat in terms of canopy and food source, whereas other industrial estates such as palm oil are not. Particularly when combined with fruit crops, they can provide a sustainable income for local communities as well as a dependable supplemental food source for orangutan populations (purchased by InfiniteEARTH and OFI from a community cooperative).

According to a joint CIFOR/USAID report titled “Tree Planting in Indonesia: Trends, Impacts and Directions”, Helping Dayak smallholders to improve their traditional rubber growing practices has been one method of increasing their incomes, thereby securing their economic welfare and political independence. Specifically targeting adoption by smallholders, the Rubber Association of Indonesia (GAPKINDO), the International Centre for Research in Agroforestry (ICRAF), the Indonesian Rubber Research Institute and the Centre for Cooperative International Agronomic Research for Development (CIRAD) are cooperating on a Smallholder Rubber Agroforestry Project (SRAP). The purpose is to develop means for incorporating improved planting materials into smallholders.
The "jungle rubber" system is a low-input agroforestry system in which rubber competes with the regrowth of the natural forest. The system is inexpensive and requires little labor to establish and maintain. SRAP organizers accept that jungle rubber gardens have a number of advantages. The mixtures of crops grown together with rubber provide a diverse income consistent with smallholder labor capacity. The gardens are also environmentally benign; they protect soil fertility, prevent erosion and have a relatively high level of biodiversity (Sivanadyan and Norhayati 1992; ICRAF 1994). The purpose of the SRAP is to leave the traditional rubber gardens essentially as they are, but increase their productivity by adding jungle rubber trees with improved planting material. The key to the ongoing research effort is to identify a variety of higher-yielding rubber that will grow in the heavily shaded, highly competitive and minimally tended jungle garden.

One very important aspect of the “jungle rubber” system is that it creates a very fast growing forest canopy, which facilitates orangutan migration across vast areas of forest in pursuit of seasonally fruiting trees. One of the biggest risks for the remaining orangutan populations is the fact that the forests in Indonesia have been highly fragmented. Depite the existence of pristine islands of primary forest, orangutans cannot survive on these islands due to the sporadic fruiting of native trees. Orangutans spend their lives traversing large expanses of forests in search of fruiting trees and when that forest canopy is broken and their mobility constrained as it is in Kalimantan, their very survival is challenged, even in the absence of all other risks.

Reconnecting these islands of primary forest by creating superhighways of high canopy plantation forests (rubber) intermingled with natural species and fruit plantations is essential to the survival and long-term growth of the resident orangutan poplulations within the Rimba Raya Reserve and the Tanjung Puting National Park. The collateral community benefits of this program are explained in more detail in the “Community Agro-Forestry” section below.

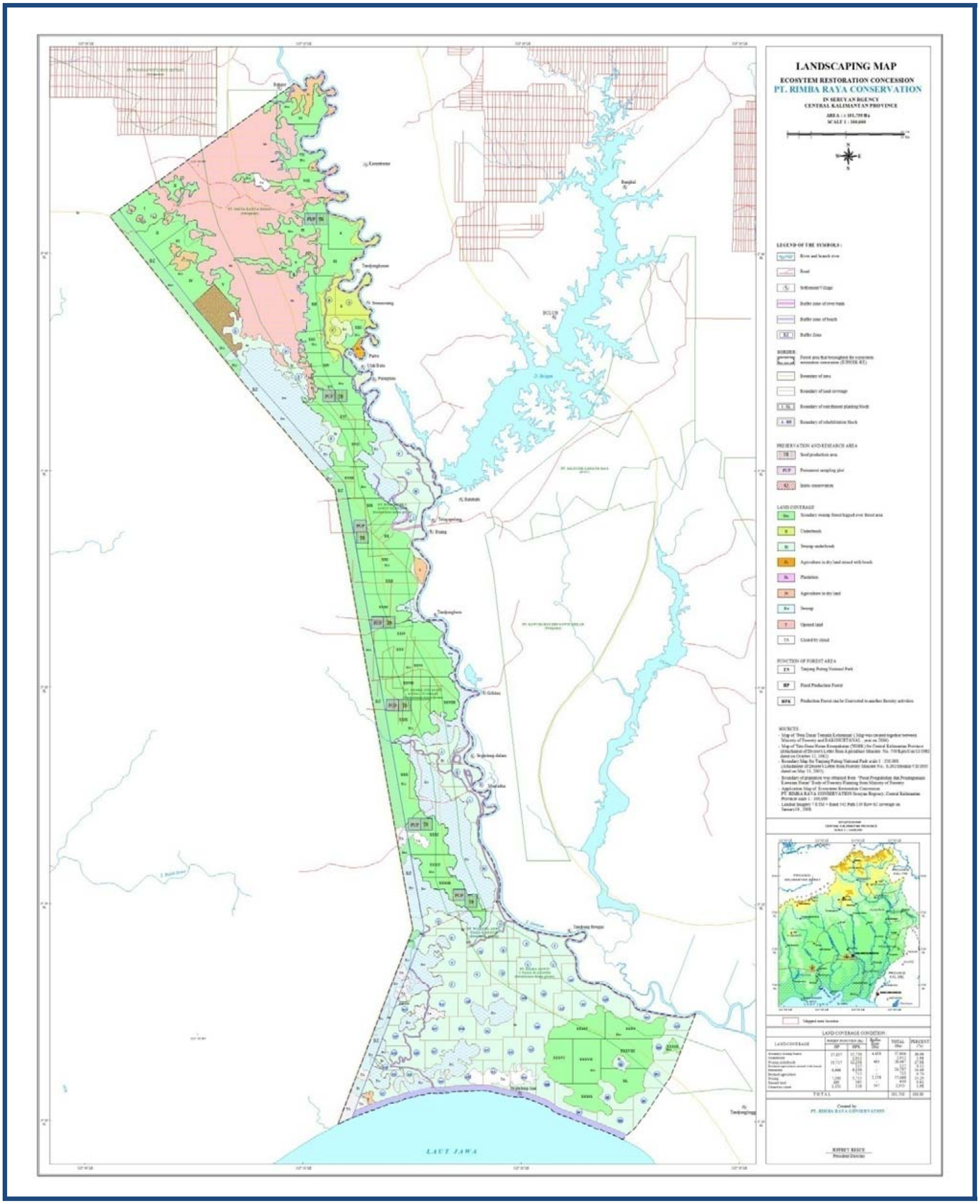


Figure 44. Map of Project Area enrichment and rehabilitation schedule.

Funding of OFI activities

Tanjung Puting National Park is one of the largest remaining protected habitats for the endangered Borneo Orangutan. For over twenty years, OFI has been rescuing orangutans orphaned by deforestation, rehabilitating them, and releasing them back into the wild, where they are monitored for research and education purposes. OFI has also managed Camp Leakey, a wild orangutan reserve inside the park, and its conservation activities have extended to securing park borders and educating communities around the park.

A portion of the revenues from the sale of the project's carbon credits will be used to fund OFI's ongoing activities, including new programs for reforestation of critical orangutan habitats and acquisition of viable habitat that does not currently meet REDD project requirements for additionality.

In addition, project proponents will build three new orangutan release centers and six feeding platforms at strategic locations inside the Project Area over the first three years of the project.

Working with project proponents, OFI will use the release centers to reintroduce as many as 300 orangutans from their Orangutan Care Center and Quarantine (OCCQ) Rehabilitation Center near Pangkalan Bun, back into the wild, utilizing the reserve as a staging ground for their migration into the park. The feeding platforms, which are mobile, will function as an integral component of the reintroduction process. By progressively moving the locations of feeding platforms farther away from the release centers, project proponents and OFI staff can monitor orangutan adaptation and exercise partial control over orangutan whereabouts for the first several months after release.

Orangutan release center and supplemental feeding platform in Rimba Raya

Co-management of Tanjung Puting National Park

The TPNP Authority currently has a staff of 56 personnel, working out of offices in Pangkalan Bun, Pembuang Hulu, Kuala Pembuang, and Kumai, whose job it is to protect over 400,000 ha of national park besieged by economic actors that would profit from its destruction. The mere presence of the Rimba Raya project along the park's exposed eastern flank will greatly reduce the resource and administrative burden for this staff.

Beyond this, and as part of their commitment to developing a for-profit conservation model for underfunded national parks, the Rimba Raya project proponents will work to strengthen the co-management agreement already in existence between Tanjung Puting National Park and OFI.

A portion of the revenues from the sale of the project's carbon credits will be used to fund directly the park's management and conservation activities. Moreover, park personnel will have access to training and capacity-building opportunities, improved equipment for monitoring and communication, and the reserve's fire brigade.

Development of Social Buffer

An essential element of the Rimba Raya project is the engagement of all stakeholders in the Project Zone in order to create a social buffer to the park and Project Area, thereby alleviating many of the external pressures that drive deforestation. The project proponents have created a process framework designed to disseminate information about project development and implementation, support community participation in all aspects of the project, and offer opportunities for capacity-building.

To create an effective social buffer, project proponents believe that a comprehensive approach to socio-economic development must be undertaken with the objective of addressing the root causes of community-based deforestation – namely poverty, hunger, disease, lack of adequate shelter, and exclusion. To that end, a slate of programs has been developed based on data from an initial social survey in the Project Zone and with reference to the UN Millennium Development Goals for Indonesia. For a full elaboration of specific social targets, see Section CM1.1, below.

Early Childhood Education and Development (ECED). According to the World Bank, there has been significant progress on human development outcomes in Indonesia over the past two decades (World Bank 2006). However, these positive national trends mask disparities at the regional and district levels and among socioeconomic groups. A large proportion of the population still lives in poverty, and there are large differences in education, health, and nutrition outcomes among districts. Furthermore, within districts, the poor suffer further disadvantages along every dimension. Children from poor families start school later, complete fewer years of schooling, and have higher dropout and repetition rates. These children also have lower rates of participation in early childhood education and development (ECED) services. Districts with high dropout rates, for example, have low enrollment in early education services.

ECED initiatives are designed to develop "school readiness" in young children. International evidence shows that these interventions can improve the poor health and education outcomes of disadvantaged children. In Indonesia, an evaluation of the World Bank-supported ECED project shows that children who participated in the project have higher levels of school readiness at age 6 than their peers. A cost-benefit analysis indicates that ECED has high economic returns in Indonesia: if these services are targeted at the poor, for every $1 invested in ECED, a return of $7 can be expected. Therefore, increased support for ECED initiatives can be expected to improve human development outcomes, boost productivity in general, and level the playing field for poor children in particular.

Materials such as music and art supplies and learning aids for building fine motor skills are taken for granted in developed countries, but they are a luxuries few children enjoy in the poor communities in this remote part of the world. While InfiniteEARTH is prohibited by law from engaging in the funding or development of formal education, we will address ECED needs through our community centers, where we will provide the necessary materials and train of local staff in the basics of ECED.

Community Centers*.* Following the successful example of OFI with communities in the park's western region, project proponents will build community centers in strategically selected villages inside the Project Zone to act as a soft interface between the project and the communities. The community centers will offer facilities for park and project staff as well as for community organizations, and they will supply news and radio communication facilities, libraries, and social and agricultural training programs.

Example of a community center built by OFI in Sungai Cabang

Agriculture & Aquaculture Productivity**.** The Rimba Raya project will also extend World Education's ongoing programs for food security, access to government services, and capacity building within the project zone. By helping local households meet their food needs utilizing land already under cultivation and by educating them about their political rights, the Rimba Raya project will eliminate many of the incentives driving illegal logging and the unnecessary conversion of forest to agricultural land. The project will also work to train project-zone community members and offer them priority employment in all major project activities. Since most of the communities are fishermen, rather than horticulturalists, far more damage to the forest originates from slashing and burning to create seasonal lakes. Once the lakes have been depleted, they are abandoned and new areas are burned.

One Laptop per Child: Mission Statement: To create educational opportunities for the world's poorest children by providing each child with a rugged, low-cost, low-power, connected laptop with content and software designed for collaborative, joyful, self-empowered learning. When children have access to this type of tool they get engaged in their own education. They learn, share, create, and collaborate. They become connected to each other, to the world and to a brighter future.

A small machine with a big mission. The XO is a potent learning tool designed and built especially for children in developing countries, living in some of the most remote environments. It's about the size of a small textbook. It has built-in wireless and a unique screen that is readable under direct sunlight for children who go to school outdoors. It's extremely durable, brilliantly functional, energy-efficient, and fun.

Many years and an infinite amount of sweat equity went into the creation of the XO laptop. Designed collaboratively by experts from academia and industry, the XO is the product of the very best thinking about technology and learning. It was designed with the real world in mind, considering everything from extreme environmental conditions such as high heat and humidity, to technological issues such as local language support. As a result, the XO laptop is extremely durable, brilliantly functional, energy-efficient, responsive, and fun.

XO is fully compliant with the European Union's RoHS Directive. It contains no hazardous materials. Its LiFePO4 or NiMH batteries contain no toxic heavy metals, plus it features enhanced battery management for an extended recharge-cycle lifetime. It will also tolerate alternate power-charging sources, such as car batteries.
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Experience shows that laptop components most likely to fail are the hard drive and internal connectors. Therefore, XO has no hard drive to crash and only two internal cables. For added robustness, the machine's plastic walls are 2mm thick, as opposed to the standard 1.3mm. Its wireless antennas, which far outperform the typical laptop, double as external covers for the USB ports, which are protected internally as well. The display is also cushioned by internal "bumpers." The estimated product lifetime is at least five years.

Community Multi-crop Agro-Forestry. In keeping with its commitments to reforesting degraded lands within the Rimba Raya Reserve, InfiniteEARTH intends to implement a community-based agro-forestry program for native cash-crop species. The program will subdivide portions of the Project Area near Project Zone villages designated for restoration into community plots. Villages can then subdivide these plots into family subplots if they choose. Each community plot and family subplot will be managed by "virtual" owners, who will enjoy the economic benefits of their labor. To support these semi-industrial smallholder estates, a seedling/sapling breeding program will be developed and funded by InfiniteEARTH with a focus on management and ownership by community women.

In addition to ecosystem restoration benefits, the program will achieve several collateral benefits. First, it will incorporate a community-based co-op structure that promotes family-owned enterprises and "virtual" land-tenure. Second, as mentioned in previous section on reforestation, the plan is based on multi-story plantations of native species cash crops, including fruit, nut, spice, and rubber trees, inter-planted with rare species (such as ramin and meranti) and all competing with the re-growth of secondary forest.

Particularly when combined with fruit crops, natural "jungle rubber" plantations can provide a sustainable income for local communities as well as a dependable supplemental food source for orangutan populations.

Protein Energy Malnutrition (PEM). Globally, 1 billion people are unable to secure a nutritionally adequate diet to keep them healthy and active, and 100 million of those people suffer from the consequences of Protein Energy Malnutrition (PEM). Childhood malnutrition claims the lives of 5 million children each year.

According to projections made by the Committee on Foreign Relations in their report on Global Food Insecurity presented to the United States Senate (February 2009), "By 2050, it is projected that population growth will require a doubling in farm output, yet growth rates in food production in some regions have been stagnated." As countries become more affluent, the demand for protein in their diet increases at rates faster than the population or food production growth rates.

PEM is the most lethal form of malnutrition and hunger. It is basically a lack of calories and protein because protein is necessary for key body functions including provision of essential amino acids and the development and maintenance of muscles.

In their pursuit of sustenance level food production, the villages surrounding the Rimba Raya project area have historically deforested progressively larger tracts of forest for the production of low nutritional value starch crops such as rice as well as burning out swamp forests for the creation of seasonal lakes for fish harvesting. Lastly, additional forest land is cleared for cattle production. In addition to planned deforestation, the use of fire for clearing is a primary source of deforestation by uncontrolled fire.

Project proponents intend to provide and finance Portable Farms Aquaponics Systems as a means of mitigating these stresses placed on the surrounding environment as well as substantially increasing the output and quality of protein and organic vegetable production.

Aquaponics is the symbiotic cultivation of plants and aquatic animals in a recirculating environment, to maximize the use of the energy and nutrients in the system in order to harvest the greatest amount of vegetables and fish protein from the system. By combining the fish, water and plants, aquaponics systems use an integrated environment to produce vegetables and fish in very small space, with very little water and land use.

The term Aquaponics is derived from the combination of hydroponics (soilless agriculture) and recirculating aquaculture (fish farming). The reference ***Village Aquaponics*** refers to an aquaponic system utilizing low-tech systems specifically set up for the purpose of providing a protein crop (the fish) and a vegetable, herb or fruit crop (the plants) to a specific rural area surrounding the operation. The primary advantage of Village Aquaponics is that it significantly reduces the land area required and is far less destructive than traditional horticultural practices and it also mitigates the primary negative aspect of aquaculture - water pollution from waste resulting from high density fish populations in a restricted area.

A Portable Farms Aquaponics System is a closed-loop food production facility housed in a climatically adapted structure and requiring the input of some energy in order to grow very large quantities of produce and fish in a small area. The energy input includes both the fish food and some electricity, which can be solar or wind generated, to pump the air and water used in the system. It requires no other fertilizers, pest controls, added chemicals or additives. Typically, in rural areas, fish food can be locally produced through insect harvesting and cultivation.

The aquaponics system duplicates what nature has been doing for billions of years. The water, containing the fish waste, is pumped out of the fish tanks to a settling tank, where the solids settle to the bottom of the tank while the nutrient-rich water then flows, by gravity, through a series of trays where the plants are growing, and then back into the fish tanks. The small amount of separated fish-waste water in the settling tank is drained off at regular intervals, and can be used to fertilize crops such as trees, ornamentals or lawns.

The cycle of the water flowing through the system repeats itself several times each day. Some make-up water has to be added at regular intervals to compensate for the water used in the settling tank cleaning, and for the water used by the plants for growth (transpiration) - a simple, elegant system requiring very little energy to produce high quantities of locally grown food.

- Significant reduction of environmental destruction from traditional slash and burn horticultural and fishing practices, replaced by small footprint, high output intensive production of fish protein and organic vegetable farming.
- Significant reduction of land clearing and methane production from cattle through substitution of fish protein.
- The 90′ x 120′ Portable Farms™ Aquaponics System produces 70,000 vegetables and 21,000 pounds of fish per year.

Successful aquaponics systems in a developing country require simplicity, reliability and ideally freedom from the need for grid power, as well as the need to control the flood and drain parameters of the system. A “Flood Valve” system developed by Travis Hughey solves this problem. The “Flood Valve” utilizes any kind of pump whether it is electric, gas, hydro-electric, solar or wind driven.

The only requirement is to pump the water from the fish tank to the “Flood Valve”, which works with flow rates lower than 100 gallons per hour, thereby significantly reducing electric power consumption. Water is pumped to the “Flood Valve” which has a standard toilet valve installed with an extension on the overflow pipe. On the side of the tank there is a small adjustable siphon that, when the water gets to the set height, starts to fill a counterweight with a small hole in the bottom. As the siphon fills the counterweight, it eventually gets heavy enough to pull open the flapper on the flush valve and dumps the flood tank to the grow beds.

As the water drains from the flood tank, the siphon breaks and the counterweight starts to empty. As it becomes light enough, the flapper closes and the tank begins filling again. The flood volume is adjusted by the height of the small siphon, and the cycle time is adjusted by the after-flow. Excess water is redirected from the pump back through a spray nozzle to aerate the fish tank. This modification to the system only requires one pump and no timers, float valves, etc. The pump runs continuously so there is no start and stop. There are, however, limitations on how deep the flood tank can be when using a rubber flapper since the water pressure can become too great for the flapper to lift without tearing.

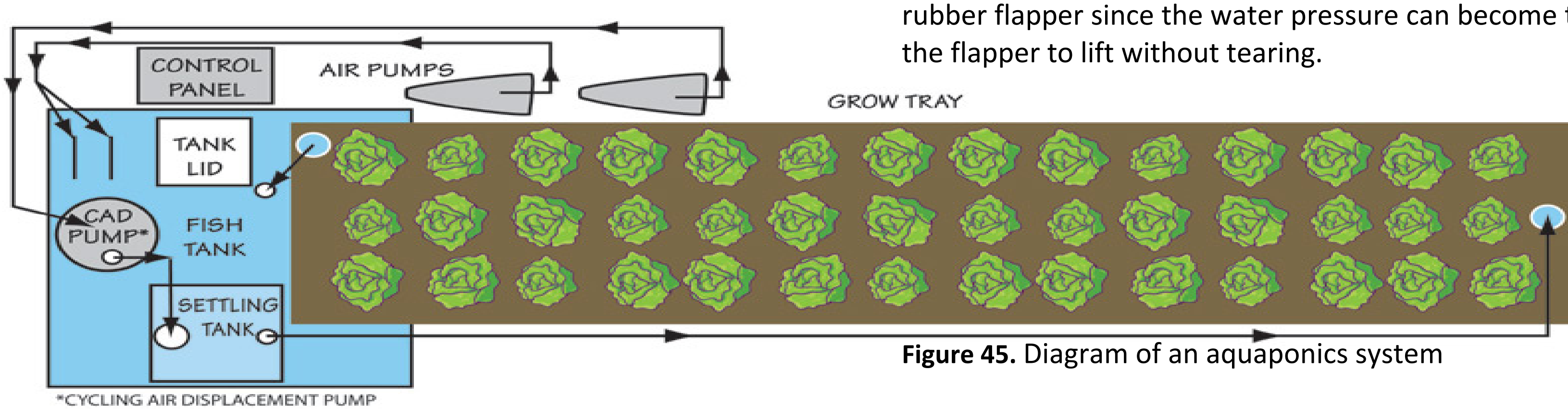


Figure 45. Diagram of an aquaponics system

A further elaboration on this concept will be field tested with the introduction of algae production in order to close the symbiotic loop in the agro-production platform. Algae production will be accomplished through a tubular photo bioreactor greenhouse roof and will provide carbon sequestration, biodiesel, and protein-carbohydrate-vitamin rich algae biomass (algae cake is a by-product of the oil pressing process), which will be used as fish feed.

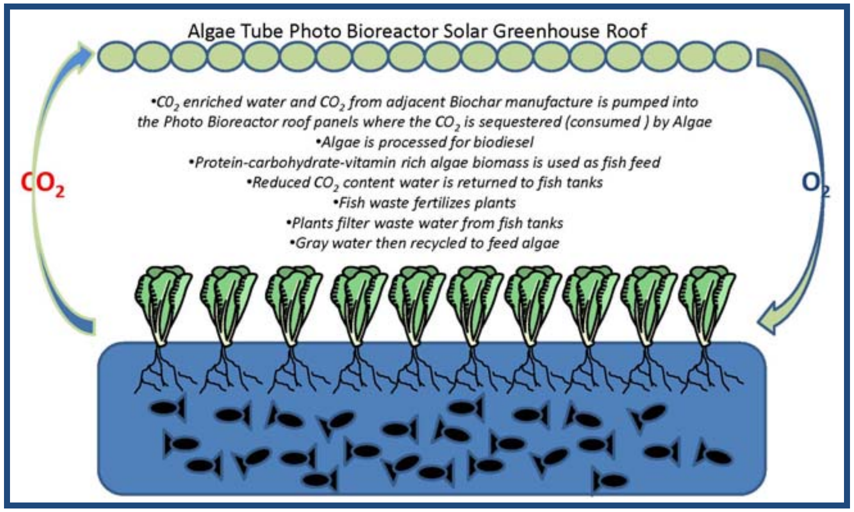


Figure 46. Conceptual diagram of a Closed Loop, Self-Sustaining Hyper Production "Algaeponics" Biosphere.

Clean Water Systems. Over a billion people on the planet still do not have access to the most basic element needed to support life: safe drinking water. Every year, 1.7 million deaths – mainly among children under the age of five – result from diarrhea caused by polluted water. The UN Millennium Development Goal for Indonesia calls for halving the population without access to safe drinking water by 2015.

Recent years have seen increased flooding in the Seruyan River watershed, and Project Zone communities have had trouble gaining access to clean water resources. Based on community surveys intended to help project proponents prioritize social programs, the first phase of programs aimed at creating a social buffer will include Potters for Peace, an organization that trains local communities to make and sell inexpensive ceramic water filtration devices.

Since 1998, Potters for Peace has facilitated the worldwide production of low-tech, low-cost, colloidal silver-enhanced ceramic water purifiers (CWP). Field experience and clinical test results have shown that this filter is effective in eliminating approximately 99.88% of water-borne disease agents.

Potters for Peace, a member of the World Health Organization's International Network to Promote Household Water Treatment and Safe Storage, will provide a five-week training workshop to a community selected on the basis of indicated desire to participate, livelihood needs, and proximity to the required natural resources for production. Water filters will be made available to all communities in the Project Zone and sold to communities beyond.

This program will improve the livelihoods of all community members, reduce the resources expended on medical treatment, and indirectly remove some of the economic pressure driving deforestation in the Project Area.

Examples of ceramic water filtration systems from Potters for Peace

***Fuel-Efficient Stoves*.** More than three billion people, or half the world's population, cook in their homes using traditional fire and stoves, burning biomass fuels like wood, dung, and crop waste. For hours at a time every day, families breathe in lethal fumes from these cooking fires. Indoor air pollution (IAP) currently claims the lives of 1.5 million people worldwide every year, which is equivalent to one person every 20 seconds. Women and children make up the vast majority of these deaths due to their increased exposure in the home. Nearly all community members in the Project Zone use wood and other biomass for their cooking fuel. This practice creates a number of problems, including IAP, long search times for fuel, and pressure on nearby forests.

The Rimba Raya project proponents intend to make available to all Project Zone communities the Envirofit B1100 Clean Cook Stoves. These inexpensive, well-designed stoves significantly reduce the amount of fuel wood required to cook and the amount of smoke generated during cooking. InfiniteEARTH plans to provide every family bordering the project area with an Envirofit stove. This program will not only reduce resources used for medical treatment and thus improve the health and livelihoods of community members, but will also decrease illegal logging inside the Project Area, thereby preserving carbon stocks and habitat for biodiversity.

Examples of the Envirofit B1100 Clean Cook Stove

***Biochar Briquettes Production*.** Traditionally, in most rural settings, people use biomass material to cook with and to heat their homes. The biomass material used is either raw or in the form of processed charcoal. This form of energy source, while being widely accessible, is inefficient, degrading to the environment and a health hazard.

The concept of biochar introduces the dimension of enhanced fuel efficiency and improved household health through the pyrolytic burning of the wood gases to provide the heat energy. Pyrolytic burning occurs under reduced oxygen and the by product is charcoal as opposed to ash through a process knows as pyrolysis. To produce biochar requires minimal change in human behavior and involves the introduction of very simple technology.

Various technologies have been introduced as a means of reducing waste, improving efficiency and more recently as a means of mitigating cliamate change. The production of torrefied biomass or biochar briquettes presents a low-tech solution that can be applied in rural settings.

One of the simplest designs for biochar briquettes production that can be applied on an individual household basis is the “charring drum”, which is a 220-litre drum of 1-2 mm thick sheet metal with a 5 cm gutter for an 8 cmhigh water seal along the upper rim. Inside the drum a perforated cone with a chimney is placed (the cone has about 200 holes of ½ inch). The metal of the cone and chimney is 2 mm. The covering lid provides a water seal. The drum and drum components are tarred against rust. The drum alone weighs about 40 kg.

This design can be transported by one person and has a life span of more than three years with continuous use. The filling of the 220-litre drum with dried biomass material and subsequent firing requires about two hours, whereas the cooling down of the drum (one batch) also requires about two hours.

A total one-day production would therefore consist of two full cycles and would produce a combined total of 300-350 litres of loose charcoal, which is then packed into a briquette mould and left to dry, producing about 500 biochar briquettes.

The production of biochar briquettes presents an additional opportunity for community based enterprise through sustainable exploitation of local resources.

Low Maintenance - Small Scale Solar Lighting. Since the dawn of mankind, fire (light) has been one of our most coveted technologies. It is hard for many people to imagine living at night without being able to obtain light at the flick of a switch. However, about half of humanity (from China to Latin America, from India to Africa) lives without light after the sunset, since they do not have access to grid-connected electricity.

The unavailability of electricity and, consequently, lighting in such rural areas affects not only the lifestyle of the inhabitants but also the economy, the culture, and the safety of communities. Without lighting, the majority of working activities must be suspended, and productivity is significantly penalized. Reading, studying, and interacting with other people become activities more difficult to realize when the sunlight is no longer available.

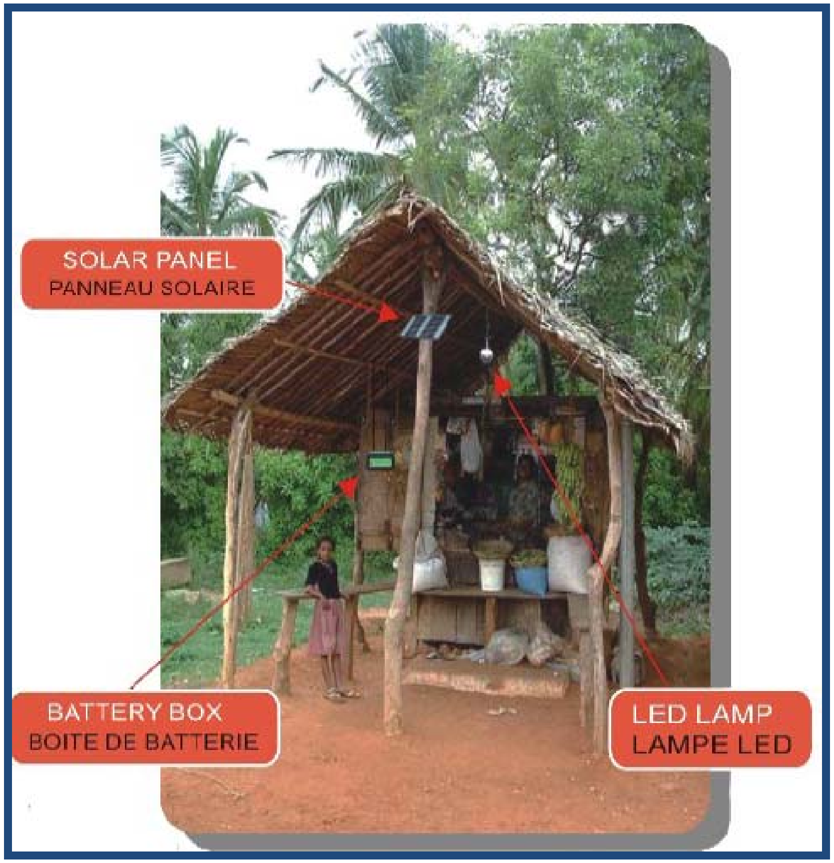
In much of the world, these communities still create light by traditional means by using fire, while more advanced communities may use candles or kerosene lamps.

All of these methods have their own disadvantages including cost, indoor air pollution (exposure to smoke and toxic fumes), fire risk and environmental degredation, while flashlights powered by batteries are used as portable sources of light for intermittent use.

These sources are cheaper than any form of electricity. On the other hand, the low efficiency, the poor quality of the light and the intrinsic fire risk of all combustion light sources supports the use of electric lighting in off-grid locations.

Among the various possibilities to fulfill this need, solar LED lighting solutions are gaining more and more consideration. These solutions combine the use of an ecological and renewable energy source with an efficient way to convert energy into light.

Roy Solar Co., Ltd. is a leading developer and supplier of self-contained rural solar systems for rural household use in developing countries.



The **SRY-01 Kit** consists of a solar panel, power supply box and LED bulb (very low energy consumption, only 1W) and is currently regarded as one the best lighting solution for people in remote areas. The system uses NI-MH (Nickel Metal Hydride) rechargeable battery instead of lead-acid battery or NI-CD battery, because of its long life, and is non toxic.
Project proponents intend to supply each village household and community center with a Roy Solar Lighting System. Roy Solar Systems will also be used to charge the “One Laptop per Child” computers as well as the pumps for the Aquaponics Systems.

Micro-Credit. Microcredit is the extension of very small loans to poor entrepreneurs and to others living in poverty. These individuals lack collateral, steady employment, and a verifiable credit history and therefore cannot meet even the most minimal qualifications to gain access to traditional credit. Microcredit is a financial innovation that is generally considered to have originated with the Grameen Bank in Bangladesh, where it has successfully enabled extremely impoverished people to engage in self-employment projects that allow them to generate an income and, in many cases, begin to build wealth and exit poverty.

IE hopes to provide all individuals inside the Project Zone with access to credit as a means to expand their livelihoods options and improve their socio-economic status. Towards that end, IE will develop a targeted micro-credit program for Project Zone communities.

One of the fundamental tenets of micro-credit is the reduction of overhead to ensure that all credit capital reaches the individuals who truly need it. Moreover, micro-credit is an extremely delicate business model, and significant amounts of time are required to align micro-credit programs with the nuances and needs of local communities. Because of these considerations, IE intends to work jointly with "MBK". MBK is featured on www.kiva.org as highly reputable field partner, and follows the Grameen model of micro-credit.

While expanding into such a remote area as the Project Zone will present real challenges, MBK has had significant success in modeling programs in Indonesia and are willing to help project proponents design a model specifically for local communities.
Project proponents will partner with these organizations to provide: 1) funding for all individuals in the Rimba Raya Project Zone; 2) budget support for field agents to work in the area; 3) supplementary budget support as needed and justified; and 4) support for training of field agents dedicated to the region (i.e., basic training program at Grameen bank in Bangladesh).

While we prefer to work under the Grameen model loaning small amounts to groups of women with weekly collection periods and no collateral, we will rely on our local partner's expertise to adjust the program in order to maximize benefits for local communities.

Sustainable Health Care Program. IE plans to develop a health care system designed specifically to meet the needs of Project Zone communities in collaboration with Health in Harmony (HIH), a Western Kalimantan-based health care program that integrates high quality, affordable health care with strategies to protect threatened forests.

The IE health care program framework will comprise three steps: 1. Assess the health care needs of Project Zone communities; 2. Develop a system that best suits their unique needs; and 3. Evaluate the program regularly to improve, adapt, and evolve as we learn more and needs change.
HIH is currently serving over 60,000 people in 52 villages with a staff of 22 people. They have found that the largest health issues in their area include high blood pressure, tuberculosis, diabetes,

upper respiratory infections, and heart disease. Additionally, the World Health Organization indicates that the major health issues in Indonesia generally are communicable diseases (i.e., TB, Malaria, and HIV/AIDS), mother and child health issues, and other non-communicable diseases (i.e., eye care, dental care, etc.). IE will use the UN MDG as benchmarks and targets for the health care program (see Section CM1.1 below).

The IE health care program is part of a comprehensive effort to develop a social buffer between Project Zone communities and the Project Area and TPNP. As such, the program will strive for sustainability, incorporating elements that reinforce conservation. While HIH never denies care to any individual in its project area, it does have an incentive program, offering discounted care to villages that do not engage in illegal logging. Project proponents will work with HIH to develop a similar program for the Rimba Raya Project Zone.

Floating Clinic. Project proponents will arrange for the construction, outfitting, and deployment of a floating medical clinic. In lieu of community clinics, a floating clinic was chosen for its mobility and the resulting ability to deliver medical services up and down the Seruyan River, effectively servicing all of the communities in the Project Zone.

InfiniteEARTH has chosen to use the Phinisi and its hand-crafted design in order to promote and preserve this traditional wooden shipbuilding industry. The ship will be constructed from sustainably harvested local hardwoods (preferably from fire damaged areas) by the local craftsmen who keep this vital part of Indonesian history and culture alive.

The Phinisi has a special place in the history and development of Indonesia. First built by the Konjo people of Sulawesi, these majestic hand-made ships date back to the famous Spice Route period, when they were the main mode of transportation for wood, spices, and rice among islands stretching from Australia to the Southeast Asia coast. Phinisi have been sailed by the Bugis people for generations and are still being built in the same traditional fashion today.

Capacity Building Programs

Below are presented a number of specific capacity building programs, researched by project proponents as potentially applicable to Project Zone community needs. However, the final programs will be designed in collaboration with the communities to ensure that they address current community concerns and prioritize community needs for capacity building.

Indigenous Peoples Eco-Tourism Knowledge Transference

According to WWF-Indonesia, "Ecotourism can create economic value for conservation areas. As long as local communities can take part in the development of ecotourism, it can become an important conservation-based enterprise and livelihood strategy. Ecotourism can also be socially and ecologically sustainable as far as fair partnerships are forged between communities, local government, and private sector" (WWF-Indonesia 2008).

As part of a broad capacity-building program, project proponents will develop "knowledge transference" programs with indigenous peoples in other parts of the world who have built successful ecotourism industries around swamplands. Specifically, InfiniteEARTH will facilitate and finance a "sister city" program between the communities bordering the Rimba Raya Reserve and the Seminole Indian Tribe of the Florida Everglades.

For nearly fifty years, the Seminole Indians have provided tourism services revolving around swamp tours, traditional village tours, and wildlife shows. The Seminole Tribe of Florida currently employs more than 2,000 non-Indians and purchases more than $24 million dollars in goods and services from more than 850 Florida vendors each year.

In addition, the Tribe pays $3.5 million in federal payroll taxes. A facilitated exchange of information and experience should help Project Zone communities to develop a thriving ecotourism program in cooperation with the Rimba Raya Reserve over the course of the project lifetime.

Orangutan Release and Tracking

An important focus of activity for the project, is to develop and implement a tracking program in order to collect information on orangutans released in Rimba Raya. This program will build on the work of Dr. Biruté Galdikas and OFI and advance conservation science and orangutan research in an understudied area. This project will also be used to disseminate information about this new for-profit national park conservation model, through global outreach and education program focusing on the work of Dr. Biruté Galdikas, OFI and affiliated researchers.

Orangutans are notoriously difficult to track, and the migration patterns of male orangutans remain relatively unknown. As part of this project activity, all released orangutans will be implanted with and tracked by state-of-the-art biotrackers, developed specifically for the project by SirTrack. A sample of male subjects from each cohort of rehabilitated orangutans released in the reserve will be particularly targeted using this tracking device to address questions about male movement patterns. The biotrackers will allow Dr. Galdikas and her research team to track the migration patterns of all research subjects as they move within Rimba Raya Reserve and into Tanjung Puting National Park.

SirTrack's system is based on the "Sky Ranger" hardware/software that is mounted on a small plane for remote detection of up to 130 targets across 14,000 ha using intelligent search strategies. This system enables multiple, radio-tagged orangutans to be simultaneously tracked in remote areas and across the full extent of Rimba Raya.

Outreach and Education

The centerpiece of this outreach effort will be a Google Earth feature that allows the public to follow the movements of individual orangutans over a number of years. Through this application, Dr. Galdikas and InfiniteEARTH hope to transform their work into a comprehensive and interactive educational experience that will engage schools across the globe.

In addition to disseminating information about OFI and Infinite Earth research programs, Infinite Earth will invite and support Indonesian and outside scientists and students in conducting biodiversity, ecology and conservation studies in Rimba Raya. Project proponents have already begun programs with Organization for Tropical Studies (OTS), CIFOR, Redlands University and ESRI which will be expanded in the first year post-verification.

Rimba Raya has proposed to host international students and faculty on an educational field visit organized by the Organization for Tropical Studies (OTS) during the OTS summer session. OTS researchers and students, guided by Forest Carbon and Infinite Earth field experts will:

- Develop an understanding of how forest restoration and rehabilitation projects are designed at large and small scales including private sector projects
- Develop an understanding of the ecological, economic and logistical processes involved in forest restoration Explore the trade-offs in approaches for biodiversity protection, timber

production and carbon sequestration

- Gain hands-on experience in restoration design and implementation
- Apply toolkits for the monitoring and evaluation of restoration projects
- Evaluate GHG emissions under various levels of degradation and the impact of a nascent carbon trading initiative

This program will be an important project to bring students, conservation workers and scientists into Rimba Raya to engage in hands-on learning and initiate more advanced, longterm research and applied conservation management.

This year, Rimba Raya will also host CIFOR's Global Comparative Study on REDD (GCS) research, which aims to analyze the impact of REDD projects in six countries, including Indonesia.

The research uses a Before and After approach, that is, we document how things are Before a project is implemented and After a project is carried out. This year, July 2010, CIFOR will carry out a "BEFORE" socio-economic analysis, returning in 2012 to carry out the "AFTER" component of research.

The comparative analysis will be used to assess the effectiveness of REDD across sites, which will contribute to this nacent approach to conservation and development. Rimba Raya will be one of six "intensive" study sites, where CIFOR researchers will spend about 2-3 months at each site, involving household, village, and proponent surveys. This will make Rimba Raya the representative site for Indonesia and will provide additional education and outreach for the project.

Project proponents have begun collaborating with the University of Redlands and Redlands Institute to develop a series of spatial analysis projects for Rimba Raya, which will provide an important exchange of educational and project benefits. University of Redlands directs programs in Geographic Information Science and is a partner to ESRI, the leader in GIS software. Redlands Institute is a partner organization that conducts applied GIS such as developing conservation monitoring tools and analysis modules. Project proponents are currently hosting a senior analyst from Redlands Institute in Kalimantan to assist in applying and improving analysis and mapping for Rimba Raya monitoring. This collaboration may also include educational exchanges with the university, and development of tools, workflows and systems for building and maintaining the monitoring database.

ESRI, the leader in GIS software, established the non-profit ESRI Conservation Program to assist NGOs worldwide to develop and use GIS for conservation management. OFI is a longtime partner and recipient of ECP grants and Rimba Raya is a new focus of GIS work under ECP. In July 2010, the Rimba Raya REDD project will be featured at the ESRI International User Conference hosted and supported by the ECP-founded Society for Conservation GIS (SCGIS). Communication, information exchange and learning are the focus of these activities and have included technology transfer to Indonesia and U.S.-based training of OFI's Indonesian GIS staff. Project proponents for Rimba Raya will carry out these same activities.

G3.3. Project Boundaries and Location of Major Project Activities

Provide a map identifying the project location and boundaries of the project area(s), where the project activities will occur, of the project zone and of additional surrounding locations that are predicted to be impacted by project activities (e.g. through leakage).

Figure 47 depicts the Project Area, Project Zone, and surrounding region. Most major project activites related to climate and biodiversity will take place throughout the Project Area, while most activities related to community goals will take place throughout the Project Zone communities. These activities have not been depicted here, but full descriptions are available in Section G3.2 above. Many leakage mitigation activities are also regional or not amenable to depiction in this format, but a full description is available in Section CL2 below.

G3.4. Project Lifetime, Accounting Period, and Implementation Schedule

Define the project lifetime and GHG accounting period and explain and justify any differences between them. Define an implementation schedule, indicating key dates and milestones in the project's development.

Project Lifetime and GHG Accounting Period

Project lifetime. The official lifetime for the Rimba Raya project is 60 years, equal to the term of the IUPHHK-RE concession license issued for the Project Area by the Minister of Forestry. This license is for an ecosystem restoration concession, and there are mandated forest restoration requirements over the life of the license.

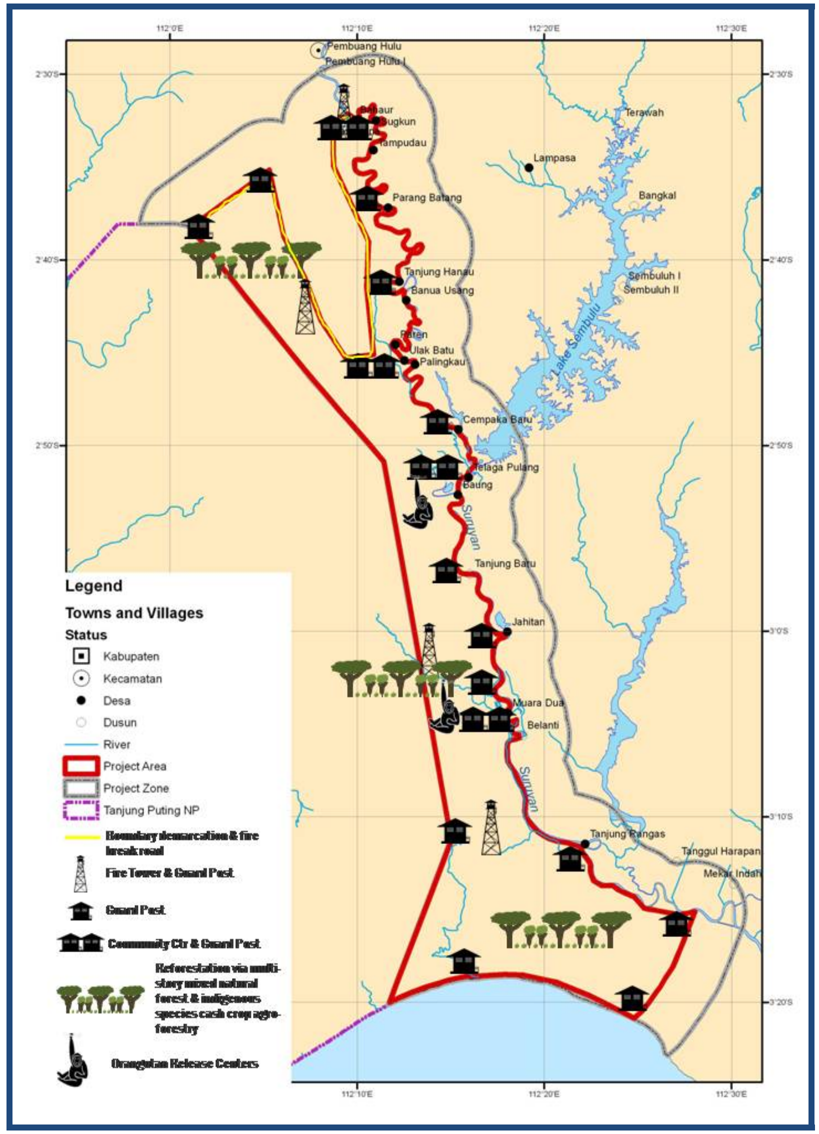


Figure 47. Map of major project activities.

Accounting period. The GHG crediting period for the project is 30 years, consistent with the date determined by the Baseline Scenario. The project has adopted a planned deforestation approach with oil palm as the driver of deforestation. Given estimated peat depths in the Project Area, our methodology estimates that all peat deposits would have been completely oxidized in the "without project" scenario at the end of this period, marking a natural conclusion to the crediting period.

Mechanisms have been put in place to ensure adequate funding for mandated ecosystem restoration activities from years 30 to 60 and for all major project activities in perpetuity after the GHG crediting period. A portion of the credits generated by the project will be sold, and the revenues invested in an endowment fund explicitly designated for project continuity after crediting revenues expire (see Section G3.7). In addition, many of the major project activities are designed to become self-sustaining over the project lifetime, such that they will not require crediting revenues to continue after the project comes to an end.

Certification schedule. Project proponents expect to undertake annual certification of carbon credits for the first ten years of the project, followed by certification every two years for the remaining twenty years, as indicated in Table 33.

Project start date. Given the complex history of land usage and land rights in the Project Area, determining an exact project start date is somewhat difficult. OFI, a partner in the project, has struggled for decades to protect this region and ensure the territorial integrity of the adjacent TPNP (see Section G2.2) and has been physically engaged in the area through active protrols since 2005. Although project proponents secured national-level support for the project as early as March of 2008, they have opted for a more conservative start date of **November 2008**, when the Bupati signed an official letter recommending the project (see Section G5.2, below). As Project Area oil palm plantations relied on the Bupati's support for their concession claims, this letter marks the date on which the project succeeded in supplanting those claims, preventing them from continuing to deforest the project area and therefore began officially "conserving carbon" per the definitions under the VCS guidelines.

Table 33. Verification Schedule for the Rimba Raya Crediting Period

Verification Number	Year	Vintage	Verification Number	Year	Vintage
1	2010	2009	11	2021	2019-2020
2	2011	2010	12	2023	2021-2022
3	2012	2011	13	2025	2023-2024
4	2013	2012	14	2027	2025-2026
5	2014	2013	15	2029	2027-2028
6	2015	2014	16	2031	2029-2030
7	2016	2015	17	2033	2031-2032
8	2017	2016	18	2035	2033-2034
9	2018	2017	19	2037	2035-2036
10	2019	2018	20	2039	2037-2038

Implementation Schedule for Major Project Activities

Table 34 details key events and milestones for the first three years of project implementation.

Table 34. Rimba Raya Implementation Schedule for CCB						
Project Phase	**Event / Milestone**	**Activity Description / Relevancy**	**Start Date**	**Finish Date**	**Status**	**Responsible Party**
1-Feasibility study	Meeting with Orangutan Foundation Intl.	Determine synergy between orangutan conservation objectives and avoided deforestation	20-Mar-2008	21-Mar-2008	Complete	Todd Lemons
1-Feasibility study	Visit potential project site area	Survey current condition of forest, assess immediate local threat from palm oil	21-Mar-2008	23-Mar-2008	Complete	Todd Lemons
1-Feasibility study	Meet independently with three members of Commission 4 (development) of the Provincial legislature	Discuss new land-use plan that intends to convert Production Forests to Palm Oil	21-Mar-2008	25-Mar-2008	Complete	Todd Lemons / Biruté Galdikas
1-Feasibility study	Meet with Provincial Governor	Determine possibility of his support given historical support of palm oil	25-Mar-2008	25-Mar-2008	Complete	Todd Lemons / Biruté Galdikas
1-Feasibility study	Meet with Conservation Dept. of the Ministry of Forestry (PHKA)	Meet with "Head of Sub-Directorate" of the dept. in order to build support at lower levels within the agency.	8-Apr-2008	8-Apr-2008	Complete	Todd Lemons / Biruté Galdikas
1-Feasibility study	Meet with Conservation Dept. of the Ministry of Forestry (PHKA)	Meet with the "Director of Area Conservation" and "Director General" to explicitly outline the project plan and ask for support	9-Apr-2008	9-Apr-2008	Complete	Todd Lemons / Biruté Galdikas

1-Feasibility study	Deliver LOI to Ministry of Forestry	Lay out plan. Demonstrate common goals with OFI and define project area.	10-Apr-2008	10-Apr-2008	Complete	Todd Lemo / Biruté Galdikas
1-Feasibility study	Meet with Minister of Forestry	Determine level of support for the project. Ask for advice on how to proceed	12-Apr-2008	12-Apr-2008	Complete	Todd Lemons / Biruté Galdikas
1-Feasibility study	Commission "Desk Top Study"	Contract ForestCarbon to conduct a Desk Top Study of the Project area	1-Jun-2008	15-Aug-2008	Complete	Forest Carbon
1-Feasibility study	Application for "Area verification"	Local branch of the National Forestry Dept determines current legal status of project area and issues letter of approval if no legal conflicts with title or proposed activities	15-Sep-2008	1-Oct-2008	Complete	Todd Lemons / Prometheus
1-Feasibility study	Meet with Chiefs of the local villages	Determine level of support for the project. Discuss community concerns and needs	15-Sep-2008	18-Sep-2008	Complete	Infinite-Earth
2-Establishment of Rimba Raya Reserve	Establishment of offices	Administrative offices established in Jakarta and Pangkalanbun and field office established in Seruyan	1-Oct-2008	31-Dec-2010	Started	Infinite-Earth
2-Establishment of Rimba Raya Reserve	Project Design	Design & Development of the Rimba Raya REDD Project	1-Oct-2008	15-Mar-2009	Complete	Infinite-Earth
1-Feasibility study	Meet with Bupati of the Seruyan Regency	Determine level of support for the project. Discuss regency needs.	15-Oct-2008	18-Oct-2008	Complete	Todd Lemons
2-Establishment of Rimba Raya Reserve	Bupati's Letter of Recommendation	Bupati of Seruyan Regency signs letter of approval and recommendation of the project	1-Nov-2008	11/31/2008	Complete	Todd Lemons / Prometheus
2-Establishment of Rimba Raya Reserve	Biodiversity Study	Commission Biodiversity Study of project area	1-Nov-2008	15-Jan-2009	Complete	Daemeter

2-Establishment of Rimba Raya Reserve	Community Assessment	Commission Assessment for all communities in the project area to determine land tenure analysis, socio-economic status and needs, etc	1-Dec-2008	1-Feb-2009	Complete	Daemeter
2-Establishment of Rimba Raya Reserve	Governor's Letter of Recommendation	Governor of the Central Kalimantan province signs letter of approval and recommendation of the project	1-Dec-2008	15-Mar-2009	Complete	Todd Lemons /Dr. Galdikas
5-Extension of OFI Activities	Construction of orangutan release centers & feeding platform	Four release stations will be built inside the project area, 1 per year for the first three years of the project	1-Dec-2008	31-Mar-2012	Started	Rimba Raya / OFI
6-Development of Social Buffer	Village Heads Meeting	OFI sponsored meeting of Project Zone Village Heads to discuss conservation issues.	23-Dec-2008	23-Dec-2008	Complete	OFI
6-Development of Social Buffer	Daemeter Social Survey	Daemeter field team visits villages in the Project Zone to gather info and elicit opinions on proposed project activities	23-Dec-2008	28-Dec-2008	Complete	Daemeter
2-Establishment of Rimba Raya Reserve	Agreement with carbon buyers	Contract for the purchase of REDD credits	15-Feb-2009	15-Jun-2010	Complete	Infinite-Earth
2-Establishment of Rimba Raya Reserve	Technical Proposal	Submit Technical proposal (Project Operational Plan) to Dept of Forestry for review	1-Mar-2009	15-Mar-2009	Complete	IE Mgt Team / Sonokoling
2-Establishment of Rimba Raya Reserve	Technical Proposal	Present Technical proposal (Project Operational Plan) to Dept of Forestry and field questions & concerns.	15-Apr-2009	1-May-2009	Complete	IE Mgt Team / Sonokoling
2-Establishment of Rimba Raya Reserve	Fire Plan	Design and Implementation of comprehensive fire prevention and response plan	1-May-2009	1-Jun-2010	Complete	Marc Nicolas
2-Establishment of Rimba Raya Reserve	PDD Pre-validation	PDD submitted for pre-validation review	1-May-2009	31-May-2009	Complete	Rainforest Alliance

2-Establishment of Rimba Raya Reserve	PDD Translation and Dissemination	PDD translated into Indonesian and distributed to all stakeholders for the CCB public comment period	1-May-2009	31-May-2009	Complete	Rini Firdaus / OFI / Rimba Raya
2-Establishment of Rimba Raya Reserve	Minister's Letter of Recommendation	Concession approved contingent on compliance with administrative steps	1-Jun-2009	30-Jun-2009	Complete	IE Mgt Team / Prometheus
2-Establishment of Rimba Raya Reserve	Monitoring Plan	Design & Development of Monitoring Plan	1-Jun-2009	15-Jan-2009	Complete	Forest Carbon / Daemeter
2-Establishment of Rimba Raya Reserve	Daemeter Phase 2 Biodiversity and Community Assessments	CCB validation and verification	1-Jun-2009	15-Jan-2010	Complete	Daemeter
2-Establishment of Rimba Raya Reserve	CCB Validation	PDD posted to CCB website and project validation commences, triggering public comment period	1-Jun-2009	15-Jun-2010	Complete	SCS
2-Establishment of Rimba Raya Reserve	2nd Validation of Methodology	Receive 1st validation of methodology, receive 2nd validation	1-Jun-2009	15-Jul-2010	Started	Bureau Veritas
6-Development of Social Buffer	Public comment meetings	Meetings in Project Zone communities to describe project and elicit comments	1-Jun-2009	15-May -2010	Complete	Rimba Raya/ OFI
5-Extension of OFI Activities	Release of rehabilitated orangutans	The coordinated release of 300 rehabilitated orangutans into the project area	15-Jun-2009	31-Dec-2012	Started	Rimba Raya / OFI
2-Establishment of Rimba Raya Reserve	Environmental Impact Assessment	Conduct Environmental & Social Impact Study per Dept of Forestry Regulations for final approval	1-Jan-2010	15-Apr-2010	Complete	Focus Consulting
6-Development of Social Buffer	Community consultations	Series of meetings with Project Zone communities to elaborate and prioritize social programs	1-Aug-2009	31-May -2010	Complete	Rimba Raya
6-Development of Social Buffer	Community consultations	Initial (1 of 2) Public Comment Period	1-May-2010	31-May -2010	Complete	RRC & World Education

6-Development of Social Buffer	Community consultations	Formal CCBA Public Comment Period	1-Sep-2010	30-Sep - 2010	Complete	RRC & World Education
2-Establishment of Rimba Raya Reserve	Minister's Decree granting IUPHHK Concession Rights	Final approval of the Rimba Raya rehabilitation and restoration concession license	1-Sep-2009	15-Jul-2011	In Final Stages	IE Mgt Team / Rimba Raya
6-Development of Social Buffer	Establishment of community committees	Establish system of community involvement in day-to-day operations , process and procedural rules for decision making, arbitration, etc. using existing socio/political/judicial structures (village counsels, tribunals)	1-Jan-2010	15-Jun-2011	Started	Rimba Raya / OFI
2-Establishment of Rimba Raya Reserve	IUPJL Business License	Application & Approval of Business License for trading Carbon Credits (under complicance scheme only)	15-May-2010	?	Pending	Infinite-Earth /Rimba Raya
2-Establishment of Rimba Raya Reserve	VCS Verification	VCS verification commences	15-Feb-2010	15-Aug-2010	Started	SCS
3-Execution of Rimba Raya Operational Plan	Guard Posts	20 guard posts built at strategic locations across the Reserve, 4 per year for the first 5 years of the project	1-Jun-2009	31-Dec-2011	Started	Infinite-Earth / OFI / Rimba Raya
3-Execution of Rimba Raya Operational Plan	Hiring and training of new personnel	Field manager, Chief Reserve warden, and 35 new guards hired and trained	1-Jun-2009	31-Dec-2011	Started	Infinite-Earth / OFI / Rimba Raya
3-Execution of Rimba Raya Operational Plan	Hiring and training of fire brigade	Fire chief engaged and fire brigade hired and trained	1-May-2010	31-Dec-2011	Started	Infinite-Earth /Rimba Raya
4-Co-Management of Tanjung Puting	Execution of Co-Management Agreement with TPNP Authority	Become an additional party to the existing and historical co-management agreement between OFI and TPNP	1-Jun-2010	1-Dec-2010	Started	Rimba Raya / OFI
5-Extension of OFI Activities	Construction of orangutan remote feeding platforms	Four supplemental feeding platforms will be built inside the project area	1-Jun-2009	31-Dec-2011	Started	Infinite-Earth / OFI / Rimba Raya

7-Outreach and Education	Biotracker development	Design and development of proprietary Biotracker implant	1-Jun-2009	15-Jun - 2011	Started	Infinite-Earth / SirTrack
6-Development of Social Buffer	Annual grants to World Education	Grants to expand World Education community activities in project zone	1-Jun-2011	31-Dec-2039	Pending	Infinite-Earth
4-Co-Management of Tanjung Puting	Commencement of annual grants to TPNP	Grants to fund TPNP conservation activities	1-Jun-2011	31-Dec-2039	Pending	Infinite-Earth
4-Co-Management of Tanjung Puting	Training of TPNP guards and staff	Bring in outside military and police training personnel to adequately train and equip staff	1-Jun-2011	31-Dec-2039	Pending	Rimba Raya / OFI
5-Extension of OFI Activities	Commencement of annual grants to OFI	Grants to fund OFI orangutan conservation and rehabilitation activities	1-Jun-2011	31-Dec-2039	Pending	Infinite-Earth
6-Development of Social Buffer	Community centers & libraries & "One Laptop per Child"	2-3 community centers & libraries will be built, 1 in Baung and 1 in Muaradua	1-Jun-2011	31-Dec-2039	Pending	Rimba Raya / OFI
6-Development of Social Buffer	Water filtration systems	Development of community based clean filtration system via "Potters for Peace"	1-Dec-2010	15-Mar-2011	Pending	Rimba Raya
6-Development of Social Buffer	Fuel efficient clean-tech sustainable cook stoves & biochar production	Finance and distribution of Fuel efficient clean-tech cook stoves and biochar production technology to each household	15-Mar-2011	31-Dec-2011	Started	Rimba Raya
6-Development of Social Buffer	Aquaponics program	Fund technical consultants on creating a high yield, small footprint aquaponics greenhouses	1-Jun-2011	31-Dec-2012	Pending	Rimba Raya
7-Outreach and Education	Orangutan study	Design and setup of orangutan tracking study	15-Jun-2009	31-Dec-2012	Started	Rimba Raya / OFI
2-Establishment of Rimba Raya Reserve	CCB Verification	Receive CCB Gold Validation	15-Mar-2009	15-Nov-2010	Started	SCS

6-Development of Social Buffer	Early Childhood Education & Development (ECED)	Begin stocking materials and hiring trainer / instructors for the ECED programs at the 2-3 community centers	1-Jun-2011	31-Dec-2039	Pending	Rimba Raya / OFI / World Education
7-Outreach and Education	Interactive Educational Platform	Creation of an interactive educational platform around the content of the research study	1-Jun-2011	31-Dec-2039	Pending	Rimba Raya / Infinite-Earth
3-Execution of Rimba Raya Operational Plan	Implementation of Monitoring Plan	Execution of Monitoring Plan	1-Jun-2009	31-Dec-2039	Started	Forest Carbon/ Daemeter / OFI / Rimba Raya
6-Development of Social Buffer	Immunization Program	Launch disease prevention & immunization program	1-Jun-2011	31-Dec-2039	Pending	Rimba Raya
3-Execution of Rimba Raya Operational Plan	Construction of fire towers	5 fire towers built at strategic locations across the Reserve, 1 per year for the first 5 years of the project	15-Mar-2009	31-Dec-2014	Started	Rimba Raya
6-Development of Social Buffer	Commencement of micro-credit program	Provide micro-finance program to local communities for agriculture, aqua-culture and other enterprise development	1-Jun-2011	31-Dec-2039	Pending	Infinite-Earth
6-Development of Social Buffer	Construction of floating clinic	Phinisi floating clinic built; operations commence along Seruyan river	1-Jun-2012	31-Dec-2014	Pending	Rimba Raya
6-Development of Social Buffer	Develop Eco-Tourism program	Create a “sister city” (sister village) type program with the Seminole Indian communities in the Florida Everglades	1-Jun-2012	31-Dec-2039	Pending	Infinite-Earth
3-Execution of Rimba Raya Operational Plan	Phase I-III Rehabilitation of degraded habitat	Rehabilitation of degraded habitat via a multi-story mixed indigenous species natural forest & community based cash crop agro-forestry approach	1-Jun-2012	31-Dec-2039	Pending	Rimba Raya

G3.5. Risks to Expected Climate, Community, and Biodiversity Benefits

Identify likely natural and human-induced risks to the expected climate, community and biodiversity benefits during the project lifetime and outline measures adopted to mitigate these risks.

Fire

Risk. The principal risk to all expected climate, community, and biodiversity benefits during the project lifetime is the loss of carbon stocks inside the Project Area due to fire, whether natural or human-induced. Fire would at once reverse climate benefits through the release of carbon emissions from aboveground forest and belowground peat deposits, undo any expected biodiversity benefits through destruction of habitat, and indirectly impact community benefits through the elimination of the main funding mechanism.

Fire is perhaps the key permanence issue facing REDD projects. Even for the Rimba Raya project, which consists in large part of peat swamp forest, both natural and human-induced fires threaten many of the project benefits for climate, community, and biodiversity. The potential surface and ground fuels are predominantly waterlogged for much of the year and do not pose a fire hazard even in periods when neighboring grasslands can burn. However, in extremely dry seasons, fires can burn in the surface fuels and penetrate into the peat beneath the ground cover to a depth of 0.5 – 2.0 m. Such fires tend to flare up into previously killed trees and become particularly difficult to control (Nicolas and Beebe 1999).

Fire in Indonesia. The serious threat posed to world environment and health first gained global notice during the 1997 / 1998 El Niño Southern Oscillation (ENSO) event, during which approximately 25 million hectares of land were affected by fire. During this period, Indonesia suffered the worst fires of any country worldwide, with over 10 million hectares burned. In Kalimantan alone, over one million hectares of *peat swamp forest* were consumed in the fires. Estimates for the economic costs of these devastating firest from forest degradation and deforestation alone range from $1.6 – 2.7 billion. Estimates for the cost of the smoke haze pollution generated by these fires range from $674 – 799 million, and for the environmental costs from emitted carbon at $2.8 billion (Tacconi 2003). Given the rampant conversion of forest land to oil palm and other uses, fire continues to pose a significant risk to forested land throughout Indonesia.

Project Zone History. The history of fire inside the Project Zone is difficult to determine with any accuracy as no records have been kept, although it is clear from anecdotal evidence that fires have periodically affected the region. During 2006, a prolonged dry season made the entire country particularly vulnerable, and fires swept through portions of TPNP and the Project Zone. OFI, in coordination with the TPNP board and the BKSDA (regency land department) Manggala Agni unit, fought the fire, contributing USD 11,000 and hundreds of man-hours to the effort. These efforts were only moderately successful, hampered by difficulty of access to areas affected by fire, subterranean peat fires, and the lack of water resources. A survey of the Project Zone after the fire revealed the following:

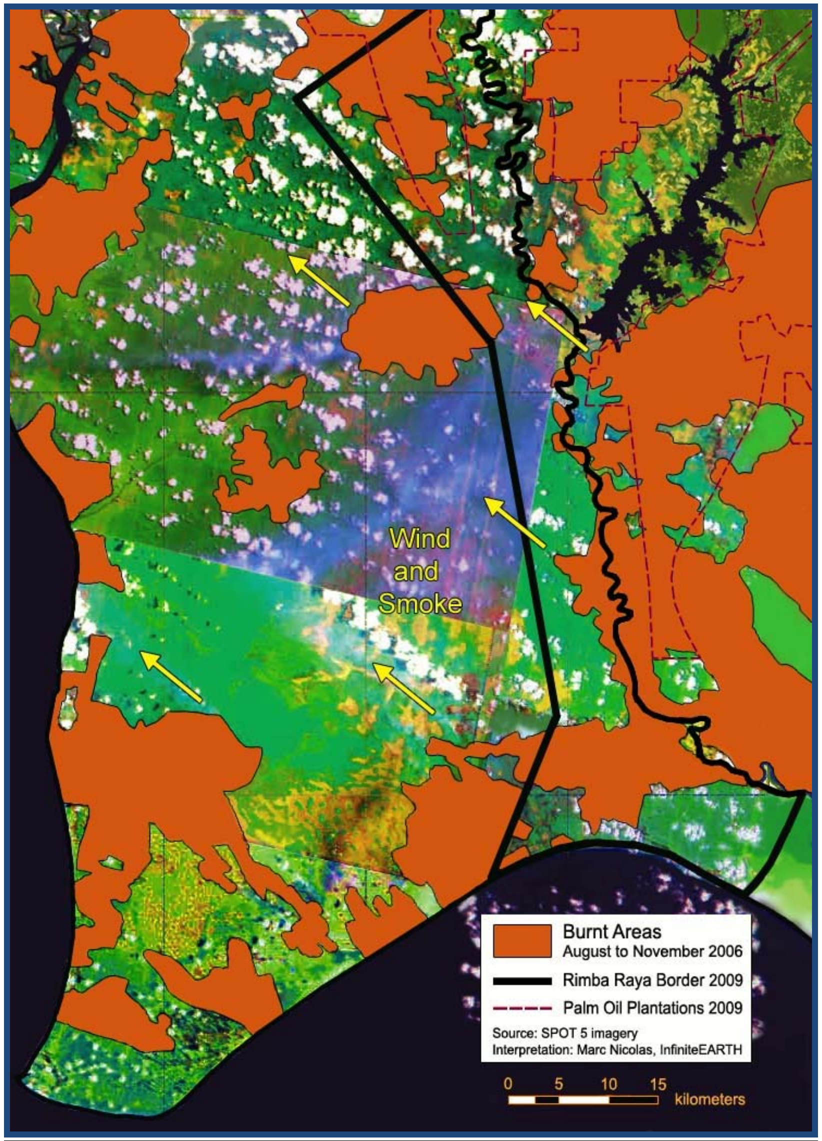


Figure 48. Map of recent fire's location & direction.

Pembuang Hulu and Tanjung Hanau region.

- Beginning in early 2006, the oil palm plantation developed by PT. KUCC adjacent to TPNP opened a number of new roads, providing direct access from the plantation to the Seruyan River to facilitate clearing. As is typical during plantation development, land was cleared using heavy equipment and the cleared material was stacked for burning.
- Under normal circumstances, fires used to dispose of the cleared material can be controlled, but during the prolonged dry season of 2006, fires set for land clearing burned out of control, spreading to other areas.
- In addition, a number mines that formerly produced gold were in use at the time by local people mining zircon sand. Miners used fire to clear overgrown roads leading to the mines, and these fires may also have spread to surrounding forest areas.

Baung and Sigintung

- The Baung area is best classified as seasonal swamp. Due to changing precipitation patterns, this area is typically flooded during the wet season and dry during the dry season. During prolonged dry seasons, the nearby seasonal lake, which can be travelled only by canoe during the wet season, is traversable on foot. The area is highly prone to fire because vegetation is dominated by shrubs and bushes with a relatively thick accumulation of peat.

- Similarly, the Sigintung area is prone to seasonal flooding, but during prolonged dry seasons it transforms into an open area dominated by bushes, with deposits of peat moss spread throughout, making it a fire hazard.
- Fire occurring in the Baung and Sigintung areas is usually caused by local fishermen, who burn bushes and brush blocking their access to creeks and streams. These small fires then spread throughout the region.

Mitigation. The Rimba Raya project has engaged Technofire Consulting Group, noted experts in fire prevention and response, to develop the project Fire Plan. Plan development will progress in two phases – an initial field assessment and design phase, followed by an implementation phase – across the four dimensions outlined below:

<u>Institutional</u>

1. Identification of the peat swamp topography, water table, old logging roads, orangutans habitat and fire-prone areas;
2. Selection of the potential partners (local communities and private plantations) and identification of possible cooperation (training and equipment, joint patrols and response, etc.);
3. Development of cooperative agreements for fire management with priority villages, private plantations, and Tanjung Puting National Park;
4. Determination of the need for access roads, water supplies, fire breaks, command posts, warehouses, and lookout towers;
5. Determination of the need for radio communication equipment and development of radio communication system;
6. Determination of the need for fire equipment and protective gear for crews from the Rimba Raya Reserve and for crews from local communities;
7. Determination of the need for transportation vehicles, small canal boats, and logistics equipment;
8. Development of the fire management organization, fire command system, and standard operating procedures;
9. Training in fire and rescue at basic and advanced levels for crew members from the Rimba Raya Reserve Fire Brigade (advanced training includes materials on fire motor pumps and training of trainers);
10. Training in fire and rescue for priority villages that will be equipped with fire equipment and protective gear (cooperative agreements).

<u>Prevention</u>

1. Determination of routine maintenance for access roads, water supplies, fire breaks, and lookout towers;
2. Determination of routine maintenance for command posts, radio communication equipment, fire equipment, protective gear, and warehouses;
3. Determination of routine maintenance for transportation vehicles, small canal boats, and logistics equipment;
4. Development of fire information system (danger rating and early warning);

5. Determination of the need for sign boards for fire danger;
6. Determination of the need for awareness campaigns, socialization, and coordination meetings;
7. Determination of the need for simulation exercises and readiness drills in collaboration with partners (cooperative agreements);
8. Determination of the need for prevention patrols in collaboration with fire crews from priority villages (by road and river).

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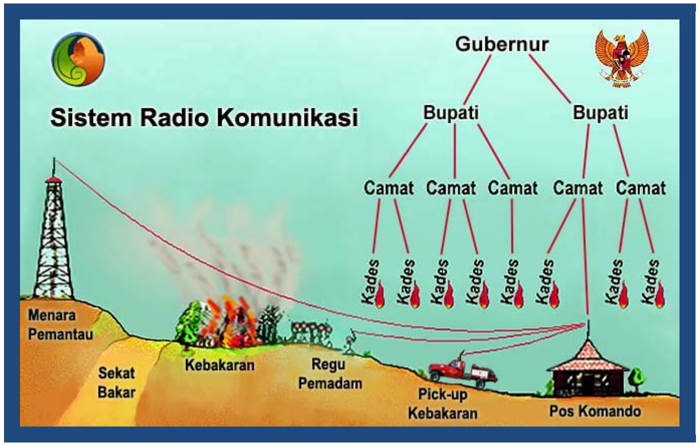
Response

1. Readiness, coordination, and first response patrols;
2. Mobilization of fire crews, equipment, and logistics;
3. Firefighting and safety during response;
4. Reinforcement with crews from partners (cooperative agreements);
5. Rescue of injured or threatened persons and orangutans;
6. Reporting on firefighting and rescue activities.



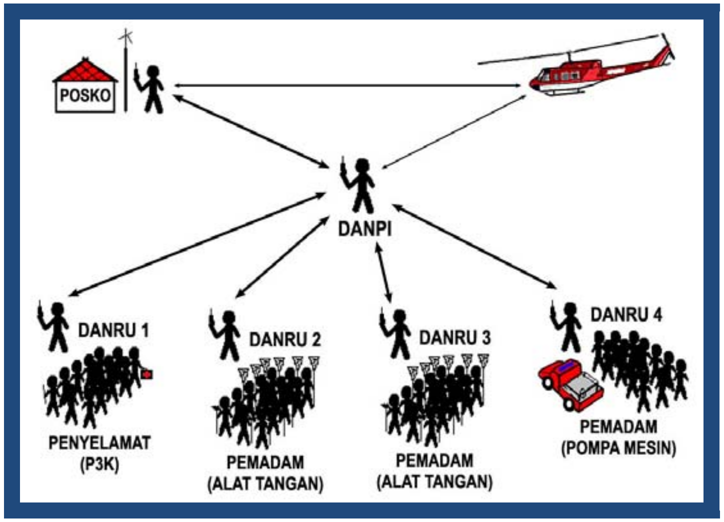
7. Rescue of injured or threatened persons and

Rehabilitation

1. Collection of evidence and investigations;
2. Evolution monitoring of the fire-affected area;
3. Fire prevention and response assessment;
4. Restoration of burned areas.

Other risks

A number of additional, minor risks also threaten expected project benefits, though to a smaller extent than the threat posed by fire. These additional threats and proposed mitigation measures are described below. *See Annex 12 for complete Fire Plan.*



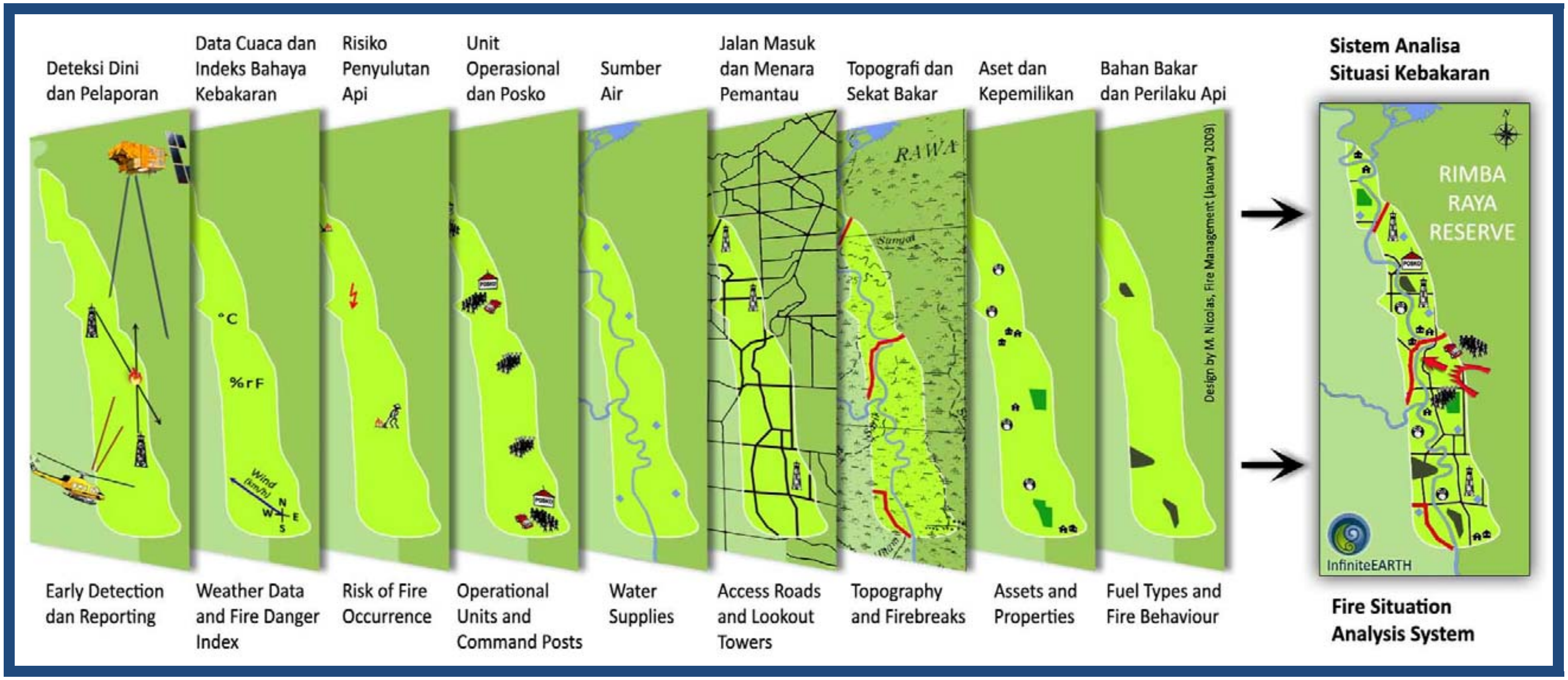


Figure 49. Planned components of the Rimba Raya Fire Plan.

Risks to climate benefits. Illegal logging poses a threat to the expected climate benefits of the project. The first step in removing this threat is to understand it by mapping the actors involved. This includes identifying who they are, who funds them, and where the logs go. If the actors are from Project Zone communities, then the solution will involve engaging them in discussion and developing alternative activities to guarantee their livelihoods. Many project activities are already aimed at reducing this threat. If the actors are from outside the Project Zone, however, then the solution will be more complex, requiring the involvement of outside parties such as law enforcement personnel. Project proponents have designed a management and monitoring system designed to identify and address this threat (see Section G3.2).

Encroachment by palm oil poses a second threat to expected climate benefits. While the Project Area is protected on three sides by the Seruyan River, the Java Sea, and Tanjung Puting National Park, palm oil plantation development in the north has already expanded beyond authorized boundaries and threatens to encroach farther into the Project Area. The continued advancement of this plantation, with its network of drainage canals, threatens to undermine all contiguous forest. While REDD methodology necessarily requires an adversarial relationship with oil palm companies during the project development phase (for "additionality"), it also promotes a more collaborative relationship during project implementation (to reduce "leakage"). As such, project proponents have devised a series of measures to induce collaboration by the plantation to the north of the Project Area (see Section CL2.2). Among those, and in addition to the management and monitoring systems designed to protect the territorial integrity of the Project Area more generally, are two specific measures aimed at preventing further encroachment. First, project proponents intend to build a road to delineate the boundaries of the northern plantation at the time of commencement of project activities. This road will reduce the potential for plantation creep and also serve as a fire break. Second, project proponents hope to collaborate in the design and management of plantation drainage canals adjacent to the Project Area to reduce the impact on contiguous forest.

Small-scale agriculture and agroforestry on the part of Project Zone community members poses another threat. While the Daemeter social survey indicates that most community land is on the east side of the Seruyan River, a number of villages and sub-villages are located on the west side of the river, inside the Project Area. Project proponents intend to honor reasonable claims of land rights by community members and excise them from the GHG accounting area. Community members may choose to make *ladangs*, and some villagers have even expressed a willingness to develop their own palm oil plantations. To reduce the risk to expected climate benefits, project proponents hope to provide more attractive alternative livelihoods to these villagers, especially through the Community Forestry program (see Section G3.2). For those who still wish to convert land on the west side of the Seruyan, mitigation measures will include education and awareness around zero burning policies and agreements to avoid conversion of forest or peat areas.
Climate change, with a concomitant reduction in the capacity of the Project Area to support peat swamp forest, poses a final, long-term, and somewhat inchoate risk to expected climate benefits. Project proponents have designed a carbon monitoring system with the capacity to identify declines in carbon stocks over time. Utilized in tandem with the comprehensive ecosystem restoration program that will commence during the first year of project activities (see Section G3.2), this system should allow for the identification and mitigation of this threat.

Risks to biodiversity benefits. The risks to biodiversity benefits are coextensive with the risks to climate benefits described above in the sense that any threat that reduces carbon stocks will also reduce habitat and lead to a diminishment in biodiversity. For those risks, the mitigation measures described above should also prove effective in protecting biodiversity.

There is in addition the risk of illegal hunting inside the Project Area. From the social survey conducted by Daemeter, this threat appears to be somewhat negligible. Nearly all Project Zone community members are of the Muslim faith, which prohibits the consumption of most species in the Project Area. Nevertheless, any remaining poachers should be deterred by the Rimba Raya Reserve's guard network and encouraged to find alternative sources of food through the various livelihoods programs that comprise the project's social buffer.

Risks to community benefits. In addition to the risks to climate benefits enumerated above, which would reduce funding for community programs, increased flooding presents a specific threat to expected community benefits. During the social survey, communities reported that flood frequency, magnitude, and duration had been predictable in the past, and limited to periodic major rain storms. Today, floods are more frequent and severe, and last for much longer periods of time. Whereas in the past floods may have lasted for one to three day, for example, a single flood today can last for one to five weeks. This flooding has already reduced the prospects of many Project Zone community members who rely on fishing for their livelihoods. Recommended actions needed for reducing flooding are difficult to ascertain without further knowledge of proximal causes, such as deforestation in upstream watersheds, canal construction by oil palm companies for swamp drainage, etc. Instead, project proponents will focus on alternative livelihoods programs as a way to mitigate the impacts of increased flooding.

G3.6. Project Design and High Conservation Values

Demonstrate that the project design includes specific measures to ensure the maintenance or enhancement of the high conservation value attributes identified in G1 consistent with the precautionary principle.

A preliminary analysis of HCVs in the Project Zone determined that 11 of the 13 HCV sub-values defined in the Toolkit for Indonesia are potentially present (see discussion in Section G1.8). Maintenance or enhancement of all these HCVs depend directly on the protection of remaining forest, retention of connectivity between remnant forests in the Project Zone with those of TPNP, potential rehabilitation of degraded riparian forest zones in the Project Area, and prevention of oil palm expansion to protect water quality and associated aquatic habitats of the Seruyan. Specific measures to achieve this are outlined in section G3.2 and their relationship to specific HCVs are discussed in Sections CM1.2 and B1.2.

G3.7. Project Benefits Beyond Project Lifetime

Describe the measures that will be taken to maintain and enhance the climate, community and biodiversity benefits beyond the project lifetime.

To fulfill permanence requirements, proponents of a REDD project must arrange for the protection of the Project Area for 30 years. IE has developed a model that will protect the Rimba Raya Project Area in perpetuity.

InfiniteEARTH will form a non-profit foundation and with 5% of its annual profits, fund an endowment sufficient to protect the project area in perpetuity, well beyond the official 30 year project life. This approach marks an effort not only to offset carbon footprints, but also to make inroads into the current global carbon deficit that is driving climate change.

Most important among these projects is a set-aside endowment to fund the preservation of the Rimba Raya reserve in perpetuity. Resources will be dedicated and inalienable from the first day of operations, ensuring that the Rimba Raya Reserve will remain intact indefinitely. During the 30 years of project life, revenues from the sale of carbon credits will be used to fund all CCBS-related programs. Once the project reaches the end of the CCBS period, remaining programs will be funded by “endowment capital.”

In order to ensure that the principle is never depleted, endowment capital will be placed in an investment vehicle that allows the Foundation partners to withdraw only interest earned, adjusted for inflation after taxes and fees.

A graphic depiction of the measures taken to ensure the permanence of project benefits is presented in Figure 50 below.

Another goal will be to fund initiatives directed at improving the social and economic welfare of indigenous populations beyond the requirements established by the CCBS. The Foundation will encourage feedback and regular program evaluation to ensure targeted spending for optimal results, collaborative priority-setting for maximum social impact, and flexibility for adaptive management.

In addition to these measures, IE intends to acquire insurance against major catastrophes, ensuring that the project will remain environmentally and financially sound.

"The power of imagination makes us infinite".

- Naturalist & Conservationist John Muir

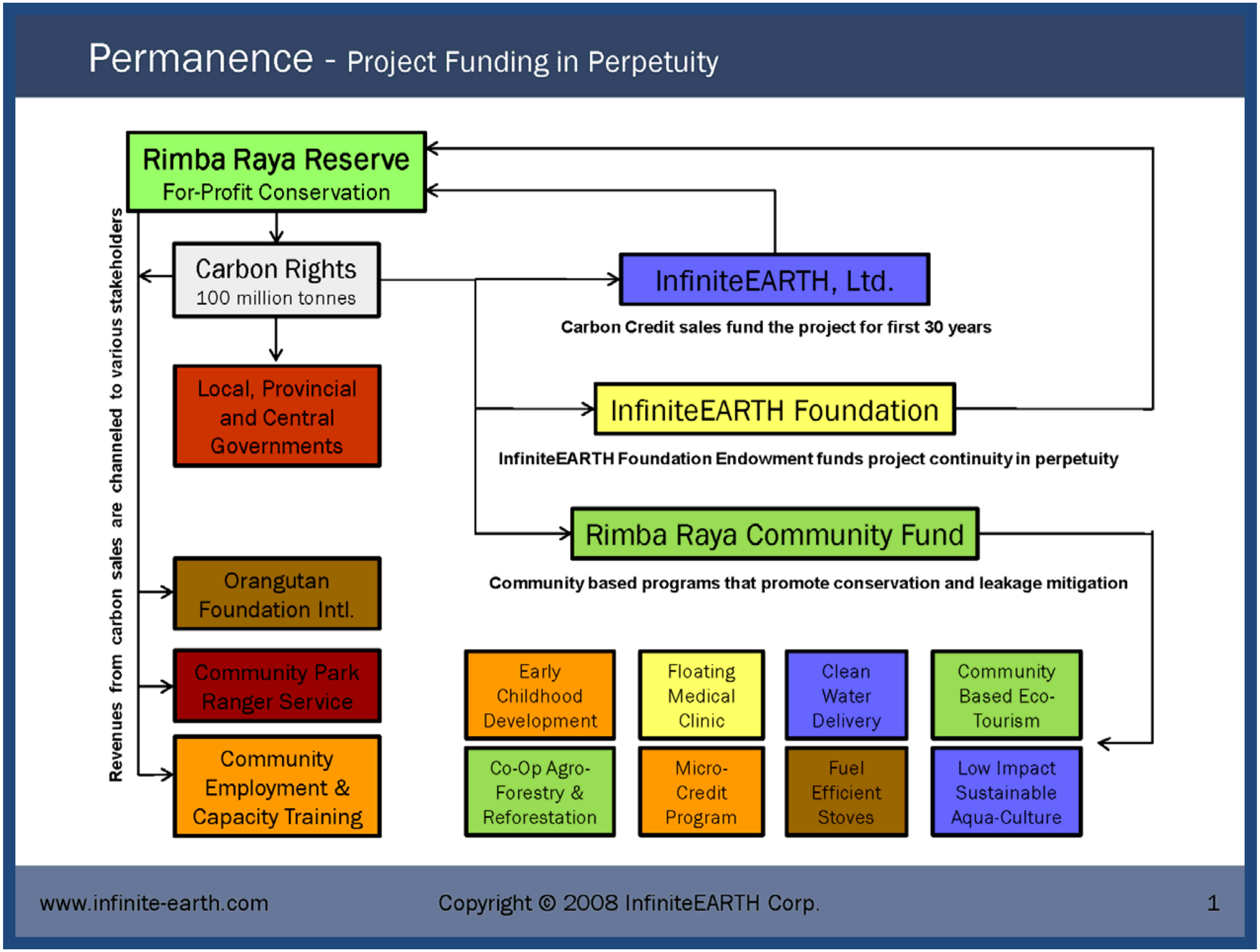


Figure 50. The InfiniteEARTH permanence model**.**

G3.8. Stakeholder Identification and the Rimba Raya Process Framework

Document and defend how communities and other stakeholders potentially affected by the project activities have been identified and have been involved in project design through effective consultation, particularly with a view to optimizing community and stakeholder benefits, respecting local customs and values and maintaining high conservation values. Project developers must document stakeholder dialogues and indicate if and how the project proposal was revised based on such input. A plan must be developed to continue communication and consultation between project managers and all community groups about the project and its impacts to facilitate adaptive management throughout the life of the project.

Stakeholders

Stakeholder categories, descriptions, and channels of communication identified during the social survey conducted by Daemeter Consulting are presented below in Table 35.

Table 35. Stakeholder categories and channels of communication		
Stakeholder Category	**Description**	**Channels of Communications**
Villagers	Recipients and beneficiaries of any program implemented in Project Zone villages.	Verbal communication from village head
		Written invitation from village head for meetings with oil palm companies, higher-level government officials, etc.
Farmers' and Women's groups	Organization with the common goal of improving members' welfare.	Word of mouth
		Letters and other written media
		Announcement board in village office or mosque
Formal Village Leaders	Village heads, Village secretaries, and BPD Chairmen (see Figure 51 below)	Word of mouth
		Letters and other written media
		Direct visit to Village Office
Informal Leaders	Village members with influence in the village, often approached to facilitate communication	Word of mouth
		Letters and other written media
		Announcement board in village office or mosque
World Education	Community organizer that implements community development programs	Internet (including email and instant messaging)
		Telephone
OFI	Community facilitator working to raise stakeholders' awareness of conservation	Internet (including email and instant messaging)
		Telephone
WALHI	Environmental protection advocacy organization	Internet (including email and instant messaging)
		Telephone
Sawit Watch	Network of civil society organizations working to raise public awareness of the negative impacts of oil palm development	Internet (including email and instant messaging)
		Telephone
Government Offices	License oil palm plantation companies; monitor their progress; implement programs at the village level; facilitate conflict resolution for any village dispute	Official letter
		Telephone
		In-person visit
Oil palm companies	Plantation development, with limited social programs for local communities	Official letter
		Telephone
		In-person visit

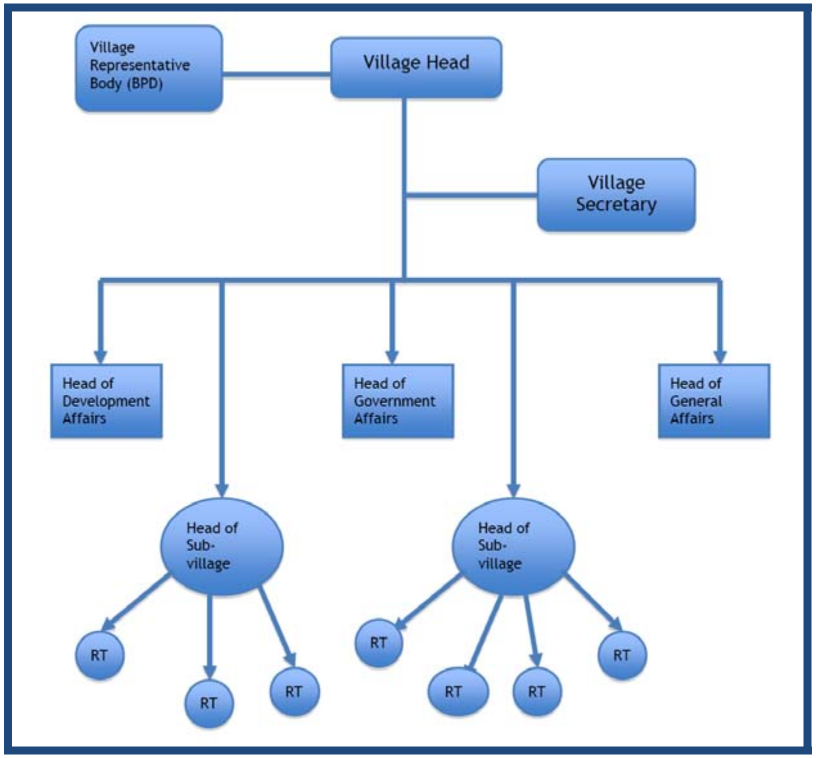


Figure 51. Organizational Structure for Village Governments.

Community Involvement Prior to Commencement of Project

Beginning in 2003, OFI and World Education commenced the Tanjung Puting Integrated Conservation and Development Project (TPICDP) with funding from USAID. During Phase 1 of the project (October 2003 - February 2006), they worked with communities to the north and west of the park with the following objectives:

1. Increase and improve community and park patrolling of TPNP;
2. Improve multi-stakeholder planning and decision-making processes related to conservation and development in and around TPNP.

The project proved successful, and Phase 2 (July 2005 – June 2007) expanded the geographic scope of the project to include five villages in the Seruyan District. Two more objectives were added:

3. Increase farmer food security and income generation through participatory sustainable agricultural development and action research on various crops and livestock;
4. Strengthen the capacity of local community-based organizations and farmer leaders to facilitate community-based learning processes for agriculture and livelihood development, and natural resources management.

Over the course of the project, approximately 1400 – 1500 impoverished rural families participated, along with park rangers, government personnel, and staff from numerous NGOs. Below are some of the project highlights relating to community engagement within the project zone:

- Starting in 2003, OFI, World Education, and the Tanjung Puting park management authorities established a co-management team to help promote the conservation of the park in a coordinated, effective manner. Regular stakeholder meetings have since been held. Under the agreement, the project's patrols, with their better ground coverage, act as monitoring agents.
- In 2003, project proponents organized a series of community meetings on the eastern side of the park to

discuss ways in which the illegal logging canals could be closed. They received community support for closing down illegal logging canal Tata J.

- In 2004, project proponents organized numerous stakeholder meetings about the proposed palm-oil plantation expansion along TPNP's eastern boundary and arranged a site visit with one of the plantation managers, government officials, local NGOs, and the media.
- Beginning in 2005, WE established a presence in the Seruyan, setting up a regional office and embedding field staff in five villages
- In 2005, WE and OFI jointly facilitated a discussion with Tanjung Hanau village about the location of the Park's eastern border, because the community wanted to open more land for farming and/or the establishment of a rubber plantation.
- In 2005, WE ran a week-long training program on "Social Analysis" and, together, WE and OFI facilitated a workshop on conflict resolution.
- In 2006-07, WE promoted and facilitated the preparation of regulations governing the protection of natural resources in six villages. The long process involved in producing a village regulation—social analysis training, mapping of social facts, analysis of strategic issues—helped build an awareness of the importance of these regulations for the long-term future of the community. The process was participatory, involving all elements of the community and in consultation with the district legal affairs office for formal legitimization.
- Hanao district, Seruyan, has commenced an embryonic communication forum for farmers' groups at the district level. The forum's activities are still limited to communication, and as yet it has no strategic agenda for promoting the villagers' aspirations. However, there are a great many multi-village issues in Seruyan, and community forums like this one are needed to build a common perception and to learn about various issues influencing communities.
- In 2007, WE organized the first stakeholders' meeting in the Seruyan District. Local government was represented by the Regional Secretary, chair of commission B, members of local parliament, the heads of the local agriculture and animal husbandry service, the district development planning agency, the local fisheries and marine affairs service, the forestry service, and three subdistrict heads from Seruyan Hilir, Danau Sembuluh, and Hanao. Discussions between villagers, village administrations, district parliament and representatives of relevant local government agencies produced 14 strategic issues, which were packaged as a document for presentation to the district head and district parliament, in the hope that policy makers would listen to their aspirations.

Community Involvement during Project Development

Despite the absence of communities or families living within the boundaries of the Carbon Accounting Area, the Rimba Raya Reserve project has, through a series of formalized meetings, gained local approval of the project by including communities bordering the buffer zone of the Carbon Accounting Area as stakeholders in the project development process. InfiniteEARTH views local stakeholder participation as the key to the project's success in terms of preventing illegal logging and fires.

In order to engage local communities, the project proponent has consummated a partnership agreement with World Education, a well-known development organization that has been working with communities in the area since 2003 on a project funded by USAID. This organization in conjunction with Daemeter Consulting conducted an initial baseline survey to assess community development needs, local uses of the surrounding forests, and community land use. A large population of community members in the Project Zone was interviewed. A summary of some the most prominent dialogues is presented below.

Survey findings related to development needs have been incorporated into the development strategy of the Rimba Raya project so that program goals match local needs. In terms of local land use in the buffer zone, it was found that local communities were highly dependent on the waterways for transport and also fishing. Community members consistently mentioned access to clean river water as an important priority and voiced their concern about the potential threat of their rivers becoming polluted with sediment and chemicals if oil palm plantations expanded in the area.

Non-timber forest products were also collected for local use and these rights will be respected by the project as they promote the sustainable use of the forest. In terms of community land use, farmers use land that lies to the east of the Seruyan River, which is outside the Carbon Accounting Area and borders the Project Zone. However, there are a few exceptional cases where farmers are cultivating small plots in the Project Zone. These land rights have been recognized by the project in order to avoid local conflict, although none of these conflicts with the Carbon Accounting Area.

InfiniteEARTH has also developed a strategic partnership with the renowned conservation organization Orangutan Foundation International, which has a major role in managing the neighboring Tanjung Puting National Park. This strong relationship has allowed InfiniteEARTH to benefit from the many years of experience OFI has in managing a large-scale conservation projects and securing community support for this type of project.

In terms of engaging the Indonesian government, InfiniteEARTH has created partnerships with the government at all levels including the village, district, and provincial level. At the village level, approval from village heads has been obtained in the form of letters encouraging the further development of the Rimba Raya Reserve. The district head along with the governor have both formally approved the project and recommended it to the Ministry of Forestry. At the national level, the project has engaged the local BKSDA (forest conservation) section of the Ministry of Forestry on developing an effective fire management plan. The project proponent has taken the approach of extensive collaboration and communication with government bodies to avoid confusion and create a more transparent process for all involved parties as this will ultimately lead to a successful project implementation.

Please see Annex 2 for a full report on community surveys, community engagement, education activities and support documents.

Table 36. Overview of the Stakeholder Meetings during Project Development

Date	Name(Village or Organization)	Purpose of Meeting	Conducted by
• December 23-26 2008	14 Villages	Initial Community Survey	Daemeter
• October 16 2009 • November	Tanjung Hanau	1. Developing agriculture, especially for woman group with 14 women 2. Zero-burning agriculture development (rice field demonstration plot)	World Education
• December 8, 2009 • October 13 2009 • November 2009	Ulak Batu	1. Planning to develop a community forest (Jelutung and Gaharu plantation) with 11 communities 2. Developing agriculture, especially for woman group with 16 women 3. Community fisheries development	World Education
• December 10 2009 • November 15 2009 • November 2009 • November 20, 2009 • October 2009 and November 2009	Baung	1. Planning to develop a community forest (Jelutung and Gaharu plantation) with: a. village head and 4 community members b. 15 communities members a joint survey was conducted c. 5 communities to determined the site of jelutung forest demo-plot 2. Community fisheries development 3. Zero-burning agriculture development (rice field demonstration plot) with 11 communities 4. Forest protection, where a joint survey was conducted on determine the cause of previous forest fires	World Education

• 2009.12.8-10	Tangjung Rengas	Planning to develop community forest (Jelutung and Gaharu plantation) with 7 communities	World Education
• 2009.12.22 • 2008.11. 16 • 2009.10.10 and 2009.11.12	Muara Dua	1. Planning to develop community forest (Jelutung and Gaharu plantation) With 2 communities 2. Community fisheries development With 11 communities 3. Forest protection, where a joint survey was conducted on determine the cause of previous forest fires	World Education
• 2000.11.6-11	Bahaur, Tanjung Rengas, Baung, Paren, Parang Batang, Tanjung Hanau, Paring Raya	Supporting Letter from Villages	RRC, WE
• 2010.01.13-14	World Education, Tanjung Puting National Park and OFI	Discussion about Rimba Raya plan of activities and sharing information with Stakeholder	RRC
• 2010.01.15-19	3 villages Ulak Batu, Baung, Muara Dua	Village visit to share more about PT RRC	RRC
• 2010.02.07-08	Agriculture Department Seruyan District Department of Forestry and Plantation Seruyan District	Additional talks about Rimba Raya to government agency	RRC
• 2010.02.09-10	Seruyan Government, 5 Villages (Muara Dua, Baung, Palingkau, Ulak Batu and Tanjung Hanau	Stake Holder Meeting	World Education
• 2010.02.26-28	3 villages (Bahaur, Telaga Pulang, Muara Dua)	Focus Discussion Group (FGD) regarding socialization of Rimba Raya	RRC, PT Focus
• 2010.02.25 – 2010.03.01	Hanau sub-district, Danau Sembuluh sub-district, and Seruyan Hilir sub-district	Preparation forum of socialization and to make sure location of the meeting and scheduling	RRC
• 2010.03.08-11	14 villages in 3 sub districts (Seruyan Hilir sub-district, Danau Sembuluh sub-district and Hanau sub-district)	Socialization of Rimba Raya Conservation on three sub-district (Seruyan Hilir, Danau Sembuluh and Hanau)	RRC, PT Focus

• 2010.03.22-23	Forestry agency district level Head of Seruyan Hilir sub-district, Environment agency (Badan Lingkungan Hidup) District level	Distribution of UKL UPL Document	RRC
• 2010.03.28-30	Forestry agency district level, Province level, Environment agency District level, Province Level	Presentation UKL UPL PT. Rimba Raya Conservation, held on BLH Province level at Palangkaraya.	RRC, PT Focus
• 2010.05.1-30	14 villages	Initial (1 of 2) CCBA Public Comment Period Field-activities	RRC and World Education
• 2010.05.17-19	5 villages (Baung, Muara Dua, Jahitan, Tanjung Rengas, Telaga Pulang)	Mini Solar Light Assistance program	RRC
• 2010.06.18-19	4 villages (Bahaur, Palingkau, Ulak Batu, Cempaka Baru)	Mini Solar Light Assistance program	RRC
• 2010.06.26-27	5 villages (Parang Batang, Paring Raya, Tanjung Hanau, Banua Usang, Paren)	Mini Solar Light Assistance program	RRC
• 2010.07.12-13	4 villages (Tanjung Rengas, Muara Dua, Jahitan, Baung)	Fire Training	BKSDA and RRC
• 2010.09.1-30	14 villages	Formal CCBA Public Comment Period Field-activities	RRC and World Education

Changes to Project resulting from stakeholder consultations

Prior to the social survey and dialogues with community stakeholders, project proponents intended to offer a limited set of social programs targeted directly at reducing community impacts on the Project Area. These early programs, building on work by OFI and World Education in the region, focused on conservation education and increased crop yields.

The results of the social survey made it clear that these measures would be insufficient. The development of oil palm in the region appears to be following the same course as in other parts of Indonesia, suggesting that the region will see an increase in conflicts and a diminishment in environmental services, even if the 'without project' scenario is successfully avoided. Already the region's ability to sustain traditional livelihoods is in decline. Fishing yields have decreased over the past few years with the rise of flooding, clean water is a scarce commodity, and oil palm companies have commenced a campaign of land seizures that will likely end only when all viable land has been usurped.

In discussions with community members, time and again access to clean water was listed as the top priority for any development program. After survey results were compiled, project proponents immediately began researching appropriate programs, and Potters for Peace (see Section G3.2) was selected as the best

candidate given local needs, project goals, and available resources.
Once project proponents understood the impoverished state of Project Zone communities, a more comprehensive effort at development commenced under the theory that only a broad-based, comprehensive socio-economic program would reduce the impact of Project Zone communities on the Project Area in a meaningful and permanent way. At this stage, project proponents adopted the UN Millennium Development Goals for Indonesia as a roadmap to community engagement. A number of additional programs linked explicitly to these goals (and referencing the needs of Project Zone communities as indicated in the social survey) were researched, budgeted, and incorporated as major project activities. Going forward, communities will again be consulted in order to refine, elaborate, and prioritize these programs.

In discussions with community members, it is clear that the following concerns are paramount to the various stakeholders and have been taken into account in the project plan.

1. Clean Water
2. Fishing Support – Since most communities in the project area are engaged in and make their living from fishing the project proponents will place a high priority to helping the communities to improve their capacity in this area.
3. Jungle Rubber (Jelutung) – Communities also see the ability to grow and tap rubber as another means of providing income to mitigate other activities that might be harmful to the project area.

In discussions with non-community stakeholders the reoccurring theme brought up by them was the need for ongoing communication and cooperation. Project proponents now have made it a priority to allocate sufficient resources including staff to maintain strong relationships with all stakeholders.

Process Framework

As part of the Rimba Raya project's community development initiatives, project proponents will focus on the following foundational issues, all of which must be addressed in a concerted fashion for true community engagement on higher-order activities:

1. Access to Information
2. Participation
3. Capacity Building

These three issues are described in Annex 2, commencing with a review of current status, identifying problems that will likely be encountered in addressing each issue, clarifying the goal state, and recommending strategies for development.

G3.9. CCB Public Comment Period

Describe what specific steps have been taken, and communications methods used, to publicize the CCB public comment period to communities and other stakeholders and to facilitate their submission of comments to CCB. Project proponents must play an active role in distributing key project documents to affected communities and stakeholders and hold widely publicized information meetings in relevant local or regional languages.

In order to ensure that the communities are aware of the CCB Public Comment Period and Rimba Raya's Grievance Process, we initiated a comprehensive training and consultation period utilizing the strengths of "World Education" a respected International NGO as our 3rd party inter-mediator and facilitator.

Together with World Education, we conducted an innovative community awareness program which focused on the dissemination of information about climate change, carbon trade and the operational plan of PT. Rimba Raya Conservation in the Seruyan watershed. Such information package is also distributed to the related stakeholders (posters, brochures, public comment SOP, etc.).

Some of the Activities Included:

- Brochures (3.000 pcs) have been distributed to the: (a) communities in 14 villages, (b) district agencies in Seruyan, (c) Staff of Tanjung Puting National Park, (d) Staff of BKSDA and all stakeholders.
- Conducted leadership training for the Village Heads (or village representative) on facilitating the management of community comment-grievance, as well as on the subject of climate change vs local livelihood.
- Installed 30 boxes in 14 villages to use as a 'post-office box' of the community comments.
- Conducted focused and comprehensive group discussions in each village for the households in 14 villages regarding CCB Public Comment Period and grievance resolution plan, as well as on the subject of climate change vs local livelihood.
- Key project documents were distributed and made available to all communities.

G3.10. Grievances and Conflict Resolution

Formalize a clear process for handling unresolved conflicts and grievances that arise during project planning and implementation. The project design must include a process for hearing, responding to and resolving community and other stakeholder grievances within a reasonable time period. This grievance process must be publicized to communities and other stakeholders and must be managed by a third party or mediator to prevent any conflict of interest. Project management must attempt to resolve all reasonable grievances raised, and provide a written response to grievances within 30 days. Grievances and project responses must be documented.

A formal grievance/conflict resolution process has been instituted and publicized. It has all elements needed in the process to make sure it meets with standard conflict resolution protocols. For Example:

1. Managed by a Third party – World Education is responsible for receiving and mediating between the communities and Rimba Raya should they be needed. This agreement is in writing and in force now.

2. Formal Process – World Education has informed all villages on the process of contacting them to submit a grievance or resolve a conflict. This process is described in the attached poster (English translation of the Indonesian version.
3. Publicized- All communities and stakeholders have been informed of the 3rd party mediation of WE. Posters have been installed in all communities. Stakeholders were informed in face to face meetings by Rimba Raya personnel. This recent awareness program was led by World Education.

As explained to the communities in person and via posters and brochures, the following is a summary of a typical grievance process.

G3.11. Project Financing

Demonstrate that financial mechanisms adopted, including projected revenues from emissions reductions and other sources, are likely to provide an adequate flow of funds for project implementation and to achieve the anticipated climate, community and biodiversity benefits.

To determine financial soundness, three distinct time periods must be considered:

1. Project commencement through carbon credit verification
2. Carbon credit verification through the end of project life
3. Post-project

Project commencement through carbon credit validation

To ensure that the Rimba Raya project is properly certified and that adequate VERs are generated, capital requirements through carbon credit verification amount to roughly 2.5M USD.
In addition to the 500K USD that management has invested in the process, IE is negotiating a binding contract with a large "bridge financier" that will provide 2M USD, using other contracts that IE has in place as leverage.

Carbon credit verification through the end of project life

IE has executed a binding contract with a large European bank in an option premium structure for 2M VERs. The contract states that upon verification the EU bank will pay IE 2M USD (1 USD per VER) for the option to buy the 2M VERs for 4 USD per VER, or 8M USD (total 10M USD).

Revenues from this one initial contract will fund Rimba Raya operations for at least the first two years of project life.

Community Conflict Resolution

The project proponent will identify a qualified third party to manage grievances. This will mostly likely be World Education at project commencement. Although involved in some aspects of project implementation, organizations such as OFI and World Education areexcellent independent organizations with strong on-going ties to Project Zone communities and have reputations for honest engagement.
During community consultations, the project proponent will explain the conflict resolution process and provide clear verbal and written guidance on how grievances can be raised to the

proponent through the third-party intermediary and/or community liaison.

A distinction should be drawn between preventative and proceduralconflict resolution with communities. Preventative management of conflicts involves holding regular stakeholder meetings and the implementation of well-designed community development programming. Procedural community conflict resolution involves the actual management and handling of individual or community wide grievances.

The draft proceduralcommunity conflict resolution process is as follows:

1. Each community has been provided with a method and contact details for a third-party intermediary who represents the project proponent. For example, a representative from World Education or OFI, who maintain regular contact with villages.
2. When a grievance has been lodged, the third-party intermediary will notify the project proponent and invite stakeholders lodging the grievance within one week after submission to discuss their concerns.
3. The stakeholder lodging the grievance will meet independently with a designated Indonesian representative of the third-party intermediary organization to identify concerns and discuss potential solutions. The intermediary will document the nature of the grievance, the actions being requested and the list of potential solutions that were discussed at the meeting with the stakeholder.
4. Where a significant grievance is lodged, the third-party intermediary will then report to the project proponent about the grievance being lodged.
5. The third-party intermediary and the project proponent will meet to decide on the appropriate course of action to address the issue. This may take many forms, such as:
    - Directly addressing the grievance in a way that solves the problem as requested stakeholder,
    - Making suggestions that arrive at a middle ground between what is being requested by the stakeholder and what is feasible from the perspective of the project proponent,
    - Offering to hold a community-wide meeting between the third-party intermediary and the stakeholder’s community, or
    - Outright rejectionof the grievance with a written explanation as to the reasonable basis of the decision.
6. The third-party intermediary will then report back to the stakeholder lodging the grievance to present the solution.
7. This exchange of information should continue until the dispute has been resolved.
8. The time frame should be no longer than 30 days.
9. Project proponents will prepare a report on the resolution process, which will be made accessible to stakeholders.

In some contexts, for example where whole villages raise a claim, it may be more appropriateto adopt local practices for conflict resolution. Often this involves the gathering of community members to sit down and discuss the issue in open where each member has an equal say in the discussion and can voice their own issues. In this case, multiple members of a third-party intermediary organization could attend the meeting. In some situations it may be appropriate for a representative from the project proponent to attend. This has been a successful approach to resolving issues at a community community level.

Other Stakeholder and Land Rights Conflict Resolutions

Preventative and procedural conflict resolution may also arise with a neighboring oil palm estate or landholder. Preventative measures will be taken to reduce the incidence of conflicts arising in the first place. This may for example include undertaking regular business-to-business consultative meetings with the estate manager to maintain a healthy dialogue.

Both the project proponent and proponent's third-party intermediary will be present. For the purposes of conflict prevention, it is important that initial meetings focus on reaching a mutual understanding of the real-world location of boundary lines. Estate owners should be notified that boundaries will be regularly monitored by the project proponent.

In cases where disagreements and conflicts do arise, a third-party intermediary procedure adopted from the community process may be necessary. For the purposes of clarifying boundary lines, land rights and other normative and legal issues,it may be more appropriate to use a legal body for this process, rather than a local NGO.

G3.11. Project Financing

Demonstrate that financial mechanisms adopted, including projected revenues from emissions reductions and other sources, are likely to provide an adequate flow of funds for project implementation and to achieve the anticipated climate, community and biodiversity benefits.

To determine financial soundness, three distinct time periods must be considered:

4. Project commencement through carbon credit verification
5. Carbon credit verification through the end of project life
6. Post-project

Project commencement through carbon credit validation

To ensure that the Rimba Raya project is properly certified and that adequate VERs are generated, capital requirements and commitments through the carbon credit verification amount to roughly $3.5 USD.

Carbon credit verification through the end of project life

IE has executed a binding contract with a large European Fortune 500 company for the pre-payment of more than 6 millions VERs that shall be delivered over the course of the thirty year crediting period. The total value of the contract has been placed in an escrow account and upon the first five years issuances, 1/5th of the amount shall be released to project proponents.

Revenues from this one initial contract will fund Rimba Raya operations for at least the first 5 years of project life. Other similarly structured smaller contacts have also been executed providing a guarantee of an additional 2 years operating capital.
Subsequent years will be financed through additional forward sales or spot sales in voluntary markets, and possibly through compliance markets currently under development.

Post-project

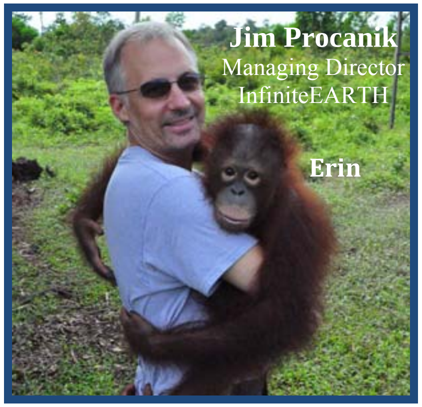
InfiniteEARTH has developed a comprehensive model to ensure the financial soundness of the project in perpetuity. In essence, a not-for-profit foundation will be established with an endowment funded from the sale of carbon credits. Assuming that all credits will have been sold by the end of the 30-year project life, the endowment will contain approximately 25M USD, which should yield in excess of 1M USD per annum when invested in low risk government bonds. This annual interest will provide for the indefinite protection of the project area. For more information, see Section G3.7, above.

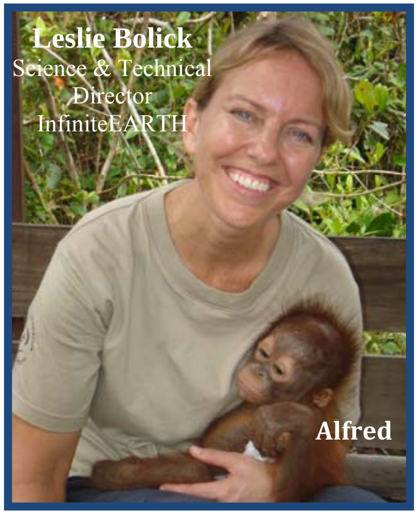
G4. Management Capacity and Best Practices

G4.1. Project Proponents and Governance Structure

Identify a single project proponent which is responsible for the project's design and implementation. If multiple organizations or individuals are involved in the project's development and implementation the governance structure, roles and responsibilities of each of the organizations or individuals involved must also be described.

InfiniteEARTH is the principal project proponent, responsible for the design and implementation of the project via its local operational entity, PT. Rimba Raya Conservation. A number of other institutions are involved in implementing specific programs or components of the project.





The primary responsibilities and skill sets and the organizational structure is elaborated in the table and two charts below:

Table 37. Required Skill Sets , Key Personnel & Related Experience for Successful Execution of Project Goals			
Project Activity	**Required Experience and Skill Set**	**Key Team Members**	**Pertinent Experience**
Forest Conservation	Project management experience of an industrial estate, forestry plantation, conservation area, etc.	Todd Lemons	Managing Director of Industrias del Oriente - Bolivia's largest forestry operation with 750,000 hectares of tropical forest lands, 10 manufacturing plants, and over 3000 employees
		OFI Dr. Biruté Galdikas	One of the three protégé's of Dr. Louis Leakey know as "Leakey's Angels" that also included Jane Goodall and Diane Fossey. Forty years experience in co-management of Tanjung Puting National Park, including the construction and permanent staffing of 19 guard posts throughout the park and within the project area. Recipient of Kalpataru (Indonesia's Highest Recognition for Environment Services) in 1997.
		BKSDA	Provincial Agency of Natural Resources Conservation (under MOF). Operational authority on conserving biodiversity and its habitat (forest area, conservation forest and biodiversity protection, including prevention and suppression of forest fires, illegal logging, forest encroachment, illegal hunting, wildlife trafficking and other disturbance activities on biodiversity) especially outside of national park.
		Leslie Bolick	20 years experience in conservation planning, tropical ecology and GIS with six years field experience in Tanjung Puting and Rimba Raya, Kalimantan. 10 years experience leading resource assessment field surveys in tropical forest with local and western experts (Polynesia and Indonesia). PhD candidate UC Davis (2010) specializing in tropical peatland and orangutan ecology, conservation, spatial analysis and remote sensing.
		Zacharia Ahmad	Forestry consultant with 20 years experience in the field, with particular experience in forestry conservation programs including work with CIFOR.
General Project Management (logistics, budgets, personnel, etc)	Project management experience of an industrial estate, forestry plantation, conservation area, etc.	Todd Lemons	25 years experience in offshore project management of natural resources projects with field operations experience in Chile, Brazil, Bolivia, Malaysia, and China
		Jeff Reece	Managed China-based private equity firm with over 1B in assets including many portfolio companies involved in the automotive, chemical and horticulture industries
		Eka Ginting	Indonesian entrepreneur, founder and CEO of Internet company indo.com, Senior Associate with McKinsey & Company, the world's leading strategy and management consulting firm.
		Jim Procanik	15 years experience in setting up and managing business operations with full P and L responsibility including several years experience in Asian developing countries where he has experience hiring and managing employees in multi-cultural environments, prior to moving to Asia Jim served as a Financial Controller in Los Angeles for 9 years.

Social and Agricultural Education	History in technical skill education, social assessment and service to indigenous communities	World Education	**World Education** is well known for its global work in environmental education, community development, maternal and child health, school governance, integrated literacy, small enterprise development, and refugee training. Since its founding in 1951, World Education has worked in over 60 countries in all regions of the world to provide training and technical assistance in many sectors. World Education supports the development of many types of indigenous non-governmental organizations (NGOs) and community-based organizations (CBOs) to achieve long-term results.
		Faisal Fuad	Faisal has had a successful 15 year career in conservation and community development having worked for Indonesian Wildlife Conservation Network and other NGOs dedicated to biodiversity conservation as well as a consultant for sustainable forestry management and certification.
		Hartjahjo Ariawan	A graduate of the Brawijaya University with a BA in Agriculture. Ariawan has worked in Community Development for almost 20 years, most recently with World Education on a joint Seruyan community conservation eduction project involving World Education and OFI and funded by USAID.
		Dr. Biruté Galdikas	Recipient of Satya Lencana Pembangunan (Medal of Development) in Social Development in 2008 from the Government of Indonesia.
		Jeff Reece	Community center development in Yekaterinburg Russia as well as a network of English teachers, job center and skills development throughout Siberia.
Community based Enterprise Development	Demonstrated ability to develop business models based on community based production, develop markets for their products	Todd Lemons	-Founder & Managing Director of Focura Flooring – a joint-venture between an indigenous community, a local manufacturer and a foreign distributor -Founder & Managing Director of Tribal Hands Foundation – enabled an indigenous community to redirect traditional wood carving skills into a community based enterprise manufacturing high-end custom millwork for export to overseas markets
		Jeff Reece	Community center development in Yekaterinburg Russia as well as a network of English teachers, job center and skills development throughout Siberia.
		Eka Ginting	Indonesian entrepreneur, founder and CEO of Internet company indo.com, Senior Associate with McKinsey & Company, the world's leading strategy and management consulting firm.
		Hartjahjo Ariawan	A graduate of the Brawijaya University with a BA in Agriculture. Ariawan has worked in Community Development for almost 20 years, most recently with World Education on a joint Seruyan community conservation eduction project involving World Education and OFI and funded by USAID.

Develop a reforestation program around community based (Co-Op) cash crop agro-forestry	Knowledge of plantation design, cultivation and management	Cam Webb (Advisor)	2005-2008 Senior Research Scientist, Arnold Arboretum of Harvard University. 2002–2005 Associate Research Scientist, Dept. Ecol. and Evol. Biology, Yale University (visiting scholar at UC Davis, hosted by Michael Sanderson). 2000–2002 Donnelley Research Fellowship of the Yale Institute of Biospheric Studies. Sponsored by Michael J. Donoghue and P. Mark S. Ashton.
		Zacharia Ahmad	Forestry consultant with 20 years experience in the field, with particular experience in forestry conservation programs including work with CIFOR.
Carbon Sales	Carbon trading and market development experience	Gazprom (Advisor)	Gazprom is an expert in carbon markets and carbon trading and is one of the world's largest energy companies.
Micro Credit	Develop a sustainable microcredit program	MBK	**- MBK** (Mitra Bisnis Keluarga) stands for "Family Business Partners". MBK is a non-bank financial company (NBFC) regulated by the Ministry of Finance and with a venture capital license issued in November 2006. Using the classic Grameen Bank methodology, MBK provides working capital to low-income households in Indonesia in order to raise their family incomes and living standards.
Develop a safe water filter production facility as a community based enterprise	Knowledge of water filtration systems and capacity building experience with traditional communities	Potters for Peace	Since 1998, Potters for Peace, a member of the World Health Organization's International Network to Promote Household Water Treatment and Safe Storage, has been assisting in the production worldwide of a low-tech, low-cost, colloidal silver-enhanced ceramic water purifier (CWP). Field experience and clinical test results have shown this filter to effectively eliminate approximately 99.88% of most water born disease agents.
Floating Clinic, Health & Immunization Programs	Develop a sustainable health care delivery system for the local communities	Health in Harmony	**-Health in Harmony** supports an innovative program in West Kalimantan, Indonesia, that partner with local communities to integrate high quality, affordable health care with strategies to protect the threatened rain forest. **-Kinari Webb, MD**: Dr. Webb first developed the vision for this work when studying orangutans in 1993 at Gunung Palung National Park. -**Hotlin Ompusunggu, Doctor of Dentistry, CeHE**: Program Manager, Dr. Hotlin comes originally from Sumatra. She has four years experience working for the Indonesian government in a rural part of Sumatra; she coordinated medical and dental teams after the Tsunami in Aceh, and lived in England for one year doing a Diploma in community development and higher education. Prior to joining Health in Harmony, she was the director of a mobile clinic on a boat in Southern Sumatra for two years.

Carbon Accounting Methodology	Develop reliable methodologies for measuring carbon stocks and assessing additionality and leakage	Winrock Intl.	**Winrock International** is a leading voice and active participant in the global environment and climate change arena. For over a decade, Winrock has been the organization trusted worldwide to bring the most cutting edge, proven information and services for greenhouse gas assessment in agriculture, forestry, and other land uses. Ecosystem Services fulfills Winrock's mission by developing innovative approaches to carbon estimation and disseminating this information to organizations and communities worldwide so they can participate in new markets. Winrock International was created in 1985 with the merger of three institutions: the International Agricultural Development Service, the Winrock International Livestock Research and Training Center, and the Agricultural Development Council (A/D/C).
Carbon Monitoring	Monitor Climate and carbon level changes related to the Project	UNPAR	The University of Palangka Raya (UNPAR) founded in 1963 is the first public university and the oldest in Central Kalimantan, Indonesia. UNPAR is well known for its Agriculture College (including Forestry Department). Currently UNPAR has a variety of joint research programs with several overseas universities such as Hokkaido University (Japan), University of Nottingham (UK), and University of Helsinki (Finland). Previously, UNPAR has collaborated with HOKUDAI on JSPS Core University Program as the title "Conservation and Land-use Management of Wetland Ecosystem in Southeast Asia" (1997-2006). The University's faculty includes globally recognized experts in peat and peat lands management and manages CIMTROP, "The Center for International Cooperation in Management of Tropical Peatland".
Biodiversity Monitoring	Monitor changes in Biodiversity as a result of project activities	UPPAR, OFI, Daemeter	**Daemeter Consulting** is an independent firm based in Bogor, Indonesia, specializing in the provision of technical services to promote responsible management of forest and agricultural landscapes. Daemeter has expertise in social, ecological and political dimensions of sustainability in Indonesia, with emphasis on High Conservation Value identification and management - Social and cultural surveys - Public consultation and stakeholder engagement - Ecosystem mapping using remote and field based methods - Biodiversity surveys - Certification mentoring.
Community Monitoring	Assess the impact of project activities on the surrounding communities	World Education	**World Education** is well known for its global work in environmental education, community development, maternal and child health, school governance, integrated literacy, small enterprise development, and refugee training. Since its founding in 1951, World Education has worked in over 60 countries in all regions of the world to provide training and technical assistance in many sectors. World Education supports the development of many types of indigenous non-governmental organizations (NGOs) and community-based organizations (CBOs) to achieve long-term results.

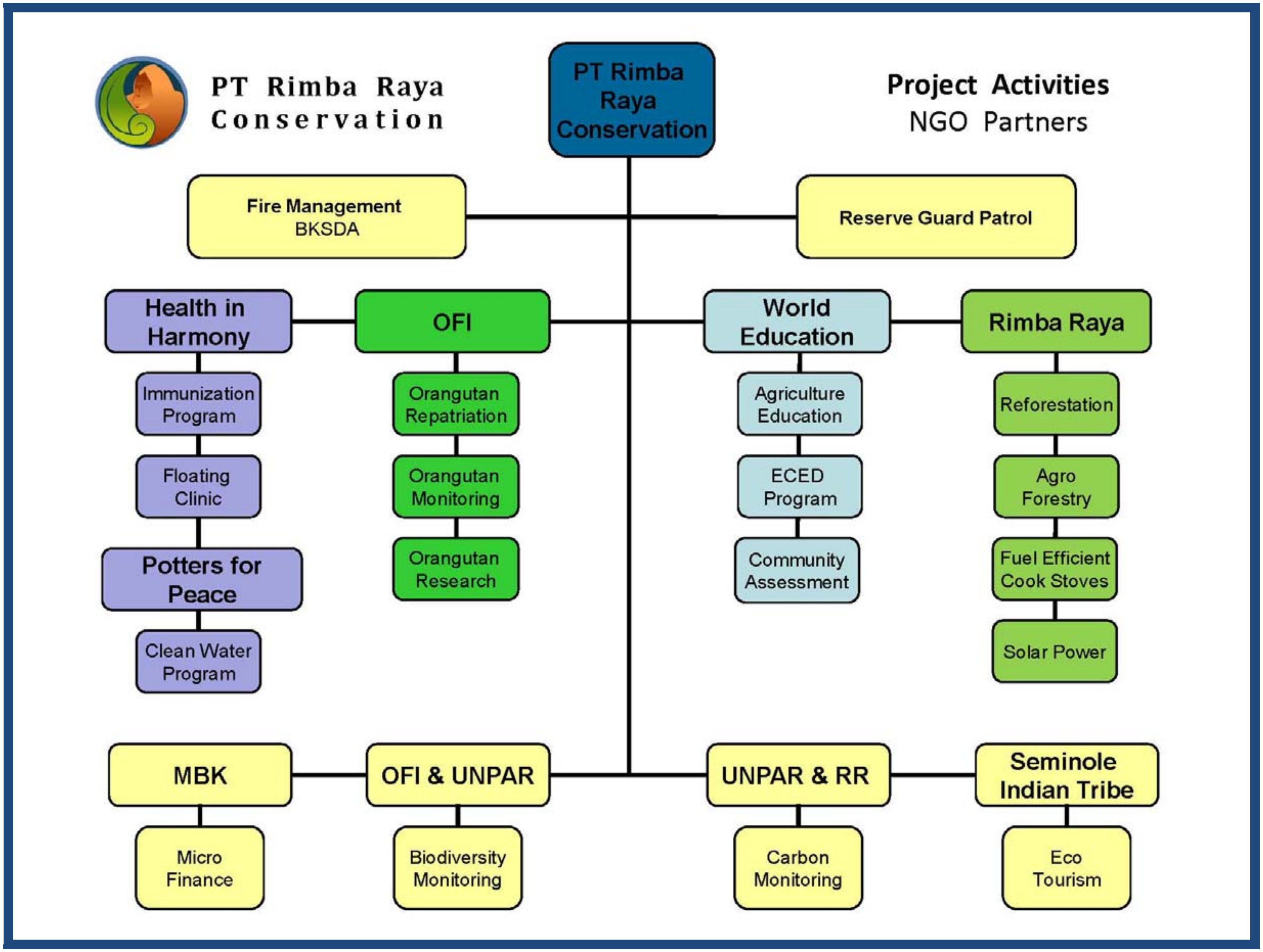


Figure 52. PT Rimba Raya Conservation by Co-Implementing Entity (NGO Partner).

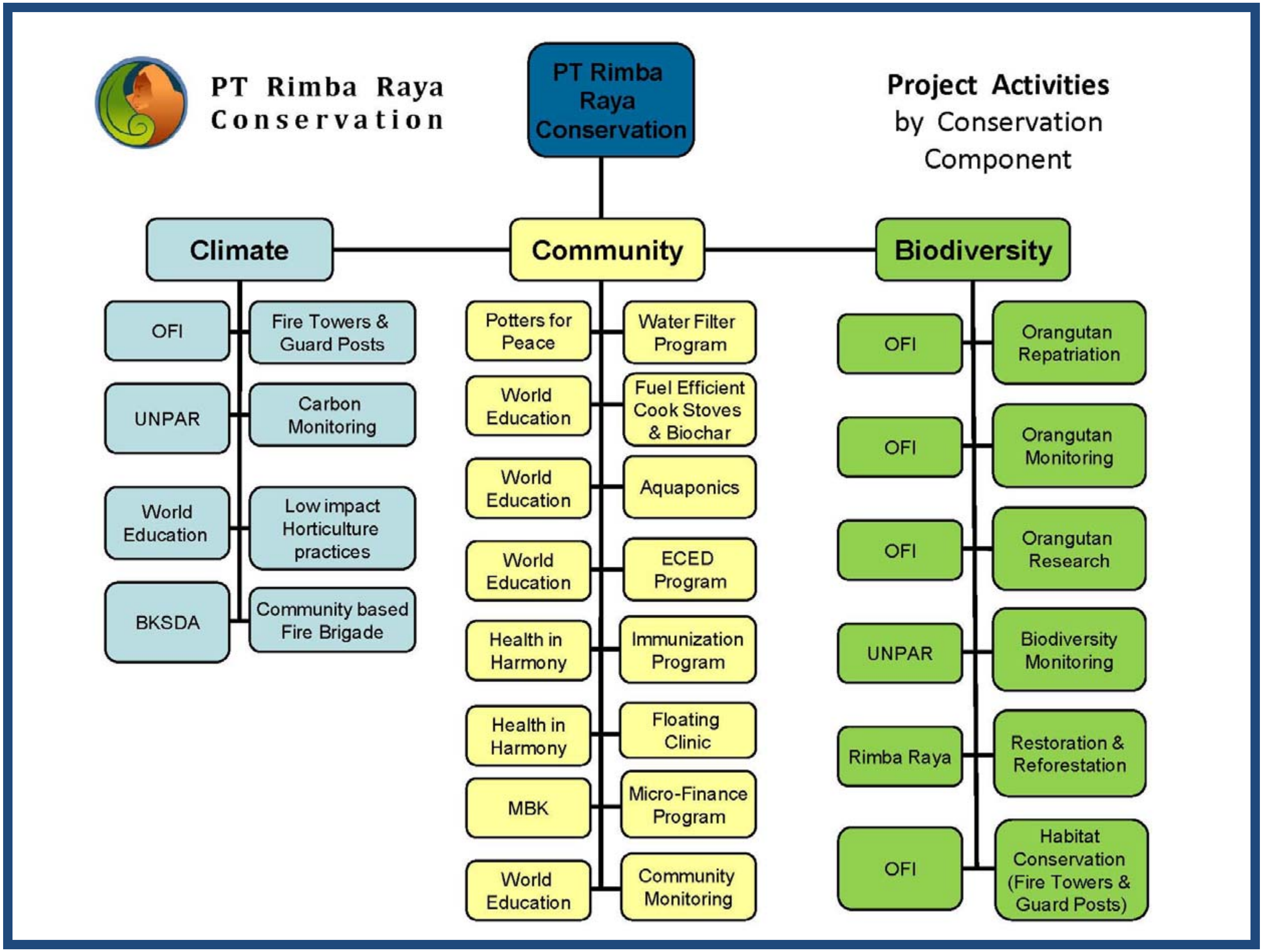


Figure 53. PT Rimba Raya Conservation Organizational Chart by Operational Sector (Conservation Component).

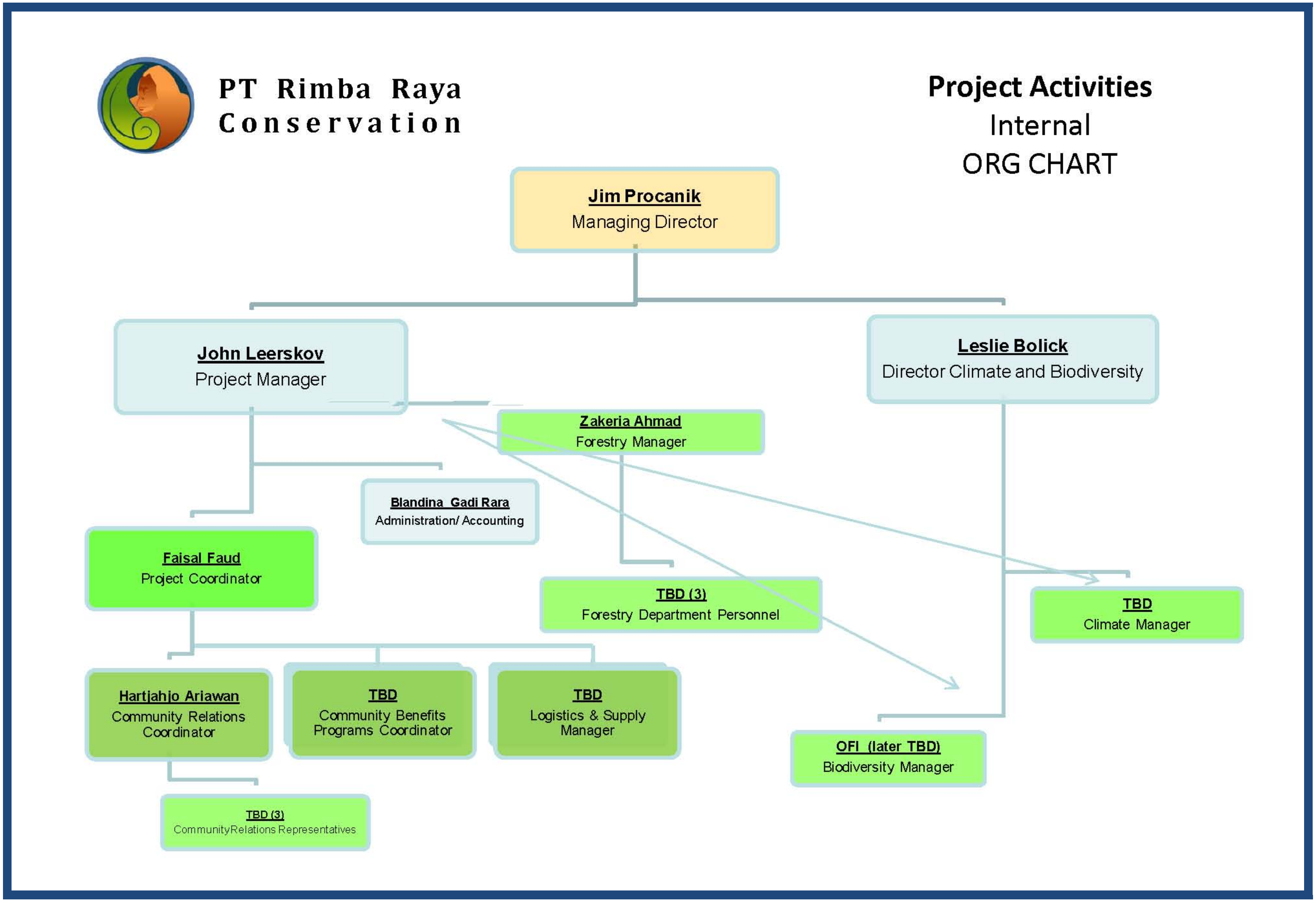


Figure 54. Project (Internal) Organizational Chart.

G4.2. Key Technical Skills for Project Implementation

Document key technical skills that will be required to implement the project successfully, including community engagement, biodiversity assessment and carbon measurement and monitoring skills. Document the management team's expertise and prior experience implementing land management projects at the scale of this project. If relevant experience is lacking, the proponents must either demonstrate how other organizations will be partnered with to support the project or have a recruitment strategy to fill the gaps.

General Project Management

Key technical skills. Key skills for general project management are divided into three categories. The first comprises skills needed to manage the physical assets of the Rimba Raya Reserve, including forest security and fire protection. The second includes general administrative skills to manage logistics, budgets, and human resources. The final category addresses skills related to REDD policy and the certification of carbon credits.

Expertise and prior experience. The InfiniteEARTH team has a wealth of experience managing forestry assets. Todd Lemons, the CEO, was managing director of Industrias del Oriente, Bolivia's largest forestry operation, with 747,237 ha of tropical forest land, ten manufacturing plants, and over 3000 employees. OFI, a principal partner organization, has 37 years of experience co-managing Tanjung Puting National Park, including the construction and permanent staffing of 19 guard posts throughout the park and inside the Project Area.

For general logistics and administrative experience, the InfiniteEARTH team has nearly 50 years of combined experience: Todd Lemons has 25 years of experience managing offshore natural resources projects with field operations experience in Chile, Bolivia, Brazil, Malaysia, and China.

Gaps. The principal gap in management of the reserve's physical assets is in fire prevention and response. To remedy this gap, project proponents have engaged Marc Nicolas, and incident commander and fires and rescue senior officer on long detachment from the French Ministry of the Interior. Mr. Nicolas has 31 years of experience in disaster management, risk and preparedness assessment, incident command system and mitigation techniques, and capabilities from field-level expertise to national strategy. He has worked previously on a number of forestry projects in Indonesia.

Community Engagement

Key technical skills. Technical skills required for community engagement and monitoring will vary at different stages of the project. Six areas that will require technical skills when working with communities include (i) communications, (ii) community organizing, (iii) conflict resolution, (iv) community mapping, (v) community development, and (vi) monitoring.

Communications. Communication will be key to successful project implementation. Effective communication will need to be implemented at each stage – making clear to communities the purpose of the project, how the project aims to involve the community, and time frames for each step in the process. Without clear communication communities often become disillusioned with projects. Failure to communicate with the community at large, opting instead to go through representatives also creates risk (i.e. that information will not get through or that information is manipulated to serve someone's personal agenda). For this reason, it is extremely important that a communication strategy is put in place to ensure that information reaches intended recipients, and that recipients have a chance to provide constructive feedback. In rural environments, such communication can take the form of meetings, printed materials (in which distribution must be overseen), and radio. It will be important to have a clear communication strategy, not only regarding the method of communication, but also content. Designing a communication strategy and managing dissemination of project information will therefore be tasked to people and organizations with skills and experience in this area.

Community Organizing. Motivating and engaging people to work collectively to improve their social situation is central to community organizing, and to the success of the Rimba Raya social programs. In each community there is likely to be someone who has naturally taken on this role (e.g. kepala dusun), but it will be important that community organizing is not left solely in the hands of this individual, for risk that certain individuals or groups will be excluded or ulterior motives promoted. Individuals with expertise in community organizing will therefore be involved in the project to guide the process (including mentoring of existing and emerging community leaders) and oversee that community engagement in the project is successful.

Conflict Resolution. In addition to a number of current conflicts between communities and oil palm companies in the Project Zone, the Rimba Raya project will likely experience other conflicts during project planning and implementation. Mediating such conflicts and guiding people through to resolution is a specialized skill that will be required onsite. A formal conflict resolution process will be developed and implemented, including a system for people to report conflicts and an individual or group with specialized skills in this area to manage issues as they arise.

Community Mapping. The clear definition of property boundaries and important natural resource and cultural areas will be undertaken early in project development. A number of good reference guides exist to guide communities through this process, but someone with experience in this area will be needed to lead the process. Some basic technical skills required for this include use of a GPS, compass, map reading, and ability to follow an instruction guide. The leader(s) of community mapping must also be skilled in community engagement and organizing to motivate local communities to participate in mapping activities.

Community Development. As a community needs assessment is carried out, some community development ideas will begin to take more concrete form. A specialist in livelihoods development will be engaged during this process to help determine the feasibility of various development ideas (see Section G3.2) and to stimulate new ideas. Specialists in specific areas of interest will also be engaged (e.g., an agronomist for agricultural programs, fisheries expert for freshwater fisheries management, and veterinarian for animal husbandry projects, etc.)

Community Monitoring. A community monitoring program (see Section CM3.1) will be set up by someone with experience in this area to ensure that design, data collection, and analysis are established properly and provide useful data to the adaptive management process. Once the monitoring program is operational, survey work can be conducted by individuals with minimal technical skills, but analysis and management in the monitoring program will continue to require specialized skills in this area.

Expertise and prior experience. As documented above (see Section G3.8), OFI and World Education have an ongoing program, funded by USAID, to promote conservation in and around Tanjung Puting National Park. Since 2003, they have engaged the communities surrounding the park in informational meetings, educational workshops, capacity building and skills development, and conservation work. In the process, they have disseminated information about the importance of protecting the park and generated goodwill in communities inside the Project Zone, laying a sturdy foundation for continued stakeholder engagement during project implementation. Both of these organizations will be intimately involved in project implementation.

Gaps. Daemeter Consulting, an independent firm based in Bogor, Indonesia, and specializing in provision of technical services to promote responsible management of forest and agricultural landscapes, was engaged during project development to conduct a social survey, assess all Project Zone communities, and develop the Rimba Raya community monitoring plan. Project proponents have an ongoing relationship with Daemeter, and will continue to engage this organization on a regular basis to produce monitoring reports and as needed to fill any gaps in technical expertise.

Biodiversity Assessment

Key technical skills. The project will need the following technical skills to assess and monitor biodiversity in the Project Zone. These skills will also provide capacity to monitor changes in HCVs 1-3 over time.

Forest cover and condition mapping will be required in order to monitor the success of the project in maintaining or improving forest cover and condition during the project lifetime. Forest cover mapping can be done adequately using conventional analysis of readily available remote sensing imagery (e.g. Landsat 5 and 7), but forest degradation mapping will require development of specialized techniques, extensive ground surveys or high (sub-meter) resolution aerial photographic data. This will require a combination of GIS, remote sensing, and field survey skills to describe forest condition classes.

Ecosystem mapping will be required to refine the current understanding and delineation of ecosystem types in the Project Zone. This will enable improvements to carbon estimation; description of flora and fauna known or likely to be present; population estimation of rare, threatened, or endemic/restricted-range species (especially wetland specialist birds); and development of more detailed management activities to ensure long-term conservation of ecosystem and associated biodiversity. Ecosystem mapping will require a combination of GIS, remote sensing, and field survey skills to describe vegetation types including diagnostic species assemblages and structural attributes.

Botanical Survey skills will be required to document more fully the diversity of plant species present in the Project Zone, which to date has not been formally surveyed. The area likely shares many species in common with nearby Tanjung Puting, but direct survey will still be required in order to provide a baseline for ongoing monitoring, as well as to confirm the presence of species of conservation importance considered potentially present. Botanical surveys should focus on the documentation and where possible population estimation of HCV 1.2 and 1.3 species. One area of special consideration for developing technical skills (perhaps best achieved through partnership with experts) is capacity to survey orchids and other rare epiphytic plants, which are likely to be present in diverse numbers in peat swamp and possible kerangas forest types of the Project Zone.

Orangutan population survey through nest counts and/or direct observation will be required to refine habitat-specific population estimates of this threatened iconic species within each of the major ecosystem types. This will provide a baseline for long term population monitoring, and enable development of targeted priority conservation interventions where orangutan population numbers are highest and threats to their-long term conservation significant. Development of this technical skill by the management team should be an especially high priority given contributions of estimated orangutan population numbers in the Project Zone to overall landscape population viability (see section G 1.7). Technical skills required for this task will include field methods in nest survey and analytical techniques for inferred population numbers based on nest counts.

Mammal surveys will be required to confirm the presence of species of conservation concern that are considered potentially present in the Project Zone, and where possible to estimate population numbers for long-term population monitoring. Particular emphasis should be placed on the documentation and where possible population estimation of HCV 1.2 and 1.3 species, especially primates. This task will require the development of technical skills to identify mammals based on direct sighting, call recognition, prints, signs of recent feeding, and scat recognition.

Bird surveys will be required to confirm the presence of species of conservation concern that are considered potentially present in the Project Zone, and where possible to estimate population numbers for long term population monitoring. Particular emphasis should be placed on the documentation and where possible population estimation of HCV 1.2 and 1.3 species. A survey of special interest should be that of migratory and rare aquatic birds that use nearby Lake Sembuluh on the eastern edge of the Project Zone. The task of surveying birds will require the development of technical skills to identify birds based on direct sighting and call recognition.

Camera trapping would also be a useful technical skill for members of the project management team to acquire, given its long term usefulness in estimating population numbers for some large body terrestrial mammals and, especially, for survey and documentation of rare or shy species infrequently encountered through direct observation in the field.

Expertise and prior experience. OFI has a deep store of technical expertise and experience in monitoring, assessing, and rehabilitating orangutans and other species of animals and plants important to the survival of orangutans. Project proponents will draw upon this set of skills and expertise in implementing biodiversity-related project activities.

Gaps. Daemeter Consulting was engaged during project development to conduct a desktop biodiversity assessment and to develop the Rimba Raya biodiversity monitoring plan. Project proponents have an ongoing relationship with Daemeter, and will continue to engage this organization on a regular basis to produce monitoring reports and as needed to fill any gaps in technical expertise.

<u>Carbon Measurement and Monitoring</u>

Key technical skills. The following technical skills will be needed for measurement and monitoring of carbon levels:

- Development of a carbon accounting methodology specifically geared to tropical peat swamp forets.
- An understanding of local, regional, and national land conversion practices and spatial planning policies in order to determine the level of threat (additionality).
- Ability to interpret satellite imagery including but not limited to SPOT & LandSat data, as well as to plot, create, and interpret data from high resolution areal photography.
- Ability to plot, create and interpret GIS data including the ability to collect ground calibration data as well as to conduct ground truthing for comparison to satellite imagery.

Expertise and prior experience. InfiniteEARTH has in-house experience led by Leslie Bolick, PhD candidate in tropical forest and peatland ecology, who directed the science and technical work for project validation and verification. InfiniteEARTH has also contracted with two of the leading experts in this field both globally (from a methodology perspective) and locally (from a field execution perspective).

Winrock International is a leading voice and active participant in the global environment and climate change arena. For over a decade, Winrock has been the organization trusted worldwide to bring the most cutting edge, proven information and services for greenhouse gas assessment in agriculture, forestry, and other land uses. Ecosystem Services fulfills Winrock's mission by developing innovative approaches to carbon estimation and disseminating this information to organizations and communities worldwide so they can participate in new markets. Winrock International was created in 1985 with the merger of three institutions: the International Agricultural Development Service, the Winrock International Livestock Research and Training Center, and the Agricultural Development Council (A/D/C).

Forest Carbon is led by Scott Stanley MSc, who has worked in Latin America and SE Asia for more than 20 years conducting forestry research and managing large forestry and conservation projects funded by the World Bank, USAID, The Nature Conservancy, Flora and Fauna International. Scott has lived in Indonesia for the past nine years and has a real world perspective on local, regional and national issues.

Gaps. Project proponents have an ongoing relationship with Winrock and ForestCarbon, and will continue to engage these organizations for thon a regular basis in order to tap their expertise as needed to fill any gaps.

G4.3. Capacity Building and Project Training

Include a plan to provide orientation and training for the project's employees and relevant people from the communities with an objective of building locally useful skills and knowledge to increase local participation in project implementation. These capacity building efforts should target a wide range of people in the communities, including minority and underrepresented groups. Identify how training will be passed on to new workers when there is staff turnover, so that local capacity will not be lost.

Capacity building is a critical element in the operation of the Rimba Raya project's social service program. In order for these initiatives to succeed, members of the community need the skills necessary to effectively implement this mandate. It is therefore imperative for the social service provisions to not just create additional employment, but also provide training in the skills required to maximise these opportunities.

A description of the Rimba Raya Process Framework, intended to address foundational issues in capacity building, is provided in Section G3.9, above. Below are presented a number of specific capacity building programs, researched by project proponents as potentially applicable to Project Zone community needs. However, the final programs will be designed in collaboration with the communities to ensure that they address current community concerns and prioritize community needs for capacity building.

Rimba Raya will target a wide range of people in the communities with our capacity building efforts with regard to the various needs of the project. Members of the communities from all groups including and especially women are encouraged to apply for available positions.

Since most or all of the communities will have members in the employ of Rimba Raya, skills and capacities will become part of the fabric of the communities regardless of turnover. As all new employees will need to be trained, the skills gained in each community will not be lost.

"The definition of capacity building is broad. It is a holistic enterprise, encompassing a multitude of activities. It means building abilities, relationships and values that will enable organisations, groups and individuals to improve their performance and achieve their development objectives. It includes strengthening the processes, systems and rules that influence collective and individual behaviour and performance in all development endeavours. And it means enhancing people's technical ability and willingness to play new developmental roles and adapt to new demands and situations."- **Capacity building for sustainable development. An Overview of UNEP Environmental Capacity Development Activities.**

Major Programs (see Section G3.2 for full descriptions):

- Forest patrol and security
- Fire fighting and prevention
- GIS equipment and techniques
- Agro-forestry and ecosystem restoration
- Wildlife monitoring
- Orangutan feeding and care
- Small business development

Fire training has already begun with the cooperation of BKSDA (see Annex 12).

Rimba Raya Community Fire Brigade trained by BKSDA

Table 38. Rimba Raya Capacity Building					
Event / Milestone	**Activity Description / Relevancy**	**Start Date**	**Finish Date**	**Capacity Building Skills**	**Responsible Party**
Development of Fire Plan	Design and Implementation of comprehensive fire prevention and response plan	01-May-09	01-Jun - 2010	Fire Prevention and Protection	Marc Nicolas
Establishment of community committees	Establish a system of community involvement in day-to-day operations, process and procedural rules for decision making and arbitration using existing socio/political/judicial structures, such as village counsels and tribunals.	01-Jun - 2010	01-Jun - 2011	Community dialogue and organisation skills	Rimba Raya / OFI
Guard Posts	20 guard posts built at strategic locations across the Reserve, 4 per year for the first 5 years of the project	01-Jun - 2009	31-Dec- 2011	Forest Security Training	Infinite-Earth / OFI
Hiring and training of new personnel	Field manager, Chief Reserve warden, 35 new guards hired and trained	01-Jun - 2009	31-Dec - 2011	Forest Security Training	Infinite-Earth / OFI
Hiring and training of fire brigade	Fire chief engaged and 5-man fire brigade hired and trained	01-May - 2010	31-Dec - 2011	Fire Prevention and Protection	Rimba Raya
Annual grants to World Education	Grants to expand World Education community activities in project zone	01-Jun - 2011	31-Dec – 2039	Early education services	Infinite-Earth
Training of TPNP guards and staff	Bring in outside military and police training personnel to adequately train and equip	01-Jun - 2011	31-Dec - 2039	Forest Security Training	Rimba Raya / OFI

Community centers & libraries	2-3 community centers & libraries will be built, 1 in Baung and 1 in Muaradua	01-Jun - 2011	31-Dec - 2012	Construction and library management training	Rimba Raya / OFI / World Education
Water filtration systems	Development of community based clean filtration system via "Potters for Peace"	01-Dec - 2010	15-Mar - 2011	Improved health services	Rimba Raya / Potters for Peace
Aquaponics Program	Fund technical consultants on creating a high yield, small footprint acquaponics greenhouses	01-Jun - 2011	31-Dec - 2012	Hydrology and Aquaculture training	Rimba Raya
Orangutan study	Design and setup of orangutan tracking study	01-Jun - 2009	31-Dec - 2012	Orangutan research	Rimba Raya / OFI
Early Childhood Education & Development (ECED)	Begin stocking materials and hiring trainer / instructors for the ECED programs at the 2-3 community centers	01-Jun - 2011	31-Dec - 2039	Project development and teacher training	Rimba Raya / OFI / World Education
Interactive educational platform	Creation of an interactive educational platform around the content of the research study	01-Jun - 2011	31-Dec - 2039	Increased education and deeper awareness of forest	Rimba Raya / Infinite-Earth
Develop Eco-Tourism program	Create a “sister city” (sister village) type program with the Seminole Indian communities in the Florida Everglades	01-Jun - 2012	31-Dec-39	Tourism services, including basic English	Infinite-Earth

G4.4. Project Recruitment Policy

Show that people from the communities will be given an equal opportunity to fill all employment positions (including management) if the job requirements are met. Project proponents must explain how employees will be selected for positions and where relevant, must indicate how local community members, including women and other potentially underrepresented groups, will be given a fair chance to fill positions for which they can be trained.

The Rimba Raya Recruitment Policy ensures that members of Project Zone communities will be given priority for all project-related positions.

Below please find excerpts from "The Rimba Raya Recruitment Policy" (translated from Indonesian)

"Acceptance of Labor and Employment Appointment

1. Recruitment and Hiring of employees shall be in line with the general requirements below as well as all Indonesian government guidelines and laws:
    a. Prospective employees must pass a written test, interview and attach a certificate of good health from doctors.
    b. Indonesian citizen, at least 18 years old when accepted as a prospective worker and a maximum of 55 years or in accordance with the purposes of the company.
    c. Good behavior, not a member and board member of a proscribed organization, and free from drug involvement accompanied by a letter from the police.
    d. Not a board member or member of an organization that is contrary to the interests of the company."

Priority will be given to community members for positions which meet with their skills. Currently, the Rimba Raya project has used community members several times as field guides and has made and effort to train community members in the skills of measuring peat and using such technical tools.

Key positions to be filled initially include: project manager, fire and forestry manager, environment and conservation manager, field operations manager, logistics and procurement manager, GIS specialist, accountant, reserve guards, fire brigade, watercraft pilots, orangutan care providers, and other monitoring and administrative staff.

Noting the means of effective communication described by the initial Project Zone social survey (see Section G3.8, above), IE will advertise applicable employment opportunities by contacting village heads and by posting to announcement boards in village offices and mosques. Partner organizations OFI and WE will also be enlisted to disseminate information.

The Rimba Raya Recruitment Policy does not discriminate based on gender and ensures that an adequate number of women and members of other underrepresented groups have the opportunity to apply. As training for most staff has been budgeted, prior technical experience will not be imperative for some positions. In many cases, specialized local knowledge and relationships will be more important than technical knowledge. For each position, once a proper applicant base has been acquired – including adequate representation from women and other minority groups – an interview process featuring verbal and written interviews with multiple IE staff will commence with the goal of selecting the best candidate for the position.

Finally, for women and other minorities that are not hired, a micro-credit program will be available to ensure that they have other project-related opportunities. See Section G3.2 above for a detailed discussion of this program.

G4.5. Laws and Regulations Governing Workers' Rights

Submit a list of all relevant laws and regulations covering worker's rights in the host country. Describe how the project will inform workers about their rights. Provide assurance that the project meets or exceeds all applicable laws and/or regulations covering worker rights and, where relevant, demonstrate how compliance is achieved.

The main body of Indonesian law governing the relations between workers and employers is UU No. 13/2003.

In addition, the following conventions of the International Labour Organisation have been ratified by Indonesia:

- C81 – Labour Inspection Convention, 1947
- C87 – Freedom of Association and Protection of the Right to Organise Convention, 1948
- C98 – Right to Organise and Collective Bargaining Convention, 1949
- C100 – Equal Remuneration Convention, 1951
- C102 – Social Security (Minimum Standards) Convention, 1952
- C105 – Abolition of Forced Labour Convention, 1957
- C111 – Discrimination (Employment and Occupation) Convention, 1958
- C138 – Minimum Age Convention, 1973
- C169 – Indigenous and Tribal Peoples Convention, 1989
- C182 – Worst Forms of Child Labour Convention, 1999

Project proponents have a comprehensive Process Framework in place (see Section G3.8), which includes components designed to inform all stakeholders of their rights with respect to the project. The Rimba Raya project will exceed all local labor requirements and will ensure that all workers are apprised of their rights.

G4.6. Occupational Risk and Worker Safety

Comprehensively assess situations and occupations that pose a substantial risk to worker safety. A plan must be in place to inform workers of risks and to explain how to minimize such risks. Where worker safety cannot be guaranteed, project proponents must show how the risks will be minimized using best work practices.

None of the project activities proposed in Section G3.2 entails None of the project activities proposed in Section G3.2 entails extraordinary risk to future Rimba Raya employees. A number of the activities (Reserve patrol, Fire response, Orangutan care) include a degree of risk inherent to those activities. Design and implementation of those activities will include measures to minimize risks to worker safety. In all cases, workers will be informed of risks and trained in best work practices to reduce them. We have composed our "SOP on Occupational Safety, Health and Safety" which details our plans and policies for worker safety (See Annex 15).

G4.7. Financial Health of Implementing Organizations

Document the financial health of the implementing organization(s) to demonstrate that financial resources budgeted will be adequate to implement the project.

Proprietary documentation provided to the verifier.

G5. Legal Status and Property Rights

G5.1. Laws and Regulations Governing Property Rights

Submit a list of all relevant national and local laws and regulations in the host country and all applicable international treaties and agreements. Provide assurance that the project will comply with these and, where relevant, demonstrate how compliance is achieved.

The Rimba Raya project will comply with all international, national, and local laws and regulations relevant to project implementation, as indicated below:

Relevant International Treaties and Agreements

- Convention on International Trade in Endangered Species (1973)
- International Covenant on Civil and Political Rights (1976)
- International Covenant on Economic, Social and Cultural Rights (1976)
- Convention on the Elimination of all forms of Discrimination Against Women (1981)
- Rio Declaration on Environment and Development (1992)
- United Nations Framework Convention on Climate Change (1992)
- Biodiversity Convention (1992)
- International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families (2003)

Laws of the Government of Indonesia

Property Rights. All land inside the Project Area is designated as federal government property. Project design and implementation therefore must be in conformity to the following national regulations.

- Government Regulation No. 6 of 2007 regarding Forest Layout and Preparation of Forest Management and Forest Utilization dated January 8, 2007, as amended by Government Regulation No. 3 of 2008 regarding Amendment of GR No. 6 dated February 4, 2008

- Minister of Forestry Regulation No. P.61/Menhut-II/2008 Regarding Provision and Application Procedure for the Granting of Business License for Forest Wood Utilization of Natural Forest in Production Forest dated October 28, 2008

There are, in addition, a host of provincial and local laws that will affect various aspects of project implementation as they relate to land use and property rights. Project proponents intend to comply with all relevant laws. A legal opinion has been drafted by SSEK, one of Indonesia's leading law firms, outlining land-use rights and carbon rights (*See Annex 15A).*

G5.2 Documentation of Project Approval

Document that the project has approval from the appropriate authorities, including the established formal and/or traditional authorities customarily required by the communities.

Government Approval

Project proponents have achieved 10 of 12 major milestones in the government approval and license process, described below and in Annex 15B. The flow diagram (Figure 55A) illustrates the procedure for obtaining the Ecosystem Resotration license (IUPHHK-RE). Key regulatory documents and government letters produced for the Rimba Raya Ecosystem Restoration license are included in Annex 15C. Additional supporting documents related to the project proponent's carbon ownership are available for review by project validators.

Seruyan District (Nov 2008), **Central Kalimantan Province** (Jul 2009) and **Indonesian Ministry of Forestry** (Dec 2009) have approved the application for the Rimba Raya Restoration Concession and the final decree is in the process of being issued. While District and Provincial approval are not federally regulated, these approvals provide important assurances for project land use rights on the ground.

The Area Verification Map (Figure 55B) issued by the Ministry of Forestry specifies the concession boundaries or Project Management Zone. Note that the Indonesian government does not differentiate the (smaller) carbon project boundary inside the project management boundary, but instead recognizes the entire concession within which carbon trading activities are allowed. The first Area Verification Letter issued October 10, 2008 showed the original 101,730 ha Rimba Raya area, which included the already-developed KUCC oil palm plantation. The plantation was later excised from the Rimba Raya concession, as referenced by **Ministerial Decree SK-617** to produce the final Rimba Raya Area Verification Map of 89,185 ha. (Note the Indonesian government letters report the Rimba Raya PMZ as 89,185 ha, and the Area Verification map as 90,830 ha, whereas the project proponents calculate these same map boundaries as 91,215 ha using the most current ArcGIS software. For consistency in project area calculations, the project proponents use GIS-based numbers in project documents. This ~2% discrepancy in the legal description and GIS boundary of the PMZ does not affect the Carbon Accounting Area or the 3km buffer zone around the Carbon Accounting Area.)

Following Area Verification, the Minister of Forestry allocated the Rimba Raya concession for Ecosystem Restoration use and instructed Forestry Planning to make an immediate change to the forest use designation from HPK (conversion forest) to HP (production forest) which bars conversion to palm oil and enables an RE license to be granted. Forestry Planning complied with this request indicated in their letter changing the designation of the Rimba Raya concession to HP forest use.

Following the Area Verification process, the Minister of Forestry conditionally approved the Rimba Raya concession and instructed project proponents to complete an environmental review, indicated in the **SP1** letter. The SP1 confers exclusive (although perpetually provisional) rights to use by the concession holder, as it bars all other applications according to Article 9 of Regulation P-61. After Rimba Raya successfully completed the Environmental Impact Assessment (UKL/UPL), the Minister then approved the Rimba Raya Environmental Report (UKL/UPL) as ordered by the SP1 and confirmed that project proponents had met all requirements necessary to obtaining the ecosystem restoration license (IUPHHK-RE) as indicated by Ministerial Letter **SP2**. In the final major step of the licensing process, the Minister has ordered the Working Area Map to be formalized in the permanent records of the department and has instructed the legal department to draft the final decree for his signature.

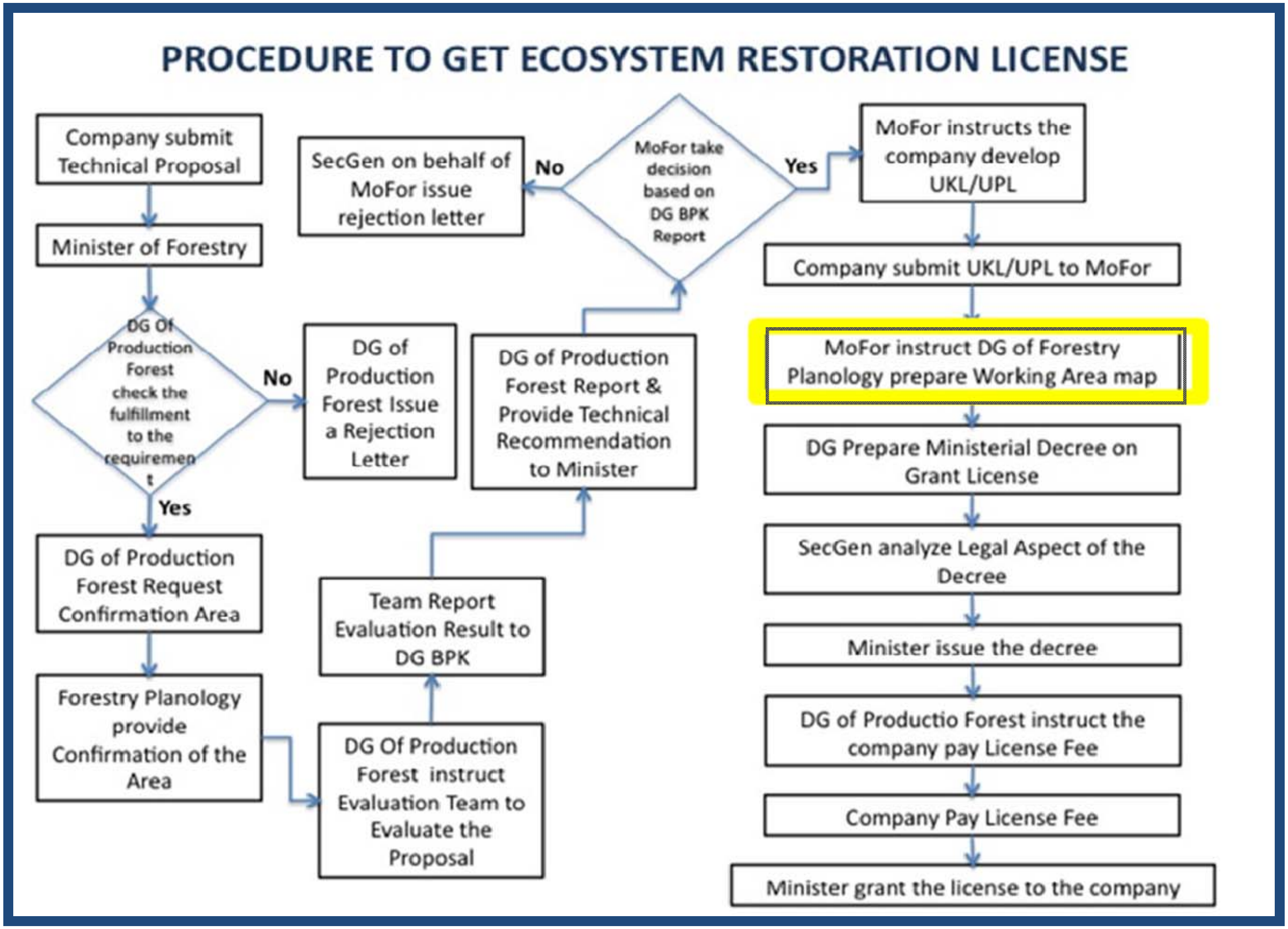


Figure 55a. Flow chart for obtaining the Ecosystem Restoration Concession License in Indonesia

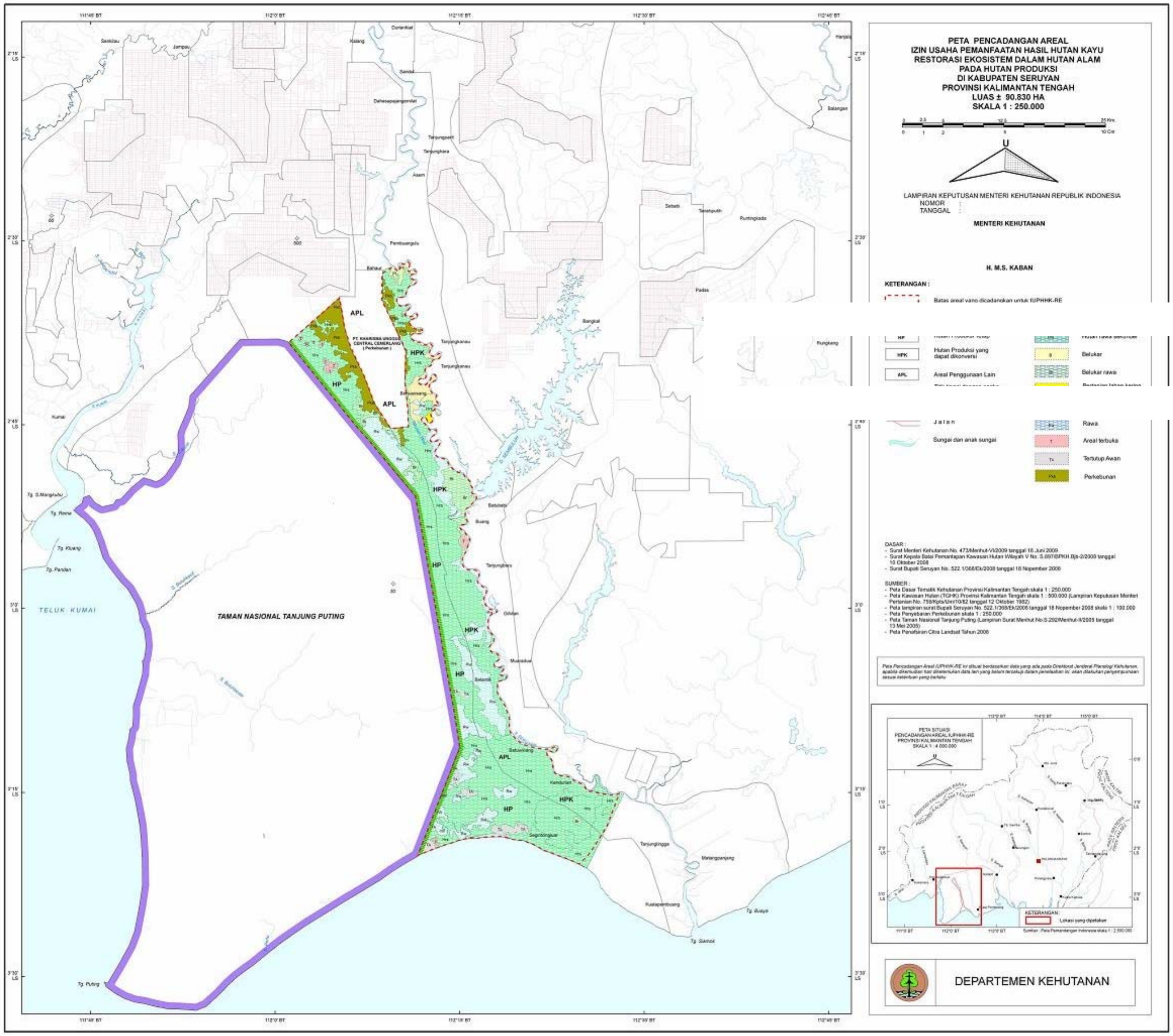


Figure 56. Final Area Verification Map of the Rimba Raya Concession showing the Project Management Zone.

Community Approval

While there is no formal process for community approval, Village heads in Project Zone communities were consulted during several social surveys and presentations, and all gave their approval ,one such written evidence is their signatures on the "**PT RIMBA RAYA CONSERVATION PROJECT COMMUNITY SUPPORT MEMO**". *See Annex 2 for a complete set.*

G5.3. Documentation of Project Property Rights

Demonstrate with documented consultations and agreements that the project will not encroach uninvited on private property, community property, or government property and has obtained the free, prior, and informed consent of those whose rights will be affected by the project.

Based on consultations with community representatives during the initial social survey (see Section G3.9 above), project proponents were able to determine that, with few exceptions, village and communal property lies to the east of the Seruyan River, inside the Project Zone but outside the Project Area. To the extent that community or individual villager property lies within the Project Area, project proponents will offer the option of integrating the property into the project's Community Agro-Forestry program (see Section G3.2 above) or excising the land from the Project Area.

All Project Area land belongs to the Government of Indonesia, and the appropriate licenses and authorizations will be in place prior to commencement of major project activities.

Customary Rights

During interviews, villagers reported no traditional or customary land claims in the Project Zone. Unlike Dayak elsewhere in Kalimantan, the villages appear not to have adat (indigenous) rules governing the management of land. Instead, land is privately owned. Though villagers do not have formal documentary evidence of ownership, it is passed down through generations, and locally acknowledged, with different parties aware of common boundaries between adjacent properties. Villagers therefore reported that they have never had local conflicts over the land tenure amongst themselves.

In the area there is another category of land status called Hutan Desa or Lahan Desa, which appears legally to belong to the Desa, or administrative township. If this is forested it is called Hutan Desa. If it is deforested it is called Lahan Desa. This land can be claimed and used by individuals for agricultural purposes, but first they need to coordinate with the desa administration to do so. This entails requesting a Surat Keterangan Tanah (SKT), which once received means the land becomes privately held. It is not clear if there is sanction from the administrative government when the rule is violated.

G5.4. Project-Driven Relocation

Demonstrate that the project does not require the involuntary relocation of people or of the activities important for the livelihoods and culture of the communities. If any relocation of habitation or activities is undertaken within the terms of an agreement, the project proponents must demonstrate that the agreement was made with the free, prior, and informed consent of those concerned and includes provisions for just and fair compensation.

The initial social survey conducted by Daemeter Consulting indicates that the Rimba Raya project does not require the relocation of any people or activities important for the livelihoods and culture of Project Zone communities.

G5.5. Illegal Activities in the Project Zone

Identify any illegal activities that could affect the project's climate, community or biodiversity impacts (e.g., logging) taking place in the project zone and describe how the project will help to reduce these activities so that project benefits are not derived from illegal activities.

Encroachment by Palm Oil Plantations

The principal illegal threat to the project's climate and biodiversity benefits is continued encroachment by the oil palm plantation inside the Project Zone to the north of the Project Area. The plantation has already expanded its operations beyond authorized boundaries, destroying valuable forest habitat. Moreover, the plantation's drainage canals threaten nearby peat deposits inside the Project Area.

Due to additionality requirements of REDD projects, the relationship between project developers and palm oil concessionaires is necessarily adversarial at project commencement. Upon project implementation, however, the relationship must become collaborative to avoid leakage. Project proponents intend to engage the palm oil company with a series of steps designed to defuse this threat. First, a road will be built between the plantation and the Project Area to prevent further encroachment and to serve as a fire break. Second, an effort will be made to work with the plantation owners to design adjacent drainage canals to prevent incidental impacts to Project Area carbon deposits. In exchange, project proponents will work with plantation owners to identify and acquire viable non-peat land that has already been deforested for additional plantations.

Illegal Logging

There is a history of illegal logging inside the Project Area, and some indication that logging in the southern part of Project Area and extending into Tanjung Puting National Park may be ongoing. An initial social survey of Project Zone communities indicates that this threat does not arise from within the Project Zone, but rather from outside communities that have no legal or traditional stake in Project Area forests.

To mitigate this threat, project proponents will establish a comprehensive network of guard towers and patrols to ensure the territorial integrity of the Project Area and prevent access by loggers. This project activity is described in greater detail under Section G3.2, above.

Resource Use Surrounding Communities

Although minor in comparison to the threat posed by both legal and illegal palm oil plantations, the surrounding communities do place some pressure on the physical integrity of the Rimba Raya Reserve. Anecdotal evidence suggests that villagers engage in limited hunting and fishing inside the Project Area and occasionally log trees for timber.

Since 2003, World Education has been working with farmers around TPNP to achieve food security and alleviate pressure on proximate forest land. In 2005, these efforts expanded into the Seruyan, beginning with the introduction of rice block management techniques to greatly reduce the impact of crop pests in four villages on the east side of TNTP. Five Seruyan villages (Tanjung Hanao, Ulak Batu, Palingkao, Buang, Muara Dua) are currently participating in a program intended to yield rice self-sufficiency and diversify crops by introducing agroforestry. Where viable, WE has sought to introduce community gardens and aquaculture.

Under the auspices of the Rimba Raya project, this program will be expanded and extended to every village in the Project Zone. Beyond that, project proponents have designed a slate of socio-economic programs designed to address poverty issues at the root of this threat. These programs, described in Section G3.2, will create a social buffer and reduce this threat to project benefits.

G5.6. Title to Carbon Rights

Demonstrate that the project proponents have clear, uncontested title to the carbon rights, or provide legal documentation demonstrating that the project is undertaken on behalf of the carbon owners with their full consent. Where local or national conditions preclude clear title to the carbon rights at the time of validation against the Standards, the project proponents must provide evidence that their ownership of carbon rights is likely to be established before they enter into any transactions concerning the project's carbon assets.

The project proponents have secured provisional tenure to the Carbon Accounting Area within the Rimba Raya concession in accordance with government procedures for obtaining an ecosystem restoration license (IUPHHK-RE). This license is the current implementing regulation conferring carbon rights.

According to **Regulation No: P-61 (2008)** Provisions and Procedures for Issuing Ecosystem Restoration Permits, the Ecosystem Restoration license is granted through applications and regulated by the Minister of Forestry based on Article 35 paragraph (3), Article 36 paragraph (5), Article 62 and Article 68 of **Government Regulation GR No. 6 (2007)** in conjunction with **Government Regulation GR No. 3 (2008)** on Forest Arrangement and Formulation of Forest Management and Utilisation Plans. The IUPHHK-RE license confers carbon rights to the project proponent as specified **in Article 33 of GR No. 6 (2007) and GR No. 3 (2008):**

Article 33

(1) The utilization of environmental service in the production forest as meant in Article 31 paragraph (2) letter b shall be done through, among others, business activities of:

a. utilization of water bank;
b. utilization of water;
c. eco tourism;
d. protection of biological diversity;
e. environmental rescue and protection; or
f. absorption and/or storage of carbon.

A formal legal opinion dated 10 February 2009 (*see Annex 15A for the full opinion and regulations*), confirms the relevance of these regulations and verifies that the IUPHHK-RE confers carbon trading rights. To date, project proponents have complied with all necessary administrative steps towards acquiring an IUPHHK-RE for the Project Area *(See Section G5.2 and Annex 15B, 15C).*

The foregoing indicates that project proponents have taken all reasonable steps to obtain clear, uncontested title to the Rimba Raya project carbon rights. Ownership of carbon rights will be established conclusively (e.g. issuance of IUPHHK-RE decree and subsequent VCS verification) before entering into any transactions concerning the project's carbon assets.

CLIMATE SECTION

CL1. Net Positive Climate Impacts

CL1.1. Estimate of Net Changes in Carbon Stocks Due to Project Activities

Estimate the net change in carbon stocks due to the project activities using the methods of calculation, formulae and default values of the IPCC 2006 GL for AFOLU or using a more robust and detailed methodology. The net change is equal to carbon stock changes with the project minus carbon stock changes without the project (the latter having been estimated in G2). This estimate must be based on clearly defined and defendable assumptions about how project activities will alter GHG emissions or carbon stocks over the duration of the project or the project GHG accounting period.

The following methodology has been used to estimate net changes in carbon stocks:

- Summarize emissions from planned deforestation component in final Baseline Scenario (Section G2.3)
- Summarize emissions from unplanned deforestation component in final Baseline Scenario (if necessary) (Section G2.3). Elements of this component:
    - o Baseline deforestation rate (%/yr) – requires the identification of a reference region, leakage belt, and accounting area.

    - o Baseline deforestation location – requires identification of drivers and modeling of land-use change
    - o Methodology for calculating changes in carbon stocks
- Estimate carbon stock changes under 'with project' scenario
- Calculate net change in carbon stocks due to project activities

Final Net Change in Carbon Stocks Due to project Activities (after 20% Non-Permanance buffer):

104,886,254 t CO2e

CL1.2. Estimate of Net Changes in Emissions of non-CO_2 Gases

Estimate the net change in the emissions of non-CO_2 GHG emissions such as CH_4 and N_2O in the with and without project scenarios if those gases are likely to account for more than a 5% increase or decrease (in terms of CO_2 equivalent) of the project's overall GHG emissions reductions or removals over each monitoring period.

The following non-CO_2 emissions will not be included:

- In the Baseline Scenario, oil palm could conceivably increase N2O emissions due to fertilization. Nevertheless, it is conservative to exclude these emissions in the final accounting.
- In the Baseline Scenario, CH4 sequestration as a result of peat drainage is insignificant in comparison with CO_2 emissions. Therefore CH_4 is exluded.

The following non-CO_2 emissions will be included:

- CH_4 and N_2O emissions from biomass and peat burning for land clearing

CL1.3. Estimate of Other Emissions Resulting from Project Activities

Estimate any other GHG emissions resulting from project activities. Emissions sources include, but are not limited to, emissions from biomass burning during site preparation, emissions from fossil fuel combustion, direct emissions from the use of synthetic fertilizers, and emissions from the decomposition of N-fixing species.

No biomass burning, N-fixing species, or synthetic fertilizers will be utilized in any project activities. Emissions from fossil fuel combustion no longer need be accounted for under CDM rules.

CL1.4. Demonstration of Net Positive Climate Impacts

Demonstrate that the net climate impact of the project is positive. The net climate impact of the project is the net change in carbon stocks plus net change in non-CO_2 GHGs where appropriate minus any other GHG emissions resulting from project activities minus any likely project-related unmitigated negative offsite climate impacts (see CL2.3).

A comprehensive estimate of net changes in carbon stocks due to project activities has been calculated in the Baseline Scenario, (see Section G2.1). Applying the Baseline to the following equation is used to estimate net climate impacts:

Net climate impacts = Net change in carbon stocks (Section CL1.1) + net change in non-CO_2 GHGs (Section CL1.2) – Emissions resulting from project activities (Section CL1.3) – Unmitigated leakage (Section CL2.3)

For Rimba Raya: 104,886,254tCO2e + A – 0 – 0, where A is expected to be small. Therefore Rimba Raya is expected to have substantial net positive climate impacts.

CL1.5. Avoiding Double Counting of Emissions Reductions

Specify how double counting of GHG emissions reductions or removals will be avoided, particularly for offsets sold on the voluntary market and generated in a country with an emissions cap.

On 1 May 2009, the Indonesian Minister of Forestry promulgated the Minister of Forestry Regulation P.30/2009 on Procedures for Reducing Emissions from Deforestation and Forest Degradation (REDD). This regulation created the world's first legal framework for the implementation and management of REDD projects and

REDD-generated carbon credits. The Indonesian government developed this regulation in anticipation of the inclusion into the post-Kyoto protocol of a mechanism that would allow for the trading of carbon credits generated from REDD projects. While negotiations for the successor to the Kyoto Protocol are not complete, it is possible – although not definite – that there will be an accounting of REDD-generated carbon offsets in the next global carbon-trading protocol.

At present, InfiniteEARTH intends to certify all emissions reductions according to the Voluntary Carbon Standard GHG accounting protocol, and all carbon credits will be registered with the VCS registry.

Nonetheless, bearing in mind the uncertainty surrounding the future of REDD regulation, InfiniteEARTH has developed a strategy that will prevent the double counting of carbon. The accompanying diagram illustrates InfiniteEARTH's response to anticipated scenarios:

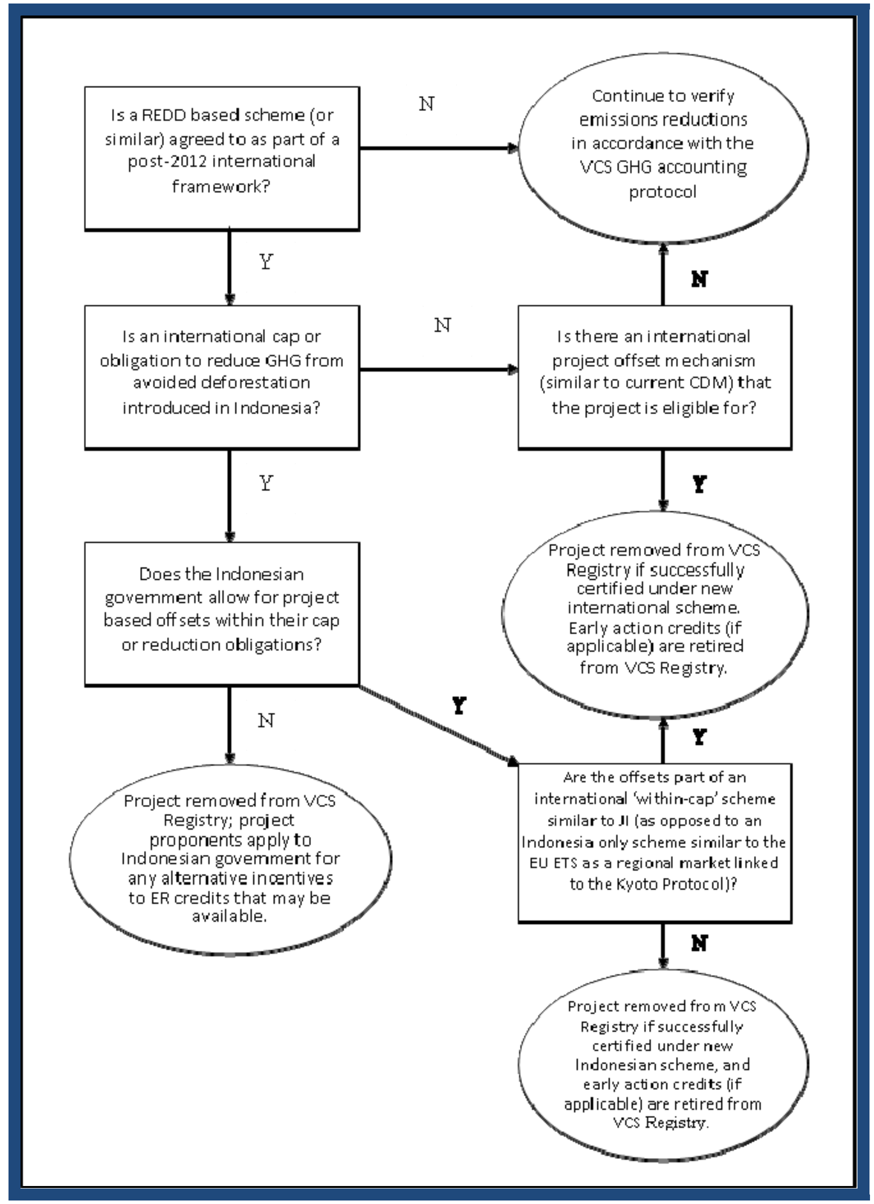


Figure 57. InfiniteEARTH Double Counting Scenario Planning.

CL2. Offsite Climate Impacts ('Leakage')

Leakage is the unanticipated decrease or increase in GHG benefits outside of a project's accounting boundary resulting from the project's activities. A number of theoretical and methodological issues complicate leakage accounting and have yet to be resolved.

First among them is the question of scale. In theory, leakage must be accounted for at the local, regional, and national levels. Realistically, national leakage accounting is beyond the purview of any individual project developer, depending instead on government land use priorities and incentives, and best addressed through a national leakage buffer or some similar mechanism. Accounting for leakage at the local scale will necessarily be the focus of project proponents, with an emphasis on regional concerns where data is available and mitigation efforts supported by the government.

Second is a question of the agent responsible for driving leakage. Primary leakage focuses on the displacement of activity by the original 'baseline agents' targeted by the project. Three forms of primary leakage have been identified in the theoretical literature (Aukland et al. 2003):

- Activity Shifting: the activities that cause emissions are not permanently avoided, but simply displaced to another location outside the Project Area.
- Market Leakage: the purchase or contracting out of the services or commodities, by the baseline agent, that were previously produced on-site.
- Ecological: indirect positive impacts on adjacent forests resulting from project activities aimed at protecting the Project Area.

Secondary leakage occurs when a project's outputs create incentives to increase GHG emissions elsewhere. Unlike primary leakage, secondary leakage activities are not directly linked to, nor carried out by, the original baseline agents. Three forms of secondary leakage have also been identified in the theoretical literature:

- Market effects: when emissions reductions are offset by new emissions created from shifts in supply and demand of the products and services affected by the project. This type of leakage is likely to occur with projects that affect market-based activities, such as commercial agriculture, timber harvesting, and reforestation and afforestation.
- Super-acceptance of alternative livelihood options: the alternative activities provided by a project may result in an influx of people attracted into the area from regions outside of the original project boundaries or target group, who may adopt the activities promoted by the project. This may result in either positive or negative leakage.
- Life-cycle emissions shifting: mitigation activities increase emissions in upstream or downstream activities (e.g., conservation leads to eco-tourism and more traffic).

The methodology outlines a direct approach to leakage accounting with a focus on primary leakage, incorporating secondary leakage concerns where they are both significant and measurable.

The third and final issue complicating leakage accounting is the theoretical distinction between positive and negative leakage. Negative leakage is the unanticipated *decrease* in GHG benefits outside the Project Area as a result of project activities, while positive leakage is the unanticipated *increase* in GHG benefits. Traditionally, positive leakage has been considered too speculative, and current methodology favors an approach that discounts positive leakage. This approach is fundamentally flawed, however, in that it fails to assess accurately the differences in value with respect to avoided GHG emissions among specific blocks of forest.

REDD is not a cure-all for deforestation, but rather a limited and targeted mechanism for saving discrete forests under imminent threat. As such, it must provide the correct set of incentives to help stakeholders prioritize which forests will be saved based on a rational calculation of all GHG benefits arising from a potential project. Fundamental to this argument is the notion that not all forests are equal in terms of the GHG benefits they provide. Some forests are isolated, and protecting them via the REDD mechanism protects only the carbon stocks within the Project Area. Other forests may in addition function as buffers, offering strategic opportunities (through site selection and project orientation) to safeguard additional carbon stocks outside the Project Area. To the extent that these external emissions reductions are additional, concrete, and measurable, they should be included in project GHG accounting to ensure that the optimal set of incentives underpins the REDD mechanism. Positive leakage accounting is arguably the best tool to accomplish this end.

CL2.1. Leakage Assessment and Estimate of Offsite Emissions

Determine the types of leakage that are expected and estimate potential offsite increases in GHGs (increases in emissions or decreases in sequestration) due to project activities. Where relevant, define and justify where leakage is most likely to take place.

Baseline drivers and agents

The principal baseline driver for the Rimba Raya project area is deforestation, with palm oil companies acting as agents. Local and provincial spatial planning maps designate most of the forest between the eastern border of Tanjung Puting National Park and the Seruyan River for conversion to palm oil. Proprietary research by OFI and InfiniteEARTH into current and historical practices by these companies suggests that the remainder of the Project Area and much of TPNP are also under threat.

Negative Leakage Analysis

Activity shifting. Likely the principal concern for project proponents. Five palm oil companies were granted illegal concessions inside the Seruyan buffer region. One company has already converted its concession to oil palm, overstepping concession boundaries and encroaching into the Project Area. Four of the companies had yet to commence operations when project proponents intervened, and their concessions have been extinguished. These displaced concessionaires (all part of the same holding company) may attempt to obtain other land suitable for oil palm development, in which case project emissions will to some degree have been displaced rather than avoided.

Theoretical Arguments Demonstrating NO Activity Shifting or Market Leakage.

The following argument was not used in the calculation of the emissions for the project nor was it incorporated in any way into the Monitoring Plan. Project proponents strictly followed the methodology with regard to monitoring, which is necessarily conservative in its approach to monitoring and accounting for leakage. Howeverproject proponents feel compelled to produce the following theoretical argument that in effect, with regard to pea lands, leakage cannot occur since peat and peatlands are ***finite, non-renewable resources****. As such, a unit (1 ha or 1 tC or 1 tCO2e) saved from deforestation and drainage is non-fungible with the same unit from another source.*

Though relevant to any national leakage accounting system, market effects are too speculative to gauge on a project basis. Its virtually impossible to confirm whether activities outside the project area by the deforestation agent are a direct consequence to displacement or whether they are simply part of a pre-planned expansion of activities.

For palm oil, moreover, the size of the market dwarfs any shifts in supply and demand likely to occur due to any one REDD project, and the economic incentives to convert any remaining forests to plantations are so overwhelming that added competition from REDD does little to increase them.

The rapid rate of deforestation of peatland has brought about great cause for concern. With the advent of REDD, there is potential to dramatically reduce the rate of global deforestation, which is critically important to both bio-diversity and climate stability. The primary challenge to the efficacy of REDD is the issue of ***leakage***, which suggests that the prevention of carbon in a localized project area may not lead to net carbon avoidance in a broader context if the carbon output activities merely shift to other areas, a practice referred to as ***activity shifting***.

The basic premise of REDD is to assign a market value to ***eco-systems*** services, namely carbon sequestration, that have previously not been factored into the total real cost of a given product. The idea is that if the fully burdened cost of the products we consume reflected the total real cost of production, including hitherto unpaid environmental services, then the price of environmentally damaging products would increase, thereby making them less competitive than more sustainable alternatives. This realignment of market pricing mechanisms is intended to bring into balance a system that currently is in disequilibrium because, up to now, there has been no cost associated with the green house gases released as a result of deforestation.

Therefore, any theoretical argument surrounding the benefits or consequences of REDD and possible risks of leakage, must necessarily entail a review of the basic economic concepts related to ***supply/demand elasticities*** and their relationship to ***price equilibriums and disequilibrium***. In the pages that follow, the following issues will be addressed:

- Due to the non-renewable nature of peat land given the hundred’s and even thousands of years required to regenerate, peat land should be treated as a ***non-renewable resource*** that is being depleted at a rate from which it will not be able to regenerate, eventually yielding very volatile climatic outcomes.

- Unaccounted for economic costs, known as ***negative externalities***, will ultimately wreak havoc on eco-systems and long term regional and global climate stability. Essentially, a negative externality is a cost, in this case to the environment and to all those reliant on its stability including plants, animals and people. In the current market paradigm, this cost is not reflected in the price of the palm oil and the products that use palm oil. Ultimately all costs are not accounted for when peat land is converted, which leads to an artificially sustained disequilibrium in excess short-term demand and long-term limited supply due to the fact that current environmental degradation is not being factored into the price today, but is rather being pushed off to the future.
- Because peat land is currently not considered, either socially or in terms of acknowledged importance, a non-renewable resource therefore peat land is significantly undervalued. Moreover, the arguments in favor of palm oil production for bio-fuel development are highly flawed when environmental costs, also known as externalities, are unaccounted for.
- Once enacted, REDD will assist in providing some revaluation to peat, both literal and figurative, as a result of the worth placed on stored carbon values and increased land use competition.
- Added competition to land will have upward pressures on short term palm oil prices due to increased demand. Ultimately, once palm oil producers shift production capacity to marginalized non-peat land the short term input price increases would equilibrate as lower cost plantation land will be identified and developed through ***allocative efficiency***. Moreover, the carbon credit market would settle at a higher equilibrium price and quantity as demand gains traction among REDD adopting developed countries.
- Increased input prices will cause ***activity shifting*** among palm oil producers due to the high level of ***demand elasticity*** for palm oil in commodities and consumer markets in order to keep costs competitive.
- This activity shifting away from the depletion and conversion of peat land to agricultural uses will ultimately yield positive leakages with respect to emissions, all else equal and the value placed on preserved peat will help to bring market outcomes closer to equilibrium as a result of ***external effect accounting***.

By definition, a ***non-renewable resource*** is a natural resource that cannot be produced, re-grown, regenerated, or reused on a scale which can sustain its consumption rate (Wikipedia, 2009). The acceptance of REDD will address the critical importance of peat land and, in doing so will implicitly re-align peat land as a highly necessary source of climate stability and biodiversity. Conceptually, this will systemically motivate governments, private enterprises, NGO's and individuals to place higher value on peat land as a non-renewable resource as opposed to an inefficient land use when compared to agricultural production. Moreover, unaccounted external costs will be brought in line which will provide for a more realistic picture of market outcomes.

Therefore, it is appropriate to examine the market functions of peatlands, both before and after REDD, from the perspective of the economics of non-renewable resources, which will be examined at depth in coming paragraphs. Moreover, in subsequent paragraphs the implications of REDD on palm oil production, land use changes and resource allocation will be focused on.

Furthermore, the concept of ***leakage*** will be defined and addressed as it relates to the acceptance of REDD. A common argument in favor of degradation is the use of palm oil as a bio-fuel. This will be addressed in terms of flaws in the arguments and negative leakages associated with the development thereof. Additionally, an examination of the relationship between scarcity and resource allocation and how these relate to and influence activity shifting will be discussed. In addition, the market interactions that will likely take place as a result of the added competition, with respect to palm oil companies' activity shifting, relative to plantation land acquisition will be addressed.

The concept of leakage will be a critical component in measuring the success of REDD. Specifically, how impactful will REDD be on local, regional and global emissions levels, particularly as they pertain to the contribution of deforestation to greenhouse gas emissions. Opponents of REDD argue that it may merely shift emissions from deforestation to the developed world as carbon credits will be purchased without attempting to reduce domestic emissions levels.

This argument is flawed in the sense that it assumes no policy or market implications resulting from REDD. An important argument in favor of peat land use as a carbon store is simply the fact that it is extremely high in carbon content.

Converting peat to agricultural use has significant environmental effects that have a measurable economic cost. In the current market paradigm, this cost is not reflected in the price of the palm oil and the products that use palm oil. These unaccounted for economic costs, known as ***negative externalities***, will ultimately wreak havoc on eco-systems and long term regional and global climate stability. Essentially, a negative externality is a cost, in this case to the environment and to all those reliant on its stability including plants, animals and people.

Ultimately all costs are not accounted for when peat land is converted, both the costs to all impacted, as well as the costs to the degradation of the environment. During depletion significant levels of carbon are emitted as the peat is burned, as well as after oxidation through subsidence. Additionally, the ability of the peat to sequester carbon is lost after it is deforested. The ability of palm oil trees to capture carbon is low relative to peat and as a result the effect of degradation and lost ability to contain the carbon compounds the negative environmental impacts.

Assuming global emission levels are held constant, the result of converting peatlands yields a negative leakage into the environment. On the other hand, assuming the peat is no longer convertible to palm oil due to land use regulations, producers are now forced to find non-peat land for the new plantation development and therefore, the carbon is contained in the peat, the peat is still able to continue to contain additional carbon and the new plantation of palm oil trees also sequestering carbon, will result in a positive leakage.

Conservatively, the least positive impact REDD may have on the palm oil industry will simply be a substitution from peat land use to alternative marginalized land uses, which will still yield reduced emissions levels by way of shifts in the allocation of resources (to be elaborated upon in the coming paragraph). In terms of the impact on primary leakages, the palm oil companies, assuming industrial technology of palm oil farmers does not become more emission heavy, will simply shift to alternative land uses thereby yielding positive impacts on adjacent forests, particularly with respect to long term climate stability. Market effects associated with secondary leakages will be illustrated below.

Ultimately, the result of REDD on emissions levels will yield positive leakages, all else being equal. A primary argument in favor of peat depletion in support of palm oil is the developing bio-fuel industry. The leakages associated with conversion in order to produce bio-fuels are both negative and substantial.

Vegetable oils, and in particular palm oil, are increasingly being used as bio-fuel due largely to crude oil price volatility and the societal inclination to ultimately reduce greenhouse gas emissions. The attraction to palm oil as bio-fuel is due in large part to its high yield, relative to other vegetable oils (Searchinger, et. al., 2005). However the long term benefits associated with bio-fuel infrastructure investment largely ignore the broader environmental impacts associated with cultivation, production and transportation of bio-fuels, which result in a significantly higher magnitude of greenhouse gas emissions in the short term.

According to a recent report, agro-fuel expansion on a large scale may only have negligible effects on greenhouse gas emission reduction (Ernsting, et. al, 2007). One of the primary arguments against bio-fuel production and distribution is the level of fossil-fuels involved in the production process. In fact, the 2007 study found that between 74% and 95% of the energy in corn ethanol is derived from fossil fuel inputs.

Moreover, the study discussed the prevalence of coal use in many of the refineries, which is very high in carbon content. A large amount of data exists which suggests that large scale agro-fuel expansion could actually accelerate the climate change process, as opposed to mitigating it (Ernsting, et. al., 2007). It is argued that this increase would be due to the added level of deforestation, increased use of fossil fuel inputs and the use of nitrous based fertilizers (a critical component for high yield fields), among others. Essentially, a key argument opposing large scale agrofuel expansion is that there is a negative leakage associated with production and additionally, benefits are overstated while costs are understated suggesting disequilibrium within the palm oil market relative to bio-fuel expansion (i.e. a significant negative external effect).

The continued increase in deforestation rates associated with broad level bio-fuel production would have a multiplicative effect on carbon release, especially on peat land, as degraded peat land loses carbon storage capacity, becomes susceptible to fire and releases large amounts of carbon annually (Rieley, 2006).

- According to a study done by Holly Gibbs (2008), it takes nearly 900 years to receive payback to palm oil as bio-fuel that is cultivated on degraded peat land.
- A recent study, which examines the land cover change in Southeast Asia in order to meet bio-fuel market demand, suggests that nearly 30 times more carbon will be released as a result of the shift to palm oil plantations from peat land (Siegert, 2006).
- Moreover, results of the study suggest that producing one tonne of palm oil on peat land will result in the release of between 15 and 70 tonnes of CO_2 over the 25 year life cycle as a result of the conversion.

The growing understanding of the impact of greenhouse gas emissions from degradation and deforestation suggests that peatlands critical role in CO_2 emissions and storage should be highly protected and, according to Dr. Susan Page, "should be used as a 'bank' because they are worth more as biodiversity and carbon stores than oil palm or pulp tree plantations." The importance of peat land is essentially magnified as a result of their importance to climate control, biodiversity and the increasing scarcity as palm oil plantations threaten their preservation due to the non-renewable nature, or high level of terminal scarcity associated with peat land.

In laymens terms, if a palm oil operator has a pool of 1 million hectares of available convertible land on which to plant palm oil and 100,000 hectares are then removed from this pool and placed in a conservation reserve it is impossible to say that because the operator (or industry) converts and plants on the other 900,000 hectares that the 100,000 hectares inside the reserve were somehow lost.

The concept of ***scarcity*** is critical to understanding the market functions associated with peat land use and preservation. In basic economic terms, scarcity is unlimited demand for a limited resource. As scarcity increases for a good, the price is generally bid up, causing quantity demanded of that good to decrease, all else being equal. In other words, in market economies with common convertible currencies, price functions as a rationing device; as quantity available decreases, price increases, which implies the growing level of scarcity of a good or resource.

Generally, all goods have some level of scarcity which is representative of a host of supply constraints. In the case of a non-renewable resource such as oil, it is understood that supply (either short- term or long-term) is finite so reductions in production levels or diminished reserves will lead to upward pressures on prices. Peat is effectively a finite resource since the replacement time is measured in hundreds and even thousands of years, far beyond the reference points of leakage arguments and the project life (25 years).

The difference between resources like peat and oil is that the level of dependence on, or scarcity of, is not necessarily implicit in its valuation. As a result, collective efforts and pressure for broad conservation are not of the magnitude they need to be considering the importance of peat land to overall climate stability. In other words, if the remaining oil supply was being depleted at a level of approximately 2-5% annually, as is peat, prices and behaviors would reflect as such on a broad scale.

The adoption of REDD should help to revalue peat land significantly as it would achieve the following: 1) more stringent land use regulation would impose an additional level of scarcity given the formal land classification that palm oil companies and REDD companies would have to compete for and 2) add value to the peat based on the carbon quantities contained therein, which would in turn make it competitive to palm oil in its natural state (not degraded). An illustration of the likely market outcomes is provided below. In addition to understanding scarcity of resources, the activity shifting that will likely take place as palm oil producers are forced to compete with carbon companies is an important contextual concept.

Economic theory suggests that there will be a shift in resource usage relative to land in competition with palm oil and carbon as a result of REDD. Another critical piece tying these arguments together are those that identify and measure the external costs versus the external benefits in order to get a true picture of the markets reflection of the benefits and costs to society. The influx of competitors for the land will likely result in displaced palm oil production resources, which could be considered a negative impact; however, once adjustments are made, the palm oil farmers do not become displaced in the long term indicating neither an external benefit nor cost but rather a long term constant state.

This inter-temporal displacement will cause activity shifting among palm oil farmers and companies. Specifically, in order to expand production, palm oil companies will be required to find alternative land uses for palm oil production, assuming the increased input costs are less desirable than finding less expensive land sources. In other words, there will be a shift in allocative efficiency of resources associated with palm oil production.

By definition, ***allocative efficiency*** is a theoretical measure of the benefits achieved, or utility derived, through the distribution, or change in distribution of resources. Meaning that through market functions, resources will continue to be distributed and redistributed such that the most efficient combination of resources will be used. Subsequently, the outcomes from these distributional shifts can be measured and "winners" and "losers" are determined based on these adjustments. When the benefits to the "winners" are greater than the lost benefits to the "losers" there is said to be an increase in allocative efficiency, and vice versa. This activity shifting that will occur as a result of REDD is simply an illustration of market forces at work.

Assuming governments uphold land use laws and markets are allowed to work freely within the constraints of the enforcement, the resources will be allocated efficiently, unused/marginalized land will be absorbed as displaced palm oil farmers are forced to be innovative with their production methods as a result of the change in supply and demand conditions for peat land in light of rapid depletion.

The external costs associated with REDD will likely be reduced from the pre-REDD condition, all else equal. This means that given the reduced emissions levels and the positive leakages associated with REDD, not only will negative externalities from deforestation be reduced, but ultimately the proposed revaluation of peat land will provide a more realistic cost given peats importance to bio-diversity and climate stability.

The levels of peat deforestation are so great that excessive levels of carbon are being released into the atmosphere on a daily basis. It is in this respect that peatlands should be examined as a non-renewable resource, particularly in areas where the rapid degradation threatens both the existence of the peat, as well as the future potential of the peat to regenerate. Land use patterns will likely be affected as more carbon credit companies move in to the area and create competition with palm oil producers.
Moreover, the market functions associated with the growing carbon credit market will likely have significant impacts on land use patterns throughout Indonesia, including the Rimba Raya project area in Central Kalimantan. Based on this determination, we introduce the first component supporting our arguments which was developed by Harold Hotelling.

The premise is that the ***equilibrium price*** trajectory for a non-renewable resource generally rises exponentially (attributable to the magnitude of the scarcity), until the point at which the price is so high that demand would be crowded out. Due to the non-renewable nature of the resource, in this case Kalimantan peat land, it is implied in the exponentially rising price, that the quantity of remaining land would be continuously falling until the resource was fully exhausted, or until such time that the resource would no longer be utilized due to substitution to alternative more cost effective resource types (see Figure 57).

While the existence of this condition empirically has not been examined at length, relative to peat land, the developing carbon credit market would have larger positive impacts on the magnitude of price exponentiation and ultimate depletion trajectory as the value of the land will be placed in its existence rather than in its degradation and conversion. This particular example illustrates the relationship between the price per unit of a finite natural resource over time, relative to remaining quantity.

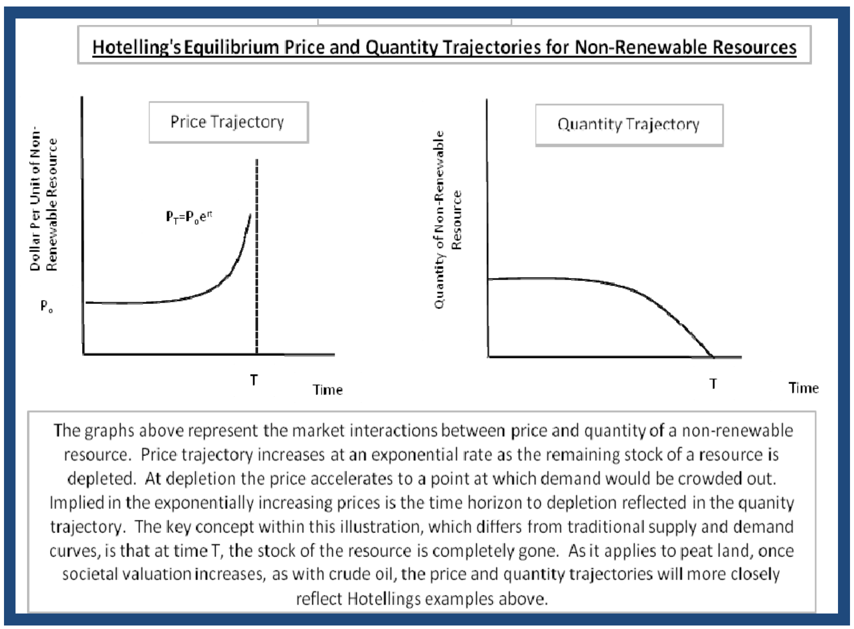


Figure 58. Hotellings Equilibrium Price and Quality Trajectories for Non-Renewable Resources.

In Kalimantan the amount of peat land is declining at a rate of 5.42% per year (Wetlands International, 2002). If REDD is enacted the total store of land will be reduced further and competition for land will increase significantly engaging not only palm oil producers, but also those looking to capitalize on the carbon store in the peat land with the intention of selling credits. This level of heightened scarcity will have significant impacts on current and future land use plans. The market responses associated with this new, more limited quantity of available land will likely follow basic market principles, assuming limited government involvement in market functionality with appropriate enforcement of land use regulations and property rights.

The model in Figure 58 represents the market for peat land both before and after REDD in a basic supply and demand framework. Notice the initial supply curve (denoted ST) is completely vertical. This represents the fixed amount of agricultural (and to be converted to agricultural) land available in Indonesia. The initial demand curve (denoted DT) represents current demand for agricultural (and to be converted to agricultural) land in Indonesia.

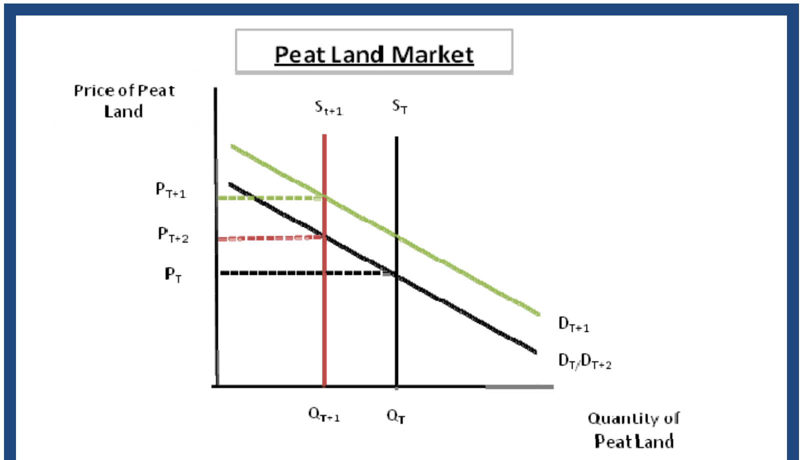


Figure two above is an illustration of the traditional supply and demand framework as applied to a non-renewable resource. Because the supply of available peat land is finite, the supply curve (represented by S_T and S_{T+1}) is vertical. This indicates that irrespective of price, the quantity supplied is constrained by resource availability and can never exist beyond S_T. The supply curve can shift leftward (for example to S_{T+1}), as supply is reduced through deforestation or land use controls. In the example above S_T represents the pre-REDD condition for peat land. The adoption of REDD will reduce the availability of supply shifting the supply curve to S_{T+1}. The short term impact would be a subsequent increase in the level of demand to D_{T+1} (increased competition from palm oil and carbon companies simultanesouly) bidding up the price. Ultimately it is expected that palm oil companies will activity shift to marginalized non-peat land and the demand level will return to approximately D_T/D_{T+2} at the elevated price level.

Figure 59. Peat Land Market Supply and Price Equilibrium.

The intersection of the hypothetical demand and supply curves yields the market clearing equilibrium price for peat land in Indonesia, (denoted PT), where P stands for price (throughout the example) and subtext T represents the present time period (i.e. prior to REDD). If REDD were to be enacted, the total supply of available land demanded by palm oil farmers and carbon credit companies would be reduced based on REDD guidelines, which is indicated by the leftward shift in the supply curve (denoted ST+1). Independent of any changes in demand, the market clearing price would be bid up as a result of the diminished stock of available land (denoted PT+1), where subtext T+1 represents the subsequent time period after period T. Empirical evidence (Othman, 2003) suggests that the elasticity of demand for palm oil and other edible oils is very high (i.e. highly substitutable).

The resulting impact on demand for peat land to be used for palm oil would be diminished by palm oil producers as a result of the relatively higher input costs associated with the increasing peat land prices. Palm oil producers would be able to either: 1) compete for the land, 2) move to other less competitive non-peat land or 3) transition productive endeavors to other industries. One likely outcome would be activity shifting due to the fact that the input costs would increase (discussed in more detail below) and the transaction costs associated with redirecting industrial production into an alternative industry would likely be significantly high enough to inhibit a substitution.

The reason for this competitive adjustment is that carbon credit companies have moved on to peat land (or conversion forests) in order to capitalize on the expected value of the carbon stored within the peat, effectively bidding up the price of the land previously demanded by palm oil companies. This is the impetus through which palm oil producers move to marginalized non-peatlands, which are not directly impacted by REDD, in order to maintain competitive cost structure within their palm production operations.

The short term impact on the carbon credit market is an increased supply of available credits (see Figure 59) due to the value added to stored carbon by the implementation of REDD. We see current market equilibrium price and quantity (PT and QT) at intersection of initial pre-REDD supply and demand curves (DT and ST). The initial increase in carbon credits will shift the supply curve to the right (to ST+1). In the longer term, assuming countries, firms and individuals adopt the policies required by REDD, the demand for the carbon credits will increase (to ST+!) yielding an increase in the longer term horizon of equilibrium price and quantity (intersection of DT+1 and ST+1).

The longer term impact of added carbon store profitability exhibits a multi-stage effect as policy implementation and land use enforcement are crucial. Specifically, the time in which it takes for users of the carbon credits to create the market breadth in order to see significant market traction will occur over time as the industry expands. At this juncture government regulation is crucial as indicated by Othman (2003), higher supply elasticities exist, wherein governmental organizations fail to enforce policies, this failure enables higher risk activities to persist, which could ultimately result in no significant additionality as palm oil producers could recapture peat land or other land gazzeted for agricultural use. In other words, higher levels of profitability to one use reduce the elasticity of supply to other uses.

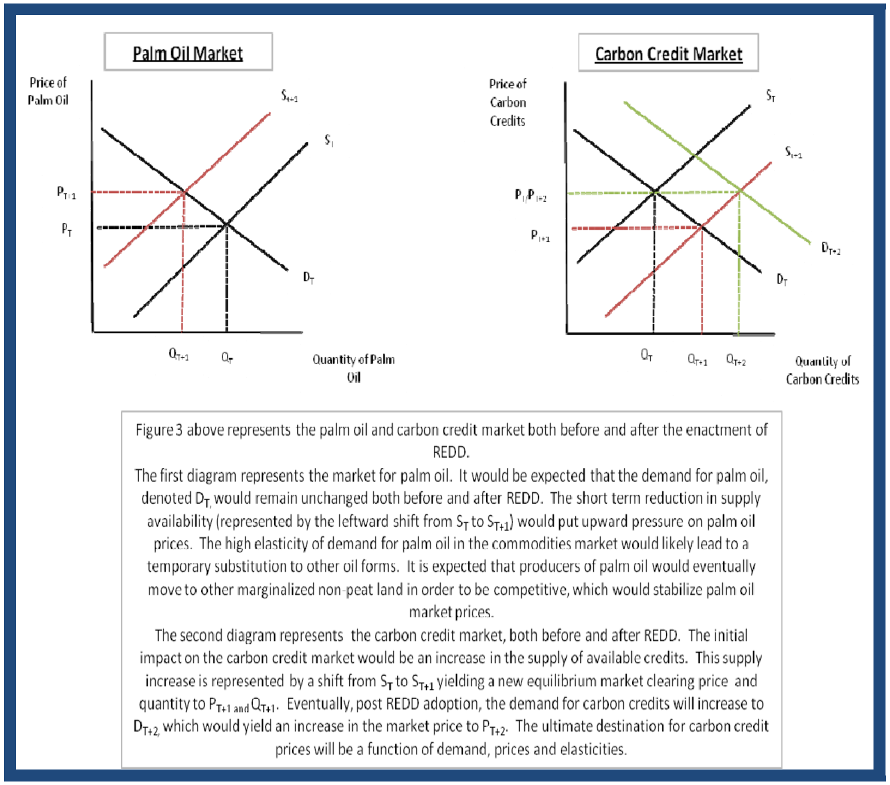


Figure 60. Short-Term Supply Reduction.

This dynamic implies that REDD provides a direct incentive to companies to acquire peat land to hold in order to sell carbon credits. As long as the land use regulation is enforced to the newly designated use, the elasticity to other uses, or opportunity cost, diminishes over time solidifying the newer less greenhouse gas intensive uses. The resulting impact on the Indonesian palm oil market is shown in Figure 59. Specifically, the impact REDD would have on the palm oil market would yield a short term supply reduction, which would reflect in upward pressure on prices, the supply curve would shift from ST to ST+1.

Eventually, through substitution to other non-peatlands, price impacts on palm oil may be mitigated. Palm oil producers would be able to compete with carbon credit companies for the same land; however, the cost structure of the domestic palm oil industry would increase, possibly creating a substitution away from palm oil in the consumer market as a result of its high elasticity.

In order to maintain competitive advantage palm oil producers would need to identify less expensive land, which after REDD would likely be to marginalized non-peatlands, or lands not as abundant in carbon. The longer term impact would result in lower input prices to agricultural land uses, although cultivation time and subsequent production costs may increase bidding up the price slightly, the long term market clearing price would likely be lower than if palm oil companies were to attempt to compete for REDD lands.

Ultimately the adoption of REDD will be a step in the right direction in terms of emissions reductions. Although, the short term impacts on the palm oil industry will consist of minor displacement of producers eventually, through efficient resource allocation, they will adapt to the change in the policy landscape and will adjust business practices accordingly.

The added level of scarcity brought about by REDD, along with the societal repositioning and pricing of palm oil as being derived from a non-renewable resource, will provide added value to peat land, which was previously only associated with palm oil production, thereby yielding a price adjustment that is more representative of the external costs associated with the production. While palm oil proponents suggest that a better use for peat land is as a land resource for palm oil plantations dedicated to bio-fuel production, there is a large body of research validating the flaws in this argument when environmental costs are taken into account.

Moreover, with the implementation of REDD, saving even one parcel of peat land will have positive leakage effects due to the high level of carbon released both during and after deforestation along with the lost sequestering capacity of peat land. Activity shifting may occur, but since there is a ***finite supply*** of peat and since it is a non-renewable resource, the activity must necessarily shift to non-peatlands. The carbon output from the re-directed production onto non-peatlands will be less than the "without project scenario".

The market will respond to the changing demand for carbon credits and peat land. Through direct and indirect price adjustments for palm oil and carbon credits, along with the elevated level of competition brought about through the scarcity imposed by REDD, both producers of palm oil and carbon credit companies should be made better off as land previously not demanded will ultimately be utilized in a more allocatively efficient way with an elevated knowledge and understanding of the external costs associated therein.

This paper has attempted to cover the fact that peat land, given the hundred's and even thousands of years required to regenerate, should be treated as a non-renewable resource that is being depleted at a rate from which it will not be able to regenerate, eventually yielding volatile climatic outcomes.

Because peat land is currently not considered, either socially or in terms of acknowledged importance, a non-renewable resource, it is therefore significantly undervalued. Moreover, the arguments in favor of palm oil production for bio-fuel development are highly flawed when environmental costs, also known as externalities, are unaccounted for.

The adoption of REDD into a global compliance scheme, will provide for the revaluation of peatlands, both literal and figurative, as a result of the cost and benefit placed on stored carbon values and increased land use competition.

Added competition for peatlands will have upward pressures on short term palm oil prices due to increased making alternative, more sustainable oils more competitive. Ultimately, once palm oil producers shift production capacity to marginalized non-peat land the short term input price increases would equilibrate as lower cost plantation land will be identified and developed through allocative efficiency. Moreover, the carbon credit market would settle at a higher equilibrium price and quantity as demand gains traction among developed countries adopting REDD. Increased input prices will cause activity shifting among palm oil producers due to the high level of demand elasticity for palm oil in commodities and consumer markets in order to keep costs competitive.

This activity shifting away from the depletion and conversion of peat land for agricultural uses to marginalized land will ultimately yield positive leakages with respect to emissions, all else equal and the value placed on preserved peat will help to bring market outcomes closer to equilibrium as a result of external effect accounting.

Super-acceptance of alternative livelihood options. While theoretically a concern, this form of leakage is realistically a non-issue with projects that displace oil palm plantations. Palm oil companies prefer to hire migrant workers, leaving communities both landless and jobless.

Positive Leakage Analysis

Ecological. The Rimba Raya Project Area was chosen specifically for its proximity to Tanjung Puting National Park. The project boundaries and license class were selected specifically for their protective functions with respect to the park. Before project commencement, palm oil companies had already succeeded in pressuring the government into redesignating land traditionally within the Park boundaries for conversion to palm oil, and one oil palm company in the north of the Seruyan buffer region had already encroached its boundaries and converted land formerly inside the Park to oil palm plantation. Project proponents, by rescuing the buffer region, have cut off access to Park boundaries and removed future threats to this portion of the park. To the extent that this positive leakage can be quantified using the same data and methodology applied to GHG accounting within the Project Area, these avoided emissions should be included in the project's carbon benefits by deducting the appropriate number of credits from the project's leakage buffer.

Definition of Leakage

Section 10 of the Methodology

"Leakage (*LK*) represents the increase in GHG emissions by sources which occur outside the project boundary that are measurable and attributable to the project activity. Leakage is assumed to occur as a result of the displacement of economic activities (i.e., planned land use conversion) to areas outside the project that lead to deforestation and land use change, estimated in units of t CO2-e. Thus, as a result of the project activity, the baseline activity of planned land use change may be temporarily or permanently displaced from within the project boundary to areas outside the project boundary.

"Activity shifting leakage shall be assessed for five full years beyond the date at which deforestation was projected to occur in the baseline."

Description of Leakage Monitoring

Leakage monitoring is conducted for five years beyond the date at which deforestation was projected to occur in the baseline (July 2009 - July 2014) in accordance with the methodology. Five main points outline leakage monitoring and are described below:

1. PT BEST operates plantations only in Central Kalimantan
2. All existing PT. BEST concessions will be monitored for development and/or expansion
3. Any new PT. BEST concession in Indonesia will be monitored
4. Unpermitted plantation expansion will be monitored within PT BEST's infrastructure
5. The area of activity shifting leakage and carbon impact will be assessed and reported at each verification

PT BEST operates plantations only in Central Kalimantan

In Rimba Raya, the agent of proposed deforestation and conversion to oil palm plantation is PT BINTANG ERA SINAR TAMA (BEST) Investment Holding. The BEST Group, established in Surabaya by the Tjajadi Family in 1982, is involved in many aspects of the edible vegetable oil business, primarily processing, transport, holding and trading palm oil but also including cultivation.[25]

[25] This description is sourced from http://www.asiacategory.com/co11011.html with reference to the PT BEST company website http://www.best-palmoil.com and confirmed by the Indonesian Ministry of Forestry to RRC.

The only palm oil plantations owned or operated by PT. BEST are located in Central Kalimantan, which are served by Group-owned crude palm oil (CPO) mills in Pangakalan Bun and Sampit. All other PT BEST activity is focused in several major commercial and port cities in Java and Sumatra (e.g. processing plants in Semarang, Surabaya and Medan; tank farms in Belawan and Jakarta) and in regional transport by Group-owned road-tankers and ships.

PT BEST oil palm concessions are limited to four districts in Central Kalimantan and total 139,424 ha on 15 parcels according to government GIS data for HGU and IzinLokasi permits in Central Kalimantan (Table 39 and Figure 60). This data augments information on permit licenses, which were also researched. Where concession name or concession location identified in permit records made a close match to the GIS data, the concession was conservatively, considered to be affiliated with PT BEST.

Table 39. PT BEST Group oil palm concessions in Indonesia

LABEL	NAME	hectares
1	PT. WANA SAWIT SUBUR LESTARI SK74 north	4,487
2	PT. WANA SAWIT SUBUR LESTARI SK74 south	8,836
3	PT. WANA SAWIT SUBUR LESTARI SK73	7,290
4	PT. WANASAWIT SUBUR LESTARI kucc north	5,708
5	PT. WANASAWIT SUBUR LESTARI kucc south	8,161
6	PT. BANGUN JAYA ALAM PERMAI south	10,824
7	PT. BANGUN JAYA ALAM PERMAI north	11,358
8	PT. BANGUN JAYA ALAM PERMAI east	2,116
9	PT. HAMPARAN MASAWIT BANGUN PERSADA north	4,638
10	PT. HAMPARAN MASAWIT BANGUN PERSADA south	6,642
11	PT. HAMPARAN MASAWIT BANGUN PERSADA east	8,135
12	PT. TUNAS AGRO SUBUR KENCANA north	8,830
13	PT. TUNAS AGRO SUBUR KENCANA south	12,641
14	PT. BERKAH ALAM FAJAR MAS	20,005
15	PT. BAHAUR ERA SAWIT TAMA	19,754
	TOTAL	**139,424**

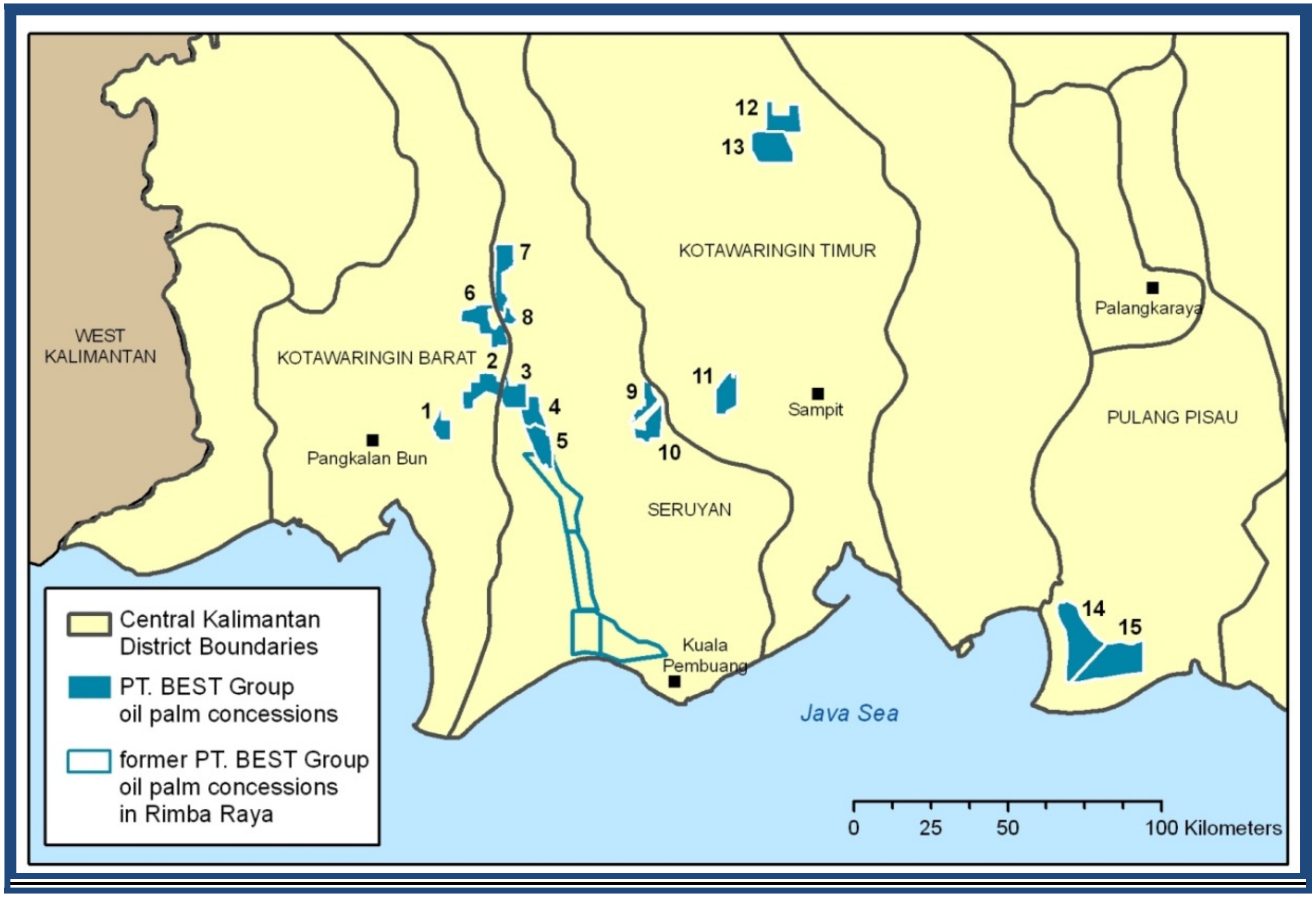


Figure 61. PT BEST Group oil palm concessions in Indonesia

Monitoring all existing PT. BEST concessions for development and/or expansion

PT BEST concessions identified in Table 39 and Figure 60 were viewed on satellite imagery (Landsat ETM+ February 2009, January 2010) to determine the extent of existing oil palm plantations, which are easily distinguished from other land cover types in Landsat data. This assessment showed that 12 of 15 concessions are already in plantation and are therefore not potential leakage sites (Figure 61).

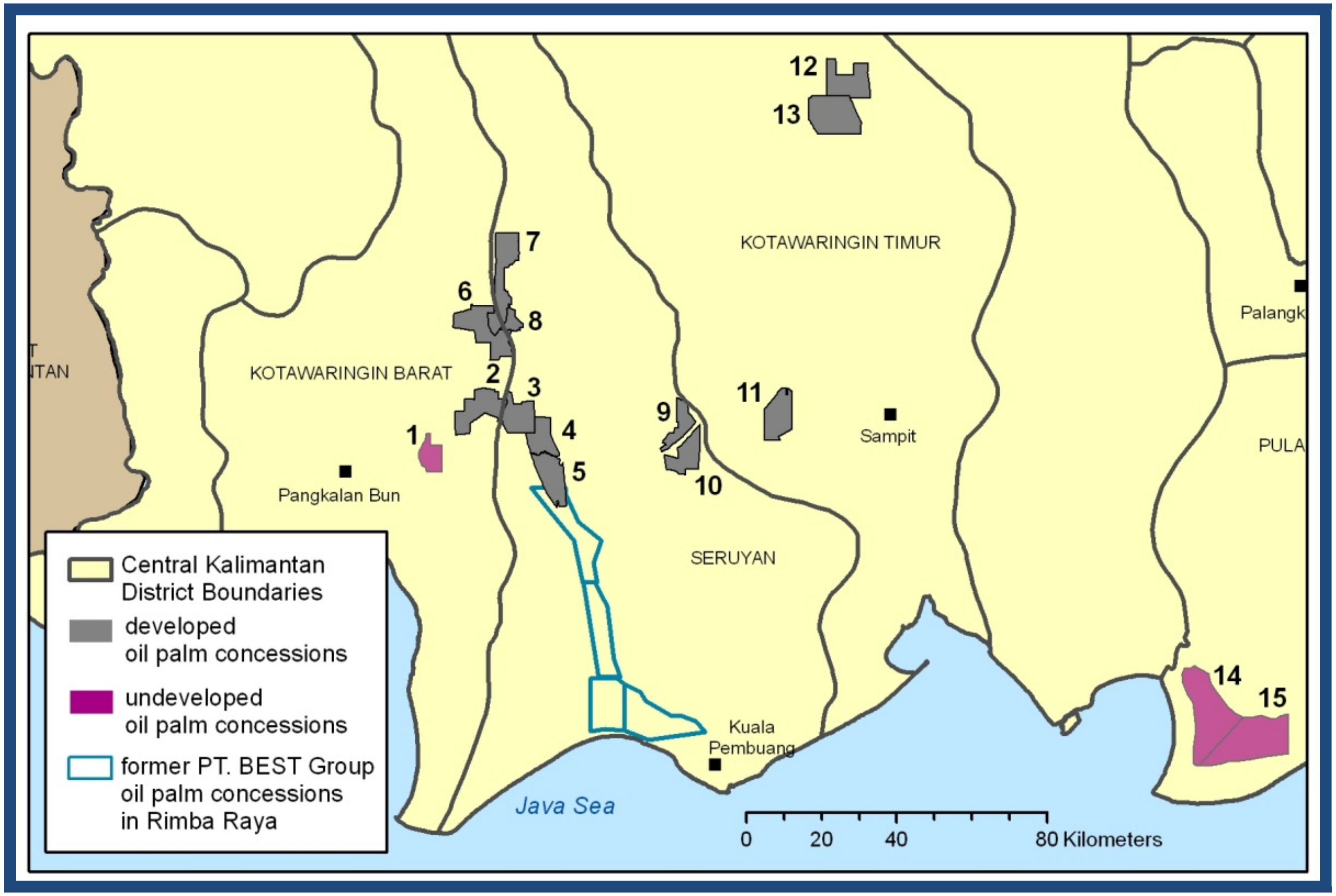


Figure 62. PT BEST Group undeveloped oil palm concessions in Indonesia

The three remaining concessions are being monitored during the 5-year period to stay informed on PT BEST activities, and any changes on these concessions will be detailed in annual monitoring reports. However, project proponents do not consider these permitted concessions to be potential leakage sites based on the following points supported by the methodology:

1. These areas have already been granted, therefore future conversion to plantation on these 3 concessions would not be considered an increase in area of government permits to PT BEST.

Section 10.2 of the Methodology

"At each verification, documentation shall be provided covering the other lands controlled by the baseline agent where leakage could occur, including, at a minimum, their location(s), area and type of existing land use(s), and management plans. It must also be demonstrated that the total area of government permits (for deforestation activities) that have been granted to the baseline agent of deforestation has not increased due to the implementation of project activities."

2. These concessions are primarily deforested and heavily degraded, therefore conversion to palm oil would have a negligible effect on aboveground carbon.

Section 10.2 of the Methodology

"No increases in GHG emissions caused by displacement of activities associated with the project are expected and LK = 0 if it can be demonstrated that all pre-project activities are displaced to degraded, non-forest land on mineral soils outside the project boundary that have negligible aboveground carbon stocks and that have been non-forest for at least ten years."

3. The land use plans for concession development were in place at the project start for these 3 concessions, so future development would not constitute a change in land use designation.

Section 10.2 of the Methodology

"In such cases, the project shall demonstrate that the management plans and/or land-use designations of other lands controlled by the baseline agent of deforestation have not materially changed as a result of the planned project (e.g., designating new lands as plantation concessions, increasing harvest rates in lands already managed for plantation products, clearing intact forests for plantation establishment);"

Any new PT. BEST concession in Indonesia will be monitored

Project proponents will also look beyond the known lands controlled by PT BEST at the beginning of the five-year monitoring period and investigate whether any new lands have come under their control. This will be accomplished by monitoring new concession licenses granted to PT BEST by the Indonesian government, through national, provincial and district land permitting offices. The following description provides background on the license process, which has informed permit monitoring.

Concession license process in Central Kalimantan

In Indonesia, district and provincial land use planning are designed to follow national land use planning established by the Ministry of Forestry. National spatial planning maps describe various land use zones such as: production forest, conservation forests, protected forests, and agricultural conversion areas. Agricultural conversion areas are designated as the legal zones where agricultural crops such as rubber and palm oil can be planted as permitted at the provincial and district levels. Conversion of forest areas outside of these zones is normally prohibited.

In Central Kalimantan, and Seruyan District, in particular, palm oil development regularly follows a bottom-up licensing process for forest conversion to agriculture. The district government is the first in the chain of approvals to grant a license that follows a typical pattern (shown left).

Thus, at any given time, there are proposed concessions (those holding an IzinLokasi) and licensed concessions (those holding a HGU) throughout the province, with the majority of these concentrated on the centers of palm oil production. In Central Kalimantan this permitting process constitutes legal palm oil plantation development and most existing palm oil plantations are developed within or adjacent to these boundaries.

Obtaining a legal license by this process takes 2-3 years, so that legal activity shifting, e.g. obtaining a new HGU prior to plantation development, is not expected to occur in less than two years after the project start and planned concessions are canceled.

Monitoring unpermitted (illegal) plantation expansion

There is a substantial amount of spatial data available that can be used to identify potential leakage, including satellite imagery for mapping plantation conversion and GIS data for overlaying mapped concession boundaries and agents. These data provide a direct method of investigating leakage and determining impact area for quantifying carbon stock and emission changes. Satellite image and GIS analysis are especially valuable for monitoring unpermitted plantation expansion beyond their legal boundaries. The series of steps below describes the process of monitoring unpermitted plantation development. These steps operationalize the general methodology requirement to monitor all activity-shifting leakage by the deforestation agent.

Unpermitted plantation expansion monitoring steps

Leakage monitoring for unpermitted plantation expansion is accomplished through a multi-step process that relies primarily on linking actual palm oil conversion derived from satellite image analysis with land-use planning maps and permits. Stratification is employed at Step 3 to focus the leakage analysis and then again in Step 6 to refine impact assessment for carbon stock and emissions changes if leakage is detected. Steps 1-3 are conducted up-front prior to monitoring. Steps 4-6 are conducted every year during monitoring and Steps 7-8 are conducted if Steps 4-6 show the occurrence of leakage.

Establish unpermitted plantation expansion monitoring zone at project start:

STEP 1. Identify agent, assess holdings and operations
STEP 2. Establish agent-specific operational distance monitoring zone for unpermitted plantation expansion
STEP 3. Stratify monitoring zone to define leakage risk areas

Conduct annual monitoring for unpermitted plantation expansion:

STEP 4. Monitor and update permitted concessions maps
STEP 5. Monitor and map actual oil palm plantations(potential leakage sites)
STEP 6. Overlay permitted concessions and actual plantations to determine leakage

Details of unpermitted plantation expansion monitoring process

STEP 1. Identify agent, assess holdings and operations

PT BEST Agro International, a large Oil Palm Conglomerate with long-term lease rights to 15 concessions in Central Kalimantan, 12 of which are already developed to palm oil. The remaining 3 are primarily deforested.

STEP 2. Establish agent-specific operational distance monitoring zone for unpermitted plantation expansion

Palm oil concessionaires rely on transportation infrastructure to haul edible grade oil palm fruit to Crude Palm Oil (CPO) processing mills within 24 hours of harvest. This places a significant operational constraint on concessionaires who must locate plantations close to processing plants especially where road conditions are poor. In Central Kalimantan, this presents an effective operational zone of no more than 100km from palm oil plantation to CPO plant. Illegal plantation expansion, if it occurs, would be expected to occur within these zones.

All of the PT BEST concessions currently under operation were developed around and are dependent on two CPO processing mills, one in Pangkalan Bun and one in Sampit. These locations form the centers of 100km operational constraint zones for monitoring illegal plantation expansion (Figure 62). Note that undeveloped concessions 14 and 15 lie outside of this monitoring zone and are cut off from Sampit by extensive deep swamps of Sebangau National Park. Currently there are no plantations in this region to monitor for expansion and no infrastructure to develop them. These concessions will be monitored as described above and infrastructure development, expected to develop south from Palangakaraya will also be monitored. Should this infrastructure and/or plantations develop during the leakage monitoring period, illegal expansion beyond permitted borders will also be monitored.

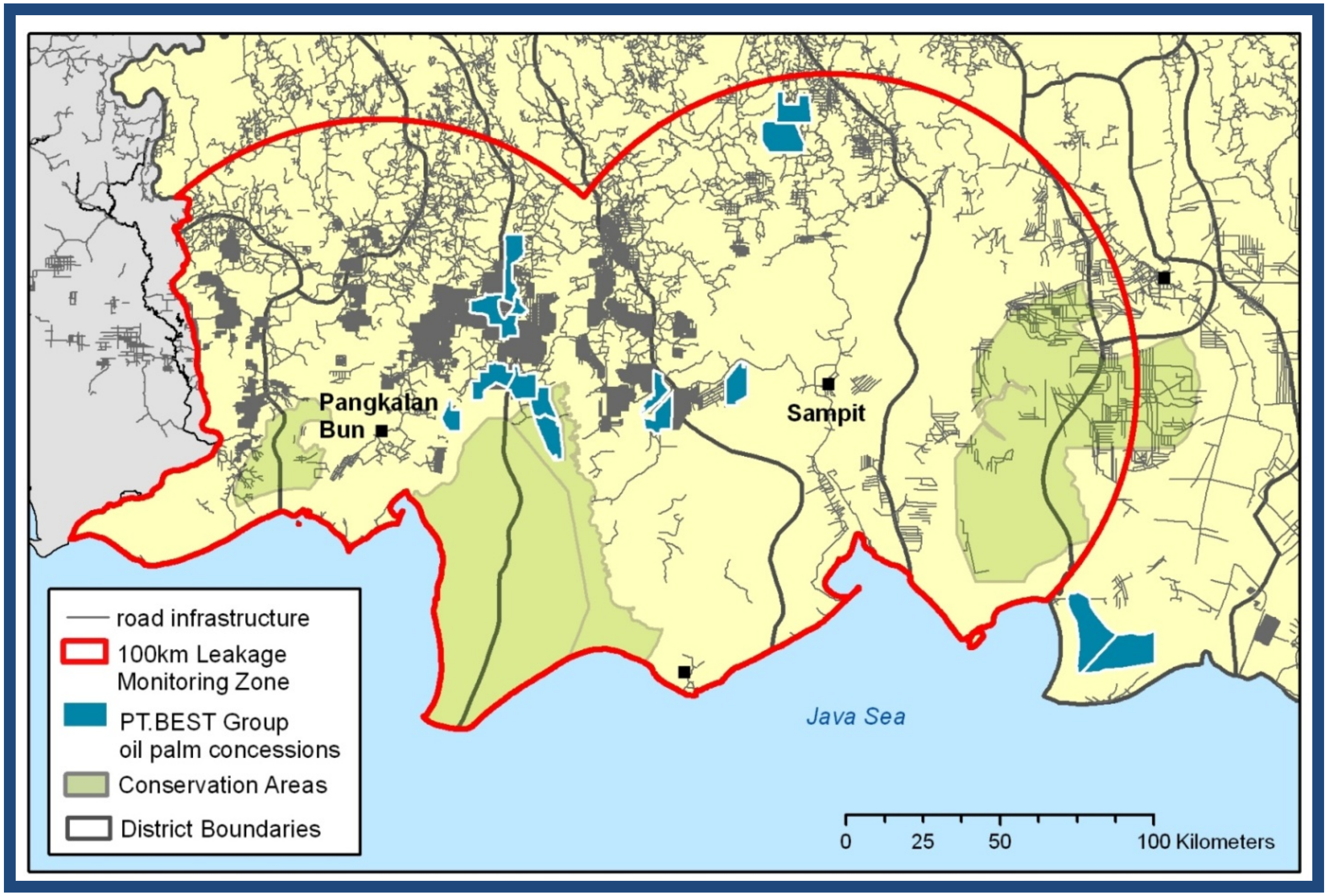


Figure 63. Unpermitted activity shifting leakage monitoring zone for Rimba Raya based on 100km distance from PT BEST Agro's CPO processing mills in Pangkalan Bun and Sampit, Central Kalimantan.

STEP 3. Stratify monitoring zone to define leakage risk areas

The unpermitted plantation expansion monitoring zone is stratified by land use and land planning information in order to focus the area of analysis to those places where leakage could occur. This analysis is carried out in GIS using overlays of spatial data to include or exclude certain layers as follows:

1. Include 100km areas centered on palm oil processing plants in Pangkalan Bun and Sampit
2. Exclude project area (Rimba Raya) and provinces where agent does not operate (West Kalimantan)
3. Include only areas that were forested in 2000
4. Exclude all permitted oil palm concessions at project start (2009 IzinLokasi and HGU permits)
5. Exclude all existing palm oil plantations at project start (2009 Landsat mapping)

Results of the first three overlays are shown in Figure 63. GIS data layers for HGU and IzinLokasi permits (Figure 64) were combined then overlaid with monitoring zone forests to exclude all areas already permitted for conversion at the project start. Concession boundaries were buffered by 500 meters in GIS to eliminate errors associated with mapping and reduce the number of "sliver" polygons produced by spatial mismatches in data layers. Tests of buffer distance were conducted to insure that the buffered GIS file captures actual palm oil expansion outside permit boundaries.

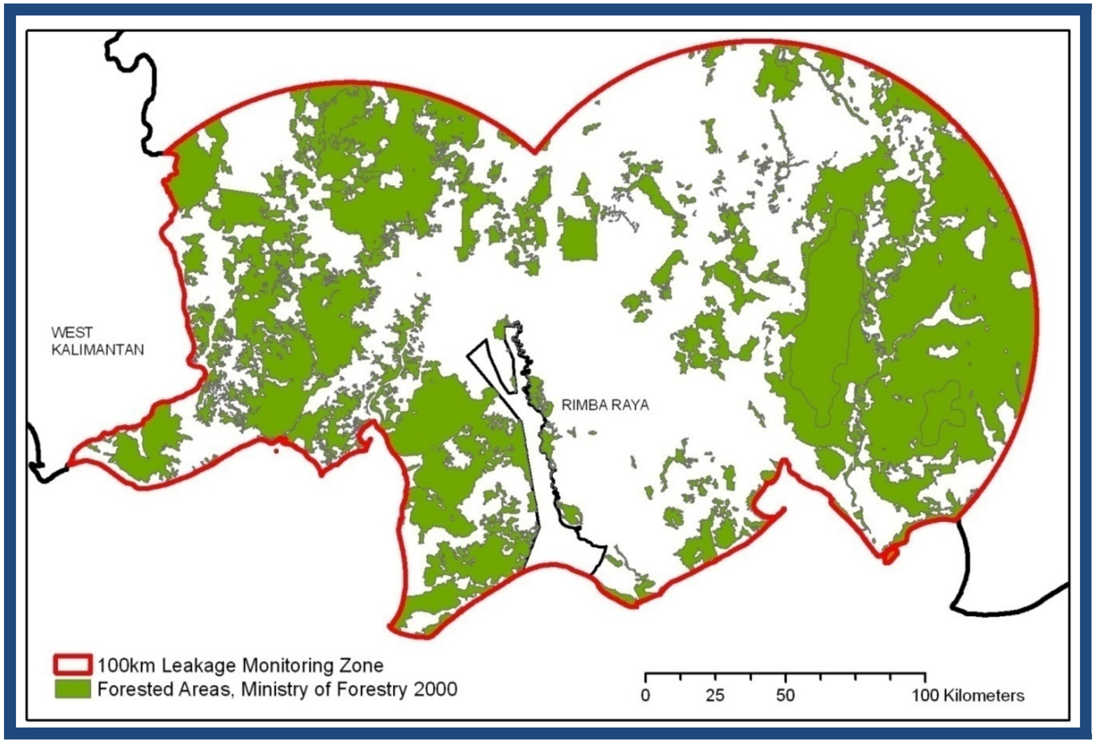


Figure 64. Results of the first three steps of plantation expansion leakage monitoring. Forested areas shown represent existing forest in 2000 for the 100km monitoring zone.

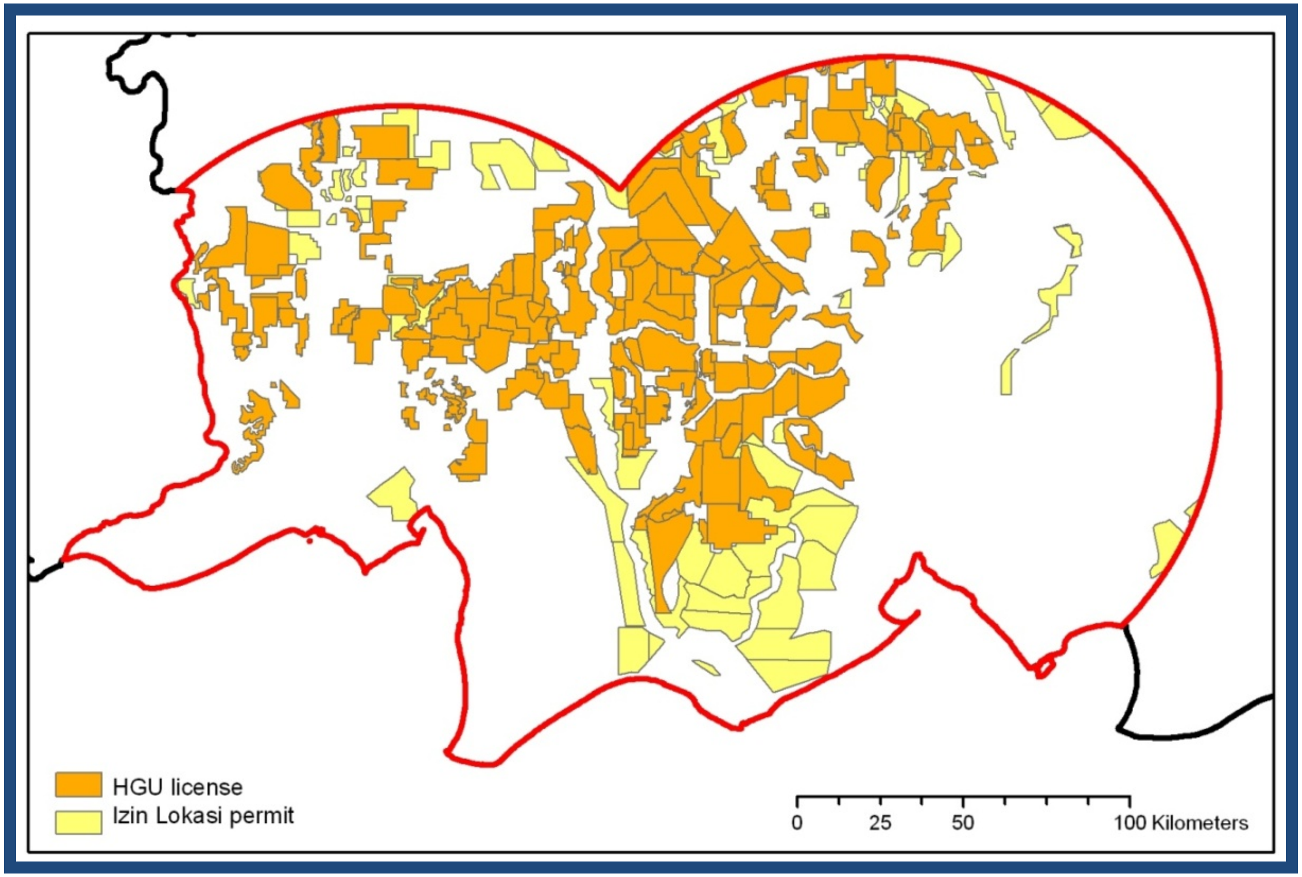


Figure 65. Existing oil palm concession licenses at project start. GIS data represents government mapping obtained through NGOs and represents the best available data as of July 2009.

All existing palm oil plantations in the monitoring zone at project start were interpreted and digitized on Landsat ETM+ satellite imagery (Figure 65). Six scenes were required to cover the monitoring zone and images were searched to find cloud-free images closest to the project start date. Two scenes each from three dates: May 13, June 7 and August 8 were selected and downloaded, bands stacked and geo-referenced if displays saved for import into ArcGIS for digitizing. Palm oil boundaries were conservatively interpreted to include already-constructed plantation blocks. Mapping shows that most HGU concessions have already been converted to plantation and conversely, the majority of palm oil conversion has occurred in or adjacent to permitted concessions. An earlier pilot study outside of PT BEST concessions showed a 15% encroachment in area beyond permitted concessions.

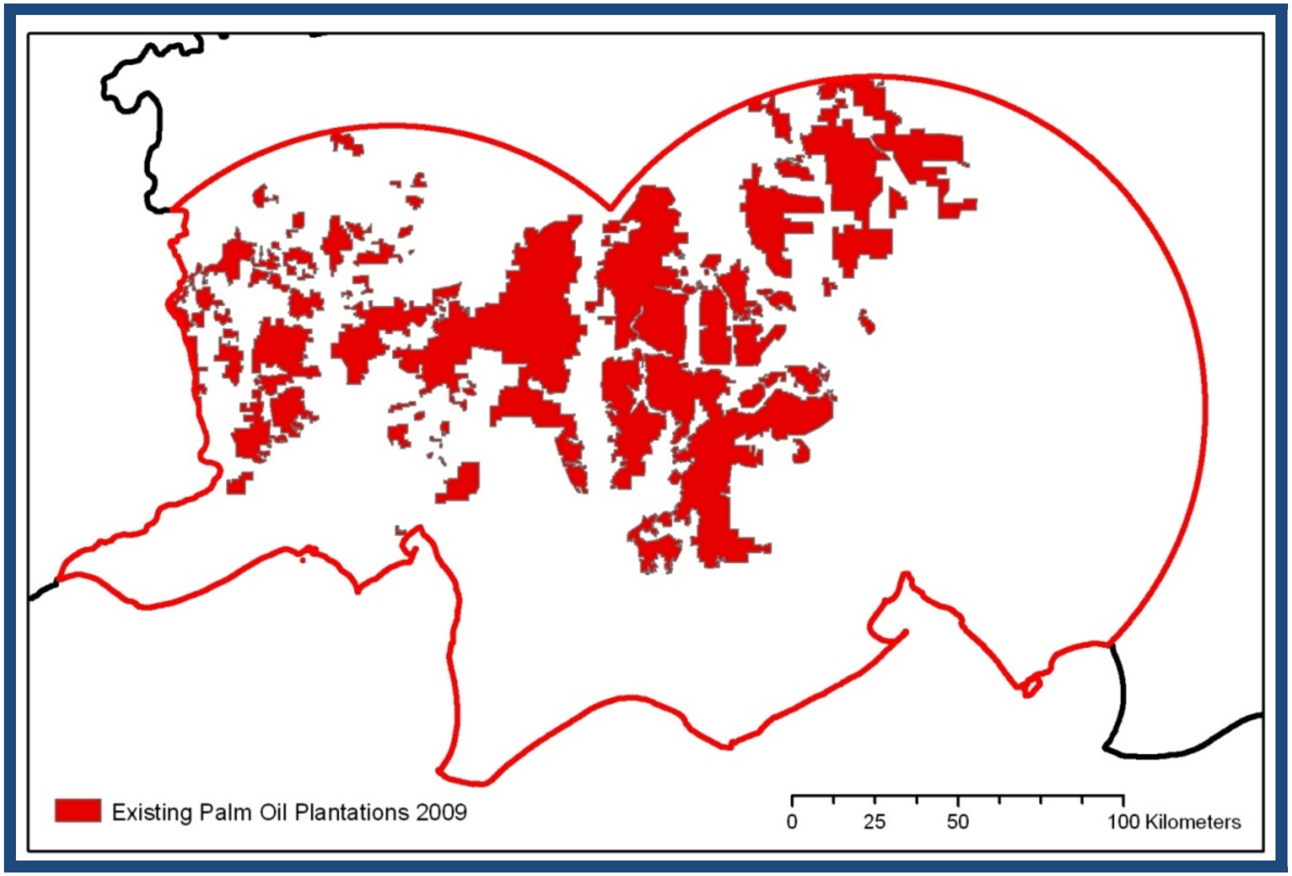


Figure 66. Existing palm oil plantations at project start interpreted and digitized from Landsat 7 ETM+ satellite imagery path-row 118-061 and 118-062 June 7; 119-061 and 199-062 May 13; 120-061 and 120-062 August 8.

After removing permitted and existing palm oil plantations, the remaining areas forested in 2000 are being monitored for plantation conversion and expansion (Figure 66). Note that conservation areas (except the project) are included in leakage monitoring although palm oil conversion is not expected to occur in these areas.

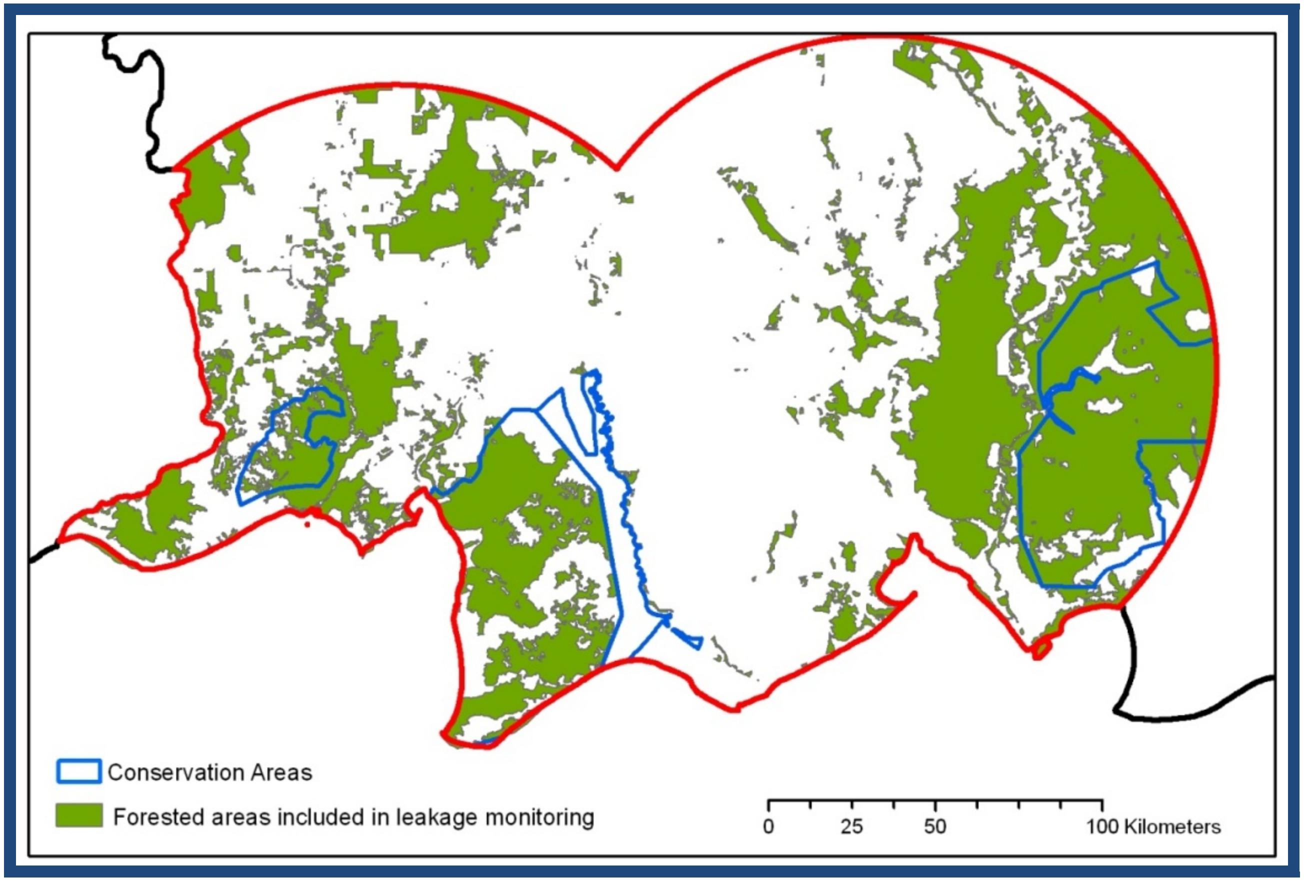


Figure 67. Leakage risk areas representing forests in 2000 inside the 100km distance buffer to CPO plants and excluding permitted concessions and existing plantations. Forests inside conservation areas are also monitored for leakage.

STEP 4. Monitor permits and update concession maps

Researching new licenses and updating GIS data on concession boundaries is the first step of the annual leakage monitoring process. Permits are searched to identify any new license activity by PT. BEST. In Step 3, the current status of existing concessions (holding a HGU) and proposed concessions (holding an IzinLokasi) was established at both the District and Provincial levels. This map and list of existing and planned conversion areas represents the known area and location of planned land conversion within the District and Province at the project start. The current HGU and IzinLokasi map (shown in Figure 64) will be updated to add any new license boundaries and improve mapping for existing boundaries consistent with government planning office GIS.

STEP 5. Monitor and update oil palm plantation boundaries(potential leakage sites)

Mapping new palm oil conversion lands consists of overlaying year t mapped plantations onto year t+1 satellite imagery and digitizing all new and/or expanded plantations in the entire 100 km monitoring zone (updating Figure 65). New areas of palm oil plantation are then overlaid with leakage risk areas (Figure 66) to identify all areas of potential leakage on the ground. The example in Figure 67 illustrates this process. In this case, palm oil conversion had begun inside permitted concessions prior to project start, but then expanded beyond concession boundaries and into the leakage risk area where it was detected during the GIS overlay process. The spatial overlay approach facilitates both a visual and quantitative assessment of potential leakage.

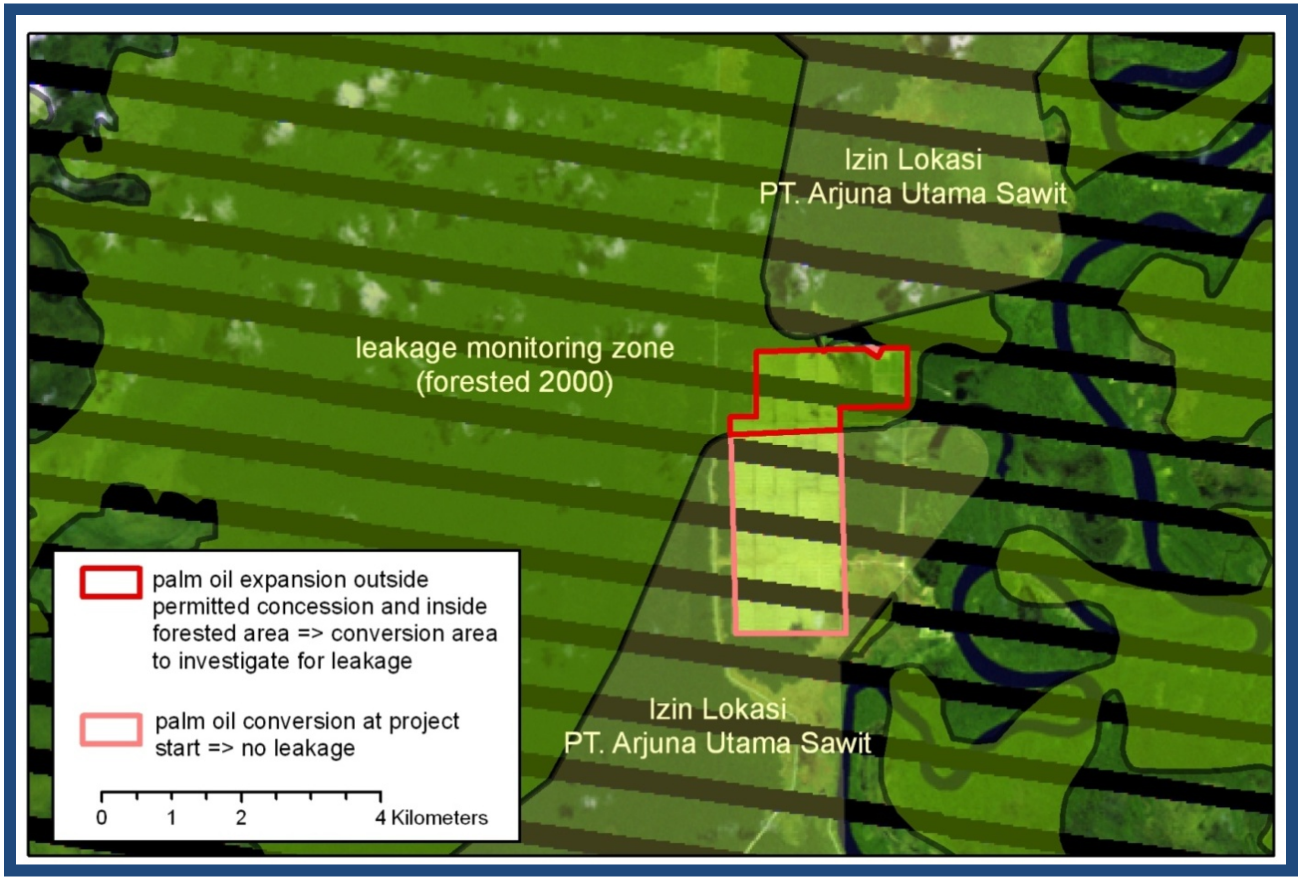


Figure 68. Example of overlay process to detect and highlight new forest conversion to palm oil.

STEP 6. Overlay concession boundaries and palm oil plantationsto determine agent

If new deforestation is detected within the leakage monitoring zone and is confirmed to be new activity outside a pre-existing concession license, then Step 6 is carried out to determine the agent of deforestation. Overlay analysis of updated concession boundaries (Step 4) and palm oil expansion (Step 5) is used to identify the agent or possible agents responsible for conversion. As illustrated in Figure 67, overlaying concession boundaries provides information about agents. In this case, plantation conversion extended 1.5 km between two concessions for which an IzinLokasi had been granted to PT. ArjunaUtamaSawit. Since this company is not an affiliate of PT BEST, whose closest concession is 75 km distant, we can conclude that PT BEST is not the agent of this conversion and therefore this palm oil expansion does not represent leakage associated with Rimba Raya. If it is determined that PT BEST is the likely agent, then steps 7 and 8 will be carried out to confirm and quantify leakage.

Assess the area of activity shifting leakage and quantify impact to carbon

Any activity shifting leakage detected during monitoring including leakage in existing or new PT BEST concessions and unpermitted plantation conversion, will be assessed and reported annually in accordance with the methodology.

Conduct site-level analysis to confirm leakage and stratify area

If it is determined that PT BEST is the likely agent of leakage, then a site-scale analysis is conducted to confirm the agent and develop data for carbon accounting. First, the boundary of the new or expanded palm oil concession will be delineated using concession permit maps and the best available satellite imagery. Then the leakage area will be stratified using the same procedures and vegetation classes as used for Rimba Raya.

Assess net carbon stock changes and GHG emissions associated with leakage

Following leakage area delineation and stratification, carbon stock changes and continued GHG emissions will be calculated according to the methodology. Emissions that result from displacement of pre-project activities to areas outside the project boundary are estimated as:

$$LK = \sum_{t=1}^{t^*} \sum_{i=1}^{M_{LK}} LKA_{planned,i,t} \cdot \Delta C_{i,t}$$

where:

LK = Leakage emissions resulting from displacement of economic activities; tCO_2e

$LKA_{planned,i,t}$ = the area of activity shifting leakage in stratum *i*, at time *t*; ha

$\Delta C_{i,t}$ = average carbon stock changes and greenhouse gas emissions in all pools in stratum *i*, $tCO_2e\ ha^{-1}$

i = 1, 2, 3, …, m_{LK} leakage strata

t = 1, 2, 3, …, t^* years elapsed since the start of the project activity

Monitoring Period and Reporting

The area of activity shifting leakage will be assessed for five full years beyond the date at which deforestation was projected to occur (July 2009). And emissions resulting from activity shifting will be tracked beyond the initial year of clearing as required and described by the Methodology Section 10.2.2.

At each verification, documentation will be provided covering lands controlled by PT BEST where leakage could occur, including their location, area and type of existing land use(s) and management plans. The status of government permits that have been granted to PT BEST will also be reported.

Market Leakage Deduction (not monitored)

In accordance with the methodology, a deduction against the biomass of timber extracted under the baseline scenario must be estimated for Market Leakage by implementing steps outlined in the methodology:

Section 10.1 of the Methodology

When REDD project activities result in reductions in wood harvest, it is likely that production could shift to other areas of the country to compensate for the reduction. Therefore, in cases where the project area would be harvested for commercial timber before clearing the site for a new land use, market effects leakage must be estimated as the baseline emissions from logging multiplied by a leakage factor:

$$LK_{MarketEffects} = \sum_{t=1}^{t^*} \sum_{i=1}^{m_{LK}} LK_{ME,it} \quad \textbf{(66)}$$

$$LK_{ME,it} = LF_{ME,i} * C_{B,XBT,it} \quad \textbf{(67)}$$

Where:

$LK_{MarketEffects}$	= Total GHG emissions due to market effects leakage through decreased harvest; t CO_2e
$LK_{ME,it}$	= Total GHG emissions due to market effects leakage through decreased harvest in stratum i at time t; t CO_2-e
$LF_{ME,i}$	= Leakage factor for market effects calculations; dimensionless
$C_{B,XBT,it}$	= Carbon emission due to displaced timber harvests in the baseline scenario in stratum i at time t; t CO_2-e

The amount of leakage is determined by where harvesting would likely be displaced to. If in the forests to which displacement would occur a lower proportion of biomass in commercial species is in merchantable material than in the project area, then more trees will need to be cut to supply the same volume and thus higher emissions should be expected. In contrast, if a higher proportion of biomass of commercial species is merchantable in the displacement forest than in the project forest, then a smaller area would need to be harvested and lower emissions would result.

Each project thus shall calculate within each stratum the proportion of total biomass in commercial species that is merchantable (*PMPi*). Merchantable biomass per stratum is conservatively defined as the total volume (converted to biomass) of all commercially valuable trees within a stratum that are above the minimum size class sold in the local timber market (see Applicability Condition J). *PMPi*is therefore equal to the merchantable biomass as a proportion of total aboveground tree biomass for stratum *I* within the project boundaries. *PMPi*shall then be compared to the mean proportion of total biomass that is merchantable for each forest type (*PMLFT*) to which displacement is likely to occur.

The following deduction factors ($LF_{ME,i}$) shall be used:

PML_{FT} is equal (±0.15) to PMP_i	$LF_{ME,i}$	=	0.4
PML_{FT} is > 0.15 less than PMP_i	$LF_{ME,i}$	=	0.7
PML_{FT} is >0.15 greater than PMP_i	$LF_{ME,i}$	=	0.2

Where:

PML_{FT}	= Mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type; dimensionless
PMP_i	= Merchantable biomass as a proportion of total aboveground tree biomass for stratum i within the project boundaries; dimensionless
$LF_{ME,i}$	= Leakage factor for stratum i market-effects calculations; dimensionless

Instead of applying the default market leakage discounts, project proponents may opt to estimate the project's market leakage effects across the entire country and/or use analysis(es) from other similar projects to justify a different market leakage value. A description of the market leakage assessment, including steps for determining where leakage is likely to occur (i.e., to which forest types leakage is likely to occur) and what the carbon stocks of those lands are, shall be outlined in the PDD. The outcome of this assessment conducted at first VCU issuance (whether using default discounts or project specific analysis(es)) shall be subject to the VCS double approval process. Market leakage assessments conducted at validation stage and at verification other than the first VCU issuance are not required to undergo the double approval process.

The next step is to estimate the emissions associated with the displaced logging activity – this is based on the total volume that would have been logged in the project area in the baseline scenario. The emission due to the displaced logging has two components: the biomass carbon of the extracted timber and the biomass carbon in the forest damaged in the process of timber extraction:

$$C_{B,XBT,it} = \left(\left[V_{B,it} * \phi_i * CF\right] + \left[V_{B,it} * LDF\right]\right) * \frac{44}{12} \qquad \textbf{(68)}$$

Where:

$C_{B,XBT,it}$	= Carbon emission due to displaced timber harvests in the baseline scenario in stratum i at time t; t CO_2-e
$V_{B,it}$	= Volume to be extracted under the baseline scenario in stratum i at time t; m^3
ϕ_i	= volume-weighted average wood density; t d.m. m^{-3} merchantable volume
CF	= carbon fraction of dry matter (0.5 t C / t biomass); dimensionless
LDF	= Logging damage factor; t C m^{-3} (default 0.37 t C m^{-3})
i	= 1, 2, 3, ..., m_{BL} baseline strata
t	= 1, 2, 3, ..., t^* years elapsed since the projected start of the REDD project activity

The total volume to be extracted under the baseline scenario in stratum *i* at time *t* (*VB,it*) can be estimated by multiplying the plot-level volume per stratum (*MVB,it* see Eq. 34) by the area cleared or logged in stratum *I* at time *t* (A cleared ,it or A logged B,it)

The logging damage factor (*LDF*) is a representation of the quantity of emissions that will ultimately arise per unit of extracted timber (m^3). These emissions arise from the non-commercial portion of the felled tree (the branches and stump) and trees incidentally killed during tree felling. The default value given here comes from the slope of the regression equation between carbon damaged and volume extracted based on 534 logging gaps measured by Winrock International in Bolivia, Belize, Mexico, the Republic of Congo, Brazil, and Indonesia.

Though project proponents have made a defensible econometrics argument that neither Activity Shifting nor Market Leakage can occur with a finite non-renewable resource (peat lands), both will be accounted for and deducted from baseline carbon emissions credits. Market leakage is not monitored but is taken one-time up-front over a five-year period consistent with estimated clearing rates and time periods.

Leakage from Market Effects was taken as one-time deduction of -4,836,855 t CO2e.

Non-Permanence Risk Analysis and Buffer Determination

This section follows the guidelines of the **VCS 2007.1Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination** and updates to this tool: Update to the VCS 2007.1: Tool for AFOLU Non-Permanence Risk Analysisand Buffer Determination 13 April 2010 and 8 September 2010.

The non-permanence risk analysis and buffer determination describes risk factors and ratings for All VCS projects (Table 40) and Avoided Planned Deforestation (APD) REDD projects (Table 41). Risk ratings and total risk for Rimba Raya were determined using the VCS Tools and are detailed in the tables below. In accordance with the VCS methodology, this section is subject to the double approval process and risk rankings and buffer withholding recommended by both VCS verifiers have been incorporated into this final assessment.

Table 40. Risk Factors for ALL VCS Projects

Risk factors for ALL VCS Projects		
Project Risk	**Risk Rating**	**Notes**
Risk of unclear land tenure and potential for disputes	Low	InfiniteEARTH will hold an Ecosystem Restoration Concession License over the project zones and area. This license will provide InfiniteEARTH usage rights for a period of up to 60 years with an option to renew for an additional 30 years beyond that.
Risk of financial failure	Low	The company has executed forward sales triggered upon the first verification that will create an endowment that will sufficiently fund the operational budget through an

		annuity for the entire life of the project and possibly in perpetuity. Confidential contracts and budgets will be shared with the validator.
Risk of technical failure	Low	No new technologies will be introduced that play a significant or vital role in the implementation of activities on the ground. Forest protection and monitoring activities on the ground invoke best practices from other protected and conservation areas utilized in other parts of Indonesia and internationally. Thus, risk of technical failure is low.
Risk of management failure	Low	InfiniteEARTH has established an experienced management team at the executive, managerial and operational field levels. Where key staff positions are not currently filled, a systematic plan for role and function of the remaining positions has been identified and the persons responsible for those duties in the interim period have been assigned. Apart from its core team, InfiniteEARTH has secured either partnerships or contractual agreements with relevant NGOs and expert consulting firms to support its core staff.
Economic Risk		
Risk of rising land opportunity costs that cause reversal of sequestration and/or protection	Low	Although rising land opportunity costs are expected to rise with the price of Oil Palm, the land tenure agreement held by InfiniteEARTH over the Rimba Raya area gives rights to the land for a period of up to 60 years with the opportunity to renew for an additional 30 years beyond that. While the government does have the right to cancel Ecosystem Restoration Concession Licenses, such cancellations can only result from evaluations of performance and a lack of compliance with required environmental impact assessments. Land opportunity costs are not a basis for license cancellation.
Regulatory and social risk		
Risk of political instability	Medium	In the post-Suharto era starting in 1998, Indonesia entered into a process of steady democratization. Since then Indonesia has maintained steady increasing political stability at national and regional levels and rapid political and commercial engagement with the West. Several national forestry sector policies decentralizing control of forest areas to local levels have been but under renewed central government control, in particular those regarding spatial planning and new national policies on Reducing Emissions from Deforestation and Degradation.

		With the re-election of President SusiloBambangYudhoyono in 2009, political stability in Indonesia is expected to continue to grow. While corruption at all levels continues to be an significant problem in Indonesia, the central government has taken strong steps to tackle the issue through the creation of the Corruption Eradication Commission (KomisiPemberantasanKorupsi) Indonesia has received intense international attention specifically with respect to REDD, making it further accountable to achieve transparency and stability as a national process. InfiniteEARTH (IE) initially evaluated this to be a low risk factor. However, IE accepts the recommended medium risk rating for political instability at project initiation, given that positive trends in political stability and transparency have yet to be fully demonstrated. IE will monitor indicators of political stability and transparency, which are expected to continue improving in the near-term. IE anticipates that a low risk ranking for this component may be demonstrated in subsequent monitoring year evaluations.
Risk of social instability	Low	Since the end of the Suharto period, there has existed no history of large social unrest in or around the project area, the Province of Central Kalimantan or on a national level that would cause any significant risk to the project. InfiniteEARTH has focused intensively the mitigation of social conflict in the design and approach to community development in Rimba Raya. InfiniteEARTH has already begun to engage with local communities on the ground and involved them directly in project development activities. Local Government and community information gathering and sharing has been a central aspect of passing knowledge about the intentions, activities and benefits of the Rimba Raya project.
Natural disturbance risk		
Risk of devastating Fire	Medium	The Rimba Raya project has been subjected to fires over its recent history. Much of this has been the result of human induced fires for agricultural land clearing. The drainage of the peat swamps creates conditions for intense and long burning fires. Thus, one of the driving carbon mitigation functions of the project is to avoid these

		fires from occurring. This is achieved through preventing the drainage of peat, and putting in place a fire management system including fire watchtowers to rapidly detect, isolate and extinguish any fires that do occur. InfiniteEARTH (IE) initially evaluated this to be a low risk factor. However, IE accepts the recommended medium risk rating for risk of fire at project initiation, given that the fire program is in the process of being fully implemented. IE expects to be able to demonstrate the effectiveness of the Rimba Raya wildfire prevention and suppression program, following its full implementation, so that a low risk rating can be re-evaluated after project initiation.
Risk of pest and disease attacks	Low	Pest and disease attacks are not believed to have been a historical issue in the Rimba Raya project area. Ecological surveys undertaken throughout the project lifetime are one method of detecting new invasive and destructive pests or diseases that may result in carbon loss from the project area through increased tree mortality.
Risk of extreme weather events (e.g. floods, drought, winds)	Low	Central Kalimantan is subject to seasonal shifts in precipitation. River flooding and mild drying of certain peat areas are the two common extremes of these weather patterns. Flooding presents limited risk to the project area, as it is comprised almost entirely of peat swamp forest areas that are already flooded seasonally. Extended droughts would present only indirect risk in that it would make the peat more vulnerable to fire. However, fire management programs that will be invoked as a result of this project will be present to manage such risk.
Geological risk (e.g. volcanoes, earthquakes, landslides)	Low	Extreme geological events in Indonesia are experienced regularly. Most notably regular earthquakes, landslides and the 2004 Tsunami. The Rimba Raya project area is of sufficient distance from coastal waters to be impacted by a Tsunami. Risks to the project from earthquakes and landslides are negligible. Borneo ranges are non-volcanic. Only one extinct volcano exists on the island and is situated in the far northern region of the island over 1,000 km away.

Total Risk Calculation	Medium[26]	InfiniteEARTH (IE) initially evaluated total risk to be low. However, IE accepts the recommended total risk rating of medium and agrees to the required buffer withholding of 20% at the initial project verification. IE plans to re-evaluate the medium risk rating in subsequent monitoring years following full project implementation and monitoring, with special attention to those components evaluated to be medium risk at project start up.

Table 41. Risk Factors and risk ratings applicable to Avoided Planned Deforestation (APD) REDD projects

Risk factors and risk ratings applicable to Avoided Planned Deforestation (APD) REDD projects		
Risk Factor	**APD Risk Rating[27]**	
Land ownership / land management type		
Land owned by private or public forest conservation organization with a good track record in forest conservation activities and able to obtain and enforce nationally recognized legal protection of the land	Medium	Land is owned by central government. InfiniteEARTH is seeking a license for ecosystem restoration that is valid for 60 years with an option for renewal for an additional 30 years. InfiniteEARTH has a partnership with Orangutan Foundation International (OFI) to undertake forest conservation activities. OFI has a long history of conservation, forest protection and orang-utan habitat management activities in the adjacent National Park, TanjungPuting, to the west. InfiniteEARTH (IE) initially evaluated this to be a very low risk factor. However, IE accepts the recommendation to set the risk as medium for

[26] According to the VCS risk tool (VCS 2008) and the updates to the risk tool (VCS 2010a, 2010b) the highest rating determines the project's overall risk class and the required buffer withholding percentage shall be the maximum percentage in the buffer range for the determined risk class. Therefore, the total risk is assessed to be Medium and equal to a 20% withholding buffer.

[27] Classifications in accordance with VCS Guidelines on AFOLU Non-Permanence REDD Risk Rating for APD, Table 8, Pp. 9-10.

		land ownership and management at initial project verification since IE does not own the land. The legal framework and precedent for securing forest protection in Rimba Raya will be further investigated and presented in future re-evaluations of project risk, as it is IE's opinion that land protection and management can be sufficiently secured to warrant a low-risk rating in the future.
Land ownership and management dispute by local communities and/or stakeholders.	Low	Although land is legally owned by central government, local community traditional and customary use rights may arise. Land tenure and zoning is a contentious issue between national and community rights across most of Indonesia. In this case however, since the project does not dissuade or prevent normal community land uses, such as local level wood collection, hunting, fishing, use of agricultural lands, communities have few or no lost opportunity costs as a result of the project. Thus, it is possible, but unlikely that land ownership and management disputes will arise as a result of the project.
Technical capability of project developer/implementer		

No previous experience in the design and implementation of activities that may ensure the longevity of carbon benefits	Medium[28]	This is InfiniteEARTH's first project as an organization, however members of InfiniteEARTH team have extensive experience in designing and implementing several elements of the project activities. Additionally, InfiniteEARTH has the direct support of carbon forestry professionals with experience in the design of activities leading to the longevity of carbon benefits, as well as the support of partners with extensive experience designing and implementing the field portion of many project activities.
Net revenues/financial returns from the project to ALL relevant stakeholders		
Lower than pre-project or lower than alternative land-uses	Low	It is reasonably assumed that alternative land-uses for the Rimba Raya area would be the conversion of the area for growing and harvesting palm oil. While Palm Oil produces high net revenues and financial returns for the palm oil company, benefits to local communities are limited. The Project proponents are delivering the same tax and royalty revenues for the land-use permit as would palm oil so there is no net loss to governments. Additionally, project proponents have demonstrated a wide range of tangible benefits to the communities (medical, agricultural, technical, etc) that deliver substantial benefits to the communities beyond anything offered by palm oil. Certainly, project benefits to OFI, a principle stakeholder, far exceed the losses it would suffer under conversion to palm oil.
Infrastructure and natural resources		

[28] InfiniteEARTH's implementing partners have exceptional experience and technical capacity in forest conservation and this partnership reduces risk. These partners bring extensive knowledge of conservation, forest protection and community development to the project, with long-term field experience in Rimba Raya specifically. InfiniteEARTH currently holds formal working agreements with three key implementing partners, these are:

a. Orangutan Foundation International (OFI) – InfiniteEARTH and OFI continue to collaborate on the implementation of forest monitoring, reporting and protection activities on the ground. The MOU has been in place since 2008.
b. Word Education (WE) – InfiniteEARTH has held an agreement with WE since 2009 to handle all grievances as an independent third party and to support and lead community projects, such as fisheries, education, health and government relations.
c. BKSDA (A Central Government Conservation department with broad powers in fire and forest security) – InfiniteEARTH signed an MoU with BKSDA in 2010 to train communities in community-based fire fighting and will expand this agreement to include forest patrols and protection.

Low likelihood of new road(s)/rails being built near the REDD project boundary	Low	New roads may be built near the project boundary. This is likely to occur in the northern most region of the project area that is already converted for oil palm plantations. InfiniteEARTH (IE) initially evaluated this to be a very low risk factor since the concession license assures tenure and the patrol plan assures control of road invasion into the concession. However IE accepts the recommended low risk rating for new roads being built as the project is in the beginning stage of implementation. IE anticipates being able to demonstrate the appropriateness of a very low risk rating for this factor following project monitoring early in the project.
High-value non-forest related natural resources (oil, minerals, etc.) known to exist within REDD project area	Low	No non-forest related natural resources are known to exist within the REDD project area.
Palm Oil encroachment	Low	The only palm oil encroachment that could take place is from the plantation that occupies the northern notch of Rimba Raya and three years ago, OFI conducted a boundary check of the plantation and found that they had cleared some area outside of their plantation. This situation was reported in the newspapers and subsequently a meeting between OFI and PT Best representatives took place. Given the continued vigilance of OFI staff and additional staff from PT Rimba Raya, the risk of further incursion is low. The nearby oil palm plantations are owned by PT Best Agro, which could be rated as a mid-sized company that produces export-grade edible palm oil; and thus, are subject to pressure from conservation advocacy groups such as Greenpeace.
Illegal Logging	Low	Avoided planned deforestation methodology utilized for Rimba Raya does not account for community level logging. Some logging for community use will undoubtedly continue. However, logging to supply the communities' internal needs would in no way exceed the re-growth rate of the natural forest. Illegal logging that has taken place to generate cash income for villagers and middlemen will eventually be brought under control once the entire range of community support

		services are initiated by Infinite Earth.
Population surrounding the project area		
Decreasing or increasing, but with low population density (e.g., <50 people/km2)	Very Low	Local village populations are few and far between and are believed to be growing at a very low rate.
Incidence of crop failure on surrounding lands from severe droughts, flooding and/or pests/diseases		
Frequent (>1 in 10 years)	Low	Flooding on surrounding lands from intense wet seasons or fires could cause crops to fail, however communities are considered to have agricultural practices adapted to such risks or have alternative land options in neighbouring areas where practices could be temporarily relocated.
Project financial plan		
Credible long-term financial strategy in place (e.g., endowment, annuity-paying investments, and the like)	Medium	InfiniteEARTH has executed forward sales triggered upon the first verification that will create an endowment that will sufficiently fund the operational budget through an annuity for the entire life of the project and possibly in perpetuity. Confidential contracts and budgets will be shared with the validator. InfiniteEARTH (IE) initially evaluated this to be a low risk factor. However, IE accepts the recommended medium risk rating for the financial strategy at initial project verification given the current uncertainty about the compliance market for REDD credits. Through the sale of carbon credits after project verification, IE expects to be able to demonstrate sufficient financial security to achieve a low risk rating for this component at subsequent project verification.
General Risk of Fire		
Fire Risk	Medium	High fire return interval (<50 years) with adequate fire prevention measures in place
Total Risk		

Risk Ranking	Medium[29]	InfiniteEARTH (IE) initially evaluated total risk to be low. However, IE accepts the recommended total risk rating of medium and agrees to the required buffer withholding of **20%** at the initial project verification. IE plans to re-evaluate the medium risk rating in subsequent monitoring years following full project implementation and monitoring, with special attention to those components evaluated to be medium risk at project start up.

*Despite the Low-Medium risk assessment by project proponents, an overall risk rating of Medium has been applied and a **20% Non-Permanence Risk Buffer** has been conservatively withheld against carbon stocks.

Risk Assessment in Subsequent Verifications

Risk rankings for most factors were assessed to be low for the Rimba Raya project: 9 low-risk versus 2 medium-risk factors applicable to all projects, and 8 low-risk versus 4 medium-risk factors applicable to REDD projects. However, in accordance with the VCS Non-Permanence Risk Analysis and Buffer Determination Tool and Updates, the highest rating determines the project's overall risk class. Therefore, the conservative medium risk rating is applied to the project. Further, while the available buffer withholding range for medium risk projects is 10% - 20%, the maximum percentage is applied to the project for withholding.

This conservative approach is appropriate in general, as REDD projects are yet in their infancy. However, project proponents believe the inherent risk to project permanence is low for Rimba Raya for a number of reasons briefly described in the tables above. Following full project implementation and through demonstrated project stability in initial project years, project proponents plan to reassess risk in subsequent verifications with the potential to re-evaluate the 20% buffer determination set in the first project verification.

[29] According to the VCS risk tool (VCS 2008) and the updates to the risk tool (VCS 2010a, 2010b) the highest rating determines the project's overall risk class and the required buffer withholding percentage shall be the maximum percentage in the buffer range for the determined risk class. Therefore, the total risk is assessed to be Medium and equal to a 20% withholding buffer.

CL2.2. Leakage Mitigation and Estimate of Impact

Document how any leakage will be mitigated and estimate the extent to which such impacts will be reduced by these mitigation activities.

Well-designed projects employing a set of leakage mitigation strategies tend to be intrinsically less prone to some forms of negative leakage. The Rimba Raya project incorporates such design features to minimize and mitigate leakage. A number of broad mitigation strategies are described below, followed by an overview of the Rimba Raya leakage mitigation plan.

Mitigation Strategies

Site selection. Selecting a block of forest in a region that is highly inaccessible, or where all nearby forests have already been removed, can obviate the risk of activity shifting leakage. Selecting a block of forest that functions as a buffer to additional blocks of threatened forest can facilitate positive ecological leakage.

Project design. Projects that integrate activities such as forest conservation, forest restoration, community development, etc., will be more successful in reducing leakage.

Leakage contracts. Agreements between project proponents and baseline agents that specify actions to deter activity shifting can reduce negative leakage.

Monitoring and discounting. Negative leakage that cannot be avoided is monitored closely, and project carbon offsets adjusted accordingly.

The Rimba Raya Leakage Mitigation Plan

Site selection. The Rimba Raya project is located in a buffer region between Tanjung Puting National Park and a broad zone designated for economic development. By managing the park's buffer zone for conservation, creating a social and physical barrier to the park, preventing deforestation adjacent to the park and subsequent degradation inside the park, Rimba Raya facilitates positive ecological leakage.

Moreover, Central Kalimantan has seen the highest deforestation rates for any province in Indonesia, and few viable forested peatland concessions remain in the area for conversion to palm oil. In the Rimba Raya region, there are few places that deforestation could be shifted, thus conservation gains achieved by the project are likely net permanent gains for the region.

Both of these factors should reduce the potential for leakage significantly.

Project design.

- Community programs. A portion of the carbon revenues will fund World Education's improved agricultural yields program in communities around the project area. Project activities also envision capacity-building and employment of local community members, as well as a host of livelihoods programs. This broad engagement of Project Zone communities should significantly reduce pressure on Project Area forests.
- Ecosystem restoration. Project proponents will undertake a comprehensive program of reforestation and ecosystem restoration, including a community forestry component, in

degraded portions of the Project Area. This program should strengthen carbon stocks and reduce the threat of encroachment by oil palm plantations into unauthorized forests within the project's vicinity.

Leakage contracts.

- Displaced concessions. Using leakage contracts, deforested and drained land in the southern portion of the Project Area will be allocated to companies displaced by the project. This mechanism should help mitigate any negative activity-shifting leakage at the local level.
- Active plantation. Project proponents will negotiate with the active oil palm plantation north of the Project Area with the following goals:
    - Build a road to delineate current plantation boundaries, function as a firebreak, and prevent encroachment in the future;
    - Participate in design and management of drainage canals adjacent to Project Area forests
    - Contract oil palm company and its employees to assist with ecosystem restoration program on degraded Project Area land
    - Cooperate on the development of a fruit plantation for supplemental feeding of rehabilitated orangutans.

Monitoring and discounting.

- Monitoring of displaced concessionaires. The investments and actions of the four palm oil companies displaced by the project will be monitored, and the destruction of native forests and peatlands on their part will be prevented or discounted from project carbon benefits.
- Community monitoring. As part of the proposed Rimba Raya community monitoring plan, the activities of resource users affected by the project will be tracked and any leakage prevented or discounted from carbon benefits.
- Set-aside. The InfiniteEARTH double offset pledge incorporates a 50% set-aside of the project's carbon stock. This should mitigate any negative market-effects leakage at the national or regional level not accounted for by the project's leakage mitigation strategy.

Leakage Mitigation Assessment

Leakage Mitigation through "Social Barriers"

The project proponents have designed multiple compound community benefits into the project that address the underlying social drivers of deforestation. The primary elements of the project's leakage mitigation plans from a community perspective are:

- Community Employment
- Capacity Building & Transference
- Access to Clean, Safe Drinking Water
- Access to Healthcare Services
- Early Childhood Development
- Access to Micro-Credit
- Direct economic revenue share from project revenues

These projects will be funded by the project proponents and executed in conjunction with exceptional NGOs with vast experience in the areas such as:

- The Orangutan Foundation International
- World Education International

- Health in Harmony
- MBK (Micro-Credit)
- Potters for Peace (low tech, clean water systems)

Interviews with the communities and their leaders within the Project Zone have shown that the programs listed above meet and exceed the needs and expectations of the commununities. Additionally, they far exceed their current conditions as well as the benefits provided or promised by the Palm Oil industry.
See section CM1 below for a full description of the project's Social Programs aimed at mitigating leakage.

The project proponents will leverage the 5-year success record that the Orangutan Foundation International and World Education have within the Project Zone with regard to providing social benefits programs in exchange for conservation. Through a USAID grant, OFI and WE have provided agricultural and conservation educational services to the major communities within the Project Zone and have built significant goodwill and "buy-in" from the communities. Their work has laid an excellent foundation of community support for the Rimba Raya project.

<u>Leakage Mitigation through "Physical Barriers"</u>

Satellite imagery of the Tanjung Puting National Park reveals that the northwestern quadrant houses the most intact and pristine forests left in the park. Other areas of the park have been seriously degraded by human activities such as illegal logging, fires and poaching.

This is not an anomaly or simply nature's design. For over 14,000 continuous days, Dr. Biruté Galdikas and her dedicated staff have physically occupied and defended the forests in that area of the park as part of their unyielding fight to save the Endangered Bornean Orangutan. The formula is simple in design: Build Guard Posts at every access point, staff them 24 hrs a day with reliable and dedicated personnel, send out regular patrols, keep a check on fires, work closely with the Forestry Department, and always keep up the pressure.

See sections G3.2 and G3.5 for a more detailed description of the Guard Post Network and Fire Plans.

The forests of Borneo are vast and remote. Deforestation occurs because of lack of interest, lack of vigilance, lack of enforcement and lack of alternatives. InfiniteEARTH and its partners will fill these voids.

CL2.3. Net Leakage Impacts and Leakage Buffer

*Subtract any likely project-related unmitigated negative offsite climate impacts from the climate benefits being claimed by the project and demonstrate that this has been included in the evaluation of net climate impact of the project (as calculated in **CL1.4**).*

Due to the nature of the project and its activities, there are no identifiable unmitigated offsite climate impacts resulting from project activities. Positive climate impacts do not rely on technologies or activities that produce emissions in such a way that unmitigated primary or secondary leakage is likely to occur. Unexpected offsite impacts are actively mitigated through preventive activities onsite, within the project area through the scope of designated project activities.
Given this, unmitigated leakage has a value of "0" and net climate impacts remain unchanged. Net climate impacts, continues to be defined as defined in CL. 1.4.

CL2.4. Leakage and non-CO_2 Gases

Non-CO_2 gases must be included if they are likely to account for more than a 5% increase or decrease (in terms of CO_2 equivalent) of the net change calculations (above) of the project's overall off-site GHG emissions reductions or removals over each monitoring period.

No non-CO_2 gases are expected to account for more than a 5% increase or decrease of the project's overall offsite GHG emissions.

CL3. Climate Impact Monitoring

CL3.1. Initial Climate Monitoring Plan

Develop an initial plan for selecting carbon pools and non-CO_2 GHGs to be monitored, and determine the frequency of monitoring. Potential pools include aboveground biomass, litter, dead wood, belowground biomass, wood products, soil carbon and peat. Pools to monitor must include any pools expected to decrease as a result of project activities, including those in the region outside the project boundaries resulting from all types of leakage identified in CL2. A plan must be in place to continue leakage monitoring for at least five years after all activity displacement or other leakage causing activity has taken place. Individual GHG sources may be considered 'insignificant' and do not have to be accounted for if together such omitted decreases in carbon pools and increases in GHG emissions amount to less than 5% of the total CO_2 equivalent benefits generated by the project. Non-CO2 gases must be included if they are likely to account for more than 5% (in terms of CO_2 equivalent) of the project's overall GHG impact over each monitoring period. Direct field measurements using scientifically robust sampling must be used to measure more significant elements of the project's carbon stocks. Other data must be suitable to the project site and specific forest type.

A Monitoring Plan has been developed for Rimba Raya and will be revised and updated as needed. *See Annex 13 for the Monitoring Plan.*

CL3.2. Development of Comprehensive Climate Monitoring Plan

Commit to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards and to disseminate this plan and the results of monitoring, ensuring that they are made publicly available on the internet and are communicated to the communities and other stakeholders.

Community Monitoring will take place bi-annually. A monitoring plan has been developed and implemented for Rimba Raya by combining OFI's long-running forest protection and management activities with the VCS methodology for carbon stock monitoring. The Carbon and Climate Monitoring Plan should be considered a living document with adjustments being made as needed on an on-going basis as part of Adaptive Management. *See Annex 13 for the Monitoring Plan.*

Purpose of carbon and climate monitoring

The purpose of monitoring for carbon accounting is to ensure that the estimates of GHG removals presented in the VCS Project Document are being met, and to identify and account for any unplanned reductions in project carbon stocks, increase in project emissions or possible leakage outside the project boundary. Additionally, monitoring the project implementation will enable project proponents to objectively assess project components, identify gaps and deficiencies and use this information to improve both monitoring and management. This adaptive management approach is a key feature of the Rimba Raya program.

Approach to monitoring

Annual monitoring activities consist of remote sensing and G.I.S. analysis, routine field patrols and directed field sampling in areas prioritized by systematic site assessments. The monitoring system takes a hierarchical approach starting with medium resolution (30-50m) satellite imagery, then high resolution satellite or aerial imagery (5-10m), and finally with ground patrols.

A key feature of the Rimba Raya monitoring plan is to employ spatial data and tools to systematically monitor land cover change, forest degradation and carbon pools in the project area and project buffer. This is combined with ground-based surveys to investigate and record information on any activities that affect project carbon stocks and peat emissions (e.g. fire, logging). Such an approach improves the efficiency and effectiveness of directed field visits, which is essential for reliably monitoring the Rimba Raya project boundary in extensive and inaccessible peat swamplands.

This type of approach to field monitoring has been employed by project partner, Orangutan Foundation International, in the project area since 2004. Rimba Raya monitoring builds on the existing field reconnaissance, forest survey and G.I.S. team training, protocols and monitoring systems already in place for many years.

Types of data and information to be reported

As part of monitoring, any increases in GHG emissions that occur within the project boundary after the start of the project must be recorded and deducted from the baseline estimated emissions. The following information will be recorded in the project database and reported at annual verifications:

1. Area where natural or anthropogenic disturbances (including fire, illegal logging and other land use change) occurred within the project boundary by date, location, biomass lost or affected, and the preventative or curative measures, if any implemented.

2. Number and location of logging gaps by date, location, biomass lost or affected, and the preventative or curative measures, if any implemented.

3. Area and depth of peat burned within the project area by date, location, estimated peat emissions, and the preventative or curative measures, if any implemented.

4. Area of peat, if any, that was drained within the project boundary by date, location, estimated peat emissions, and the preventative or curative measures, if any implemented.

5. Information on forest protection practices

Data sources

Monitoring data will be derived from multiple direct sources including field measurements recorded using GPS, hardcopy field data sheets and electronic data recording instruments as well as spatial analysis tools including remote sensing, G.I.S., statistics and spreadsheet software. Other scientific research, academic literature and expert opinion will be used to supplement field measurement and analysis where appropriate and as recommended by the methodology. Such indirect sources are necessary for developing and refining reliable assessment tools for carbon accounting in peat swamps where the science is still new and growing. It is hoped that publication of Rimba Raya monitoring and research can help build this important regional database for similar REDD peat conservation projects.

Monitoring description

Monitoring will target landcover change and activities potentially affecting carbon stocks and GHG emissions in defined strata of the project boundary, project management zone (including 3km buffer) and leakage areas. Estimation, modeling, measurement and calculation approaches will follow requirements of the VCS methodology.

Routine monitoring patrols at guard posts, major waterways and project access points will be ongoing monthly as part of forest protection activities throughout the project management zone. Patrol activities will be compiled in quarterly reports.

Land cover change monitoring using readily available satellite imagery such as Landsat and ALOS will be monitored quarterly to ensure complete temporal and spatial coverage of the project management zone. In addition, high spatial resolution imagery such as Quickbird, Ikonos or LIDAR satellite data or aerial surveys will be collected annually for the carbon accounting area to record forest condition and identify forest gaps. Detected change will be recorded and investigated using image analysis techniques followed by survey patrols. These patrols will be deployed as needed depending on the frequency and scale of deforestation and will be used to record any new logging, canal building or other deforestation activity as described in the methodology. It is expected that such activities will be limited in the project area and that two to three annual patrols will be sufficient to report on activities and record damage. Land change monitoring reports will be compiled annually.

Fire monitoring will be conducted over a range of frequencies depending on the season and fire condition and will rely on the Fire Information for Resource Management System (FIRMS) delivery of MODIS satellite maps of hotspot and fire locations. After the rainy season begins, usually December, fire map data will be monitored monthly. As the dry season approaches, usually July, fire map data will be monitored weekly. And at the height of fire season, usually August-October, fire data will be monitored daily. Satellite monitoring will be implemented as part of the comprehensive fire plan and will be used to direct and deploy fire fighting and survey teams on an as-needed basis. Fire monitoring and response activities will be reported annually at the end of fire season surveys.

Biomass plots surveyed at the project start were established on permanent transects and recorded to facilitate regular monitoring over the life of the project. Such monitoring is additional to methodology requirements but can provide detailed accounts of forest condition over time. Provided that all required land change monitoring necessary for carbon accounting can be accomplished, biomass plots will be resurveyed every four to five years. By surveying in years 1, 5 and 10, three surveys will have been completed by the ten-year baseline reassessment required by VCS, thus allowing trends in biomass change to be detected.

The project boundary and stratification will be monitored for any changes to land cover that reduce project carbon stocks or increase GHG emissions. Since the project boundary is not a functionally discrete hydrological unit, a 3km buffer zone surrounding the project boundary will be monitored for new drainage activities that could potentially impact peat emissions inside the project boundary. Stratification of the project area will be monitored and periodically updated to incorporate any land change into revised land cover classification maps based on new data.

Leakage or activity displacement outside the project boundary will be monitored and accounted in order to adjust net GHG emissions avoided by the project. Monitoring will include existing or new concessions operated by PT Best (the agent of baseline deforestation) as well as any unpermitted land conversion by PT BEST.

Monitoring components, times and periods

There are eight major components of monitoring: three that are focused on project conditions and forest protection (Table 42) and five that are focused on annual land change assessment for carbon accounting (Table 43).

Table 42. Monitoring Components: Project Conditions and Forest Protection

Monitoring Component (pg ref in Meth)	Activity and Years	Times and periods	Detection frequency	Remote sensing data, resolution, coverage and years	Field survey frequency	Reporting frequency
Boundary (p.67)	Mark in field [Yr1 temp stakes on boundary with palm oil, Yr2& Yr3 permanent stakes in other high risk areas – replace as needed]	Year-end	Non-specific	n/a	1 field survey annually	Annually
	Patrol Yr1-Yr30		Annually	ALOS 50m or Landsat 30m + high res aerial or satellite imagery (1-5m) every 2 years starting Yr2		
Stratification (p. 68)	Land cover classification (Yr1 develop model, Yr2-3 refine model, Yr 4-30 apply standard model)	Year-end	Annually	ALOS 50m or Landsat 30m + field data + sample high res aerial or satellite imagery (1-5m) for accuracy assessment in Yr 1,3,5 etc. Full coverage high res aerial or satellite imagery (1-5m) + field data in Yr 2,4,6 etc.	1 field survey annually	Annually
Forest Protection (p. 68)	Routine patrols and as-needed intervention (expanding coverage and intensity of intervention Yr-1 to Yr-3 in conjunction with community and stakeholder involvement)	Year-round	Quarterly	ALOS 50m or Landsat 30m + SPOT and high resolution imagery collected for boundary and strata monitoring	1 patrol quarterly and as-needed	Quarterly

Table 43. Monitoring Components: Land Change Assessment for Carbon Accounting

Monitoring Component (page reference in Methodology)	Activity and Years	Times and periods	Detection frequency	Remote sensing data, resolution, coverage and years	Field survey frequency	Reporting frequency
Land change (p. 70, 83)	Detection and area calculation of land change caused by agents other than logging or fire (e.g. mechanical clearing)	Year-round	Semi-annually	Landsat 30m for detection plus targeted high resolution imagery (aerial or satellite with 1-5m resolution) as needed to support analysis and field surveys	2-3 field surveys annually	Annually
Logging (p. 71)	Detection and area calculation of deforestation caused by logging	Year-round with increased activity during wet season	Semi-annually	high resolution imagery (aerial or satellite with 1-5m resolution) as needed for logging gap analysis	2-3 field surveys annually	Annually
	Detection and survey of transport canal-building associated with logging			high resolution imagery (aerial or satellite with 1-5m resolution) and ground data		
Fire (p.78)	Detection of fire ignitions, calculation of burn areas (deforestation associated with fire)	Year-round with increased activity during dry season	Monthly, weekly, daily	MODIS imagery (1 km thermal band detects fires as small as 100m2 and imagery is collected and posted daily)	2-3 field surveys annually	Annually
Biomass plot surveys (not required)	Survey of above ground biomass originally conducted for the baseline carbon assessment	End of year	None	linked to high resolution aerial imagery (1-5m)	1 field survey every five years	10-year baseline reports
Leakage (p.40)	new permit activity	Year-round(first five years of project 2009-2014)	Quarterly	n/a	n/a	Annually
	Spatial analysis of new palm oil in areas of possible leakage	End of year (first five years of project 2009-2014)	Annually	Landsat 30m for palm oil boundary interpretation and delineation	none	Annually

Monitoring roles and responsibilities

Monitoring will be carried out by RRC and OFI professional field and GIS teams under the direction of the project coordinator. Monitoring systems have been in place for the project management area since 2005 and have been and will continue to be improved by the project since 2008. Guard posts are staffed 24-hours with two full-time staff that carry out routine observations, nearby patrols and daily reporting via radio to the OFI office. The office operations manager records daily reports into a permanent log book. The GIS team led by a GIS manager collects remotely sensed imagery and conducts monitoring analyses in the office.

These analyses are provided to the field manager who uses this information to plan and schedule field surveys. The field manager prepares transportation and logistics and handles field budgets. Field team leaders direct staff in the field for conducting surveys, recording data and delivering data back to the GIS team who conducts data entry. Fire monitoring is similarly implemented with a specialized fire team manager and trained fire team. Field reports are written by field team leaders and provided to the project coordinator, as are GIS data and maps. The project coordinator uses this information to compile quarterly and annual reports and conduct or supervise the carbon accounting that must be reassessed every year prior to verification. The project coordinator also ensures the QA/QC plan is followed and is responsible for updating SOPs and coordinating regular team training as well as training of new personnel.

Managing data quality, storage and access

Managing data quality is key to conducting successful monitoring and will be accomplished by implementing a series of protocols and standard operating procedures, conducting annual training for field staff, implementing a QA/QC plan and assigning senior personnel to supervise key phases in data handling.

Field survey protocols are described in the Carbon Stock Assessment SOP and Forest Protection SOP. Data handling, storage and access methods follow the QA/QC plan as required by the VCS methodology. These plans will be employed by project staff, updated annually, and included in annual monitoring reports.

In accordance with the VCS, the project proponent is committed to storing all project data in a secure and retrievable manner for at least two years after the end of the project crediting period. Project data will be stored and regularly maintained on redundant external hard drives at onsite (Pangkalan Bun, Central Kalimantan) and offsite (Jakarta) locations and secured with backup software using standard protocols. Any changes in these locations will be listed in annual verification reports. Project data will be managed by the Rimba Raya Conservation (RRC) project coordinator in conjunction with the GIS manager to ensure security, accessibility and long-term storage. In order to facilitate project management and long-term accounting, all primary data outputs supporting annual verification including the spatial database, will be stored and maintained for each 10-year crediting period.

COMMUNITY SECTION

CM1. Net Positive Community Impacts

(Study conducted by Daemeter Consulting)

CM1.1. Estimate of Impact of Project Activities on Communities

Use appropriate methodologies to estimate the impacts on communities, including all constituent socio-economic or cultural groups such as indigenous peoples (defined in G1), resulting from planned project activities. A credible estimate of impacts must include changes in community well-being due to project activities and an evaluation of the impacts by the affected groups. This estimate must be based on clearly defined and defendable assumptions about how project activities will alter social and economic well-being, including potential impacts of changes in natural resources and ecosystem services identified as important by the communities (including water and soil resources), over the duration of the project. The 'with project' scenario must then be compared with the 'without project' scenario of social and economic well-being in the absence of the project (completed in G2). The difference (i.e., the community benefit) must be positive for all community groups.

At the Millennium Summit in September of 2000, the largest gathering of world leaders in history adopted the UN Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and elaborating a series of time-bound targets, with a deadline of 2015, that have become known as the Millennium Development Goals. The Millennium Development Goals (MDGs) are the world's short-term, quantified targets for addressing extreme poverty in its many dimensions – income poverty, hunger, disease, lack of adequate shelter and exclusion – while promoting gender equality,

education, and environmental sustainability. They are also basic human rights – the rights of each person on the planet to health, education, shelter, and security. In an effort to create a social buffer for the Project Area and nearby Tanjung Puting National Park, InfiniteEARTH has designed many project activities around targets and success indicators proposed by the MDG program for Indonesia (for a complete description of targets and indicators, see Annex 16):

Goal 1: Eradicate extreme poverty and hunger
Goal 2: Achieve universal primary education
Goal 3: Promote gender equality and empower women
Goal 4: Reduce child mortality
Goal 5: Improve maternal health
Goal 6: Combat HIV/AIDS, malaria and other diseases
Goal 7: Ensure environmental sustainability
Goal 8: Develop a Global Partnership for Development

<table>
<tr><th colspan="25">Table 44. InfiniteSUSTAINABILITY Matrix for Rimba Raya Monitoring Plan & UN MDGs</th></tr>
<tr><td rowspan="2">Rimba Raya Collateral Benefits Programs</td><td colspan="24">Meeting and Exceeding United Nations Millennium Development Goals for 2015</td></tr>
<tr><td colspan="3">1 ERADICATE EXTREME POVERTY AND HUNGER</td><td colspan="3">2 ACHIEVE UNIVERSAL PRIMARY EDUCATION</td><td colspan="3">3 PROMOTE GENDER EQUALITY AND EMPOWER WOMEN</td><td colspan="3">4 REDUCE CHILD MORTALITY</td><td colspan="3">5 IMPROVE MATERNAL HEALTH</td><td colspan="3">6 COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES</td><td colspan="3">7 ENSURE ENVIRONMENTAL SUSTAINABILITY</td><td colspan="3">8 GLOBAL PARTNERSHIP FOR DEVELOPMENT</td></tr>
<tr><td rowspan="2">Roll Out Plan</td><td colspan="4">2010</td><td colspan="4">2011</td><td colspan="4">2012</td><td colspan="4">2013</td><td colspan="4">2014</td><td colspan="4">2015</td></tr>
<tr><td colspan="4">0%</td><td colspan="4">20%</td><td colspan="4">40%</td><td colspan="4">60%</td><td colspan="4">80%</td><td colspan="4">100%</td></tr>
<tr><td rowspan="2">Construction & operation of Guard & Fire Towers and Orangutan Care Facilities</td><td colspan="8">1 ERADICATE EXTREME POVERTY AND HUNGER
Indicators:
#1-5</td><td colspan="8">3 PROMOTE GENDER EQUALITY AND EMPOWER WOMEN
Indicators:
#11</td><td colspan="8">7 ENSURE ENVIRONMENTAL SUSTAINABILITY
Indicators:
#25-29</td></tr>
<tr><td colspan="16">The construction and ongoing operation of the guard and fire towers and the orangutan care facilities provides substantial employment opportunities to the local community at well above subsistence levels wages. In particular, the orangutan care facilities will be staffed predominantly by women</td><td colspan="8">Community staffed towers and care facilities creates a strong physical and social net around the project area and the adjacent Tanjung Putting Park</td></tr>
<tr><td rowspan="2">Equal Opportunity Employment at Rimba Raya Reserve</td><td colspan="6">1 ERADICATE EXTREME POVERTY AND HUNGER
Indicators:
#1-5</td><td colspan="6">3 PROMOTE GENDER EQUALITY AND EMPOWER WOMEN
Indicators:
#11</td><td colspan="6">7 ENSURE ENVIRONMENTAL SUSTAINABILITY
Indicators:
#25-29, 32</td><td colspan="6">8 GLOBAL PARTNERSHIP FOR DEVELOPMENT
Indicators:
#45-48</td></tr>
<tr><td colspan="6">Employ at least one member in 50% of all families in the project area by 2015</td><td colspan="6">Target 50% of all employment for women</td><td colspan="6">Create a social and physical barrier around the reserve by linking community welfare with conservation</td><td colspan="6">Make local communities financial stake holders in the success of the project</td></tr>
<tr><td rowspan="2">Fuel-Efficient, Low Emissions, Biomass Cook Stoves, Bio-Char Kilns, & Solar Lighting</td><td colspan="12">4 REDUCE CHILD MORTALITY
Indicators:
#13-15</td><td colspan="12">7 ENSURE ENVIRONMENTAL SUSTAINABILITY
Indicators:
#25-29</td></tr>
<tr><td colspan="12">Indoor air pollution is a significant health hazard, particularly for pregnant women and children and can lead to long-term chronic health issues. The lack of adequate lighting prevents children from reading and studying during non-daylight hours when usually they are engaged in thefamilies horticulturalactivities.</td><td colspan="12">A significant amount of pressure is placed on local forests by rural communities simply from basic fuel source needs for cooking and for light during the12 hour equatorial nights.</td></tr>
</table>

Carbon, Community, & Biodiversity Monitoring	1 ERADICATE EXTREME POVERTY AND HUNGER — Indicators: #1-5	3 PROMOTE GENDER EQUALITY AND EMPOWER WOMEN — Indicators: #11	7 ENSURE ENVIRONMENTAL SUSTAINABILITY — Indicators: #25-32
	Locally staffed monitoring programs provide capacity building and above subsistence level wages	Monitoring jobs are easily filled by women	As the adage goes: "What gets measured, gets managed"
Capacity Building Programs	3 PROMOTE GENDER EQUALITY AND EMPOWER WOMEN — Indicators: #11	7 ENSURE ENVIRONMENTAL SUSTAINABILITY — Indicators: #25-31	8 GLOBAL PARTNERSHIP FOR DEVELOPMENT — Indicators: #45-48
	Capacity building programs will provide essential transferable skills, giving the community members, particularly women, viable new employment options	Nearly all of the capacity building programs are centered around conservation awareness and the skills necessary for the implementation of environmental initiatives	- Agriculture: World Education -Orangutan Conservation: OFI -Eco-Tourism: Seminole Indians -Micro-Finance: Yamida or MBK
Annual Grants to OFI, TPNP, Local Universities for Scientific Research	7 ENSURE ENVIRONMENTAL SUSTAINABILITY — Indicators: #25-29	8 GLOBAL PARTNERSHIP FOR DEVELOPMENT — Indicators: #45-48	
	Funding of grants to local universities and NGOs for scientific research and linking them with outside organizations supports local capacity building and promotes local engagement in the conservation effort. Providing direct funding to the Tanjung Putting National Park Management Authority provides tangible additional protection and therefore significant positive leakage for/from the park (an area four times the size of the project area)		
Community Centers, Libraries & "Early Development" Program & "One Laptop per Child"	2 ACHIEVE UNIVERSAL PRIMARY EDUCATION — Indicators: #6-8		
	Make early childhood education and development programs available to every child in all communities within the project zone via learning materials in the community centers and through funding of trained instructors and training programs for instructors from the communities		
Immunization Program	4 REDUCE CHILD MORTALITY — Indicators: #13-15	6 COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES — Indicators: #21-24	
	Fund and promote malaria prevention methods, programs and related equipment to reduce the incidence of child mortality from malaria in the communities by half. Cut the mortality rate from tuberculosis amongst children and adults by half		

Phinisi Floating Clinic	Indicators: #13-15; Indicators: #16-17; Indicators: #21-24	Provide mobile Medical & Dental, Emergency medical, professional maternity care including birthing, and minor surgery to the communities along the Seruyan River
Micro-Finance	Indicators: #1-5; Indicators: #11; Indicators: #25-32; Indicators: #45-48	A portion of the revenue share with the local communities will be delivered through our micro-finance program. As with most micro-finance programs, ours will focus on women as the primary beneficiary group, funding programs such as the seedling/sapling greenhouse nurseries, small scale eco-tourism (home stays), poultry and small scale low impact aquaculture projects, etc. InfiniteEARTH will subcontract the administration of these programs to Yamida or MBK
Restoration Project through Community Based Agro-Forestry & Aquaponics	Indicators: #1-5; Indicators: #25-29; Indicators: #45-48	Achieve restoration and reforestation goals through integrated natural forest re-growth with community based cash crop, multi-story mixed agro-forestry and low-impact aquaculture programs that alleviate hunger, poverty and pressures on the surrounding primary and secondary forests. Execute in cooperation and participation of the palm oil concessionaires (as JV partners) in order to address leakage risk.
Community-Based Eco-Tourism	Indicators: #1-5; Indicators: #11; Indicators: #25-29; Indicators: #45-48	Create a “sister city” (sister village) type program with the Seminole Indian communities in the Florida Everglades who have a long and successful history of community based eco-tourism based on indigenous cultures and swamp forests. From this collaboration and knowledge transfer, create a community based eco-tourism business for the communities in the project area through micro-financing program and through potential JVs with intl. groups

**At the close of 2015, project proponents will assemble a review board for the purposes of assessing the extent and degree of completion of these goals. The review board will consist of third-party service providers and advisors to the project, community project management committee members, and other strategic advisers drawn from related NGOs in the region. At this time, recommendations will be solicited for a new set of goals, targets, and indicators for the remainder of the project lifetime. The review board will most likely rely on new MDGs set forth by the UN at that time.*

CM1.2. Impact of Project Activities on High Conservation Values

Demonstrate that no High Conservation Values identified in G1.8.4-6 will be negatively affected by the project.

(Study conducted by Daemeter Consulting)

Maintaining and enhancing forests and other natural ecosystems is key to protecting HCVs 4-6 and their associated sub-values in the Project Zone, as described and identified under Sections G1.8.4-6.

Some of these HCV sub-values require attention to specific areas within the Project Zone, including: preserving mature forest for natural fire breaks near sources of fire in the south (HCV 4.3); protecting shoreline forest or other natural vegetation along Lake Sembuluh; rehabilitating riparian forest zones along the Seruyan and its major tributaries (HCV 4.1); and monitoring communal forest areas used for subsistence timber production outside of the Project Area but inside the Project Zone east of the Seruyan (HCV 5). Additionally, maintenance of some HCVs will require education programs for local communities, e.g. to reduce or eliminate the use of fire in the open wetlands in the south where it has been suggested fishermen do this periodically to renew seasonal shallow water fishing grounds.

None of the planned project activities will have a negative impact on HCVs in the Project Zone. Project activities are heavily focused on maintaining and enhancing forests and natural ecosystems, and thus the environmental, social, and cultural benefits derived from them. Such activities will have a strong positive impact on HCVs 4-6. Table 45 below summarizes key threats to HCVs and recommended project activities to address threats within the framework of the project.

Table 45. Threats and management recommendations for HCVs 4-6 in the Project Zone		
HCV	**Threats to HCV**	**Management Recommendation & Activities**
4.1	Oil palm expansion and deforestation leading to continued pollution and degradation of the watershed draining into the Seruyan River on which communities depend for water & fisheries (see also HCV 5)	Prevent further oil palm expansion; maintain and enhance remaining forests in the Project Zone; possibly rehabilitate select riparian forest zones; prevent spread of forest fires, especially into peat areas with direct impact on water quality of the Seruyan
4.2	Deemed not present	N/A
4.3	Continued fire, illegal logging, and oil palm expansion	Protect all remaining forests (esp. natural forests) and wetlands from periodic fire; prevent further conversion to industrial scale agriculture, which increases fire risk; reduce possible deliberate use of fire for renewal of shallow water fishing grounds through education and awareness campaigns
5	Water: pollution and sedimentation of the Seruyan from oil palm; pollution from local human populations, in particular river use for sanitation purposes; conversion of riparian forests.	Water: Prevention of further oil palm expansion; education and outreach to create viable safer alternative for public sanitation; prevention of further conversion and loss of riparian forests, as well as possible rehabilitation of key riparian zones.
	Fisheries: same as for water.	Fisheries: same as for water above, plus planned efforts to explore potential for facilitating communities to organize and establish a fisheries cooperative, local rules and management regulations, and associated local enforcement bodies.
	Building Materials: forest loss, especially through land clearance related to oil palm expansion, but also including small scale agriculture.	Building materials: Prevention of forest loss by oil palm expansion and possible development of local bodies to manage local timber harvesting levels to promote chances for long-term sustainable supplies.
	Fuel wood: forest loss (more data required on exactly where such fuel wood is sourced.	Fuel wood: prevention of large-scale natural vegetation clearance for oil palm.
6	HCV deemed unlikely but potentially present in the form of remnant natural forest areas east of the Seruyan (outside the Project Area but inside the Project Zone) that are managed communally for subsistence wood production; further research is required to understand if such forests have cultural meaning in addition to their utility as wood and fiber sources.	Prevention of forest loss by oil palm expansion and possible development of local bodies to manage communal forest areas in a more structured fashion to promote chances for long-term sustainability of forest areas.

CM2. Offsite Stakeholder Impacts

CM2.1. Potential Negative Offsite Stakeholder Impacts

Identify any potential negative offsite stakeholder impacts that the project activities are likely to cause.

If the project successfully prevents oil palm companies from operating in the Project Area, some people who might have been employed by these companies may not have access to employment in the region. The overwhelming trend in standard employment practices of local palm oil companies is to hire transmigrant labor from offsite locations such as Java and Sumatra. Therefore, in practice very few of these employees would have been hired from inside Project Zone communities and those that would be employed would most likely be hired on an "as needed" seasonal basis. During interviews with the local communities, project proponents, World Education, OFI and Daemeter all independently found that only a handful of community members were employed by the large palm oil operator on the northern border of Rimba Raya. *See Community sections for more details.*

There is a history of illegal logging inside the Project Area and extending into Tanjung Puting National Park, and evidence that some illegal logging activities may be ongoing in the southern portion of the Project Area. If project activities are successful in protecting these forests and eliminating the threat of illegal logging, then individuals who rely on this practice for their livelihoods will see their benefits reduced. However, available information indicates that most if not all large-scale illegal logging is undertaken by communities from outside the Project Zone, and that they have no traditional or communal claims to the land. The loss of benefits derived from such illegal activities is outside the scope of project requirements as defined by the CCB standard.

<u>Threat to Subsistence Livelihoods</u>

Project Proponents recognize that one of the fundamental components to Rimba Raya's success is the participation and support of affected communities. Villages have patterns of hunting and harvesting that are both steeped in tradition and contribute to local economies. Consequently, it is important that efforts at protecting the forest do not inadvertently infringe upon these activities. Concurrently, there are concerns that a reduction in regional palm activity would diminish employment opportunities on plantations, further harming local economies. Taken together, it is necessary to address possible negative community impacts from the project.

Although InfiniteEARTH aims to safeguard the forest against the incursion of palm oil plantations, there will *not* be an imposition of curbs to traditional modes of hunting and harvesting. InfiniteEARTH recognizes the economic and cultural value of such activities, and does not seek to restrain them. In fact, curbs are largely unnecessary, as hunting and harvesting from the forest are not significant contributors to local economies. Moreover, the opportunity cost of jobs from palm is minimal, as most labor is hired from outside of local communities. InfiniteEARTH will also provide employment through the provision of social service programs.

Hunting – Communities in the Project Zone are predominantly Muslim. To that end, they tend not to engage in the hunting of bush meat – such as wild boar – that are common in other parts of Indonesia. Social surveys indicated that hunting is limited to deer which can be found in and around the project area. Meat protein is largely acquired through fishing in the Seruyan River and project area and poultry raising in villages. Maintaining local peat swamp and other forest types through project actvities is expected to improve fish and game stocks used by communities.

Forest Harvesting – In the past, many communities planted dry rice and vegetables and collected rubber from rubber gardens. From 2005 – 2008, however, monthly flooding has limited their livelihood activities to fishing and palm sugar production (from the tree *Arenga pinnata*). Surveys indicated that Project Zone communities are not actively engaged in the harvesting of forest beyond simple usage. As a means to provide further revenue soruces to the communities from sustainable activities, InfiniteEARTH will incorporate a “Jungle Rubber” project into its reforestation efforts. *See Community and Biodiversity sections for further information.*

Employment – In Kalimantan, a standard palm oil plantation employs one person per every eight hectares of land. The communities within Rimba Raya comprise roughly 2,000 families. Given the size of Rimba Raya, the number of workers required to work on palm concessions would comfortably exceed the supply of labor provided by Project Zone communities. To compensate for the shortfall, the majority of laborers who would work in palm would be hired from other parts of Indonesia (primarily Java). Indeed, it is common for palm companies to hire laborers from outside of local communities. There are two reasons for this: migrant laborers are less concerned with protecting local forest; and as migrant laborers become economically dependent on palm, they tend to be more loyal to the company. Palm companies’ preference for hiring outside labor thereby limits opportunities for Project Zone communities to benefit from palm employment. The opportunity costs associated with palm employment will thus not have a large impact on Project Zone communities.

Moreover, InfiniteEARTH’s double offset program will provide revenue into a non-profit foundation that will create jobs through the provision of social services. In addition to the positive externalities generated by implementing UN Millennium Goals, the foundation will create direct employment in fire prevention, forest security, and Orangutan care. Increased access to education, healthcare and microfinance will also positively affect local economies.

CM2.2. Mitigation Plans for Negative Offsite Stakeholder Impacts

Describe how the project plans to mitigate these negative offsite social and economic impacts.

To a large extent, the offsite stakeholders impacted by the loss of oil palm employment are impossible to identify as they are brought in for temporary work as needed. With current plans on the part of the national and provincial government to expand palm oil plantations throughout Indonesia, this speculative group of negatively impacted stakeholders should have ample employment opportunities in other oil palm plantations.

As a matter of policy, members of Project Zone communities will be given priority in hiring for most project-related positions. To the extent that positions are not filled internally, however, they will be offered at large, and offsite stakeholders who are negatively impacted by the loss of oil palm employment opportunities may apply as well.

Finally, for those people who currently work in the active plantation to the north of the Project Area and who would be negatively impacted by the project's plans to prevent further expansion of that plantation into the Project Area (expansion that is currently illegal by the terms of the plantation's license), the project intends, via leakage mitigation contracts, to undertake a cooperative forest rehabilitation program that would offer these stakeholders additional employment opportunities.

CM2.3. Net Impacts on Other Stakeholder Groups

Demonstrate that the project is not likely to result in net negative impacts on the well-being of other stakeholder groups.

All off-site stakeholders negatively impacted by project activities either belong to an inchoate group (displaced oil palm plantations) or are engaged in illegal activities (logging operations). Conversely, project activities may result in substantial positive off-site impacts both from maintenance and improvements in ecosystem services and from secondary and indirect effects of social and economic programs undertaken by project proponents.

Ultimately, estimating net impacts on off-site stakeholders is too speculative to be of much use, although it should be noted that the total potential off-site impacts are minor in comparison to the significant and overwhelmingly positive on-site stakeholder impacts of proposed project activities.

CM3. Community Impact Monitoring

CM3.1. Preliminary Community Monitoring Plan

Develop an initial plan for selecting community variables to be monitored and the frequency of monitoring and reporting to ensure that monitoring variables are directly linked to the project's community development objectives and to anticipated impacts (positive and negative).

The Rimba Raya project is committed to the development of sustainable livelihoods for communities in the Project Zone. Monitoring activities used to measure the project's impact on community livelihoods will need to be designed to suit specific goals and interventions. A sustainable livelihoods framework (based on Bebbington 1999) can be used to guide this process. The framework is based on the premise that user groups and individual households have five capital assets, which they can use for various livelihood outcomes. These five capital assets include:

1. Physical capital (e.g., household assets, agricultural implements, transport, energy, communication and other infrastructure, technology).
2. Financial capital (e.g., credit, savings, remittances, pensions).
3. Social capital (e.g. adherence to rules, relationships of trust, mutuality of interest, leadership, kin and ethnic networks, social networks or organizations, access to wider institutions, ability to demand).
4. Natural capital (e.g. soil fertility, water resources, forest resources, grazing resources, land quantity and quality)
5. Human capital (e.g. knowledge and information, skills, health, ability to work).

All five of these capital assets are closely linked to each other and important to the development of sustainable community livelihoods. In the table below, the capital assets approach is used to frame principles, criterion, and indicators that may be appropriate for the Rimba Raya Project Zone. The listed criteria and indicators were chosen based on community livelihood needs identified during the preliminary social survey. Specific interventions will initially be chosen with reference to the UN Millennium Development Goals (See Section CM1.1, above), and adjusted to meet local needs in a participatory fashion, with target communities helping to identify the appropriate principles, criteria, interventions, and indicators for their area. Also note that criteria can be developed for various scales (e.g., household, village, and district levels). The examples below focus on the household and village level.

Table 46. Parameters for the Rimba Raya Community Monitoring Plan			
Capital Asset	**Principle**	**Possible Criterion**	**Possible Indicator for the Seruyan Area**
Physical	Physical capital is maintained and improved over time.	Physical status of housing is maintained or improved.	Number of households that have upgraded from leaf to aluminium roofs.
		Access to fishing equipment is maintained or improved	Number of individuals with fishing boats or other fishing equipment.
Financial	Financial capital grows and is equitably distributed.	Household savings grow and are equitably distributed.	Income and expenditures of families (e.g., proportion of households with income higher than the current level of income)
		Job opportunities increase and are equitably distributed.	Employment rates (e.g., number of family members with a job or business; distribution of job opportunities across gender and social status)
Social	Maintenance of a set of dynamic rules and norms.	Increased community involvement in community organizations.	Number of households with members involved in at least one community organization or program
		Increased participation in formal electoral process.	Proportion of families who participate in the formal electoral process (Number of households with actual voters.)
		People are empowered with regard to negotiations over land rights.	Number of grievances recorded against oil palm companies declines.
		Local village laws, *adat*, are maintained and enforced.	Level of adherence to *adat* laws and frequency of penalties being given for those breaking them.
Natural	Yield and quality of natural resource goods and services is improved.	Communities have increased access to arable land.	Decrease in flooding of their agricultural land. Increase in productivity of arable land.
		Communities have land security.	Forests and agricultural areas that are important to meeting basic needs become available.
		Water quality of river improves	e.g., water quality monitored for turbidity and pollution, draining of peat swamps in the area stopped, hopefully in turn reducing flooding

Human	Improved and equitable distribution of human capital. Improved and equitable distribution of human capital.	Hygiene improves	Proportion of households or individuals with knowledge and information on hygiene (post promotion through communication, social mobilization, community participation, social marketing, and/or advocacy).
			Number of incidence of diarrhoea, typhoid
		Sanitary sewage disposal increases	Proportion of households with sanitary toilet facilities (not excreting into the Seruyan River where they wash dishes and bathe)
			Improved sanitation facilities (hand washing soap, safe water containers, water treatment)
		Communities have access to clean water for bathing, cooking and drinking	Percentage of households with access to clean water
			Number of water treatment facilities in a village
		Community health and access to health care improves	Mortality rates (infant, child, mother)
			Existence of medical centers (including number of doctors and nurses and number of patient visits)
			Prevalence of acute and chronic malnutrition and disease
		Education and access to education and capacity building activities improves	Number of children attending school
			Percent of family members who go/have gone to school
			Number of family members who are able to read and write
			Number of family members who have attended some type of livelihood related training

CM3.2. Preliminary High Conservation Values Monitoring Plan

Develop an initial plan for how they will assess the effectiveness of measures used to maintain or enhance High Conservation Values related to community well-being (G1.8.4-6) present in the project zone.

All of the monitoring described above under Section CM3.1 applies directly to monitoring under this section for ensuring the maintenance of HCVs 4-6 in the Project Zone. Moreover, an initial social survey of the Project Zone found that rivers provide an important source of water and fish protein to local communities. These HCV5 and HCV6 areas will be mapped definitively in parallel with community land mapping activities described in Section CM3.3 below as part of a full HCV assessment.

CM3.3. Development of Comprehensive Community Monitoring Plan

Commit to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards and to disseminate this plan and the results of monitoring, ensuring that they are made publicly available on the internet and are communicated to the communities and other stakeholders.

Project proponents are committed to developing a full community monitoring plan within twelve months of validation against the CCB Standards. In addition to the development of a monitoring plan, Phase II of the Community Assessment – to be conducted by Daemeter Consulting – will focus on four main tasks:

Project proponents commits to disseminate this comprehensive community monitoring plan and the results of monitoring, ensuring that they are made publicly available on the internet and are communicated to the communities and other stakeholders

<u>Community Needs Assessment</u>

An in-depth community needs assessment will be carried out for each community in the Project Zone prior to any on-the-ground project implementation. Such an assessment is important for identifying gaps between community needs and desired conditions with regard to all five capital assets (as described in Section CM3.1 above) – the foundation for creating sustainable livelihoods. This information will feed into all elements of project development, and will particularly guide the design of suitable community development programs. Importantly, it will also initiate relationship-building, crucial to project success. Engaging communities early in the project, with a focus on their needs, is also an important way to build a sense of belonging to the project. It must be noted that this can also be one of the riskiest stages in project development as it is often the stage where communities' hopes are raised and expectations can soar. Communities will be hoping for programs that offer immediate tangible benefits (jobs, healthcare, and other income-related activities). If such hopes are unwittingly created during this initial engagement, and subsequently unmet, conflict will likely arise, risking project success. It is critical that this assessment is undertaken in a manner that manages this risk. To avoid these risks, this assessment will be undertaken in cooperation with World Education, which has active programs and a productive working relationship in three Project Zone villages (Baung, Ulak Batu and Palingkau).

LARASITA

Project proponents will work together with the local BPN office (*Badan Pertanahan Nasional*) through its LARASITA Program (*Program Layanan Rakyat untuk Sertifikat Tanah*; Public Service for Land Certification) to establish formal land ownership for communities. This will be a major step towards resolving current land tenure issues and safeguarding against future ones. Involvement in this program will be done in parallel with the participatory mapping of community land and resources. To date, the land conflicts that have occurred in villages in the Project Area – especially between villagers and oil palm companies – have been a result of an uncoordinated licensing system by the Seruyan District. It is common practice that a license is issued by the District Head *(Bupati*) without taking into account other stakeholders' concerns – especially that of villagers or communities, which do not have the legal documentation to support the claim that their land has been unfairly taken by the licensed company

Job Opportunities with the Rimba Raya Project

Conflict between projects and local communities often occur when projects hire non-locals for all skilled and senior positions, offering only unskilled jobs to local community members (e.g., casual work during planting or harvesting seasons in oil palm plantations). The Rimba Raya project will invest in a strong strategy to provide training and other educational programs with the goal of increasing local capacity to fill more skilled and permanent positions within the project organization. The Phase II Community Assessment will seek to identify appropriate positions and individuals from within Project Zone communities.

Illegal logging

Illegal logging appears to be an on-going threat to forests and biodiversity in the Project Area. Mapping the real actors involved in this illegal activity will be the first step in preparing strategies to resolve the issue. Given that a number of village heads in the Project Zone were recently arrested for their involvement in illegal logging, it will be important to gain a clear picture of these individuals, their involvement, and their level of influence over community members.

BIODIVERSITY SECTION

(Study conducted by Daemeter Consulting)

B1. Net Positive Biodiversity Impacts

B1.1. Estimate of Impact of Project Activities on Biodiversity

Use appropriate methodologies to estimate changes in biodiversity as a result of the project in the project zone and in the project lifetime. This estimate must be based on clearly defined and defendable assumptions. The 'with project' scenario should then be compared with the baseline 'without project' biodiversity scenario completed in G2. The difference (i.e., the net biodiversity benefit) must be positive.

The net biodiversity benefit for the Project Zone over the project lifetime will clearly be positive, as seen in a comparison of the 'with project' and 'without project' scenarios along any metric. The 'without project' scenario equates to conversion of most or all remaining forests in the Project Area to oil palm plantations, currently the greatest threat to biodiversity in the Project Zone and throughout Borneo more generally (see Section G 1.7 for detailed discussion of oil palm impacts on biodiversity). Four oil palm plantation licenses have already been issued inside the Project Area, covering 47,237 ha of mature to lightly disturbed forest. A fifth plantation to the north is already operational and was therefore excluded from the Project Area. This plantation and has cleared large areas of forest on peat and mineral soils (see Section G1.2), with direct negative impacts on biodiversity on site and associated off-site impacts, including apparent increases in the occurrence of fire (see Section G1.8.4).

Without the project, the other four oil palm license areas will soon become operational, likely extending their reach beyond authorized boundaries and placing the entire Project Zone at risk. The realization of this threat will lead to a sharp decline in the biodiversity of the Project Zone through direct negative impacts of land clearing and associated indirect impacts (e.g., providing access to more remote forests – including the nearby TPNP – for hunting, illegal logging, and the draining of peat swamp forest; see Section G 1.7).

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B1.2. Impact of Project Activities on High Conservation Values

Demonstrate that no High Conservation Values identified in G1.8.1-3 will be negatively affected by the project.

Maintaining and enhancing forests and other natural ecosystems is key to protecting HCVs 1-3 in the Project Zone. Some of these HCV sub-values require protection of specific areas within the Project Zone (e.g. ecotones and areas that provide connectivity between the Project Area and neighboring Tanjung Puting National Park). Additionally, maintenance of some HCVs will require education programs for local communities, e.g. to protect important bird areas, such as wetlands, and to reduce hunting pressure (if deemed at some point in the future to become a serious concern – see Section G1.7).

None of the project activities planned for the Project will have a negative impact on HCVs in the Project Zone. Project activities are heavily focused on maintaining and enhancing forests and natural ecosystems, and thus connectivity among them. Such activities will have a strong positive impact on HCVs 1-3. Table 47 below summarizes the most severe threats to each HCV in the Project Zone and provides associated management recommendations and activities to alleviate these threats. This highlights the project focus on maintaining and enhancing forests and natural ecosystems to protect HCVs 1-3. Threats and project activities to mitigate key threats are discussed further below.

Table 47. Threats and management recommendations for HCVs 1-3 in the Project Zone		
HCV	**Threats to HCV**	**Management Recommendation & Activities**
1.1	Disconnecting HCV 1.1 forests from the Project Area; degrading or removing forest or other natural habitat from the supporting area (Project Zone)	Maintain and enhance forests in the Project Zone and connectivity to the Project Area because of its supporting function to neighboring TPNP
1.2	**Plants:** Illegal logging, fire, small scale agriculture, conversion to oil palm	**Plants:** Cessation of logging (except limited selective timber harvesting for local consumption); protection all remaining forests
	Herps (possibly one terrapin): hunting, egg harvesting, degradation of riparian habitats and sand beaches along river used for nesting	**Herps:** Protection of the Seruyan and its tributaries through stabilizing land use and potentially replanting some areas to restore riparian zone and flood plain buffers. Education program for local communities.
1.3	Habitat loss, habitat degradation, hunting	Protecting all remaining forests (esp. natural forests) and wetlands; prevent further conversion to industrial scale agriculture; reducing hunting through education and awareness campaigns
1.4	**Lakes & water bodies:** water pollution, human inhabitation, conversion of shores, hunting.	**Lakes & water bodies:** Education and protection of important bird areas
	Grassy banks & slow moving rivers: habitat conversion	**Grassy banks & slow moving rivers:** Education and protection of areas important to birds for nesting or foraging.
	Ecotones: Habitat disturbance, especially through land clearance	Ecotones: Protection of forest and wetland ecotones from any form of disturbance
2.1	HCV deemed not present because large tracts of forest already fragmented by anthropogenic causes (fire and logging)	Potential to enhance landscape level forest connectivity (in turn restoring this HCV) by preventing further isolation of remaining fragments and reconnecting large remnant patches of forest
2.2	Habitat degradation and conversion	Protecting wetlands and forests where ecotones exist
2.3	Habitat degradation and conversion; hunting	Protecting wetlands and forests; reduce hunting
3	Logging and forest conversion	Not to clear forest in HCV 3 areas

HCV 1.1 Support Function to Protected Areas

HCV 1.1 draws attention to areas that contain or provide biodiversity support function to protection or conservation areas in or near the Project Zone to ensure that management actions are taken to maintain or enhance the function of such areas.

HCV 1.1 is considered present in the Project Zone, given its current condition (at least partially forested) and direct contiguity with the eastern boundary of TPNP, a protected area of very high biodiversity conservation importance. The Project Zone provides vital biodiversity support function as a buffer zone of TPNP, by expanding the effective area of lowland forest cover in the greater Tanjung Puting landscape by 14% (OFI 2008), as described above under Sections G1.8.1-2. This buffer zone function expands available habitat for orangutans and a wide variety of other threatened or protected plant and animal species in the national park.

The Project Zone also contains legally mandated protection zones along riparian-zone floodplains of the Seruyan River and its numerous tributaries, as well as lake shore buffer zones associated with undiscovered wetland areas potentially present within the freshwater/peat swamp mosaic of habitats in the Project Zone, and the western shores of the Sembuluh Lake system overlapping the eastern boundary of the Project Zone.

Key threats to this HCV include forest loss due to fire and oil palm conversion, degradation of the biodiversity value of the buffer through logging and degradation of riparian and lake side buffer zones through small-scale conversion for agriculture and development of human settlements in lakeside environments. All of the conservation efforts described in more detail below to maintain HCVs 1.3, 1.4, 2.2, and 2.3 will ensure positive net impacts on HCV 1.1 by the project.

HCV 1.2 Critically Endangered Species

Conservation activities of the project will have net positive impacts on HCV 1.2 species as follows:

Birds and Mammals. No HCV 1.2 birds or mammals are thought to be present in the project zone.

Plants. Twenty-five HCV 1.2 plants were identified as likely present in the Rimba Raya Project Zone. These species occur in various forms (freshwater swamp forest, peat swamp forest and lowland dipterocarp forest) and all are considered CR due primarily to habitat loss. Proposed HCV 1.2 management will address precisely this threat, pursued in parallel with HCV 1.3 and 3 (see below), where the goal will be to maintain and manage sufficient habitat to ensure long-term population viability of all threatened, protected and restricted range species.

At present, insufficient data are available to estimate existing population sizes for HCV 1.2 plants in the Project Zone, or to determine minimum necessary population sizes to ensure long-term viability. However, as the project aims to retain all remnant natural forest, successful conservation measures taken by the project to protect natural forests will serve to increase long-term population viability of these HCV 1.2 species.

It should also be noted that the HCV Toolkit for Indonesia makes provision for limited harvesting of CR plants of demonstrable economic importance – e.g., locally common dipterocarp species that contribute substantially to commercial timber volumes in a logging concession – provided that a management plan is in place to ensure long term population viability through sustainable harvesting. In this situation, management of commercial HCV 1.2 plants becomes identical to that of HCV 1.3, namely to retain sufficient habitat for maintaining viable populations. In the case of the Rimba Raya project, this management provision of HCV 1.2 would permit limited selective timber harvesting of CR dipterocarps for local use by communities within the Project Zone as part of a broader livelihoods development program.

Herptofauna. Only one HCV 1.2 species of herptofauna was identified as potentially present in the Project Zone, the CR Painted river terrapin (*Callagur borneoensis*). This species is known to inhabit the tidal portions of rivers and estuarine mangrove areas and to feed on fruit, leaves, and clams. As the project aims to prevent further degradation of the Seruyan River and its tributaries through stabilizing land use and replanting some areas to restore riparian zone and flood plain buffers, these successful conservation actions will have a positive net impact on this HCV 1.2 species, if present.

Conclusion. Overall, conservation efforts planned by the project to protect remaining natural forests and prevent further degradation of river quality will result in net positive impacts on HCV 1.2 species likely present in the Project Zone.

HCV 1.3 Areas that Contain Habitat for Viable Populations of Endangered, Restricted-Range, or Protected Species

The aim of HCV 1.3 is to identify areas where viable populations of endangered, restricted-range, or protected species are known or likely to occur, and to ensure that management action is taken to conserve sufficient habitat for long-term viability of the population. In the assessment of this HCV, populations of species confirmed or likely present are assumed to be viable until credibly proven otherwise through population modeling, analysis of habitat extent and condition, or exhaustive field surveys. HCV 1.3 species also include viable populations of CR species listed above under HCV 1.2.

Conservation activities of the project will have net positive impacts on HCV 1.3 bird, mammal, or plant species as follows:

Birds. A total of 110 HCV 1.3 bird species are considered likely present in the project zone. Of these, 38 (35%) are thought to depend solely on natural forest, while another 34 (31%) use natural forest as well as disturbed forests. Nineteen species are known to use converted non-forest lands, but only 3 of these exist solely in non-forested areas. Thirty-nine species are wetland and/or coastal species.

Major threats to HCV 1.3 birds include habitat loss and degradation, especially of riparian and wetland habitat for aquatic birds. As with other parts of Kalimantan, bird capture for local consumption and the commercial pet trade may represent a further threat to HCV 1.3 birds, but there were no indications of such activity during preliminary field visits to villages in the Project Zone.

Based on habitat needs for HCV 1.3 birds, long-term population viability will require protecting forests and non-forested wetlands. Project conservation measures to protect all remaining forests and to restore targeted riparian and floodplain buffer zones in the Project Area will address the most important threat to HCV 1.3 species by securing remaining habitat and preventing further losses. Protection of non-forest wetland areas, if present, will also be required, but since the project aims to protect all remaining natural habitat, especially by preventing conversion to oil palm, wetland protection seems likely to be achieved by the project.

Additional environmental outreach and education activities, planned as part of a broader livelihoods and community engagement program, will also serve to reduce hunting and trapping pressures on bird populations, which as noted already appear to be low. If these project activities are successfully implemented, net project impacts on HCV 1.3 bird populations will be positive.

Mammals. Fifty-five HCV 1.3 mammal species are potentially present in the Project Zone. Of these, eight are listed by IUCN as Endangered and 21 as Vulnerable, six are listed by CITES in Annex I and 18 in Annex II, a total of 24 species are protected by the Government of Indonesia, and 15 species are endemic to Borneo.

As with birds, many HCV 1.3 mammals are dependent on natural forest habitats. Thirty-four HCV 1.3 mammals in the Project Zone are dependent on forest, and seven of these rely exclusively on primary forest. While the remaining 21 species use forest, they are also known to use non-forested areas (e.g. *ladang* agriculture, scrub, short secondary forest regrowth), usually when such areas are in close proximity to forests. Only the orangutan and pangolin are known to enter and use gardens and plantations on a regular basis when food is available.

The major threat to HCV 1.3 mammals is habitat loss and degradation, especially intact lowland dipterocarp and peat swamp habitats. As with other parts of Kalimantan, mammal capture for local consumption may be a further threat to HCV 1.3 mammals, but preliminary data collected during field visits to villages in the Project Zone indicate a very low frequency of hunting, due in part to the fact that most communities are Muslim and therefore may consume a small number of mammal species. Project conservation measures to protect all remaining natural habitat and to restore targeted riparian and floodplain buffer zones in the Project Area will address the most important threat to HCV 1.3 mammals by securing remaining habitat and preventing further losses. Additional environmental outreach and education activities, planned as part of a broader livelihoods and community empowerment program, will serve to reduce potential hunting pressure further, which as noted already appears to be low. Together, these project activities will serve to maintain or enhance HCV 1.3 mammals.

Project benefits for orangutans deserve special mention. Much of the land in the Project Area remains undeveloped, providing an estimated 44,000 ha of additional forest contiguous with TPNP to the west of the Project Area (OFI 2008). This represents 14% of forest in the region of TPNP and adjacent areas, providing significant habitat for orangutans and other wildlife. A recent study on orangutans in TPNP and its buffer, including portions of the Project Area, found resident orangutan populations averaging 1.9 orangutans per square kilometer (Galdikas et al. unpublished report, cited in OFI 2008). More recent field surveys by OFI confirmed similar orangutan densities in the Project Area as a whole and showed that individual orangutan home ranges cross the park boundary into the Project Area. This demonstrates occurrence of one or more inter-connected orangutan population(s) in TPNP and the Project Area.

The current orangutan population of TPNP is estimated to be more than 4,700 individuals (OFI 2008). Adjacent forests in the Project Area provide an additional 44,000 hectares of suitable orangutan habitat, supporting an estimated 760 individuals. This figure represents an augmentation of the TPNP orangutan population by an additional 14%.

It is expected that the project will greatly reduce deforestation rates over the coming years, primarily by preventing oil palm plantation development in the park buffer and limiting access to the national park from the eastern border. These preventive measures will have marked impacts on the long-term population status of the orangutan. A 2008 analysis of past and future projected deforestation in the Project Area found that forest in the Project Area would be completely deforested in a 'without project' scenario and that TPNP would lose an estimated 147,237 hectares (60%) of its forest cover during this same period. By extrapolation, this simplified 'without project' scenario suggests that the orangutan population in the Project Area would be reduced by more than one-half and that of the greater TPNP orangutan population would be reduced by a third.

Plants. Twenty-four HCV 1.3 plant species were identified as confirmed or likely present in the Project Zone. Most common among these are members of the Dipterocarpaceae (18 of 24 species), including six species listed as Vulnerable by IUCN, 14 as Endangered IUCN, and six protected under Indonesian law. These species are concentrated mainly in peat and mixed freshwater swamp ecosystems of the Project Zone, but at least 14 species are also likely to occur in the area of lowland dipterocarp forest in the north. All of these species, especially dipterocarps, are largely or totally dependent on natural forest for pollination by out breeding, seed predator avoidance, seedling recruitment, and growth.

The two most significant threats to HCV 1.3 plants in the Project Zone are illegal logging (most HCV 1.3 plants are timber species) and habitat loss by fire, small scale agriculture, and conversion to oil palm. As mentioned under HCV 1.2, the cessation of logging, apart from limited selective timber harvesting for local consumption in the Project Zone, will be the main conservation intervention measure of the project. In addition, the project aims to protect all remaining forest by eliminating any further conversion to oil palm and controlling fire. If successful, net project activities will therefore serve to maintain or enhance HCV 1.3 plants by eliminating the two main threats to long-term viability of plant populations.

There is the possibility that livelihood activities supported by the project could take place in a location where HCVs 1-3 are present (e.g., limited wood production for local subsistence consumption through selective logging). Considerations for how to minimize such impacts were discussed in Section G1.8.1, and will be adopted by the project. The key element of a management strategy to minimize this potential negative impact will be to ensure subsistence harvesting levels do not exceed those required to maintain or enhance viable populations of HCV 1.3 tree species whose harvest may be permitted as part of a broader livelihoods development program (e.g., *Shorea uliginosa* in mixed peat swamp forest or *Shorea balangeran* in freshwater swamp and riparian forest).

Herptofauna. Seventeen HCV 1.3 reptiles are identified as likely or potentially present in the Project Zone, seven of which have been confirmed in neighboring TPTN. Of these, five are listed as Endangered by IUCN: False Ghavial (*Tomistoma schlegelii*), Malayan giant turtle (*Orlitia borneensis*), Asian brown tortoise (*Manouria emys*), Black-breast leaf turtle (*Geoemyda spengleri*), and Spiny turtle (*Heosemys spinosa)*.

Of particular concern are the False Ghavial (*Tomistoma schlegelii*), which has been hunted to extinction in most of Borneo, and the Estuarine crocodile (*Crocodylus porosus*), both of which are present in TPNP and may be present in the Seruyan River based on reports from villagers in the Project Zone.

Management of these HCV 1.3 species, as well as other herptofauna, will focus on protecting wetland areas and undisturbed forests (preferred habitats for Bornean herptofauna), reducing hunting, and maintaining water quality in rivers and wetlands. Sedimentation, river pollution by oil palm effluent and nutrient loading, and destructive fishing practices (e.g. cyanide) all have negative impacts on the distribution and viability of water/river-dependent species. As the project aims to (i) protect habitat for these species by protecting forest and associated wetland areas, (ii) prevent further industrial agricultural encroachment (with attendant negative impacts on water quality), and (iii) conduct environmental education awareness and livelihood activities focused on the promotion of sustainable fishing practices and avoidance of hunting of HCV species, net project impacts on HCV 1.3 herptofauna will serve to maintain or enhance this HCV.

Conclusion. Overall, conservation efforts planned by the project to protect remaining natural forests and prevent further degradation of river quality will result in net positive impacts on HCV 1.3 species likely present in the Project Zone.

HCV 1.4 Areas that Contain Critical Habitat of Temporary Use by Species or Congregations of Species

Three habitat types under HCV 1.4 were highlighted as potentially present in the Project Zone: (i) lakes and open water bodies; (ii) grassy banks and slow-moving, shallow rivers; and (iii) possible ecotonal transitions among major ecosystem types that may be important as travel routes for locally nomadic frugivores, such as the orangutan. Major current and future threats to wildlife dependent on lakes and open water bodies include pollution caused by oil palm plantation run-off (and possible improper treatment of mill effluent), conversion of shoreline ecosystems due to expanding human habitations, and possible over-hunting and fishing. Major threats to grassy banks and slow moving rivers, as well as ecotonal transitions, are habitat destruction and degradation through logging, fires, and conversion to oil palm.

Project activities to mitigate these threats, and enhance HCV 1.4 management, will include identification and protection of potentially important wetland bird areas (including efforts to protect shoreline areas of Lake Sembuluh), education outreach to raise awareness about the importance of maintaining water quality to local livelihoods and wildlife and the impact of different local practices on water quality, identification and protection of ecotonal transitions from, e.g., wetland to non-wetland and from kerangas to non-kerangas.

Conclusion. Combined impacts of the project to eliminate the risk of widespread forest loss and ecosystem conversion by oil palm, together with efforts to map and protect potentially important wetland areas and ecotonal transitions, shoreline vegetation along Lake Sembuluh, and possibly other wetlands, and education outreach to raise awareness and change behaviors related to human impacts on water quality and wetland protection will have net positive impacts on HCV 1.4.

HCV 2.1 Large Landscapes with Capacity to Maintain Natural Ecological Processes and Dynamics

HCV 2.1 was deemed not present in the Project Zone. Therefore no specific management to maintain this value is recommended. It is noted, however, that if the project succeeds in protecting and potentially enlarging forest cover and connectivity in the Project Zone, then it is possible in the long term that this project will restore the large intact landscape function (HCV 2.1) once present in the area.

HCV 2.2 Areas that Contain Two or More Contiguous Ecosystems

HCV 2.2 aims to identify and maintain ecotones and ecoclines that connect different ecotypes (ecosystem classes), especially where they occur in large forest landscapes. Such transitional environments are important not only for the maintenance of key ecosystem functions, by ensuring movement of species and flux of materials and energy across boundaries, but also as centers of biodiversity in their own right.

For the Project Zone and nearby TPNP, maintenance of ecotones will be important for long-term population viability of mobile, locally nomadic frugivorous vertebrates that forage among multiple habitat types tracking seasonal availability of fruit. Broadly different ecosystem types often show asynchronous phenological patterns of fruiting, and therefore enable specialist frugivores, such as hornbills and gibbons, to maintain a positive energy balance by tracking fruit availability among different habitat types. Such taxa present in the Project Zone and nearby TPNP include orangutans, gibbons, bearded pigs, pigeons, and fruit bats among others.

Ecosystem transitions listed under HCV 2.2 in the Toolkit present in the Project Zone include the following (see maps in Section G1.2):

Adjacent wetland and non-wetland area. The most notable wetland to non-wetland transition in the Project Zone occurs along the western edge of Lake Sembuluh.

Adjacent swamps and non-swamp areas. The swamp to non-swamp transitions are centered on three kinds of swamp: (i) shallow periodically inundated grasslands or marshes; (ii) freshwater or riparian swamps; and (iii) peat swamps.

Adjacent kerangas and non-kerangas areas. Kerangas to non-kerangas are most common in northern parts of the Project Zone.

The main threats to this HCV are uncontrollable spread of wildfires into peat forest areas adjacent to periodically inundated grasslands in the south (see Section G1.8.4), and continued expansion of oil palm, in particular southward from the estate in the north.

Conclusion. Conservation efforts planned by the project to protect remaining natural forests by (i) reducing fire risk through prevention of logging, (ii) fighting fires directly through construction of observation towers and development and deployment of fire fighting teams and equipment, and (iii) prevention of continued expansion of oil palm will result in net positive impacts on HCV 2.2 in the Project Zone.

HCV 2.3 Areas that Contain Populations of Most Naturally Occurring Species

HCV 2.3 aims to identify landscapes supporting representative populations of most naturally occurring species in the study region and with a capacity to maintain such populations in the long term.

The Project Zone is an important part of a large landscape mosaic of diverse natural and anthropogenic ecosystem types, covering c. 500,000 ha of terrestrial and aquatic ecosystems. This area includes c. 266,000 ha of natural forest, representing at least five major terrestrial ecosystem types; numerous ecotonal transitions among contrasting terrestrial ecosystem; a complex network of rivers and associated riparian environments draining nutrient-poor sandy soils and/or peat swamps, which produce so-called 'black water rivers' with distinctive aquatic fauna; and (iv) a large black water lake system (Lake Sembuluh).

The area is considered likely to support some of the largest populations of threatened and protected species known from south central Kalimantan, including a total of 361 species of birds, 167 species of mammals (including 45 species of bats), and at least 180 species of free-standing large woody plants (excluding orchids, pitcher plants, lianas, epiphytes, and understory herbs).

HCV 2.3 is therefore considered present in the Project Zone and nearby TPNP, to which it makes vital contributions of lowland habitat to support landscape-level populations of most naturally occurring species.
The two largest threats to HCV 2.3 are habitat degradation and conversion resulting from oil palm expansion and wild fire. Possible future threats include intensified logging and hunting. Presence of HCV 2.3 in an area is effectively a combination of dimensions of HCVs 1.2 and 1.3, relating to species, and HCVs 1.1, 1.4, 2.1, and 3, relating to habitats. For this reason, the analysis provided above (and below) relating to net positive project impacts on these component values apply to HCV 2.3 as well.

Conclusion. Overall, conservation efforts planned by the project to protect remaining natural forests by preventing oil palm expansion, logging, and fires, combined with efforts to prevent further degradation of river quality and open wetlands will result in net positive impacts on HCV 2.3 in the Project Zone.

HCV 3 Rare or Endangered Ecosystems

All remaining natural vegetation types in the Project Zone are provisionally considered rare or endangered ecosystems under HCV 3 (see Section G1.2 above). Immediate threats to HCV 3 include all factors described above as drivers of habitat loss and forest conversion within the Project Zone. All conservation activities described above in relation to prevention of continued forest loss and ecosystem conversion apply to management of HCV 3.

Conclusion. Conservation efforts planned by the project to protect all remaining natural forests and other natural ecosystem by (i) reducing fire risk through prevention of widespread illegal logging, (ii) fighting fires through immediate detection using observation towers and rapid response through deployment of fire fighting teams and equipment, and (iii) prevention of continued expansion of oil palm will result in net positive impacts on HCV 3 in the Project Zone.

B1.3. Project Activities and Invasive Species

Identify all species to be used by the project and show that no known invasive species will be introduced into any area affected by the project and that the population of any invasive species will not increase as a result of the project.

The Rimba Raya project plan includes both an enrichment component for forested areas (divided into 40 blocks, I - XL) that may have been slightly degraded due to illegal logging, and a rehabilitation component for deforested and highly degraded areas (divided into 60 blocks, A – BH) that require significant restoration work. The species to be used for enrichment and rehabilitation are listed in Table 48 below. None of these species is invasive.

Table 48. Species to be used for Rimba Raya project rehabilitation and enrichment activities			
No.	Species		Block Plantation
	Local Name	Scientific Name	
I	**ENRICHMENT PLANTING**		
1	Meranti	*Shorea sp.*	I - XL
2	Jelutung	*Dyera costulata*	I - XL
3	Ramin	*Gonystylus bancanus*	I - XL
4	Keruing	*Dipterocarpus sp*	I - XL
5	Ulin	*Eusideroxylon zwageri*	I - XL
6	Tengkawang	*Shorea stenoptera*	I - XL
7	Merawan	*Hopea sp*	I - XL
8	Dahu	*Dracontomelon sp.*	I - XL
9	Melur	*Dacrydium sp*	I - XL
10	Gelam	*Melaleuca sp*	I - XL
11	Nyatoh	*Palaquium sp)*	I - XL
12	Terentang	*Campnosperma sp*	I - XL
13	Pulai	*Alstonia scholaris*	I - XL
14	Durian Hutan	*Durio Sp.*	I - XL
15	Bintangur	*Callophyllum sp.*	I - XL
16	Jambu-jambu	*Eugenia sp.*	I - XL
17	Kayu Arang	*Diospyros sp.*	I - XL
18	Resak	*Vatica sp.*	I - XL
19	Puspa	*Schima sp*	I - XL
20	Saninten	*Castanopsis sp.*	I - XL
21	Gembor,	Alseodaphne spp.	I - XL
22	Karet hutan (Hevea brasiliensis Mull.Arg)	Hevea brasiliensis Mull.Arg	I - XL
II	**REHABILITATION PLANTING**		
1	Jabon	*Antocephalus cadamba*	A-BH
2	Binuang	*Octomeles sumatrana Miq*	A-BH
3	Makaranga	*Macaranga sp*	A-BH

B1.4. Project Activities and Non-Native Species

Describe possible adverse effects of non-native species used by the project on the region's environment, including impacts on native species and disease introduction or facilitation. Project proponents must justify any use of non-native species over native species.

N/A

B1.5. Project Activities and GMOs

Guarantee that no GMOs will be used to generate GHG emissions reductions or removals.

Project proponents guarantee that no GMOs will be used to generate GHG emission reductions or removals.

B2. Offsite Biodiversity Impacts

B2.1. Potential Negative Offsite Biodiversity Impacts

Identify potential negative offsite biodiversity impacts that the project is likely to cause.

The project is unlikely to have any negative impacts on biodiversity outside the Project Zone resulting directly from project activities. There is the possibility for activities currently active in, or slated for, the Project Area to be displaced into neighboring areas or other parts of Kalimantan. For example, oil palm companies that are unable to operate in the Project Area (as a result of the project) may purchase licenses to operate in neighboring areas, having a clear negative impact on biodiversity in that area. Similarly, illegal logging currently taking place in the Project Area may be displaced into other neighboring areas, intensifying damage to these areas.

At a landscape spatial scale, oil palm development and illegal logging will continue to spread into other areas regardless of project activities in the Project Area. This can be argued based on the current distribution of both activities in and near the Project Zone, existing oil palm licenses in the region, local development plans for a major Crude Palm Oil export facility on the southern coast of the Project Area and ongoing expansion of both activities across Kalimantan. For oil palm, current land use planning in Kalimantan, current and predicted expansion rates for oil palm in Kalimantan, and continued market demand for this relatively inexpensive oil indicate that oil palm will continue its rapid expansion. For illegal logging, a lack of enforcement of Indonesian laws limiting unpermitted logging and timber export, and continuing global markets for cheap, illegal wood, indicate that this threat to biodiversity will also continue.

The project's presence may shift the spatio-temporal dynamics and/or intensity of when these activities reach other areas in the immediate vicinity, but given the full range of factors driving oil palm expansion mentioned above, the incremental impact within the Project Zone and adjacent areas is likely to be small. One possible exception is the short-term response of the four oil palm companies whose licenses are retired if the project is implemented as planned. If these licenses are simply retired through a commercial transaction, then off-site biodiversity impacts will be zero. If a license swap is pursued, whereby the current licenses are retired and/or traded for licenses in new areas, then biodiversity impacts in these new areas will be negative. In this scenario, net biodiversity impacts will depend on exactly where such licenses are established, and subsequent comparisons of biodiversity gains in the Project Area compared to biodiversity losses where the new licenses are issued. The project has a clear plan for tracking the future business activities of the companies whose licenses will be retired in the 'with project' scenario.

From a biodiversity perspective, both oil palm and illegal logging are environmentally unsustainable options, to be minimized or avoided wherever possible. By creating and protecting a large area of natural habitat contiguous with TPNP, the project will be helping to maintain and enhance biodiversity in a region that would otherwise be degraded or lost to these two activities. Maintaining biodiversity in rain forests is highly dependent on maintaining ecosystem dynamics between species, and retaining large enough tracts of habitat for species with the largest ranges. Oil palm plantations completely uncouple ecosystem dynamics and illegal logging can heavily disturb the dynamic and make forests susceptible to fire, which results in vast losses of biodiversity.

B2.2. Mitigation of Negative Offsite Biodiversity Impacts

Document how the project plans to mitigate these negative offsite biodiversity impacts.

To gauge off-site impacts to biodiversity that may be caused by the project, project proponents will monitor the movements and business activities of oil palm companies that will retire their licenses in the Project Area as a result of project activities. To mitigate the potential off-site impacts of oil palm displacement, project proponents will attempt to cooperate with displaced companies via leakage contracts to shift their operations to non-peatland that has already been deforested.

The project will also document the political economic dimensions of illegal logging activities in the Project Zone (e.g., where loggers originate, who is funding the illegal logging) and report the activity to appropriate authorities. Alternative job opportunities will be sought for local residents involved in the illegal logging through community development initiatives. The project will also attempt to track where illegal logging operations relocate, in an effort to monitor off-site impacts to biodiversity.

It should be noted, finally, that any potential off-site negative impacts to biodiversity will be more than offset by the projects role as a physical buffer to Tanjung Puting National Park and the protection that the project will offer to the park's biodiversity.

B2.3. Demonstration of Net Positive Biodiversity Impacts

Evaluate likely unmitigated negative offsite biodiversity impacts against the biodiversity benefits of the project within the project boundaries. Justify and demonstrate that the net effect of the project on biodiversity is positive.

The evaluation of on-site biodiversity benefits of the project in comparison to potential off-site unmitigated negative impacts can be framed as follows:

There is a risk that disturbance to remaining biodiversity in neighboring areas may intensify more quickly than it would without the project (off-site negative impacts), which may offset to an unknown degree the enhanced security of an important, at-risk biodiversity area that would eventually be lost without the project (on-site positive impacts).

Given that the areas to be protected by the project – namely, nearby TPNP and the associated buffer zone – are widely acknowledged as the most important biodiversity reservoirs in southern Kalimantan, and that they are both highly threatened, any rational evaluation strongly suggests that net impacts will be overwhelmingly positive.

B3. Biodiversity Impact Monitoring

B3.1. Preliminary Biodiversity Monitoring Plan

Develop an initial plan for selecting biodiversity variables to be monitored and the frequency of monitoring and reporting to ensure that monitoring variables are directly linked to the project's biodiversity objectives and to anticipated impacts (positive and negative).

Four broad categories of monitoring activities that address biodiversity management goals of the project include: (i) change in forest cover and condition; (ii) plant and wildlife population; (iii) quality and condition of aquatic habitats – including rivers and lakes – and of terrestrial wetland ecosystems such as marshes and inundated grasslands; and (iv) fires.

Forest Cover and Condition

As most biodiversity management goals are linked to the maintenance and protection of forests, monitoring the extent and condition of forest cover in the Project zone will be a top priority. This portion of the plan also links directly to maintenance and monitoring of carbon stocks, so the ultimate design of a forest cover and condition monitoring system must be sufficiently robust to describe change within acceptable levels of precision as required by the CCB and VCS at the verification stage.

Forest cover and condition monitoring can be achieved through a combination of remote sensing methods and field observation. Medium-resolution imagery (e.g. Landsat 7) should be obtained and analyzed every six months, supplemented with high-resolution (Ikonos, QuickBird, or aerial photography) imagery obtained and analyzed on an annual basis. Forest cover and condition classes should be analyzed using at least three classes, e.g. > 70%, 70-50% and < 50% canopy cover. These classes can be defined first through image classification, but should then be investigated intensively on the ground during the first year to test that degradation classes based on image analysis in fact correspond to real difference in canopy cover, perhaps using basal area as an easily measured proxy.

Accurate interpretation of satellite imagery to classify forest cover and condition classes may require ecosystem-specific methods (e.g., peat swamp vs. kerangas vs. lowland dipterocarp forest) in order to increase global accuracy across the Project Zone.

Another form of field data collection that should be incorporated into a forest cover and condition monitoring plan is ground-based forest observation patrols. Because potential forest loss or degradation can take place at a spatial scale finer than what can be readily detected by satellite image analysis, a set of permanent 10-20 km transects should be marked and walked on a continuous basis across all the major forest ecosystem types to monitor tree-by-tree losses in the Project Zone. This approach will provide direct evidence for individual trees losses (which may be permitted in some areas for subsistence purposes) and a robust measure of effectiveness for protection measures. Ground surveys to monitor logging within the Project Zone should operate on a continuous basis with quarterly interim reports and an annual summary.

Plant and Wildlife Populations

The fact that current hunting pressures and the incidence of capture of song birds for the commercial pet trade in the Project Zone appears to be low means that a robust program for monitoring the success of forest protection efforts will serve as a reasonably good proxy for success of overall biodiversity conservation efforts. However, such pressures could rise over time, and off-site impacts originating in oil palm plantations to the north or climate change more generally could intensify. A system must be in place to ensure such impacts can be measured over the duration of the project. For this reason, a monitoring program for targeted plant and wildlife populations in the Project Zone should be developed.

Such a monitoring program must include the following key elements:

- Selection and justification of focal taxa for monitoring purposes – this can be based on the status of individual species or guilds as iconic species, umbrella species, indicator species, top predators, or other keystone functions (e.g., predatory large forest cats; seed dispersal agents such as fruit bats, hornbills, or gibbons; strangler figs for frugivores; amphibians as indicators of disturbance).
- Selection and justification of parameters to be measured – alternatives include: (a) composition and diversity of species within a guild or taxonomic group (e.g., all birds or mammals or herptofauna; tall canopy trees; all primates or arboreal frugivores or understory birds); (b) population size and range movements of target taxa of exceptional importance (e.g., orangutan); or (c) changes in abundance and distribution of indicators for disturbance, such as relative abundance of closely related light-loving versus shade-dependent plant species (e.g., *Macaranga* versus *Mallotus* in the plant family Euphorbiaceae).
- Development and justification of taxon-specific approaches to sampling – these must be adequate to quantify mean and variance of the parameters, and with sufficient replication to detect meaningful changes in the parameters over time.
- Determination and justification of data collection schedules – should be at least once annually, but some data collection will be essentially continuous, such as forest monitoring outlined above and orangutan population surveys.
- Clarification and justification of analytical methods for data analysis to ensure data are adequate to capture changes in whatever parameters are being measured, such as population size for individual species of concern (e.g. orangutans), community composition, diversity, or species richness.
- Identification of who will do the data collection and analysis, what forms of training will be required, and who can deliver this training to increase local capacity both for increasing project awareness and involvement, as well as local job creation.

Quality and Condition of Aquatic and Wetland Ecosystems

Given the prevalence of open wetland or other hydrologically sensitive ecosystems within the Project Zone, consideration should be given to monitoring the status of these ecosystems. At a minimum, monitoring of water quality in the Seruyan River, and possibly nearby Lake Sembuluh, should be included in the plan.

Water quality measurements should include basic health and ecological parameters such as dissolved organic matter, sedimentation loads, pH and alkalinity, dissolved oxygen levels, and phyto and zooplankton loads, among other. Experts should be consulted in the development of specific methods of data collection and analysis, subject to the same quality considerations outlined under point (ii) above.

Fire

The seasonal occurrence of fire in periodically inundated grasslands, which historically have been a main source of ground fires, should be monitored. Periodic fires have direct negative impacts on resident wetland wildlife, and can set back the regeneration or accumulation of biodiversity habitat in these important areas. Moreover, such burning, especially in peat areas, has off-site negative impacts on water quality in the Seruyan and air quality in the Project Zone (which can affect pollination success of insect-dependent plant species). Such fires also increase the risk of wildfires spreading from the south into the mature central areas of peat swamp forest identified as high priority in Section G 1.8.2.

B3.2. Preliminary High Conservation Values Monitoring Plan

Develop an initial plan for assessing the effectiveness of measures used to maintain or enhance High Conservation Values related to globally, regionally or nationally significant biodiversity (G1.8.1-3) present in the project zone.

All of the monitoring described above under Section B3.1 applies directly to monitoring under this section for ensuring the maintenance of HCVs 1-3 in the Project Zone. The protection of forests, maintenance and/or restoration of connectivity, sustainability of wildlife populations, and prevention of fire are central to both biodiversity in the broad sense and the exceptional biodiversity attributes emphasized under Sections G1.8.1-3.

B3.3. Development of Comprehensive Biodiversity Monitoring Plan

Commit to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards and to disseminate this plan and the results of monitoring, ensuring that they are made publicly available on the internet and are communicated to the communities and other stakeholders.

Project proponents are committed to developing a full biodiversity monitoring plan within twelve months of validation against the CCB Standards. In addition to the development of a monitoring plan, Phase II of the Biodiversity Assessment – to be conducted by Daemeter Consulting – will focus on four main tasks: (i) the refinement of ecosystem mapping in the Project Zone through a combination of remote sensing (preferably using high resolution imagery) and field surveys; (ii) confirmation of species considered potentially or likely present (see Section G1.7), in particular species of concern under HCV 1.2 and 1.3 (see Section G1.8); (iii) a systematic avifaunal survey of nearby Lake Sebuluh, which is partly covered by the Project Zone; and (iv) follow-up work for any other HCVs requiring more detailed study to determine condition, spatial extent, and proper long-term management.

Improved Ecosystem Mapping

This component will be required to refine the current understanding and delineation of ecosystem types in the Project Zone, which will enable improvements in carbon estimation; description of flora and fauna known or likely to be present; population estimation of rare, threatened, or endemic/restricted-range species (especially wetland specialist birds); and development of more detailed management activities to ensure long-term conservation of ecosystem and associated biodiversity. Accurate ecosystem mapping will require a combination of GIS, remote sensing, and field survey techniques to describe vegetation types based on structural attributes and diagnostic species assemblages. Mapping should take advantage of any high-resolution imagery or aerial photography used for other components of the Rimba Raya project (e.g., carbon estimation) to develop a draft vegetation map integrating these data with other secondary sources such as improved soil maps, geology, and RePPProT land systems.

Confirmation of Species Likely or Potentially Present

Apart from the orangutan and a limited number of other species, most of the biodiversity data prepared for the PDD are inferential, based on geographic range of species and availability of suitable habitat rather than on direct observation. For this reason, most species are listed as likely or potentially present in the species tables. Field surveys will be required during Phase II to confirm the presence of these species in the Project Zone, so as to deepen understanding of the overall biodiversity value of the area and spatial patterning of biodiversity within it. This work will be vital to prioritize conservation actions and develop more detailed monitoring plans. In the medium term, it should be adequate for surveys to focus on major taxonomic groups, including plants, birds, mammals, and herptofauna. In the future, surveys can be expanded to include less studied groups, including insects, fish, and aquatic invertebrates. The surveys should be designed as general inventories of all species encountered, but where possible special emphasis should be placed on confirming the presence of species listed under HCVs 1.2 and 1.3, as well as other special taxa mentioned below.

Botanical Survey. Botanical and descriptive vegetation surveys provide the basis for understanding spatial patterning of biodiversity. Such surveys will be required during Phase II to document more fully the diversity of plant species present in the Project Zone, which to date has not been formally surveyed and is certain to be diverse. The area likely shares many species in common with nearby Tanjung Puting, but direct survey will still be required in order to provide a baseline for ongoing monitoring in the Project Zone. Botanical surveys should focus on documentation and where possible population estimation of HCV 1.2 and 1.3 species. One area of special consideration should be the survey of orchids and other rare epiphytic plants, which are likely to be present in diverse numbers given the presence of peat swamp and kerangas forest types. This work requires specialized skills, however, which might be sourced through the Herbarium Bogoriense in Cibinong, West Java.

Avifaunal surveys. Birds can be an extremely useful and cost-effective indicator of habitat quality and diversity due to the dependency of certain species on specific habitat types that retain relatively intact ecosystem function. Such surveys must be performed throughout the Project Zone both to confirm the presence of bird species considered likely or potentially present under HCV 1.2 and 1.3 and to begin developing a sense for areas rich in rare, threatened, or protected bird species as a means for prioritizing conservation and habitat protection activities. Bird surveys should be carried out in coordination with surveys for other taxa, in particular plants, and the selection of survey sites should be informed by refined vegetation maps.

Mammal surveys. The indicator value of most readily surveyed mammal species is lower and less cost-effective than of birds. Nevertheless, there is a large number of HCV 1.3 mammals considered likely or potentially present in the Project Zone and their presence must be confirmed. Mammal surveys should be carried out in coordination with surveys for other taxa and, as for birds, the selection of survey sites should be informed by improved maps of ecosystem types and condition. The orangutan merits special attention during mammal surveys, and should perhaps be considered a survey project unto itself. The primary goals of orangutan surveys should be to map orangutan distribution within the Project Zone, estimate approximate population densities within different ecosystem types (in particular peat vs. not-peat and mature vs. recently disturbed areas), orangutan ability to move among different ecosystem types, and threats to population persistence (if any) beyond factors related to the direct risk of habitat loss by conversion to oil palm.

Herptofauna surveys. Reptiles and amphibians can be very informative indicators of habitat quality due to their small body size, porous skin, and dependence (in some cases) on remarkably narrow ecological niches characteristic of mature natural habitats. Herptofauna surveys can be extremely time-intensive, however, making it difficult to sample with sufficient replication across large areas to characterize large landscapes. Herp surveys also require specialized skills for confident identification. These downsides notwithstanding, herptofauna surveys must be given high priority during Phase II, as the predominance of wetland and/or waterlogged ecosystem types are very suitable habitat for amphibians in particular.

One Critically Endangered species of herptofauna was identified as potentially present in the Project Zone: the Painted river terrapin (*Callagur borneoensis*). This species is known to inhabit tidal portions of rivers and estuarine mangrove areas, where it feeds on fruit, leaves, and clams. Females nest on sand beaches along riverbanks and coastal beaches. Distribution of the species on Borneo is unclear, but based on preliminary descriptions of habitat types in the south of the Project Zone, the species is considered potentially present. Follow-up surveys should address this possibility.

Other aquatic reptiles of concern – and which should be surveyed in tandem with the Painted river terrapin – are the False Ghavial (*Tomistoma schlegelii*) and the Estuarine Crocodile (*Crocodylus porosus*). The False Ghavial is considered Endangered by IUCN and has been hunted to extinction throughout much of Borneo. The species is still present in nearby Tanjung Puting, and may also be present in the Seruyan River inside the Project Zone. The Estuarine Crocodile (*Crocodylus porosus*), also present in Tanjung Putting, is listed as lower risk by IUCN, but has suffered severe overhunting and is listed as CITES Annex II and protected by Indonesian law. While conducting social surveys in the Project Area, villagers reported that crocodiles still exist in the Seruyan River and its tributaries. Surveys for both species should therefore be considered.

<u>Bird Survey of Lake Sebuluh</u>

Migratory and aquatic birds associated with Lake Sembuluh on the eastern edge of the Project Zone comprise a category of avifauna of special interest for survey. Some 62 bird species from

11 families that use inland or sub-coastal wetlands are considered potentially present at Lake Sembuluh, as regular migrants or a seasonal non-breeding visitors. Species of conservation concern include 31 'shorebirds' or 'waders'; 10 herons, egrets, and bitterns; six ducks; six rails and crakes; three gulls and terns; two kingfishers; and four migratory passerines. Twenty of these species are protected under Indonesian law, and four are listed as Near Threatened by IUCN – the Band-bellied Crake (*Porzana paykullii*) and three Palearctic waders: Black-tailed Godwit (*Limosa limosa*), Eurasian Curlew (*Numenius arquata*), and Asian Dowitcher (*Limnodromus semipalmatus*). Sixteen of these species have been recorded previously at nearby Tanjung Puting and may also be present in the Project Zone. This should be confirmed.

HCV Full Assessment

A subset of HCVs identified for section G 1.8 of the PDD will require follow-up assessment in the field. The most onerous of these are linked to biodiversity values (HCVs 1-3), but at least one of these (*HCV 1 – Areas with Important Levels of Biodiversity*) will be adequately addressed by outputs from activities (i) – (iii) described above. If it is desirable to identify HCV 3 (*Rare or Endangered Ecosystems*) in the Project Zone using the Analytical Method described in the revised HCV Toolkit (rather than the Precautionary Approach reported in section G1.8.3), then this work will need to be done during Phase II. Follow-up assessment of HCVs 5 & 6 must also be conducted, as explained in Section G1.6. This requirement should be addressed adequately, however, as part of structured community surveys and outreach activities anticipated for the Phase II Community Assessment (see Section CM3.3 above).

"Everything you want in life has a price connected to it. There's a price to pay if you want to make things better and a price to pay just for leaving things as they are"

- Author & Inconoclast, Harry Browne

GOLD LEVEL SECTION

GL1. Climate Change Adaptation Benefits

The Rimba Raya project is applying for Gold Level status under the CCB standard on the basis of providing significant support to communities and biodiversity in adapting to the impacts of climate change described below.

GL1.1 Anticipated Local Climate Change Scenario

Indicator: Identify likely regional climate change and climate variability scenarios and impacts, using available studies, and identify potential changes in the local land-use scenario due to these climate change scenarios in the absence of the project.

<u>Importance of peatland ecosystems</u>

Tropical peatland ecosystems, in addition to storing and sequestering carbon (Neuzil 1995) and harboring unique biodiversity (Whitmore 1984), provide economically valuable timber and non-timber resources to communities (Parish 2002). Peatlands also serve as water cachements, flood control systems and act as a coastal buffer between salt and fresh water hydrologic systems (Rieley et al. 1997, Page et al. 1999). These ecosystem services are essential to communities whose livelihoods are tightly linked to their environment. Likewise, disruption to the peatland ecosystem, through climate change, is likely to negatively impact resource-dependent communities in a number of ways.

<u>Context: drought and fire in human-influenced peatlands</u>

The Rimba Raya peatland ecosystem is adapted to seasonal flooding and drying on an annual basis. Ombrogenous (rainfed) peat swamp forests are seasonally inundated during the wet season, which may vary annually by several months, typically November-June. Water levels drop significantly during the dry season, July-October, and some areas of peat swamp forest may dry completely. More infrequent and prolonged droughts naturally occur in association with El Nino Southern Oscillation (ENSO) events across Borneohistorically every 6-7 years (Sakai 2006). Drought conditions cause lowland forest dipterocarp trees and a suite of co-evolved plant families to synchronously flower and fruit, producing an abundant food supply to vertebrate populations during “mast” years.

Annual and periodic droughts underlie the spatial and temporal distribution and ecology of forest plant and animal species, and are a natural ecosystem process which structures biodiversity and forest-based community resources. In human-influenced ecosystems, such as Rimba Raya, droughts can also promote the uncontrolled spread of fire. The interaction between drought and fire has led to extensive and devastating loss of forest in the region, especially during ENSO eventson the islands of Borneo and Sumatra (Goldammer and Mutch 2001; Tacconi 2003). During 1997-98, a strong El Nino associated with extremely dry conditions, caused fires to burn more than 5 million hectares of forest in the province of East Kalimantan alone (Page et al 2002).

Fragmented and degraded forests are more susceptible to fire than intact forests since they are drier due to increased evapotranspiration and carry higher fuel loads(Cochrane et al. 1999; Laurance 2003), especially since these areas often lie in close proximity to active and incidental fires associated with human activity. Degraded peatlands are especially prone to extensive and severe fires where exposed peat and low water tables create conditions conducive to long-burning below-ground fires. Therefore, peatland forests already impacted by human activities, such as those in Rimba Raya, are at moderately high risk for deforestation.

Climate change: increased frequency and duration of drought and fire.

The frequency and severity of ENSO-driven drought has increased substantially in the past three decades (Harrison 2001) and climate models suggest this may be the result of global warming (e.g. Timmermann et al. 1999). Kalimantan experienced major landscape-altering fires in 1982-83, 1997-98 and 2006. In Rimba Raya, drought and fire are the expected to be the primary drivers of climate change-related impacts on community and biodiversity.

IPCC Predicted Climate Change Impacts on Communities affecting or likely to affect Rimba Raya.

Food Security

- *At lower latitudes, especially seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increases (1-2°C), which would increase risk of hunger.*
- *Regional changes in the distribution and production of particular fish species are expected due to continued warming, with adverse effects projected for aquaculture and fisheries.*

Income

- *Increases in the frequency of droughts and floods are projected to affect local production negatively, especially in subsistence sectors at low latitudes.*

- *The most vulnerable industries, settlements and societies are generally those in coastal and river flood plains, those whose economies are closely linked with climate-sensitive resources, and those in areas prone to extreme weather events.*

Health

- *Projected climate change-related exposures are likely to affect the health status of millions of people, particularly those with low adaptive capacity, through:*

- *increases in malnutrition and consequent disorders, with implications for child growth and development;*
- *increased deaths, disease and injury due to heat waves, floods, storms, fires and droughts;*
- *the increased burden of diarrhoeal disease;*
- *the increased frequency of cardio-respiratory diseases due to higher concentrations of ground levelozone related to climate change;*
- *the altered spatial distribution of some infectious disease vectors.*
- *Endemic morbidity and mortality due to diarrhoeal disease primarily associated with floods and droughts are expected to rise in East, South and Southeast Asia due to projected changes in hydrological cycle associated with global warming. Increases in coastal water temperature would exacerbate the abundance and/or toxicity of cholera in South Asia.*

Vulnerabilityof community and biodiversityto climate change impacts

Communities and biodiversity in the Rimba Raya project zone are especially vulnerable to the negative impacts of local climate change. Communities remain dependent on a resource-based economy centered on subsistence farming, fishing and resource extraction from nearby forests; therefore any loss or change to these resources has an immediate and direct effect on communities. Loss of farmland, loss of forest, declining water quality and soil loss, lack of diversity in livelihood resources, and lack of capacity for developing new livelihood strategies have created poor communities with little resilience to climate change in the absence of the project.

Poor communities can be especially vulnerable, in particular those concentrated in high-risk areas. They tend to have more limited adaptive capacities, and are more dependent on climate-sensitive resources such as local water and food supplies.

–IPCC 2008

Biodiversity is similarly at risk from local climate change, which has already caused more frequent severe droughts leading to more destructive fires causing forest loss and degradation, with major landscape-altering fires occurring in Kalimantan in 1982-83, 1997-98 and 2006. Such fires have been shown to dramatically reduce structural and biological complexity (Schindele et al. 1989), reduce tree biodiversity(Slik 2004) and cause population declines and local extinction of forest-dependent animal species (Peres et al 2003) because of severe declines in food resources (Frederikkson et al. 2006).

Maintaining biodiversity in the project is dependent on stabilizing and improving habitat for small populations at risk of extinction. The interaction of expected climate change effects (drought) and human activities (fire) would be expected to lead to complete deforestation with a dramatic loss of biodiversity in the absence of project activities aimed at protecting and restoring habitats and managing human resource use and activity.

> **The resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land use change, pollution, over-exploitation of resources).**
>
> **–IPCC 2007**

Path analysis diagrams of climate change impacts

In order to demonstrate the interrelated effects of climate change on community and biodiversity, path analysis diagrams are used to identify impacts and illustrate the ways in which drought and fire affect community (food security, health, income) and biodiversity. These diagrams also aid in the assessment of how impacts are minimized and mitigated (section GL1.2) andprovide a context for adaptation to climate change (section GL1.4).

Climate change impact on food security

In the absence of project activities, drought and fire would be expected to reduce food security through multiple pathways. Agricultural productivity would be expected to decline as a direct result of drought-induced water shortage and soil nutrient loss from fire. Agricultural crop loss due to flooding would also be expected to become more prevalent in the absence of the project. Peatlands act as flood control systems where forest and peat remains intact. Fire damage to forests and peat negatively impact these flood control services. Erosion and siltation of rivers would be expected to accompany fire damage to forests. This, coupled with direct loss of fisheries due to fire, would be expected to reduce fish catches. Given the current dependence on farming and fishing, climate change related impacts would have a significant negative impact on the food security of communities (Figure 68).

Climate change impact on income

Communities in the project management zone historically have had limited means of earning cash income with primary dependence on fishing, farming and collecting timber and non-timber resources from local forests This natural resource based economy is especially vulnerable to climate change including the cascading effects from drought and fire that lead to reduced agricultural and fish harvests. Additionally, fire-driven forest loss and damage directly reduce forest-sourced products, further reducing cash income (Figure 69).

Climate change impact on health

Climate change and associated drought and fire would be expected to have a negative impact on water quality and health in the absence of the project. Peatlands act as water catchment and buffering systems providing water storage and protecting against flooding. Ecosystem damage would negatively impact this ecosystem function. Communities are dependent on the Seruyan River for all their water needs and project activities include improving access to clean drinking water, which is not readily available in Seruyan villages. Drought and flooding, predicted with climate change would be expected to constrain clean water access and increase the prevalence of water-borne disease in the absence of the project. Increased water temperatures associated with climate change would also be expected to increase the prevalence and toxicity of cholera outbreaks (Figure 70).

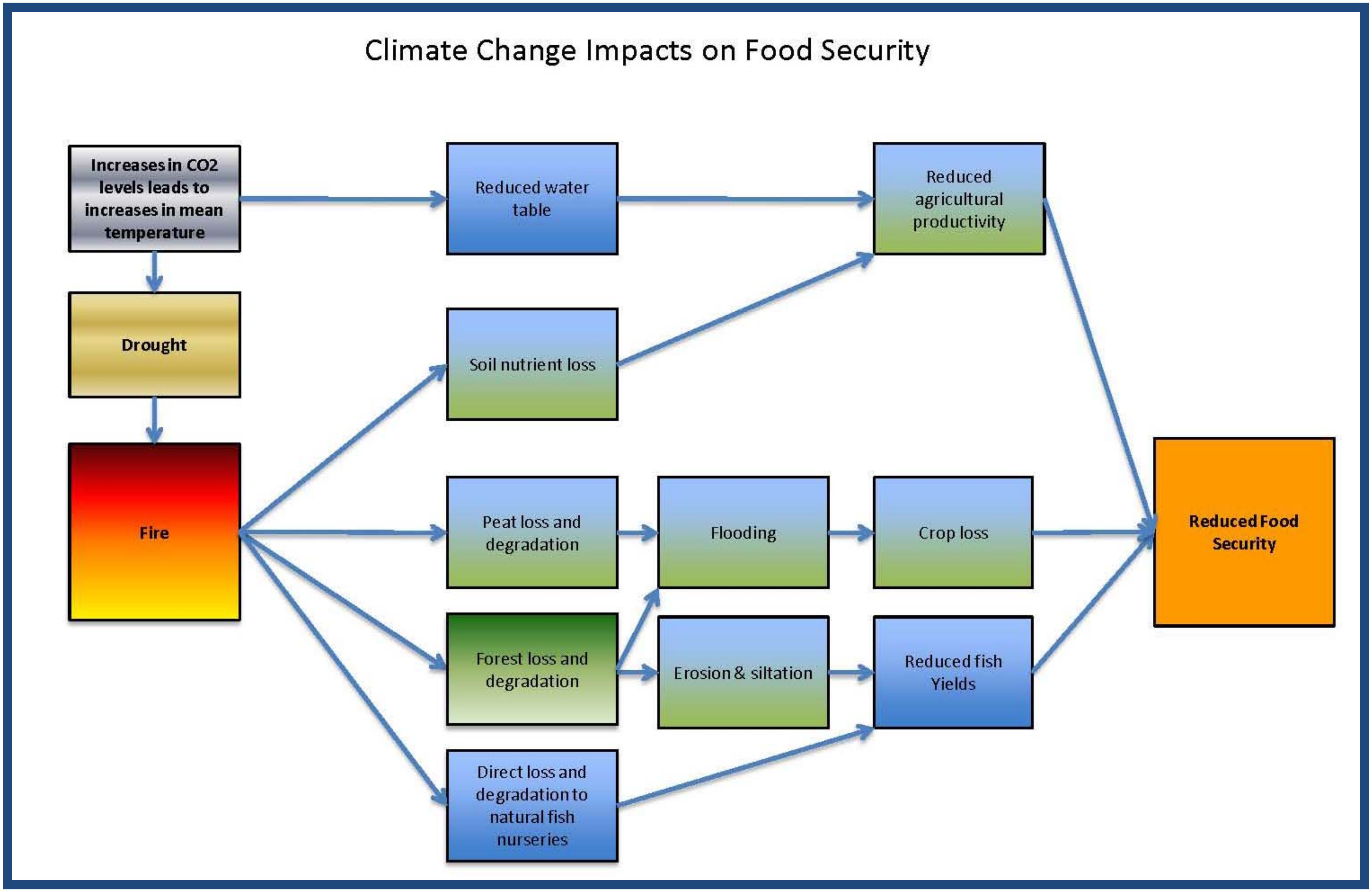


Figure 69. Diagram of Climate Change Impacts on Food Security

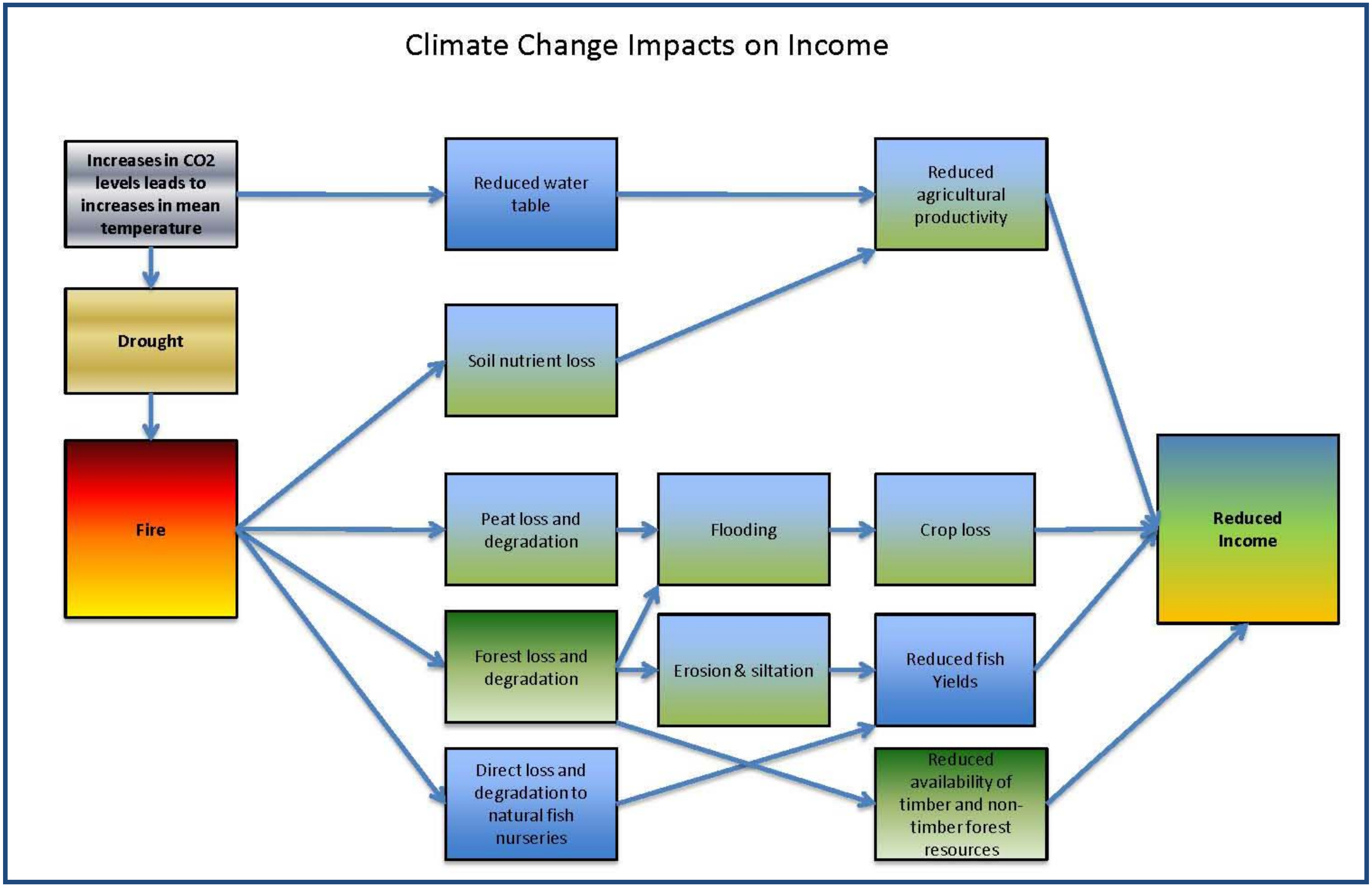


Figure 70. Diagram of Climate Change Impacts on Income

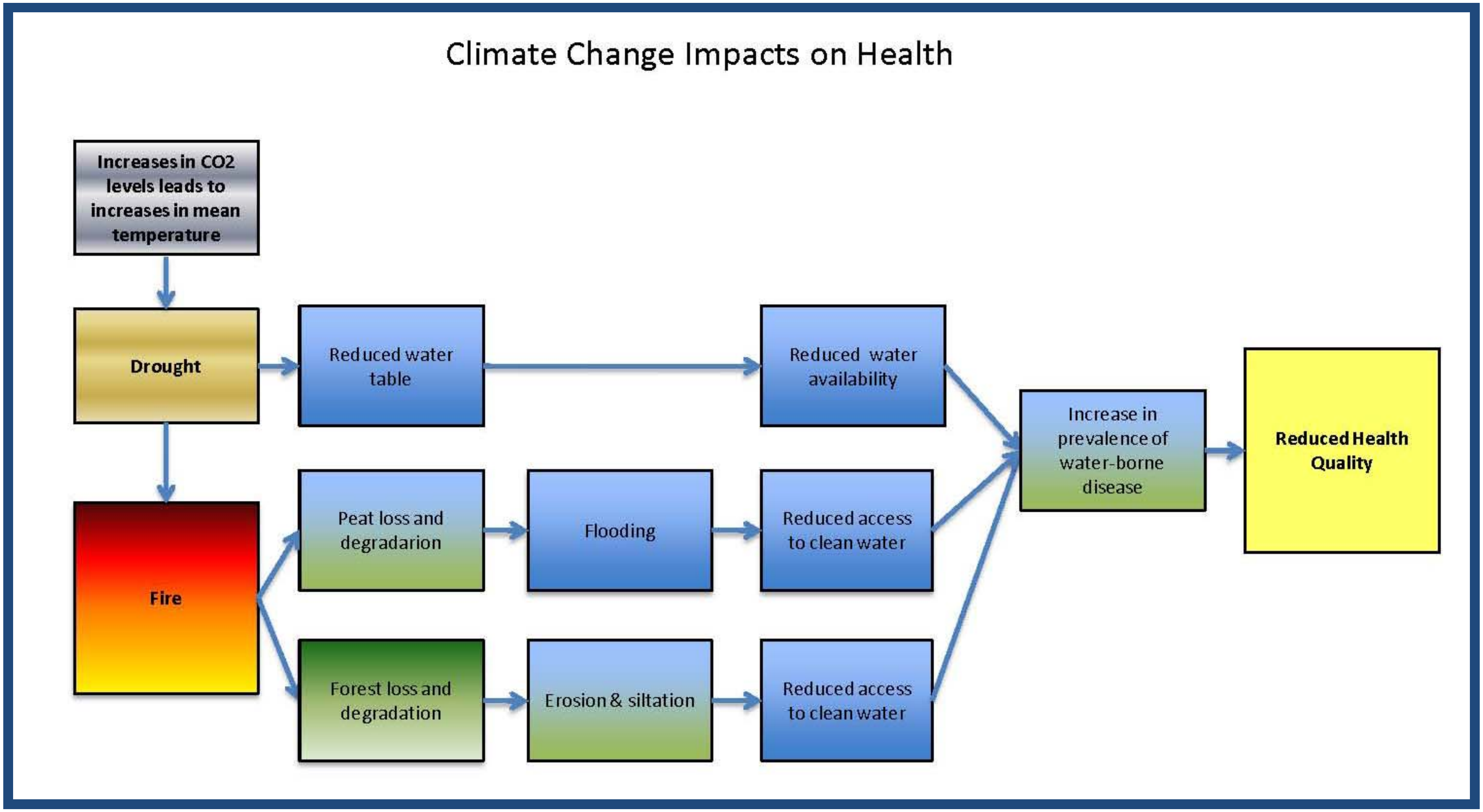


Figure 71. Diagram of Climate Change Impacts on Health

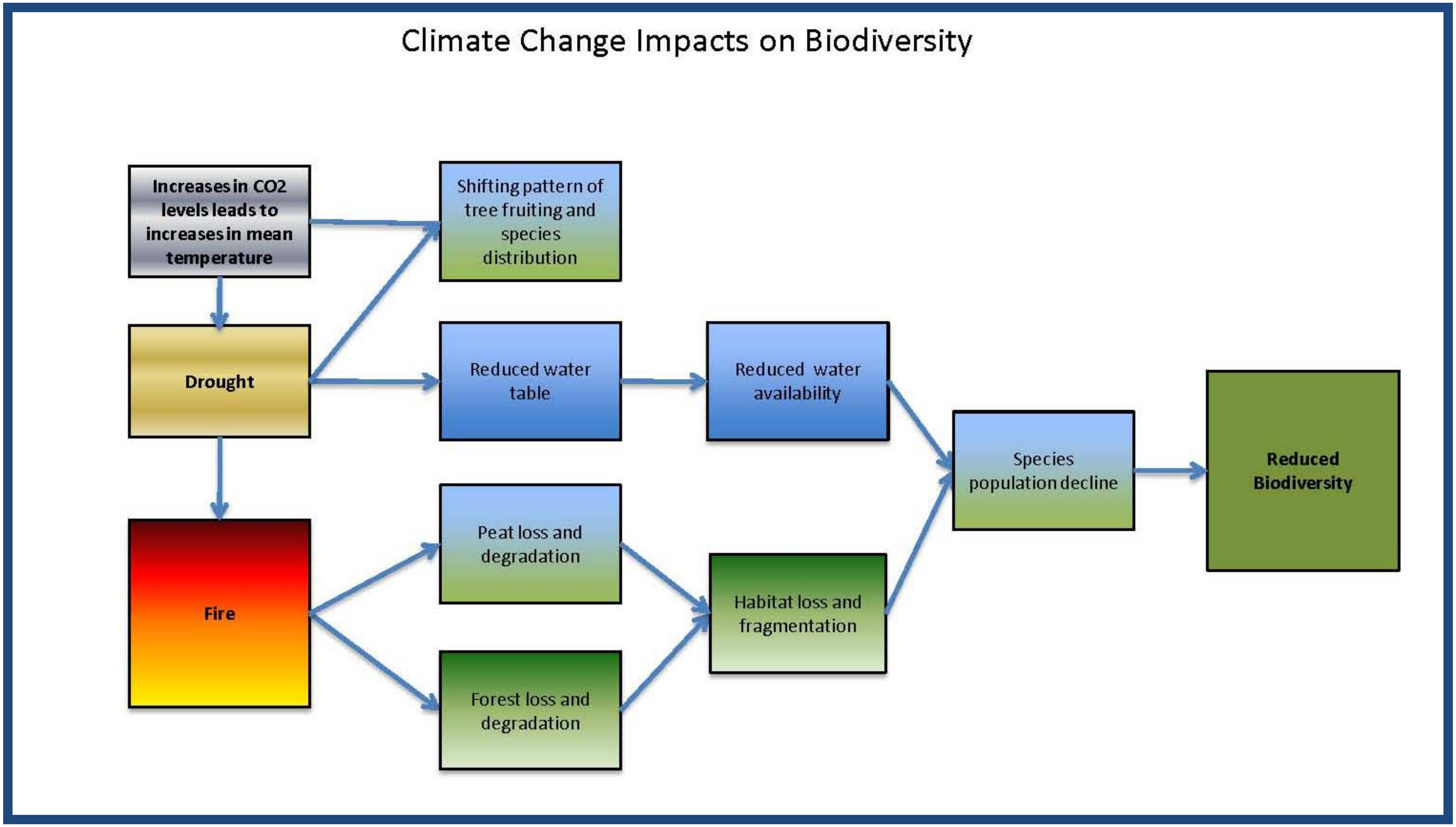


Figure 72. Diagram of Climate Change Impacts on Biodiversity

Climate change impact on biodiversity

Climate change, drought and fire would be expected to have independent and compounding negative impacts on biodiversity in the absence of the project. As described in Section GL1.1, fire can have a devastating impact on biodiversity, causing high rates of tree mortality contributing to species extirpation and habitat fragmentation that reduces habitat quality and value for many forest-requiring species. Drought can also have a direct impact on forests through tree mortality, which is expected to increase with increased frequency of drought (Nishimua et al. 2006). Warmer temperatures and drought, especially severe droughts associated with ENSO events may cause changes in the patterns of fruiting. The ENSO cycle currently repeats roughly 2–3 times per decade, a pattern has potentially changed relatively recently (Cannon et al 2007), and is likely to shift due to climate change (Trenberth & Hoar 1997). Such shifts may disrupt or change synchronous fruiting unique to Bornean ecosystems with cascading effects on plant and animal species (Cannon et al. 2007) and negative consequence for biodiversity (Figure 71).

GL1.2 Community and Biodiversity impacts of local climate change

Indicator: Demonstrate that current or anticipated climate changes are having or are likely to have an impact on the well-being of communities and/or the conservation status of biodiversity in the project zone and surrounding regions.

IPCC Observed and Predicted Climate Change Impacts to Communities affecting or likely to affect Rimba Raya.

In 2007, the IPCC Working Group II published findings based on a number of observations and models on the current and likely impacts of climate change. Based on Rimba Raya community surveys and land use analysis, the following impacts have already been observed or are likely to occur in the near future in Rimba Raya:

Food Security

- *At lower latitudes, especially seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increases (1-2°C), which would increase risk of hunger.*
- *Regional changes in the distribution and production of particular fish species are expected due to continued warming, with adverse effects projected for aquaculture and fisheries.*

Income

- *Increases in the frequency of droughts and floods are projected to affect local production negatively, especially in subsistence sectors at low latitudes.*

- *The most vulnerable industries, settlements and societies are generally those in coastal and river flood plains, those whose economies are closely linked with climate-sensitive resources, and those in areas prone to extreme weather events.*

Health

- *Projected climate change-related exposures are likely to affect the health status of millions of people, particularly those with low adaptive capacity, through:*

    - *increases in malnutrition and consequent disorders, with implications for child growth and development;*
    - *increased deaths, disease and injury due to heat waves, floods, storms, fires and droughts;*
    - *the increased burden of diarrhoeal disease;*
    - *the increased frequency of cardio-respiratory diseases due to higher concentrations of ground levelozone related to climate change;*
    - *the altered spatial distribution of some infectious disease vectors.*
    - *Endemic morbidity and mortality due to diarrhoeal disease primarily associated with floods and droughts are expected to rise in East, South and Southeast Asia due to projected changes in hydrological cycle associated with global warming. Increases in coastal water temperature would exacerbate the abundance and/or toxicity of cholera in South Asia.*

Observed and Predicted Climate Change Impacts on Biodiversity affecting or likely to affect Rimba Raya.

Climate change has caused numerous shifts in species distributions and abundance over the last three decades (Thomas et al. 2004), which can cause population fragmentation and decline leading to species extinction. As much as 50% of Asia's biodiversity is at risk of extinction due to climate change (Cruz et al. 2007).

In Borneo, climate change driven fires are expected to directly impact species populations and biodiversity (CIFOR 2006). Forest fire is the primary driver of deforestation, which has accelerated in the last decade and is projected to cause the near-complete deforestation in Rimba Raya by 2020 (see Figure 72) in the absence of the project activities aimed at protecting and connecting large habitat patches.

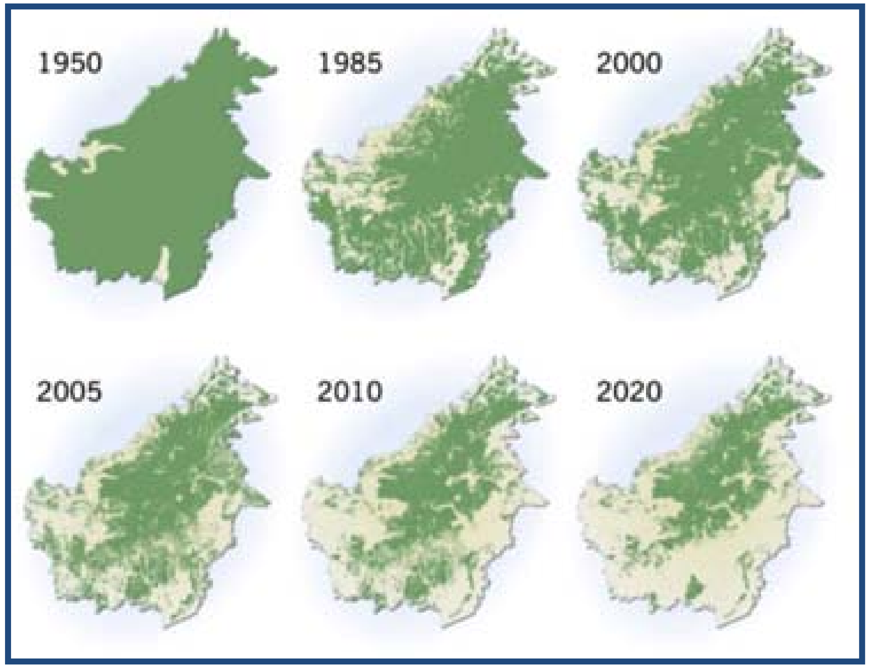
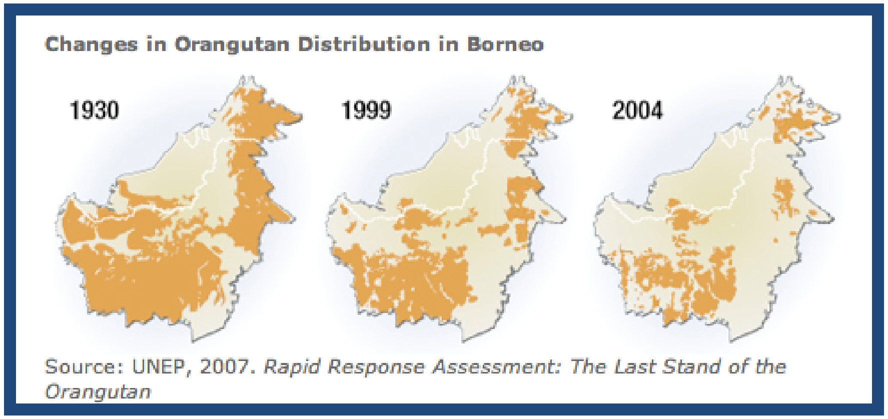


Figure 73. Extent of Deforestation in Borneo 1950-2005 and Projection to 2020

Such forest loss would cause severe declines in biodiversity and further threaten at-risk populations of globally endangered species including a number of primates. The orangutan, whose distribution declined by 91% this century (see Figure 73, UNEP 2007), continues to suffer population losses due in part to climate change induced fire, habitat loss and fragmentation (Wich et al. 2008).



Source: UNEP, 2007. *Rapid Response Assessment: The Last Stand of the Orangutan*

Figure 74. Decline of Orangutan Distribution in Borneo from 1930-2004

Shifts in the timing and extent of dry seasons and fruit abundance is also likely to affect orangutan and other populations by reducing food availability and interrupting breeding and birth cycles. Fire and drought that reduce abundance of fruits will negatively impact orangutan populations because females are more likely to conceive during periods when food resources are not limited (WWF 2002).

Climate change is occurring at the same time as another problem of global and historical proportions – the sixth mass species extinction crisis in the history of life on earth.
–Totten et al. 2003

GL1.3 Identification and mitigation of risks to community and biodiversity benefits

Indicator: Identify any risks to the project's climate, community and biodiversity benefits resulting from likely climate change and climate variability impacts and explain how these risks will be mitigated.

Many climate change impacts can be avoided, reduced or delayed by mitigation. Project activities are designed to address the negative impacts associated with drought and fire - the primary drivers of environmental degradation associated with climate change. This also makesproject benefits more resilient to local climate changesince programs are already in place to address these impacts e.g. soil enrichment is being used to improve crop production*and also sustain this benefit even with expected climate change impacts*. Given the adaptive management framework of the project, the location, frequency, level and duration of interventions such as soil enrichment will be adjusted as needed to achieve project benefits in an expectedly variable and changing environment.

Furthermore, the climate project benefits will be protected, monitored, quantified and closely tracked in order to meet the requirements of avoided emissions under the Voluntary Carbon Standard (VCS). Since the primary objectives will be to protect peat and forests, these activities are expected to stabilize and mediate predicted climate change impacts.

GL1.4 Project activities that assist communities and biodiversity adapt to local climate change

Indicator: Demonstrate that the project activities will assist communities53 and/or biodiversity to adapt to the probable impacts of climate change.

While it should be cautioned that climate change can slow the pace of sustainable development, implementation of well-designed development activities can also reduce the vulnerability to climate change by enhancing adaptive capacity and increasing resilience. Some impacts can be mitigated, but for unavoidable impacts, adaptation is the only available and appropriate response(Case et al. 2008).Adaptation will be necessary to address climate change impacts that are already in process (IPCC 2007), especially those addressing near-term impacts (Case et al. 2008). Activities to assist communities and biodiversity adapt to climate change are summarized below.

Adaptation will be necessary to address impacts resulting from the warming which is already unavoidable due to past emissions.

–IPCC 2007

Case et al. 2008 suggest there is value in adopting a portfolio or mix of strategies that includes mitigation, adaptation, technological development and capacity building (to enhance both adaptation and mitigation) and research (on climate science, impacts, adaptation and mitigation). The Rimba Raya project employs such a range of strategies and is working to combine policies, incentive-based approaches, and actions across stakeholders including community members, regional and national government and agencies and NGOs.

By targeting climate change impacts in project development the Rimba Raya project aims to increase adaptive capacity of biodiversity (biological systems) and community. Project proponents also recognize that impacts of climate change will vary spatially and temporally within the region and project, and are committed to meeting the expected increasing costs of implementing programs and activities to mitigate impacts of climate change to project benefits.

The tables below summarize activities that used to minimize, mitigate and/or assist communities and biodiversity adapt to climate change impacts that could affect project benefits.

Table 49. Climate Project Benefit: Reduced GHG Emissions

Climate Change Associated Risk	Impact Addressed	Activity	Minimize Impact	Mitigate Impact
Fire	Peat loss and damage, forest loss and damage	Fire suppression, education and training (see Fire Management Plan - Annex 12)	X	
Drought & Fire	Peat drying and oxidation	Peat re-wetting (see Couwenberg 2009)	X	
Fire	Forest loss and damage	Reforestation/Agro-Forestry-Afforestation (see Section G3.2)		X

Table 50. Community Project Benefit: Improved Food security

Climate Change Associated Risk	Impact Addressed	Activity	Minimize Impact	Mitigate Impact	Adapt to Impact
Fire	Peat loss and damage, forest loss and damage	Fire suppression, education and training (see Fire Management Plan - Annex 12)	X		
Drought	Reduced water table	Water conservation, improved irrigation techniques		X	
Fire	Soil nutrient loss due to fire	Soil enrichment with Biochar (see Section G3.2)		X	
Fire and forest loss and damage	Erosion, siltation	Reforestation & Agro-Forestry (see Section G3.2)		X	
Multiple Climate-driven environmental changes	Reduced agricultural productivity and crop loss	Crop diversification, harvest rotation and application of new technologies for improved production (see Section G3.2)			X
Multiple Climate-driven environmental changes	Reduced fish yields	Aquaponics (see Section G3.2)			X

Table 51. Community Project Benefit: Increased Income

Climate Change Associated Risk	Impact Addressed	Activity	Minimize Impact	Mitigate Impact	Adapt to Impact
Multiple Climate-driven environmental changes	Same impacts to forest, agriculture and fishing described in Food Security Project Benefits	Same activities as those described in Food Security Project Benefits (see Table 50)	**X**	**X**	
Fire	Reduced income from forest products,	New agroforestry development and application of technology for sustainable yields (see Section G3.2)			**X**
Multiple Climate-driven environmental changes	Reduced income from agriculture and fishing	Capacity building for income diversification (see Section G4.3)			**X**

Table 52. Community Project Benefit: Improved Health

Climate Change Associated Risk	Impact Addressed	Activity	Minimize Impact	Mitigate Impact	Adapt to Impact
Fire	Peat loss and damage, forest loss and damage which leads to flooding	Fire suppression, education and training (see Fire Management Plan Annex 12)	**X**		
	Forest loss and damage and flooding	Reforestation & Agro-Forestry (see Section G3.2)		**X**	
Drought	Reduced water table	Water conservation, improved irrigation techniques		**X**	
Multiple Climate-driven environmental changes	Increased Disease	Community education and build clinics to provide better access to healthcare (see Section G3.2)			**X**

Table 53. Biodiversity Project Benefit: Longterm Maintenance of Biodiversity

Climate Change Associated Risk	Impact Addressed	Activity	Minimize Impact	Mitigate Impact	Adapt to Impact
Fire	Forest loss and damage which leads to habitat loss and fragmentation	Fire suppression, education and training (see Fire Management Plan Annex 12)	**X**		
	Forest loss and damage which leads to habitat loss and fragmentation	Protect and manage large patches of contiguous forest			**X**
Multiple Climate-driven environmental changes	Change in pattern of forest fruiting (impacting vertebrate fauna)	Protect and manage large patches of contiguous forest			**X**

GL2. Exceptional Community Benefits

The Rimba Raya project is applying for Gold Level status under the CCB standard on the basis of the exceptional biodiversity benefits described below.

GL2.1. Human Development Ranking

Demonstrate that the project zone is in a low human development country OR in an administrative area of a medium or high human development country in which at least 50% of the population of that area is below the national poverty line.

Indonesia is a Medium Human Development country on the UNDP Human Development Index (UNDP 2007). Poverty level of the administrative area of the project, therefore, is used to qualify for Criterion GL2.1.

The national poverty line in Indonesia, set by the Indonesian Bureau of Statistics (*Badan Pusat Statistic – BPS*), is defined by household ability to afford a specified minimum food intake and other essential non-food items. The Indonesian poverty line is stricter than that commonly used by international organizations, such as the World Bank and UN. Where these organizations set the threshold for extreme poverty at US$1/person/day, and moderate poverty at US$2/person/day, BPS has set the Indonesian poverty limit at $1.55/person/day (WB 2006).

This difference ($0.45) may seem trivial, but its impact on poverty statistics is profound – tens of millions of Indonesian households meet World Bank and UN definitions of poverty, but not national ones, and are thus included from national statistics.

For example, in 2006 BPS reported 17.8% of Indonesians were said to live below the national poverty line, yet 49% of the population was living on less than $2/day (WB 2006). Additionally, Indonesian national poverty statistics do not reflect the lack of access to basic services and poor human development outcomes that are endemic to most outer lying regions of the archipelago, including the Project Area.

It is in this light that we review Indonesian poverty statistics and the reality on the ground in the Rimba Raya Project Area in order to justify qualification of the project for this criterion.

The Rimba Raya Project is located in the Seruyan District (*Kabupaten*) of Central Kalimantan. BPS data from 2004 show 5-10% of the population in Central Kalimantan fall below the national poverty line – 500,000 to 1 million individuals (WB 2006). According to Provincial data alone, the Project would not meet the '50% of the population' threshold for this criterion. But one must look at spatial patterns of regional development within the Province to evaluate GL2.1 appropriately.

The Seruyan District has a population of c.112,000 people. In 2004 (the most recent data available) Seruyan was reported to have a per capita income of Rp. 7,012,379/year (PDKS 2004). At the 2004 exchange rate, this is equivalent to $2.22/person/day – approaching, but still exceeding, the $2/day international threshold for poverty.

Project Zone specific economic data is available. Table 54 below summarizes data compiled from the **Central Bureau of Statistics of the Seruyan District**. This data indicates that the average household income in the Project Zone for 2008-2009 was 500,000 Indonesian rupia or USD$55/month. Of a total population of 15,826 in 2,886 households this equates to approximate 5 people per household equaling a meager **$0.36/person/day.**

Additional standard indicators of poverty include access to education, health care, clean drinking water and housing. As detailed above in the community section, access to all four of these services are extremely limited and/or non-existent in the Project Area. Both health care and education facilities require distant travel and cost is a limiting factor. Sanitation facilities are not available (e.g. septic tanks are not used), with toilets designed to drop waste directly into rivers – the same rivers used to bathe, wash and collect water for drinking and cooking. Supporting data for these conditions are based on direct observations acquired during a recent social survey, site visits and from other national and international organizations working in the area (OFI and World Education). Limited available government data are consistent with this conclusion.
A government health program called Jaminan Kesehatan Masyarakat (Jamkesmas) to assist poor families with the cost of health care announced last year that 27,143 residents out of the c. 112,000 of the Seruyan District (c. 24%) were too poor to cover their own medical costs, thus qualifying for this program (Kapuas 2008). Again, this averages across the entire Seruyan District, not specifically for the communities or sub-districts in the Project Area, which by anecdotal data are amongst the most impoverished people in the Seruyan district. When widely recognized severe disparities of income between urban and rural populations are considered, the extreme rural conditions of the Project Area would suggest that far more than 24% of the population cannot afford access to basic medical care.

Economic Impact of Project Activities on local Communities

Quantifiable economic impacts to the communities are difficult to support and at this early stage are necessarily descriptive. However, the project's projected budget closely approximates the entire aggregate household income of the communities (see Table 54). Additionally, planned programs such as reforestation / agro-forestry and aquaponics programs are designed to replace income from unsustainable practices. These new income sources should provide income growth as well as mitigate environmental pressures. Lastly, other collateral benefits such as access to health services, clean water, early childhood development, and micro-credit will substantially increase the standard of living and quality of life indexes for these communities. Proponents believe therefore, that it is fair to conclude that the project will have an overwhelmingly positive and quantitative impact on all communities bordering the project zone.

GL2.2. Project benefits to the lowest 50% of households

Demonstrate that at least 50% of households within the lowest category of well-being (e.g., poorest quartile) of the community are likely to benefit substantially from the project.

This section describes how the project will identify households in the lowest category of well-being and how these households will benefit from the Project.
Households in the lowest category of well-being will be identified through a comprehensive household livelihood security assessment (HLSA) or similar tool. Such an assessment incorporates all elements that contribute to a household's well-being, and analyze whether households have adequate and sustainable access to income and resources to meet basic needs, such as access to food, drinking water, health facilities, educational opportunities, housing, and time for community participation and social integration (CARE 2002).

The population of the Project Area is approximately 15,826 individuals from 2,886 households. Fifty percent of the poorest quartile amounts to 1,978 individuals, or c. 361 households, that must benefit substantially from the Project to meet Criterion GL2.2.

The Project is designed such that it will offer a multitude of programs and activities to communities across the Project Area. As described previously in this report, these will include an early childhood education program, three community centers, a micro-credit program, a mobile health clinic, reforestation in three locations spread across the Project Area, agroforestry initiatives, an orangutan reintroduction project and more. These programs and activities will be designed and implemented to target and prioritize involvement of individuals in the poorest quartile of households, and they are expected to reach far more than 50% (361 household) of the poorest quartile.

Table 54. Demographic & Economic Data for Local Communities within the Project Management Zone

No	Village	Number of House holds	Men	Women	Total	Average monthly income / household	Source of Income
1	Bahaur	147	766	584	1350	Rp. 500,000	Plantation, agriculture, fisheries, palm oil plantation worker
2	Paring Raya	151	348	303	651	Rp. 500,000	Agriculture, plantation by villager and fishery
3	Parang Batang	197	522	507	1029	Rp. 500,000	Agriculture, plantation by villager, oil palm plantation workers and fishery
4	Tanjung Hanau	119			478	Rp. 500,000	Oil palm plantation workers, plantation by villager and fishery
5	Banua Usang	372	500	490	990	Rp. 500,000	Income from fisheries and rubber plantation
6	Paren	117	197	179	376	Rp. 400,000	Income from fisheries and rubber plantation
7	Ulak Batu	54	141	144	285	Rp. 400,000	Income from fisheries and rubber plantation
8	Palingkau	49	93	78	171	Rp. 400,000	Income from fisheries and rubber plantation
9	Cempaka Baru	133	322	291	613	Rp. 500,000	Income from fisheries and rubber plantation
10	Telaga Pulang	421	804	680	1.484	Rp. 800,000	Variation of income from trade, plantation, agriculture, fisheries, oil palm plantation and services
11	Baung	171			690	Rp. 500,000	Variation of income from plantation, agriculture, fisheries, oil palm plantation, bark
12	Jahitan	143	266	216	482	Rp. 500,000	Fisheries, oil palm plantation
13	Muara Dua	169	281	276	557	Rp. 500,000	The main income is fishing
14	Tanjung Rangas	643	1452	735	2187	Rp. 500,000	The main income is fishing
Totals:		**2886**	**5692**	**4483**	**15826**	Approx $150,000 USD/month aggregate total for all households	

**Compiled from the Central Bureau of Statistics of the Seruyan District.*

The poorest quartile is expected to benefit substantially by gaining access to resources previously unavailable to them; clean water, health care, education, training, credit and employment opportunities. Their involvement in any of the programs and use of any of the services will be optional, but participation is expected to be high based on initial community consultation and feedback from local and international NGOs working in the area. Individuals in this quartile will be offered services and opportunities that will improve quality of life for their families, empowering them and to lift themselves from chronic poverty.

GL2.3. Barriers to project benefits reaching the poorer households

Demonstrate that any barriers or risks that might prevent benefits going to poorer households have been identified and addressed in order to increase the probable flow of benefits to poorer households.

The two greatest barriers, or risks, that might prevent project benefits reaching the poorer households include: 1) Communication on program opportunities being restricted, intentionally or unintentionally, from reaching the poorer households. For example, the village head (which is usually relatively affluent in a community and frequently used as the sole conduit for distributing information) may try to guide or restrict program participation based on his personal interests and family or other personal relationships. 2) The communities are provoked by a project opponent and misguided to categorically reject the project. In this scenario, communities in the area are erroneously seen as accepting of every development project or program offered to them, when in fact, they may wish to filter out questionable initiatives. If the Project does not provide a mechanism for communities to provide such fed back, this renders communities vulnerable to provocation by individuals with alternative agendas threatened by the Project.

These two risks will be addressed through routine, direct communication with the target households, taking advantage of, but not relying exclusively on, traditional forms of communication. Communication will therefore follow two paths: the traditional system via local government (sub-District, township and village heads) and a direct grassroots system, delivering project information directly through physical site visits. This approach aims to appease local government and traditional leaders, not overstepping or offending them, but also ensures communication with the poorest households will be fluid and maximizes their participation in project activities.

GL2.4. Identification and mitigation of negative impacts from project to poorer households.

Demonstrate that measures have been taken to identify any poorer and more vulnerable households and individuals whose well-being or poverty may be negatively affected by the project, and that the project design includes measures to avoid any such impacts. Where negative impacts are unavoidable, demonstrate that they will be effectively mitigated.

Measures to identify the most vulnerable households and individuals will be undertaken as part of the HLSA described in GL2.2 above. Part of this assessment will be to identify ways in which all households, including the poorest households, may be negatively affected by the project. At the moment livelihoods in the Project Area are largely dependent on fishing and a limited amount of farming (with productivity in apparent steep decline). Project activities are designed to enhance these activities, improving techniques and returns. Socially and politically, the project is thought to provide negligible risk to poor or vulnerable households. Although currently deemed unlikely, the risk of previously unidentified negative impacts arising is always present and will be monitored throughout the project.

GL2.5. Effectiveness of Community Impact Monitoring with focus on poorer households and women.

Demonstrate that community impact monitoring will be able to identify positive and negative impacts on poorer and more vulnerable groups. The social impact monitoring must take a differentiated approach that can identify positive and negative impacts on poorer households and individuals and other disadvantaged groups, including women.

Monitoring and evaluation of project impact on communities will follow the HLSA methodology. Other resources, such as CARE's Benefits Harms Guidebook (2001) that has a focus specifically on unintentional negative impacts will also be used as reference. Disadvantaged groups that have been identified in the Project Area include: 1) women, 2) the elderly, 3) the poor, and 4) landless individuals that make a living working on other people's farm land (usually a neighbor). These groups of people will be surveyed differently to the rest of the community, making an effort to monitor each individual or household as opposed to representative sampling. Community-based monitoring initiatives are part of the HLSA methodology, making this goal of reaching each individual realistic and achievable.

GL3. Exceptional Biodiversity Benefits

Study conducted by Daemeter Consulting

The Rimba Raya project is applying for Gold Level status under the CCB standard on the basis of meeting the Vulnerability Criterion. Additionally, the Project is thought to qualify under the Irreplaceability Criterion. Both are demonstrated below.

GL3.1. Vulnerability

Vulnerability. Regular occurrence of a globally threatened species (according to the IUCN Red List) at the site.

Based on data from neighboring Tanjung Puting National Park, the Rimba Raya project area is very likely to have a large number of globally threatened species. As described in the biodiversity section above, forest between TPNP and the project area is contiguous, with similar vegetation types, forest structure and ecosystem mosaics. Species previously identified in TPNP are therefore a solid proxy for species likely to occur in the project area. As displayed in the table below, a total of 54 species listed as *Critically Endangered* or *Endangered* by IUCN are likely present in the Rimba Raya project area, 17 of which are confirmed present in TPNP. An additional 40 species listed as *Vulnerable* by IUCN are likely present in the project area, 13 of which are confirmed in TNTP.

GL3.1.1. Critically Endangered or Endangered Species

Critically Endangered (CR) and Endangered (EN) species - presence of at least a single individual.

The following table lists the 17 Critically Endangered (CR) and Endangered (EN) species confirmed present in nearby TPNP. Most notable among these is the Bornean orangutan (EN), which is confirmed as present in the Project Area.

Table 55. Estimated Total and Confirmed Number of Endangered, Threatened & Vulnerable Species Found in Project Area

Certification Number	CR & EN Species	VU Species
	Total (confirmed)	Total (confirmed)
Mammal	8 (6)	21 (12)
Bird	1 (1)	8 (6)
Plant	39 (7)	6 (1)
Reptile	6 (3)	5 (0)
Total	**54 (17)**	**40 (19)**

Mammals

Six EN mammal species are confirmed present in TPNP and/or the Project Area, including the Bornean orangutan (*Pongo pygmaeus*), agile gibbon (*Hylobates agilis*), proboscis monkey (*Nasals larvatus*), pangolin (*Manis javanica)*, hairy-nosed otter (*Lutra sumatrana),* and Borneo bay cat (*Catopuma badia*). All six of these species, except the pangolin, rely on forested habitats, with the agile gibbon dependent on mature or primary forest. The banteng (*Bos javanicus*) was previously confirmed present in TPNP, but is now likely locally extinct.

Plants

All of the seven confirmed CR and EN plants listed are large emergent or canopy trees in the Dipterocarpaceae, including one in the genus *Dipterocarpus*, five *Shorea* and one *Vatica* species. Distribution of these species is restricted to mature lowland rain forest in its various forms (freshwater swamp forest, peat swamp forest, and lowland dipterocarp forest) and all are considered CR or EN due primarily to habitat loss. Based on habitat type and extent in the Project Area, large populations of these species are likely to be present, in particular the CR species *Dipterocarpus coriaceus* and *Shorea balangeran*.

Birds

Of the 361 bird species considered likely to occur in TPNP and the Project Area, one species – the Storm's Stork (*Ciconia stormi*) – is classified as EN. Endemic to the Sunda sub-region, less than 1,000 individuals of this stork remain in the forested swamps of Borneo, Sumatra and the Malay Peninsula. It is considered likely present on the basis of geographic range, and the condition and extent of suitable habitat.

Reptiles

A further three species of EN herptofauna are likely present in the Project Area based on confirmed presence in TPNP and contiguity of suitable habitat: the False ghavial (*Tomistoma schlegelii*); Malayan giant turtle (*Orlitia borneensis*) and Asian brown tortoise (*Manouria emys*).

One notable CR species of herptofauna is considered potentially present in the Project Zone, the Painted river terrapin (*Callagur borneoensis*). This species inhabits the tidal portion of rivers and estuarine mangrove areas and feeds on fruit, leaves, and clams. Females nest on sand beaches along riverbanks and coastal beaches. Its distribution on Borneo is unclear, and is likely widespread but rare. It is considered potentially present on the basis of suitable habitat in the Project Zone.

Table 56. Endangered & Critically Endangered Species Found in Project Area		
Mammals		
Catopuma badia	Borneo bay cat	EN
Hylobates albibarbis	Bornean agile gibbon	EN
Lutra sumatrana	Hairy-nosed otter	EN
Manis javanica	Sunda pangolin	EN
Nasalis larvatus	Proboscis monkey	EN
Pongo pygmaeus	Bornean orangutan	EN
Birds		
Ciconia stormi	Storm's Stork	EN
Plants		
Dipterocarpus coriaceus		CR
Shorea balangeran		CR
Shorea platycarpa		CR
Shorea quiso		CR
Shorea leprosula		EN
Shorea teysmaniana		EN
Vatica mangapchoi		EN
Reptiles		
Tomistoma schlegelii	False ghavial	EN
Orlitia borneensis	Malayan giant turtle	EN
Manouria emys	Asian giant tortoise	EN

GL3.1.2. Vulnerable Species

Vulnerable species (VU) - presence of at least 30 individuals or 10 pairs.

In addition to the 47 species with CR or EN status that are confirmed or likely present in the Project Area, an additional 40 species classified as *Vulnerable* by IUCN are considered likely present in the project area. Nineteen of these have been confirmed present in nearby TPNP, and are listed in the table below. As noted, these species are considered very likely to occur in the Rimba Raya project area based on habitat contiguity with the TPNP and comparatively low levels of hunting reported in the Project Area.

Table 57. Vulnerable Species Found in Project Area	
Mammals	
Arctictis binturong	Binturong (bearcat)
Helarctos malayanus	Sun bear
Hipposideros ridleyi	Ridley's roundleaf bat
Macaca nemestrina	Pig-tailed macaque
Megaerops wetmorei	White collared fruit bat
Murina aenea	Bronzed tube nosed bat
Murina rozendaali	Gilded tube nosed bat
Neofelis diardi	Sunda clouded leopard
Nycticebus menagensis	Bornean slow loris
Rusa unicolor	Sambar deer
Sus barbatus	Bearded pig
Tarsius bancanus	Sunda tarsier
Birds	
Leptoptilos javanicus	Lesser Adjutant
Treron capellei	Large Green Pigeon
Lophura erythrophthalma	Crestless Fireback
Melanoperdix nigra	Black Partridge
Pitta baudii	Blue-headed Pitta
Setornis criniger	Hook-billed Bulbul
Plants	
Gonystylus bancanus	

To illustrate the likelihood of at least 30 individuals of one VU species occurring in the Project Area (as required by this criteria for Gold Standard), three species from the table above were selected and analyzed based on known densities for those species. The table below shows the known range of densities for the slow loris, binturong and sambar deer (small, medium and large mammals). Also shown are conservative estimates for minimum areas of habitat required to maintain 30 individuals of each species. A conservative method of estimation was used, based on lowest recorded densities for each species. This conservative approach enables evaluation of whether sufficient habitat is present in the Project Area to support 30 individuals of each species, even if present at low densities in the Project Area.

Based on 2005 satellite imagery the Project Area contains c. 32,000 ha of mature forest and c. 15,000 ha of secondary forest (c. 47,237 ha total). In comparison, estimated minimum areas required for populations of at least 30 individuals of the slow loris, binturong and sambar deer are c. 10,000, 13,700 and 15,000 ha, respectively. This demonstrates that even at lowest recorded densities, mature forest habitat alone is more than sufficient to support 30 individuals of these three species. In fact, minimum populations of at least 2-3 times this size (60-90 individuals) are more likely.

As noted, extremely low density estimates were used for this exercise, yet for many species, densities will, in fact, be highest in mature forest areas, which remain extensive in the Project Area. This further emphasizes the conservative nature of estimates. When viewed in the broader landscape context, the Project Area and TPNP together likely provide sufficient habitat for 30 individuals of all 19 Vulnerable Species confirmed as present in the area.

Table 58. Density & Habitat Range of Species Found in Project Area

Species	Density Range (indiv. km^{-1})	At low density (indiv. ha^{-1})	Ha $indiv^{-1}$	Ha needed for 30
Slow loris[a]	0.3-80	0.003	333	10,000
Binturong[b]	0.218- 0.352	0.00218	459	13,761
Sambar deer[c]	0.2-1.42	0.002	500	15,000

[a] Wiens 2002; Nekaris et al. 2008
[b] Grassman et al. 2005; Meijaard et al. 2005
[c] Kawanishi & Sunquist 2004; O'Brien et al. 2003

GL3.2. Irreplaceability

Irreplaceability. A minimum proportion of a species' global population present at the site at any stage of the species' lifecycle according to the following thresholds:

The Rimba Raya Project also qualifies for the Biodiversity Gold Level status under Irreplaceability Criteria GL3.2.2 and GL3.2.4 based on the presence of the Bornean orangutan in the Project Area.

GL3.2.1. Restricted-Range Species

Restricted-range species - species with a global range less than 47,237 km2 and 5% of global population at the site;

N/A

GL3.2.2. Species with Large but Clumped Distributions

Species with large but clumped distributions - 5% of the global population at the site;

Project benefits for the Bornean orangutan (*Pongo pygmaeus*), endemic to Borneo, deserve special mention. Much of the land in the Project Area remains undeveloped, providing an estimated 44,000 ha of additional forest contiguous with TPNP to the west of the Project Area (OFI 2008). This represents 14% of forest in the region of TPNP and adjacent areas (the 'greater TPNP landscape'), providing significant habitat for orangutans and other wildlife. A recent study on orangutans in TPNP and its buffer, which partly includes the Project Area, found resident orangutan populations averaging 1.9 orangutans per square kilometer (Galdikas et al. unpublished report, cited in OFI 2008). More recent field surveys by OFI confirmed similar orangutan densities in the Project Area as a whole, and showed that individual orangutan home ranges cross the park boundary into the Project Area. These data demonstrate the occurrence of one or more inter-connected orangutan population(s) in the greater TPNP landscape, including Rimba Raya.

The Bornean orangutan population of TPNP is estimated to be more than 4,700 individuals (OFI 2008), or c. 9.8% of the total estimated population of c. 48,000 for all of Borneo (Ancrenaz et al. 2008). Adjacent forests in the Project Area provide an additional 44,000 hectares of suitable orangutan habitat, supporting an estimated 760 individuals. This augments the TPNP orangutan population by an additional 14%, and the global population by nearly 2%.

It is expected that the project will greatly reduce deforestation rates over the coming years, primarily by preventing oil palm plantation development into the park buffer zone along the western bank of the Seruyan, and by limiting access to the national park from the eastern border. This will have marked impacts on the long-term population status of the orangutan. A 2008 analysis of past and future projected deforestation in the Project Area found that forest in the Project Area would be completely deforested in 20 years and that of the park would lose an estimated 147,237 hectares (60%) of its forest cover during this same period. By extrapolation, this simplified 'without project' scenario suggests that the orangutan population in the Project Area would be reduced by more than one-half and that of the greater TPNP orangutan population would be reduced by one third, in the absence of project activities to mitigate these losses.

Thus the Project Area itself contains nearly 2% of the global population and provides vital protection and support to guarantee long term persistence of a further 9.8% of the global population of this species.

GL3.2.3. Globally Significant Congregations

Globally significant congregations - 1% of the global population seasonally at the site;

N/A

GL3.2.4. Globally Significant Source Populations

Globally significant source populations - 1% of the global population at the site;

Estimated total global populations of the Borneo orangutan number fewer than 48,000. OFI has estimated a remnant wild orangutan population of 500 to 900 in the project area, thereby comprising in excess of 1% of the total species population. Additionally, up to 300 orangutans currently at the OFI Quarantine and Rehabilitation Center will be released into the Rimba Raya Reserve.

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