Best Management Practices

for Coexistence with Orang utans in

Mixed Forest/Oil Palm Agricultural Landscapes

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KINABATANGAN PROJECT

YAYASAN

Contents

Abbreviations and Definitions

Alluvial	Soil and other material picked up and deposited along riverbanks by dynamic water courses, especially in floodplains.
Anthropogenic	Human-transformed.
Corridor	Short hand for wildlife corridor.
Generation time	Average time between two successive lineages of a population. Specifically, the average time it takes for a population to grow by a net factor of its net reproductive rate. Commonly used in laboratory microbiology, small animal and insect pest management and conservation population viability analysis. It is derived from a series of parameters including population size and distribution, proportions of reproductive animals of each sex, average age at first birth for each sex, inter-birth interval, age differences between parents and offspring, average number of offspring that reach adulthood, etc. These measured values are especially difficult to establish accurately in long-lived wild animals. Nevertheless, generation time provides a rough estimate of biological reproductive potential. The average estimated generation time of orang utans is 24-27 years (Wich *et al*., 2009).
ha	Hectare or 100 square kilometres.
HCV	High Conservation Value.
LKWS	Lower Kinabatangan Wildlife Sanctuary – 10 disconnected forest fragments (lots) ranging from 840 to 7329 ha in size, spanning 188 km of the lower reaches of the longest river in Sabah (550 km).
Metapopulation	Spatially separated groups or individuals of the same species which must function over-distance as an integrated community in order to maintain viability.
Mosaic habitat	Places of exceptionally broad plant diversity and richness especially along rivers and in floodplains. These areas are created by changes in the main channel of rivers, groundwater, springs, and ponds that creates a patchwork of different environmental conditions resulting in a mix of different habitat types in a relatively small area. In the Kinabatangan, characteristic of tropical rainforest mosaics on mineral soils, the mosaic components are delineated by the likelihood of flooding, i.e., riparian, semi-inundated or seasonal swamp, swamp, and dry or hill forest.
MSPO	Malaysian Sustainable Palm Oil
RSPO	Round Table on Sustainable Palm Oil
Riparian Buffer Zone	In an ecological sense, a riparian or buffer zone is the interface between terrestrial and aquatic ecosystems along watercourses such as freshwater streams, rivers or even lakes. The extent of regular seasonal flooding often delineates this land on the banks of fresh water. In a conservation sense, this land is often sequestered to conserve biodiversity in this transitional habitat, as a buffer to limit the extent of flooding, control soil erosion, filter runoff and provide access for terrestrial wildlife that must migrate along river banks.
Riverine	Whereas riparian refers specifically to the ecosystem on the banks of rivers, riverine is the broader term that refers to the whole ecosystem associated with river systems, including the river, the land along and nearby water and features within the watercourse itself. Concerning orang utans, their prime (or most suitable) natural habitat is riverine lowlands (below about 500m in Borneo and 800m in Sumatra).
RTE	Rare, Threatened, and Endangered species
SWD	Sabah Wildlife Department
Unplanted or unplantable area	Place within oil palm estates that is not planted with oil palm or any other crop, i.e. water catchment areas. These can be open areas with no trees, naturally forested, or rocky outcrops. On some plantations, these areas are developed for human use i.e. quarry sites for building and road materials, security training and target practice, picnic or recreational areas for estate staff.
Viable	The ability of a cell, organism or population to reproduce successfully over time and sustain its life, growth, and development. The term is often used to describe the ability of a population to avoid inbreeding that leads to a decrease in the overall fitness (health) of a population. However, a population can become non-viable for other reasons such as when the rate of off-take by hunting or death before reaching reproductive age exceeds the normal rate of reproduction or when habitat loss is so severe adequate numbers of animals are unable to sustain themselves.
VFR	Protected Virgin Forest Reserve.

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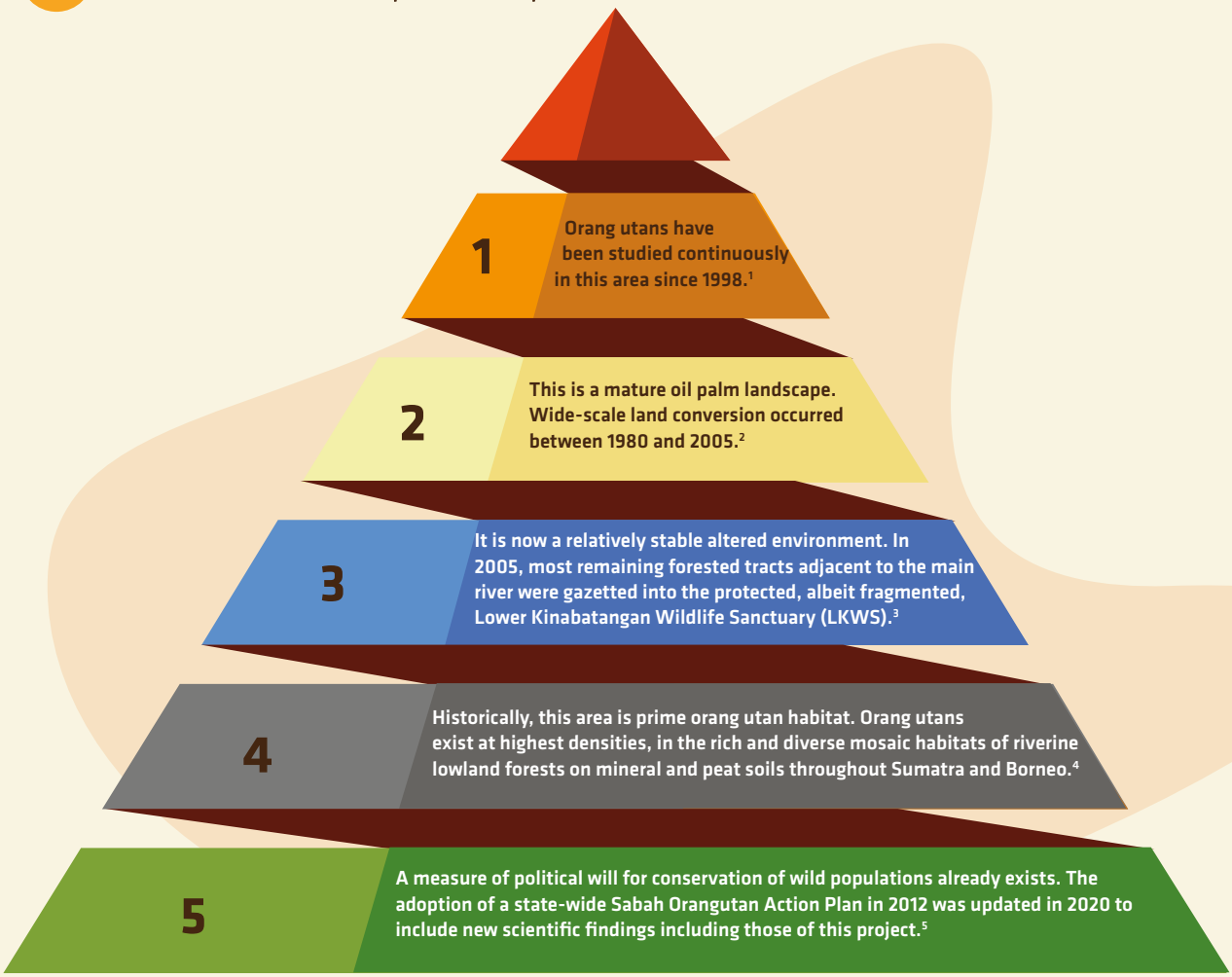
Executive Summary

This Best Management Practices for Coexistence with Orang Utans in Oil Palm Agricultural Landscapes is a key output of The Creation of a Human and Orang utan Coexistence Landscape in Kinabatangan, Sabah project, funded by Yayasan Sime Darby, PONGO Alliance Bhd. and the Alliance pour la Préservation des Forêts (French Alliance for the Protection of Forests). The project term was April 2019 – December 2022. Principal project staff were Felicity Oram, PhD, and Pravind Segaran in collaboration with the orang utan research team staff of HUTAN, particularly Mohamed Daisah Kapar and Hartiman Abdul Rahman.

An earlier Best Management Practices for Orang utan Conservation in Oil Palm concluded that more data and better synthesis of findings were required to "base rational management" decisions (page 4) necessary to "improve *in situ* (in place) conservation of orang utans" (page 1) in mixed oil palm/fragmented forest landscapes. (Denis *et al*., 2010). This document serves to address this knowledge gap by amending and extending previous work.

Research to develop these evidence-based guidelines was conducted along the Kinabatangan River, the most extensive river system in Eastern Sabah, Malaysian Borneo.

The Kinabatangan region is well suited to address the conservation potential of wild orang utans in mixed forest/oil palm landscapes because:



1. Lackman-Ancrenaz *et al*., 2001, Ancrenaz *et al*., 2004; Ancrenaz *et al*., 2005; Ancrenaz *et al*., 2015; van Noordwijk *et al*., 2018; Oram, 2018, Oram *et al*., 2022.
2. Gunarso *et al*., 2013.
3. Ancrenaz *et al*., 2015, Oram, 2018.
4. van Schaik *et al*., 1995, Delgado & van Schaik, 2001, Husson *et al*., 2009, Marshall *et al*., 2009.
5. SWD 2012, SFD 2020, SWD 2020.

Methods

We used a mixed method approach of conventional orang utan survey, bio-social and citizen or community science to engage a collaborative network of palm growers, estate field staff, government and non-government wildlife agency staff to inform this study. (Oram *et al*., 2022).

Goals

- To provide **practical guidelines** for oil palm growers, plantation staff, government and non-governmental agencies, community organisations and citizens **to support integrated conservation management of orang utans across the protected and privately administrated landscape** throughout their range in Borneo and Sumatra.
- To **augment and update previously published materials** by various agencies and companies.
- To **address the mandate of the new Sabah state Orangutan Action Plan 2021-2029** to, "*Ensure orang utans can survive in agricultural landscapes*", "*Halt habitat loss and restore habitat across the landscape*" and "*Ensure better protection of orang utans across their entire habitat*" (SWD 2020).

Key findings of this project (Oram *et al*., 2022)

- ✓ Signs of orang utan use were found in every non-oil palm planted patch surveyed within oil palm estates that had minimal human use, native species trees above 5 m in height, and were within 10 km of any other forest or mangrove in several directions. These forested islands ranged in size from 0.5–242 ha.
- ✓ Orang utans routinely use mature oil palm plantations to cross between disconnected forest fragments. Migratory adult male orang utans must cross oil palm plantations between now fragmented forests in the regional landscape to adequately meet their nutritional needs and prevent inbreeding, if long-term survival of the species will be possible.
- ✓ Some resident adult females and offspring still live in forest fragments WITHIN oil palm plantations. Female orang utans stay in the place where they were born for life (Arora *et al*., 2012). When forest is removed adult females and immature animals are lost at higher rates than males. Therefore, our findings are very encouraging as they mean slightly more females still live in the area than previously surmised. Survival of all remaining individual adult females and immatures in situ (in the place where they live now) is essential if long-term survival of the species will be possible.

- Given these results, it is clear oil palm growers, especially those operating in the prime riverine habitat of the orang utan in the lowlands of Borneo and Sumatra, now have a vital role to play in facilitating conservation of remaining orang utan populations.

- In summary, our findings reveal, despite being seldom seen by plantation workers, orang utans are extensively using nearly every small naturally forested patch regardless of quality in both the protected and privately administered landscape the Kinabatangan up to 50 years following drastic wide-scale forest loss and fragmentation.

- We found that misperceptions about orang utan ecology, behaviour, and habitat needs are key barriers to wild orang utan coexistence in mixed forest/oil palm landscapes. Misconceptions by agricultural, governmental and conservation agencies lead to actions that further disrupt rather than support the animals' attempts to survive and maintain viability in a human-transformed landscape.

Main barriers to coexistence are:

a. Misconceptions of the biology, ecology, behaviour and habitat needs of this species.
b. Persistence in employing exclusionary management practices (translocation) despite new policy to mandate coexistence with wild orang utans
c. The fact laws are in place that protect the animals but access by the animals to the overall landscape, necessary for conservation of wild populations is generally not supported by most agencies across sectors.
d. A lack of appropriate support in the field to implement and manage new policy that properly reflects current ecological knowledge of the habitat needs of this species.

Caveats, Cautions and Appeal

The following guidelines define ways we could avert the progressive decline to extinction of orang utans based on study in the lower Kinabatangan region, a mature oil palm landscape punctuated by fragmented forests in Eastern Sabah, Malaysian Borneo.

Reconnaissance visits to other regions indicate the guidelines presented in this document fundamentally apply to orang utans throughout their range and, conceptionally, to other forest wildlife.

However, some consider orang utan persistence in the Kinabatangan as either "exceptional" or "a temporary anomaly" and, therefore, irrelevant to orang utan conservation elsewhere or for other wildlife species. This perception needs revision as important insights of wider benefit can be gained from circumstances in this region.

1 KNOWLEDGE GAP

Monitoring population numbers alone is not a conservation action

Unsurprisingly, our studies revealed people are generally aware that population number estimates from orang utan nests counts are regularly derived for the Kinabatangan region and that these surveys are less frequent in other places.

However, we found people often did not realise that despite frequent monitoring the population trend in the Kinabatangan is still negative and the only recent change is that the rate of decline has slowed from catastrophic to less dire since the gazettement of the Lower Kinabatangan Wildlife Sanctuary in 2005.

Population Viability Assessment has revealed that orangutan populations cannot remain viable if the annual loss rate is 1% or above (Marshall *et al*., 2009). Based on the last Kinabatangan measurements in 2018, the current annual rate of decline is 0.7 %. Therefore, the situation is by no means hopeless, but it is certainly not overly optimistic or "exceptional" either, and whether orang utan persistence in Kinabatangan is just a "temporary anomaly" is not yet a foregone conclusion."

Population surveys are appealing because the results appear definitive. However, a single survey only describes circumstances in a defined "snapshot in time".

Regular population monitoring is required to give conservation practitioners the tools to calculate critical population trends. However, there are often financial and logistical challenges that limit the frequency and scope of population surveys.

It is also important to be aware that population size alone is just one aspect of conservation monitoring and does not address the underlying factors responsible for declines.

Instead, integrating population estimates with broader ecology and behavioural study is necessary to understand the full spectrum of species-specific habitat needs, and the physical and social constraints that govern space utilisation. This holistic information is necessary to properly understand and systematically address critical barriers to survival.

2 KNOWLEDGE GAP

Preservation of even degraded forested habitat is critically important. Restoring forest that has been clear felled is admirable and important for long term recovery, but it is necessary to remember that wildlife who survive the catastrophic effect of land conversion do so by depending on forest that is left relatively intact.

In other words forest restoration, by natural succession or assisted can be a great benefit to biodiversity in the long-term but cannot offset drastic habitat loss quickly.

For example, our studies revealed even though orang utans extensively USE the human-transformed landscape, most of the core reservoir of the local orang utan community that survives today RESIDES in PROTECTED forests (i.e. 26,000 hectares of the Lower Kinabatangan Wildlife Sanctuary (LKWS) and 15,000 hectares of Virgin Forest Reserves scattered throughout the regional landscape (see map page 10).

Long-term continuous work in the region coupled with the findings of this study reveal **two key factors that made the creation of the LKWS especially favourable to the local persistence of orang utans:**

A

The LKWS sequestered high quality forest habitat.

The ten disconnected and degraded forest fragments that make up the LKWS are adjacent to the river. Riverine mosaic forests historically support orang utans at the highest densities throughout their range (van Schaik *et al*., 1995; Delgado & van Schaik, 2000; Marshall *et al*., 2009a).

We found that these protected fragments, especially of greater width (~2k metres+) and minimal human disturbance, sequestered sufficient quality to provide refugia for a core number of orang utans at 10-20% of the pre-1980 levels across the discontinuous network (Ancrenaz *et al.*, 2004a; Ancrenaz *et al.,* 2004b, Ancrenaz *et al*., 2004c, Oram, 2018).

Our studies also found that despite being degraded from selective extraction of commercially important timber, these LKWS forest fragments retain excellent quantity (richness) and variety of plants (floristic diversity) to meet a full range of orang utan habitat needs (Lackman-Ancrenaz *et al*., 2001; Oram, 2018).

Furthermore, the LKWS is a wildlife refuge left mainly to natural regeneration with NO silviculture management to remove lianas (vital food sources) and with restricted terrestrial use by people, key contributing factors that support orang utan persistence locally (Oram, 2018).

B

The protected forest fragments, though disconnected, are broadly distributed along the main river.

The gazettement of even fragments of the richest forest habitat immediately adjacent to the river preserved different resident female orang utan family groups across the regional landscape. That is, despite being disconnected, focal community anchors survived relatively intact and, most importantly, remained distributed across a broad area. This action likely averted a complete breakdown of the regional community structure essential to maintain overall population viability (Goossens *et al*., 2006, Arora *et* a*l*., 2012, Oram, 2018, Ancrenaz *et* a*l*., 2021, Oram *et al.*, 2022).

Recognising the value of forest fragments for conservation does not mean that more extensive contiguous protected forests are unimportant. Instead, it highlights the crucial additional value of smaller forest fragments, especially in riverine areas, as refugia for wildlife.

In summary, our studies demonstrate that the action to sequester essential forest habitat at a critical time, despite being degraded and disconnected fragments, has turned out to be visionary and "exceptional" given prevailing attitudes that tend to devalue actions like this as "too little too late".

The example above should inspire people elsewhere that retaining even smaller, fragmented and degraded forest is of value to wildlife. The idea that wildlife "will return" to areas that are clear felled and then restored later overlooks the fact that the best reservoir for species recovery resides in those individuals that still manage to persist in the altered habitat while restoration is taking place. As humans, we must accept the consequences of our actions. To conserve as much biodiversity as possible, we must retain as much natural habitat as possible.

Finally, another favourable factor in the Kinabatangan is that local indigenous people in this region traditionally tolerate orangutans, monkeys, and other wildlife. This tradition of tolerance is less evident on oil palm plantations, as many people from outside the region now live in the area. Nevertheless, traditional cultural values persist to some degree, reflected in a general respect for protected forest areas. However, the ongoing conversion of non-protected forests further reduces wildlife habitat, forcing animals to live closer to people, such that the increased chance of even seeing a wild animal is often enough to make people less tolerant.

Therefore, while the circumstances in Kinabatangan may be more favourable, the challenges are the same as those faced by people and orang utans throughout Borneo and Sumatra.

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Output Overview

This Best Practice document is the final companion piece of three written project outputs.

1 **The first underpins the scientific basis of this project in the paper "Engaging the Enemy": Orang utan *(Pongo pygmaeus morio)* Conservation in Human Modified Environments in the Kinabatangan floodplain of Sabah, Malaysian Borneo"** (Oram *et al.*, 2022). Published in a special issue of the International Journal of Primatology titled : What Works and What Doesn't Work? The Challenges of Doing Effective Applied Conservation Research and is accessible by the following link - **https://rdcu.be/cLiH8**. Findings are summarised on Page 4 and 5.

2 Throughout field engagement, across sectors, we found people tended to understand aspects of orang utan ecology and conservation but become confused when trying to integrate concepts. We created a user-friendly resource in a question and answer format to address this confusion.

The book is available in print by request and is currently published in two language versions:

1 **Bahasa Melayu**, as Ada Apa Dengan Orang Utan?, Soalan Lazim tentang Orang Utan dan Kelapa Sawit - Dijawab

and

2 **English**, as What About Orang Utans?, Frequently Asked Questions About Orang Utans and Oil Palm - Answered.

3 The following Best Management Practices are designed to provide guidelines to inform more appropriate conservation practices across the remaining protected and privately administered forests of specific relevance to the oil palm industry and others working in Borneo and Sumatra.

It consists of 5 chapters:

1. Introduction
   Updated information on the biology, ecology and conservation of orang utans.
2. What orang utans are doing in oil palm plantations
   Based on the results of this study.
3. What people are doing in the oil palm landscape with respect to orang utans
   Based on the results of this study.
4. Bringing it all together - Guidelines to manage coexistence
5. Next steps

There is also an Appendix with native species recommendations for habitat rehabilitation.

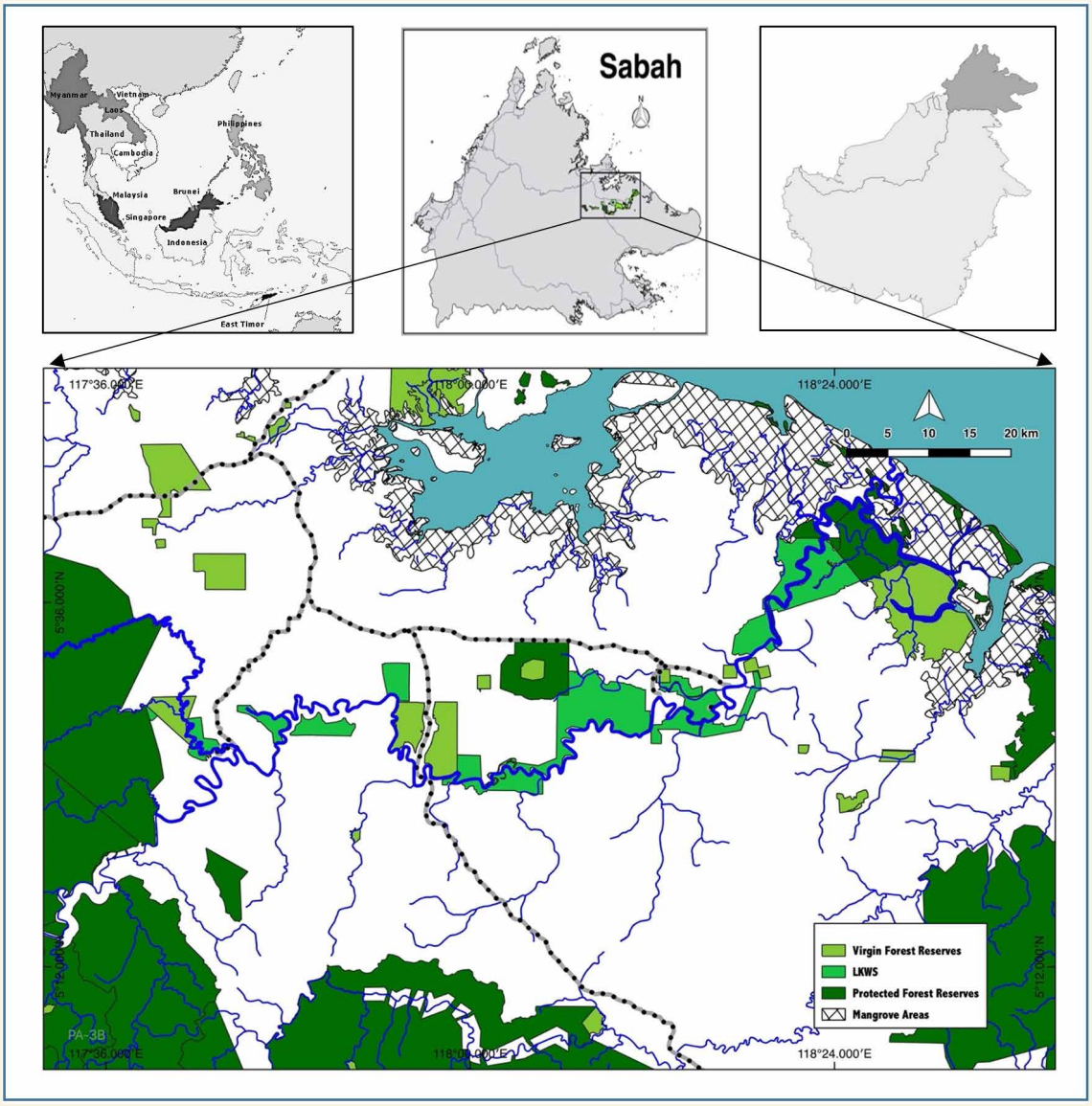

Figure 1 – The 500,000 ha Kinabatangan project area is shown above. The white areas are mostly privately managed oil palm plantations. The dotted lines indicate main roads and solid lines are rivers. All solid colour areas are forests with varying degrees of protected status, from completely protected Virgin Forest Reserves and the Lower Kinabatangan Wildlife Sanctuary to production forests designated for sustainable logging practices under the Forest Stewardship Council (FSC). The cross-hatched areas are mangrove swamp forests. Orang utans and other wildlife are protected in the mangrove forests, but fishing is allowed.

From Oram *et al.*, 2022 Page. 1071

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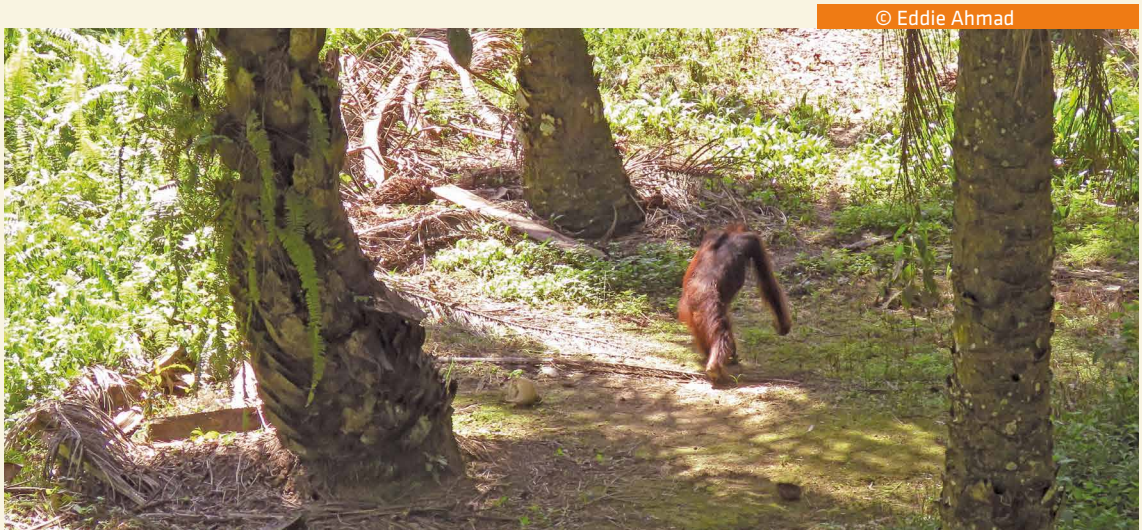

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Introduction

A synopsis of relevant, up-to-date scientific information on wild orang utan ecology and behaviour.

Some may feel there is no need for introductory material as orang utans are arguably one of the most well-known non-human primates. However, our research revealed fundamental misconceptions of this species are a key factor in their ongoing decline in human-modifiied landscapes.

We found these misunderstandings were not limited to people in rural communities or commercial agriculturalists but extended across sectors to government and non-government animal management agencies, conservation NGOs, zoos, rescue and rehabilitation facilities, academia, educators, and the general public.

Summary of key relevant facts about the ecology and conservation of orang utans:

1. Orang utans are **Asia's only Great Ape**. Great apes are in the same taxonomic Family as people. Orang utans are **not** monkeys.[1]

2. For the past 10-12 thousand years, wild orang utans have likely only existed on the islands of Sumatra and Borneo.[2]

3. **Orang utans are the largest habitually arboreal (tree-living) animals.**[3]

4. Orang utans depend entirely on natural forest habitats rich in the amount and variety of native plants. However, it does not necessarily need to be intact primary forest.[4]

5. Mosaic lowland forests on BOTH mineral soils and peat, characteristic of **the lowlands along rivers especially floodplains in Borneo and Sumatra, best support orang utans.**[5]

6. **Orang utans are opportunistic, not obligate, fruit eaters.** This means they eat fruit when available but do not only eat fruit. **Other plant parts are not a "fallback food" but are an essential component of their diet.** In fact, our studies reveal orang utans eat leaves every day but do not eat fruit every day.[6]

7. Orang utans depend on all plant parts from a wide variety of trees and vines. In Kinabatangan, they use over 150 plant genera, with many yet to be classified to the species level. Native vine sources comprise a third of the diet of orang utans in Kinabatangan.[7]

8. **Monoculture plantings of exotic agricultural species** (i.e. *Elaeis guineensis* [oil palm], *Acacia* spp., and *Eucalyptus* spp.) **or pioneer species stands** (i.e. *Neolamarckia cadamba* [Laran]) **or a single seasonally producing native fruit species** (i.e. *Ficus* spp., and *Durio* spp.) even if considered a "favourite food", **do not provide sufficient plant diversity to support orang utans adequately.** [8]

9 Unlike many other primates, **orang utans are "solitary foragers".** This means they usually look for food and consume it on their own rather than in groups. This is why people generally see only one individual or a female with dependent offspring at a time.[9]

10 Despite being solitary foragers, **orang utans are NOT a solitary living species. Instead, they live in diffuse but cohesive communities that function as an integrated whole across a wide regional area that, in natural circumstances, is separated only by major rivers or high mountain ranges.**[10]

11 **Orang utan society is based around groups of related females that occupy overlapping home ranges on the ancestral land of their maternal genetic line.**

Various "genetic clusters of related females" distributed across the landscape collectively form the anchor points of the local, regional community. Therefore, the foundation of orang utan society is based on females remaining resident in parts of forests that have provided well for generations.

Orang utan females are philopatric with exceptionally high site fidelity. This means females stay on the land where they were born for life, and because unrelated females do not tolerate each other, individuals are highly reluctant to move away from their home forest even if it is clear-felled.[11]

12 **While females and immature individuals stay in one place, adult males migrate throughout the wider landscape following seasonal fruiting cycles and travelling between the places various clusters of related females live.**

Orang utan males are the dispersing sex. That means males leave permanent residence in the forest where they grew up and where their closest maternal relatives live and circulate throughout the broader region as adults.[12]

13 **In the wild, adult male orang utans exist in 2 body forms (morphologies).**[13]

a One type has fully developed secondary sexual characteristics with fibrous facial discs on either side of its face (Flanges) and an enlarged throat sac that makes them capable of creating the characteristic long call vocalisation. Flanged males do not tolerate other flanged males. Flanged males are twice the size of females.

b The other type of adult male (unflanged) does not have the full complement of secondary sexual characteristics and cannot produce long calls. Development of the complete set of secondary sexual characteristics is not reversible. However, males are known on Borneo to have remained unflanged for at least 20 years and possibly for life. Unflanged males are not much larger than females but are more robust with larger faces. Unflanged males tolerate other unflanged males and even travel together at times. Flanged males are indifferent to unflanged males.

c In captivity, all males appear to become flanged. Perhaps this is because adult males in zoos and rehabilitation centres are, for various management reasons, usually held in separate cages due to intolerance of a flanged male father of his son as he matures. Thus, all males have the potential to become flanged, but the social circumstances that regulate this in the wild are not fully understood.

d Both types of adult males can and do sire offspring in the wild. The full extent of male ranging and many aspects of how their social hierarchy operates in the wild are not yet fully understood. Given this knowledge gap, the indiscriminate translocation of males away from their regional community cannot be assumed to have no conservation impact.

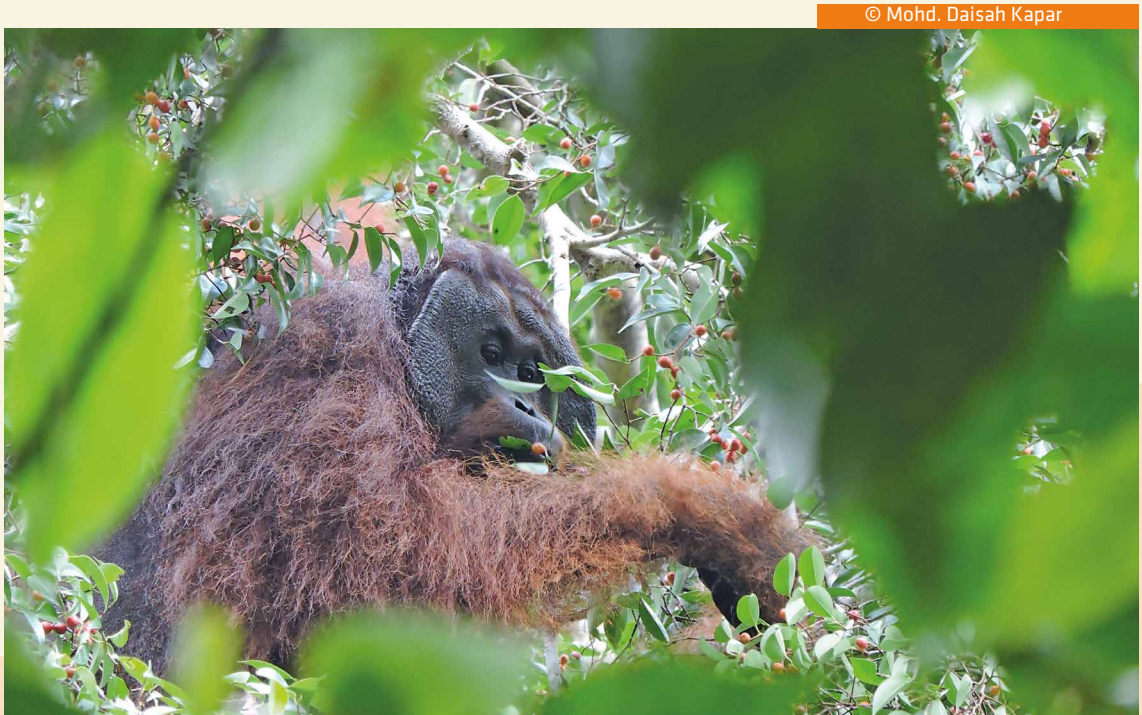
14 Wild orang utans have exceptionally long childhoods. It takes around 15 years to learn all the forest skills from their mother to survive a wild lifespan of up to 50 - 60 years. From 0-7 years, they are always with their mother. Males remain another 7 years in their maternal relatives' territory before they reach adulthood at around 15 years, when they take on the more nomadic life of an adult male.[14]

15 Maintaining normal community function or "metapopulation dynamics", despite forest fragmentation, is key to long-term survivorship of this Critically Endangered and fully protected great ape. This means that integrated conservation management across the protected and unprotected landscape is required.[15]

16 Forest conversion to oil palm agriculture has been a leading cause of habitat loss for orang utans and other wildlife in the equatorial tropics. Forest loss for different reasons, i.e., roads, mining, and tree plantations, is equally detrimental to the survival of forest-dependent wildlife.[16]

17 There is a global concern for this great ape. Since 2016, orang utans, throughout their remaining range in Borneo and Sumatra, are listed by the International Union for the Conservation of Nature (IUCN) as Critically Endangered. This elevated threat level is due to ongoing forest habitat loss, proactive removal (translocation) to clear forests for land conversion, offtake of young for the pet trade, occasional subsistence and trophy hunting, or being killed or translocated because of presumed or actual crop foraging or just because of sightings in unexpected places.[17]

1. Nater *et al*., 2017, Groves, 2018.
2. Delgado & van Shaik, 2000, Rijksen & Meijaard 1999, van Schaik, 2001.
3. Cant, 1980.
4. Haile, 1963, Lackman-Ancrenaz *et al*., 2001, Marshall *et al*., 2009a, Ancrenaz *et al*., 2010, Oram, 2018.
5. Contrary to (Denis *et al*., 2010), that suggested mineral soil habitats were not key orang utan habitat. This is unsupported by literature (van Schaik *et al*., 1995, Marshall *et al*., 2009;,Husson *et al*., 2009) and the findings of this study.
6. MacKinnon, 1974, Morrogh-Bernard *et al*., 2009, Harrison & Marshall, 2011, Oram, 2018.
7. Oram, 2018.
8. Oram, 2018.
9. Bearder, 1987.
10. van Schaik, 1999.
11. Arora *et al*., 2012, Oram, 2011, van Noordwijk *et al*., 2012 .
12. Nater *et al*., 2011.
13. Dunkel *et al*., 2013.
14. Russon, 2006, van Noordwijk *et al*., 2009.
15. Ancrenaz *et al*., 2021, Oram, 2022.
16. Gaveau *et al*., 2016, Alamgir *et al*., 2019, Supriatna *et al*., 2017, Pandong *et al*., 2019 .
17. Ancrenaz *et al*., 2016.



The following provides an expansion of the above points in the form of routinely asked questions:

Why do people need to co-exist with wild orang utans?

- **It is the law.** Orang utans are fully protected by law throughout their remaining range within the geopolitical boundaries of Indonesia and Malaysia. It is completely illegal to harass, harm, kill or trade in parts or live animals nationally in Indonesia and Malaysia and internationally through CITES. (*Convention on International Trade in Endangered Species*) Malaysia and Indonesia are both signatories of this multi-lateral international trade agreement.

- **Orang utans are Critically Endangered and are now rare in the wild throughout their remaining range,** regardless of debates about precise numbers (Ancrenaz *et al*. 2016). Since there is a mandate to protect this species in the wild, it is the responsibility of all citizens not to harm this animal.

- It is **good for business** if the oil palm industry acts now to truly participate in orang utan conservation that addresses worldwide concerns about palm oil and Asia's only great ape.

Why is it reasonable that there are fewer orang utans than there used to be?

1

Today, there is less habitat to sustain these largest Asian primates.

- For survival, orang utans depend on natural tropical rainforests.

- There can be little debate that there is less natural forest cover on Borneo and Sumatra today than even 5-10 years ago.[14] So there cannot logically be more wild orang utans today (*See Chapter 4 Section E*).

2

Biologically their wild population numbers cannot "bounce back" quickly. Despite being long-lived (up to 60 years in the wild), orang utans are one of the slowest reproducing species alive today (van Schaik, 2001).

- Young orang utans are always with their mother for the first 7 years. For the following 7 years until around 14-15, "adolescent" orang utans travel more independently, but still stay within their maternal family group's home range under the guidance of their mother and other adult female relatives (van Noordwijk & van Schaik, 2005, Yaeaggi *et al*., 2008).
- Despite being excellent mothers, with an offspring survival rate (to adulthood at 15 years) of over 90 %, a female orang utan generally raises only 3-5 offspring in her lifetime. The intensive investment in one baby at a time means wild orang utan females have long interbirth intervals of 6-9 years (van Noordwijk *et al*., 2018).
- The estimated generation time of orang utans is 24-27 years (Wich *et al*., 2009).
- Overall, wild orang utan numbers throughout their range are still declining (Ancrenaz *et al*., 2016).
- Therefore, even if we stop declines entirely, today, we will not see much of a notable increase in overall population numbers for at least 50-100 years.

- Because of female orang utans' exceptional site fidelity, when their home forest is clear-felled, female and immature orang utans are lost at higher rates than males, who tend to move away from disturbance more readily (Ashbury *et al*., 2020, Arora *et al*., 2012). This disproportionate loss of females and young is a grave conservation concern.

- As conservation practitioners, wildlife protection officers, oil palm growers and citizens, the first goal is to stop further unnatural losses of all age, sex classes of orang utans and thereby support natural population growth at a manageable rate, which is the appropriate conservation action for this species.

True or False: Orang utans do not have territories or social rules, therefore moving individuals from one forest to another (translocation) is nonconsequential and an appropriate conservation management approach.

- ✓ Orang utans are cryptic by nature and are difficult to study in the wild. Scientists and wildlife managers indeed used to believe orang utans lived entirely solitary lives with little enduring social relationships beyond the mother–infant bond, previously assumed to last only around 3-4 year. (Horr, 1975. 1977).

- ✓ Landscape-wide genetic analysis and long-term behavioural ecology studies have revealed orang utans have prolonged childhoods (15 years), exist as distinct regional communities that function diffusely across vast regional distances, and clusters of related females maintain lifelong associations that anchor the overall regional society. (Arora *et al*., 2012, van Noordwijk *et al*., 2012, Oram, 2018).

- ✓ Moving individuals from their home forests to another location disrupts the normal community structure of the local population, which is essential for the long-term survival of wild populations.

- ✓ People often call for the translocation of an orang utan if sighted in an unexpected place because they assume it is lost. However, the only sure result of capturing an orang utan and translocating (transported by people), usually away from the regional community where it lives, is to deprive it of all familiar orientation points. Hence, the only clear outcome of translocation from the animal's perspective is that it is now well and truly lost.

- ✓ Moving a female from their home forest takes them away from the area that has historically provided well for their family for generations. Resident females are intolerant of unknown female orang utans and exclude these newcomers from resources (van Noordwijk et al., 2012). So translocated females not only face an unfamiliar forest that may or may not be adequate to support them and their dependent offspring, they are likely, not welcome by any already resident orang utans.

- ✓ Because adult male orang utans are more accustomed to navigating in less familiar areas, the impact of translocation may be less dire than for females. Nevertheless, scientists still have much to learn about male orang utan social hierarchy, so the impact of translocation on male individuals, the community they came from, or the community they are entering is largely unknown.

True or False: Orang utans require primary forest, therefore any forest that is degraded is of limited value to the species.

FALSE

- It is now well-known that orang utans tolerate moderate levels of selective extraction of commercially important native timber species.[4]
- Little undisturbed forest remains in the lowlands on Sumatra and Borneo Islands (Gaveau *et al*., 2014). Therefore, few orang utans live in intact primary forests today.
- Our studies found that disturbed forests left mainly to natural succession without extensive silviculture management (that is, without removal of natural vines) retain high value as orang utan habitat (Oram, 2018).

  The most important plant species for orang utans in the degraded forests of Kinabatangan and the intact forest of Danum Valley is *Spatholobus* spp., a native vine species. Our studies revealed that plant parts sourced from natural vine species make up one-third of an orang utan's diet (Kanamori *et al*., 2015, Oram, 2018).

True or False: If an orang utan is sighted in an unexpected place outside a forest, it is lost and needs to be rescued and taken to a large forest away from people so it will be safe.

FALSE

- There are few forests in the lowland habitat required for orang utan survival that have no human impact today.
- Male orang utans must migrate throughout their home region following seasonal fruiting cycles so they do not deprive resident females and immatures of food resources in any single area. Male orang utans also need to circulate regionally to reduce the chance of inbreeding.
- Today, most forests are fragmented by various human uses, i.e., farms, villages, and roads. Male orang utans must be able to move between these now-disconnected forests, and they usually travel alone. Therefore, spotting a solitary male outside a forest fragment does not necessarily mean the animal is lost or in trouble.
- A more holistic assessment of the circumstances is required to decide if moving an animal from where it is found is really the best option for the individual and the population.
- For example, in the Kinabatangan where over 80% of the previous population has been lost in the past 50 years, ALL remaining individuals are important to the overall conservation of the regional population.

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What orang utans are doing in oil palm plantations

Below is a summary of key findings of our survey of small forests within the Kinabatangan oil palm landscape and their use by orang utans reported in Oram *et al.,* 2022 with additional details specifically relevant to best management guidelines.

Our study revealed **that natural-forested patches in mature oil palm plantations do indeed provide stepping-stone connectivity for orang utans** in the protected forest/oil palm monoculture matrix of the Kinabatangan floodplain.

Therefore, at least **some degree of normal orang utan metapopulation dynamics essential for long-term viability is still functioning despite drastic habitat modification in the Kinabatangan region** (Ancrenaz *et al.,* 2021, Oram *et al*., 2022).

We defined "forest patches" as areas with a minimum size of 0.5 ha where some non-oil palm vegetation remains within monoculture cropland. Oil palm companies commonly refer to these areas as "unplanted or unplantable areas". They are not commonly referred to by HCV status even on RSPO member estates. We surveyed only one patch with a HCV 1 status and this ranking was afforded due to RTE plants, rather than RTE wildlife. In fact, there was general resistance from oil palm plantations to any mention of uplifting HCV status due to RTE wildlife use of a forest patch found in our surveys.

- Forested patches on estates were generally on rocky hills, deep ravines, or flatter water catchment areas.
- Estates often use more accessible unplanted areas as quarry sites for road building materials, for physical training, or recreational use by plantation staff and occasionally for non-oil palm agriculture.
- We found that most surveyed forest patches (92%) within estates contained resources of value to orang utans. Resources ranged from only a few native species trees of sufficient height for temporary shelter to a rich diversity of native tree and vine species serviceable as longer-term regugia within the privately administered landscape. (See Oram *et al*., 2022 for details on habitat assessment and Appendix 1 for plant list).
- Patches most useful to orang utans:

01 Contained areas that were difficult to access and offered seclusion
02 Contained well established trees (at least 5-10m)
03 Were undisturbed by human use.
04 Contained diverse native species tree and vines.

- The most pronounced negative impact on habitat quality of forest patches in estates was infestation by the invasive leguminous vine, *Mucuna bracteate*, planted in the oil palm stands for erosion control and to improve soil nitrogen levels. When this vine overruns into forest patches, it chokes existing native trees and inhibits natural seedling recruitment.

- We found most forested areas used by orang utans in estates (91%) were devoid of commercial timber species but otherwise, where native species forests in natural recovery (no restorative forest management, i.e., silviculture or enrichment planting) for the past 10–40 years.

- We assessed orang utan use by noting nests, feeding sign, characteristic tree scars from decayed nests, direct sightings, interviews with field staff and from estate sighting records (see Oram *et al*., 2022 for details).

- Overall, 80% of the forest patches surveyed in the Kinabatangan to date were used by orang utans.

- The median size of forest patches surveyed was 13.5 ha. However, smaller forest patch size was not necessarily an indicator of lesser value since patches used by orang utans ranged from the smallest (0.5 ha) to the largest (242 ha).

- Orang utans used patches up to 10 km from another forest or mangrove. It appears the network of forest patch options does not need to be connected (i.e. a corridor) or even oriented in a straight line to be useful in this mineral soil landscape where many natural landscape features are still present (streams, hills).

- Most forest patches (93%) spaced 5 km or less apart were used routinely, at least on a transitory basis, despite the fact that oil palm staff rarely encounter these animals inside estates.

- Many forest patches surveyed (60%) were on hills that likely provide a useful navigational aid for migrating males. Although orang utans sightings are rare, sightings in contiguous oil palm were often noted at higher points with observers often expressing that the animal appeared to be “looking out across the landscape”.

- In addition to making use of elevated areas, orang utan males are historically observed to use rivers and streams as navigational aids to circulate in the landscape. The fact that rivers and streams in the Kinabatangan landscape generally have not been rerouted is therefore advantageous.

- These surveys took place when the oil palm around these patches was mature. We have noted less use near some patches now that second-cycle replanting is occurring. Ongoing monitoring is necessary to assess if they will be used again at the same rates once new planting is completed.

- Orang utans are more comfortable moving in areas with some cover, where they can move through trees and on the ground as needed. Therefore, they can hide from people more effectively in mature oil palms than in replanting or new planting areas.

Summary of Forest patches NOT used by orang utans:

Summary of Forest patches USED by orang utans:

1. No minimum size for transitory use.
2. Spacing of ≤ 5 km is excellent but 10 km or ≤ is also good.
3. Distributed around the landscape in a network with multiple options.
4. Ravines are excellent refuge habitat.
5. Access to high points in the landscape and along streams and rivers is important as a navigational aide for migrating males.

The majority of sighting reports were of males or likely males. This indicates a degree of the normal migratory behaviour of male orangutans is still possible in this human-transformed landscape.

We found some previously unknown resident females with healthy dependent offspring live in forest patches isolated within plantations up to 40 years after the conversion of the surrounding forest to oil palm agriculture (Oram et al., 2022). Because of their reluctance to leave their home territory, females and young are lost during land at higher rates during land conversion. Therefore, every female orang utan and immature individual still surviving in the landscape today is essential to the overall population viability.

The collective findings above are encouraging for conservation because they are consistent with the normal community structure of orang utans, whereby males are the dispersing sex and circulate over more expansive areas between forests where related clusters of highly philopatric females with dependent offspring live (Goossens *et al.*, 2006; Arora *et al.*, 2012; van Noordwijk *et al.*, 2012; Nietlisbach *et al.*, 2012; Nater *et al.*, 2013; Ashbury *et al.*, 2020).

However, no orang utan can be assumed to be safe in this landscape given that the overall population numbers are still declining, and reception of information of their need to use estates was not met with enthusiasm by most estate managers.

The median forest patch size used by resident females in our study was 52 ha. We found females living in forest patches as small as 15 ha. However, we still need to understand the full scope of forest resources available to females in smaller patches. A Kinabatangan regional study reported a mean home range of 65 ha for adult female orang utans in undisturbed forests (Horr, 1975). Other published female home range estimates for this orang utan subspecies span from 40 to 180 ha and vary with analysis metrics, habitat type, resource availability, life stage, and social dynamics (Singleton *et al.,* 2009; Morrogh-Bernard *et al.,* 2009; Wartmann *et al*., 2010; Ashbury *et al.,* 2020).

We are often asked what "attracts" orang utans to oil palm plantations?

- **The answer is orang utans are not specifically "attracted" to oil palm plantations.**

  Orang utans enter plantations primarily because they must cross them to reach other forests. Typical behaviour for orang utans is to forage as they move. So they will generally feed a bit on whatever they find as they pass through. However, orang utans require diverse diets and usually feed on 5-20 different types of plants daily. They do not seek out monoculture oil palm as a specific food source or destination (Oram, 2018; Oram *et al*., 2022).

Damage to oil palm that can be definitively attributed solely to orang utans is generally very small except in instances of new forest clearing when rapid and drastic loss of forest resources forces displaced orang utans and other forest dependent wildlife to forage in newly planted oil palm.

- ✓ Foraging on newly replanted 2nd cycle oil palm by orang utans is minimal.
- ✓ Orang utans occasionally feed on oil palm fruits but this is limited as they do not digest these fruits well.
- ✓ Orang utans do occasionally feed on the pith (umbut) at the base of new palm frond spears on the top of mature oil palms. This is usually restricted to the first or second row of palms along the buffer region of a forest border. Our study indicated at routine levels pith foraging on mature palms does not negatively affect productivity (Ancrenaz *et al*., 2015). However, in some locations when a few forest border palms are repeatedly used the accumulated damage can be more deleterious, but the number of plants impacted is small.
- ✓ In over 25 years of long-term feeding ecology study within the protected forests of Kinabatangan, we found pith was an exceptionally rare component of the wide spectrum of plant parts consumed by orang utans. Overall pith from non-oil palms, i.e. *Calamus* sp. or other plants i.e. *Arenga undulatifolia* (Polod) found in these degraded forests made up only 0.08% of orang utan diets locally. Native tree and vine species make up over 99% of their diet - consisting of 62 % fruit, 25 % leaves, 6% cambium (inner vascular layer of bark), 4 % flowers and 2 % insects and 1 % other plant parts. (Oram, 2018).

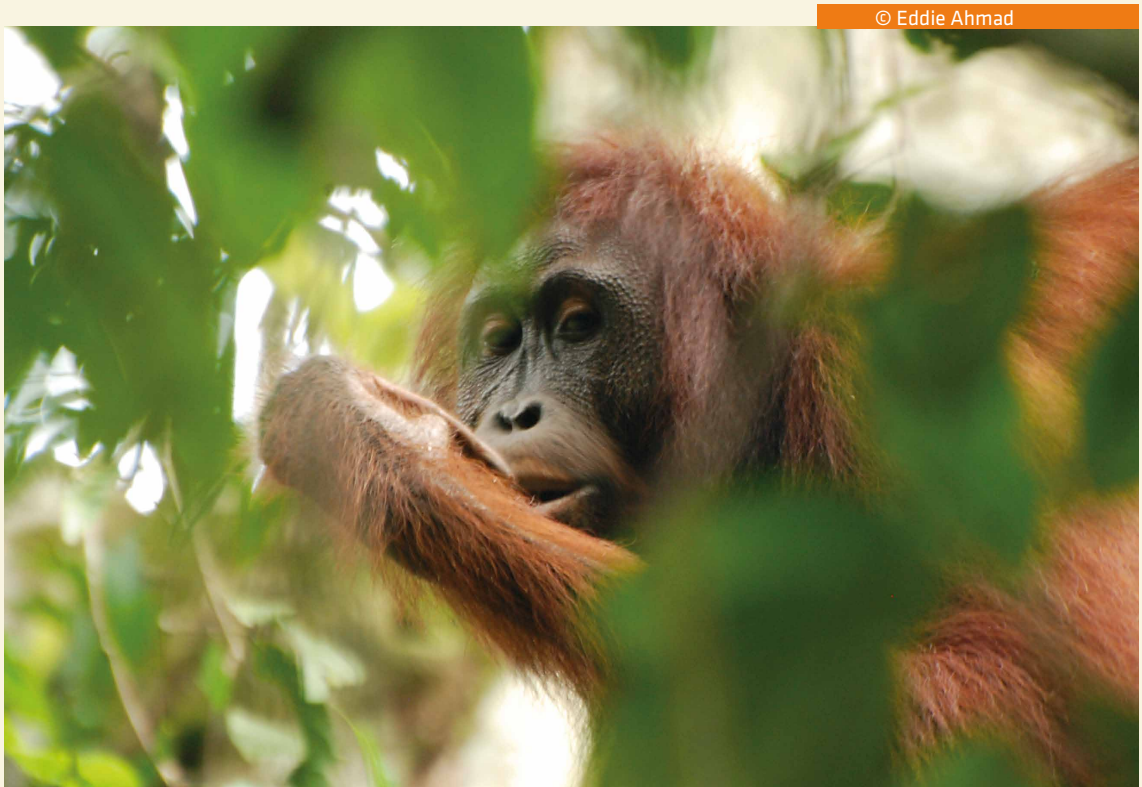
The value of degraded forests for orang utans does not diminish the importance of extensive, intact, protected forests for wildlife conservation.

Instead, we show the additional value smaller forest fragments provide to support functional connectivity of orang utan meta-populations and the pivotal opportunity for oil palm growers to contribute to conservation of remaining orang utan populations.

Nevertheless, the presumption that "agricultural best practice" requires exclusion of wildlife, and thereby any orang utan detected in or near an oil palm plantation requires intervention by people to move the animal elsewhere, remains a firmly held dogma on the ground across sectors.

Tangible collaborative commitment and action by oil palm companies are needed to:

1. **Maintain the integrity of existing "stepping-stones" in estates.**
2. **Increase the number and distribution of stepping-stones in the oil palm landscape, where needed.**
3. **Allow safe passage of male orang utans across oil palm plantations between forest patches.**
4. **Provide habitat security and assurance of long-term survivorship of all remaining females and offspring *in situ* on their ancestral land, even if this is within the privately administered landscape.**
5. **Augment protected area size by increased connectivity along major rivers in well-targeted ways to facilitate orang utan movement outside oil palm plantations and better support necessary metapopulation dynamics.**



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What people are doing in the oil palm landscape with respect to orang utans

> *"Human-wildlife conflict is normally better understood as conflicts between different human groups, sometimes over how wildlife should be managed, but expressed as a clash between human and wildlife needs and activities."* Page 15 (Hill, 2017).

When we began this study, we found **the general impression of oil palm companies, government agencies, and many NGOs was that it was an anomaly for an orang utan to be in an oil palm plantation.**

- ✓ Given this belief, it is a logical presumption that any orang utan sighted in an estate must be "lost" and the "rescue" of this Fully Protected and Critically Endangered (RTE) species is required.
- ✓ Consistently, **the prevailing standard policy was to capture any orang utan sighted in or near an estate and translocate it to a forest, preferably far away from where it was found** (Ancrenaz *et al*. 2015; Oram *et al*. 2022).
- ✓ This policy was very convenient for oil palm growers and other industries.
- ✓ However, it is increasingly challenging for wildlife agencies to find a suitable forest "far away" to relocate displaced orang utans.
- ✓ Furthermore, **this traditional approach is inconsistent with what we know now about the ecology of this species**.

The new Sabah Action Plan 2021 - 2029 amended the policy above from one of routine translocation of orang utans away from human-use areas to one that advocates coexistence.

However, **we found little awareness of the update and a need for support across sectors to practically address this drastic policy change in the field.**

On initial engagement, ALL oil palm companies and estate managers we met in the Kinabatangan stated that orang utans had little impact on mature oil palm landscapes.

- ✓ People in the region were well aware that orang utans still live in the protected forests of the LKWS.
- ✗ However, when asked if estate staff ever saw orang utans in the oil palm stands, the general reply was that while orang utans were often seen in estates immediately following land conversion "long ago", these animals are "long gone" from estates today.

Therefore, oil palm companies and estate managers felt orang utan conservation was of little direct relevance to their operations today.

- It is important to note that in the Kinabatangan region, many managers, especially at upper levels, are from West Malaysia, where orang utans are absent.
- Likewise, nearly all field labour staff in the Kinabatangan region are from the Philippines or parts of Indonesia(i.e., Sulawesi), where wild orang utans do not exist.
- Wild orang utans can be challenging to detect even by experienced researchers in well-established forest study sites. So, the fact that these intelligent and cautious animals can avoid detection is not surprising.

Given the perception above, we did not initiate surveys based on orang utan sighting reports. Instead, we focused initial reconnaissance on surveying "unplanted" areas inside estates and on estates that border forests or mangroves.

Estate staff always accompanied us on our surveys. Therefore, when we found signs of orang utans or, at times, even had direct sightings, we were in a position to share our findings immediately.

As a follow-up, we usually requested interviews with field labour staff who work adjacent to forested areas, especially harvesters who work alone or in small groups. Many provided valuable insights. **Generally field labourers viewed orang utans more favourably than estate managers and security personnel**.

- Most field labourers said that on a first sighting, they were afraid as the animal is large and often quiet and seems to appear suddenly.
- Workers were also struck by the non aggressive nature of an unprovoked orang utan but also were aware of the vocalisations and the tearing and dropping branches behaviour characteristic of an orang utan in distress.
- Though labourers said they always remained cautious, those who had seen an orang utan previously were usually aware that these animals tend to try to avoid people.
- Several workers were also aware that chasing or throwing things at orang utans was ineffective and just ignoring the animal and letting it go on its way was the best approach.
- Generally, workers stated they were obliged to report these orang utan sightings because of their RTE status.
- However, more experienced workers were often more concerned about getting pulled away from a work opportunity that day rather than being fearful of an orang utan.
- Conversely, monkeys were a nuisance because they were usually in groups and would approach people, so keeping track of them took time and effort, but shooing them away was straightforward.

- Elephants were more of a direct safety concern because their presence restricted access around the area or impeded workers from returning to where they lived on the estate.

It is important to add that the more measured view of orang utans held by some experienced harvesters was not generally shared by other estate staff and managers.

In summary, estate staff and others less familiar with the species were greatly surprised and even shocked to learn that orang utans routinely use and, in some cases, even live inside forests that remain on estates.

Despite the initial widely held view that orang utans had little impact on operations, in the landscape today, engagement did not yield a uniformly positive response on the ground to our findings that orang utans, though seldom seen, were routinely using areas outside of protected forests.

- This project focused on larger estates, but we generally found those with more locally based management were more open at least to the concept of a more coexistence focused approach of *in situ* orang utan conservation across the protected and privately administered landscape.

- Many others, including some NGOs and government agency staff remain sceptical. Therefore, the misperception that any sighting is, by definition a conflict persists.

- Additionally, as engagement progressed some estates began to report an increased concern of damage and a renewed framing of benign sightings as conflict. This may have been due to a general sense of unease about potentially different responsibilities associated with a new policy of coexistence.

- Curiously, some estates with the strongest held exclusionary attitude to wildlife were the most interested in participating in "tree planting" within their estates. This contradiction suggests companies may not necessarily view planting trees as habitat rehabilitation for wildlife use in the same way as conservation agencies.

The uneven "buy-in" to coexist with wildlife is understandable as it represents a drastic change in the standard paradigm of farming practice that has been one of wildlife removal and exclusion since the beginning of agriculture.

The concept of coexistence is also new for conservation, as the historical approach was to partition land by designating separate areas for wildlife and others for exclusive use by people. To many this "fortress conservation" approach appeared to work when plenty of undeveloped lands still existed (Brockington, 2002) .

Today, an updated, less exclusive approach to human modification of landscapes is required if we are to simultaneously mandate the preservation of RTE species.

We found two main underlying concerns about coexistence that frame key barriers to more effective conservation of orang utans across protected and privately administered landscapes.

1

A primary concern of estates was to avoid any chance that an RTE species death (including orang utans) could be recorded as having occurred on their estate.

- Logically the surest way to prevent this potential mishap is to exclude wildlife from crossing the estate border.
- Some estates even proactively capture an orang utan sighted on or near their estates, so it can be contained and accounted for when wildlife agencies arrive. Ironically, the stated need for this is usually "to keep track of the orang utan so it will not escape".
- Unfortunately, capture by estate staff tends to place both the orang utan and people at increased risk and diminishes the chance there can be any clarity over the circumstances of the sighting.
- Furthermore, allowing the orang utan to proceed unimpeded is likely the most efficient way to minimise the impact on operations and is generally the most appropriate conservation action.

This issue exemplifies the ongoing need for the collaborative network we initiated on this project to manage concerns, address sightings, and better learn how to handle them in a way that supports rather than further disrupts the measures orang utans are adopting to keep their communities connected while simultaneously supporting oil palm estate staff and government agencies to manage these circumstances on the ground.

2

Another chief concern was that by supporting orang utan survival and conservation, estates would soon be forced to contend with too many orang utans.

- This logical but misguided concern reflects a fundamental confusion about what *in situ* or "in place" conservation means.
  - From a biological point of view and under natural circumstances, any chance of being overrun by orang utans in a short time frame is impossible.
  - Orang utans are one of the slowest reproducing species on the planet (van Schaik, 2001).
  - Their numbers are still declining in the Kinabatangan and throughout their range.
  - Increasing numbers to a healthier level within suitable habitats that remain in the landscape will take 50-100+ years.

Instead, the immediate conservation goal is to stop the decline and support normal orang utan community function WHEREVER they still live in the wild.

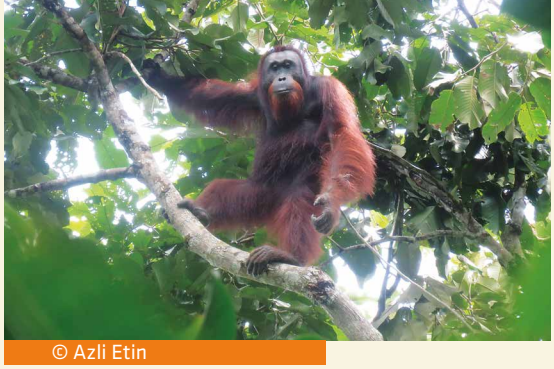
- Practically, our first responsibility is to stop unnatural death and ensure the survival of younger adults.
- Conservation to support normal community functionality, or what scientists call metapopulation dynamics, is what *in situ* conservation is all about.
- Conversely, *ex situ* conservation is indeed about increasing animal numbers, often at an accelerated rate, using captive management and other technologies. In a practical sense, this approach is separate from addressing habitat needs, wild competency, or coexistence in mixed-use landscapes. Not all animals or circumstances wildlife face require or are suited to *ex situ* approaches.
- Orang utans will not be extinct as an animal if they no longer exist in the wild. There are thousands in captivity worldwide. However, the competence to survive and adapt to changing climate and habitat conditions resides only within the remaining wild populations.
- An orang utan does not need forest survival skills in captivity. When this highly intelligent great ape lives under human care, it focuses on mastering different skills more relevant to managing these new circumstances. Therefore, the skills necessary to survive in the wild are not retained and, more importantly, not passed down to the next generation.
- No human can completely replace an orang utan mother's tutelage in forest survival skills. This deficiency does not mean rescue and rehabilitation centres are not necessary, they are.
- Nevertheless, the ultimate goal of effective *in situ* conservation of orang utans is to minimise the need for *ex situ* human care of orphan and displaced orang utans.
- Then wildlife agencies can better focus resources on advocating for habitat preservation, law enforcement, emergency response, and the best quality care for individual orang utans who do require sustained human support for various reasons.

All quotes below from Hill, C. M., Webber, A. D., & Priston, N. E. (Eds.). (2017). *Understanding conflicts about wildlife: a biosocial approach* (Vol. 9). Berghahn Books.

Human Wildlife conflict was formally defined initially by the International Union on the Conservation of Nature (IUCN) in 2003 as follows: "Human-wildlife conflict occurs when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife. These conflicts may result when wildlife damage crops, injure or kill domestic animals, threaten or kill people' (IUCN 2003)." Page 274 (Madden & McQuinn 2017)

"The original definition ignored how conservation conflicts often serve as proxies for underlying social and cultural conflicts, including struggles over group recognition as well as social, political and cultural identity. It also failed to account fully for stakeholders' sense of disempowerment and disenfranchisement and impacts on wildlife or the people affected by it." Page 274 (Madden & McQuinn 2017)

"While wildlife's capacity to adapt to change is limited, if the social and psychological needs of people are met through more effective stakeholder engagement (that targets the deeper-rooted human identity needs) and relationship-building, then evidence suggests human receptivity to creating the conditions for coexistence expands considerably (Lederach 1997; Madden 2004; Lederach 2005; Madden 2006; Frahm and Brown 2007; Smith and Torppa 2010; Madden and McQuinn 2014)." Page 274 (Madden & McQuinn 2017). "The reverse is also true: if we do not address these needs, social carrying capacity for wildlife decreases, sometimes precipitously." Page 279 (Madden & McQuinn 2017)



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Bringing it all together – Practical steps to manage co-existence

Today, we know maintaining metapopulation (or regional community) functionality by co-existence across the protected and privately administered landscape is necessary for wild orangutan conservation.

Based on the resilience of orang utans in degraded riverine forests despite wide-scale forest conversion up to 50 years ago, we recommend the following guidelines in 6 sections:

- **A** Habitat Protection
- **B** Habitat Rehabilitation (Reforestation)
- **C** Habitat Enrichment
- **D** Connectivity - Stepping Stones, Corridors, Buffers and Artificial Canopy Bridges (ACBs)
- **E** Understanding Population Monitoring
- **F** Managing Sightings and Encounters

Guidelines

A. Habitat Protection

✗ A previous Best Management Practices document started," if new oil palm plantations are established only on degraded mineral soils where there are few or no orang utans, then the impact of the plantations on orang utans would be greatly reduced" (Denis *et al*., 2010, page 3,4).

✓ While restricting forest loss on peat is beneficial, **the claim that clearance of degraded mineral soil forests has little impact on orang utans is entirely unsupported by this study.**

✓ The vast majority of orang utans in Kinabatangan live in degraded forests on mineral soil habitat. The Kinabatangan orang utan population is arguably one of the most vital in Sabah, Malaysian Borneo. Sabah is home to at least 80% of the remaining *Pongo pygmaeus morio* subspecies. The vast majority of all orang utans that remain in Sabah live in degraded forests on mineral soils.

✓ Due to the highly cryptic nature of orang utans generally and especially in human-transformed habitats, specialised skillsets are required to assess orang utan use of mixed-use landscapes.

Based on our study and others since 2010, an appropriate undated general statement regarding habitat protection in 2023 is:

NO lowland forest patches of any size, on mineral soils OR peat, intact primary OR degraded, whether occupied by resident orang utans OR not, on Borneo OR Sumatra that still exist today can be summarily dismissed as potential habitat for forest-dependent wildlife including orang utans.

The corresponding updated general recommendation regarding habitat protection strictly with respect to biodiversity conservation is:

ALL remaining forest patches whether currently protected or privately administered, below 500 m asl on Borneo and 800 m on Sumatra along major rivers and within floodplains, should be retained as refugia for orang utans and other wildlife.

1.1 Orang utans are an umbrella species with respect to habitat needs because of the wide range and amount of forest resources this largest Asian primate requires.

1.2 Although orang utans can withstand the loss of dipterocarp species while other animals may not, preserving lowland forests necessary for orang utans also benefits the conservation of many other forest-dependent wildlife.

Preserving orang utan metapopulation, or community, functionality requires integrated management across the protected/privately administrated landscape.

Orang utans are Critically Endangered due to ongoing population declines over the past two generations (50 years) and because there is no indication that forest conversion to other land uses, a root cause of much of this decline, will cease within the next two generations (Ancrenaz *et al*., 2016).

Orang utans traditionally occur at highest densities below 500m on Borneo and below 800m on Sumatra along major rivers and floodplain networks in mosaic forest habitats on peat AND mineral soils (van Schaik *et al*., 2001; Marshall *et al*., 2009).

Orang utans occur at low densities, even in ideal habitat conditions. Densities of 1- 2 individuals per km2 are not unusual (Delgado & van Schaik, 2000; Husson *et al*., 2009). So finding only a few orangutans present in a particular area of a large forest or within a small forest fragment is not necessarily an anomaly and is actually consistent with historical distribution patterns (Oram, 2018).

Very little lowland habitat remains in pristine condition in Borneo or Sumatra today (Gaveau *et al*., 2014). Fortunately, orang utans do not necessarily require only primary forests. However, they must have a forest that has a diverse mix of natural tree and vine species. (Lackman-Ancrenaz *et al*., 2001; Oram, 2018).

Therefore, protection of habitat for orang utans and much other forest-dependent wildlife is critical at 500 m asl and below on Borneo and 800 m below on Sumatra along rivers and floodplain networks.

Orang utans use a vast range of plants as food species, so they may be more resilient than some other animals to potential changes in floral diversity with climate change. As a tree-living species, flooding is a barrier to orang utan survival only if tree spacing and vine connectivity are insufficient to provide arboreal connectivity, at least in the short term.

Oil palm plantations, especially those at lower altitudes and within river networks, can have a tangible conservation impact if they take active measures to accommodate remaining wild orang utans and other forest-dependent wildlife.

2 **Pre-emptive removal of orang utans from forests should not be tolerated.** It is inconsistent with policy and law that fully protects this animal throughout its remaining range.

3 **Protection of orang utans together with their habitat is essential for conservation.**

3.1 Wild orang utan populations possess the reservoir of experiential flexibility to give the species the best chance to accommodate habitat and climate change. Therefore, supporting orang utans in the place where they live (*in situ*) is the most suitable conservation action, rather than moving them to or from a different place where they may be less well-equipped to survive .

4 **Preserving native species forest patches regardless of size or condition is preferable to conducting wholesale forest clearing then reforesting later.**

4.1 **Well-managed diverse native species rehabilitation and enrichment planting is more beneficial to wildlife conservation than replanting bare land.**

4.2 Reforestation takes considerable time. When a forest is lost, wildlife are lost and those animals that survive depend on what is left. When forests are removed, plant biodiversity is lost, and the animal biodiversity that depends on those plants is also lost.

5 **Preserving the integrity of unplanted areas inside already established plantations and on other privately administered land as refugia for migrating and resident orang utans is necessary for landscape-wide conservation and consistent with laws that fully protect this species.**

6 **Preserving natural forest patches in still-developing estates, retaining forest patches during replanting on established estates, and creating new patches where needed to facilitate connectivity and provide places where wildlife are able to avoid people is essential.**

6.1 Orang utans must cross plantations and other human-use areas.

6.1.1 There is no guarantee that they will not forage or nest in oil palms to some degree.

6.1.2 However, preserving forest patch integrity within estates can benefit estate operations by helping orangutans better avoid people. For example, we have reports of reduced orang utan use of oil palm planted areas when forest access along a riparian border was improved.

6.2 The ONLY patches where we did not find any sign of orang utan use in our floodplain study were:

6.2.1 More than 10km from any other forest patch of any size;

6.2.2 Where there was a history of routine removal of orang utans; or

6.2.3 In patches that markedly lacked natural forest integrity.

1. i.e. no trees of at least 5m existed;
2. were extensively choked with invasive species; or
3. were planted with a monoculture of non-native timber species.
4. **ALL the above can be addressed by appropriate habitat rehabilitation and enrichment** (see sections B and C).

7 **Use of "unplanted" areas and forest patches by people must be minimised to provide safe shelter for wildlife.**

7.1 Plantations wish to minimise encounters with orang utans to prevent disruption of operations.

7.2 Fortunately, wild orang utans do their best to avoid encounters with people.

7.3 However, people need to provide orang utans and other wildlife with sufficient space and options to be able to avoid encounters.

8 **The RSPO recommendation to leave forest on 25% and stepper grade above or below ground level is an excellent starting point for building a stepping stone or corridor network. Preservation of below-grade steep slopes (ravines) is particularly beneficial.**

9 **Retaining hills and the normal course of rivers inside estates provides important navigational aids to assist wildlife migration.**

9.1 A "stepping stone" forest patch network may be adequate to provide necessary connectivity in areas with retained hills, where water courses are unmodified, and the patches are 10km or less from another forested area. In these circumstances, orang utans can still use naturally occurring navigational aids.

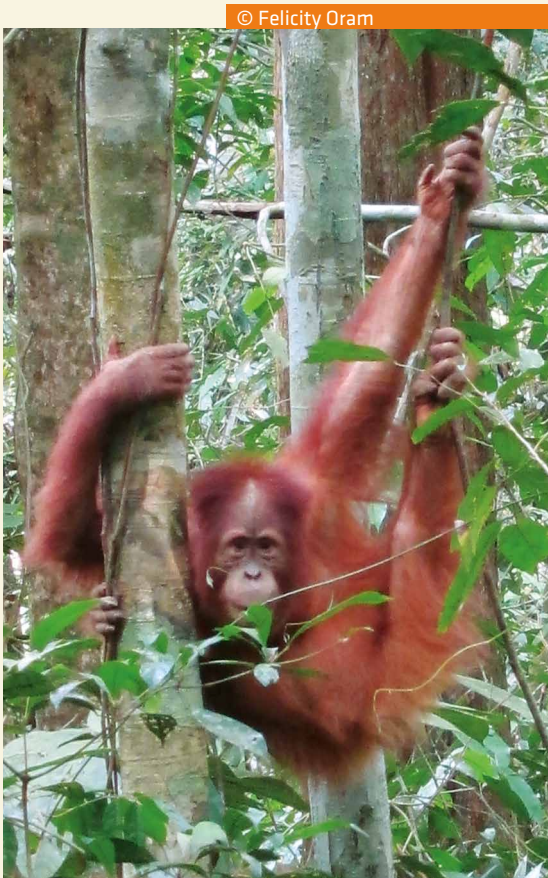
9.2 In flat terrain with drastically modified water courses (i.e. on peat), stepping stones may be inadequate because of the loss of crucial navigational orientation points. In these landscapes, "corridors" may be necessary to assist orang utans and other animals in crossing extensively modified landscapes (see section D – Connectivity for more details).

10 **Preserving suitable hydrological buffers in water catchment areas, and controlling runoff to preserve the integrity of water systems, benefits animal and human health.**

11 **Judicious and consistent safe handling protocols of pesticide and herbicide management for people applies equally to wildlife.**

12 **Action by oil palm companies, other private land owners,and administrators to sequester tracts of land along rivers as dedicated fully protected areas on the model of the LKWS, will preserve critical habitat and have a tangible impact on conservation of orang utans and other wildlife.**

13 **We strongly recommend closer collaboration with specialist conservation professionals on a case-by-case basis to better assess habitat use by orang utans and thereby more effectively improve habitat protection and facilitate coexistence.**



B. Habitat Rehabilitation (Reforestation)

Habitat protection is essential, but reforestation and habitat rehabilitation are also needed.

Over the course of this project, we encountered great interest in "tree planting" but far less interest in investing in "tree growing".

While tree planting activities are a feel-good exercise enjoyed by everyone, the same enthusiasm and investment in the longer-term processes of reforestation, habitat rehabilitation, and appropriate enrichment are necessary.

To some, a forest is merely a group of trees. However, building an ecologically functional forest requires a diverse assemblage of native species trees, vines, and other plants that attract a broad group of smaller living things like microorganisms, fungi, and insects, which together with the larger forest-dwelling species create a self-sustaining whole.

So, we may want to save the forest for animals like pangolins, orang utans, hornbills, proboscis monkeys, sun bears and elephants. However, reforestation is about much more than megafauna!

As agriculturists understand, growing anything from bare land is often challenging. The traditional focus of government and academic forestry departments is to optimise growth and sustainably manage commercially valuable forest species. Few long-term wildlife feeding ecology studies are conducted, by biologists often because these studies are laborious and difficult to fund.

Nevertheless, knowledge gaps can be addressed by better integrating the collective skills of industrial agronomists, forestry research botanists, field ecologists, plant nursery professionals and community nursery citizen scientists.

It is important to remember that environmental rehabilitation aims to create a habitat used by wildlife. While some protection of plants is required as they become established, creating an undisturbed exhibit or display garden is not the objective of reforestation for biodiversity conservation.

14.1 There is little conservation value achieved if human activity to improve the habitat discourages animals from using the area or adds resource quantity without sufficient diversity or balance to sustain wildlife year-round and rebuild overall forest ecological function.

Fundamental to habitat rehabilitation, reforestation and enrichment is good planning to improve natural habitat quality while avoiding disturbance of the refuge value it is already providing wildlife that remain in human-transformed landscapes.

Responsible habitat rehabilitation, reforestation and enrichment is accomplished by:

15.1 Being aware that habitat rehabilitation is about rebuilding a forest community, not just providing a restaurant. In other words, wildlife need forests to meet their social needs, as shelter, and protection from disturbance by people and other animals, not only as a place to acquire food.

15.2 Planning the overall project so that it can be implemented with minimal impact and maximal conservation benefit.

15.3 Implementing activities in stages and in various places within the patch rather than over the whole patch at one time.

15.4 Limiting numbers of staff to those who really need to be there to do the actual work.

15.5 Briefing staff thoroughly before any activity within the patch to ensure expedient work.

15.6 Avoiding campsites for work crews within the patch itself.

15.7 Limiting the number of vehicles, boats or other equipment nearby or inside the site.

15.8 If a PR event that involves planting is deemed necessary, consider creating a demonstration planting area that is on the periphery of a forest patch to minimise wildlife disturbance.

The most useful first approach to habitat rehabilitation is to expand the size of pre-existing forest patches known to be used by orang utans. Care must be taken to avoid disturbing wildlife using the area in this process, however.

Our findings support the RSPO recommendation to reforest areas currently planted with oil palm at 25% grade and steeper, above and below ground level in the next planting cycle.

17.1 Since productivity declines on older palms, it may be worth considering initiating the forest rehabilitation process on these steeper grade areas before the end of the typical replanting cycle term for additional conservation benefit and impact.

17.2 **Above-grade steep slopes generally benefit from enrichment planting. However, below-grade steep slopes (ravines) usually have retained good habitat quality. Therefore, ravines may only need protection to avoid infestation from invasive species on the edges rather than extensive replanting, which may disturb wildlife.**

17.3 Regrading for the possibility of more mechanised operations in the future makes sense, but regrading of steep slopes on hills to avoid this RSPO recommendation is not supported by our study of orang utan habitat needs.

It is also important to create NEW forest patches as stepping stone habitat refugia within estates where no forest or mangrove exists 10 km or more in any direction in areas where dedicated orang utan specialists have established a regional presence of the species exists.
(See section D – Connectivity).

18.1 Location of these new patches may be a more important factor than size.

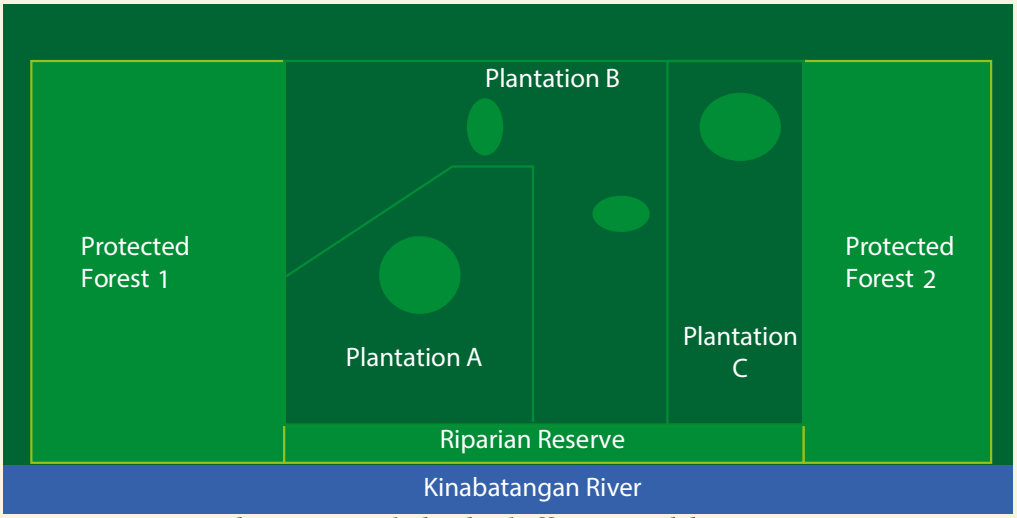
18.1.1 Precise locations should be determined on a case-by-case basis from an overall assessment of the regional landscape.

18.1.2 Consultation with skilled specialists familiar with orangutan use of human-transformed landscapes is recommended to assess the value to wildlife of additional sites proposed by a company (other than the ≥25% grade).

18.2 Our studies revealed no practical minimal size in potential usefulness to wildlife especially for transient use.

18.2.1 The average size of forest patches inside oil palm estates surveyed in our study was 13.5 ha. Although patches as small as 0.5 ha and even single native species tress where used.

18.2.2 Nevertheless, based on our assessment, the minimum recommended size that provides a good measure of shelter and cover is 4-6 ha.



Stepping stones and Riparian buffer connectivity

More practical research is urgently needed to learn how to propagate and grow a broader range of native species trees, vines and other plants required to more effectively recreate natural forest that supplies a wider spectrum of wildlife habitat resources.

19.1 **Appendix 1 contains recommended native plants for expanded propagation and growth reserach.**

19.1.1 This plant list is based on an analysis of a 20-year orang utan feeding ecology dataset in Kinabatangan (Oram, 2018, in collaboration with the HUTAN orang utan research team). It is not based solely on orang utan needs but on general value to birds and other mammals observed in the same forest over time.

19.1.2 Genus and species are directly relevant throughout Sabah. However, as designed, it should be a useful template for consultation with local skilled field staff to generate appropriate recommendations elsewhere.

19.2 **Collaboration should be well-integrated to include forestry department research staff, agronomists from industry, NGO staff, academic botanists, and local community nursery staff.**

19.2.1 We found confusion about plant identification was often expressed as the initial barrier to broadening native species diversity in nurseries. A good first step would be a collaborative field workshop on plant identification based on the list in Appendix ! to systematically address this challenge.

The value of natural vines or lianas to tropical wildlife needs to be recognised and incorporated into planting and maintenance programmes.

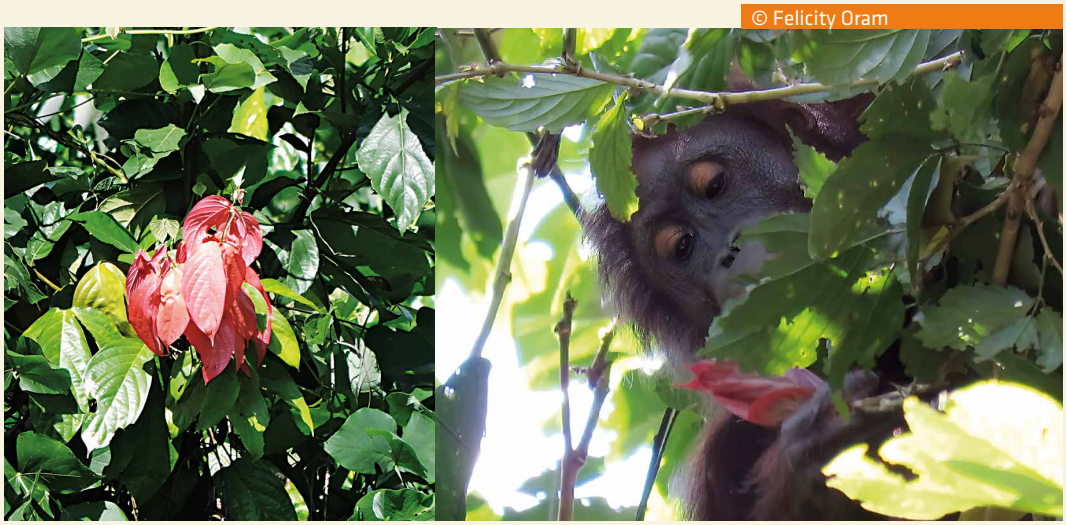
20.1 Key vines are included in the plant list found in Appendix.

20.2 Native species vines, because they are well distributed compared to more clumped tree resources, are especially important for sustaining the value of degraded and smaller forest fragments in Kinabatangan for wildlife (Oram, 2018).

20.3 Native vines make up one third of the diet of orang utans in Kinabatangan (Oram, 2018).

20.4 For example, *Spatholobus* spp., a native vine, is the topmost consumed species by orang utans in degraded AND primary forests (Oram, 2018; Kanamori *et al*., 2010). It is also an important component of elephant diets in Kinabatangan (English *et al*., 2014).

20.5 Orang utans also depend on native vines to move in the forest canopy comfortably and to better avoid encounters with people.



21 Capacity-building in seedling supply chains to achieve reliable production of a broad diversity of native plants is urgently needed.

21.1 Seedling supply from community nurseries is excellent for rural livelihood development.

21.2 The transport time and distance seedlings need to travel are reduced when supply comes from community nurseries distributed throughout the landscape.

21.3 A challenge for nurseries is keeping up with high demand. To keep up with orders, suppliers tend to favour plants that are easiest to acquire, grow quickly, survive well in the nursery, and withstand transport rather than focusing on providing adequate plant diversity.

21.4 Improving nursery skills in production, plant care and supply chain management to create a reliable supply of a wider range of species is required.

22 Avoid overzealous preparation and maintenance of planting areas as pre-existing plants may provide valuable support to wildlife and new plants.

22.1 Augment as much as possible any natural vegetation already present to minimise further habitat degradation before new plants can become established.

22.2 Do not dismiss the value to wildlife of even highly degraded forests in natural recovery. Local wildlife may be relying on these resources for survival.

22.3 Use any native pioneer species already growing in the area to support the establishment of a variety of new plants, i.e. provide shade, maintain soil integrity, etc.

22.4 The LKWS is a good example of a series of degraded forest fragments with high value to wildlife. In many parts, it has been in natural recovery since the 1990s.

23 The customary practice of wholesale vine removal (silviculture) needs to be modified immediately.

23.1 Currently, vines are typically removed as routine maintenance at reforestation sites and production forests to support the growth of tree species. However, many native vine species are necessary to support wildlife adequately.

23.2 There is a need for forestry professionals to seek out ways to achieve a better balance to support tree growth while retaining sufficient native vine species to accommodate wildlife needs.

23.3 Amending traditional practices to maintain some native vines, especially *Spatholobus* spp., in reforestation areas and production forests may even reduce nuisance predation on less established tree species.

24 Take care to minimise harm to wildlife and the environment in rehabilitation and enrichment areas.

24.1 Do not feed wildlife.

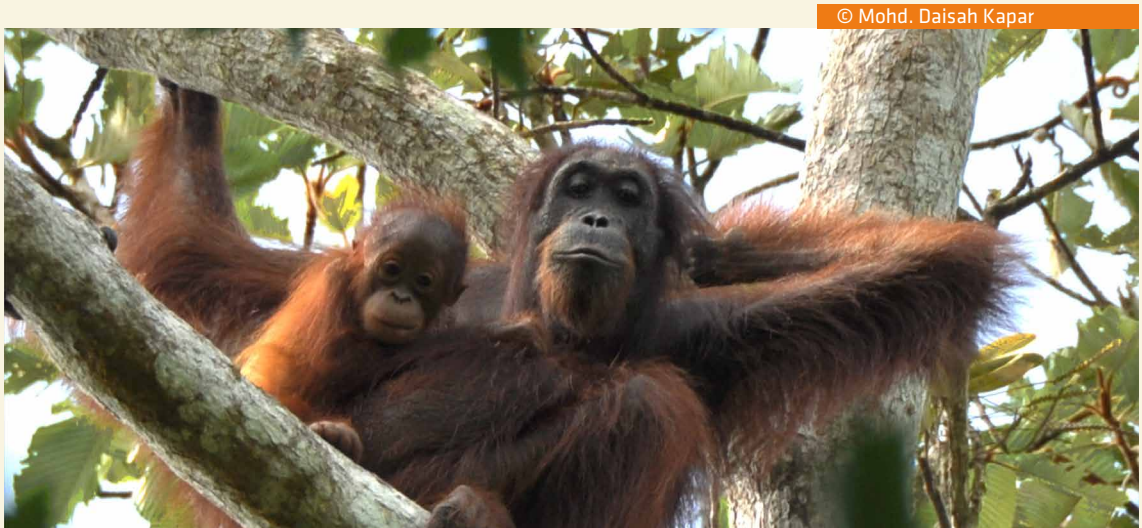
24.2 People who are unwell should not be on site.

24.3 Dispose of human food and other waste responsibly.

24.4 Do not litter - Remove any rubbish.

- **24.4.1** Rubbish can be dangerous to wildlife especially plastic bags and twine.
- **24.4.2** Consider biodegradable alternatives to seedling poly bags.
- **24.4.3** Consider if plastic based twine is necessary – If something needs to be tied up only for a short time consider cotton, which will serve its purpose before rotting

25 Skill building and collaboration with planting staff is needed to establish a uniform practical data collection system that consistently measures plant survival and growth under various conditions, and systematically informs reforestation efficacy.



C. Habitat Enrichment

Habitat enrichment or improvement of forest patches for wildlife is best conducted with the objective of augmenting natural forest recovery.

Excellent habitat enrichment can be achieved by measures that do not involve "tree planting" such as:

26.1 Reducing disturbance and expanding habitat size by rerouting an access road so it no longer bisects a forest patch.

26.2 Reducing disturbance by conducting outreach to limit use of a forest patch.

26.3 Improving the quality of water resources in forest patches.

26.4 Controlling invasive species infestation.

A serious detriment to habitat quality in forest patches is infestation by invasive species.

27.1 ***Mucuna* spp.** is routinely planted in oil palm stands for erosion control and to improve soil nutrients. However, when it overruns non-oil palm planted areas it chokes existing native species and inhibits natural species recruitment.

27.1.1 *Mucuna* spp. is NOT a food source for orang utans. Areas chocked with highly tangled *Mucuna* spp. vines are impassable even for orang utans.

27.1.2 Chemical control of *Mucuna* spp. inside a forest patch is not recommended and targeted manual cutting is laborious.

27.1.3 However, since most unplanted areas are ringed with plantation roads, focused control of spread across roads near forest patches may be the best approach, paired with periodic manual cutting inside the patch as necessary.

27.2 Some 'unplanted' areas in oil palm estates are, or were, used for a different cash crop, i.e. rattan or exotic hardwood.

27.2.1 **Rattan** - Although orang utans forage to a limited extent on young rattan, the characteristic spiny quality and invasive nature is detrimental to wildlife.
Integrated skills are needed to effectively remove or sequester rattan to harvest without reducing the overall patch value for wildlife.

27.2.2 We surveyed a stand of established **exotic hardwood** planted about 20 years ago, 2 km from several other forest patches used by orang utans. Despite its proximity, and apparent shelter value, we found no indication there was ever any orang utan use of this patch. This finding reinforces the importance of native species enrichment.

If planting is done to improve forest patch habitat it should:

28.1 Include a wide variety of native species well suited to the specific conditions (i.e. dry open, swampy, riparian, hill etc.) so natural species recruitment is enhanced.

28.2 Enhance what is already present with the goal of providing a full spectrum of resources, i.e. shelter, and a variety of food sources that produce reliably throughout the year (see Appendix).

29 Monoculture plantings of a seasonal species, even if it is naturally occurring, in large numbers in one area is NOT recommended.

29.1 Creating circumstances whereby a specific, especially fruit food resource, is intensified results in atypically high seasonal surges in animal numbers. Creating an abnormally high clumped and valued food resource increases conflict between animals that often spills over to corresponding increases in conflict between animals and people.

30 Enrichment planting of fruit trees or setting out fruit for animals to attract them to designated feeding sites away from agricultural areas is not a valid enrichment strategy.

30.1 Habitat enrichment is not explicitly about feeding animals. Food provisioning by humans is incompatible with coexistence.

D. Connectivity – Stepping Stones, Corridors, Buffer Zones, and Artificial Canopy Bridges

- ✓ The concept that fragmented habitats are deleterious for wildlife is widely understood.
- ✓ The concept that connectivity between isolated forests is necessary to conserve megafauna (especially elephants) is widely understood.
- ✗ However, the meaning of the different terms used to provide connectivity often needs clarification.

Terms

Stepping stones work well for orang utans, especially when other natural navigational features of the landscape remain (hills, streams, rivers). However oil palm growers and wildlife officers need support to learn to tolerate orang utan movement through non-forested areas.

- ✓ **Stepping stones** are small forested patches in oil palm plantations or other human-modified areas used by wildlife when travelling between larger forests.
- ✓ Unlike **stepping stones**, where the animal decides how to move between "forested rest stops" across the landscape in a self-directed way, **a corridor is a prescribed route that is often fenced.**
- ✓ Corridors may be a necessary navigational aid between forests in extensively modified topographies and flat, featureless terrain. However, orang utans may or may not stay within the boundary of the corridor.
- ✓ Like corridors**, buffer zones are designated areas but are usually unfenced. Though buffer zones accommodate wildlife movement they also serve other purposes.** For example, riparian buffers preserve ecological integrity and provide flood control along rivers. Oil palm/forest buffers help animals and people recognise and manage land-use change boundaries.
- ✓ **Artificial canopy bridges can restore connectivity impaired by human landscape modification.** For example, clearing trees along streams and smaller rivers eliminates the natural tree overhang gibbons and orang utans require to cross arboreally. Likewise large roads, especially dual carriageways (e.g., the Pan Borneo Highway) are barriers to safe terrestrial movement of wildlife.

Corridors – General considerations

- ✓ The idea of a limited "prescribed route" appeals to agriculturists who generally feel most comfortable with the traditional practice of excluding wildlife from farms.
- ✓ Likewise, wildlife officers and conservationists historically favour the concept of segregating animals from people.
- ✓ The idea of taking only a small strip of land out of production to provide a tangible conservation action easily understood by the general public is attractive to everyone.

However, creating a prescribed route can be a "devil is in the details" situation because:

A All wildlife do not use and move through space in similar ways.

- Birds do not need a terrestrial corridor.
- As arboreally-most-comfortable-but-terrestrially-capable wildlife, orang utans are flexible but strongly prioritise cover to avoid detection by people. So, they may or may not use a corridor depending on what they perceive as safer at the time.
- For gibbons with less terrestrial capability an arboreal pathway is required.
- For both apes above, a corridor needs to serve individuals or very small groups.
- For terrestrial herd animals like elephants, a corridor needs to support large and small groups in various social configurations at different times and provide safe footing for all age animals, including the very young, so that they can keep up with the herd regardless of weather conditions

B A sense of safety and security is a main concern for animals regarding use of a prescribed route created by people.

- Allow ample time (6 months ++) for animals to become accustomed to the new landscape feature.
- Depending on length, remember the animals will not necessarily know where it leads to at first.
- Do not open the corridor if the exit point is not yet open. Wildlife do not feel comfortable if they feel cornered or contained.

32 For a corridor to be effective it must address wildlife needs and be perceived by the animals as the safest way to move between two places.

32.1 Is there any evidence that animals need the corridor and will use it as intended?

32.2 Did wildlife go between these places before the area was fragmented?

32.3 Do they choose the route you want to prescribe?

32.4 Or, typically, use a different way over land you may be less willing to give up?

32.5 Do the animals still need to travel between these places?

32.6 Are wildlife genuinely trying to cross between these forests, or are they entering the agricultural landscape on an in-and-out, back-and-forth basis and not trying to cross the whole area?

32.7 What will be the human impact at the in-point and out-point of the corridor?

Unfortunately, because normal patterns of animal migration are often already impaired or "controlled" in many cases the answers to the questions above may be challenging to answer precisely. However, careful consideration is essential if the corridor will actually be useful to wildlife.

The objective of the corridor must be clear.

A. Is the objective of the corridor to be used strictly as a passageway?

Or

B. Is it intended as a way to expand wildlife habitat as well?

We found that private land administrators often intend objective A. while conservationists typically have B. in mind. Therefore, all parties must discuss the goals of the corridor carefully to be sure the intent is clear because these objectives are not mutually exclusive.

33 If the corridor is to be a passageway only, it is paramount that:

33.1 There is a clear reason the animal needs to go between these places.

33.2 There are no barriers on either side to enter and exit the corridor.

33.3 The animals can efficiently use the passageway to get between these places expediently.

33.1.1 For example, if the passageway is for terrestrial mammals, perhaps investing in surface integrity to ensure sound footing regardless of the weather is a priority.

33.1.2 Or if the passageway is for use by arboreal and terrestrial wildlife, a contiguous line of trees at least 10m tall, spaced 6m apart (i.e. *Neolamarckia cadamba*, Laran, a quick-growing pioneer species) along the fence line to facilitate and delineate the arboreal pathway for orang utans and other wildlife that feel safer moving above ground is recommended. This will frame the corridor, which is also helpful for all wildlife.

33.1.3 If the goal is for animals to pass through only, consider if enrichment planting for grazing and feeding within the corridor is sending a mixed message to wildlife about how you want them to use the space.

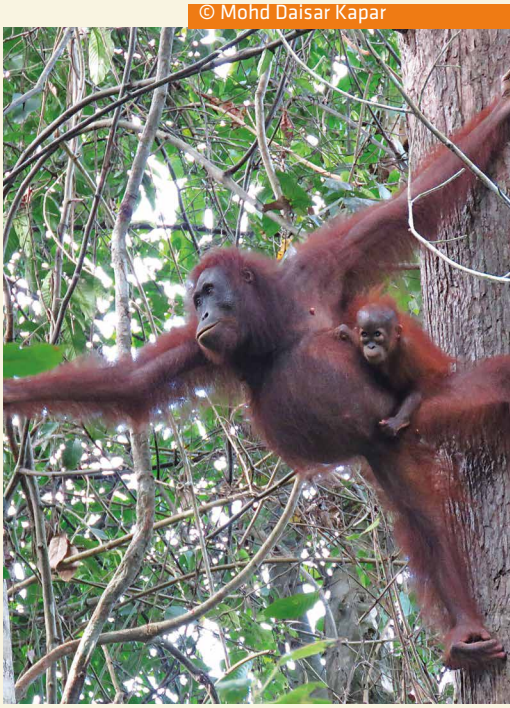
34 If the corridor is to function as a passageway AND enriched habitat extension, additional provisions are needed.

34.1 Width of the corridor must be considered more carefully, as it must be wide enough to accommodate appropriate social distancing to minimise conflict between and within species when grazing or foraging.

34.2 A minimum of 100m is required, and perhaps more depending on the numbers and species expected to use the area.

34.3 It is also essential to balance plant species to avoid specifically attracting larger numbers of wildlife seasonally that could overcrowd the confined space.

34.4 More investment in perimeter fencing may be required, and a buffer area along the fence line tolerated.



BUFFER ZONES

35 Forested riparian borders along riverbanks buffer seasonal flood waters to minimise negative impact, and provide natural filtering of runoff to contain sediment and limit erosion.

35.1 Balanced native species rehabilitation and enrichment is essential in these areas to restore or improve the buffering capacity of riparian areas.

35.2 Because of frequent flooding these areas are especially challenging for habitat rehabilitation

35.2.1 Following HUTAN reforestation team recommendations, we have found planting on 2m spacings with a priority of flood tolerant species to establish some cover and enriched later with species of higher value for wildlife has been most successful.

35.3 An additional challenge with rehabilitation and enrichment planting in riparian buffers is that wildlife such as orang utans and elephants must also use areas for regular migration. So, enrichment and rehabilitation efforts must not restrict access.

35.4 Any remaining taller trees in riparian buffers should be retained as landmarks, nest sites for orang utans and as safe sleeping trees for other wildlife.

36 Forest/plantation buffers are created along some protected area borders in Kinabatangan. Usually 20 m wide (2 rows of oil palm) but sometimes up to 50 m (5 rows of oil palm), these areas buffer the transition from forest to cropland.

36.1 These border areas are planted with oil palm and harvested, but estates usually tolerate the damage by wildlife in these prescribed areas. These buffer zones are an excellent example of coexistence and a great example of voluntary conservation action by companies.

36.2 To retain its effectiveness as an indicator to wildlife of a habitat transition from animal to human use, we advise against enrichment planting in these edge areas inside estates. Rather, it should left as is, and during replanting either left as abandoned palm or replanted with oil palm but remain as an area where use by forest wildlife is tolerated.

36.3 If the prescribed buffer area is improved by enrichment planting, wildlife will likely view the area as a habitat extension. If this is the intention from a conservation point of view, this is welcome. However, it will likely undermine the transition zone indicator function indicated in 36.2 above.

Artificial canopy bridges (ACBs)

Using ACBs to restore arboreal connectivity for wild orang utans over small rivers and culverts used to drain flooded estates in Kinabatangan was pioneered by the NGO HUTAN in 2004. Since that time, design and techniques have evolved to become highly effective if well placed and maintained property.

37 Artificial canopy bridges can restore connectivity effectively. Consultation with specialist conservation practitioners is recommended.

37.1 Artificial canopy bridges can be advantageous only if:

- **37.1.1** There is a clear need for animals to cross between the areas spanned by the bridge.
- **37.1.2** A solid commitment to the safety of orang utans and other wildlife while on the bridge and at both entry and exit points exists.
- **37.1.3** There is tolerance for monkeys and other animals who will use this bridge more commonly than orang utans.
- **37.1.4** The bridges are built appropriately and installed correctly, i.e., so anchor trees are not damaged.
- **37.1.5** There is a solid commitment to maintaining the bridge. It is only reasonable to provide access if it is reliable.
- **37.1.6** Proper consideration of the impact of the bridge on people and other animals has been made.

37.2 Orang utans may use a bridge sparingly. This is to be expected and does not mean the bridge is ineffective.

37.3 Orang utans often tend to avoid camera traps even when they are mounted on bridges. So, careful placement so as not to discourage bridge use is necessary.

37.4 ACBs can restore connectivity across small rivers.

- **37.4.1** Orang utans and gibbons cannot swim.
- **37.4.2** Genetic study reveals that orang utans do not cross major rivers.
- **37.4.3** Major rivers delineate subspecies on Borneo.
- **37.4.4** Well-built artificial canopy bridges restore access across impassable small rivers when natural overhanging trees that used to provide a natural arboreal pathway no longer exist.

37.5 ACBs can restore connectivity across roads.

- **37.5.1** Orang utans and other arboreal wildlife use overhead electrical wires along roads and to cross over roads.
- **37.5.2** Orang utans and other wildlife are sometimes electrocuted in this process.
- **37.5.3** Conducting regular maintenance and insulation repair and even pursuing innovations in new insulation materials for electrical wires to provide greater safety for people and animals would be beneficial.
- **37.5.4** Providing artificial bridges to cross roads could be advantageous. However, experimentation will be needed to make them appealing. Orang utans are especially cautious with human-made structures, so it is best to have specialist advice on location, construction and installation.

E. Understanding Population Monitoring

Population surveys require specialist practitioner skills.

✓ Misunderstandings of population survey results have inadvertently led to misguided decisions regarding orang utan conservation, particularly in human-modified habitats.

✗ This study does not support a common presumption that forests below 200 ha have no value for orang utans.

✗ Likewise, this study does not support the belief that low orang utan density in a forest fragment (below 1-2 individuals/km²) indicates nonviability, and translocating these animals somewhere else, then clearing the forest patch, is nonconsequential to species conservation.

✗ Conversely, the presumption that high orang utan density (above 2-3 individuals/km²) alone suggests overcrowding in a forest patch is also not supported.

✓ Our study reveals that a common practice of evaluating orang utan numbers independently of the overall regional orang utan community context needs to be revised. Dynamic use of the overall landscape is characteristic of the normal functioning of a regional orang utan populatiion.

- ✓ Orang utan social structure is based on the fact that forests are not uniformly productive.
- ✓ Adult males must migrate so forests can provide equality for all age/sex classes and, second, to avoid inbreeding.
- ✓ Today, orang utan metapopulation viability relies on movement of males between now fragmented forests where clusters of females and immatures live.

No orang utan densities measured in any forest patch can be deemed too small to be viable or too large for the habitat to sustain the numbers based on fragment size and population surveys alone.

38.1 Nevertheless, well-conducted population surveys paired with behavioural ecology and habitat assessment are invaluable conservation tools.

38.2 For example, this project has relied on regional and protected forest population survey data collected over the past 50 years in Kinabatangan. This accumulated trend information, augmented by survey of forest fragments in the privately administered landscape, is used to assess the overall orang utan community in Kinabatangan.

38.3 Therefore, we know that the Kinabatangan has a population of around 750 individuals, representing an 80-90% loss in the past 50 years. We also know the current trend is still negative, with an annual rate of decline of about 0.7 %.

38.4 Population Viability Analysis models surmise that an annual loss rate of 1% or greater is incompatible with metapopulation viability (Marshall *et al*., 2009b). Therefore, the situation in Kinabatangan is very serious but not hopeless.

38.5 Unfortunately, this baseline information is unavailable for much of the orang utan range.

The reason for this lack of baseline orang utan population monitoring data in many places is :

Challenge #1:

Systematic regional surveys can be expensive as they require skilled staff, considerable time, and for aerial surveys, specialist equipment. Furthermore, surveys at regular intervals (5-10 years, depending on threat level) are needed to provide critical trend information necessary to target appropriate conservation action.

To address this challenge, we recommend the following:

Regular judicious regional population surveys by locally based teams, especially in lowland riverine areas throughout the orang utan range on a 5-10 year basis with proper interpretation by specialists experienced in evaluating orang utans in fragmented landscapes. Where surveys are impossible, consultation based on results in Sabah or other representative places could be carefully applied.

39.1 **Challenge #2:**

Orang utan population numbers are measured indirectly by counting the nests they leave behind, which is not ideal but is necessary because:

39.1.1 Orang utans are masters at avoiding detection by people.

39.1.2 Orang utans occur at low densities over broad areas, even in ideal habitats.

39.1.3 Therefore, nest surveys are usually done in small areas considered representative of the larger area and extrapolated to arrive at an estimated regional population size.

39.2 There are two main methods of counting nests.

39.2.1 A single survey method or Standing Crop Nest Count is the most common.

39.2.2 Another method requires at least two surveys within a short predefined period whereby only new nests built within the interval are counted. This Marked Nest Count method yields a more precise estimate within a narrower time interval. However, it requires more time investment, so it is less often used.

39.3 Regardless of nest count method, orang utan population numbers are derived through a series of mathematical computations including other parameters (i.e. nest decay rates, number of nest builders in the population, and number of nests orang utans usually build per day in the area). The calculated average population size is reported as an estimated number of individuals per kilometre squared (ind./km^2).

39.4 **Many people ask: Does one nest mean one orang utan?**

The answer is no. The presence or absence of nests is an important consideration of orang utan use of a forested area. However, the number of nests does not directly correspond to the number of orang utans living in or even using a forest patch.

39.4.1 Generally, orang utans build a new nest every day, but not always.

39.4.2 Even orang utans that live in an area do not return to the same place every night to sleep.

39.4.3 Some nests are easily visible, while others are well concealed and easily missed by non-specialists.

39.4.4 We found that orang utans living in human-transformed areas are exceptionally good at concealing their sleeping sites to avoid detection by people.

39.4.5 For example, suppose we find three nests in a forest patch. In that case, it could mean one orang utan was there for three days, three orang utans for one day, or one orang utan one day in one week, one the next week, and another the following week. It could also mean one orang utan built the nest and used it; three weeks later, another orang utan also used it. Three months later, another orang utan could have added some fresh leaves and used it again.

39.5 Challenge #3:

People often multiply the estimated average orang utan density (ind./km²) by the survey area and take this to indicate the number of animals living in a forest patch. This number is misleading because it does not accurately represent the number of animals living in an area or even the number present on a single day.

39.5.1 Nest survey results yield an average estimate of the number of orang utans who USED an area in "a snapshot of time" prior to the survey.

39.5.2 This period is either within the past 1.5 months for a Marked Nest Count survey or as long as 6+ months for a Standing Crop Nest Count survey.

39.5.3 Nest surveys do not reveal the age/sex class ratio (see challenge #6 below).

39.5.4 Though females and immature orang utans usually stay in smaller areas, the number of regionally migratory adult males present in any single area typically varies with seasonal food availability, localised disturbance, barriers to normal movement, and other factors. Contextual information, i.e., seasonal productivity variation, is typically not recorded during nest surveys.

39.6 Challenge #4:

Different habitat types support orang utans at different densities, even under ideal conditions. Therefore, defining a "good" orang utan density is not always straightforward.

39.6.1 Mean measured orang utan densities in undisturbed primary forests are very broad, varying from 0.8-8 individuals/km² on Sumatra, while on Borneo, the reported range is 0.6-4 individuals/km².[2]

39.6.2 There are a few definitive general statements about orang utan density:

a	Orang utans exist at overall higher average densities in Sumatra attributed to the richer volcanic soils characteristic of Sumatra compared to Borneo.[1,2,4]
b	Orang utans on both islands exist at the highest densities in the mosaic floodplain habitats on mineral soils and in peat swamps.[2,3]
c	Orang utan density declines with altitude on both islands. However, more orang utans are found at higher altitudes on Sumatra than on Borneo.[1,2,3,4.]
d	Mean orang utan densities in some but not all larger degraded forest fragments 800 ha+ in the Kinabatangan floodplain are equivalent to historical primary forest floodplains on Borneo.[2,5.]

1. Rijksen & Meijaard, 1999
2. Delgado & van Schaik,2000
3. Marshall *et al.*, 2009a
4. Husson *et al.*, 2009
5. Oram, 2018 and unpublished 2022 surveys

39.7 For this study in degraded floodplain habitat, we consider an average of 2-3 individuals/km² with a range between 1-6 ind./km² reasonable throughout the region overall.

39.8 The Kinabatangan reference above is based on the average density measured over 12 years from 66 surveys between 2005 to 2016 in one of the best habitat areas of the LKWS, which was 3.06 ind./km² – 95% CI – 2.74 – 3.37 with a short term variation range of 1.10 – 5.81 ind./km² (by Marked Nest Count surveys) (Oram, 2018).

However, it is only a reference value because:

39.9 Challenge #5:

People often assume that orang utan distribution is uniform within a particular habitat. However, it varies widely even in large continuous forest blocks.

39.9.1 Clusters of more resident animals (females and immatures) live in parts of forests that are historically more consistently productive year-round. In other places with more seasonal resources or where migratory adult males are just moving through, they are used on a more transitory basis.

39.9.2 Population surveys cannot accommodate natural variation across the landscape when calculating overall density estimates from regional monitoring, especially of large continuous blocks.

39.9.3 Today, most orang utans live in highly fragmented discontinuous forests (3000 ha and below), especially in their prime lowland habitat along rivers.

39.9.4 So great care must be taken to include assessment of habitat quality and type of habit use in addition to measured orang utan densities when evaluating the value of forest fragments for regional orang utan conservation.

39.10 Challenge #6:

Density estimates do not provide any information about the age/sex class composition of the population. This information is essential to assessing population viability, especially in fragmented forests.

39.10.1 Orang utans under seven years old share their mother's night nest. So population surveys do not measure the number of these youngest orang utans, representing the population's future resilience.

39.10.2 Adolescents (7-15-years-old) are highly mobile and characteristically go slightly beyond the boundaries of their "neighbourhood" and mix with adolescents from other "neighbourhoods" (KOCP unpublished). This behaviour can confuse population assessments and make these young animals vulnerable to harassment and translocation, which could be especially deleterious to the future health of the regional community.

39.10.3 The extreme site fidelity and strong home-loving nature (philopatry) of female orang utans and their immature young means these age/sex classes are preferentially lost when the natural forest is converted to other uses. Adult males, as the dispersing and more migratory sex, tend to move away from local forest loss, if possible. So the current adult population in the Kinabatangan and likely other places have a male skew (Marshall *et al*., 2009b).

39.11 **People often ask:** If population monitoring yields a marked increase (i.e. from 2-4 ind./km²) in density between two successive surveys or a higher density than 2-3 ind./km² in a single survey, does this mean there are enough orang utans and there should be no conservation concern? Or does this indicate there are too many, and animals should be translocated to other places?

The answer to both questions is no.

39.11.1 Wild orang utans are biologically and socially incapable of increasing their population numbers quickly. Generation time is a complex calculation based on many biological and demographic factors, estimated at around 24-27 years for orang utans (Wich *et al*., 2009). Significant population growth by natural means cannot occur between two successive surveys alone, even if 5-10 years apart. Longer-term trend information is required.

39.11.2 A "sudden" higher density is more indicative that:

a	Forest has recently been cleared elsewhere in the region, and males are migrating away from disturbance into this still forested area.
b	A local fruiting season has produced a higher-than-normal amount of food resources allowing migrating males to accumulate and linger in the area.
c	Resident females in the local area have recently weaned offspring, attracting males into the area above normal migration levels.

The second and third above are positive signs of overall population health; however, the first is a cause for concern.

39.11.3 In Kinabatangan, we have observed elevated densities from migration away from nearby forest clearing. We have also observed through long-term monitoring that these higher densities were not sustained (Oram, 2018). That is, migrants were likely not tolerated by more resident orang utans on a longer-term basis.

39.11.4 Regarding the presumption that there are too many orang utans – in all three of the above potential reasons for elevated densities, none are permanent circumstances.

39.11.5 Our study has indicated that orang utans in Kinabatangan are more capable of navigating human-transformed landscapes than previously assumed.

39.11.6 Therefore, more bio-social specialist evaluation to address barriers to normal landscape-wide habitat use is preferable to more invasive measures such as translocation.

39.12 **Conversely, we are often asked: If an orang utan density is below 2-3 individuals/km² in a forest fragment does this mean the population is non-viable, and it is best to translocate the remaining animals somewhere else, and thereby acceptable to clear the forest?**

The answer is no.

39.12.1 Our study found that in these circumstances, the remaining individuals are females and dependent offspring. Since most females and young animals tend to be lost during land clearance, all surviving wild females and young are critical to overall population survival.

39.12.2 It is important to remember that these females grew up in the fragment where their mother likely survived forest clearance all around them. Or the female, herself, is the last survivor of a larger genetic cluster that occupied the forest before land conversion.

39.12.3 Therefore, any surviving female and their immature offspring likely represent additional previously unknown genetic diversity now critical to overall population viability.

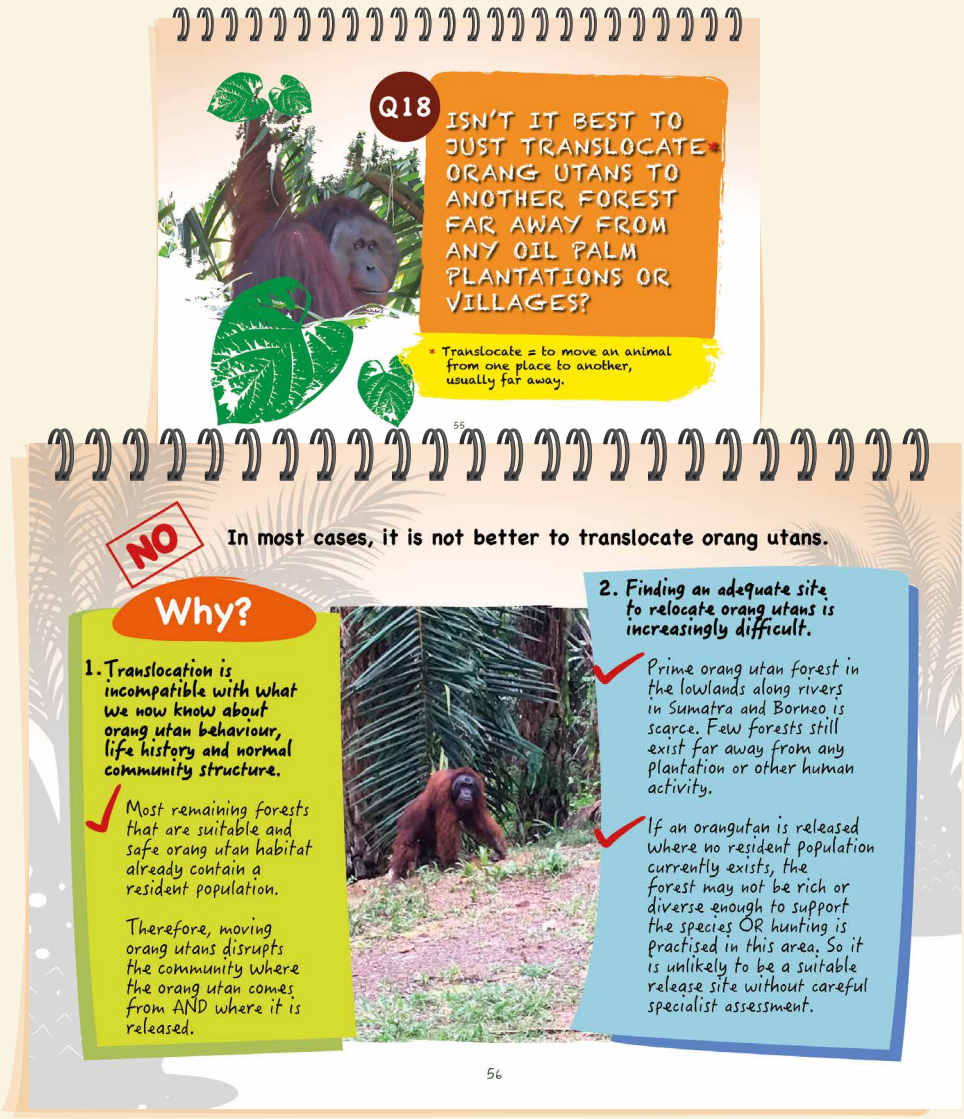
40 It is a clear and necessary conservation action for private land administrators, wildlife agencies, and citizens to protect females and offspring in the forests where they live regardless if it is formally protected land or not.

40.1 Adult males are no less important. Because of their migratory nature, as the dispersing sex, they are often sighted in human-use areas and vulnerable to harassment and translocation.

40.2 Population viability analysis has indicated that regional annual losses of 1-3% during migration events between forests will result in a steady decline to extinction. (Marshall *et al.*, 2009b).

40.3 Animals lost from the regional community by translocation can have the equivalent population effect as off take by hunting (Marshall *et al.*, 2009b).

41 Likewise, for private land administrators, wildlife agencies, and citizens to provide safe passage for orang utans across mixed use landscapes is a clear and necessary conservation action.



tell me MORE

Translocating orang utans disrupts orang utan communities.

Every surviving wild adult female is vital to the conservation of the species and needs to be retained in place, even if on privately administered land.

Female orang utans are the philopatric (home-loving) sex.

- Resident females do NOT tolerate unknown females. Therefore, local females will likely not allow the newcomer translocated into their area access to resources.
- The home-loving nature or "site fidelity" of female orang utans means they tend to stay in place even when their forest is removed. This means that females and immatures are typically lost at higher rates than adult males when land clearing occurs.

- **Male orang utans are the dispersing sex.** This means adult males leave permanent residence in the forest where their mother lives and take up a more nomadic life, circulating around the broader local region.
- Males will generally move away from disturbance on their own if given the opportunity. They may become temporarily disoriented the further away they travel from where they grew up. But referencing familiar landmarks and following older, more experienced males is something male orangutans are accustomed to doing.

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MORE tell me MORE

An orang utan encountered outside a protected forest is not necessarily "lost" merely because it is seen in an unexpected or undesirable place.

Presumably, it travelled independently to the place it was encountered, so **the orang utan is likely in its home region. If translocated far away from any familiar reference points, the only certainty is that the orang utan will now be genuinely lost.**

To conserve orang utans in the wild, we need to:

1. Keep them safe from unnatural losses where they live.
2. Support their efforts to sustain normal community functioning, even if forests are now separated by oil palm plantations, villages, roads, and other human activities.

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F. Managing Sightings and Encounters

MORE tell me MORE

Retaining wild populations is essential for orang utan conservation.

- The remaining pre-existing wild orang utan communities have already adapted to environmental changes in the lowlands along rivers. Supporting these animals already in place is the best bet for conservation.
- Our studies show wild orang utans are using their intelligence to do all they can to keep their communities connected.

People have the intellectual capacity to learn how to co-exist with wild orang utans. If this is something we choose to do.

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42 The first step is to reframe our collective thinking; an orang utan sighting is not, by definition, a conflict.

42.1 Orang utans, like people, are just trying to get through their day and manage a natural environment that's been drastically altered in the space of a single orang utan lifetime.

SOLUTION 1

The first critical step to co-existence is for ALL of us to **REframe our thinking and language.**

- Any wildlife sighting is not automatically a conflict. Wildlife are not "raiding", "vandalising", "stealing", "destroying" or trying to do anything overtly malicious. Like people, wildlife are just trying to live their lives and adapt to new circumstances.
- People must take responsibility for their actions that result in rapid and drastic environmental change.
- Since wild orang utans try to avoid people, this is advantageous for co-existence with this species. But with less and less forest habitat, wildlife are forced nearer to people.
- Perceiving any sighting as a conflict is a one-way street, where wildlife are blamed for just existing!

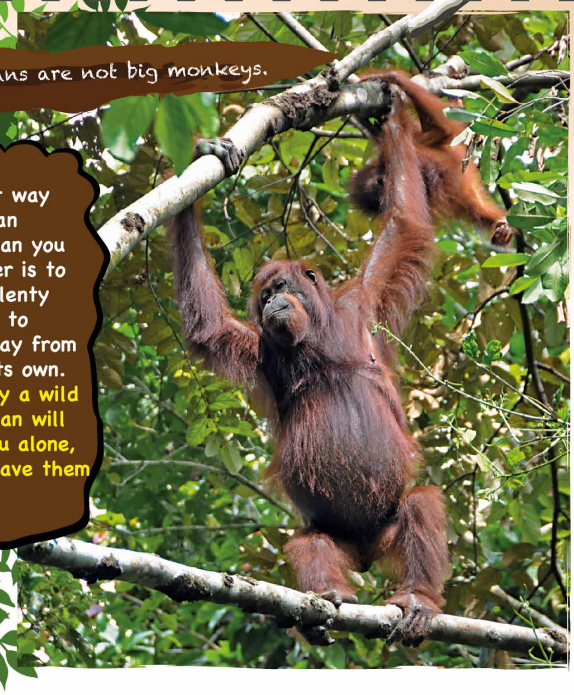
- Co-existence must be a two-way street. Without mutual respect and some accommodation, co-existence is impossible.

100

43 **A benefit when encountering wild orang utans is that they are highly intelligent and very wary of people so they will do their best to avoid being detected. However, orang utans are not monkeys and do not behave like monkeys, therefore cannot be managed like monkeys.**

tell me MORE

Remember, orang utans are not big monkeys.



1. **Even though wild orang utans are generally shyer than monkeys, if detected, they usually do not run away quickly like monkeys.** People may misinterpret this as arrogance or aggression. But it is actually because orang utans can't run and jump like monkeys. This is why trying to shoo them away by chasing them or throwing things is ineffective because orang utans must move more carefully. See page 23.
2. **Orang utans are not risk takers around people like monkeys.** Orang utans can't rotate their heads as far as people, so they can't see what is happening around them just by turning their heads, especially if they are on the ground. Instead, they have to turn their whole body to face you. This can be misinterpreted by people as aggression when they are just trying to see what is going around them. If people crowd around them they can even become "frozen" in fear.

The best way to help an orang utan you encounter is to give it plenty of space to move away from you on its own. Generally a wild orang utan will leave you alone, if you leave them alone.

44 **Overall, the best approach is to support orang utans in avoiding and getting away from us.**

First, Do NOTHING but observe

Remember, it is illegal throughout Malaysia and Indonesia to harass, harm or kill an orang utan.
Do stay away from the orang utan - 20 m or more if it is in a tree and 50 m ++ if it is on the ground.
Maintaining more distance is better- Give the orang utan lots of space to find the safest way to move away from you.

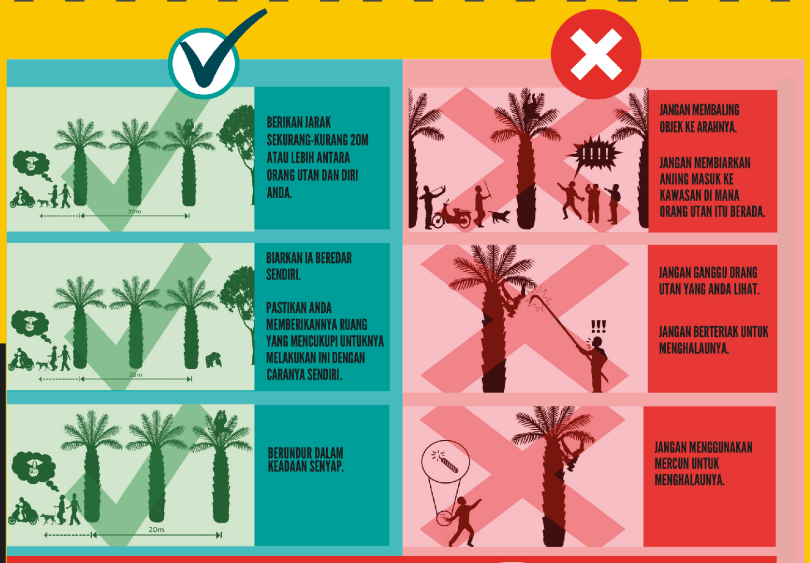
- ✓ Do NOT approach the orang utan to get a better picture.
- ✓ If it is in a tree, do NOT stand directly underneath it.
- ✓ Do NOT crowd around it.
- ✓ Do NOT shout at it or make lots of noise.
- ✓ Do NOT wave things around or throw things at it.
- ✓ Do NOT shoot at or around it with any type of gun or slingshot.
- ✓ Do NOT hit or shake the tree or structure the orangutan is in.
- ✓ Do NOT try to chase it.
- ✓ Do NOT let dogs near it.
- ✓ Do NOT set fires nearby.

Do NOT take matters into your own hands.

Defer to your local government wildlife agency regarding concerns about orang utans.

DO LEAVE IT ALONE AND LET IT PASS BY ON ITS OWN.
DO Consider yourself a very lucky person to have seen a wild orang utan! Watch for a few minutes at a distance and then leave it alone.

WHAT SHOULD YOU DO WHEN YOU SEE AN ORANG UTAN?



HARRASING, INJURING OR KILLING ORANG UTANS IS PUNISHABLE BY LAW UNDER THE WILDLIFE ENACTMENT OF SABAH. IF FOUND GUILTY YOU MAY BE IMPRISONED AND FINED.

ORANG UTANS ARE A TOTALLY PROTECTED SPECIES AND THE LAW SHOULD BE ADHERED TO AND RESPECTED.

JANGAN MEMBURU.

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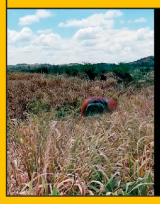
WHAT TO DO IF YOU SEE AN ORANGUTAN ON THE GROUND?

ORANGUTANS ARE A FULLY PROTECTED SPECIES - IT IS AGAINST THE LAW TO ATTACK OR HURT THEM

When wild orangutans are on the ground, they are more afraid of people than when they are in the trees.

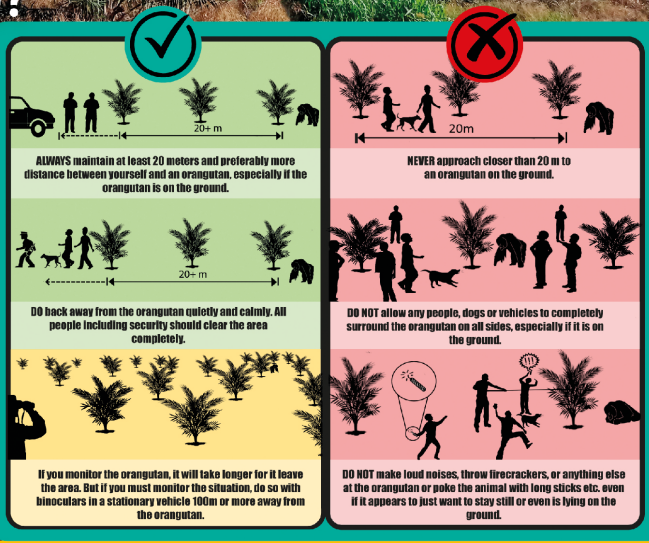
Orangutans cannot turn their heads from side to side to see what is happening around them as well as people can. When they are on the ground this is really a problem for them.

It is normal for male orangutan to travel large distances on their own between forests that are now separated by large oil palm plantations.



When there are no nearby trees for them to climb on, a wild orangutan **can become so afraid they just lie down on the ground or find a drain to hide in.** This does not necessarily mean they are hurt or injured.

Never approach an orangutan on the ground. Orangutans are much stronger than people and have an arm reach of around 1.2 meters. They are not naturally aggressive, but if cornered, they will defend themselves and can inflict serious injury.



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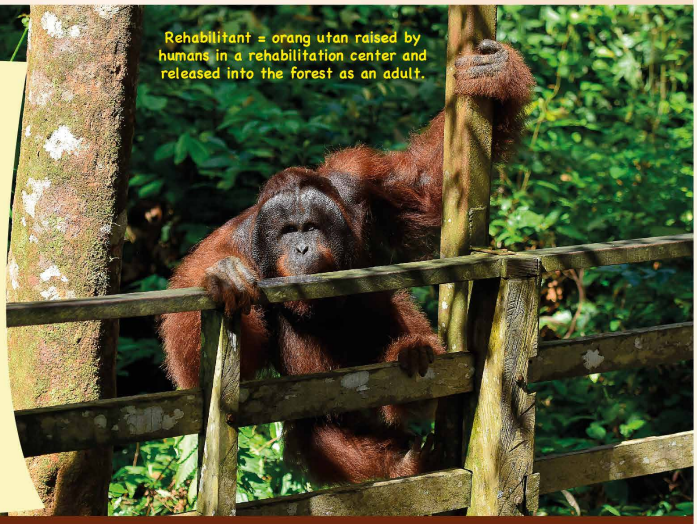
MORE tell me MORE

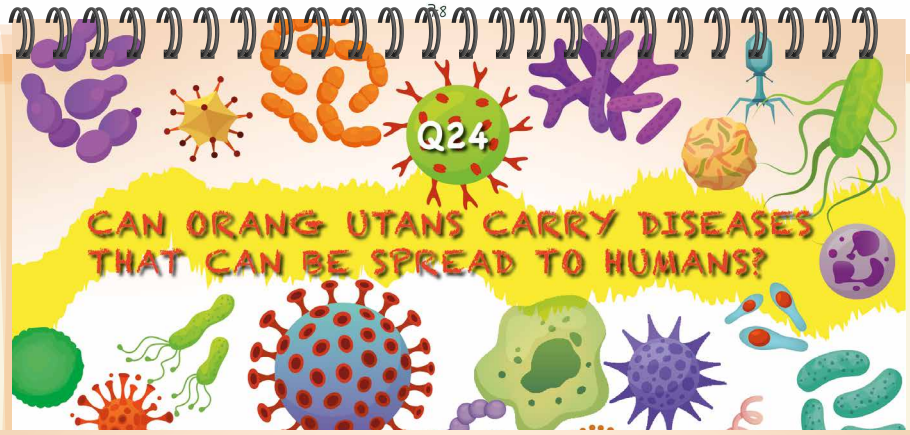
Encountering a free-ranging rehabilitant.

- In or near rescue and rehabilitation centres, people are more likely to encounter a rehabilitant orang utan.
- A rehabilitant or orang utan accustomed to being near people may be less predictable in their behaviour.
- **Because some rehabilitants may be translocated into areas where wild orang utans live, it is essential to be cautious and maintain as much distance as possible from any orang utan you may encounter.**



Rehabilitant = orang utan raised by humans in a rehabilitation center and released into the forest as an adult.

- Always defer to wildlife authorities with respect to wildlife management.



YES!

But it works both ways. Being close biological relatives, humans can also spread diseases to orang utans, such as flu, pneumonia, tuberculosis, hepatitis and even COVID.

Maintaining as much distance as possible is good health practice.

A wild orang utan will generally try to maintain distance from people. Rehabilitant orang utans may approach and sometimes get too close, because they were raised by people. **So, people should actively work to maintain a healthy distance.**

Q25 CAN AN ORANG UTAN BE DANGEROUS TO HUMANS?

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YES

Orang utans are much stronger than people and are capable of inflicting severe injury. However, this is usually a defensive rather than offensive action as wild orang utans are not aggressive by nature.

- Orang utans have a very firm grip, and an arm reach of up to 1.5 metres. They have large teeth, and even young orang utans have powerful jaws.
- Wild orang utans will typically try all possible options to avoid humans. Nevertheless, any orang utan cornered, attacked, or harassed by people, will defend itself.
- Rehabilitant orang utans may approach you, so they can be more dangerous.
- Do not take matters into your own hands! Do not approach an orang utan.

- Remember orang utans are a fully protected species - Defer to government wildlife authorities regarding any concern about orang utans.

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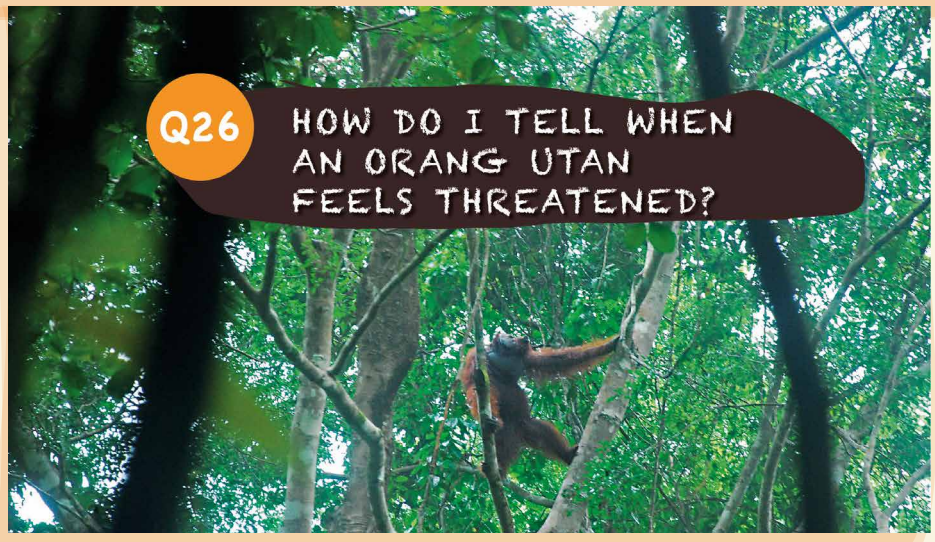


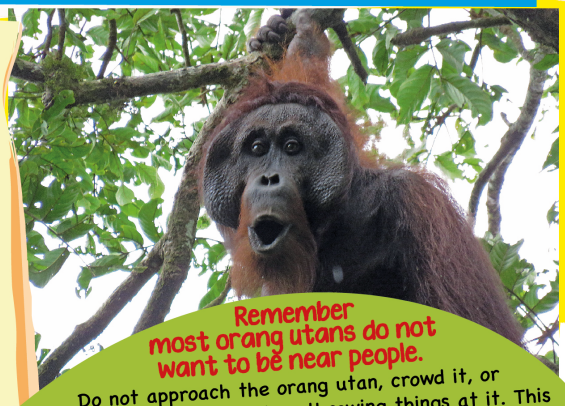
Q26 HOW DO I TELL WHEN AN ORANG UTAN FEELS THREATENED?

Despite their large size, orang utans are very good at hiding in the forest.

But if detected by people, they often become agitated, moving around in a tree, tearing off branches and dropping them to discourage you from approaching.

They also make a characteristic distress call scientists refer to as a "kiss squeak".

- A kiss-squeak is a roaring sound made by rapidly inhaling and exhaling through their mouths. Orang utans do not have a voice box, so they cannot produce very sophisticated sounds.
- If you back away 10 m and are not directly below them, orang utans will usually stop making this noise. Then an orang utan will usually turn its attention to finding a way to escape from you as quickly as possible.
- If the orang utan is on the ground, it may become so afraid it just lies down on the ground.



Remember most orang utans do not want to be near people.

Do not approach the orang utan, crowd it, or harass it by yelling at it or throwing things at it. This will will make it defensive and dangerous. Just back away and give them a clear path to figure out how to get away from you, safely.

(Refer to poster on page 77)

45

Better understanding by people of how wildlife, including orang utans, perceive aspects of human behaviour and land use is crucial to coexistence. Below are some examples; These and others are best addressed through ongoing cross-sector collaboration with conservation practitioners specialising in animal behaviour. The first question below is: If orang utans are dependent on forest food why do they sometimes enter orchards?

1. **Not enough wild forest food is available.**

Retaining forest-dependent wildlife such as orang utans without natural forests is impossible.

- When a forest is cleared, and natural food is no longer available, wildlife must seek whatever food they can find.
- The only food available may then be plants cultivated for human use.

SAVING AS MUCH NATURAL FOREST AS POSSIBLE IS CRUCIAL TO CONSERVATION AND CO-EXISTENCE WITH WILDLIFE, ESPECIALLY IN MIXED-USE HABITATS.

2. **They have been fed by people and developed the habit and expectation that this is appropriate food for them.**

People should not feed wild animals to avoid teaching them to approach people for food.

- Fruits created for human consumption are often larger, sweeter and easier to process than wild varieties.
- Wildlife fed human food may prefer this over their natural food.
- Rehabilitant orang utans may not know well enough about natural forest food. Hence, they seek out human food to survive because it is what is most familiar to them.

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3. **Wild animals fundamentally do not understand the human concept of ownership rights to ALL the fruit in a tree, ALL the time.**

If people are in the area but not actively harvesting, the orang utan or other wildlife will perceive the fruit as freely available. To the animal this is just foraging not "stealing" as viewed by the human with a different value system.

By this logic, even if there is adequate food in a nearby forest, they may sometimes take fruit from a local orchard.

Also, humans generally prefer fruit at a riper stage than orang utans. So "just right" for wild orangutans is often "not quite ripe" for people.

These cases can be complex and difficult to address.

72

Following are a few final points about managing sighting reports:

46 Careful vetting of age/sex/class designations reported by observers is necessary before appropriate management decisions can be made.

46.1 We found that orang utan age/sex/class assignment in reports from the field is unreliable. Even for specialists, initial assessment is challenging.

46.2 Orang utan size can be difficult to establish. It often depends on how far away and high up in a tree the animal is compared to the observer. The same individual can seem small when sitting on a branch, then much larger when moving and their limbs are fully extended.

46.3 Older adolescent orang utans (12-14 years-old) can appear adult-size even though they still rely on the support of their mother.

46.4 Orang utan females making repeated distress calls can look like flanged males.

46.5 Any adult unflanged individual who appears alone (without an accompanying baby) is usually assumed to be male. However, this is not always the case.

46.6 Two animals seen together are not always a female with offspring. Adolescents of the same or different sexes, as well as adult unflanged males sometimes travel together.

46.7 Older but healthy wild orang utans sometimes seem less fully muscled, and their legs and arms often appear more "bony"; this is part of normal ageing and not necessarily an indication they are sick. Orang utans have longer average life expectancies in the wild than most captive individuals.

46.8 Wild animals often appear thinner than captive animals. Captive orang utans generally have higher fat-to-lean muscle ratios.

46.9 **Correctly establishing age/sex/class is essential as each have different habitat requirements, as mentioned throughout this document.**

- **46.9.1** Video clips from as many angles as possible are helpful but maintaining safety and avoiding extra stress for both people and the orang utan is also a priority.
- **46.9.2** An interview by a skilled wildlife officer of the people who have actually seen the animal, including a full report of the circumstances of the sighting and confirming visual, is needed.
- **46.9.3** Consultation with behavioural and veterinary specialists is important.

47 An orang utan lying down on the ground is not necessarily sick or injured.

47.1 Orang utans can walk on the ground but are much more comfortable in the trees because this vantage point allows them to better see what is happening around them.

47.2 Orang utans cannot rotate their head from side to side as far as people can, and when they have to lean forward to walk with their hands and feet on the ground, it is even more difficult for them to monitor their surroundings.

47.3 In replanting or new planting situations or other open areas where there are no trees or other structures of sufficient size for an orang utan to climb on, they can become so overwhelmed that they lie down in a low spot and try to make themselves appear as small and unthreatening as possible.

47.4 It is important not to approach an orang utan as they have at least a 1.5 m reach and a firm grip.

47.4.1 Though wild orang utans are not naturally aggressive and tend to do all they can to avoid people, they will defend themselves.

47.4.2 Do not corner, obstruct or prevent it from moving to a more comfortable and sheltered area.

47.4.3 It is best to have all people leave the area entirely.

a In an open space, the animal will take some time (hours) to regain its confidence and move on its way.

b Depending on the circumstances, if people feel they must check to see if the animal has moved, they can pass by the area, as far from the animal as possible, using binoculars.

c However, the more checks, the longer it will take for the animal to move off.

47.5 If the animal is showing obvious signs it is ill, i.e., vomiting, convulsing, or has obvious recent wounds or people know it has been wounded, this must be reported to wildlife authorities immediately.

47.5.1 In these circumstances, it is still unwise to approach the animal; this will only add to its distress.

47.5.2 Do not attempt to catch the animal .

47.5.3 Leave it alone.

47.5.4 Stay no less than 20 m, preferably 50 m away.

47.5.5 Concentrate efforts on facilitating veterinary services access to the area as expediently as possible.

48 An orang utan baby that appears alone is not necessarily an orphan.

48.1 Especially in human-modified environments, we found that careful evaluation is necessary to establish if an immature orang utan is truly unaccompanied by its mother.

48.1.1 Field studies show that most wild adult females are constantly parenting at least one immature offspring throughout their adult life. Once one infant is weaned, at around 7 years of age, we have observed that another baby is usually born within 3-4 months (KOCP unpublished).

48.1.2 Even weaned offspring spend another seven years of their adolescence (7-15 years) under the guidance and protection of their mother, even though they may not travel with her all the time.

48.2 Adult orang utan females living in mixed-use habitats are so cryptic that people usually do not even know they live in a nearby forest fragment. However, youthful curiosity often means younger orang utans are less cautious than adults.

48.2.1 Compared to captive orang utans, wild orang utans often appear quite small, even up to 4 years old.

48.2.2 Young orang utans from 1 year old begin to explore within their mother's reach and then progressively extend this range. By 3-4 years old, they are proficient at moving around inside trees but often need help crossing between trees.

48.2.3 Adult females sometimes park their young in one tree, go to an adjacent tree for various reasons, and then return. Likewise, we found some females station juveniles inside forest borders while they go outside the forest for short periods (KOCP unpublished).

48.2.4 We have observed that the adult female's fear of people in human-modified habitats can be so great that it may override her well-described powerful maternal bond such that she will remain hidden and not expose herself to retrieve her offspring if that means being detected by people.

48.3 Notwithstanding, the above, the expectation of people who report this incidence as well as the routine action by wildlife officers is to take the animal into care immediately.

This is action done for compassionate and efficiency reasons because :

48.3.1 An orang utan under the age of 5-6 years in the wild is unlikely to be capable of independent survival, especially if its matrilineal community is no longer intact, which may be the case in a small forest fragment.

48.3.2 People reporting this finding may already know an adult female was killed accidentally or intentionally. Since it is well known that it is illegal to kill an orang utan, it is unlikely this information will be volunteered to wildlife officers and conservation practitioners.

48.3.3 It is equally well known that there is a demand for young orang utans in the pet trade, so it is often deemed safest to remove the animal quickly to avoid any risk of this illegal activity.

48.3.4 However, **if we are to conserve orang utans we cannot continue to lose competent adult females and immature animals out of the wild even into compassionate care. This is not an animal problem this is a people problem and needs to be better addressed.**

49 Translocation because of fear for the animal's welfare is a failure in law enforcement and conservation action.

49.1 **In modern circumstances, considering how little forest remains and how few wild orang utans are left, live removal (translocation) as a default "solution" to an orang utan sighting is incompatible with orang utan conservation.**

49.2 **If the choice is to conserve orang utans, collective action to co-exist with the remaining wild individuals and support them to maintain self-determining communities in mixed used landscapes is required.**

49.3 If the animal requires veterinary care, returning it close to where it was initially found after treatment is the best conservation action. The first question below is: If orang utans are dependent on forest food why do they sometimes enter orchards?

49.4 **In conclusion, we are often asked, sometimes incredulously, by estate managers, "so you are essentially saying if we see an orang utan the best thing is to just leave it alone and it is helping orang utan conservation?" Perhaps it is human nature to feel when situations are dire we need to intervene actively to do things when in many respects what is more needed is a change in mindset.**

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Next Steps

Today, orang utan metapopulation viability relies on movement between now fragmented forests. Dynamic use of the overall landscape is characteristic of the normal functioning of regional orang utan communities.

Orang utan social structure is structured around the fact that forests are not uniformly productive, even in pristine conditions. Adult males must migrate so forests can provide adequately for all age/sex classes and to avoid interbreeding. Any wild orang utan female raising offspring in forests anywhere today, whether protected or under private administration, is vital to the conservation of the species.

The guidelines presented in Chapter 4, Section A addressed coexistence by preserving forested habitats. Sections B and C recommended ways to rehabilitate and enrich habitat appropriately. Section D explained various structural approaches to facilitate connectivity in fragmented mixed-use landscapes. Section E emphasised the importance of an integrated landscape-wide community preservation or metapopulation approach to orang utan population monitoring. Section F focused on the most practical aspect of coexistence, how to manage interactions.

Chapters 1, 2 and 3 show that wild orang utans do not seek out plantations or encounters with people. Nevertheless, orang utans need to use estates. However, the idea of sharing cropland with orang utans or other wildlife is challenging to agriculturists, wildlife agencies and most conservationists.

The general public, nationally and internationally, perceives the palm oil industry negatively with respect to orang utan conservation, even though palm oil is the most land-efficient vegetable oil product to produce.

Regardless of the extent of forest loss that has already occurred, one clear outcome of this study is that conservation of the remaining wild orang utans throughout Borneo and Sumatra will only be possible with the cooperation of oil palm growers today. Therefore, there is an opportunity for the oil palm industry to be pioneers in establishing a coexistence conservation model for Asia's only great ape species.

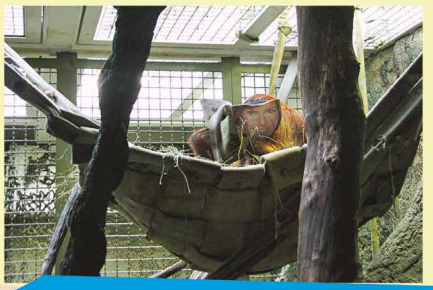
It will take time and ongoing collaboration between industry, wildlife agencies and conservation practitioners to achieve the necessary shifts in traditional agricultural and wildlife management practices to retain wild populations of Critically Endangered wildlife like the orang utan.

Foremost, we do not recommend dependence on a tourism approach that promotes orang utan presence in estates because coexistence with wildlife, especially in production landscapes, is incompatible with creating guaranteed viewing opportunities (i.e. zoos), especially of highly cryptic wildlife, such as orang utans. However, there is still much opportunity for innovation.

Finally, although this document is titled "Best" Management Practices, it remains a process of dynamic continuous improvement! In the true spirit of collaboration that creates something better than a single stakeholder can achieve alone. We look forward to continuing to learn together how to "Ensure orang utans can survive in agricultural landscapes", "Halt habitat loss and restore habitat across the landscape", and "Ensure better protection of orang utans across their entire habitat". Though these goals are part of the latest Sabah Orang utan Action Plan, informed by this project's work, and others, they have equal relevance throughout Borneo and Sumatra.

NO The wild population is the reservoir for conserving this species because ONLY wild orang utans possess ALL the skills and knowledge to be self-supporting in the forest.

1 Orang utans in captivity do not need to find their own food or a safe place to sleep. Cages are often insufficient to retain the climbing skills and physical conditioning necessary to survive in the wild.



Forest skills are not relevant in captivity, so this knowledge is not retained or passed on in the captive population.

2 Like human children, young orang utans are not born knowing how to survive. They need to learn forest skills from their orang utan mother.

Captive orang utans live different lives than wild orang utans!

tell me MORE REtaining and supporting natural REcovery of already competent wild orang utan populations is essential.

REintroducing captive orang utans into the wild **is exceptionally challenging, often with poor results.** Maintaining captive orang utans so they retain adequate forest skills is resource, labour and cost prohibitive.

What about REforestation?

Forest restoration is important but achieving this isn't quick or easy because REforestation is about growing a forest, not just planting trees.

- ✔ Planting trees is just the first and simplest step.
- ✔ Skilled and labour-intensive maintenance of saplings is necessary to revive a natural forest.

✔ REtaining and supporting the natural REcovery of degraded forests with or without habitat enrichment is also essential.

15

APPENDIX

Important natural plants needed to support orang utans and other wildlife
RECOMMENDATIONS for Habitat restoration projects

WHAT ORANG UTANS EAT IS RELEVANT TO MANY OTHER FOREST ANIMALS.

Many forest animals eat fruit when it is available. This includes small mammals, many birds, most primates, sun bears, and even elephants. However, orang utans are the largest primates in Bornean and Sumatran forests that depend on forest fruits when in season. Therefore, what orang utans eat is also relevant to the survival of many other forest animals.

MOST TROPICAL FOREST ANIMALS WHO EAT FRUIT ALSO DEPEND ON OTHER PLANT PARTS.

Animals that mostly eat plants are known as herbivores. Herbivores are sometimes sub-classified as those that are more fruit-eating (frugivores) or more leaf-eating (folivores). However, fruit is a seasonal resource, so it is not always available. Therefore, most tropical forest frugivores rely on other plant parts as well. Some animals, including a few types of primates, particularly macaques, eat a broader range of food. They are known as omnivores, compared to the stricter plant-eaters (herbivores), meat (carnivores) or insect-eaters (insectivores).

ORANG UTANS AND MANY OTHER FOREST SPECIES:

- **Require different plants to provide food and shelter**
  Many animals, including orang utans, require a variety of plants to ensure a balanced diet. Wild orang utans studied for over 25 years in Kinabatangan consume various parts from at least 3-15 different genera per day, depending on the season (Oram, 2018). Therefore, to account for seasonal variation in plant-producing cycles and adequately meet nutritional needs, a diversity of species is required to provide food all year-round. Animals also require trees to provide shelter. In the case of orang utans, they require taller stable trees of at least 15-20m as nest sites.

- **Depend on a various plant parts**
  For example, even though 60% of the overall orangutan diet in Kinabatangan and throughout their range consists of fruits that supply energy, they rely on young leaves and shoots (pucuk) for essential protein and consume these other plant parts daily (Oram, 2018). Orang utans also extract the sugars and minerals from the vascular layer (cambium) beneath the outer bark of trees and woody lianas. This is likely used as an energy source when the fruit is less available. Orangutans also eat flowers and insects (termites and ants).

- **Rely on food sourced from native lianas (woody vines) as well as trees**
  In addition to trees, about a third of the orangutan diet in Kinabatangan is from vine sources (Oram, 2018). Vines are usually more widely distributed and often fruit in less synchronised patterns than trees. These characteristics make vines especially beneficial when overall forest size is greatly reduced. Lianas are also an underappreciated food resource for many other tropical forest animals in Sabah, from birds to elephants. - About a third of the orang utan diet in Kinabatangan is from Native vine sources (Oram, 2018). Vines are especially important as they are well distributed and often fruit in less synchronised patterns than many trees. This is especially important when the forested landscape is greatly reduced in overall size and highly fragmented.

- **Do not depend on commercial timber species as food sources**
  To provide adequate habitat enrichment for most wildlife species; commercial timber species must not be overrepresented. These generally slow-growing species contribute little to support wildlife in the critical early stages of habitat restoration work. Also, non-native timber varieties, being introduced species, are not relevant for use in replanting projects aimed at habitat restoration to support natural-occurring local wildlife. Orang utans use native timber species for nesting, but only if they are above 15-20 m tall. Therefore, the value of timber species in restoration schemes is longer term.

- **Given the above, to achieve habitat restoration that truly provides resources useful to wildlife:**
  - ✓ Only native plant species should be used in habitat restoration projects if the goal is to support native wildlife.
  - ✓ Growing appropriate native trees and lianas is more important than just planting them.
  - ✓ Monoculture plantings of a single genus and/or species is not recommended.
  - ✓ Planting a wide variety of native plants of documented use to local wildlife is recommended.

CHALLENGE

Throughout the PONGO Alliance – Kinabatangan project, we found a limited range of natural species in most plant supply nurseries. We found that some of the reasons for this were a lack of knowledge of what would be useful to wildlife and a lack of skill to identify, source and grow a more comprehensive variety of native species.

RECOMMENDATION

The following table lists recommended native plants for habitat restoration based on a PhD synthesis of 20 years of orangutan feeding ecology data in Kinabatangan (Oram, 2018). The list consists of plants that are consistently and most frequently relied on by orang utans locally. However, this is only a partial list of all the over 300 plant varieties orang utans use locally. Though this study focused on orang utans, we selected those relevant to other forest wildlife based on our observations over time.

This list below aims to serve as a starting point to broaden the range of native species diversity in reforestation projects.

	Scientific	*Malay*	*Type*	*Notes*
1.	*Spatholobus* spp. Leguminosae	Akar remus	liana	This genus is the most commonly consumed plant by orang utans in degraded habitat (Kinabatangan) and primary forest (Danum Valley). This is also an underappreciated food source for other animals as well from birds to elephants.
2.	*Ficus* spp. Moraceae	Kayu ara	tree and liana (hemi-epiphyite)	Especially *F. benjamina* (Waringin) because it is used even more often for feeding on young leaves than for seasonal fruit, and *F. racemosa* * (Tangkol merah) though slow growing is a riparian edge specialist species. There is one Ficus species that is NOT consumed by orang utans or any other primates, *Ficus obpyramidata* locally known as Tangkol hijau. The only animal species observed to eat *Ficus obpyramidata* is the Flying fox (*Pteropus* spp). However, because this soecies is a common ornamental or perhaps because it is confused with Tangkol merah, it is planted in restoration sites.
3.	*Diospyros* spp. Ebenaceae	Kayu malam	tree	Orang utans consume many species. *Diospyros elliptifolia* - kayu malam kulit nipis is especially good as it is quicker growing than some others and will grow in more swampy areas
4.	*Dracontomelon* spp. Anacardiaceae	Sengkuang or Assam - Assam	tree	Top exclusively fruit source for orang utans *D. costatum* (smaller fruits) and *D. dao* (larger fruits) are consumed in Kinabatangan
5.	*Neolamarckia cadamba* Rubiaceae	Laran	tree	This quick growing species is not only important as a food source (fruit, cambium) it is the most preferred nesting tree species for orang utans in degraded habitat so it is of key value to restoration
6.	*Xanthophllium* spp. Polygalaceae	Minyak beruk	tree	Leaves, shoots and fruits are consumed
7.	*Lophopyxis maingii* Celastraceae	Akar tatu	liana	Leaves, shoots, fruits and cambium are consumed
8.	*Gnetum gnemoides* Gnetaceae	Akar Gnetum	liana	Fruits, leaves, shoots and cambium are consumed.
9.	*Eugenia cerassifimis* (is just one of many) Myrtaceae	Obah merah	tree	Fruits in order of frequency consumed – Obah merah > Obah putih > Obah nasi Obahs generally fruit at least once a year in the degraded forests of the Kinabatangan. Note: Obah jangkang (*Syzgium fastigiatum*) is often found in nurseries but it is not as important a food species for orang utans– Obah jangkang is used as a nest species, however. *Glochidion borneensis* - fast growing and and will grow near rivers, but not in standing water
	Dimorphocalyx murinus (is just one of many) Euphorbiaceae	Obah putih	tree	
	Glochidion borneensis Phylianthaceae	Obah nasi	tree	
10.	*Nauclea orientalis* Rubiaceae	Bangkal daun besar	tree	Many community nurseries do stock Bangkal daun besar. This species does well when in flood prone areas based on HUTAN experience. The other two Bangkal species at left do not do as well Bangkal daun besar in flooded areas.
	Nauclea subdita Rubiaceae	Bangkal Ais Krem/Bangkal Kuning	tree	
	Ludikea borneensis Rubiaceae	Bangkal Merah	tree	
11.	*Bauhinia borneensis* Leguminosae	Akar Tapak kerbau	liana	Leaves, shoots, fruits, cambium are consumed.
12.	*Symplocos fasciculate* Symplocacea	Jiak	tree	Leaves, shoots, fruits, flowers - this is one of the few species that orang utans have been observed to also eat mature leaves
13.	*Bridelia stripularis* Eurphorbiaceae	Balatotan	liana	Fruits, leaves, flowers are consumed.

	Scientific	Malay	Type	Notes
14.	*Madhuca* sp *Pauteria cf malaccensis* - Sapotaceae	Nyatoh Nyatoh tipu	tree	Fruits, leaves, cambium are consumed.
15.	*Pterospermum elongatum* Malvaceae	Bayur	tree	This species is not much used as a food source by orang utans but it along with Laran the predominate nest species selected by orang utans in degraded habitats - since orang utans spend up to 11 hours a day in a nest in a tree this species is an critical component to effective habitat restoration for them.
16.	*Cananga odorata* Annonaceae	Bunga gadong	tree	Fruits and leaves are consumed.
17.	*Entada reheedii* Leguminosae	Akar Bantal Pipit	tree	Seeds - often found on river banks are consumed.
18.	*Dimocarpus longan* - (besar) *Dimocarpus fumatus* - (kecil) Sapindaceae	Mata Kucing	tree	Fruits and cambium are consumed.
19.	*Sandoricum koetjape* Meliaceae	Sentul Hutan	tree	Fruits are consumed.
20.	*Microcos crassifolia* Tilaceae	Kerodong damaak damak	tree	Fruits are consumed
21	*Uvaria surgonensis* Annonaceae	Akar pisang-pisang	liana	Fruits are consumed.
22.	*Maranthes corymbosa* Chysobalanaceae	Bengkawang	tree	Flowers are consumed
23.	*Mallotus muticus* Euphorbiaceae	Mallotus Paya	tree	Fruit, leaves, cambium are consumed
24.	*Colona sirratifolia* Tiliaceae	Lamba	tree	Cambium is consumed - This is also a species that grows readily in flooded areas. It is used sometimes as a nest species.
25.	*Vitex pinnata* Lamiaceae	Kulimpapa	tree	Fruit and flowers are consumed
26.	*Poikilospermum* sp Urticaceae	Seringkalang	liana	Fruit, leaves, flowers, cambium are consumed

Eating *Spatholobus* spp. leaves

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