Building a Green Economy in Borneo:
Assessing Outcomes for Ecosystem Services under Different Business and Policy Decisions

The third largest island in the world, Borneo was once dominated by vast forests of exceptional biological diversity. More than two decades of unsustainable logging, fires, plantation development and mining have dramatically reduced forest extent and quality across the island and degraded freshwater resources. By 2005, these practices led to the loss of almost 1/3 of the forest area present in 1985 (WWF 2005). Yet, 30% of Borneo's land area (also called the 'Heart of Borneo') still contains one of the largest contiguous tropical forest systems remaining in Southeast Asia (van Paddenburg et al. 2012). The forest and freshwater ecosystems support a high number of rare and endemic species, such as Bornean orangutans, clouded leopards, pygmy elephants, sun bears and rhinoceros. The region also contains the headwaters of 14 of Borneo's 20 major rivers.

The governments of Indonesia, Malaysia and Brunei Darussalam, which share the island, recognize the importance of this region as a life-support system for food and water security, climate stability, biodiversity and livelihoods. In 2007 they jointly committed to manage central Borneo's forest ecosystems sustainably in the Heart of Borneo (HoB) Declaration (van Paddenburg et al. 2012).

WWF is supporting the three governments to implement the HoB Declaration. The goal is to develop a Green Economy, where governments, companies and communities value ecosystems for the services they provide, and thereby halt conversion of natural forests and biodiversity loss, generate new opportunities for sustainable and meaningful livelihoods, and reduce greenhouse gas emissions. The establishment of a Green Economy will be supported by ecosystem-based spatial planning, smart fiscal policy, and incentives that reward these groups for conservation and sustainable development practices.

The three governments are developing national action plans to realize these commitments. However, design and implementation have proven challenging. Existing economic and spatial plans do not consider the values of ecosystem services and fail to recognize the importance of conservation and sustainable land management. Revenues from economic

Figure 1 The island of Borneo and designated protected areas (green), protected forests in Kalimantan, Indonesia (brown), and forests on areas slated for development in Kalimantan (yellow) in 2008. The Heart of Borneo indicated by light green includes areas for production harvest such as timber harvesting.

sectors such as mining and palm oil are far greater than existing market revenues from sustainable management of natural forests. The opportunity costs of conservation are therefore significant, with few local incentives to implement national-level commitments. Policy and finance mechanisms that reward provision of ecosystem services – such as ecotourism, forest carbon projects, conservation agreements, and payments for watershed protection – are emerging, but not yet at scale.

What was the analysis?

In 2011, WWF and partners carried out a climate, ecosystem and economic assessment using several modeling tools, including a suite of ecosystem service models, Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST); a scenario development package, IDRISI Land Change Modeler (LCM); and a dynamic simulation tool for development planning, Threshold 21. WWF aimed to highlight how conservation and sustainable land management in the Heart of Borneo can help create a Green Economy. The principal objectives were to: 1) showcase the many values of Borneo's ecosystems and biodiversity, 2) account for the contribution of natural capital to the economy, 3) estimate the investment needed to transition to sustainable landscape management, and 4) identify the policies and development strategies required to mainstream natural capital into national and local economic development plans.

WWF and partners conducted a study to assess the ecosystem service returns of continuing with business as usual as compared to shifting course through alternative policy and business practices to create a Green Economy. First, the partners developed two alternative future scenarios for Borneo in the year 2020 using LCM. The first scenario envisioned a future under business-as-usual, where forests continue to be converted and economic growth depends on rapid expansion of existing sectors, such as oil palm and timber. In the second Green Economy scenario, forests are conserved and restored through environmental markets and more sustainable economic choices, such as reduced impact logging, locating palm oil plantations on already degraded lands, and expanding ecotourism. InVEST was then used to map several ecosystem services, including erosion control, water yield, and water purification through nutrient retention. Where data were available, the partners assessed economic values for ecosystem services and identified where services originate and are used.
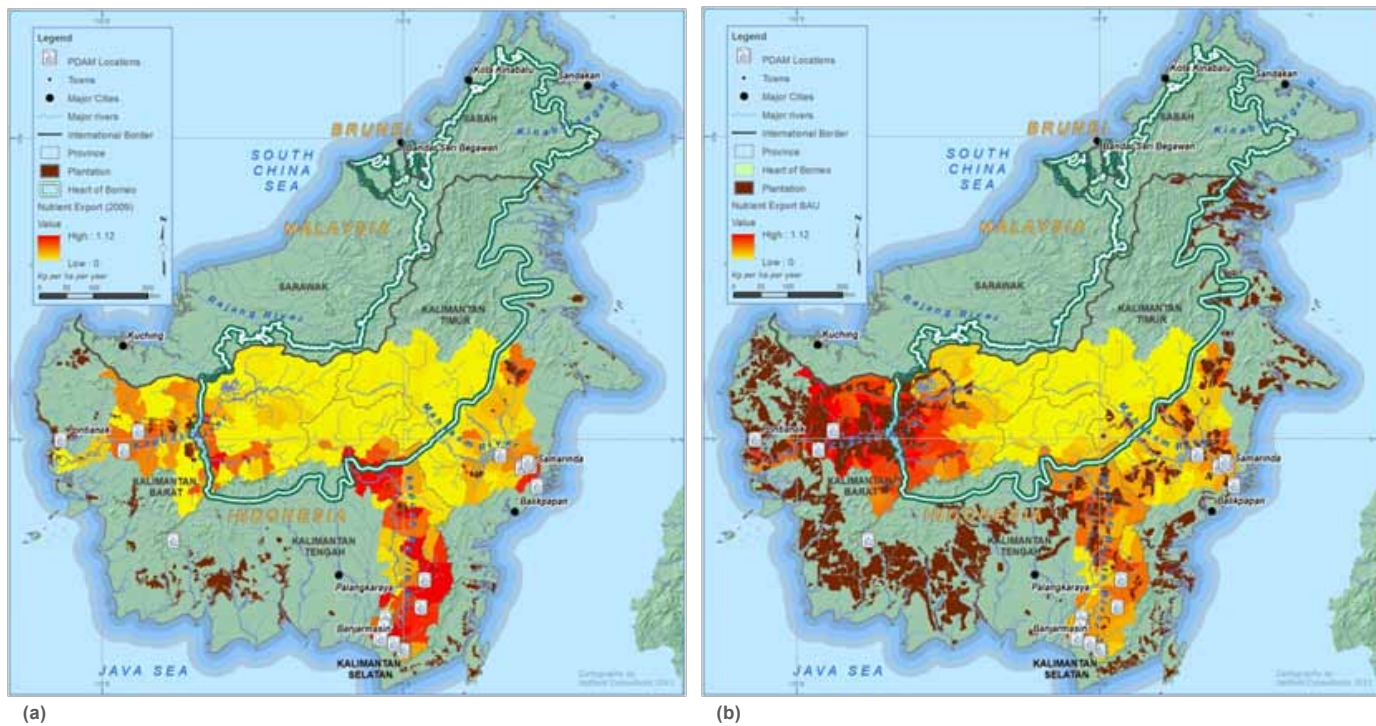

Figure 2 Maps of Nitrogen export, where red is high and yellow is low, for three watersheds that originate in the Heart of Borneo. Map (a) shows the nutrient pollution in 2009 affecting PDAM locations in Indonesia. Map (b) shows the likely distribution of nutrient pollution and affected PDAM locations under a business-as-usual scenario in 2020.

The InVEST analysis indicated that the Heart of Borneo contributes as much as 60%, 40% and 55% of annual water supply to the Kapuas, Kapuas-Barito, and Mahakam River basins, respectively. These basins provide water to 70% of the population of Kalimantan. In these three watersheds, the InVEST analysis showed that palm oil plantations affect water quality through increased nitrogen export from extensive fertilizer use, particularly in the Kapuas-Barito

basin (Figure 2a). Under the business-as-usual scenario, the largest impacts occur in the Kapuas basin, due to major expansion of palm oil plantations (Figure 2b), affecting up to 11 Indonesian regional water utilities (known as PDAMs). Under business-as-usual, additional application of fertilizer and loss of filtering riparian forests along waterways could increase nutrient export tenfold compared to 2009 in the three basins (van Paddenburg et al. 2012).

Additional Carbon (1,000 tonnes)
- 0–256
- 256–625
- 625–1046
- 1046–1640
- 1640–3175

The analysis also identified opportunities for building a Green Economy. WWF assessed the potential for ecosystem service benefits from shifting conventional logging practices to Reduced Impact Logging (RIL), which can improve carbon storage of a working concession by up to 30% (Putz et al. 2008). The carbon storage and sediment retention benefits of RIL in timber concessions under a Green Economy were compared to the expected outcomes in 2020 if business-as-usual management practices continue.
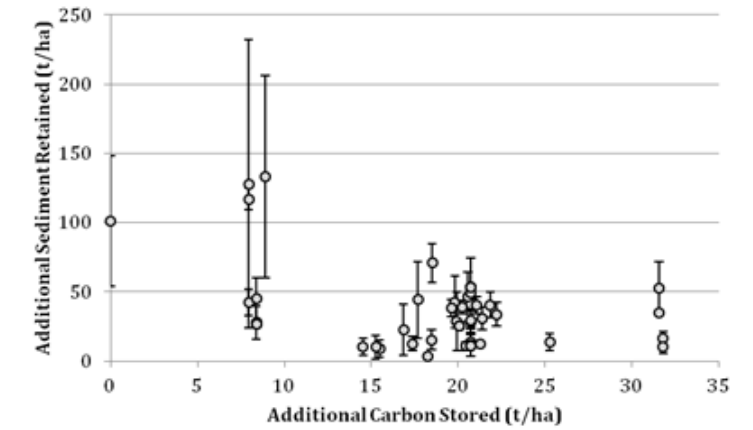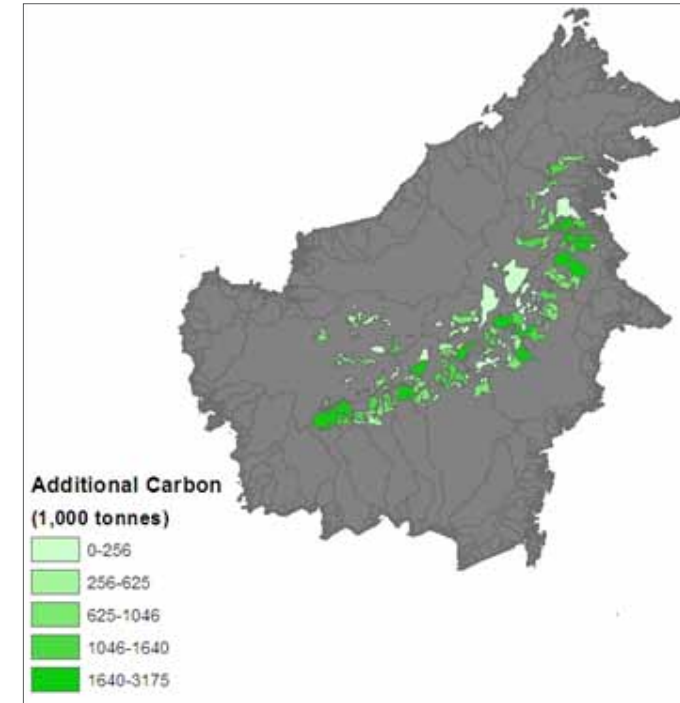

Figure 3 Potential additional carbon stored in forestry concessions in Indonesian HoB, in Fisher & Prihatna 2012.

Figure 4 Mean additional sediment retained (per ha) versus the mean additional carbon stored (per ha) under the Green Economy for the 49 timber concession in the Mahakam basin.

The analysis indicates that a total of approximately 115 million additional tonnes of carbon (tC) could be stored by implementing RIL in 158 timber concessions (Figure 3). With improved timber management practices, about 19 more tonnes of carbon (tC) per hectare could be stored as compared to existing concession management practices. In the Mahakam basin, the InVEST analysis showed that improved timber management could increase sediment retention through 2020 by close to 900,000 tons across all 49 timber concessions in the basin, with a mean avoided erosion of around 37 tons of soil per hectare (Fisher & Prihatna 2012, Figure 4).

How does the analysis apply to policy and business?

The above analyses illustrate how information about nature's benefits can help us make better decisions about how we use our natural resources. In Borneo, studies of the trade-offs of different land-use and planning decisions can inform better policies and help target financial mechanisms. These studies can identify Green Economy practices that generate revenues, provide livelihoods, and reduce costs to society from decreasing water quality, loss of fertile soils, sedimentation of waterways, and degradation of other ecosystem services under business-as-usual.

The value to society of avoiding more greenhouse gas emissions by implementing improved timber concession management practices is clear. Based on the social cost (i.e., the damage to global society) of these emissions calculated in the United States Social Cost of Carbon Regulatory Impact Analysis (US$21 per tCO2), it is estimated that the social value of storing that carbon would be close to US$4 billion. Under these assumptions the largest timber concession alone could provide a social value of over US$250 million by implementing RIL. The managers of these concessions

also have the potential to earn revenue in a carbon market by changing practices. In a global market, the avoided emissions could be valued at more than US$3.8 billion. Depending on the costs of changing practices, adding carbon revenue could equal or exceed existing timber profits. Even with a large cost associated with changing to RIL practices, a US$12 or greater price for carbon credits would allow more than half of the 158 timber concessions to maintain existing profits, and thereby provide additional ecosystem service benefits (e.g. sediment retention) to society (Fisher & Prihatna 2012). Further analyses with InVEST, LCM, Threshold 21, and other tools can be found in the report *Heart of Borneo: Investing in Nature for a Green Economy* (van Paddenburg *et al.* 2012). These results are providing a basis for policy discussions, investments by national government and multilateral and bilateral donors, and implementation of pilot projects that pioneer new policies and local incentives.

What are the next steps?

A next step is to conduct a tri-national analysis to understand the implications of different policy and business choices in Borneo for the benefits from nature that people rely on. More precise data from across Borneo and information about additional ecosystem services, such as agricultural production, flood control, and potential for tourism, could improve existing analyses by presenting a more comprehensive and detailed picture of the costs and benefits associated with alternative development trajectories. A related critical step is to engage stakeholders in a participatory process to decide which services and benefits are most important to address and which alternative options are under consideration. At the sub-national or watershed scale, these kinds of analyses can help communities and companies determine whether and how payments for ecosystem services (PES) schemes could work for them.

WWF will continue to use InVEST and a suite of other tools and approaches to monitor changes in ecosystem services and help the governments of Borneo formulate programs and indicators that protect natural capital and support a lasting economy.

Sources:

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