PUBLIC PREFERENCES FOR CONSERVATION OF ENDANGERED BORNEO PYGMY ELEPHANT IN SUKAU KINABATANGAN, SABAH, MALAYSIA

By

SHAFINAZ BINTI NAIM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

December 2021

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DEDICATION

To my parents,
Naim Daud & Atistah Utoh
The reasons of what I become today
Thanks for your great support and continuous care.

and

To Mohd. Suhaimi,
My amazing husband,
Whose sacrificial care for me and our children
made it possible for me to complete this work
and to our two sons
Muhammad Rizqa Al Fateh, Muhammad Furqan Al Fattah
Who are indeed a treasure from the Allah S.W.T

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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December 2021

Chairman : Associate Professor Zaiton Samdin, PhD
School : Business and Economics

The recent deaths of Pygmy elephants in Sabah have raised concerns about the state's reputation as a nature conservationist. The elephants are becoming increasingly exposed to humans as forests are cleared for development, potentially leading to more conflict between humans and the animals. With only between 1,500 and 2,000 Pygmy elephants left in the wild, conservation efforts are crucial.

To protect the Pygmy elephants in Sukau Kinabatangan, a study was conducted to assess public preferences and conservation values for the species. The study objectives: i) to estimate the willingness to pay (WTP) value and preferences for conservation management of Borneo Pygmy elephants, ii) to examine the influence of wildlife value orientation on risk perception, and iii) to investigate the mediation effects of specific positive beliefs between wildlife value orientation and risk perception.

This study used the Choice Experiment (CE) method and the Structural Equation Modeling with Partial Least Square (SEM-PLS) to assess the responses of 400 Sukau residents and 401 visitors. The CE method was used to estimate the WTP value and preferences for conservation management of the Borneo Pygmy Elephant, and the SEM-PLS was used to examine the influence of wildlife value orientation on risk perception and the mediation effects of specific positive beliefs between wildlife value orientation and risk perception.

This study found that local people most preferred attributes is to increase the number of populations to 3,000 with the marginal value of RM4.55 and visitors preferred systematic fencing as the most preferred attribute with the marginal values of RM19.53.

This study also found that domination positively influenced risk perception for both local people and visitor respondents. However, the results did not find any support between mutualism and risk perceptions for visitor samples. This indicates that domination wildlife value orientation was related to risk perception in both groups of respondents.

Furthermore, the mediation effects of specific positive beliefs between wildlife value orientation and risk perception were also investigated. The study found that mutualism positively influenced specific positive beliefs, specific positive beliefs negatively influenced risk perceptions, domination positively influenced risk perceptions, and domination negatively influenced risk perceptions mediated by specific positive beliefs of Borneo Pygmy elephants.

The study recommends policy changes based on the results. As the public is willing to pay for the conservation of Pygmy elephants, policymakers could consider charging a conservation fee in the future based on the most preferred attributes selected by locals and visitors. The study also emphasizes the importance of taking into account human orientation and beliefs when designing conservation programs. The findings suggest that policymakers should design conservation programs that can create more positive perceptions and beliefs about the Borneo Pygmy elephant to avoid extinction in the future.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KEUTAMAAN AWAM UNTUK PEMULIHARAAN SPESIS TERANCAM GAJAH PYGMY BORNEO DI SUKAU KINABATANGAN, SABAH, MALAYSIA

Oleh

SHAFINAZ BINTI NAIM

Disember 2021

Pengerusi : Profesor Madya Zaiton Samdin, PhD
Sekolah : Perniagaan dan Ekonomi

Kematian terbaru Gajah Pygmy di Sabah telah menimbulkan kebimbangan tentang reputasi negeri tersebut sebagai konservasionis alam. Gajah-gajah ini semakin terdedah kepada manusia seiring dengan pembersihan hutan untuk pembangunan, yang berpotensi meningkatkan konflik antara manusia dan binatang. Dengan hanya terdapat antara 1,500 hingga 2,000 Gajah Pygmy yang tinggal di habitat liar, usaha konservasi adalah sangat penting.

Untuk melindungi Gajah Pygmy di Sukau Kinabatangan, sebuah kajian telah dijalankan untuk menilai keutamaan masyarakat dan nilai-nilai konservasi bagi spesies ini. Objektif kajian ini i) untuk menganggar nilai kesediaan membayar (WTP) dan keutamaan pengurusan konservasi bagi Gajah Pygmy Borneo, ii) untuk memeriksa pengaruh orientasi nilai hidupan liar terhadap persepsi risiko dan iii) untuk menyiasat kesan pengantaraan kepercayaan positif tertentu antara orientasi nilai hidupan liar dan persepsi risiko.

Kajian ini menggunakan kaedah Choice Experiment (CE) dan Structural Equation Modeling with Partial Least Square (SEM-PLS) untuk menilai respons daripada 400 penduduk Sukau dan 401 pelawat. Kaedah CE digunakan untuk menganggar nilai kesediaan membayar dan keutamaan pengurusan konservasi bagi Gajah Pygmy Borneo, manakala SEM-PLS digunakan untuk menyelidiki pengaruh orientasi nilai hidupan liar terhadap persepsi risiko dan kesan pengantaraan kepercayaan positif tertentu antara orientasi nilai hidupan liar dan persepsi risiko.

Kajian menemui bahawa penduduk tempatan paling mengutamakan peningkatan jumlah populasi hingga 3,000 dengan nilai margin RM4.55, manakala pengunjung paling mengutamakan pagar sistematik sebagai atribut paling diingini dengan nilai margin RM19.53.

Kajian juga menemui bahawa dominasi secara positif mempengaruhi persepsi risiko untuk kedua-dua kumpulan responden tempatan dan pelawat. Walau bagaimanapun, hasil kajian tidak mendapati sebarang sokongan di antara mutualisme dan persepsi risiko bagi sampel pelawat. Ini menunjukkan bahawa orientasi dominasi nilai hidupan liar berkaitan dengan persepsi risiko dalam kedua-dua kumpulan responden.

Selain itu, kesan pengantaraan kepercayaan positif tertentu antara orientasi nilai hidupan liar dan persepsi risiko juga diselidiki. Kajian menemui bahawa mutualisme secara positif mempengaruhi kepercayaan positif tertentu, kepercayaan positif tertentu secara negatif mempengaruhi persepsi risiko, dominasi secara positif mempengaruhi persepsi risiko, dan dominasi secara negatif mempengaruhi persepsi risiko melalui kepercayaan positif tertentu bagi Gajah Pygmy Borneo.

Kajian mengesyorkan perubahan dasar berdasarkan keputusan. Memandangkan orang ramai sanggup membayar untuk pemuliharaan gajah Pygmy, penggubal dasar boleh mempertimbangkan untuk mengenakan yuran pemuliharaan pada masa hadapan berdasarkan sifat yang paling disukai yang dipilih oleh penduduk tempatan dan pelawat. Kajian ini juga menekankan kepentingan mengambil kira orientasi dan kepercayaan manusia semasa mereka bentuk program pemuliharaan. Penemuan menunjukkan bahawa penggubal dasar harus mereka bentuk program pemuliharaan yang boleh mewujudkan persepsi dan kepercayaan yang lebih positif tentang gajah Pygmy Borneo untuk mengelakkan kepupusan pada masa hadapan.

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Alhamdulillah, thank you Allah the Almighty God for giving me the strength and continuous determination to complete this study. Completing this study has been a challenging and arduous task to me.

I would not have been able to complete this study without the advice, knowledge and support by my supervisory committee members. In particular, I would like to acknowledge and extend my heartfelt gratitude to the chairman of my thesis supervisory committee, Associate Professor Dr. Zaiton Samdin for her excellent supervision, patience, understanding, insightful comments, intellectual support, motivation and guidance. Your supervision is simply exemplary.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

Zaiton binti Samdin, PhD
Associate Professor
School of Business and Economics
Universiti Putra Malaysia
(Chairman)

Shafique Fahmi bin Ahmad Sidique, PhD
Professor
School of Business and Economics
Universiti Putra Malaysia
(Member)

Diana Emang, PhD
Senior Lecturer
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 8 September 2022

Declaration by Members of the Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature: _____
Name of Chairman of Supervisory Committee: Associate Professor Dr. Zaiton Samdin

Signature: _____
Name of Member of Supervisory Committee: Professor Dr. Shafique Sidique

Signature: _____
Name of Member of Supervisory Committee: Dr. Diana Emang

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AREAS	Asian Rhino and Elephant Action Strategy
BES	Bornean Elephant Sanctuary
BORA	Borneo Rhino Organization
BPE	Borneo Pygmy elephant
BV	Bequest Value
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CE	Choice Experiment
CM	Choice Modelling
CR	Critically Endangered
CR	Contingent Ranking; Composite Reliability
CRt	Contingent Rating
CV	Compensating Variation
CVM	Contingent Valuation Method
DGFC	Danau Girang Field center
DUV	Direct Use Value
EN	Endangered
EV	Existence Value; Equivalent Variations
GOF	Goodness-of-Fit
HEC	Human-Elephant Conflicts
HP	Hedonic Pricing
HTMT	Heterotrait-Monotrait Ratio of Correlations
HUTAN	Kinabatangan Orang-Utan Conservation Project
IUCN	International Union for Conservation of Nature

IUV	Indirect Use Value
KWS	Kinabatangan Wildlife Sanctuary
MPOC	Malaysian Palm Oil Council
MPOWCF	Malaysian Palm Oil natural world Conservation Fund
MRS	Marginal Rate of Substitution
mtDNA	mitochondrial DNA
MU	Marginal Utility
MWHCB	Malua wildlife Habitat Conservation Bank
MxL	Mixed Logit Model
NGO	Non-Governmental Organisation
NUV	Non Use Value
OECD	Organisation for Economic Co-Operation and Development
OV	Option Value
PC	Pair Comparison
POIC	Palm Oil Industrial Cluster
RUM	Random Utility Models
RUT	Random Utility Theory
SEM	Structural Equation Modelling
SPCE	Stated Preference Choice Experiment
SWD	Sabah Wildlife Department
T&E	Threatened and Endangered Species
TCM	Travel Cost Method
TEEB	The Economics of Ecosystem and Biodiversity
TEV	Total Economic Value
UV	Use Value

VN	Vulnerable
WCE	Wildlife Conservation Enactment
WRU	Wildlife Rescue Unit
WTP	Willingness to Pay
WWF	World Wildlife Fund
TSMP	Tun Sakaran Marine Park
CE	Choice Experiment
MAP	Malaysian Agricultural Park
CL	Conditional Logit Model
MXL	Mixed Logit Model
ESA	Endangered Species Act
WVO	Wildlife Value Orientation
NEP	New Ecological Paradigm
VO	Value Orientation
EC	Environmental Concern
GAC	General Awareness of Consequences
CMT	Conservation Management
IDD	Independently and Identically Distributed
IIA	irrelevant alternatives
MWTP	Marginal willingness-to-pay
ML	Maximum Likelihood
RMSEA	Root-Mean-Square Error of Approximation
SRMR	Standardized Root Mean Square Residual
CFI	comparative fit index
TLI	Tucker Lewis index

NFI	Normed- Fit Index
RNI	Relative Non-centrality fit
CFA	Confirmatory Factor Analysis
AVE	Average Variance Extracted
NOAA	National Oceanic and Atmospheric Administration
EFA	Exploratory Factor Analysis
PCA	Principal Component Analysis
CA	Cronbach's Alpha

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Sabah encompasses a total land area of 73,631 sq km or 28,499 sq mi and 60% of it is forested (Sabah Tourism board[1]) and comprised 10% of the Bornean Island. The beautiful state of Sabah is a home for significant array of flora and fauna (Table 1.1) species as Borneo is the third largest island in the world. According to World Wide Fund for Nature, WWF[2], Borneo Forest is one of the most biodiverse on the planet. The diversities of flora and fauna with an estimation of at least 206 mammal species (44 endemic), 352 residence birds (37 endemic), 112 amphibians, 155 freshwater fish (19 endemic), 15,000 plants (6000 endemic) and more than 400 undiscovered since 1994[3] become the main attraction for tourism sector in Sabah.

Table 1.1 : Diversity and Status of Major Groups of Fauna in Sabah

	Total Number of Species	Total Number of Families
Mammals	206	31
Birds	352	65
Reptiles	215	28
Amphibians	112	6
Freshwater Fishes	155	?
Invertebrates	150,000?	?

(Source : Sabah Biodiversity Outlook, 2020)

The island of Borneo is outstanding for its natural resources and tropical rainforests, giving a perfect common living creature to live in. As part of the Borneo Island, the western part of Sabah is for the most part rocky, containing the three most prominent mountains in Malaysia. The most notable range is the Crocker, which houses a few piles of diverse range from around 1,000 meters to 4,000 meters. In Southeast Asia, Mount Kinabalu is known as the tallest mountain with 4,095 meters of height. Owing to the great diversity of plant species, along with its unique land, geological, and climatic conditions, the Kinabalu National Park has been designated as a world Heritage site in 2000.

[1] http://www.sabahtourism.com/essentials/about-sabah
[2] https://www.worldwildlife.org/places/borneo-and-sumatra
[3] Borneo Trilogy Sarawak: Volume 1

Numerous well-known and lesser-known mammals, as well as an increasing number of new species, have been discovered in the heart of Borneo's tropical forests. These woodlands are home to a diverse range of wildlife, including the Sumatran rhino, Borneo Sun bear, and up to 13 different species of primates, including orang-utans and proboscis monkeys (Sabah Biodiversity Outlook, 2020). One of the most popular attractions in Sabah is Borneo Pygmy elephant in Lower Kinabatangan due to his uniques characteristics.

The Borneo Pygmy Elephant is one of Sabah's most popular animals. Scientists believe that Borneo Pygmy elephants are genetically unique from other Asian elephants for the first time, implying that they may constitute a new subspecies. According to DNA analysis, elephants split from their Asian and Sumatran counterparts some 300,000 years ago. Borneo Pygmy Elephants are well-known around the world due to their smaller stature when compared to Asian elephants in other parts of their habitat. They are found only in the state of Sabah and the northern sections of the Indonesian province of Kalimantan, both of which are located on the island of Borneo (Figure 1.1).

Figure 1.1 : Wildlife in Sabah
(Source : Sabah Travel Guide)

Foreign trade and globalisation have undoubtedly created vast amounts of wealth and lifted millions of people from poverty. Global business expansion, on the other hand, is putting pressure on the Earth's natural assets, namely the ecosystem – the primary source of wealth creation. Nevertheless, extinction had become a major problem faced by most of the countries around the world and is largely known as a global issue (Wallmo and

Lew, 2011). Species extinction and biodiversity loss caused by human activities have surprisingly become critical concerns. As the human population and development increase, so does the threatened biodiversity and the rate of plant and animal extinction (Tilman et al., 2017).

As illustrated in Figure 1.2, deforestation of Borneo was increase from 2002 to 2020. From 2002 to 2020, Malaysia Borneo primary forest loss for about 13% and tree cover loss around 16% (Butler, 2020). This number increase due to logging, transmigration, and oil palm (Butler, 2020). Loss of forest cover will destroy many habitats of Threatened and Endangered species (T&E). Most forest loss is because of nation growth that leads to many projects of development such as subsequent conversion to oil palm (Hearn et al., 2019), road expansion (Sloan et al., 2019) and timber extraction (Hearn et al., 2019). Due to the highest number deforestation, threatened mammal get the highest proportion (Sodhi et al., 2010).

Meanwhile, Wild animals are being forced out of their natural environment as a result of rapid development around the world (Calvert, 2017), with plenty of other wandering into housing estates or towns, town centres, and business premises. For instances, in the five years since 2012, around 2,130 wild animals have died in road accidents. Most of the animals killed are endangered species like tapirs, sun bears, elephants, mountain goats, and tigers. Most of the accidents happened when the animals were trying to cross roads or highways to find shelter, food, mates, and habitats (Bernama, 2017). Near the town of Gua Musang in the Malaysian state of Kelantan in the north, similar things happen. A native Malaysian villager was killed by a tiger, and government rangers had to shoot the animal. Tiger attacks on people are rare, but they have happened in places where people are building near the animals' natural habitat (Agence France-Presse, 2022). Wild animal is classified as either annoyances or pests. Endangered animals will be moved. They will either be killed, culled, or captured and eaten if they are not secured. Wildlife is still the victim of villagers, fisheries, and plantations founded on wild habitats. This was shown by the horrific incident in Tawau[4] in January 2013, when ten pygmy elephants were discovered dead. While signs indicated that they had been poisoned, the mystery remains unsolved to this day.

[4] https://www.thestar.com.my/news/nation/2013/01/29/10-borneo-pygmy-elephants-found-dead/

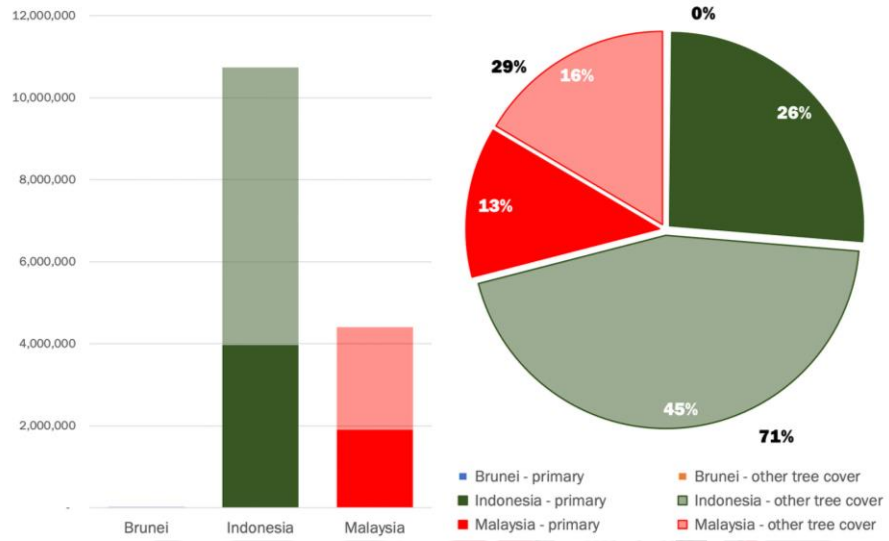

Figure 1.2 : Primary forest and tree cover loss in Borneo, 2002-2019 (hectares)
(Sources : Butler, 2020)

As the Sabah state pushed toward the establishment of a cash-crop estate economy, these issues had an impact on Sabah's Borneo biodiversity (Yan et al., 2011) specifically on threatened and endangered (T&E) species like Borneo pygmy elephant (Gatti et al., 2020). Any species under Critically endangered (CR), Endangered (EN), or Vulnerable (VN) on the IUCN (International Union for Conservation of Nature) Red List or listed in Appendix 1 of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) or listed as protected under Malaysian legislation (federal or state) is characterized as threatened and endangered species. Among the threatened and endangered species in Sabah are Sumatran rhino, Sunda Pangolin, Borneon Orangutan, Banteng and Borneo Pygmy elephant[5] as shown in Table 1.2.

[5] http://www.forest.sabah.gov.my/usm/pdf/HCV%201.2.pdf

Table 1.2 : List of terrestrial mammals (IUCN: Critically Endangered & Endangered) recorded since 2009 to 2020 within USM-SFM project area

No.	Common Name	Family	Scientific Name	WCE	IUCN Red List
1	Sumatran rhinoceros	***Rhinocerotidae***	*Dicerorhinus sumatrensis*	I	Critically Endangered
2	Sunda Pangolin	Manidae	*Manis javanica*	I	Critically Endangered
3	Borneon Orangutan	**Hominidae**	*Pongo pygmaeus morio*	I	Critically Endangered
4	Banteng (Borneon Banteng)	Bovidae	*Bos javanicus*	I	Endangered
5	Baycat (Borneon Bay Cat)	Felidae	*Pardofelis badia*	II	Endangered
6	North Borneo Gibbon	Hylobatidae	*Hylobates muelleri*	II	Endangered
7	Bornean Pygmy Elephant	Elephantidae	*Elephas maximus*	II	Endangered
8	Flat Headed Cat	Felidae	*Felis planiceps*	II	Endangered
9	Otter Civet	Viverridae	*Cynogale bennettii*	II	Endangered
10	Proboscis Monkey	Cercopithecidae	*Nasalis larvatus*	I	Endangered
11	Bearded Pig	Suidae	*Sus barbatus*	III	Vulnerable
12	Bearcat (Binturong)	Viverridae	*Arctictis binturong*	II	Vulnerable
13	Clouded Leopard (Borneon Clouded Leopard)	Felidae	*Neofelis diardi bornensis*	I	Vulnerable
14	Horsfield's tarsier	Tarsiidae	*Tarsius bancanus*	II	Vulnerable
15	Sabah grey langur	**Cercopithecidae**	*Presbytis sabana*	II	Vulnerable
16	Oriental Small Clawed Otter	Mustelidae	*Anoyx cinerea*	II	Vulnerable
17	Pig Tailed Macaque	Cercopithecidae	*Macaca nemestrina*	II	Vulnerable
19	Sambar Deer	Cervidae	*Cervus unicolor*	III	Vulnerable
20	Slow loris	**Lorisinae**	*Nycticebus sp (menagensis & kayan)*	II	Vulnerable
21	Borenon Sun Bear	Canidae	*Helarctos malayanus*	I	Vulnerable
22	Tufted Ground Squirrel	Sciuridae	*Rheithrosciurus macrotis*	II	Vulnerable

(Source : www.forest.sabah.gov.my)

In this thesis, the study focuses on Borneo Pygmy elephant considering the species' status in the IUCN Red List as endangered, protected under Part 1 of schedule 2 section 25(2)(a) of the Wildlife Conservation Enactment (WCE) 1997 in Sabah, and an evolutionary significant that deserve proper conservation measures (Fernando et al., 2003). The Economics of Ecosystem and Biodiversity, (TEEB) says that the continuing decline in wildlife is partly because people don't see the economic value of wild nature. Markets don't usually put a price on the mostly public benefits of conservation, but they do put a price on private goods and services whose production may damage ecosystems (TEEB, 2008). So, economic valuation is a must if humans want to come up with good ways to protect Borneo Pygmy elephants. Therefore, this study aims to estimate the economic value and preferences of Borneo Pygmy elephant conservation management (CMT) in Sukau, Kinabatangan.

1.2 Asian Elephant

Elephas maximus, or commonly known as Asian elephants, is the largest terrestrial animal in Asia. Geographically, they are found in thirteen Asian elephant range countries: India, Bangladesh, Thailand, Bhutan, Laos, Cambodia, China, Indonesia, Malaysia, Myanmar, Nepal, Sri Lanka, and Vietnam (Ling et al. 2016). According to the IUCN Red list, Asian elephant falls under the endangered (EN) status since 1986 (Suba, 2017). The global population of Asian elephants is estimated to be 35,791 to 49,626 animals (Menon et al., 2019), India is home to the most Asian elephants, with a population ranging from 22,800 to 32,400 (Padalia et al., 2019; Ling et al., 2016). Meanwhile, since the 1970s, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has classified Asian elephants as an endangered species (Ling, 2016). Asian elephant populations in the wild have declined by at least 50% over the last three generations (Montez, 2021; IUCN, 2018).

The major subspecies of Asian elephants, according to Ling et al. (2016) and Menon et al., (2019) are Asian mainland elephants (Elephas maximus indicus), Indian elephants (Elephas maximus indicus), Sri Lankan elephants (Elephas maximus maximus), Sumatran elephants (Elephas maximus sumatranus), and Borneo Pygmy elephants (Elephas maximus borneensis) as shown in Figure 1.2. Nonetheless, based on the results of mitochondrial DNA (mtDNA) sample study, some have found Borneo Pygmy elephants (BPE) to be a distinct species as compared to the range states of other Asian elephants (Ling et al., 2016).

Furthermore, even though the native of Borneo Pygmy elephants are Borneo Malaysia and Indonesia, microsatellite loci analysis indicated that Borneo Pygmy elephants are unlikely to be the same species as the Asian elephants and are different from the Asian elephants living in Peninsular Malaysia (Ling et al., 2016).

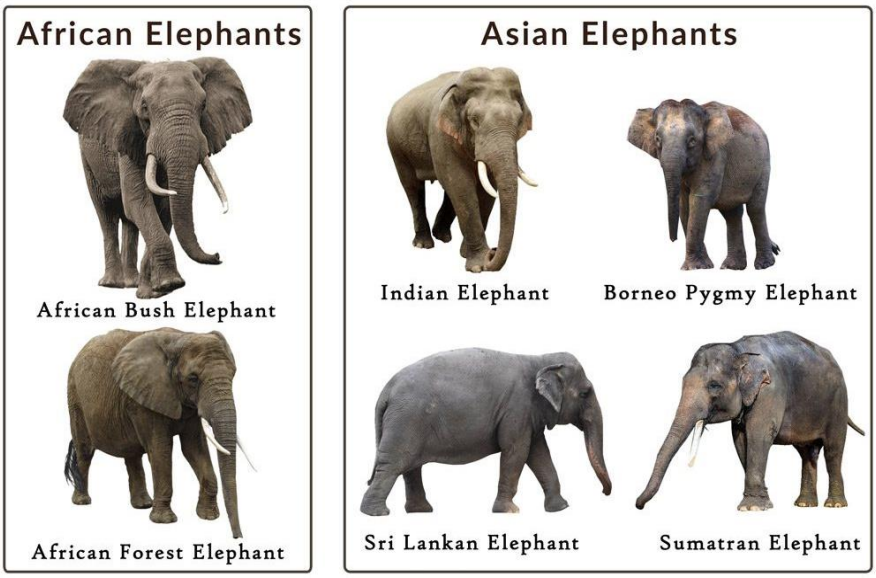

Figure 1.3 : Types of Elephants
(Source : animalspot. Net)

Figure 1.3 shows the giant extinct elephant Palaeoloxodon antiquus is closely related to the African forest elephant, not the Asian elephant or the African savanna elephant, according to a recent report on the elephant's family tree. The findings call into question palaeontologists' long-held belief that the extinct giant Palaeoloxodon antiquus was most closely related to the Asian elephant.

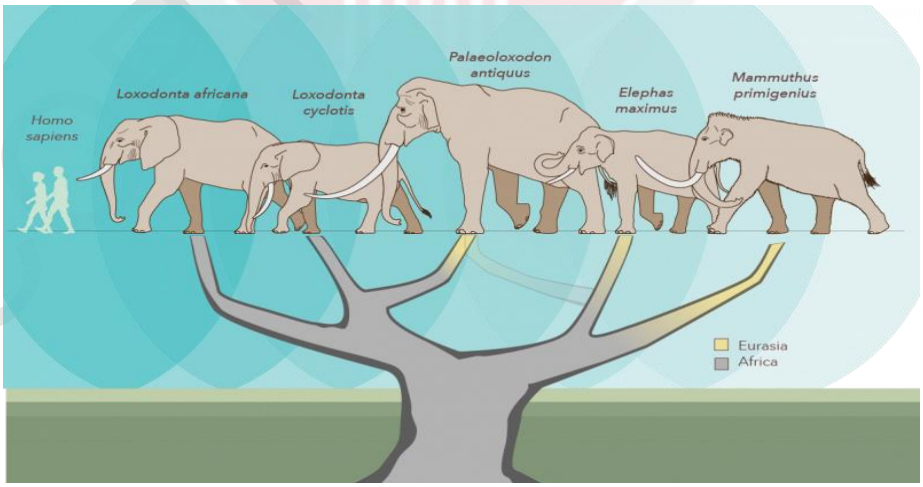

Figure 1.4 : Elephant Family Tree
(Source : Meyer, 2017)

1.3 Borneo Pygmy Elephant

The Borneo pygmy elephant, also known as Elephas maximus borneensis, is a subspecies of the Asian elephant that is critically endangered. It is distinguishable from other Asian elephants both in terms of its appearance and its behaviour (Evans et al., 2020). An examination of microsatellite loci has shown that Borneo Pygmy elephants are not of the same species as Asian elephants. Furthermore, Borneo Pygmy elephants are distinct from the Asian elephants that are native to Peninsular Malaysia.Borneo Pygmy elephants are native to Borneo Malaysia and Indonesia (Fernando et al., 2003).

1.3.1 Origin and Taxonomy

This species origin continues to be a subject of intense debate. There are two competing hypotheses proposed; one, hypothesis said that Bornean elephant stems each from a current introduction within the 17th century. The introduction speculation is primarily based on historic information suggesting that the current-day population represents the descendants of a domesticated herd that previously existed on Sulu Island, Philippines, and were added to eastern Sabah via the Sultan of Sulu in the 17th Century (Cranbrook et al., 2008; De Silva et al., 1968; Shim, 2003).

The second theory contends that the Bornean elephant is endemic to Borneo and that, despite the potential introduction of domestic elephants to Borneo, the wild population was not added by humans from a historical invasion several thousands of years ago (Sharma et al., 2018). This theory gained traction after a seminal observation demonstrated the genetic uniqueness of the Bornean elephant and its descent from Sundaic stock (Fernando et al., 2003). If elephants did exist on Borneo, they would have colonised the island during the Pleistocene glaciations, when most of the Sunda shelf became exposed, as seen in Figure 1.4. It depicts the central sampling locations, i.e. the countries sampled, as well as the number of actual sampling locations within the thirteen Asian elephant range countries of Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand, and Vietnam.

Despite the arguments of the Bornean elephant's origin, it no longer veers away from the fact that it is far from precise and that it merits conservation efforts. Due to their small length, mild nature and comparatively massive ears, straight tusks, long tail that reaches the floor and might additionally demonstrate some behavioural differences, they were dubbed "pygmy" elephants (Fernando et al., 2003). Borneo Pygmy elephants can be determined ordinarily within the Malaysian state of Sabah, making the state the main homeland of smallest known sub-species of Asian elephants. While unique sub-specific status would highlight their conservation importance, evaluation of their status in terms of evolutionary remains relevant.

1.3.2 Legal Status and Protection

According to the International Union for Conservation of Nature's Red List (IUCN, 2018), the Asian elephant (including the Borneo Pygmy elephant) is endangered and is included in Appendix 1 of CITES (Convention of International Trade in Endangered Species of Flora and Fauna). Elephants are protected in Sabah under Schedule 1 of the Wildlife Conservation Act 1997, thus they cannot be hunted or shot. Elephants are therefore prohibited from being killed under any circumstances.

Section 25 of the Wildlife Conservation Enactment 1997 makes it illegal to kill an elephant or possess elephant products (skulls, skin, bones, tusks, and so on). The penalty is a minimum fine of RM50,000 and a maximum fine of RM250,000, as well as a minimum of six months and a maximum of five years in prison. Elephants in Borneo are critically endangered, with only 1,500 to 2,000 remaining in a shrinking ecosystem fragmented by commercial palm oil plantations.

1.3.3 Behaviour and Ecology

In total, the Bornean elephant is the smallest subspecies in the taxon, with males ranging from 1.57 – 3.64 m and females from 1.45 – 2.26 m. (Wildlife Rescue Unit unpublished data) As a whole, the Bornean elephant is also a lot calmer than Asian elephants (Shim 2000; Othman et al. 2013; Payne and Davies 2013).

Female matriarchs rule elephant families, which are polygynous by nature. Their social structure is sexually dimorphic, with males leaving the family unit as adults. Males only reconnect with females during reproducing. A family unit can have as few as three or four females and their young, or as many as twenty members, depending on the size of the group (Borneon Elephant Action Plan, 2020-2029). The social structure is dominated by fission-fusion, allowing enormous herds of over 100 individuals (Sukumar,1989).

Evans et al. (2020) predict that non-fragmented elephant home ranges range from 250-400 km2 and disturbed fragmented home ranges range from 600 km2 (Alfred et al. 2012). Sabah's elephants don't "migrate," but they walk far. In order to meet their ecological and dietary needs, they appear to travel in semi-regular circles over vast distances, returning to the same spots at regular intervals (English et al. 2014a). Disruption of elephant social connections due to habitat fragmentation and human harassment is a real possibility due to the elephants' highly sociable nature.

Elephants prefer low-lying areas with easy access and avoid high slopes. The animals have always chosen woods near rivers, valleys, and flatlands with food sources. They are often encountered in "degraded" areas with grasses and bushes (Alfred et al. 2011). Their food consists of monocotyledon plants from the Poaceae, Arecaceae, and Musaceae families, as well as the bark, leaves, and other parts of trees and climbers from

the Euphorbiaceae family (English et al. 2014b). Monocotyledons (grasses) are essential for pachyderm survival because they return to the same area to feed on grass regeneration (English et al. 2014).

1.3.4 Population of Borneo Elephant

Borneo Pygmye elephants have a very small distribution, occupying approximately 5% of the island in the extreme northeast, mostly in Sabah and Kalimantan (Indonesia). Its population in Kalimantan is restricted to a small area above the Sembakung River in the region's east. Borneo elephants prefer lowland rainforest and valleys as their preferred habitat. They are typically found in family groups of five to twenty individuals, which sometimes combine to form larger herds of up to 200 individuals (Gossens et al., 2016). They are present in five major ranges and have a total population of 2000 individuals (Goosens et al., 2016; Elephant Action Plan, Sabah Wildlife Department, 2020–2029).

Figure 1.4 shows the past and present locations of Bornean Elephant distribution range within areas in Sabah. The grey area represents the former range in 1980 and the black area in 2002. The distribution area is declining as depicted in green areas.

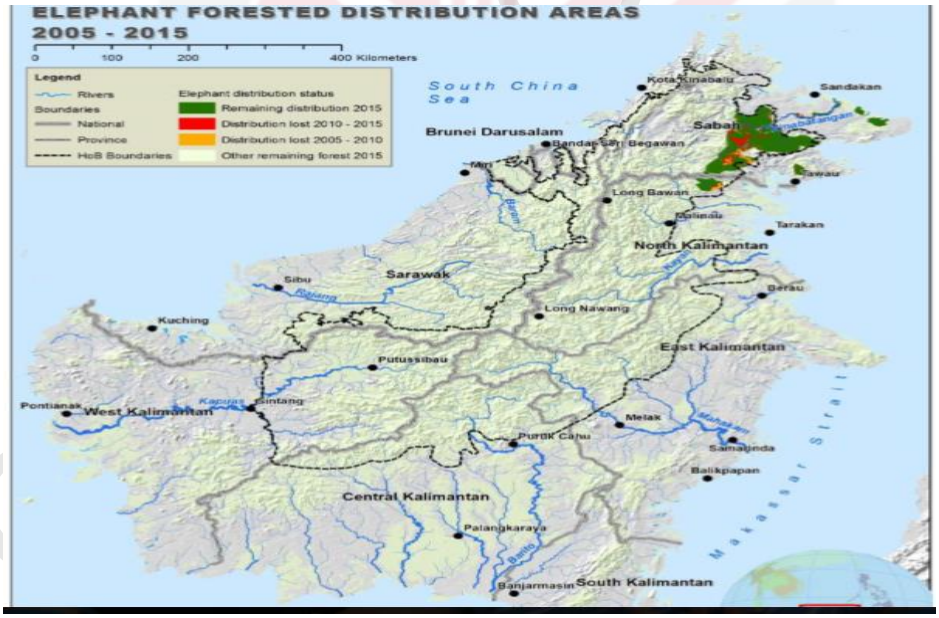

Figure 1.5 : Distribution of Bornean Elephants in Sabah
(Source : The Environmental Status of Borneo, 2010[6])

[6] https://d2ouvy59p0dg6k.cloudfront.net/downloads/isi_full_report_hob_2016_rev__12_higres_compressed.pdf

Project Ark Foundation (a non-profit organisation dedicated to promoting the welfare of the world's most endangered species and biodiversity) conducted a survey in Borneo from 2010 to 2016 to see how the pygmy elephant population had changed. The number of Borneo Pgymy Elephants has been steadily declining over the course of time as a result of persistent threats such as the destruction of their natural habitat and direct conflict with humans (Borneo Pygmy elephant, n.d.). There are only around 1,500 Borneo Pygmy elephants left in the wild in 2016 as shown in Figure 1.6 and today, the number expected to be much lower (Cheah & Yoganand, 2022). The estimated Borneo Pygmy elephant population in 2010 was estimated to be about 1,850 individuals, indicating a decline of 360 individuals over a 6-year period. Despite the fact that this number does not seem to be high, the species is in grave danger due to habitat destruction, hunting, and human-animal conflict. Individuals that are distressed are less likely to breed, resulting in a steeper population declined (Cheah & Yoganand, 2022).

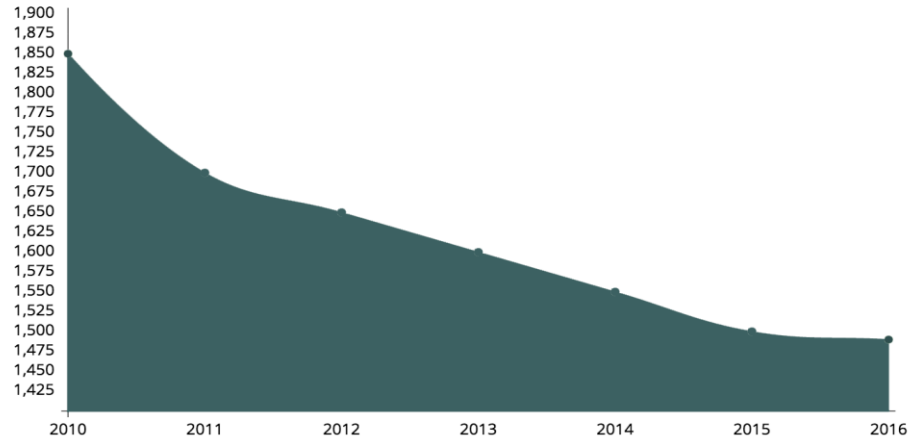

Figure 1.6 : Estimated Borneo Pygmy elephant population figures between 2010 and 2016[7]
(Source : Project Ark Foundation, 2016)

To sustain stable populations, elephants need large areas of habitat. Radio trackers were used in recent research by the WWF, the Sabah Wildlife Department, and other NGOs to discover that herds inhabited 250 to 400 square kilometres of high-quality woodland, but this nearly doubled where the forest was fragmented. Bornean elephants, like all pachyderms, live long lives and breed slowly, with calves born every six years on average (with a gestation period of almost two years, the longest of any mammal). As a result, all sustainable restoration efforts would be long-term, and population recovery could take decades.

[7] http://www.projectarkfoundation.com/animal/borneo_pygmy_elephant

1.3.5 Major Threat, Conservation Challenges and Cost to society

Elephant conservation faces a number of issues throughout the majority of elephant range states, including habitat loss and fragmentation, poaching and illegal trading in elephant body parts, conflict between human[8] and a lack of knowledge in the general public of the species' protection needs (Elephant Action Plan, 2020-2029; Goosen et al., 2016; Suba, 2017; Evans et al., 2020; Ling et al., 2016). The increasing conflicts between human and elephants is driven by increasing number of human populations. When elephants consume or stomp on crops, humans typically slaughter the elephants, and hundreds of people are also killed each year as a result of the conflicts. The number of elephant death increase as shown in Figure 1.6. due to poison, killing using home made gun, snares, killing traps and hunting (Borneon Elephant Action Plan for Sabah, 2020-2029).

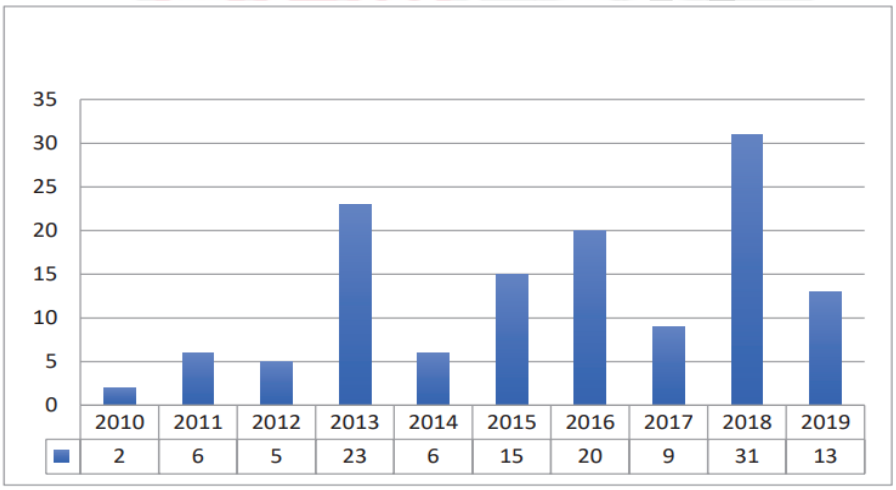

Figure 1.7 : Numbers of Elephant Death Reported to the Sabah Widlife Department Until 2019
(Source : Borneon Elephant Action Plan 2020-2029)

This would be detrimental to elephants and humans alike. For instance, between 2011 and 2018, the total loss related with HEC was RM 24,227,234.70 only for few estates (Ghani, A.B., 2019). The future of elephant, whether inside or outside the protected areas, is indirectly related to mitigating such human-elephant conflicts (HEC) and has challenged Asia's efforts to conserving this species (Ling et al., 2016). Conflicts between humans and elephants have had serious financial consequences. One estate in Sandakan spent a total of RM7,359.04 on HEC operational costs every month for an 8-person ground team (Ghani, A.B., 2019).

[8] https://www.worldwildlife.org/press-releases/satellite-tracking-reveals-threats-to-borneo-pygmy-elephants

Loss and depletion in wild habitat may also have an effect on human genetic composition, either directly or indirectly, by restricting gene flow and increasing levels of genetic drift and inbreeding (Othman, 2017). It is proven that Bornean orang-utans that share the same habitat as elephant's changes in genetic diversity linked to habitat fragmentation (Goossens et al., 2016). Due to extreme habitat loss and range contraction, the Bornean elephant may face a dwindling population as a result of genetic diversity loss, inbreeding despair, and, eventually, extinction (Goosen et al., 2016; Bunkeri, 2020). Elephants, for example, are a long-lived species with overlapping generations, so genetic loss signatures can be obscured for several years, if not centuries.

Land conversion into an oil palm is also the main threat for Bornean elephant. Due to the decreasing amount of land that is appropriate for development in Peninsular Malaysia, most of the recent expansion has taken place in the states of Sabah and Sarawak (Nambiappan et al. 2018; Shevade and Loboda 2019). As can be seen in Figure 1.7, oil palms covered around 1.54 million hectares in Sabah in the year 2020 (Parveez et al., 2021). To stop further population loss and make way for the reestablishment of a viable elephant population in Kalimantan, prevent further encroachment of oil palm plantations in elephant habitat and regulate land use change are the keys (Suba et al., 2017). Changes in land use use in Southeast Asia have resulted in fierce competition for space and resources between humans and wildlife (Newsome et al., 2019; Othman et al., 2019), and elephants are especially vulnerable to land use change (Suba, 2017; Evans et al., 2020).

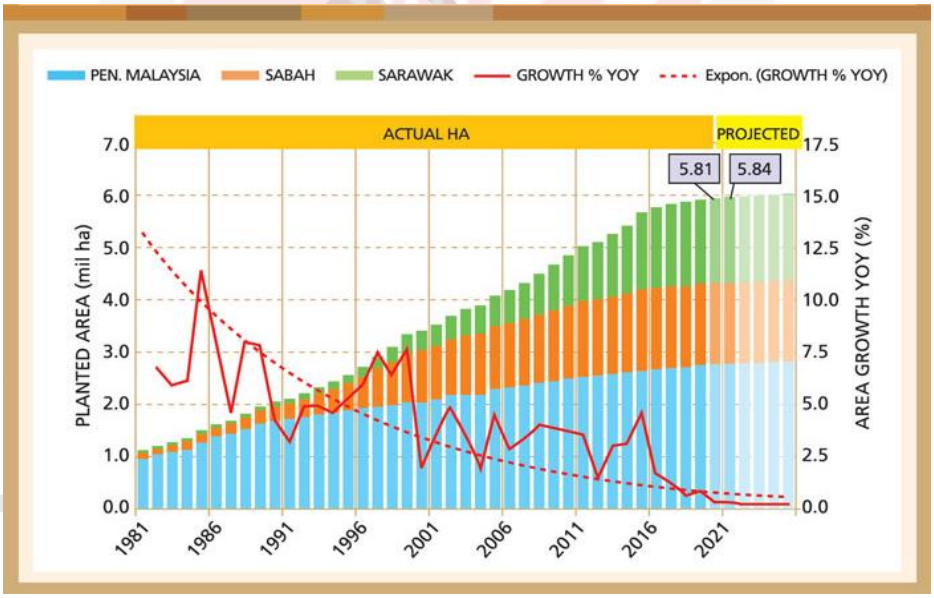

Figure 1.8 : Oil Palm Planting Growth in Malaysia from 1981 to 2021
(Source : MPOB, Ganling Estimates 2020-09)

Poaching is the third major threat to Bornean elephants (Ling et al., 2016). Elephants are primarily sold for their body parts, such as ivory, meat, tail fur, hide, feet, and trunk, in the illegal trade. The market for ivory is causing tuskers to become extinct in some Asian populations. Elephant populations have been decimated by large-scale hunting for ivory, bushmeat, skins, and other items across a wide range of countries, from Myanmar to Indonesia (Menon, 2019). In December 2017, wildlife officials in Sabah discovered the remains of a beloved male elephant called Sabre because of his unusual tusks[9]. The elephant was most likely killed for the tusks. Wild elephants are also hunted for domestic use, which is popular in Thailand, for large-scale tourism businesses, which has resulted in a significant reduction in the elephant population. The conservation of the Borneo pygmy elephant faces numerous challenges as a result of these threats (Menon et al., 2019). Finally, the threats must be thoroughly researched in order to develop recovery and preservation methods that will ensure their existence (Abeysinghe, 2016).

1.3.6 Conservation Effort

To supplement national and international efforts, the Sabah Biodiversity Strategy 2012–2022 is a ten-year plan outlining Sabah's commitment and contributions to Malaysia's commitment to implementing the Convention on Biological Diversity (CBD). The strategy has defined five objectives that will guide Sabah's efforts during the next decade. Among the five goals, by 2022, we will 1) have engaged and harnessed the commitment of all stakeholder groups to ensure our biodiversity is protected; 2) will have significantly reduced direct and indirect pressures on biodiversity; 3) will have protected and well managed all of our key ecosystems, species, and genetic diversity; and 4) will have significantly improved our understanding of biodiversity and ecosystem services to enable more effective resource management and; 5) All stakeholder groups, including government institutions, indigenous communities, and civil society organisations, as well as the corporate sector, government institutions, the research and education community, and local governments, will have the capacity to conserve biodiversity.

The Borneo Pygmy elephant is listed on CITES Appendix I, implying that the Asian elephant's top conservation priorities are: 1) habitat conservation and connectivity through securing corridors; 2) control of human–elephant conflicts as part of an integrated land-use coverage that recognises elephants as economic assets from which nearby people must benefit or at the very least inflict no damage; 3) increased safety for the species by improved regulation and law enforcement, advanced and superior technology; Similarly, monitoring conservation strategies should provide assessment of the interventions' progress or failure in order to ensure that necessary changes (i.e., adaptive management) can be made. As part of the monitoring and adaptive management strategy, accurate estimates of population size and trends will be needed.[10].

[9] https://www.theguardian.com/environment/2017/jan/03/wborneo-pygmy-smallest-elephants-pygmy-killed-for-ivoryorlds-smallest-elephants-killed-for-ivory-in-borneo
[10] http://www.iucnredlist.org/details/7140/0

The government has introduced various plans, and multiple industries have initiated various action plans. In order to provide direction and guidance on the strategies, objectives, and activities for elephant conservation in the state of Sabah, the Borneo elephant action plan for Sabah (2020-2029) was established. There are a few goals that must be met: Protect and halt elephant poaching to minimise the current level of elephant deaths; 2) increase landscape and connectivity; 3) provide the best ex-situ practises for elephant management and conservation; and 4) ensure that elephant population trends can be monitored and forecasted.

MPOWCF is a substantial effort by the palm oil business to protect wildlifehabitats. .'s In 2006, the Malaysian Palm Oil Council provided RM 10 million in initial funding for the fund, which is maintained by the Malaysian Palm Oil Council (MPOC). Many of the MPOWCF-sponsored environmental initiatives are under the management of MPOC. Wildlife rescue centre, biodiversity plan for manager, Tabin wildlife reserve and many more projects are carried out by the MPOWCF. The initiatives are being carried out to help convey a positive image of Malaysian palm oil by offering concrete assurances that its production does not result in deforestation or the loss of species and their habitat through a focused conservation study programme to be carried out by specialists from academia, government agencies, and NGOs. The Project also provide funds for studies on wildlife, biodiversity, and environmental conservation while taking into account the palm oil total impact.

The concern on conservation has been highlighted since in the Eleventh Malaysia Plan (2016-2020). One of the six thrusts laid in the plan is to exercise green growth for sustainability and resilience nation. Essentially, the shift would enable Malaysia to re-evaluate the functionality of natural assets and the environment in its socio-economic improvement, while simultaneously protecting each development gains and biodiversity. Most importantly, on the matter of conserving natural resources for present and future generation by conserve endangered plant and wildlife species. Despite other stakeholder efforts, very little made by local communities due to the lack of knowledge and financial assistant (Pimid et al., 2022; Othman et al., 2019).

1.4 Socio-environmental and Economic Benefits in Sukau Kinabatangan

This study will focus on Borneo Pygmy elephant in Sukau Kinabatangan. Lower Kinabatangan contains a number of towns along the Kinabatangan River, including Abai, Sukau, Bilit, Batu Putih, Bukit Garam, and Sungai Lokan (all of which can be found in Lower Kinabatangan). Orang Sungai refers to the people who live along the river's banks as a group (River People). They've lived for hundreds of years by the Kinabatangan River, and their way of life is characterised by the river and the trees that surround them. By 2008, Sukau had 1207 residents, Abai 326, Sukau 1208, Bilit 1206, Gomantong Jaya 232, Sentosa Jaya 359, and Batu Putih 776.

River resources have traditionally been an important source of revenue for the Orang Sungai. Furthermore, the resources of the forest are exploited by the inhabitants as a

source of food, fuel, and medicine. Locals engage in small-scale agriculture, planting rice, fruit trees, and vegetables. It is crucial to note that the establishment of the LKWS in 2005 created both issues and opportunities for those working with the government, communities, and other organisations to better utilise the Kinabatangan floodplain. Furthermore, it has hindered the inhabitants from accessing the forest's resources.

Conservation elephant very important for the local people and the country economic benefit. Accroding to Wong et al., (2021), based only on the desire to pay for the well-being of elephants in the forest and their role as an umbrella species that helps conserve other animals, the predicted annual intrinsic value of wild elephants in Johor is at least MYR 7.3 million (USD 1.8 million). The existance of elephant also improve the socio-economic of people live nearby elephant habitat as more wildlife tourism activities (Meyer et al., 2021) and community-based tourism (Lo et al., 2021) opened. The lost for elephant might cause a loss of income to local community that depends on tourism for example study done by (Naido et al., 2016) showed that Africa's savannah loses about USD $25 million each year because of elephant poaching.

Due to increase number of tourist in Lower Kinabatangan to see wild animal (Latip et al., 2018), number of tour operators have opened lodges, and the local people is becoming more active. Homestays in Batu Putih (Miso Walai Homestay), Sukau, Bilit, and Abai have already integrated local residents into tourism. As a result, the Miso Walai Homestay in Batu Putih serves as a model for other Malaysian homestay programmes. The homestay provides a variety of services for travellers, including boat service and guides, as well as natural and cultural activities such as jungle trekking. It produces revenue for the local community by leveraging the surrounding natural surroundings and culture (Chan et al., 2021). Employment at lodges, supplying fish to Kinabatangan River-based tourism facilities, and building their own guesthouses, are other ways towns benefit from tourism. In reaction to the area's growing tourism, the local populace is becoming increasingly interested in becoming involved (Chan et al., 2021).

Conservation is an important measure to ensure the survival of the pygmy elephants. This study seek information on how much people are willing to pay for conservation pygmy elephants in Borneo and to determine what attributes that influence local people and visitor willingness to-pay for conservation decision making choices. The Wildlife Value orientation and specific positive beliefs of public people will be examined towards risk perception of this endangered species to create a successful conservation program. Thus, it is imperative to protect endangered pygmy elephant for the benefit of present and future generations.

1.5 Problem Statement

Constructing and administering successful voluntary elephant conservation programmes might be complicated by the difficulty of locating adequate funding sources. Currently, there is no economic value that has been assigned to the Borneo Pygmy elephant. The challenges in addressing the conservation problems are to identify the real value, which is to obtain financial resources (Senzaki et al., 2017). There is no national estimation of the transaction costs of species conservation or the opportunity cost of public funds spent on species recovery (Ericsson et al., 2008). Endangered species like elephants, with minimal economic or consumptive advantages, on the other hand, are often undervalued by market costs. Without estimation of the real value of species conservation, many studies have shown that the current charge is smaller than the Willingness to pay (WTP) value estimate (Peter and Hawkins, 2009; Baral and Dunghana, 2014; Vincent et al., 2014). This will lead to a loss in public funding that could be used for conservation. Therefore, the WTP and preferences for conservation management of Borneo Pygmy elephant are important to be valued for financial support of conservation management of Borneo Pygmy elephant.

The problem with current conservation program does not attract public participation (Borneo elephant Action Plan for Sabah, 2020-2029) therefore, conservation program that reflect preferences of the main stakeholders (local people and public) are needed. Nevertheless, all this requires resources, especially money. The more money is available, the more public can support various program while saving the pygmy elephants' population (Christie et al, 2012). Since there is no real value attached to pygmy elephant and no conservation fee has been applied, this calls for the need to assess the conservation value for this species.

There are many researches about T&E valuation in western countries (Rubino et al. 2017, Lew 2015, Loureiro et al. 2008, Kotchen et al. 2000, Eagle and Betters 1998, Richardson and Loomis 2009, Bandara and Tisdell, 2004). While there are several studies involved Malaysia Asian elephant (Magintan et al., 2017; Ling et al., 2016; Kaffashi et al., 2015), but remains insufficient data from Borneo case, especially those pertaining pygmy elephant's value and preferences. The WTP and preferences towards Borneo Pygmy elephant conservation in Kinabatangan are unknown as no study related with.

Human-elephant conflicts (HEC) complicate matters even further, and elephant mortality and illegal trade in elephant body parts are on the rise (Alfred et al., 2011). Until now, the coexistence between human and elephant still low (Rubino et al., 2021). Inaccurate descriptions of elephant behaviour have contributed to unfavourable risk perceptions among locals, altering their attitude and tolerance for elephants (Ebua et al. 2011; Kansky and Knight 2014). The general public values elephants differently, which may influence their acceptance of conservation measures. Local people that live among elephants have a more negative value orientation and perception as a result of HEC. However, visitors are more eager to engage with the species. The relationship between wildlife orientation and Borneo pygmy elephant risk perception must be identified in

order to ensure that all stakeholders voluntarily participate in accomplishing conservation goals.

Pygmy elephants are among the threatened species targeted under the Sabah State Elephant Action Plan 2020-2029. Several non-governmental organisations (NGOs) such as HUTAN, Forever Sabah, WWF-Malaysia, and the Responsible Elephant Conservation Trust to protect the Borneo elephant population in Sabah are also actively engaged in conservation initiatives including the pygmy elephant and committed to preserving its population. For example, Seratu Aatai, to better understand how to develop an elephant-friendly landscape outside of protected areas they conducted a scientific study and educated the local populations about the necessity of safeguarding and conserving elephants. Despite their commitment and efforts, mankind continues to trap or murder elephants for trampling their land and ruining their crops in Sabah.

The effort for conservation of pygmy elephants might be in vain since the number of poaching and killing of the species continue to increase, driving their existence towards the edge of extinction[11]. The conservation program seems to attract certain types of people such as environmental members and NGO but nothing much from public (Othman, 2017). Their different beliefs influence wildlife orientation, risk perceptions and directly will affect the conservation effort. If public perceived risk on their health, safety or crop due to Borneo pygmy elephant existance, the tendency to accept the conservation management program will not succeed. Conservation of the elephant in Malaysia, and in Sabah specifically, is now critically dependent on the level of tolerance and appreciation of elephants by the local people and visitors who interact with the elephants on a regular basis.

The settlement of Sukau has been recognised as one of two key obstacles preventing elephants from moving freely in their natural habitat. While people continue to view elephants as a nuisance and a source of conflict, it is difficult to garner their support for elephant conservation (Othman et al., 2019). It's important to teach people to be more accepting of elephants. Peaceful coexistence will only be possible if public knowledge and comprehension of this subspecies' ecology and behaviour enhance (Othman et al., 2019). To accomplish this, it is necessary to understand public attitudes and perception towards Borneo Pygmy elephants.

[11] https://www.thestar.com.my/news/nation/2017/12/14/yet-another-endangered-borneo-pygmy-jumbo-found-dead-in-sabah/

1.6 Research Questions

Based on the research objectives of this study, the research question are as follows:

i. How much value of WTP should be use for Borneo Pygmy elephant conservation management (CMT) fee?
ii. What are the determinants of WTP for conservation management Borneo Pygmy elephant?
iii. What is the relationship between Wildlife Value Orientation (WVO) and risk perception towards Borneo Pygmy elephant?
iv. How does mediation effects of Specific Positive Beliefs influence the relationship between Wildlife Value Orientation and risk perception?

1.7 Research Objectives

The main objective of this study to assess the public[12] preferences for Borneo Pygmy elephant conservation management. The specific objectives of the study include the followings:

i. To estimates the WTP value and preferences for conservation management on Borneo Pygmy Elephant;
ii. To examine the influence of wildlife value orientation on risk perception; and
iii. To investigate the mediation effects of Specific Positive Beliefs between value orientation and risk perception.

1.8 Significance of the Study

Environmental valuation of threatened and endangered species and wildlife reserves provides essential significance for Borneo, especially the state of Sabah. In line with Sabah Wildlife Department's mission to conserve the intact and diverse resources as well as ensuring that the country's use of resources for wildlife is sustainable and for the next generations to come. Therefore, the aim of this study is to provide an insight on the benefits and values provided by the environmental resources that benefits the current and future generations. The significance of this study will be explained according to the different objectives.

[12] The term 'public' and the 'respondents' are representing both local people and visitor are used interchangeably throughout this paper.

1.8.1 Objective 1: To estimates the WTP value and preferences for conservation management on Borneo Pygmy Elephant

The result obtained would help understanding of the economic values of threatened and endangered species as well as the roles and function in sustaining the ecosystem. Additionally, the information obtained from the function and values of T&E species would ensure better implementation of conservation and management services by policy makers and center manager. Also, the outcome would contribute significantly to the effectiveness conservation and management of T&E species in Sabah as well as in Malaysia.

It is possible that this will have a good impact, such that the effort being made will achieve a proper balance between the expectations of the general people and the goals of the conservation and development of Borneo Pygmy elephants. The key contributions of this thesis are the information concerning public's opinions on increased wildlife conservation and the findings on WTP. The information will help Sabah Wildlife Department, Sabah World Wildlife Fund (WWF), planters and farmers to deliver better services and protect the ecosystem based on public's preferences. Furthermore, it is hoped that this study will benefit the government and NGOs in conserving and managing the threatened and endangered species as standards policies and benchmarks to other wildlife reserves in the state of Sabah and Malaysia as a whole. The study will uncover the real value that the public put on Borneo Pygmy elephants. Thus, this value can be used as a conservation fee and offer more available resources to created protection program.

From the perspectives of conservation related parties, findings from this study would provide information that facilitate in decision making. As the number visitors to Sabah Borneo continue to soar, result from the study can be used to implement pricing policy that can help fund conservation and management while also conserving other wildlife to maintain sustainable environment. Thus, this research can help assist the management as guidelines to policy implementation. Environmental goods and services are fundamentally hard to manage which requires effective integration because they are complicated by a combination of different incompatible, inconsistent and contrast values. Various management options related to public decision-making need multi-criteria decision support procedures of valuation techniques like Choice Modelling (CM) that highlighted alternative management strategies with impose different implications of attributes and levels imposed on the evaluation.

The entrance fee charge at any wildlife park/center were set without asking the visitor about willingness to pay for conservation of pygmy elephant. The result from the estimated value could provide the reserve managers with strategic information about the real value that visitor is willing to pay which can be used in the implementation of entrance or conservation fee. As an increasingly number of tourists to Borneo, the management should implement pricing policy that can help fund the sanctuary as well as conserved the pygmy elephant and other wildlife inside to maintain sustainable

environment. Thus, this research can help to assist the management as guidelines to policy implementation.

The main significant value of this study is contributing to the body of knowledge. There are several studies pertaining T&E species in Malaysia but as far as it is known, it currently lacks of study that focuses on non-market value, particularly Borneo Pygmy elephant (Nantha and Tisdell, 2009; Tisdell, 2011 and Thompson, 2017). None of the literature has use choice modelling to elicit public preferences related with Borneo Pygmy elephant. By conducting this study, the non-market value of pygmy elephant can be measured and therefore, the value can be used as a reference in the literature.

From the academic perspective, this study will show the non-market valuation on threatened and endangered (T&E) species using Choice model (Bartkowski et al., 2015), which is relatively a technique in environmental and natural resources assessment. A number of choice modeling methods are consistent with consumer theory; their focus on an attribute-based theory of value permits a superior representation of many environmental management contexts (Hanley et al., 2001).

Among the increasingly numerous methods being used in valuing non-market commodities, Choice Modelling (CM) particularly suited in dealing with situation where changes are multidimensional and trade-offs between them are particularly of interest due to its natural ability to separately identify the value of individual attributes of a good or program, typically supplied in combination with one another. Hence, this method does a better job in measuring the marginal value of changes in various characteristic of environmental program (Hanley et al., 2001). Moreover, the use of discrete choice model in assessing the value of threatened and endangered species in Malaysia has not been done yet.

Economist believed that in public's decision making, any available resources should be taken into account and used in the best manner as a rational choice so that any result will maintain the sustainability of the environment. Therefore, monetary value is needed to capture the total value of public goods for example, marine park, bird sanctuary, protected areas and wildlife reserve. The notion of public goods that underlies market failure problem leads to difficulty in assessing monetary value by using market mechanism. Thus, the use of choice modeling as methodological approaches will facilitate the estimation of the monetary value.

1.8.2 Objective 2 and 3: To examine the influence of wildlife value orientation on risk perception; and to investigate the mediation effects of Specific Positive Beliefs between value orientation and risk perception

By assessing the risk of perception through Wildlife Value Orientation and the anticipated positive beliefs towards this species could be utilized to create conservation program that reflect the real public orientation. This will attract more public to participate in the conservation program. Most importantly, the role assumed by the public is vital to the development of a successful conservation program that can guarantee the existence of the species for future generation.

Finding out how the public views the risk from the Borneo Pygmy elephant and the unique positive beliefs that go along with it might assist reposition conservation priorities in the eyes of the general public while still achieving the goals of conservation centres. As a result of maximising public satisfaction or utility, main stakeholder like visitors would revisit wild and captive wildlife centre such as Lok Kawi Wildlife Park or Tabin Wildlife Reserve to observe Borneo Pygmy elephants. As a result, the funds collected by access fee levies could provide assurance for the conservation and management of the pygmy elephant for future generations.

Meanwhile, the latent variable approach applied in a Structural Equation Modelling (SEM) to examine the Wildlife value orientation and specific positive beliefs can help in assessing the risk perception of Borneo Pygmy elephant as determinant of local people and visitor perceptions. When individual attitudes measure in the set of structural equation, the main contribution in terms of methodological is when specific value orientations and specific positive beliefs are included as measures environmental attitudinal variables whether in direct effect or mediaation effect. The expected results are expected to influence preference heterogeneity for wildlife conservation.

1.9 Scope of the Study

This study covers only four hundreds local people and four hundred one visitors in Sukau Kinabatangan. Due to the many numbers of village in Kinabatangan, Sukau village is the closest village in Borneo Pygmy Elephant Habitat and area for most homestay and lodge that becomes visitor popular choices. The use of attributes and level were also based on focus group with expertise suggestion based on current ecology, geographic and demographic in Sukau. Therefore, the attributes and attributes level, and risk perceived by respondents will not represent the total population of Borneo Pygmy elephant in Sabah.

1.10 Organisation of the Thesis

This dissertation is divided into five chapters. Chapter 2 delve deeper into research on the use of stated preference procedures in economic valuation. The section begins with a discussion of total economic value (TEV) components and related ideas that support the explanation that is applicable to public behaviour while seeing wild animal. Later in the chapter, the Stated-preference option experiment, which was chosen for this analysis, is discussed (SPCE) and Structural Equation Modelling (SEM). It starts with the theoretical review followed by empirical review for all three objectives. Finally, the stages of SPCE implementation, which include attribute and level assignment, experimental design, questionnaire design, data sampling and selection. The topic includes data estimation and the use of SPCE in local and international research. The overview of the analysis methods used for this thesis is presented in Chapter 3. Steps for determining the attributes used in this analysis, as well as experimental and questionnaire design issues, are also given.

Chapter 4 reports the results of discrete choice in determining the willingness-to-pay for conservation and management of Borneo Pygmy elephant. Secondly, the Simple Conditional Logit Model, Simple Interaction Conditional Logit Model, Mixed Logit Model and Mixed Interaction Logit Model were presented to find out the public preference on conservation and management of Borneo Pygmy elephant. The results of Marginal Value and odds ratio for both model Simple and Mixed model are also explained in this chapter. The final part elaborates the third objectives of the study that comprises findings from factor analyses and Structural Equation Modelling (SEM) to determine the effect of Wildlife value orientation and specific positive beliefs towards Borneo Pygmy elephant perceived risks.

Last but not least, the concluding Chapter 5 presents a summary of the findings, a conclusion regarding the current study, a discussion of the limitations of the study, and finally, a recommendation regarding additional research.

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Conflict management can benefit from a better understanding of how societal values influence what people see and how they absorb information (Thome, 2015). When people's values shift, so do their behaviours (Thome, 2015; ,Manfredo, 2017). Stakeholder perceptions and support for conservation strategies can be influenced by social values (Bahtia et al., 2022; Wallach et a1., 2018; Gale et al., 2020). The public's win–lose perspective on wildlife management affects their participation in conservation projects (Oduor, 2020).

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