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CHAPTER 14

Assessing the conservation status of the Bornean orangutan

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Abstract: Bornean orangutan (*Pongo pygmaeus*) represents one of Asia's most iconic and critically endangered great apes, with Sabah and Sarawak hosting vital populations that require integrated approaches to harmonise conservation with sustainable development. This paper attempts to provide a comprehensive review of the status of orangutans across both states based on published papers, field studies, and conservation initiatives to present an updated assessment of their distribution and population. Current published information suggests a minimum of 13,000 orangutans in Sabah and Sarawak, with 80 – 90% occurring within protected areas. This paper also outlines the conservation challenges and their underlying factors, including habitat conversion, illegal wildlife activities, and forest fires, among others. Case studies from key conservation sites including protected areas and community -managed areas illustrate both successful interventions and ongoing challenges. These examples demonstrate diverse approaches ranging from habitat protection and restoration to conflict mitigation and ecotourism development. Critical opportunities for enhanced conservation include enforcement capacity, landscape connectivity initiatives, local community partnerships, and integrated land-use planning and cross-sectoral and inter-state collaboration between Sabah and Sarawak. Building upon significant conservation efforts already undertaken by both state governments, sustained and coordinated action across governmental, private sector, non-governmental organizations, and local communities remain essential to ensure the long-term survival of the Bornean orangutan for future generations.

INTRODUCTION

Orangutans are one of Asia's most iconic great apes and are endemic to the islands of Borneo and Sumatra. Three distinct species are currently recognised: the Bornean orangutan (*Pongo pygmaeus*), Sumatran orangutan (*Pongo abelii*), and the more recently described Tapanuli orangutan (*Pongo tapanuliensis*) (Ancrenaz *et al*. 2024; Nowak *et al*. 2024; Singleton *et al*. 2024). Within Borneo, conservation geneticists further recognise three subspecies based on their geographical distribution: *P. p. morio* in northeastern Borneo including Sabah, *P. p. pygmaeus* in northwestern Borneo including Sarawak, and *P. p. wurmbii* in southwestern and central regions of the island (Utami-Atmoko *et al.* 2017; Simon *et al.* 2019; Santika *et al.* 2022). All three orangutan species are listed as Critically Endangered on the IUCN Red List of Threatened Species (Ancrenaz *et al.* 2024). As custodians of important orangutan populations in Sabah and Sarawak, Malaysia plays a vital role in securing the long-term survival of these great apes across their ranges.

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DISTRIBUTION AND POPULATION

Across the two states, Sabah hosts a larger orangutan population distributed across both protected and non-protected areas, while Sarawak's smaller population is more concentrated in specific protected areas, particularly the Batang Ai-Lanjak-Entimau (BALE) Landscape.

Sabah

In the 1980s, a statewide orangutan population survey in Sabah revealed an estimated 9,800 to 21,000 individuals, with a major decline reported during the 1980s-1990s due to large -scale deforestation for cocoa and oil palm plantations (Payne 1988). Twenty years later, aerial surveys conducted in 2002 – 2003 estimated Sabah's total orangutan population at approximately 11,000 individuals, which showed a minimum of 35% population decline from earlier estimates. Subsequently, with the exhaustion of Sabah's timber combined with the slowing down of forest conversion for agriculture and improved forest practices in the next 15 years, the species has remained at about 10,300 orangutans. Surveys conducted between 2014 – 2017, which covered 63% of previously surveyed areas, confirmed this population estimate (Simon *et al.* 2019).

Given these recent numbers and the additional 1,159 orangutans from Ancrenaz *et al.* (2005), the population is considered stable at about 11,000 individuals. However, orangutan losses may be higher in state land or alienated land, as these statewide surveys have not assessed orangutan numbers in forests outside of forest reserves or state parks. With the expansion of protected areas driven by the Sabah Government's goal of securing 30% of its landmass as Totally Protected Area (TPAs) by 2025, about 80% of the orangutan populations in Sabah are now within protected areas.

Sarawak

Batang Ai National Park and Lanjak-Entimau Wildlife Sanctuary are home to 90% of the orangutans in Sarawak. Nest count surveys conducted between 2003 and 2007 at the core orangutan habitats of this Batang Ai-Lanjak-Entimau (BALE) Landscape provided an estimate of 1,984 orangutans with a 95% confidence interval of 1,175 to 2,582 individuals (Pandong *et al.* 2018). Subsequently, nest count surveys conducted at seven study sites outside of protected areas in Sarawak resulted in a combined estimate of 355 orangutans with a 95% highest density interval of 135 to 602 individuals (Pandong *et al.* 2018). One of the orangutan habitats located in an area outside of established protected areas is the Ulu Sungai Menyang Conservation Area. The orangutan population in this approximately 140 km^2 area was estimated at 167 individuals in 2025 (Ling 2025). Beyond the BALE Landscape, orangutans are also present in the Sedilu-Sebuyau-Lesong Landscape, situated about 130 km west of Lanjak–Entimau Wildlife Sanctuary. However, the population size and viability of this group is still uncertain (Ling 2023).

HABITAT ECOLOGY

Habitat types

Habitat requirements in Sabah and Sarawak both emphasise lowland dipterocarp and peat swamp forests with high canopy connectivity. Studies in Sabah by Davies *et al*. (2017) using light detection and ranging (LiDAR) and drone surveys reveal that orangutans preferentially move through areas with tall, closed canopies. However, this preference does not preclude their use of open or fragmented habitats, as growing evidence indicates that orangutans are more terrestrial than previously assumed and can persist in heavily degraded landscapes, including areas with discontinuous canopy cover and even oil palm plantations (Ancrenaz *et al.* 2014; Gregory *et al.* 2014).

In the multiple-use landscapes of Sabah, orangutan distribution correlates strongly with the presence of key food sources such as strangler figs, indicating that forest quality and resource availability shape ranging patterns (Milne *et al.* 2021). This finding is supported in sustainably managed logged forests in Deramakot and Tangkulap, where aerial nest surveys show that large populations persist in these forest reserves, while fragmented populations in eastern Sabah surrounded by oil palm have declined (Simon *et al.* 2019). These findings underscore the importance of continuous forest blocks for long-term viability. However, it is increasingly recognised that orangutans are highly adaptable and are actively learning to cope with intense forest degradation and fragmentation. Individual orangutans have been documented roaming and living in oil palm-dominated landscapes, representing a critical dimension of their contemporary ecology that conservation strategies must account for (Ancrenaz *et al.* 2014; Gregory *et al.* 2014). In Sarawak, wild populations are now largely confined to the BALE Landscape and smaller peat swamp fragments of the Sedilu-Sebuyau-Lesong Landscape (Tisen and Silang 2016).

Ranging patterns

Orangutan ranging behaviour reflects semi-solitary ecology, but they have shown to change this pattern when their habitat is disturbed. In intact forests, females maintain stable home ranges overlapping with males, while in fragmented habitats, individuals increasingly use small forest patches and even oil palm mosaics for movement, though such behaviour elevates mortality risk (Singleton *et al.* 2009; Seaman *et al.* 2025). Long-term monitoring in Deramakot shows density fluctuations linked to logging cycles, yet well managed forests can sustain orangutans if hunting is controlled (Simon *et al.* 2019). Overall, orangutans in Sabah and Sarawak have been observed to persist in selectively logged forests and mixed-use landscapes (Ancrenaz *et al.* 2010), provided structural canopy integrity and connectivity are maintained, and anthropogenic threats minimised (Davies *et al.* 2017; Pandong *et al.* 2019; Simon *et al.*2019).

THREATS TO SURVIVAL

Bornean orangutans in Sabah and Sarawak face mounting challenges to their survival due to ongoing habitat conversion, increasing illegal wildlife activities and forest fires, underscoring the urgency to address both current and emerging risks.

Habitat conversion

Sabah has had the highest deforestation rates in Borneo between 1973 – 2010, particularly for agriculture expansion and tree plantation development (Gaveau *et al.* 2014). In the 1980s, more than 50% of Sabah was logged, with reports of a few orangutans killed during tree felling and large numbers displaced to other undisturbed areas (Davies 1986). However, it was expected that larger numbers of orangutans declined during the vast agricultural expansion between the 1980s and 2000s (Ancrenaz *et al.* 2005). In the past 20 years (2002 – 2024), 12% of natural forests were lost and it was mainly caused by oil palm expansion. This land-use change has contributed to the fragmentation of orangutan habitats and is associated with estimated population reductions of up to 30% in some areas since 2001 (Voigt *et al.* 2018). At present, oil palm plantations cover about 20% of Sabah's landmass and forests account for 63.3% of Sabah's landmass, of which 26.4% is designated as TPA (Sabah JASPO 2025).

At present, approximately 6,000 km^2 of commercial forest reserves have been allocated for the establishment of industrial tree plantation (ITP) (Sabah Forestry Department 2022). About 2,000 km^2 were deemed unsuitable for planting, leaving 4,000 km^2 for development by 2036. As of 2022, about 1,600 km^2 have been planted. This initiative is helping to reduce logging pressure in the natural forests, but a substantial portion of the

planned ITP zones also overlap with known orangutan habitats. While orangutans have demonstrated resilience in tree plantation landscapes, it is not known whether the populations will be viable in the long run (Meijaard *et al.* 2010; Wiggs and Cunningham 2022). Another emerging threat to orangutan habitat in Sabah is large-scale mining exploration with concessions overlapping within TPAs. However, the impact of mining on orangutans there are currently not precisely known.

In Sarawak, land-use changes have primarily resulted from regulated logging activities, the establishment of industrial plantations such as oil palm and pulpwood, and associated infrastructure development (Pandong *et al.* 2019; C. Chin, pers. comm). These initiatives have led to the concentration of wild orangutans within the BALE Landscape and smaller peat swamp areas (Tisen and Silang 2016). While ongoing landscape fragmentation presents challenges to ecological connectivity, the Sarawak Government remains committed to implementing zero-loss policies and sustainable management practices to safeguard remaining habitats (Pandong *et al.* 2019; A. Aimran, pers. comm).

Illegal wildlife activities

Poaching and illegal trade continue to pose significant conservation challenges for orangutans in Malaysian Borneo, though comprehensive data remain limited. Research by Sherman *et al.* (2022) in Indonesian Borneo indicates that orangutan mortality from hunting may surpass the 1 – 2% annual threshold that jeopardizes population sustainability, while law enforcement rates are currently low, with only 0.9% of reported cases resulting in convictions.

In the 1980s, hunting of orangutans was reported in the west and south-west regions of Sabah, with some local communities engaging in this activity for subsistence, and for 'sport' killing using shotguns in incidences involving timber camp employees (Davies 1986). At present, strengthened legal protections, heightened public awareness, and limited expansion of oil palm plantations in recent years have contributed to a significant decline in orangutan killings. Nevertheless, continued vigilance is required, as unreported incidents may still occur and isolated cases of illegal pet keeping have been observed over the past decade (Simon 2022). In Sarawak, the gradual decline of traditional taboos against hunting orangutans has led to instances of opportunistic hunting, particularly in areas where law enforcement and community engagement require further strengthening (Pandong *et al.* 2019).

Forest fires

Fire risk is lower in Sabah and Sarawak compared to Kalimantan, but degraded forests in Sabah and peat swamp areas in Sarawak remain vulnerable during drought years. Reviews by Chew *et al.* 2022 on fire management in Malaysia highlight that episodic fires—often linked to land clearing—degrade habitat quality and exacerbate fragmentation, indirectly affecting wildlife survival by reducing food resources and forcing displacement. While large-scale fire events have not been as devastating in Malaysian Borneo as in Central Kalimantan, the growing incidence of fires and regional haze linked to human activities such as land clearing poses increasing long-term health risks to orangutans and other wildlife (Erb *et al.* 2018).

Other emerging threats

Human-wildlife conflict increasingly occurs as orangutans venture into agricultural areas, necessitating community-based mitigation strategies (Abas *et al.* 2025). Infrastructure development, including roads and mining activities, facilitates access to previously remote habitats (Santika *et al.* 2022). Forest fragmentation continues to isolate populations, reducing genetic diversity and compromising long-term viability (Bruford *et al.* 2010; Santika *et al.* 2017).

In addition, several emerging risks in anthropogenic landscapes also warrant urgent attention. Orangutans navigating human-dominated environments face heightened exposure to diseases, road kills, and conflict with domestic dogs and other animals, while the destruction of natural bridges above rivers through logging activities and the creation of artificial barriers such as drainage canals further impede movement and accelerate functional isolation (Lanjouw *et al.* 2024). Translocation, although widely practiced as a conservation intervention, has also been increasingly recognised as potentially deleterious to the long-term sustainability of wild populations, as released individuals may struggle to integrate into existing social structures and compete for limited resources (Sherman *et al.* 2025).

Addressing these interconnected and emerging threats through integrated conservation planning, enhanced enforcement, improved landscape connectivity, and broad stakeholder collaboration is essential to ensure the long-term survival of orangutans in both states.

CONSERVATION MEASURES TAKEN

Conservation efforts in Sabah and Sarawak have progressed to address the interwoven threats highlighted above through three key interventions: habitat protection, conflict mitigation and community partnerships, and habitat restoration for connectivity.

Habitat protection

Both states have expanded TPAs to safeguard orangutan habitats. In Sabah, Bukit Piton Forest Reserve exemplifies successful habitat protection and restoration. Once degraded, it was reclassified as a Class I Protection Forest in 2012 and rehabilitated through partnerships between the Sabah Government, the private sector, and non-governmental organisations (Mansourian *et al.* 2020). Today, it supports nearly 400 orangutans, with ongoing monitoring via aerial nest surveys to ensure long-term viability (Fong 2024). The Sarawak Government has set aside over 2,340 km^2, including Lanjak-Entimau Wildlife Sanctuary and Batang Ai National Park, which together support 90% of the state's estimated 2,000 wild orangutans (Pandong *et al.* 2019). Patrol efforts under the United Nations Development Programme and Global Environment Facility (UNDP-GEF)'s Global Wildlife Programme Malaysia have strengthened boundary security and law enforcement particularly at the Sedilu -Sebuyau-Lesong Landscape (Aubrey 2025), complemented by community-inclusive strategies such as the recruitment of local community members and army veterans as Wildlife Guardian Rangers (DayakDaily 2024).

Conflict mitigation and local community partnerships

Practical solutions in both states emphasise co-existence and livelihood diversification. In Sabah's Kinabatangan floodplain, HUTAN has pioneered community-based wildlife wardens and conflict mitigation squads, alongside ecotourism ventures that provide economic benefits to participating communities (Sinajin 2019). As orangutans are increasingly encountered in oil palm plantations and local orchards, occasional conflicts with landowners do arise. However, research by Ancrenaz *et al.* (2025) shows that the actual damage to oil palms was often minimal. Despite this, negative perceptions toward orangutans persist among some landowners, which can fuel intolerance and lead to retaliatory actions, including increased killing. Addressing these perceptions through community engagement, mitigating human-orangutan interactions, and demonstrating the economic value of co-existence is critical for fostering sustainable solutions that benefit both people and orangutans.

In Sarawak, the Ulu Sungai Menyang Conservation Area showcases inclusive conservation, where indigenous communities participate in monitoring and habitat management. These partnerships have stabilised local populations and fostered stewardship, demonstrating that integrating traditional knowledge with scientific monitoring can yield measurable outcomes (Ling 2025).

Habitat restoration and landscape connectivity
Restoration initiatives target fragmented landscapes to reconnect orangutan habitats. In Sabah, the Bukit Piton project restored 24 km^2 of degraded forest, creating corridors that enable orangutan movement and reduce isolation (Mansourian *et al.* 2020). Similar efforts in Mount Wullersdorf-Ulu Kalumpang Forest Reserves have earned global recognition for applying best practices in ecological connectivity (Lee 2025).

In Sarawak, as development in the form of road infrastructure grows deeper through previously inaccessible forests, establishing ecological connectivity for orangutan habitat becomes critical. One such potential area is a 3.89 km^2 corridor linking Gunung-Lesong and Ulu Sebuyau National Parks. Community conservation, co-management and community-led initiatives would be ideal but needs to be coordinated and executed well so that all stakeholders are on a level playing field (C. Chin, pers. comm).

FURTHER ACTION NEEDED

Enhancing law enforcement initiatives and spatial planning
Strengthening enforcement requires targeted investment in inter-agency coordination, ranger capacity, and surveillance technology using the Spatial Monitoring And Reporting Tool (SMART) approach (Pandong *et al.* 2019). Research highlights that low conviction rates for wildlife crimes undermine deterrence, so resources should focus on improving investigative capacity and judicial follow-through (DayakDaily 2025). Both states have recommended the integration of habitat connectivity into spatial planning by using ecological modelling to identify priority corridors linking TPAs. Embedding these measures into state development plans ensures long-term protection beyond project-based interventions.

Cross-sectoral coordinated actions
Orangutan conservation is a collective effort and the stakeholders involved span beyond forestry and wildlife agencies (Morgans *et al.* 2019). Sabah's experience with the Bagahak Ecological Corridor restoration that was achieved through partnerships between the Tabin Wildlife Reserve, NGOs, and private sector, demonstrates how corporate engagement can accelerate habitat recovery (Miwil 2023). Scaling such models requires formal frameworks for public-private partnerships and incentives for plantation companies to maintain riparian buffers and wildlife corridors. In Sarawak, community-led initiatives in the Ulu Sungai Menyang Conservation Area show how ecotourism and participatory monitoring can align livelihoods with conservation goals (Ling 2025).

Coordinated monitoring platforms and shared databases between agencies in Peninsular Malaysia, Sabah and Sarawak such as under the UNDP-GEF Global Wildlife Programme, would enhance the protection of iconic Malaysian wildlife species including Bornean orangutans by strengthening the capacity to prevent, combat and investigate inter-state wildlife crimes (Aubrey 2025; Zainal 2025). The way forward hinges on embedding orangutan conservation into enforceable policies, financing mechanisms, and cross-sector partnerships, while fostering community stewardship and inter-state collaboration to secure habitat connectivity and long-term population viability.

Promoting co-existence between people and orangutans
Securing the long-term future of orangutans in Sabah and Sarawak requires a fundamental shift in how agricultural and forest landscapes are planned and managed. Agricultural practices must be adapted to accommodate orangutan survival within productive landscapes, including through agroforestry to restore habitat connectivity and food resource availability (Meijaard *et al.* 2023). Priority should be given to retaining and restoring fragmented forest

patches, particularly those occupied by resident females whose home ranges anchor local population continuity (Ancrenaz *et al.* 2021). In addition, robust best management practice frameworks should be developed to guide industries operating in wildlife-inhabited areas, alongside proactive conflict mitigation strategies (Massingham *et al.* 2023a).

Moreover, long-term population monitoring and rigorous evaluation of conservation interventions must be embedded into state-level wildlife management plans to ensure evidence-based and adaptive decision-making (Ancrenaz *et al.* 2021). Crucially, conservation outcomes will only be sustained if local livelihoods are meaningfully improved. Expanding wildlife-based tourism and providing equitable economic incentives in orangutan-inhabited areas can transform local communities into active conservation stewards. Finally, underpinning all these efforts, promoting positive human wellbeing is recognised as a pragmatic and inclusive way forward to co-exist with one of the world's most iconic great apes (Massingham *et al.* 2023b).

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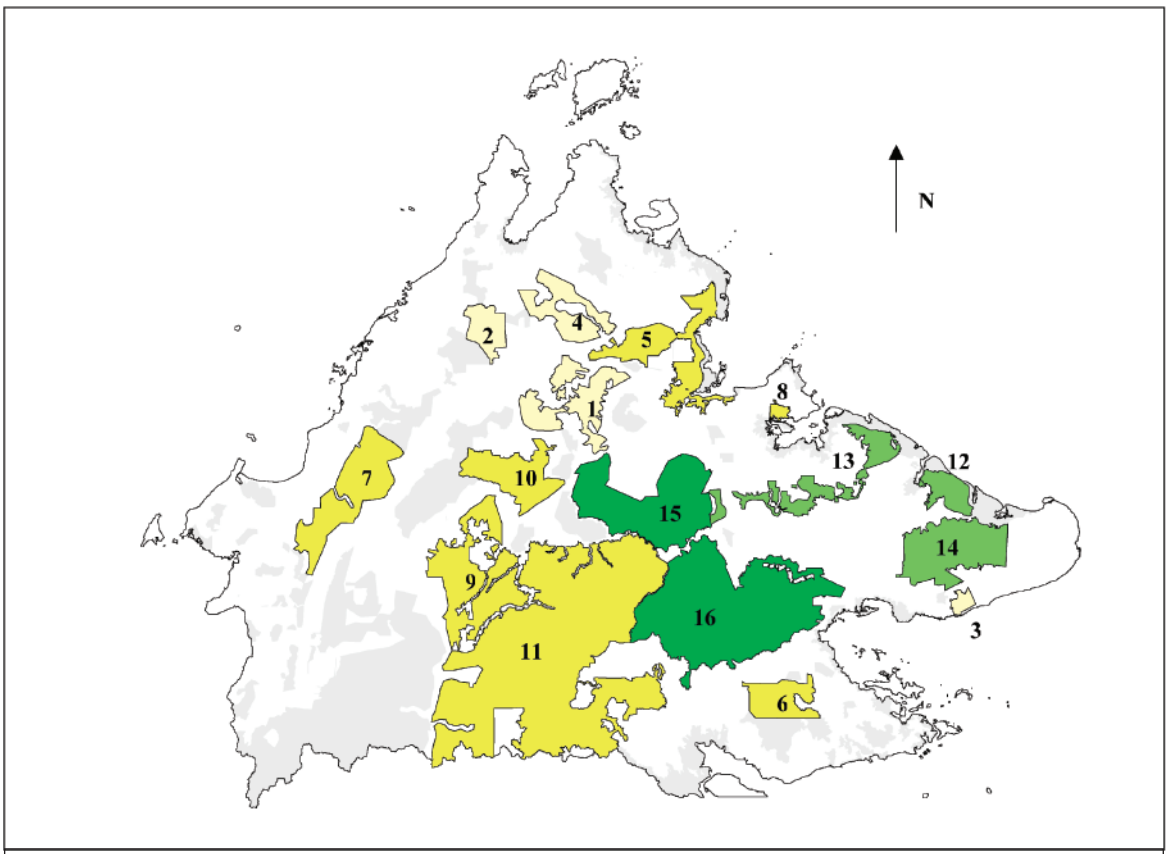
SUPPLEMENTARY MATERIALS

Appendix 1. Map of orangutan distribution and population groups in Sabah based on the 2002 - 2003 aerial survey by Ancrenaz *et al*. (2005).

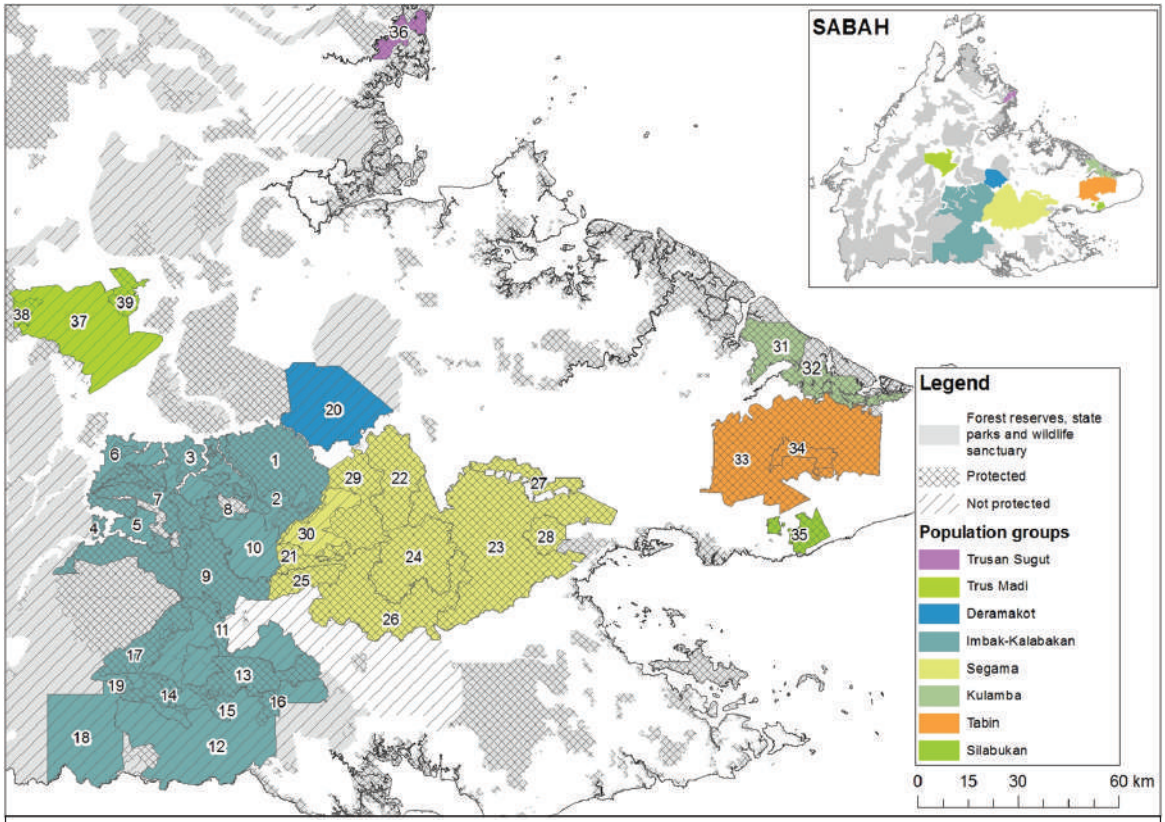


Population

1	Ulu Tungud	9	Pinangah
2	Mount Kinabalu	10	Trus Madi
3	Silabukan	11	Kuamut
4	Lingkabau	12	Kulamba
5	Bongaya	13	Kinabatangan
6	Ulu Kalumpang	14	Tabin
7	Crocker Range	15	Upper Kinabatangan
8	Sepilok	16	Segama

Forest areas without orangutans
<100 individuals
100 – 500 individuals
500 – 1500 individuals
>1500 individuals

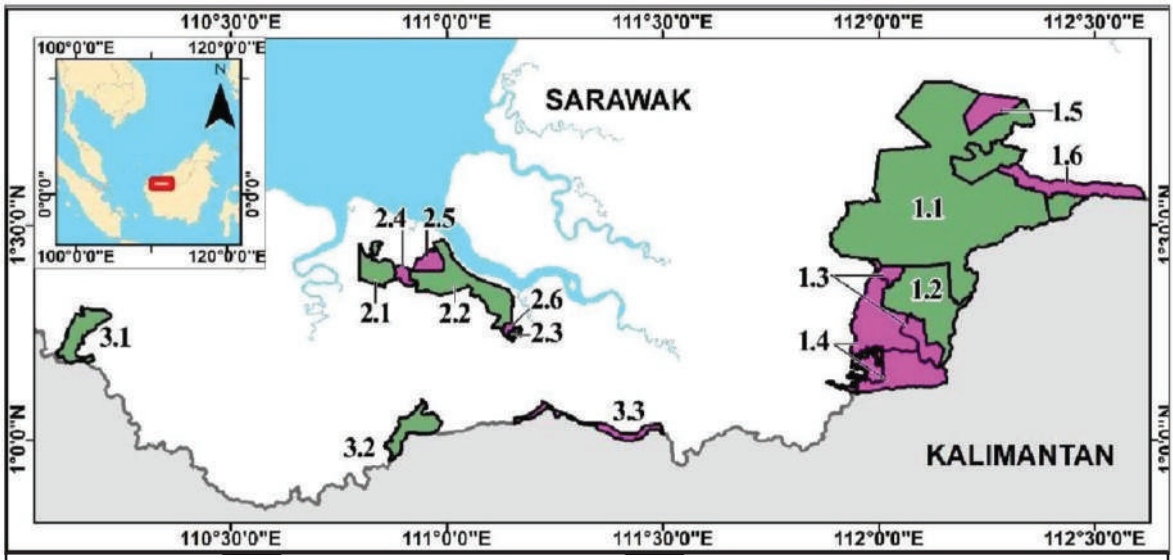
Appendix 2. Map of orangutan distribution and population groups in Sabah based on the 2014 - 2017 aerial survey by Simon *et al.* (2019).



Forest Reserve

1	Northern Kuamut (West)
2	Kuamut (West)
3	Sg Imbak Bufferzone
4	Sg Lulunguyon
5	Sg Pinangah
6	Sg Ayop
7	Imbak Canyon
8	Sg Imbak
9	Gunung Magdalena (West)
10	Gunung Rara
11	Gunung Rara Corridor
12	Kalabakan
13	Sg Tiagau and Ext
14	Tambulanan
15	Sg Anjeran Jemut
16	Sg Sumagas
17	Maliau Buffer
18	Sapulut
19	Nurod-Urod
20	Deramakot
21	Northern Gunung Bera
22	Malua
23	Ulu Segama
24	Danum Valley
25	Gunung Magdalena (East)
26	Gunung Louisa
27	Bukit Piton
28	Sg Taliwas
29	Northern Kuamut (East)
30	Kuamut (East)
31	Kulamba
32	Kuala Meruap
33	Tabin
34	Gunung Hatton
35	Silabukan
36	Trusan Sugut
37	Trus Madi
38	Nuluhon Trus Madi
39	Bukit Taviu

Appendix 3. Map of sites with conservation interest for orangutans in Sarawak as adapted from the study by Pandong *et al*. (2019).



Gazetted areas Areas proposed for protection

1. Core habitats	1.1	Lanjak-Entimau Wildlife Sanctuary (LEWS)
	1.2	Batang Ai National Park (BANP)
	1.3	Proposed BANP extensions
	1.4	Ulu sungai Menyang Conservation Area
	1.5	Proposed LEWS extension
	1.6	Ta Ann Group's Ulu Pasin Concession Area
2. Remnant sites	2.1	Sedilu National Park
	2.2	Ulu Sebuyau National Park
	2.3	Gunung Lesong National Park
	2.4	Proposed Ulu Sebuyau-Sedilu Corridor
	2.5	Proposed Ulu Sebuyau extension
	2.6	Proposed Ulu Sebuyau-Gunung Lesong connector
3. Historical ranges	3.1	Bungo Range National Park
	3.2	Sabal National Park
	3.3	Proposed Klingkang Range National Park