The Valuation of Conservation Options Versus Tropical Deforestation

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ABSTRACT

This paper presents the findings of a study to compare the long term economics of 'business-as-usual' deforestation activities such as logging and farming occurring within Gunung Palung National Park, West Kalimantan, Indonesia ('GPNP') against a 'portfolio' of low emission conservation based alternatives such as carbon credits, ecotourism, bio-prospecting, biodiversity credits, and sustainable harvesting of non-timber forest products. These portfolio activities are often promoted as 'solutions' to deforestation and this study aims to test this hypothesis and quantify values using discounted cash flow methodology on long term projections. GPNP is a species rich park in Indonesia but has a history of high deforestation rates. Demand for logs in Indonesia is projected to double over the next 30 years. The projections also suggest that a food production deficit may occur around 2030 due a reduction of rice crop yields as a result of climate change. The findings indicate that the value in dollar terms from current deforestation activities exceeds that offered by the portfolio alternatives as most of the latter options may be challenging to implement in practice. For the time being, conservation efforts are likely to remain a critical factor in minimizing deforestation rates.

Key words: *biodiversity, bioprospecting, carbon credits, climate change, deforestation, ecotourism, farming, food, Kalimantan, logging, valuation.*

INTRODUCTION

Aim

The aim of the project is to assess the economic case for reducing greenhouse gas emission from deforestation in GPNP by assessing the viability and values of low emission conservation based alternatives.

High rates of deforestation due to Business-As-Usual (BAU) illegal forest activities have been documented in a number of earlier studies in GPNP (Curran 2004, Hiller *et al* 2004, and Zamzani *et al* 2009).

Conservation based alternatives include carbon credits, ecotourism, bio-prospecting, biodiversity credits, and sustainable harvesting of non-timber forest products (NTFP) are often cited as 'solutions' to deforestation though not often quantified.

It is acknowledged that there may be other forest use options with value, though not necessarily quantifiable in dollar terms, but such options was outside the scope of this study.

Context - Indonesia, the World's Third Largest Emitter of GHG

Indonesia is, after China and the US, the world's third largest emitter of greenhouse gases (GHG). In 2005, Indonesia's emissions accounted for 2.1 billion tons of CO2e (~4.5% of global), with deforestation and conversion of land contributing 78% of national emissions (NCCC 2010).

It is estimated that over 24 million hectares (ha) of forest cover was lost in Indonesia between 1990 and 2010, including 3.4 million ha between 2005 and 2010 (Blaser *et al* 2011). In 2005, approximately 44 million m3 of industrial roundwood (logs) were consumed including 20 million m3 believed to be sourced illegally (Manurung *et al* 2007).

Study Site

Located on the island of Borneo, Gunung Palung National Park is one of the most species rich parks in Asia with high densities of endemic and endangered species such as clouded leopards, sun bears, proboscis monkeys, and the largest populations of wild orang-utans in Kalimantan (Hiller *et al.* 2004).

The 90,000 ha park is located within the Kayong Utara and Ketapang regencies of the West Kalimantan province, Indonesia. The park consist mainly of low plains with a few mountains, the highest being Gunung Palung (1,116m). The region contains seven types of tropical rainforest ecosystems: sub-alpine, montane, lowland, alluvial, moss, swamp, mangrove rainforests and rheofite vegetation formations (Soetarto *et al* 2001).

Historical studies indicated high deforestation rates within the park between 1999 and 2004 (Curran *et al* 2004, Hiller *et al.* 2004, Zamzani *et al.* 2009). As much as 9,000 ha was lost in 2002 due to illegal logging and illegal land clearing for farming (Curran *et al* 2004). Local experts are concerned that *'within 20 years, all of the forest may be gone, if we can't provide economic alternatives'.*

METHODS

Model Design

The project involved a number of phases include stakeholder buy-in, model design, validation, data collection, and review of findings. The valuation model design was based on a review of forestry valuation models and application of standard valuation methodologies.

The valuation methodology is based on the Discounted Cash Flow ('DCF') method using projected 30-year cash flows for each activity which are 'discounted' by an appropriate risk adjusted discount rate to obtain 'present values'. The summation of the all discounted cash flows (both positive and negative) is referred to as the net present value ('NPV'). A positive NPV generally means the project is viable.

The model design validation involved seeking input from industry experts to get a better understanding of key drivers.

Data collection included detailed literature reviews of the respective sectors, market data and/or statistics, and other sources. In 2011, EOS commissioned a survey of 255 households of villagers surrounding the park to obtain socio-economic, faming and logging data.

Various scenarios were developed around parameters such as economic growth (EG), physical impact of climate change (PI), and policy support for the environment (PS). The base case scenario assumes that most assumption follow current and/or historical trends i.e. 'business-as-usual' and include the effects of a potential reduction in rice crop yields. The 'pessimistic case' (from the viewpoint of deforestation) assumes high levels of EG, PI and low levels of PS (e.g. low carbon credit prices, conservation efforts, etc). The 'optimistic case' is the opposite of the pessimistic case.

Data Collection – 2011 EOS Household Survey

EOS commissioned a face-to-face survey of 255 households from 21 villages around GPNP which was conducted between October to November 2011 by a professional Indonesian market research firm to obtain household-level socio-economic, and data on logging and farming practices.

Approximately 2.4% of the respondents admitted to being engaged in illegal logging activities within GPNP, potentially representing 250 households in total. At Rp2.2 million per month, these households had monthly incomes that were 22% lower compared to non-logging households. Kayong Utara is one of the poorest districts with a GDP per capita of about US$955 in 2010 compared to US$1,400 for West Kalimantan and US$2,200 for Indonesia (BPS 2010).

The main reason given for participating in illegal logging was the lack of alternative incomes, and perceived higher wages. Almost all surveyed were prepared to stop logging if there were alternative stable income sources of Rp50-90,000 per day (~US$5-10).

Figure 1. Key Logging Statistics

Logging Statistics	1991	1999	2011
Logging trips per year per team	n.a	26	1.7
Team size (persons)	6.0	4.7	6.6
Average timber extracted per team (m3)	15	37	14
Total timber extracted (m3)	15,282	38,000	940 - 1,900

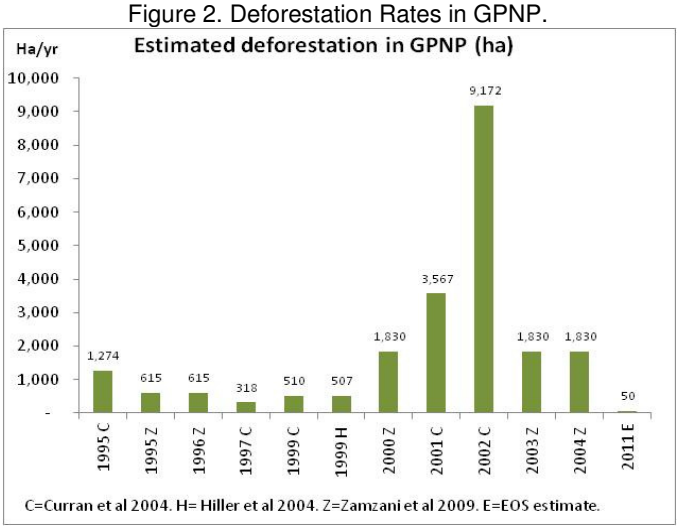
1991, 1999 source: Hiller et al 2004. 2011 EOS Household Survey

Based on the survey data, the average timber extracted was estimated at about 14m3 per trip (ranging from 2m3 to as a high as 30 m3).

The 250 households that could be involved in illegal logging (with 1.04 members involved per household) suggesting that about 40 logging teams may have been operating in GPNP in 2011.

Thus, approximately 950 - 1,900 m3 of timber could have been extracted during the year, which is potentially equivalent to a deforestation rate of about 11-22 ha p.a. (see Figure 2).

Figure 2. Deforestation Rates in GPNP.



Less than 3% of households admitted to having cleared land within the Park for farming purposes. This suggests that potentially 290 households may be cultivating a total area of under 80 ha based on the average figure of 0.27 ha per household indicated by data from the survey. The 80 ha figure is substantially lower than that indicated by earlier studies (Zamzani *et al* 2009), and could be due to potential under-reporting by respondents.

Less than 3% of households admitted to having collected woodfuel from within the Park. Most of these households were also involved in illegal logging. Each household collected an average of 43 kg per month. This is potentially equivalent to an area of less than 2 ha per year.

RESULTS

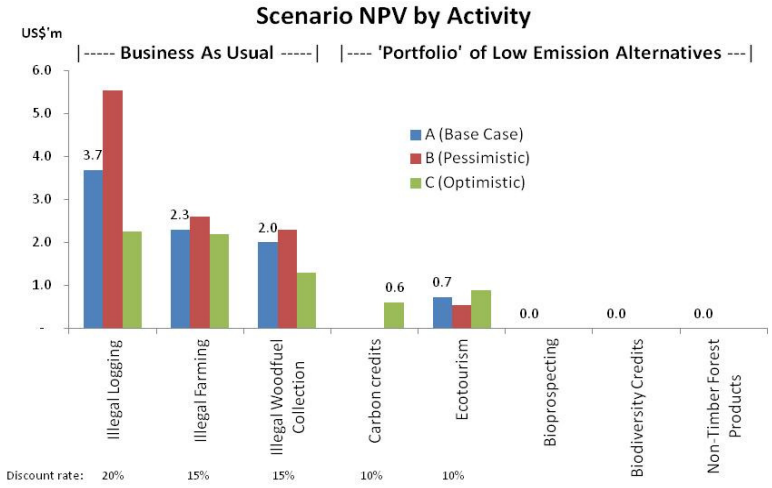
In summary, the BAU activities appear to offer the highest net present values (NPV) compared to the Portfolio activities, with the highest

Figure 3. Summary of Results.

contribution being from illegal logging activities.

Ecotourism offers some potential for further development.

No values for bioprospecting, biodiversity credits and NTFP were provided for as potential cash flows were deemed highly uncertain or insignificant.



DISCUSSION

Demand for Logs in Indonesia

The demand for industrial roundwood (logs) in Indonesia is estimated at 53 million m3 for 2010 according to the data from FAOStat.

Based on a timber sub-module developed by EOS, the above figure could double over the next 30 years, with demand coming mainly from pulp production, sawnwood and panels.

A significant source of supply is likely to be from the development of large scale plantation forests.

Despite this, the level of illegal logging could rise from an estimated 7 million m3 in 2011 to 18 million m3 by 2041.

Figure 4. Demand and Supply for Logs in Indonesia.

Source: EOS projections; figures indicative only due to model limitations.

The implications are that illegal logging could be even higher if legal sources of log supply (e.g. from plantation forests and forest concessions) is less than projected.

Total deforestation from all sources could potentially amount to 36 million ha (assuming no forest re-growth). Indonesia had a forest cover of 48% or 87 million ha in 2010 but by 2041 the figure could decline to as low as 44 million ha if the above projections materialize.

Illegal Logging in GPNP

Due to possible under reporting for both the illegal logging and land clearing for farming, a deforestation rate of 50ha is assumed for GPNP in 2011. This figure is projected to triple to 144 ha over the next 30 years. This would correspond to 2,662 ha being cleared and over 202,000 m3 of logs extracted.

In 2011, tropical hardwood logs were worth US$365/m3 in the international market, while illegal domestic prices are estimated at US$100/m3. Future prices of tropical hardwood logs are assumed to continue rising by the 30-year historical cumulative average growth rate of 4% p.a. (IndexMundi).

The base case net present value of the logs extracted over the next 30 years is estimated at about US$3.7 million using a 20% discount rate. Approximately two thirds of this value is likely to go into the hands of the logging financiers ('cukong'), one third to 'other stakeholders' i.e. bribe takers, and only about a tenth going to the local community mainly in the form of logging labour wages. The relative breakdown is based on earlier log production studies (Klassen 2010, and Obidzinski *et al* 2003).

Illegal Farming

Based on the 2011 EOS Household Survey, an estimated 80ha was cultivated illegally within GPNP (actual figure may be higher). The main reasons provided was the need to feed their families, while others cited the lack of alternative jobs, and lack of land, and belief that they had customary rights to do so.

On average, the farmers cultivated 0.3ha within the park plus an additional 0.3ha outside the park. The main crops were rice (59% by area), rubber (36%) and some palm oil.

Most Indonesian farmers operate on less than one-half hectares of land which is deemed impossible to produce sufficient income. Long term demand for land for farming is driven by ultimately by household food needs, which is assumed to be dependent on household size and household income (Molyneaux *et al* 2004).

Food volume purchased is subject to available income, and any shortfall is assumed to be met by own production. Food production was forecasted based on farming statistics obtained from the 2011 EOS Household Survey.

The base case scenario physical effects of climate change are based on the IPCC A1B scenario which suggests a 2.8℃ rise in temperature by 2100. Such a rise in temperature could result in a 25% reduction in rice yields (Hundal *et al* 1996). This effect is modelled in our projections, pro-rated annually to an assumed 9% decline by 2041.

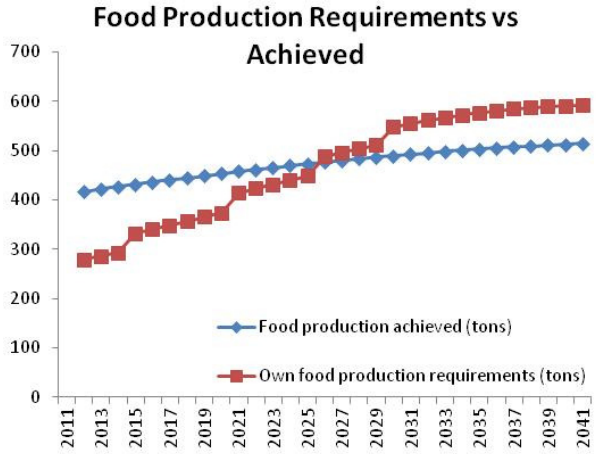
The projections suggest a possible deficit between food requirements and production around 2030 of as much as 14% of food production requirements by 2041 (see Figure 5).

However, the value of cash crops is expected to exceed the value of the food deficit. It is assumed that the food deficit (mainly rice) can be purchased from other sources or changes made to alternative food sources.

China could also similarly face insufficient basic food supplies, while other countries in Southeast Asia will see food production decline significantly by 2030 (Vidal 2013).

Over the last 30 years the price of rice has been increasing by an average of 3% p.a. (IndexMundi).

Figure 5. Food Production Deficit due to Climate Change



Source: EOS projections

Climate change may add a further 50% to global maize prices and slightly less for rice and wheat by 2050 - on top of price increases due to population growth (Vidal 2013).

Population growth pressures are projected to increase the planted area inside GPNP by 35% to 108 ha by 2041. If alternative food supplies cannot be found or cash crop incomes are less than the value of the food deficit, then the above figure could be higher.

Illegal Collection of Woodfuel

Based on the 2011 EOS Household Survey, less than 3% of householders were engaged in the collection of woodfuel illegally from within GPNP, and collectively collected an estimated total of 240-275m3 per year.

Potentially this would be equivalent to an area of about 2 ha p.a. but as the collection is mainly from dead trees or limbs, and that the forest tends to re-grow no actual deforestation is expected according to experts.

As no actual market prices exist for woodfuel, the prices of charcoal in Kalimantan are used as a proxy. Despite assuming a gradual move to alternative cooking energy sources, increased population around the area is expected to maintain the long term demand for woodfuel at close to current levels.

Carbon Credits

A carbon credit is the price the market is willing pay to offset, abate or reduce the emission of one tonne of carbon dioxide (CO2). This is probably one of the most often promoted 'alternative' solutions to deforestation.

Currently, credits from projects to reduce emissions from deforestation or degradation (REDD) can only be sold in the voluntary market. International discussions are underway to include REDD projects within the mandatory market for implementation by 2020.

Projects seeking to develop carbon credits must comply with a carbon standard, which spells out the qualifying criteria and specific methodology used to determine the GHG emission reductions (Chenost *et al* 2010).

The applicable methodology deemed most appropriate for GPNP was "*VM0006 Methodology for carbon accounting in project activities that reduce emissions from mosaic deforestation and degradation*" developed by the leading carbon standard Verified Carbon Standard (VCS).

One of the key elements in estimating the eligible carbon credits is the determining 'baseline scenario' GHG emissions that describes what would occur without the presence of a carbon credit project (Chenost *et al* 2010). The baseline takes into account the trend of historical deforestation rates (minimum of 10 years), as well as future expected or likely deforestation rates.

Thus, a carbon credit program will be possible under our 'optimistic case' scenario where future deforestation rates are projected to be lower than the baseline or base case figures.

Assuming a total deforestation reduction of about 1,340ha in the optimistic case compared to the base, equivalent to a growing stock of 0.21 million m3. This would equate to approximately 0.66 million tonnes of CO2 emissions saved. However, a 30% 'buffer' is assumed to be required (actual figure subject to project risks and verification) making only 0.46 million carbon credits being potentially available to the carbon credit program.

Assuming a rise in carbon credit prices from US$5 in 2012 to US$36 by 2041, the optimistic case overall NPV is estimated at US$0.6m. This is inclusive of US$1.1 million that we assume will mostly go to the local stakeholders in the form of expenditure associated with emission reduction activities.

The NPV due to the investor is minus US$0.5million (despite a nominal total profit of US$1.6 million), suggesting that it will unlikely to attract interest i.e. not viable at present.

Ecotourism

The International Ecotourism Society defines ecotourism as: "*responsible travel to natural areas that conserves the environment and improves the welfare of local people*" (Bien 2007).

According to a report by the IFC (2004), a number of factors influence the success of an ecotourism project including attractiveness of the location, proximity to an international airport, abilities of the entrepreneur, development cost of facilities, local community programs, advertising, and existence of a multi-lodge business model.

In 2011, about 7.7 million foreign tourists visited Indonesia (average growth rate of 7% p.a.) of which 80% headed to Bali (BPS 2011). In 2009, less than 90,000 foreign tourists visited Indonesia's 50 national parks where the top five sites accounted for 70% of visitors. In 2007, less than 1,000 persons visited the 8 national parks located in Kalimantan.

In 2011, a total of 219 persons visited the GPNP including 119 foreign visitors. Foreign visitor arrivals have been on a declining trend since 2009 (171 persons). A local tour operator holds a monopoly for tourism activities within the park offering very basic accommodation.

A comparison was made with other ecotourism locations to determine possible limits or 'carrying capacity' to the size of tourist number. Borneo Adventure's Ulu Ai Tourism Project which is located next to the 24,000ha Batang Ai National Park in Sawarak (Malaysia) supports about 1,200 persons per year.

GPNP could, therefore, potentially support up to 4,500 persons per year which is equivalent to about 12 persons per day. Assuming a more conservative long term target of just over 1,300 eco-tourists per year, GPNP should be able to support a higher quality 3-room 'enhanced' mid-range eco-lodge with good quality bedrooms and bathroom facilities.

The NPV from the existing BAU facilities is estimated at US$0.4 million without the new lodge. This is expected to improve to US$0.7 million with the addition of the enhanced ecolodge (with a range of US$0.6-0.9 million under the pessimistic and optimistic case respectively).

The investor's NPV is also positive, thus, a new enhanced mid range ecolodge appears viable. Higher values could be possible with a higher tourist numbers assumed.

Bioprospecting

Bioprospecting can be defined as "the systematic search for genes, compounds, designs, and organisms that might have a potential economic use and might lead to a product development

More than half of the 150 most-prescribed drugs in the USA are derived from, or patterned after, natural sources. Annual sales of products derived from traditional knowledge of genetic resources are estimated at US$3 billion for the cosmetic and personal care industry, US$20 billion for the botanical medicine sector, and US$75 billion for the pharmaceutical industry.

There are few hard numbers regarding the size of the bioprospecting industry, but growth to date has disappointed many advocates. One source suggests that the current market is worth US$17 – US$30 million, although by 2050 this could grow to over US$500 million (Bishop *et al* 2008).

However, the appetite for bioprospecting by pharmaceutical development companies has clearly diminished since the Rio Earth Summit in 1992 (Harvey 2012). "*While once widely regarded as a 'saviour' of tropical forests ... the reality is that bioprospecting does not result in large financial flows to poor countries*" (Pearce 2005).

Key revenue streams to local communities include sample collection fees and royalties in the event a commercial product is successfully marketed.

The 'hit rate' or frequency with which collected material will result in a marketable product ranges from one in 6,000 to 30,000. In addition, pharmaceutical products can take up to 12 years to bring to the market in the United States, while the product development costs averages US$230 million. Total worldwide sales for a successful product can range from US$100 million to over a US$1 billion (Lesser *et al* 2007).

To date, over 1,800 individual plants have been legally collected from GPNP and DNA sequences for over 500 of these have been derived (Triono *et al* 2012). In comparison to the 'hit

rate' of 6,000-30,000, the probability of developing a marketable product from GPNP appears low. Therefore, no cash flows from bioprospecting were projected for GPNP.

Biodiversity Credits/Offsets

Biodiversity offsets are conservation activities intended to compensate for the residual, unavoidable harm to biodiversity caused by economic development projects (Bishop *et al* 2008).

Currently there are 39 existing programs around the world, and another 25 in various stages of development or investigation covering at least 86,000 hectares. The global annual market size is estimated at $1.8-$2.9 billion of which US$2.4 billion is accounted for by programs located within the US (Madsen *et al* 2010).

One of the key success factors of the above biodiversity markets is supporting legislation and a regulatory compliance setting. The government sets a limit on the impact to a species or habitat and then allows the market to resolve the cost of offsetting impacts above the limit or 'cap.' Through regulation, government creates a demand for biodiversity that government, the private sector, or non-profits can supply (Madsen *et al* 2010).

The Malua Biobank is a biodiversity conservation effort to protect 34,000ha of rainforest and is located northeast of GPNP in Sabah, Malaysia. Backed by US$10 million in funding and strong support from the local government, the program issues conservation certificates in which receipts are used for habitat restoration and conservation. Unfortunately, as the program operates in the voluntary market its certificates have yet to be been completely sold.

In the absence a supporting legal framework in Indonesia, projections of possible sale of biodiversity credits on a voluntary market basis is considered highly uncertain. As such, no values have been ascribed to the biodiversity activity.

Sustainable Harvesting of Non-Timber Forest Products

Non-Timber Forest Products (NTFP) include honey, plants and fruits, animal, wood resin gaharu (fragrant wood resin contained within *aquilaria* trees), rattan and others.

In the 2011 EOS Household Survey, gaharu extracted from GPNP accounted for the highest value while the other NTFP's accounted for less than 2% of the total figure. The export price of gaharu can be as high as Rp 400 million (>US$4,000) per kilogram, but can be as low as Rp25,000 (US$2.50) locally depending on the quality. Less than 2% of households surveyed were engaged in the illegal collection of NTFP from within GPNP, typically by the same households engaged in illegal logging.

Conservation efforts have assumed that the commercialization of NTFP extraction will produce more value than logging. However, further studies have indicated a number of issues suggesting that such estimates of value can be overly optimistic (Neumann *et al* 2000).

Promoting the extraction of NTFP could also result in overharvesting (Valkenburg 2001). In the case of GPNP, the extraction of gaharu in the late 1990's resulted in 75% of the *aquilaria* trees being felled in the first wave, and almost all the remaining trees in the subsequent wave (Paoli *et al* 2001). These trees are now under threat of extinction and have been listed as an endangered species (Sitepu *et al* 2011).

Collection of any product including NTFP from within GPNP is deemed illegal. Hence, 'sustainable' (and legal) harvesting of NTPF must come from the cultivation of such products outside of GPNP.

Commercial cultivation of gaharu is possible though it carries high risks of pest and disease attack, sometimes affecting 100% of trees. Gaharu forming trees require inoculation of the appropriate fungi strain, but further research and trial tests are required (Sitepu *et al* 2011).

An NGO operating near GPNP is also promoting the development of other NTFP such as palm sugar though efforts are still at an early stage. Rattan was also investigated but prices in recent years had dropped by 90% due to an oversupply and competition from synthetic rattan.

Given the uncertainties of the potential success of the above options, no significant values have been ascribed to the sustainable harvesting of NTFP.

CONCLUSIONS

The following summary conclusions can be made:

1. The local community and other local stakeholders continue to derive substantial financial value from the ongoing illegal forest activities.
2. The level of illegal logging appears to have reduced significantly compared to the last decade, though confirmation of the actual deforestation rates will require other data sources such as satellite imaging and analysis.
3. Villagers engaged in illegal logging activity are prepared to cease their activities if alternative livelihoods and/or stable income jobs (with wages as little as US$5-10 per day per person) were available, though it might not eradicate illegal logging completely.
4. Long term demand for timber is expected to double over the next 30 years thereby increasing the pressure on the park but may be mitigated by further development of plantation forest.
5. Climate change is expected to reduce rice crop yields which may result in a food deficit around 2030, and as such, food and income diversification (e.g. cash crops) may play a critical role.
6. Apart from ecotourism, most of the other Portfolio low emission alternatives do not appear to be viable at this point in time.

Continued park monitoring and enforcement, and conservation efforts are recommended in order to keep illegal forest activities to a minimum.

Low budgets and limited manpower of the Forestry Department are just some of the hurdles to effective park monitoring and enforcement. Assistance in monitoring deforestation and/or forest degradation rates, say by satellite imaging and analysis, could be provided possibly through joint efforts with international and local NGO's.

Conservation efforts may include the development of alternative livelihood programs, and incentives to reduce participation in illegal forest activities. Providing alternative farming land may be another option. Job creation would also be beneficial in reducing illegal forest activity.

Unfortunately, Kayong Utara offers little to outside investors apart from palm oil developments where much of area surrounding GPNP is slated for. We suspect that in the end, much will depend on sustained efforts by conservationists in combating future deforestation activities in Gunung Palung National Park.

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