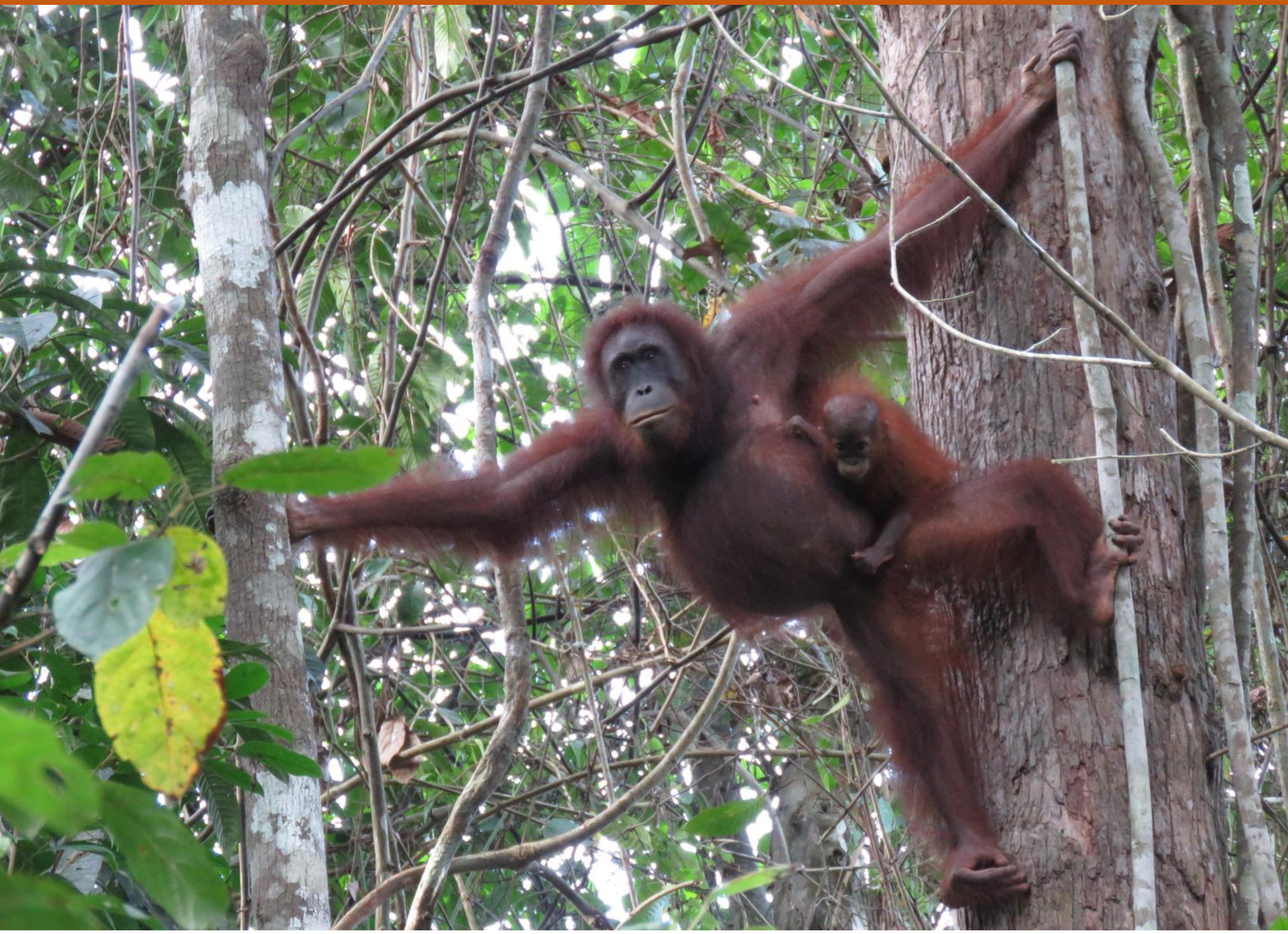
Orangutan, Oil palm and RSPO:
Recognising the importance of the threatened forests of the Lower Kinabatangan, Sabah, Malaysian Borneo

Nicola K. Abram & Marc Ancrenaz



Ridge to Reef

Borneo Futures science for change

Living Landscape Alliance

Land Empowerment Animals People

HUTAN Kinabatangan Orang-utan Conservation Programme

First published by Ridge to Reef, Living Landscape Alliance, Borneo Futures, Hutan, and Land Empowerment Animals People (Kota Kinabalu, Sabah) in 2017

Citation: Abram, N.K. and Ancrenaz, M. (2017) Orangutan, Oil palm and RSPO: Recognising the importance of the threatened forests of the Lower Kinabatangan, Sabah, Malaysian Borneo. Ridge to Reef, Living Landscape Alliance, Borneo Futures, Hutan, and Land Empowerment Animals People. Kota Kinabalu, Sabah, Malaysia.

Cover: Female orangutan with a baby in the forest canopy of the Lower Kinabatangan Wildlife Sanctuary. Cover and all other photos in this report are credited to Hutan/Kinabatangan Orangutan Conservation Programme (KOCP).

ABOUT THIS REPORT

This report is part of the International Institute for Environment & Development (IIED) project on *Assessing and addressing the impact of large-scale land acquisitions on ape conservation,* funded by the Arcus Foundation. This project has two case studies from the Cameroon in Africa and the island of Borneo in South-east Asia. According to the terms of reference, the objectives of the two case studies were to:

- Build an evidence base on the geographic overlap between areas currently targeted for agribusiness investments and areas of importance for ape conservation;
- Identify the scale, trends and drivers of agribusiness investments;
- Identify the impact that agribusiness investments are having on ape conservation and build in-country engagement and awareness on this issue;
- Assess opportunities and constraints in legal frameworks and political economy; and,
- Identify key issues generated by the interface between agribusiness investments and ape conservation in order to highlight lessons learned and help the Arcus Foundation develop a global strategy on ape conservation in the context of large-scale land acquisitions.

The Borneo case study was undertaken by Ridge to Reef, Living Landscape Alliance, Borneo Futures, Hutan, and the grant administered by Land Empowerment Animals People (LEAP). As part of the case study four reports were developed. These included:

1. An analysis of the geographical overlap between Bornean orangutan habitat and areas demarcated for large-scale oil palm developments, as well as the extent to which orangutan habitat lies within existing protected areas in Kalimantan, Sarawak and Sabah (Abram *et al.,* 2017);
2. An analysis of how legal frameworks and political economies interact with the oil palm industry and orangutan conservation in Malaysian and Indonesian Borneo (Jonas, 2017);
3. A fine-scale analysis of these issues in the Lower Kinabatangan region in eastern Sabah (Abram & Ancrenaz, 2017), which is globally renowned for its orangutan population, but has undergone significant forest loss to small- and large-scale oil palm plantations.
4. A synthesises report that draws on key findings from the three reports and provides targeted recommendations for synergising oil palm development and orangutan conservation (Jonas *et al.* 2017).

The production of the reports listed from 1 to 3 above, although were for IIED and funded by the Arcus Foundation, the contents do not necessarily reflect the views of either IIED or the Arcus Foundation, and responsibility for the information and views expressed therein lies entirely with the authors.

ACKNOWLEDGEMENTS

The authors would like to thank Philippine Sutz and Lorenzo Cotula from IIED for their support and feedback regarding the development of this report. We would also like to thank other members of IIED who provided comments and/or assistance in the development of this report; as well as the Arcus Foundation for financially supporting this project.

ABOUT THE AUTHORS:

Dr. Nicola K. Abram

NICOLA KAREN ABRAM (PHD) is an interdisciplinary conservation scientist from the UK based in Sabah, Malaysian Borneo. Nicola has been conducting research in Borneo since 2010. She specialises in interdisciplinary spatial planning that aims to better understand synergies that promote biodiversity conservation and sustainable development agendas, as well as human-environment linkages in multi-use landscapes; and has a significant portfolio of peer-review publications and reports on these subjects. Nicola is a Technical Coordinator for spatial planning for the organisation *Forever Sabah*, and she is also the founder and a co-director of the UK not-for-profit *Living Landscape Alliance*; as well as a collaborating scientist to *Borneo Futures*.

livinglandscapealliance.org
nicola_abram@hotmail.com

Dr. Marc Ancrenaz

MARC ANCRENAZ (PhD) is the co-founder of the French NGO Hutan and runs the Kinabatangan Orang-Utan Conservation Programme (KOCP), a community-based initiative located in Sabah, Malaysian Borneo. He is a scientific adviser for the Sabah Wildlife Department. Marc is also the co-founder of the "Borneo Futures Initiative" that aims to provide cutting-edge science to increase awareness, collaboration and understanding among decision-makers, the media, NGOs and the public in Borneo. His expertise includes wildlife research, medicine, population management and policy formulation with 25 years of experience in wildlife range countries (Gabon, Congo, Saudi Arabia, Indonesia and Malaysia).

www.hutan.org.my
www.borneofutures.org
marc.ancrenaz@yahoo.com

ACRONYMS AND ABREVIATIONS

CL	Country Land Title
CR	Critically Endangered
EIA	Environmental Impact Assessment
EN	Endangered
GIS	Geographic Information Systems
HCS	High Carbon Stock
HCV	High Conservation Value
IIED	International Institute for Environment & Development
IUCN	International Union for Conservation of Nature
KOCP	Kinabatangan Orangutan Conservation Program
LEAP	Land Empowerment Animals People
LKWS	Lower Kinabatangan Wildlife Sanctuary
LLC	Land Capability Classification
MPOB	Malaysian Palm Oil Board
NT	Native Title
NGO	Non-Governmental Organisation
PA	Protected Areas
PFR	Permanent Forest Reserve
RSPO	Roundtable on Sustainable Palm Oil
SFD	Sabah Forestry Department
SIA	Social Impact Assessment
SWD	Sabah Wildlife Department
tC/ha	Metric tons per hectare
VJR	Virgin Forest Reserve
VU	Vulnerable

LIST OF BOXES, FIGURES AND TABLES

TABLE OF CONTENTS

EXECUTIVE SUMMARY

In this report, we identify the remaining, threatened High Conservation Value (HCV) forests within the Lower Kinabatangan floodplain (east Sabah, Malaysian Borneo), in the hope that rapid and adequate action will be taken to safeguard them and support forest connectivity across the wider landscape. We demonstrate their importance for stabilising orangutan populations, and their value as habitats for many other globally threatened species; as well as their forest types and carbon stock. In addition, we discuss how Sabah's commitment to the certification of palm oil within its jurisdiction could help protect HCV forests in future, while also assessing the risks the existing allocation of forested land for oil palm may pose.

The Lower Kinabatangan region in eastern Sabah (Malaysian Borneo) is well known for its amazing wildlife diversity and abundance. A string of protected forests has been set aside in the region to ensure the long-term survival of its wildlife. These protected forests have made significant steps for securing habitat for wildlife in the region, yet they are nevertheless highly fragmented and insufficient in size for ensuring viable wildlife populations.

In the Lower Kinabatangan, the number of orangutans has fallen from more than 4,000 in the 1960s to 1,125 animals in 2001, and less than 800 individuals today. Populations of many other species are following a similar trend such as the Bornean gibbons, leaf monkeys, pangolins, sun bears, and hornbills; and less fortunate species are already extinct in the region i.e. the Sumatran rhinoceros, wild buffalo (Banteng), and freshwater sawfish. This decline is primarily due to deforestation. Indeed, the Lower Kinabatangan is considered a prime area for oil palm production, and more than 80 per cent of the lower parts of the floodplain have been converted to this crop over the past 40 years. Today, the landscape is a mosaic of small and large-scale oil palm production, and patches of protected and non-protected (on private or state lands) forest, all at different stage of degradation and fragmentation.

This report focuses on the conservation value of non-protected forest. At the landscape level, we identified that all of the remaining forest outside of the string of protected areas is of high conservation value (HCV) for rare, threatened and endangered mammal species, while acknowledging that some areas are more suitable for supporting a wide diversity of species than others. This report also shows that 91 per cent of all remaining non-protected forest is suitable orangutan habitat. Furthermore, 14-93 per cent of the non-protected forest could also support another 13 species of large mammals. These non-protected forests were also found to be important in terms of their carbon stock and forest type; since they are largely composed of formations known as 'swamp forest associations' which are increasingly threatened throughout Borneo. The future of biodiversity and ecosystem functionality in the Lower Kinabatangan will primarily depend on what happens to these forests, which are found on both state-owned and private land.

In 2005, approximately 36,000 ha of non-protected forest remained on the floodplain. Most of these non-protected forests were connected with the current network of protected forests, either the Lower Kinabatangan Wildlife Sanctuary or the Virgin Jungle Reserves found in the floodplain, and thus played a very important role in sustaining the remaining wildlife populations. In a 10-year period (2005 to 2014), around 13,000 ha of these forests were converted. This trend is continuing, degrading the functionality of all ecosystems in the floodplain.

Our analysis also shows that the Kinabatangan is a biophysically heterogeneous landscape, and not all areas are suitable for oil palm. In fact, the region is host to more than 15,000 ha of failed oil palm in areas that are prone to seasonal or tidal flooding, leading to substantial net losses. As for the existing – but non-protected – forests in the Lower Kinabatangan floodplain, around three-quarters are forest types associated with flooding regimes (for example, seasonal freshwater swamp forest or freshwater swamp forest). Planting oil palm in such areas is likely to lead to mass palm deaths and substantial financial losses. Despite this clear risk, the majority (if not all) of these non-protected forests have been allocated for oil palm development.

The best hope for the survival of the remaining non-protected forest of the Kinabatangan may lie in the commitment made by the state of Sabah to ascertain certification from the Roundtable for Sustainable Palm Oil (RSPO) by 2025. This is a potential game-changer for biodiversity conservation in oil palm-dominated landscapes since the RSPO prohibits the new planting of oil palm in areas identified as having a High Conservation Value (HCV). It is otherwise unclear how these areas can be conserved within Sabah's current legal and policy framework. Nevertheless, the adoption of state-wide certification may be the lifeline needed to ensure the short- and long-term survival of Kinabatangan's biodiversity.

Even if all remaining forests are conserved, the long-term viability of orangutan – and many other species – within the region will also depend on large-scale reforestation efforts to both increase connectivity between the fragmented protected areas and extend the size of the available habitat for wildlife. Reforestation efforts are underway but more strategic efforts are needed to target key areas, and the oil palm industry should play an active role in rehabilitating natural forests, especially in areas where forests have been converted but palms have failed due to flooding.

Whichever mechanisms and strategies may be most feasible for helping to conserve and grow the region's forests, the long-term viability of the Lower Kinabatangan ecosystem is dependent on us being able to rewind time to create a connected and protected forested landscape that will support its biodiversity long into the future.

1 GENERAL INTRODUCTION

The Malaysian state of Sabah is situated in northern Borneo and covers 73,965 km^2. It has the most oil palm planted of any of the country's 13 states, accounting for more than 29 per cent of national oil palm coverage (MPOB, 2012); and producing 10 per cent of the world's annual palm oil output. Palm oil, by far Sabah's biggest export, contributed 40 per cent of the State's revenue in 2010 (Sabah State Government, 2012). In 2011, 19.3 per cent of Sabah's land mass (14,300 km^2) was under oil palm. The state's economic development strategy declared that oil palm development could increase to up to 21,000 km^2 to help quadruple Sabah's Gross Domestic Product by 2025 (IDS, 2007; MPOB, 2012).

In November 2015, the State Government pledged that Sabah's palm oil production would be 100 per cent certified according to Roundtable on Sustainable Palm Oil (RSPO) standards by the year 2025 (RSPO, 2013). The RSPO is a voluntary initiative aimed at improving production standards globally to limit negative impacts on the environment and society (Traeholt & Schriver, 2011). This jurisdictional approach to certified sustainable oil palm at the state level is a potential game-changer since it means that all oil palm growers – whether smallholders or medium to large estates – will have to meet RSPO's criteria under its eight overarching principals. Crucially, these include no new plantings of oil palm in High Conservation Value (HCV) areas. HCVs are areas deemed to be of outstanding significance or of critical importance at the national, regional or global level due to their biological, ecological, social or cultural value. Preventing their removal or destruction in Sabah would be a breakthrough for biodiversity conservation within the state.

Sabah is a biodiversity hotspot containing some of the world's highest levels of species endemism and biological diversity (Whitten *et al.*, 2012). The state is home to significant populations of rare, threatened and endemic species (categorised as HCV 1, see www.hcvnetwork.org). For example, Sabah has an estimated population of 11,000 Bornean orangutans (*Pongo pygmaeus morio*) (Ancrenaz *et al.*, 2005), around 6,000 proboscis monkeys (*Nasalis larvatus*) (Sha *et al.*, 2008); 2,000 Bornean elephants (*Elephas maximus borneensis*) (Alfred *et al.*, 2010); and unknown populations of other important species, including the Bornean gibbon (*Hylobates muelleri*); Malayan sun bear (*Helarctos malayanus euryspilus*); and Sunda clouded leopard (*Neofelis diardi borneensis*). About 40 per cent of the 215 species of mammals found in Sabah are considered to be of conservation concern (Sabah State Government, 2012). With only 47 per cent (35,006 km^2) of natural forest remaining in 2010 in Sabah (Gaveau *et al.*, 2014), habitat loss, along with poaching, constitutes one of the main threats. Lowland forests have been particularly targeted for oil palm, since the palm *Elaeis guineensis* can only thrive at elevations lower than 500 metres above sea level, which has resulted in around an 80 per cent loss of Sabah's lowland mixed dipterocarp forest.

1.1 Objectives of this report

This report is a part of a wider study: *Assessing and Addressing the Impact of Large-scale Land Acquisitions on Ape Conservation in Borneo*. In this report, we undertake a through-the-lens, fine scale case study of the Lower Kinabatangan region in eastern Sabah – in Malaysian Borneo – an area that has experienced significant forest conversion to oil palm. Specifically, we identify threatened HCV areas within the region in the hope that rapid and adequate action will be taken to safeguard these forests to preserve as much connectivity as possible in the landscape as a whole. We demonstrate the importance of these forests in: stabilising local orangutan populations; providing habitats for other rare, threatened and endangered species; as well as their value for preserving important forest types and the above-ground carbon stock they hold. Additionally, we discuss the conflicts between RSPO requirements and existing legal barriers for HCV protection on titled lands.

1.1.1 Other reports in this study

Concurrent reports produced within the wider study *Assessing and Addressing the Impact of Large-scale Land Acquisitions on Ape Conservation in Borneo*, include: (1) an analysis of the geographical overlap between Bornean orangutan habitat and large-scale oil palm developments and protected areas throughout Borneo (Abram *et al.*, 2017); (2) an analysis of the legal frameworks and political economies that interrelate with the oil palm industry and orangutan conservation (Jonas, 2017); and, (3) a synthesis of these three reports (Jonas *et al.*, 2017).

2 OVERVIEW OF THE KINABATANGAN LANDSCAPE

The Lower Kinabatangan is located in the Kinabatangan District of Sabah, at approximately 5º30'N and 118ºE. The area is a vast low-lying flood plain dotted with small, mostly limestone hills. The Kinabatangan is the longest river in Sabah (560 kilometres) and the entire Kinabatangan catchment area covers about 16,800 km^2, equivalent to 23 per cent of the total land mass of the State. The low-lying regions of the catchment (or Lower Kinabatangan) form the largest floodplain in Malaysia, covering about 4,000 km^2. The coastal environment was once linked to the highland areas of the interior by unbroken, forest. Spanning mangrove to interior forest, this connectivity supported critical ecological and ecosystem processes, including species movements (Lackman-Ancrenaz and Manokaran, 2008). However, these forests were gradually broken up by the intense mechanized timber extraction that started in the region in the 1950s, followed by agricultural development in more recent decades. Since the 1990s large-scale oil palm production has proceeded apace in the Lower Kinabatangan forest ecosystem. This has led to extreme forest loss and fragmentation and today less than one per cent of the region’s primary forest remains (Sabah State Government, 2012).

2.1 Wildlife and forest types

Despite the damage to its forests, the region remains globally significant for its many rare and threatened species, with around 800 Bornean orangutans (Ancrenaz *et al.*, 2014a), 300 Bornean elephants (Estes *et al.*, 2012), and 1,400 proboscis monkeys (Sha *et al.*, 2008). It harbours a further 119 mammal species, 314 species of birds, 101 species of reptiles and 33 species of amphibians (Lackman-Ancrenaz and Manokaran, 2008).

Historically, the floodplain is comprised of an array of forest types including beach, nipah and mangrove forests near to the coast, buffered by transitional forests then freshwater swamp and peat swamp forests in inland waterlogged areas. Riparian forests and mixed-lowland dipterocarp forests are also found in well-drained areas, and limestone forests on karstic hills and escarpments. Today, due to oil palm cultivation, these forests are primarily gone or degraded, and some are threatened with complete removal.

2.2 Protected forests

The Lower Kinabatangan retains several types of protected forests (Figure 1):

The Lower Kinabatangan-Segama Wetland Ramsar site is on the coastal floodplain, and 78,803 ha was gazetted as the Lower Kinabatangan-Segama Wetlands Ramsar site in October 2008. The Trusan Kinabatangan Forest Reserve forms the single largest Mangrove Forest Reserve (Class V) in the Lower Kinabatangan.

The Lower Kinabatangan Wildlife Sanctuary (LKWS) consists of twelve Lots of disconnected forest totalling 26,103 ha spanning an area of about 100 km in length. The LKWS was gazetted in 2005 under the jurisdiction of the Sabah Wildlife Department: see Text Box and Figure 1.

Virgin Jungle Reserves (VJR-Class VI) and other protected forests are also found within the landscape and fall under the jurisdiction of the Sabah Forestry Department. These include six fully protected Class VI Virgin Jungle Reserves: Pin-Supu (4,696 ha) close to the village of Batuh Puteh; and Sungai Lokan (1,852 ha). In 2010, Sungai Gologob Forest Reserve (7,900 ha) was also declared Class VI because of its potential role for rhinoceros conservation in the region at that time.

These protected/managed forests have made significant steps towards securing habitat for wildlife in the region, yet they are nevertheless highly fragmented and are insufficient to ensure viable wildlife populations (Figure 1).

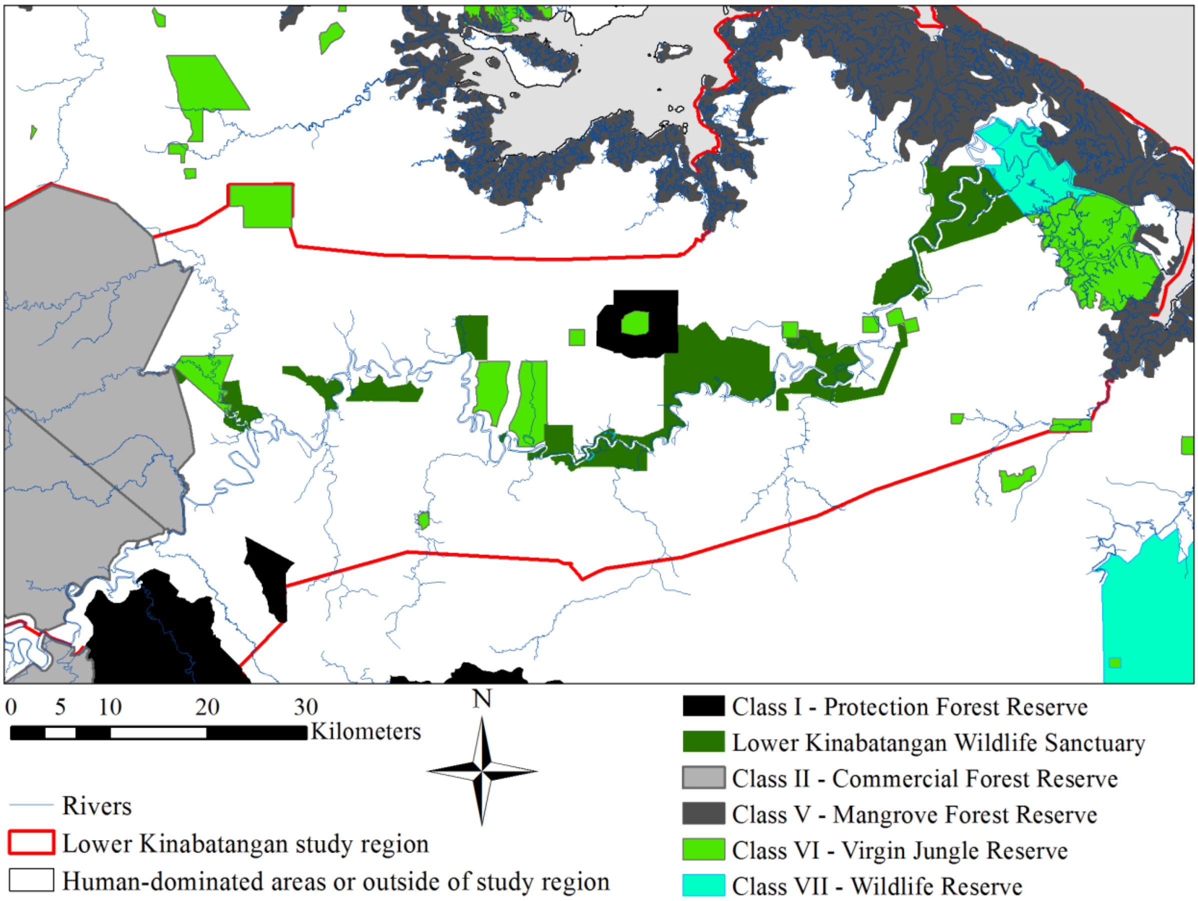
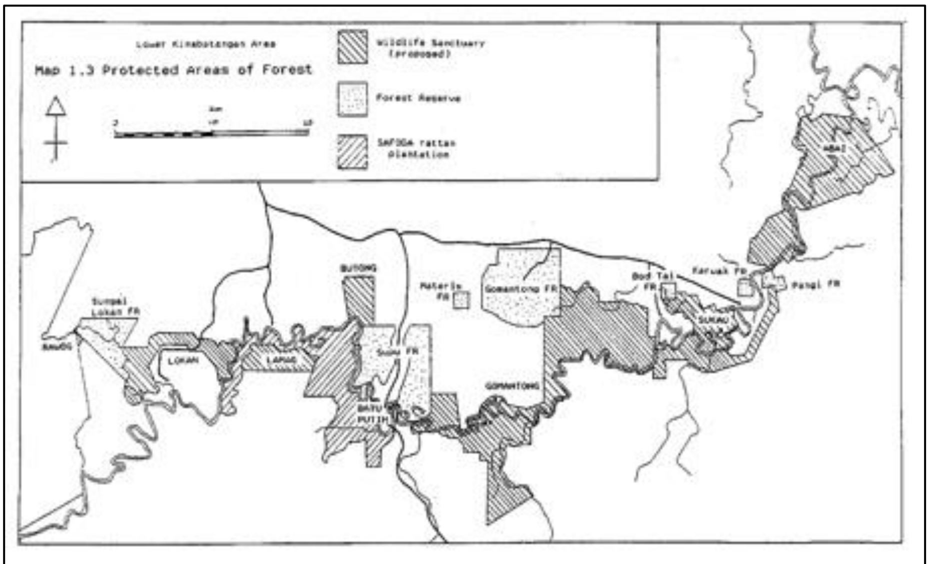


Figure 1: The study region (red outline) in the Lower Kinabatangan with protected areas (Class I, Class V, Class VI, Class VII and the Lower Kinabatangan Wildlife Sanctuary); and Commercial (production) Forest Reserves in Sabah, Malaysian Borneo.

TEXT BOX 1: HISTORY OF THE LOWER KINABATANGAN WILDLIFE SANCTUARY

Created in 1925, Gomantong was Sabah's first nature conservation reserve, established in the Lower Kinabatangan to secure a colony of swiftlets that produced edible nests. In 1930 colonial authorities extended the protection of other limestone outcrops in the region to safeguard other swiftlet colonies (such as the Bod Tai, Keruak, Materis and Pangi Forest Reserves); and in 1984 these areas were gazetted as *Virgin Jungle Reserves (VJRs)*. In the early 1970s, a proposal was submitted to protect 6,700 ha of forest located close to Sungai Lokan (the upper part of the Lower Kinabatangan floodplain near to the current Lot 10 of the LKWS) as a game sanctuary for orangutan conservation. Unfortunately, however, this proposal was never passed. WWF-Malaysia and the Game Branch (Sabah Forestry Department) conducted a comprehensive state-wide wildlife survey in 1979-1981. At this time, only 1.4 per cent of the entire landmass of Sabah was fully protected. Based on the survey findings, Dr John Payne (who was at that time with WWF-Malaysia) proposed to protect 50,000 ha of forest in the Lower Kinabatangan.



Map of the sanctuary approved in 1994

In 1994, the State Cabinet agreed to the establishment of the Kinabatangan Wildlife Sanctuary. By that time, the proposed Sanctuary had already been reduced to 30,610 ha. It consisted of eight segments joining the Virgin Jungle Reserves and the SAFODA area, close to the village of Batu Puteh, planted with rattan (see Map).

This Sanctuary formed a relatively contiguous corridor between the coastal mangroves and the commercial forests of the interior. However, industry and political pressure on the government resulted in the exclusion of several areas from the proposed sanctuary. In May 1996, the State government called another meeting to further reduce the proposed sanctuary and to reallocate the land to oil palm plantations. At this time, the Permanent State Secretary, Datuk Chun Kui Bee, instructed the Land and Survey Department to carry out a complete demarcation of the boundaries of the Sanctuary. To speed up the process, it was decided to split the entire sanctuary into ten different Lots with each lot being allocated to a private government-approved surveyor. In 1999, the Chief Minister of Sabah, Datuk Osu Sukam, declared about 26,000 ha of forest as a Bird Sanctuary and Malaysia's first "Gift to the Earth." In 2002 Tan Sri Chong Kah Kiat – then Chief Minister of the State – launched the Kinabatangan "Corridor of Life." However, it was not until 11 August 2005 that the "Kinabatangan Wildlife Sanctuary" was officially gazetted under the Sabah Wildlife Enactment.

This Sanctuary is now comprised of 10 Lots and is extremely fragmented within a matrix of extensive oil palm plantations and smallholdings. The current orangutan meta-population found in the floodplain is split into at least 12-15 isolated sub-populations, with some too small to be biologically viable in the long term (Bruford *et al.*, 2010).

2.3 Major conservation issues

Forest loss: More than 80 per cent of the floodplain is covered with agricultural plantations, mostly oil palm. Rapid and drastic forest destruction over the past 30 years has resulted in a severe decline in biodiversity throughout the floodplain.

Forest degradation: The remaining forests are at different stages of degradation and regeneration. Light-demanding pioneer and/or invasive plant species have colonised these forests, negatively affecting the viability and abundance of forest-dependent species.

Forest fragmentation: Fragmentation increases the susceptibility of remaining sub-populations to stochastic natural or man-made events, and can lead to local extinctions. Remaining forest patches become more sensitive to edge effects and are less resilient to climate change.

Human wildlife conflicts: Conflicts with large mammals (such as elephants, orangutans or crocodiles) and smaller species (such as bats, porcupines, wild boars) are intensifying due to habitat loss. The conflicts cause people to experience anxiety, fear and economic losses, and can lead to injury or death for animals and villagers; often undermining support among local communities for local conservation initiatives (Lee, 2002).

Hunting: Non-selective hunting practices (such as snares, nets, poison) impact many non-targeted and protected species such as clouded leopard and sun bears. Hunting has already resulted in the extinction of iconic species in the area, such as Tambadau and Sumatran rhinoceros.

Human health risk: The increased proximity and repeated contacts between wildlife and people leads to an increase of emerging diseases that can affect both people (such as leptospirosis, malaria) and animals (such as malaria, parasites).

Pollution: A lack of compliance in maintaining forested 20 metre 'river reserves' along water causeways has led to an increase in sediment loads and pollutants in the rivers, largely from adjacent oil palm plantations and mills (Ensolve, 2011). These pollutants have not only affected the aquatic ecology and traditional fisheries in the area but are causing problems for human heath in local communities (ERE, 2009).

2.4 Human communities

The Lower Kinabatangan is home to the "Orang Sungai" or "People of the River" who traditionally relied on fisheries and small-scale agriculture. There are around twelve villages found along the river and waterways in the region, with a total population of less than 10,000 people. Today, villagers have largely shifted their livelihoods and major sources of income to oil palm cultivation; and to a lesser degree wildlife tourism. Improvements in basic road infrastructure have shifted job demographics to the nearby towns and large plantations, which offer a higher and more reliable income. Workers on oil palm plantations represent a relatively large population of 30,000 people, mostly foreigners from Indonesia.

2.5 The political ecology of forest loss

Although commercial timber exploitation in Sabah started in the late 1890s, rates of logging climaxed during the 1980s, when extraction rates reached up to 90 m^3/ha – among the highest in the tropics (Collins *et al.*, 1991; Marsh and Greer, 1992). As a result, valuable hardwood disappeared extremely fast, and in the late 1980s and early 1990s, Sabah's economic policy shifted from timber exploitation to agriculture. In the Lower Kinabatangan, forest conversion to agriculture started in the late 1970s with tobacco, rubber, cocoa and coffee. In the late 1980s, oil palm was introduced into the region and today an estimated 45 per cent to 68 per cent of the district's land use (300,000–450,000 ha) is under oil palm.

There are many policy instruments that are relevant to land-use management in the State. However, three in particular have had – and continue to have – a huge impact on how land is utilised. These are discussed in turn below.

The Land Capability Classification (LLC): these maps and associated documents were prepared in 1976 for the Land Resources Survey (Thomas *et al.*, 1976). Priority areas were allocated for mining, agriculture, forestry and wildlife/recreation, in order of their perceived highest return (McMorrow & Talip, 2001). To this day, the LCC influences the partitioning of Sabah's land resources between agriculture and forestry by policymakers, and the choice of agricultural land by investors. To our knowledge, new technologies such as remote sensing and spatial analysis have not yet been used to refine this document.

The Land Code (or Land Ordinance Chapter 68 (1930) and amendments): favours agriculture over other land uses and encourages the conversion of forest to permanent cash crops. For example, clauses in these instruments stipulate that the state can reclaim the right to any alienated land that is not developed and planted within three to five years.

Land Alienation Policy 1963: allows the leasing of land rights (otherwise known as *alienation*) to individuals or companies for agriculture. This often results in the partitioning of forest (state land and Permanent Forest Reserve (PFR)) from agricultural (alienated) land.

Since independence, successive governments in Sabah have seen agricultural development as the best way to alleviate rural poverty; and the converting forests for agriculture has been considered the main route to achieve this objective. As a result, forests not included in the "Permanent Forest Reserve" (PFR) were converted at an alarming rate. In 1973, forest cover was equally distributed between PFRs (49 per cent) and land outside PFRs (51 per cent) in Sabah. By 1992, forest cover outside PFRs had fallen to 15 per cent.

2.6 Forests allocated for oil palm

All forests found in the floodplain provide essential habitats for wildlife and facilitate connectivity between the protected areas. If these forests are lost, human-wildlife conflicts will increase and wildlife populations will further decline.

In 2010/11, it was estimated that there was still more than 30,000 ha of forest outside of the protected areas in the Lower Kinabatangan (Abram *et al.*, 2014). Around two-thirds of these forests were on alienated land allocated for oil palm. Alienated land in the Lower

Kinabatangan region falls under Native Title or Country Land Title. Native Title (NT) includes titles for smallholdings for oil palm for perpetuity (999 years) and less than 40 ha in size (Section 70, Sabah Land Ordinance, 2010); and Country Land (CL) title are for commercial oil palm under a 99-year lease (Section 53, Sabah Land Ordinance, 2010).

Under the Sabah Land Ordinance, NT titles are required to be fully cultivated within three years. For CL titles, one-fifth of the concession must be cultivated each year if the area is 40-250 ha; for titles of more than 250 ha, yearly equivalents are compulsory until the area is fully cultivated. Failure to cultivate can leave the land liable to be seized by the government (Section 70.4), though this rarely happens in practice. Although NT is aimed at 'native' people, this type of concession can be subleased for 30 years to individuals or companies (amended Section 17).

3 METHODOLOGY

3.1 Forest extent and forest loss in the Kinabatangan

To calculate the extent of forest and forest loss for the Kinabatangan, we used satellite images for 1996 and 2005/06 using Landsat 30 metre resolution images, 2010/11 using SPOT5 2.5 metre resolution images, and 2014 using Landsat 15 metre resolution images to digitise forest boundaries using ArcGIS 10.3. Although we do not present the 2010/11 data in this report, we used this information as the baseline for our 2014 data.

3.2 Identifying High Conservation Value (HCV) Areas

A High Conservation Value (HCV) is an area of biological, ecological, social or cultural value of outstanding significance or critical importance (Figure 2). RSPO's Principals & Criteria 5.2 and 7.3 state that primary forests and HCVs need to be protected and properly managed in plantations and the wider landscape (RSPO, 2013). For new oil palm plantings over 500 ha, the RSPO requires a comprehensive, participatory and independent social impact assessment (SIA); an environmental impact assessment (EIA); and a High Conservation Value (HCV) assessment (RSPO, 2013).

In line with the availability of current data and our emphasis on ape conservation, this report focuses on: (1) HCV 1, which includes endemic, rare, threatened or endangered (RTE) species that are of significance at global, regional or national levels; (2) HCV 2, which focuses on landscape level ecosystems and mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance; and, (3) HCV 3, which focuses on ecosystems and habitats that are rare and threatened or are habitats or refugiums for endangered species.

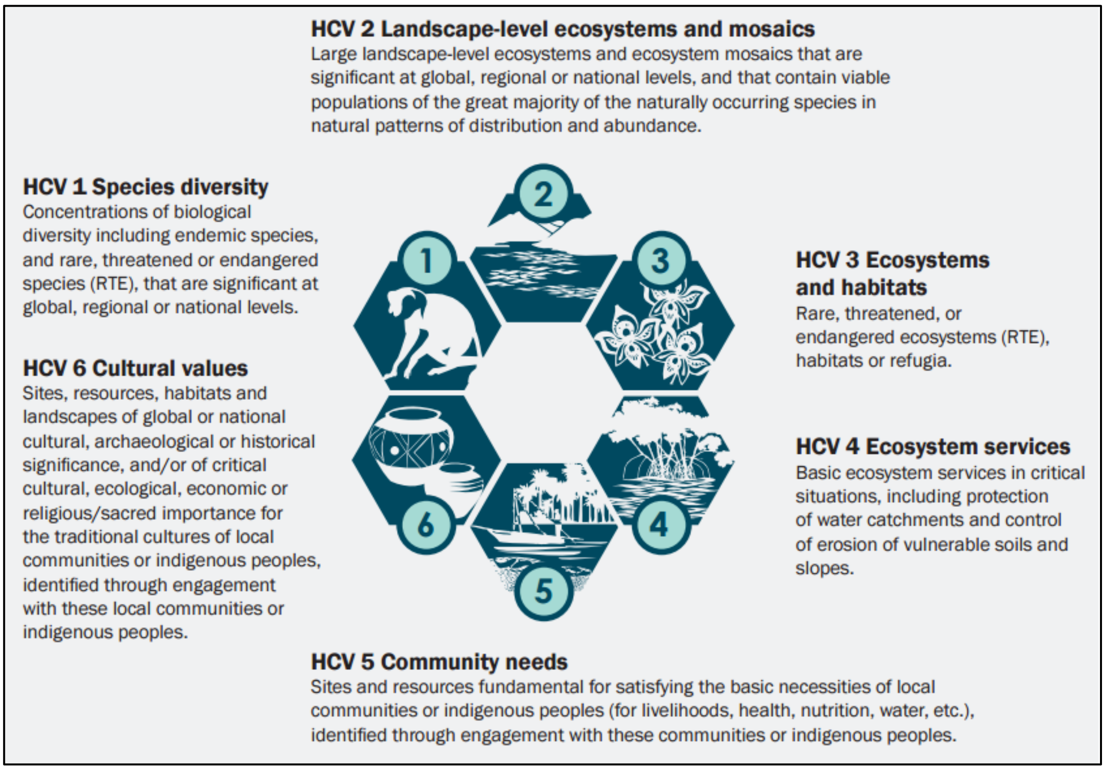


Figure 2: The six High Conservation Values (HCV) used within RSPO's HCV assessments.

3.2.1 Orangutan population in the Lower Kinabatangan

Orangutan population estimates for the Lower Kinabatangan were derived from aerial and ground surveys by the NGO HUTAN in 2001 (Ancrenaz *et al.*, 2004), 2006/2007 and 2015 (Table 1). In 2001, HUTAN determined that around 51,710 ha of forest in the floodplain may be orangutan habitat (Ancrenaz *et al.*, 2004). These areas included 27,400 ha of forest to be gazetted as the Lower Kinabatangan Wildlife Sanctuary under the Sabah Wildlife Department in 2005; 11,970 ha of protected forests that were Virgin Jungle Reserves under the Sabah Forestry Department; and an estimated 12,300 ha of forest that belonged to the state or to private individuals on alienated land.

Table 1: Year and sampling extent of the three orangutan surveys undertaken in the Lower Kinabatangan during the period 2001-2015.

Year	Ground survey	Aerial survey	LKWS	Other forests
2001	89.7 km	136.8 km	Totality	Yes
2006/2007	172.9 km	182.5 km	Totality	No
2015	55 km	233.8 km	Totality	Yes

3.2.2 Identifying wildlife habitat in the Lower Kinabatangan

In addition to orangutan, the Lower Kinabatangan is home to many threatened mammal species that are classified by the International Union for Conservation of Nature (IUCN) as vulnerable (VU), endangered (EN) or critically endangered (CR) (http://www.iucnredlist.org/; see Table 2).

Habitat suitability models were developed for 13 mammal species in the Lower Kinabatangan (Table 2, see Abram, 2016). These models integrated species presence data from 2007-2011 with environmental predictor variables – at one hectare resolution – using a Maximum Entropy Modelling approach (Phillips and Dudík, 2008). These spatial predictors included: Euclidian distance to forest; Euclidian distance to major rivers; degree of surrounding forest; land-use land cover that included forest type information described in Abram *et al.* (2014); above-ground carbon stock, developed by Abram *et al*. (2016); elevation; and slope.

To update these models, we removed areas of predicted habitat that had been lost from the original 2010/11 models to the 2014 forest extent layer we created for this report. The 13 habitat suitability maps were then integrated to generate a scaled habitat importance map from '0' (unsuitable habitat for any of the species) to '13' (suitable for all modelled species). These categories were then reclassified to: 1 – 5; 6 – 10; and more than 10 species, mapped and hectares calculated in ArcGIS 10.3.

Table 2: Species' common and scientific names, with their State Schedule Importance (I, II or III), IUCN Red List threat categories (critically endangered-CR, endangered-EN, vulnerable-VU), and endemism.

Common name **(Scientific name)**	**State Schedule ***	**IUCN threat category**	**Endemi c to Borneo**
Bornean orangutan (*Pongo pygmaeus morio*)	I	CR	Yes
Bornean elephant (*Elephas maximus borneensis*)	I	EN	Yes**
Proboscis monkey (*Nasalis larvatus*)	I	EN	Yes
Bornean gibbon (*Hylobates muelleri*)	II	EN	Yes
Sunda clouded leopard (*Neofelis diardi)*	I	VU	Yes**
Malayan sun bear (*Helarctos malayanus*	I	VU	Yes**
Sunda pangolin (*Manis javanica*)	II	EN	No
Pig-tailed macaque (*Macaca nemestrina*)	II	VU	No
Banded palm civet (*Hemigalus derbyanus*)	II	VU	No
Flat-headed Cat (*Prionailurus planiceps*)	II	EN	No
Slow loris (*Nycticebus coucang*)	II	VU	No
Sambar deer (*Rusa unicolor*)	III	VU	No
Bearded pig (*Sus barbatus*)	III	VU	No

* State Schedule List is ranked as I ("Totally protected" and may not be hunted, traded or kept under any circumstances), II & III (allow limited hunting, subject to the licensing agreement) under the aegis of the Wildlife Conservation Enactment 1997.

**Sub-species is endemic to Borneo

3.2.3 Identifying forest types in the Lower Kinabatangan

Fine-scale forest type data for the years 2010/11 were available for the region (Abram *et al.*, 2014). To update these data we overlaid the forest type data with the 2014 forest extent layer and removed areas that had been converted between 2010/11 and 2014. Forest types found in the Lower Kinabatangan can be seen in Table 3 along with their annual flooding patterns.

Table 3: Forest system and forest type classes found in the Lower Kinabatangan with flooding periods.

Forest systems and forest type class	**Annual flooding period**
Mangrove:	
Beach forest: Occurs on sandy substrate along coastal areas.	Tidal
Mangrove forest: Found in saline coastal sediments.	Tidal
Nipah palm forest: Native type of palm (*Nypa fruticans*) found within the mangrove system.	Tidal
Transitional forest: Occurs between mangrove and freshwater swamp forest. Brackish water.	Semi-tidal
Seasonally flooded forests:	
Freshwater swamp forest: Formed in back swamps and largely on poorly drained soil.	>6 mths
Seasonal freshwater swamp forest: Heavy degradation thought to have occurred, pioneer sp.	3-6 mths
Peat swamp forest: Oligotropic peat substrate, poorly drained forests exposed to flooding.	>6 mths
Swamp: Open reed, swamp vegetation.	>9 mths
Lowland dry forest:	
Lowland dry forest: Previous dipterocarp forest, secondary forest.	<3 mths
Lowland dry dipterocarp forest: Logged lowland mixed dipterocarp forest, Dipterocarp sp. Dominant.	Never/rarely
Limestone forest: Gomantong substrate association of hill and ridge escarpments. Low disturbance.	Never/rarely
Mixed vegetation types:	
Severely degraded areas with unknown previous forest types dominated by shrub/low lying vegetation.	Varied

3.2.4 Identifying areas of good above-ground carbon

Above-ground carbon data was available for the region, see Abram *et al.* (2016). These data were developed from 110 hectares of carbon plot data that was integrated with remote sensing information using a step-wise Object-Based Image Analysis approach. The carbon spatial data consisted of six classes using metric tons of carbon per hectare (tCha): <50 tC/ha; 50-100 tC/ha; 100-200 tC/ha; 200-300 tC/ha; 00-400 tC/ha; >400 tC/ha. Firstly, these data were updated to reflect the extent of forests in 2014 by removing areas that had been converted to oil palm or other land-use types. Secondly, these data were reclassified into areas of low carbon stock (by merging the <50 tC/ha and 50-100 tC/ha classes), and areas of high carbon stock (through aggregating classes of 100-200 tC/ha and above). We calculated the extent of each class in hectares and mapped the locations of low and high carbon stock in the Lower Kinabatangan region.

We used a threshold of 75 tC/ha to define areas of low and high carbon stock, as above-ground carbon for mature oil palm is around 75 tC/ha (Morel *et al.*, 2011). This is also in line with a 75 tC/ha threshold proposed to the RSPO by a study funded by large palm oil companies (i.e. Musim Mas, Sime Darby and Wilmar). The RSPO's newly-adopted High Carbon Stock (HCS) approach goes above and beyond simply using a carbon threshold. Nevertheless, we adopted this threshold as a means to quickly identify areas with higher above-ground carbon than that of mature oil palm stands.

3.3 Identifying threats to forests outside of protected areas

To find out how far the forests standing outside of the protected areas overlapped with land titles allocated for oil palm, we used data digitised from publicly available cadastral maps (*n*=14). These showed areas under Native Titles and Country Land titles (see Section 2.7).

The cadastral maps also showed areas of demarcated State land with boundaries but no identity code; these areas were assumed to be under land application but not yet alienated. Furthermore, the cadastral maps also had areas with no demarcations that were assumed to be State lands with no applications pending. It is important to note that the cadastral maps were not up-to-date and therefore some of what they identify as State land may already have been alienated.

3.4 The current and future oil palm landscape

Floodplains vary in suitability for oil palm cultivation. We updated 2010/11 data from Abram *et al.* (2014) using the 2014 Landsat imagery and classified the oil palm landscape into three categories: (1) immature and mature oil palm (seven years and older) with good canopy; (2) areas that were cleared for planting, or that had planted palms under six years old; and, (3) areas of previously planted oil palm that had experienced palm die-off resulting in less than 25 per cent of the palm surviving – typically in seasonal or tidal flood prone areas (Abram *et al.*, 2014). The prevalence such flooding in the Lower Kinabatangan raises crucial questions over how suitable its forests may be for oil palm – a plant that is intolerant to waterlogged conditions (Abram *et al.*, 2014).

To understand what a future scenario might look like if all forests outside of the protected areas were converted to oil palm, we identified and mapped all forest types associated with unsuitable areas for oil palm (such as those in the mangrove system, seasonally flooded forest system and limestone forest).

4 RESULTS AND DISCUSSION

The Bornean orangutan population has declined throughout its range across the island. The severity of the situation was underscored in 2016 when the IUCN Red List reclassified the species from 'endangered' to 'critically endangered', citing the primary causes of population declines as habitat loss and fragmentation, illegal hunting and fires (Ancrenaz *et al.*, 2016). Although the Lower Kinabatangan is one of Sabah's strongholds for orangutan, this region has seen dramatic declines in orangutan numbers and habitat.

4.1 Declining orangutan population and habitat loss

4.1.1 A dramatic decline in orangutan since the 1960s

The orangutan presence in the Lower Kinabatangan floodplain has been documented since the early 1960s (Haile, 1963; Yoshiba, 1964; McKinnon, 1974; Horr, 1975). However, a genetic analysis of the Kinabatangan orangutan population showed that this population had suffered a ten-fold decline in the last two hundred years, mostly due to human activities (Goossens *et al.*, 2005). The rapid decline started when modern rifles were introduced to Sabah and it suddenly became much easier to shoot them. The decline accelerated with the onset of mechanised logging practices and the expansion of industrialised plantations. In the early 1960s, Yoshiba gave a precise description of the orangutan presence in several forests of the Kinabatangan floodplain. Based on these observations, it is estimated that a minimum of 4,000 individuals were to be found in the region that corresponds to what is today called "lower Kinabatangan" (Yoshiba, 1964).

Surveys conducted in 2001 by the NGO HUTAN in the Lower Kinabatangan estimated the orangutan population to be around 1,125 individuals (with a 95 per cent confidence interval of 691-1,807 animals); implying a very substantial loss of 72 per cent of the former population in less than four decades (Ancrenaz *et al.*, 2004).

4.1.2 Significant orangutan population in alienated lands

Of the area surveyed in 2001 (51,710 ha), around 70 per cent (36,430 ha) was estimated to be suitable habitat for orangutan; 20 per cent of the individuals were distributed within 8,750 ha (out of 11,970 ha) of forest in the Virgin Jungle Reserves; and, 60 per cent of the individuals were in 24,050 ha (of the 27,400 ha) in the proposed Lower Kinabatangan Wildlife Sanctuary. The remaining individuals (around 220) were distributed in 8,480 ha (out of 12,300 ha) of forests that were either on State land, or alienated land that belonged to private individuals and were most likely allocated for oil palm.

Those areas found not to be suitable for orangutan, which totalled around 30 per cent of the surveyed area, included land completely devoid of trees and therefore likely not to be able to sustain orangutan. These included areas burnt by fires where natural forest recovery cannot take place, and areas severely degraded by past logging operations that had caused extreme soil disruption and compaction (Ancrenaz *et al.*, 2004).

4.1.3 A 30 per cent decline in orangutan population from 2001-2015

The decline in the Lower Kinabatangan orangutan population persists. Surveys in 2006/2007 revealed a 28 per cent decline in orangutan numbers compared to the 2001 baseline estimate. The estimated population size for 2006/07 was 812 individuals (with a 95 per cent confidence interval of 425-1418 animals) – a dramatic loss, considering that this was only around five years after the baseline assessment in 2001.

Furthermore, recent aerial surveys in 2015 showed a further drop in numbers from 812 in 2006/07 to 785 individuals (with a 95 per cent confidence interval of 414-1,467 animals). **This means that from 2001 to 2015 there has been a 30 per cent decline in orangutan numbers in the Lower Kinabatangan.**

4.1.4 Forest loss an overarching driver of orangutan population decline

Today, the killing of orangutans in the region is rare, and thus we attribute the vast majority of the decline in orangutan numbers to widespread forest conversion (Ancrenaz *et al.*, 2007). In the mid-1990s, forest cover in the Lower Kinabatangan was far more extensive than it is today, with good connectivity both north and south of the river (Figure 3).

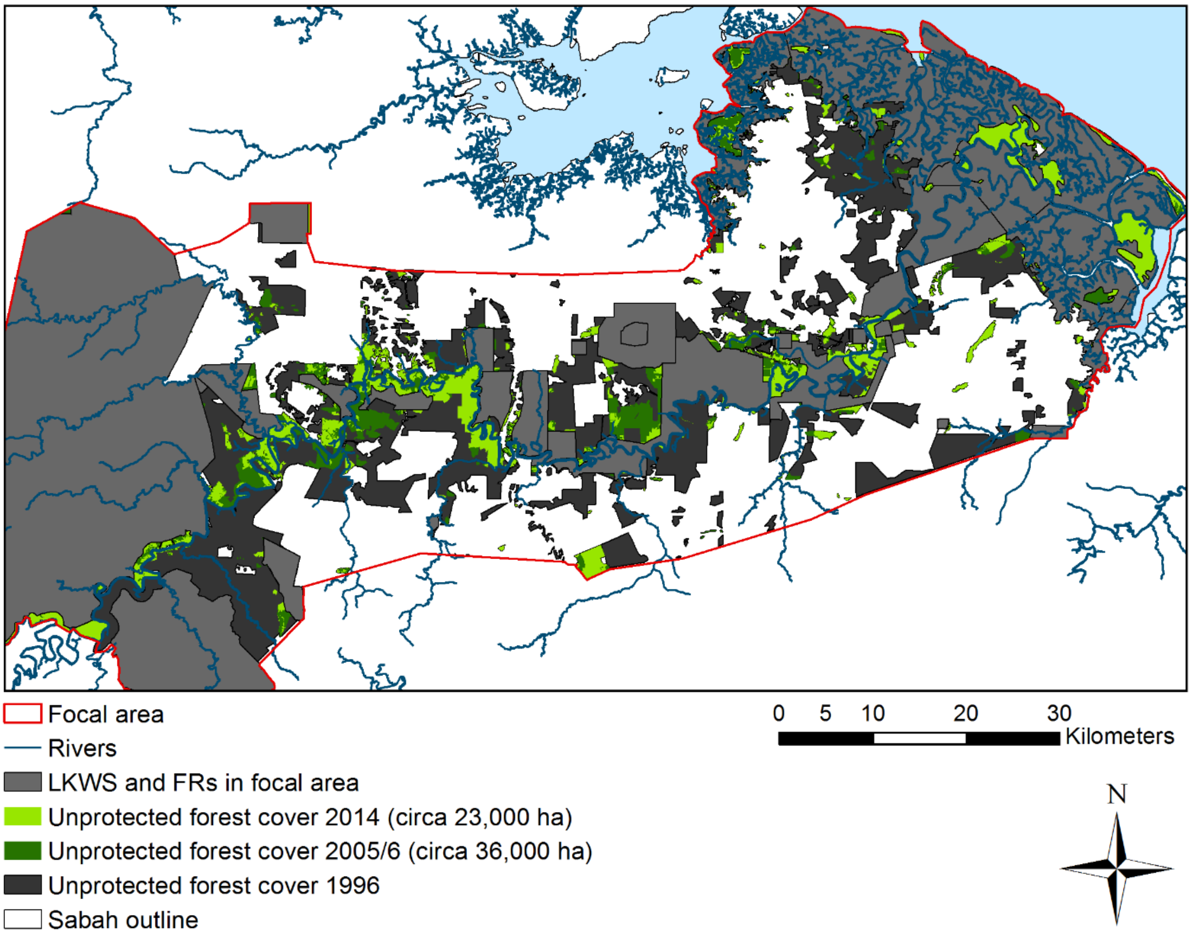


Figure 3: Map of the Lower Kinabatangan study region (red outline) showing the 2005 protected area network (cross hatch) with: the extent of the forest in 1996 (using Landsat TM images); 2005 forest extent (Landsat TM); and 2014 forest extent (Landsat EM).

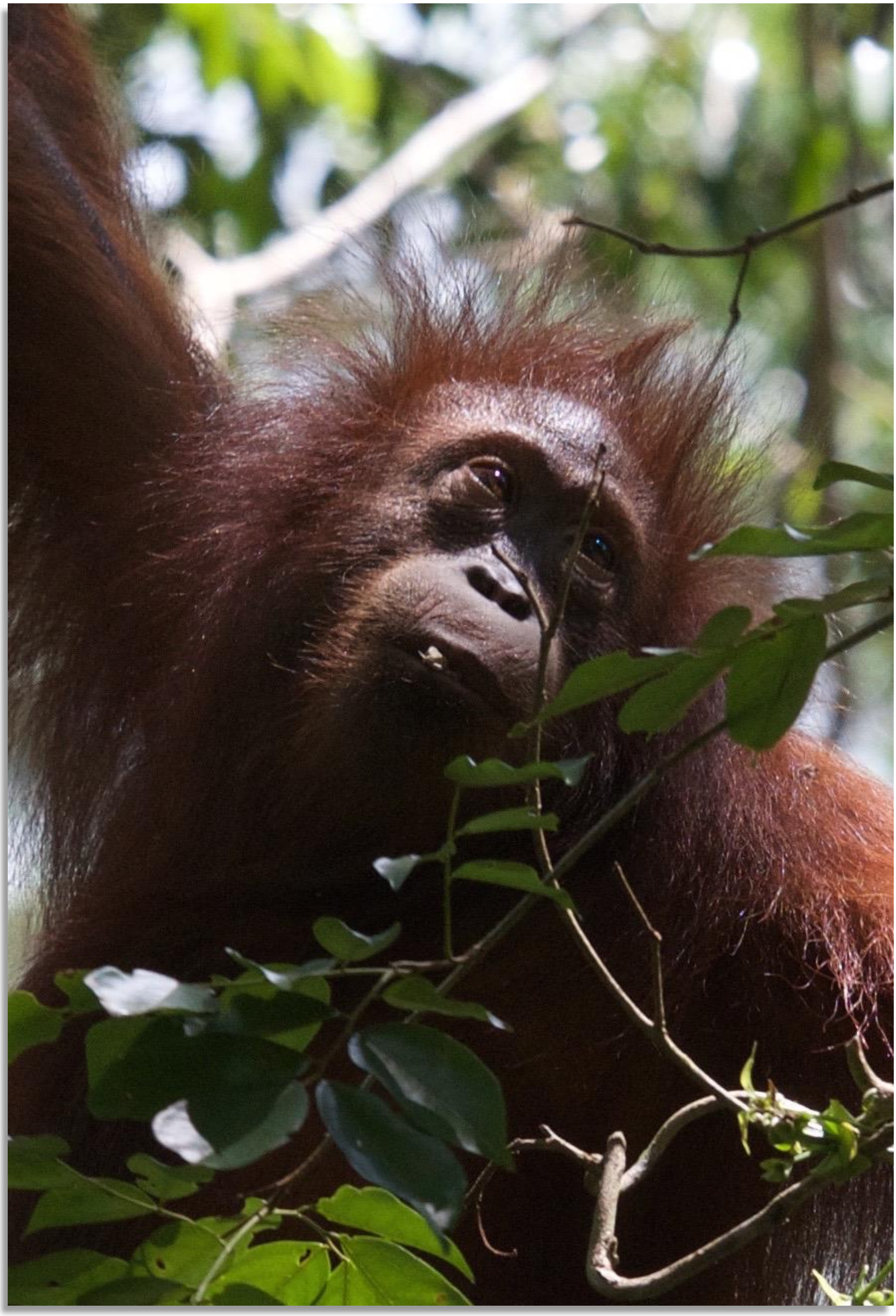
In 2005 however, forest cover had been dramatically reduced and approximately 36,000 ha of forest remained outside the gazetted Lower Kinabatangan Wildlife Sanctuary and other protected areas. From 2005-2014, around 13,000 ha of these forests were lost. Most of these forests were connected with the current network of protected forests – either the LKWS or the Virgin Jungle Reserves found in the floodplain – and thus played a very important function in sustaining remaining wildlife populations.

In 2014, around 23,000 ha of forest remained outside of the protected areas. These forests are threatened with conversion to oil palm in the near future, and if converted, we will see an increased loss of orangutan habitat and habitat fragmentation.

4.1.5 11,000 ha of additional forest is needed to safeguard orangutan populations

The intense fragmentation and loss of habitat is a major threat to the long-term survival of the resident orangutan population in Lower Kinabatangan. A Population Habitat Viability Analysis (or PHVA) for this population showed that under a *non-intervention management scenario* (or "business-as-usual"), the genetic and demographic viability of the smaller sub-populations of orangutan in the Lower Kinabatangan would be compromised in the medium-term with the majority of them having a more than 5 per cent chance of local extinction in the next 250 years (Bruford *et al.*, 2010). However, scenarios where forest corridors were established to reconnect isolated sub-populations improved these smaller sub-populations' chances of survival by reducing the risk of genetic drift and inbreeding. Reconnecting all isolated orangutan sub-populations is an explicit goal set down in the current management plan for the area and for the species (Sabah Wildlife Department, 2012). However, this is a lengthy and expensive process that will depend on factors including: political will; cost of land; speed of forest regrowth and reforestation in those areas that are devoid of trees; and rates of habitat occupancy and use of newly created corridors by wildlife.

Considering the genetic variability documented for the orangutan population living in Kinabatangan, a minimum of 270 "founders" (in other words, non-related individuals; 180 north of the river and 90 south of the river) will be necessary to secure the genetic viability of the population, which would mean a total population of about 1,915 individuals (Goossens *et al.*, 2006). Considering the current orangutan densities (see Text Box 2) and the estimated carrying capacity of the Lower Kinabatangan ecosystem, this would require an area size of about 52,000 ha, which would mean the addition of about 11,000 ha of forest to the current network of forests (split broadly half/half between the northern and southern banks of the River). Most of this land would have to be acquired from oil palm companies through land purchase (through land is very expensive) or other conservation management strategies.

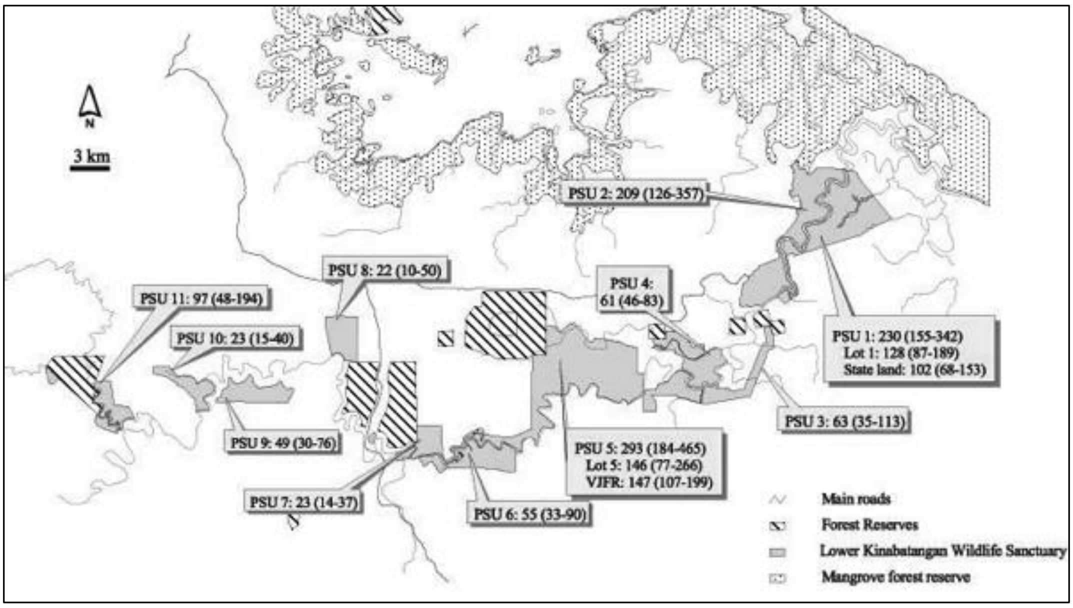


TEXT BOX 2: CHANGES IN ORANGUTAN DENSITY

In the 2001 surveys – for most areas – the average orangutan densities fluctuated between 0.5 and 3.5 individuals/km^2, with these values being within the range reported previously for the region (Payne, 1987). Overall, the results showed that heavy habitat disturbance had a negative impact on orangutan densities, with the lower densities encountered in the most degraded forest patches (Ancrenaz *et al.*, 2004). However, degraded forests still harboured a significant number of animals.

Very high densities were found in Lots 1 and 2 (see Figure below) with more than five individuals per km^2 in large forest patches and where habitat was generally less disturbed. The high densities encountered in some of these forest patches is likely to have been due to a temporary influx of (mostly) non-territorial adult – unflanged – males that move away from disturbed areas (Yoshiba, 1964; Bruford *et al.*, 2010). This so-called *compaction effect* (or influx of refugees) in the forests of Lower Kinabatangan is thought to have occurred in the 1980s and 1990s when forest conversion was at its peak. If this is the case, then it is likely that the 2001 survey may have inflated orangutan densities, especially in larger lots located close to newly established plantations (Lots 1, 2 and 5). In the 2006/07 surveys, densities showed a drastic decline in Lots 1, 2, 5 and 9, which were the major orangutan strongholds in 2001. Further forest conversion was linked to the loss of animals in Lot 9. The decline in other Lots was largely explained by a "rebound" effect (i.e. loss of individuals from an area) that followed the earlier *compaction effect of the 1980s/1990s*. Indeed, ongoing research by the NGO Hutan shows that excess males that leave active areas of disturbance (such as logging zones) often take refuge in nearby forests but can later recolonize previously disturbed areas or even utilise more mature agricultural landscapes when these areas start to stabilize (Ancrenaz *et al.*, 2014b).

Continued monitoring of orangutan population patterns and trends will be critical to further understand how this species is adapting to changes within the landscape, which can then help inform effective management of wild populations in such dynamic and human-dominated areas.



Map showing the orangutan sub-populations (or "Primary Sampling Units": PSU) and Lot numbers, along with the estimated number of individuals per Lot and confidence intervals (in parentheses) calculated from aerial and ground surveys in 2001 (map from Ancrenaz *et al.*, 2004).

4.2 Suitable habitat for rare, threatened and endangered species

Forest loss in the region has had a severe impact on the orangutan population, driving a dramatic decline in numbers over 15 years. Deforestation will also have had a big impact on an array of other forest-dependent species, though population trend data is limited.

Of the forests found outside of the protected areas, 91 per cent were predicted to be suitable for orangutan. For other species, the proportion of non-protected forests offering suitable habitats ranged from 14 per cent to 93 per cent, demonstrating the importance of these forests as HCV1 areas (Figure 4). These figures suggest that – despite considerable disturbances by humans – the forests of the Lower Kinabatangan continue to provide a suitable habitat for many species of large, threatened Bornean mega-fauna, supporting the well-established notion that human-altered forests can retain conservation value for wildlife (Meijaard, 2008; Edwards *et al.*, 2011).

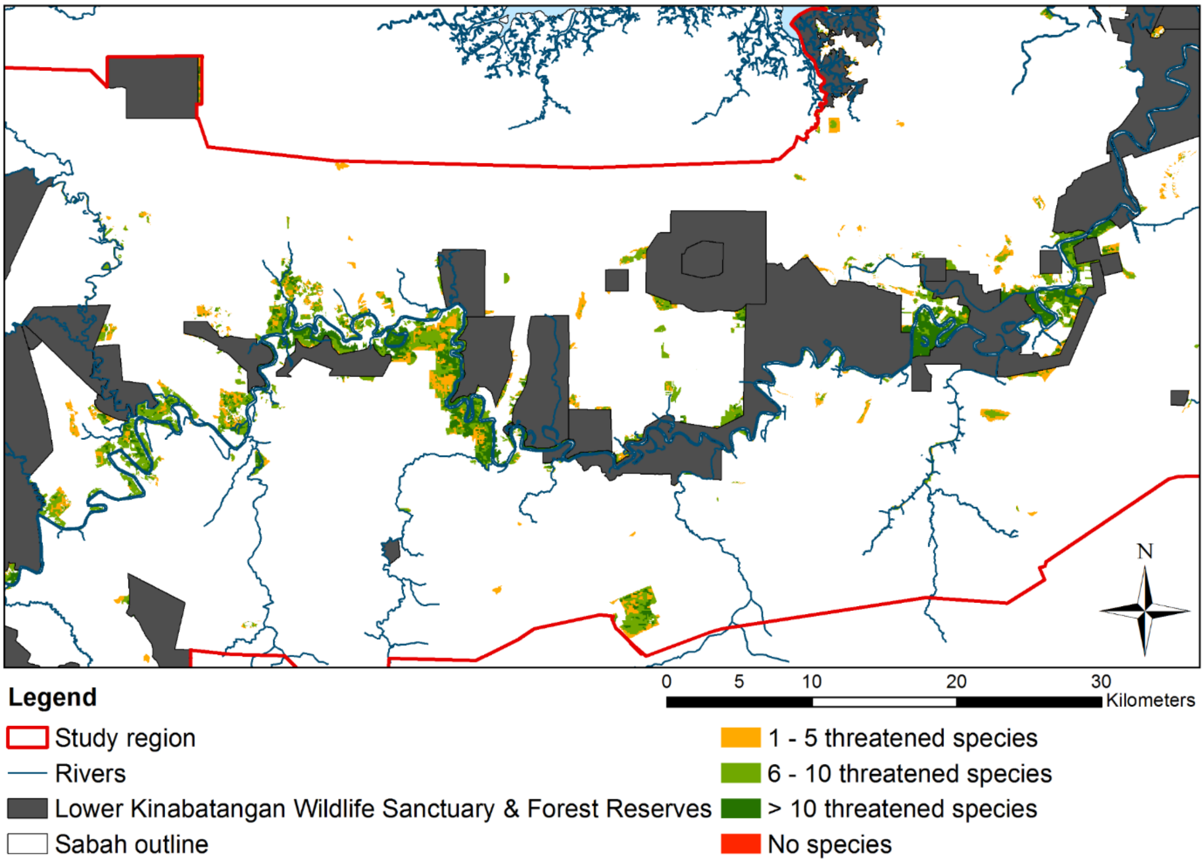


Figure 4: Identified areas of suitable habitat in forests outside of the protected areas in the Lower Kinabatangan; for thirteen rare, threatened and endangered mammal species (classified into habitat suitable for: 1-5 species; 6-10 species; over 10 species; no species).

However, species thresholds in modified environments may be tenuous in the long-term and their viability will largely depend on the degree of human disturbance and the availability of resources (Kakati *et al.*, 2009). Ensuring the long-term survival of forest-reliant species will therefore largely depend on maintaining and enhancing existing forests – particularly those outside of protected areas – to ensure they can continue to support key wildlife species in the region. Further loss of habitat will clearly have negative consequences, particularly for specialist species such as the proboscis monkey, which is restricted to habitat less than one km from river systems (Sha *et al.*, 2008), or those less resilient to human land use, such as the Bornean gibbon (Kakati *et al.*, 2009).

The survival of these forests and the populations of large mega-fauna species that reside in them are also crucial to the international tourism industry in the region, which is essential to local livelihoods within the Lower Kinabatangan.

One crucial aspect of the RSPO approach is the conservation and maintenance and/or enhancement of HCVs in areas allocated for oil palm. How these HCV areas can be equitably conserved and oil palm cultivations averted in Sabah remains to be seen. Nevertheless, the adoption of a State-wide RSPO approach may just be the lifeline that can ensure the short-and long-term survival of wildlife in the Lower Kinabatangan.

4.3 Implications of forest loss to carbon storage and threatened forest types

4.3.1 Forest loss and threatened forest types

Further loss of forests will be a major blow for the Lower Kinabatangan ecosystem – and not only in terms of the impact on threatened species. Floodplain forests provide a wide range of ecosystem function and services such as above- and below-ground carbon storage and sequestration, which is essential to mitigate climate change. Forests outside of the Kinabatangan's protected areas hold a sizable above-ground carbon stock of 4.7 million metric tons according to a 2010/11 study (Abram *et al.*, 2016). Through the reclassification of above-ground carbon stock data, this study shows that 17,140 ha (74 per cent) of forests found outside of the protected area network were identified as having a high carbon stock (in other words, their carbon stock was greater than that of mature oil palm stands). Moreover, 50 per cent of forests outside of the protected areas were predicted to have from 100-200 tC/ha, and 22 per cent had more than 200 tC/ha of above-ground carbon (Abram *et al.*, 2016). By securing these forests, Sabah could not only facilitate the long-term population viability of key wildlife species in this region, but also help make headway in Malaysia's commitment to cut its carbon emissions (NRE & UNDP, 2013).

4.3.2 Forest loss and threatened forest types

Continued forest loss will also have profound implications for lowland forest types that are becoming increasingly rare and threatened due to their widespread removal for oil palm plantations and smallholdings, settlements and other uses.

A previous study in Sabah found that only a small proportion of the historic distribution of many of these forest types remains (Abram *et al.*, 2013). For example, lowland mixed dipterocarp forest had only 23 per cent – or 600,000 ha – of its historic range remaining, with much of the cleared area now being used for oil palm. For lowland freshwater swamp forest associations; seasonal freshwater swamp forest was found to have only 17 per cent (43,000 ha) of its historic distribution remaining, whereas freshwater swamp forest had 33 per cent (23,500 ha) remaining, and peat swamp forest had 36 per cent (42,000 ha).

The Lower Kinabatangan is a particularly important area for the lowland freshwater swamp forest associations, hosting about 37 per cent (40,000 ha) of Sabah's total extent of these forest types. Of those in the Lower Kinabatangan, 23 per cent (more than 9,000 ha) are located in private or un-alienated lands and therefore not protected, which underscores the urgency of taking steps to safeguard these forests (Table 4). In fact, the Lower Kinabatangan region is the largest and most forested floodplain in Sabah – with partial forest connectivity from mangrove to the interior. It is also probably the most forested floodplain in Borneo, exemplifying its wider significance.

Table 4: Forest system and forest type classes found in the Kinabatangan with flooding periods and extents (in ha) outside of the protected areas (i.e. on alienated or state lands).

Forest System	**Forest type**	**Forest type outside PAs**	**Forest system outside PAs**
Mangrove	Beach forest	659 ha	5,613 ha
	Mangrove forest	492 ha	
	Nipah palm forest	1,234 ha	
	Transitional forest	3,228 ha	
Seasonally flooded forests	Freshwater swamp forest	4,583 ha	9,282 ha
	Seasonal freshwater swamp forest	3,996 ha	
	Peat swamp forest	27 ha	
	Swamp	676 ha	
Lowland dry forests	Lowland dry forest (lacking dipterocarp sp. due to logging)	6,945 ha	8,209 ha
	Lowland mixed dipterocarp forest	987 ha	
	Limestone Forest	277 ha	
Mixed vegetation types	Severely degraded areas	4318 ha	

4.4. Flooded forests are not suitable for oil palm

The Lower Kinabatangan is regarded as a very conducive region for oil palm. However, its heterogeneous landscape means that the crop cannot be grown everywhere. Understanding landscape-level constraints in floodplain systems and translating them into policy and practice will therefore be essential to promoting informed land use and preventing forests being cleared in areas where palm oil will not be viable. Furthermore, understanding these kinds of landscape-level constraints may help identify otherwise concealed conservation opportunities in smaller forested areas or those on alienated titles.

We estimated that around half of forests outside of the protected areas are not suitable for oil palm development due to seasonal or daily (tidal) flooding, despite it being allocated for this purpose (Figure 5). According to previous economic analyses, converting unsuitable forested areas to oil palm production would yield a net financial loss and would likely result in the destruction of about 15,000 ha of land in the Lower Kinabatangan without any benefit for people or for biodiversity (Abram *et al.*, 2014); Table 4. If converted to oil palm, these forests would soon become commercially redundant areas: most palms would die and the overall net cost for converting forest to oil palm would significantly outweigh any revenue (estimated net present value over 25 years ranged from US $-65 to US $-300/ha per year). Investing in oil palm in unsuitable areas may therefore have disastrous financial consequences.

Although flood mitigation measures can be implemented in flood prone areas, these are very costly and have been largely ineffective in preventing inundation within the Lower Kinabatangan (Hoh & Ishak-Amin, 2001). For example, in 2000 one company experienced palm mortalities in 5,000 hectares of immature palm, with estimated financial losses of US $3 million (equivalent to US $600/ha) due to high flood water (14 m above sea level) (Hai *et al.*, 2001). The impacts of flood-related financial losses can be particularly catastrophic for small-scale farmers who establish plantations or smallholdings through formal credit systems, or borrow money through informal arrangements, or by investing a large proportion of their savings. Failed oil palm ventures therefore represent a very poor return on investment for small-scale producers (Vermeulen & Goad, 2006).

Larger companies with processing mills are likely to face a smaller risk from converting flood-prone land since they can offset any losses with earnings from other areas in their mosaic of holdings. Nevertheless, large estates have social and environmental corporate responsibilities and conserving forests in unproductive areas may help companies achieve these requirements, especially if they are HCV areas.

4.5. Rehabilitating forests in areas where oil palm failed

Targeting estates with large areas of failed oil palm for strategic reforestation might offer opportunities for relatively easy wins for conservationists since companies are less likely to resist rehabilitation initiatives on unproductive land. Fortunately, these areas are largely located in regions that would greatly facilitate connectivity between the Lower Kinabatangan's protected areas, and would also offer additional services, such as buffering flood events or mitigating erosion (Figure 5).

However, reforestation can be expensive – rehabilitating a single hectare of degraded land in the Lower Kinabatangan can cost US$5,000-15,000 if intensive methods are used (KOCP, unp. data). Rehabilitation can be made a lot cheaper by using less intensive methods that typically do not involve protective electric fencing or post-planting care of saplings, but the survival rates of newly-planted native trees tend to fall accordingly. Reforesting large areas of land is therefore costly in terms of time and money and strategic planning at the landscape level will be needed to capitalise on such efforts on behalf of wildlife such as the orangutan. Reforestation should certainly not be seen as a substitute for protecting existing HCV areas.

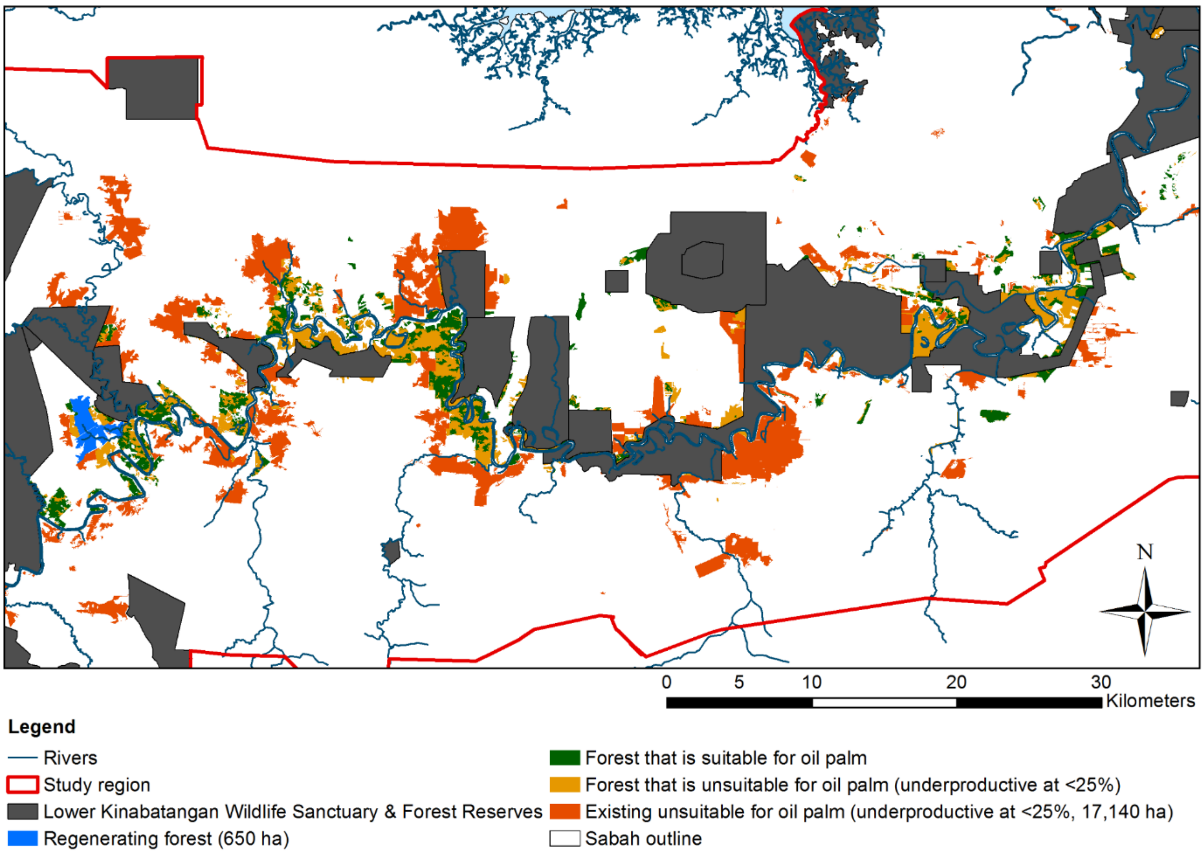


Figure 5: Extent of failed oil palm areas due to seasonal flooding (dark orange), areas of non-protected forest that would be suitable for oil palm (green) and areas of non-protected forest that would be unsuitable for oil palm (light orange).

4.4 HCV areas outside of protected areas are allocated for oil palm

In 2014, 23,100 ha of HCV forest stood outside the protected areas. Preserving viable wildlife populations – and general ecosystem functionality – in the Lower Kinabatangan will primarily depend on what happens to these forests. Most of them belong to private landowners, with 6,350 ha under Native Title, and 7,170 ha within commercial or Country Land titles (Figure 6). The remaining forests identified on state land, or titles under land application, are most likely already alienated for oil palm.

By law, alienated land should be cultivated within several years of the title being acquired. However, the large extent of alienated but undeveloped forest suggests that many landholders have not complied with these regulations. This could be due to a number of reasons. For those titles that are certified as sustainable under RSPO, retaining and managing HCV areas is a key requirement. Alternatively, landholders may understand that these lands are not suitable for oil palm (see Section 4.4); or title-holders may simply not yet have had the time or the financial resources to convert the forest. Nevertheless, there is a window of opportunity here for urgent, strategic intervention to protect these vital habitats.

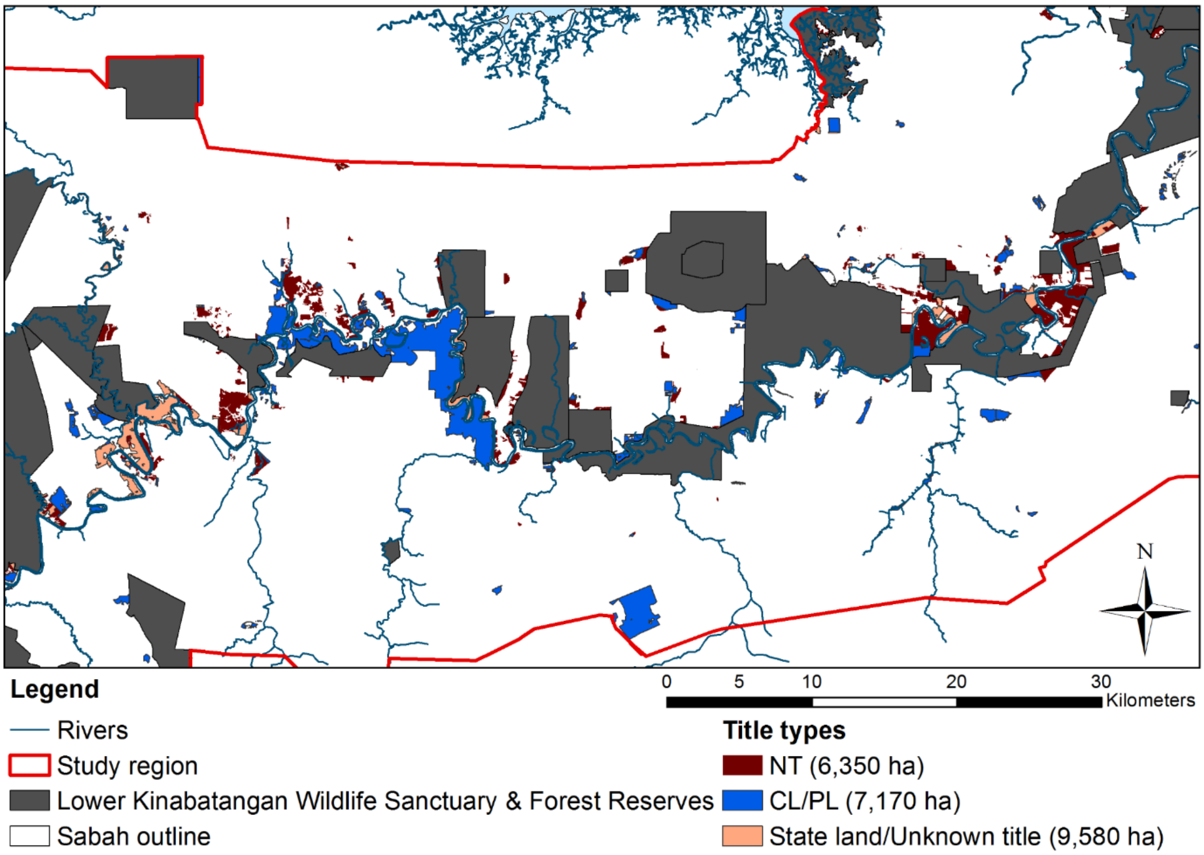


Figure 6: Extent of forest on smallholdings of Native Titles (NT), on commercial Country Land titles (CL/PL) and on potential State land.

4.5 Intervention strategies for conserving HCV areas or for reforesting lands

4.5.1 Jurisdictional certification of palm oil

To date, NGOs and government have made some headway in protecting the Lower Kinabatangan's forests (for example, by gazetting the LKWS, and land purchases for conservation and research). Nevertheless, forest conversion to oil palm continues unabated. The overall approach to conservation in the region has so far been piecemeal, and insufficient to ensure the long-term viability of the Lower Kinabatangan ecosystem.

Sabah's commitment to undertaking jurisdictional certification for palm oil could be a much-needed game-changer and provide a platform for landscape-level conservation of HCV and High Carbon Stock (HCS) areas in the region.

One concern, however, is that the HCV forests outside of the protected areas are fragmented and small. In the Malaysian National Interpretation of the RSPOs Principles and Criteria, HCV forests under 500 ha will only require external assessments if internal assessments identify 'significant' environmentally sensitive areas/issues (see Principal 7, RSPO, 2013). Consequently, the safeguards for HCV forests under 500 ha may be inadequate, regardless of their conservation value (Edwards *et al.*, 2012). Although we did not assess the size of each forest, we did look at the extent of HCV forest in titles under parent companies (Table 5). Only three parent companies have collectively more than 500 ha of unprotected forest within their titles, reflecting the highly fragmented nature of the remaining forests in the landscape. Another potential drawback is that RSPO grants greater leniency for smallholders on forest conversion for new plantings (Proforest, 2016), which places a question mark over the future of the 6,000 ha of HCV forest on native titles.

Table 5: Extent of alienated land under parent companies, along with their membership to the RSPO, size of estate and HCV areas within their estates; for commercial or CL titles only.

Company/Parent company	**RSPO (member)**	**Total area of estates (ha)**	**HCV areas (ha)**
Unknown title holders	Unknown	40,140	2,740
Sawit Kinabalu Bhd. (Borneo Samudera)	Yes	2,766	2,072
Kim Guan Hing Limited	Unknown	1,951	885
IOI Corporation Bhd.	Yes	22,141	492
Felda Global Ventures (Pontian)	Yes	10,935	284
Petrojasa Sdn. Bhd.	No	3,407	217
Genting Plantations	Yes	8,310	146
Sime Darby	Yes	12,088	119
Malmubi Group	Unknown	1,623	77
Hap Seng Plantations Holdings Bhd.	Yes	12,012	75
Genting Plantations	Yes	1,653	39
Tung Hup Enterprises Sdn. Bhd.	No	973	17
Kwantas Corporation Bhd.	Yes	1,504	10
TOTAL		**119,503**	**7,173**

Another issue is that Sabah's current land-use policies prohibit forest retention on private land (Sabah Land Ordinance, ver2010). Laws preventing such initiatives are currently a major obstacle for private conservation ventures on alienated lands in Sabah as a whole, and not least to landholders who need to comply with RSPO standards. Amendments to the Land Ordinance are urgently needed to enable state-wide certification of sustainable palm oil and will need addressing by the states jurisdictional committee for sustainable certification (JCSC), and beyond that at the highest level of decision-making in Sabah – the State Cabinet.

4.5.2 Excising and purchasing of land

Voluntary land purchases through NGO-governmental efforts have secured more than 100 hectares that will be gazetted as a Wildlife Sanctuary. However, the high price of land limits the scope for landscape-level purchase schemes. There are more plausible mechanisms for the compulsory acquisition of land by the Sabah Government, and these could provide highly effective in preserving forests of less than 500 ha that fall outside the RSPO safety net. However, this approach would have to be handled delicately to avoid antagonising communities or companies whose goodwill towards biodiversity conservation is essential.

5 CONCLUSION

The Lower Kinabatangan in eastern Sabah is renowned for the abundance and stunning diversity of its wildlife, including the critically-endangered orangutan. Though a network of protected forests has made a significant contribution to preserving this trove of biodiversity, it is too small and fragmented to guarantee the survival of viable populations of orangutan and many other rare, threatened and endemic species. Survey data shows that the region's orangutan population has fallen by 30 per cent from 2001-2015. Although many factors contributed to this dramatic decline, the main one is forest conversion.

Currently, a significant amount of High Conservation Value forest remains outside the protected areas in private (or alienated) lands. This study has identified these areas (about 23,000 ha) as important habitats for a number of threatened mammal species (such as orangutan, Bornean gibbon, Bornean elephant, Sunda clouded leopard). It has also demonstrated their value as important carbon stocks and representatives of threatened forests types, especially those associated with swamp forest types. Many of these privately owned forests have been earmarked for oil palm despite a large percentage being so flood-prone that any new plantations established on them will almost certainly die. Nevertheless, the decision by Sabah to pursue state-wide jurisdictional certification under the RSPO might not only save these areas from being converted, but spur the reform of legal and policy frameworks to permit the lawful preservation of such forests.

However, even if all remaining forests are conserved, the long-term viability of orangutan – and many other species – within the region will also hinge on large-scale reforestation efforts to both increase connectivity between the fragmented protected areas, and extend the size of wildlife habitats. Although some reforestation efforts are underway, more strategic efforts will be needed to target key areas. The oil palm industry should play an active role in rehabilitating natural forests, especially in converted areas where palms failed to survive due to flooding. Regardless of which mechanisms and strategies prove most feasible for helping to conserve and grow the region's forests, the long-term viability of the Lower Kinabatangan ecosystem will depend on our ability to rewind time and create the kind of connected and protected forested landscape proposed by Dr John Payne, and approved by State Cabinet back in 1994 (Text Box 1). Honouring their vision will be the best way to support the Lower Kinabatangan ecosystem to survive long into the future.

6 REFERENCES

Abram, N (2016) Trade-offs between ecosystem protection and oil palm development. Royal Institution of Chartered Surveyors, London.

Abram, N *et al.* (2013) Spatial Planning for Conservation and Sustainable Development 'SPaCe': Report for Sabah Structure Plan 2033. Living Landscape Alliance, HUTAN, and WWF-Malaysia. Kota Kinabalu, Sabah, Malaysia.

Abram, N *et al.* (2017) Assessing and Addressing the Impact of Large-scale Land Acquisitions on Ape conservation: Borneo Case Study. Ridge to Reef, Living Landscape Alliance, Borneo Futures, Hutan and Land Empowerment Animals People. Kota Kinabalu, Sabah, Malaysia.

Abram, N *et al.* (2014) Synergies for Improving Oil Palm Production and Forest Conservation in Floodplain Landscapes. *PLoS ONE*, 9, e95388.

Abram, N *et al.* (2016) Identifying Where REDD+ Financially Out-Competes Oil Palm in Floodplain Landscapes Using a Fine-Scale Approach. *PLoS ONE*, 11, e0156481.

Alfred, R (2010) Density and Population Estimation of the Bornean Elephants (*Elephas maximus borneesis*) in Sabah. *Journal of Biological Sciences*, 10, 92-102.

Ancrenaz, M (2007) The Costs of Exclusion: Recognizing a Role for Local Communities in Biodiversity Conservation. *PLoS Biology*, 5, e289.

Ancrenaz, M *et al.* (2004) Determination of ape distribution and population size using ground and aerial surveys: a case study with orang-utans in lower Kinabatangan, Sabah, Malaysia. *Animal Conservation* (7):375-385.

Ancrenaz, M *et al.* (2016) The IUCN Redlist of Threatened Species 2016: *Pongo pygmaeus*. IUCN, e.T17975A17966347.

Ancrenaz, M *et al.* (2014a) Of Pongo, palms and perceptions: a multidisciplinary assessment of Bornean orang-utans *Pongo pygmaeus* in an oil palm context. *Oryx*, FirstView, 1-8.

Ancrenaz, M *et al.* (2014b) Of pongo, palms, and perceptions – A multidisciplinary assessment of Bornean orangutans in an oil palm context. *Oryx*, doi:10.1017/S0030605313001270

Ancrenaz, M *et al.* (2005) Aerial Surveys Give New Estimates for Orangutans in Sabah, Malaysia. *PLoS Biology*, 3, e3.

Bruford, M *et al.* (2010) Projecting genetic diversity and population viability for the fragmented orang-utan population in the Kinabatangan floodplain, Sabah, Malaysia. *Endangered Species Research*, (12) 249-261.

Edwards, D *et al.* (2012) High Conservation Value or high confusion value? Sustainable agriculture and biodiversity conservation in the tropics. *Conservation Letters* (5):20-27.

Edwards, D *et al.* (2011) Degraded lands worth protecting: the biological importance of Southeast Asia's repeatedly logged forests. *Proceedings of the Royal Society B: Biological Sciences*, (278) 82-90.

Ensolve (2011) Impact study of palm oil mills, oil palm plantations and other pollutants on the quality of selected rivers in Sabah. Environment Protection Department, Ministry of Tourism, Culture and Environment, Kota Kinabalu, Sabah Malaysia.

ERE (2009) Study on pollution prevention and water quality improvement for Sungai Kinabatangan Basin. Department of Environment Malaysia, Ministry of Natural Resources and Environment, Kota Kinabalu, Sabah, Malaysia.

Estes, J *et al.* (2012) Quantity and Configuration of Available Elephant Habitat and Related Conservation Concerns in the Lower Kinabatangan Floodplain of Sabah, Malaysia. *PLoS ONE*, 7, e44601.

Goossens, B (2006) Genetic Signature of Anthropogenic Population Collapse in Orang-utans. *PLoS Biology*, 4, e25.

Goossens, B (2005) Patterns of genetic diversity and migration in increasingly fragmented and declining orang-utan (*Pongo pygmaeus*) populations from Sabah, Malaysia. *Molecular Ecology*, (14) 441-456.

Hai, T *et al.* (2001) Balancing the Need for Sustainable Oil Palm Development and Conservation. *ISP National Seminal 2001: Strategic Directions for the Sustainability of the Oil Palm Industry.*, Kota Kinabalu, Sabah, Malaysia.

Haile, N (1963) Orang-human co-existance in north Borneo. *Sarawak Mus Journal*, (11) 259-261.

Hoh, C and Ishak-Amin, J (2001) Oil Palm Cultivation in the Lower Kinabatangan Floodplain: A Case Study. *Forum on Making Land Use Sustainable in the Lower Kinabatangan Floodplain.*, Kota Kinabalu.

Horr, D (1975) The Bornean orang-utan: population structure and dynamics in reationship to ecology and reproductive stratergy. *Primate behaviour* (4) 307-323.

IDS (2007) Sabah Development Corridor, Socio-Economic Blueprint 2008-2025, Harnessing Unity in Diversity for Wealth Creation and Social Wellbeing. Institute for Development Studies, Sabah, Kota Kinabalu, Sabah.

Jonas, H (2017) An analysis of the legal ecosystem and political economy of large-scale oil palm and orangutan conservation in Borneo. Ridge to Reef, Living Landscape Alliance, Borneo Futures, Hutan and Land Empowerment Animals People. Kota Kinabalu, Sabah, Malaysia.

Jonas, H *et al.* (2017) Addressing the Impact of Large-scale oil palm plantations on orangutan conservation in Borneo: A spatial, legal and political economy analysis. IIED, London.

Kakati, K *et al.* (2009) Status of Western Hooklock Gibbon (*Hooklock hooklock*) Populations in Fragmented Forests of Eastern Assam. *Primate Conservation*, (24) 127-137.

Lackman-Ancrenaz, I and Manokaran, K (2008) Kinabatangan Biosphere Reserve Nomination Dossier. HUTAN. Kota Kinabalu, Sabah, Malaysia.

Lee, S (2002) *Human and elephant conflict in Lower Kinabatangan, Sabah*. University of Malaysia Sabah, Kota Kinabalu.

McKinnon, J (1974) The behaviour and ecology of wild orangutans (*Pongo pygmaeus*). *Animal Behaviour* (2) 3-74.

McMorrow, J and Talip, M (2001) Decline of forest area in Sabah, Malaysia: Relationship to state policies, land code and land capability. *Global Environmental Change* (11) 217-230.

Meijaard, E (2008) Cuddly animals don't persuade poor people to back conservation. *Nature*, 454.

Morel, A *et al.* (2011) Estimating aboveground biomass in forest and oil palm plantation in Sabah, Malaysian Borneo using ALOS PALSAR data. *Forest Ecology and Management*, (262) 1786-1798.

MPOB (2012) Malaysian Oil Palm Statistics 2011, 31st Edition. *Malaysian Palm Oil Board, Ministry of Plantation Industries and Commodities, Malaysia.*

NRE & UNDP (2013) Malaysia's REDD+ Readiness Project National Stakeholder Consultation Proceedings of Workshop 20-21 February 2013. Kuala Lumpur.

Payne, J (1987) Surveying orangutan populations by counting nests from a helicopter: A pilot survey in Sabah. *Primate Conservation* (8) 92-103.

Phillips, S andDudík, M (2008) Modeling of species distributions with Maxent: new extensions and a comprehensive evaluation. *Ecography* (31) 161-175.

Proforest, R (2016) RSPO Management System Requirements and Guidance for Group Certification of FFB Production.

RSPO (2013) Principals and Criteria for the Production of Sustainable Palm Oil 2013. Roundtable on Sustainable Palm Oil.

Sabah Land Ordinance (ver2010) State of Sabah Land Ordinance (Sabah Cap.68). Land Ordinance.

Sabah State Government (2012) Sabah Biodiversity Strategy 2012-2022: Biodiversity is our shared heritage; it must also be our shared responsibility. Kota Kinabalu, Sabah. Malaysia.

Sabah Wildlife Department (2012) Orangutan Action Plan 2012 - 2016. Sabah Wildlife Department. Kota Kinabalu, Sabah. Malaysia.

Sha, J *et al.* (2008) Status and Conservation of Proboscis Monkeys (*Nasalis larvatus*) in Sabah, East Malaysia. *Primate Conservation*, 23, 107-120.

Teoh, C (2000) Land Use and the Oil Palm Industry in Malaysia: Report of WWF Malaysia.

Thomas, P *et al.* (1976) The land capability classification of Sabah. Land Resource study 25. Land Resource Division, Ministry of Overseas Development Surbiton.

Traeholt, C and Schriver, C (2011) RSPO P&C - The Challenge of Making the Principles and Criterial Operational. *Oil Palm Industry Economic Journal*, 11

Vermeulen, S and Goad, N (2006) Towards better practice in smallholder palm oil production. *Natural Resource Issues Series No. 5*. International Institute for Environment and Development. London, UK.

Whitten, S *et al.* (2012) Designing conservation tenders to support landholder participation: A framework and case study assessment. *Ecosystem Services*,

Yoshiba, K (1964) Report of the preliminary survey on the orang-utan in North Borneo. *Primates*, 5, 11-26.