



Economic Valuation of Forest as Habitat for Elephants: Case Study at Belum-Temenggor Forest Complex

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ABSTRACT. The conversion of forests to other land uses, such as agriculture or housing, has led to an increase in the interaction between people and elephants that can highly result in human-elephant conflict. This conflict led to various socio-economic losses, such as losses of crop yields and the temporary decline in the tranquillity of villages and fear during the period of the conflict. Conceptually, the value of these losses could be used as a basis for the minimal value of the forest as a habitat for elephants. These studies value the HEC losses using economic valuation methods (replacement cost, change in productivity and contingent valuation methods). A case study of the invasion of the elephant herd from Belum-Temenggor Forest Complex is provided as an illustration. The case study result shows that if the forest is being established as a protected area to conserve elephants, the aggregate value of potential avoided losses from HEC is RM2,977 per villager, and the estimated value for 150 households is RM0.45 million per year.

Keywords: Belum-Temenggor Forest Complex, Economic valuation, Human elephant conflict

INTRODUCTION

The conversion of forests to other land uses, such as agriculture or housing, has led to an increase in interaction between people and elephants that can highly result in human-elephant conflict (Talukdar et al., 2020; Goswami et al., 2014; Othman et al., 2013; Nelson et al., 2003). Human-elephant conflict (HEC) refers to negative interactions, such as crop raiding by elephants and human injuries/deaths caused by elephants (Govind et al., 2021; Talukdar et al., 2020; Goswami et al., 2014). This conflict occurs when people and elephants are forced to share limited resources available as both require large tracts of land in their habitat. This leads to crop raiding, livestock destruction and sometimes the loss of life for both people and elephants (Talukdar et al., 2020; Goswami et al., 2014; Othman et al., 2013; Jadhav et al., 2012; Nelson et al., 2003; Hoare, 1999). The conflict between human and elephant have proven to be destructive, costly and prevent economic growth, social equality and resource sustainability (Govind et al., 2021;

Abdullah et al., 2013; Goswami et al., 2014; Othman et al., 2013; Gubbi, 2012; Sitati et al., 2003b). Table 1 shows the Human Elephant Conflict (HEC) reported case in Peninsular Malaysia from 2006 to 2015.

Table 1. HEC reported cases in Peninsular Malaysia from 2006 to 2015

Year	Total HEC reported cases
2006	978
2007	1038
2008	1026
2009	1108
2010	905
2011	1114
2012	1071
2013	1164
2014	991
2015	933
Total	10328
Total Average per year	1032.8
Total Average per month	86.1

A protected area, according to the IUCN, is a clearly defined geographic region that has been acknowledged, devoted, and managed through legal or other effective mechanisms in order to accomplish the long-term conservation of nature and related ecological services and cultural values (Day et al., 2019).

In Peninsular Malaysia, the conflict can be traced back to the 1950s when Malaysia adopted the 5-years Malaysia Plan to boost the economy by encouraging the agriculture sector and other economic activities as an engine of growth (Magintan et al., 2017; Zafir et al., 2016; Othman et al., 2013). Although thousands of domesticated Asian elephants are found in Southeast Asia, this magnificent animal is threatened by extinction in the wild because of rapidly growing human populations and the fast depletion of the elephant's habitat (Hankinson et al., 2020; Magintan et al., 2017; Hoare, 1999; Jadhav et al., 2012; Nelson et al., 2003). An expanding human population deprives the elephants of space and thus compresses them into areas that are too small to be viable, deprives them of their ancestral migratory routes and separates them from their families and friends. Elephant herds in the wild follow well-defined seasonal migration routes between wet and dry seasons. Thus, it is the task of the leader to remember and follow the traditional migration routes. When human settlements and farms are found in these old routes, confrontations occur, which often lead to damage to crops and properties as well as injuries and deaths to both species (Kitratporn et al., 2022; Zafir et al., 2016; Mohd et al., 2009).

Malaysian elephant (*Elephas maximus*) has been categorised as an "Endangered" species on IUCN Red List Status and "Vulnerable" on Peninsular Malaysia Red List (Taher et al., 2020; Zafir et al., 2016; IUCN, 2015; Fallis, 2013). An elephant in Peninsular Malaysia is protected under the Protection of Wildlife Act No. 76, 1972, which makes it an offence for anyone to unlawfully shoot, kill, take or possess an elephant or part thereof. If guilty, the penalty is a

maximum fine of RM3,000, 3 years imprisonment, or both. If it is a female elephant, the maximum fine is RM6,000 or 3 and a half years, or both. A juvenile elephant entails a maximum fine of RM3,500 or 2 years' imprisonment, or both. Anyone who injures, mistreats, starves, or confines in an enclosure or cage not conducive to the elephant's comfort or health is liable to a maximum fine of RM5,000 or 3 years' imprisonment, or both. Anyone who provokes or wounds an elephant that becomes an immediate danger to human life will be fined up to RM5,000 or 3 years' imprisonment, or both. Table 2 shows the population of elephants in Peninsular Malaysia until 2015, and Figure 1 shows the elephant distribution in Peninsular Malaysia.

Table 2. Population of elephants in Peninsular Malaysia

States	Estimated Elephant Population
Pahang	150
Perak	230-280
Johor	130-280
Kelantan	250-300
Terengganu	120-140
Kedah	50-60
Negeri Sembilan	3
National Park (Kelantan, Pahang, Terengganu)	290-350
Total	1223-1463

Elephants mirror humans in many ways – in terms of longevity, development, family ties and lifelong bonds of friendship. In the forest, elephants are the only species large enough to eat and disperse the seeds of some very important plant species. Without elephants, many of these plant species would be unable to reproduce. Many trees that depend on elephants for seed dispersal produce large fruits with thick shells. The shells surrounding the fruits may be a quarter of an inch thick, and only elephants are large and strong enough to break open the fruit. The nutlike pits inside these seeds pass through an elephant's intestine unharmed. The seed is then deposited with the animal's dung, fertilising the new plant as it germinates and grows. HEC would not have occurred if the ability of the forests to provide adequate habitat to the elephants were not jeopardised (Kitratporn et al., 2022; Taher et al., 2020; Abdullah et al., 2013; Gubbi, 2012; Sitati et al., 2003a; Plotnik et al., 2006). The value of the losses and fears would have been avoided had the forests been intact and their functions as habitats for elephants unimpeded. Hence, an alternative approach to assess the value of forests as a function of elephant habitat could be proxied by the avoided losses that society would have to incur owing to the disturbance of the tranquil environment provided by forests.

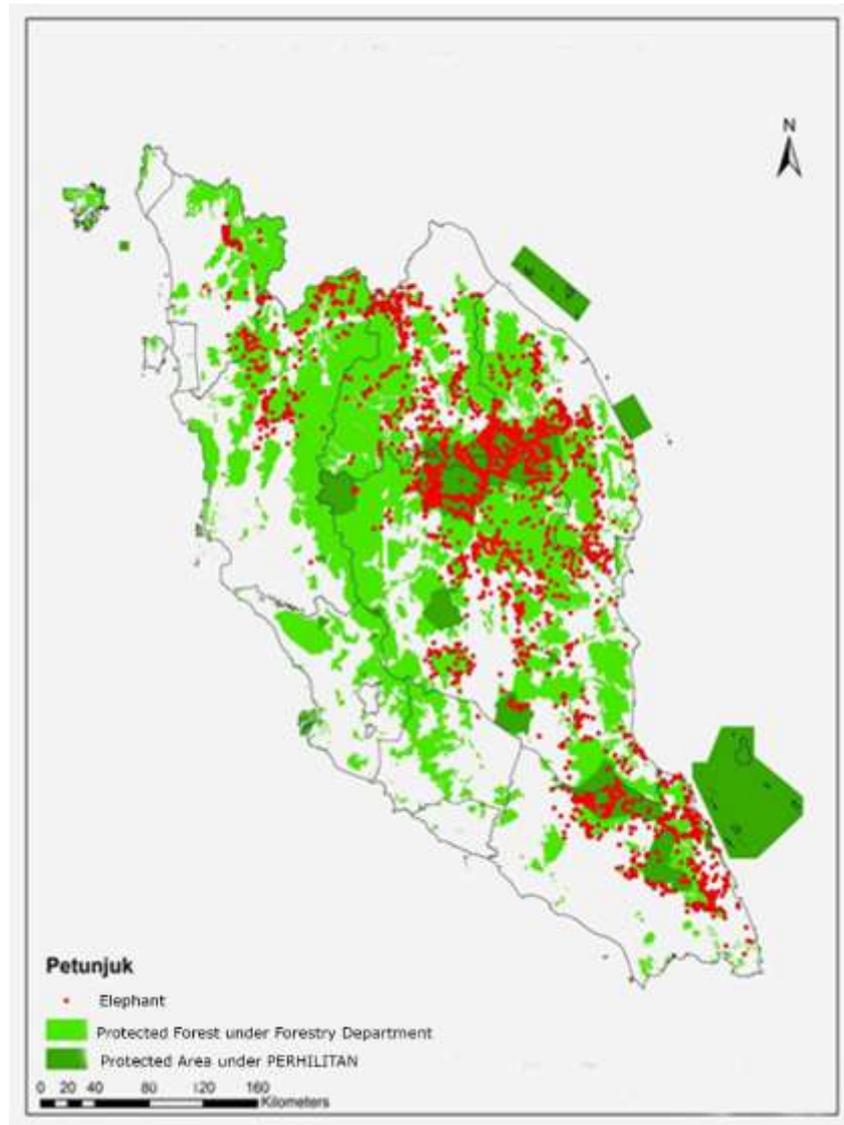


Figure 1. Elephant Distribution in Peninsular Malaysia (PERHILITAN Malaysia, 2020)

Conceptually, the value of these losses could be used as a basis for the minimal value of the forest as a habitat for elephants. These HEC losses could be valued using various economic valuation methods, including adopting replacement cost, change in productivity and contingent valuation methods. The objective of this study is to estimate the economic value of damages incurs in HEC using various types of economic valuation. The conceptual framework of this study is provided in Figure 2 (Talukdar *et al.*, 2022; Saif *et al.*, 2019; Plotnik *et al.*, 2006; Leimgruber *et al.*, 2003).

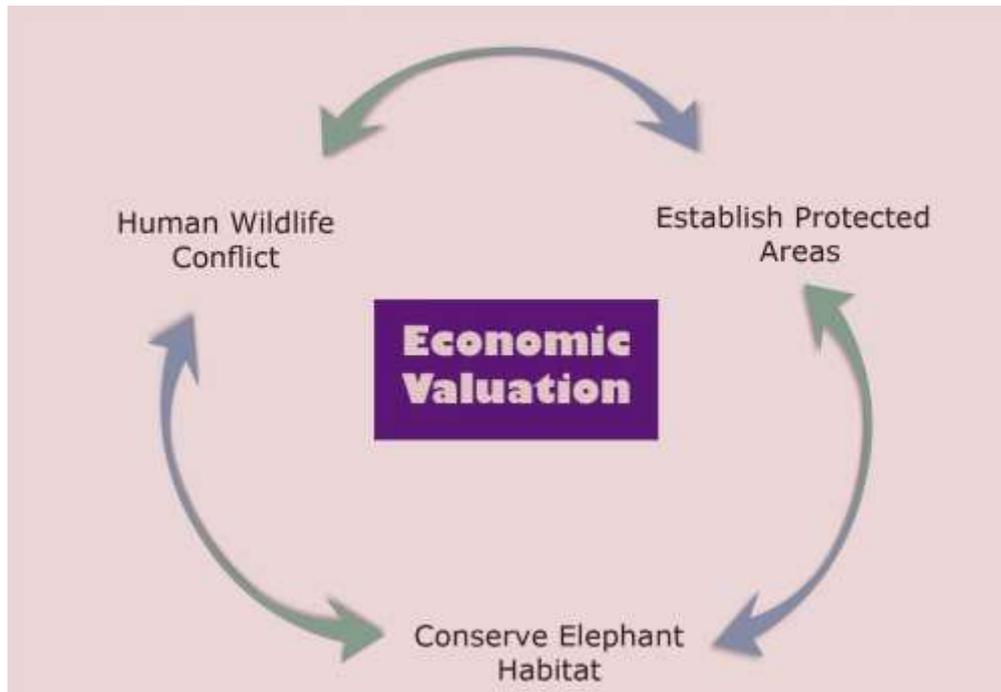


Figure 2. Conceptual framework of this study

METHODOLOGY

Materials And Method

The direct approach to valuing the function of the forest as a habitat for elephants is to assess the contribution of forest habitat in generating the benefits provided by elephants to society. However, the direct assessment of the benefits of elephants as keystone, flagship, cultural and aesthetic values is difficult. If attempted, it is open to many academic disputes in its valuation and estimation procedures.

An alternative approach is needed to value the elephant habitat function provided by forests. The approach is to create a scenario where the elephant habitat functions of forests are jeopardised. This decline in function could be timber harvesting or forest clearance for agricultural and development projects. The impact of this habitat disturbance would have an effect of encouraging the elephant herds to leave their habitat in the forest into agricultural farms or orchards and human villages. This situation would create human-elephant conflicts, such as elephants damaging the fences of farms and feeding on young rubber tree shoots and oil palm young pith/core and shoots. Substantial losses would be incurred by rural farmers and folks (Table 3).

The mere rumours of elephants wandering in the rural areas, not to mention actual intrusion into farms, would have created fear and trauma throughout the affected village. These fear and trauma are not limited to households having their farms attacked only but almost to all the households in the village concerned. These fear and trauma have further

psychological and economic impacts, such as the fear of being outdoors at night and much time spent collectively guarding palm oil and rubber smallholdings at night. The latter further affects the ability to tap rubber trees in the early mornings and the latex collection following the night guards. All in all, substantial economic losses and psychological fear would be incurred by villagers (Talukdar *et al.*, 2022; Saif *et al.*, 2019).

Table 3. Potential losses if the forest could not function well as an elephant's habitat

Impacts	Form of losses	Economic Valuation
Fruit trees in gardens and smallholdings were destroyed, and fruits were eaten.	Fruit trees of n years old were destroyed (n < 2 years). The current cost of replanting or loss of investment makes during initial planting.	Replacement cost
	Loss of potential fruits from the year of attack (n) until maturity if no replanting (25-n) years is undertaken. Net present values (NPV) of potential revenue loss.	Change in productivity
	Loss of lag/delayed yield from the year of attack until replanted trees, bear fruits if replanting is undertaken. Net present values of delayed revenue.	Change in productivity
Young shoots of rubber trees from smallholdings and estates were eaten.	Mortality proportion of rubber trees when shoots are eaten and trampled. The current cost of replanting or loss of investment makes during initial planting.	Replacement cost
	Mortality proportion of rubber trees when shoots are eaten and trampled loss of potential latex yield if no replanting. NPV of potential revenue loss.	Change in productivity
	The proportion of rubber trees experiencing stunted growth because of young shoots being eaten and loss of lag/delayed latex yield during the stunted growth period. Net present values of delayed revenue.	Change in productivity
Damage to infrastructures such as perimeter fencing of smallholdings and estates, and farm stores, loss of income	Losses from infrastructure damage. Losses from no rubber tapping in the mornings after the night sentries. Foregone revenue.	The market price of damaged property or replacement cost
Sentry activities	Night sentry cost	Defensive expenditure
Injuries incurred related to an elephant	Losses from injury Foregone revenue Medical treatment	Change in productivity cost of illness
Deaths related to Human-Elephant Conflict (HEC)	Loss of human lives. Net present value of lifetime foregone earnings.	Change in productivity
Fear and trauma of elephant intrusion into the village	Loss of normal living patterns and tranquillity	Contingent Valuation Method
Translocation of elephants to forest reserves	Translocation to prevent further damage to agricultural crops and settlements	Defensive expenditure

The above losses, either economic or psychological, would not have occurred had the ability of the forests to provide adequate habitat to the elephants were not jeopardised. The value of the losses and fears would have been avoided had the forests been intact and their functions as habitats for elephants unimpeded. Hence, an alternative approach to assess the value of forests as a function of elephant habitat could be proxies by the avoided losses that society would

have to incur owing to the disturbance of the tranquil environment provided by forests. The above economic valuation approaches can be categorised into four main categories (Table 4).

Table 4. Categories of economic valuation method

Functions being value	Economic valuation approaches
Ecotourism Values	Travel cost method and contingent valuation method
Biodiversity Values	Market-Based (Residual Method)
Local Economic Multiplier	Market-Based (Residual Method)
Wildlife habitat function and human-wildlife conflicts: property damages, replanting, loss of income opportunities, trauma,	Change in productivity method, replacement cost approach, opportunity cost approach, and contingent valuation approach
Financial budget required for the increasing number of staff and support services	Direct cost approach
Financial budget required for the survey on the external boundary of AJFR and promotion activities such as conferences	Direct cost approach
Financial budget required for R&D and other preparatory works on the ecological corridor	Direct cost approach
Financial budget required for the planning and construction of the viaduct	Direct cost approach
The economic value of the carbon sequestration function of the BTFC	Benefit transfer technique

In conducting the above valuation exercise, field surveys to obtain relevant data were collected from:

- i. One hundred sixty respondents were tourists/visitors to BTFC and Tasik Temenggor involving. The objective of this survey is to capture the economic benefits received from tourism.
- ii. Local communities and villagers along the Gerik – Jeli Highways, including Kampung Air Banun, Desa Damai, Kampung Desa Permai, and Kampung Rebe, with a total number of 100 respondents. The objectives of this survey were to obtain the value of the economic dependence upon the natural forest and the economic losses incurred by villagers affected by human-wildlife conflicts.
- iii. Ten local businesses involved in the tourist industry to BTFC. The objective is to obtain the value of economic benefits from increasing visitation to BTFC and Tasik Temenggor.
- iv. The general population in Ipoh, Taiping and Kuala Kangsar to obtain the non-use values of the conservation of BTFC through the CFSEC at Gerik, Perak project totalling 166 respondents.
- v. Officers at relevant government agencies such as the Forestry Department and the Department of Wildlife and National Parks (DWNP).

Study Site

Temenggor Forest Reserve and Royal Belum State Park are in the Gerik district, north of Perak. This area borders Thailand in the north, Kelantan forest in the east and Ulu Muda forest reserve, Kedah, in the west. It is known as a forest complex (Belum-Temenggor Forest Complex- BTFC) as its vast land comprises Temenggor Permanent Forest Reserve (148,870 hectares) (including Lower Belum Forest Reserve) and the Royal Belum State Park (117,500 hectares) (Figure 3). The lower Belum Forest Reserve changed its name to Banding Forest Reserve after being

gazetted by the state government. On its northern boundary, BTFC is contiguous with both the Hala-Bala Wildlife Sanctuary and the Bang Lang National Park in southern Thailand (Abdullah *et al.*, 2013; Lim *et al.*, 2000).



Figure 3. Human man-made lake at BTFC

In 1989, the Malaysian government opened BTFC for logging, agriculture and tourism activities (Abdullah *et al.*, 2013). More than 85% of the ecological corridor within BTFC is covered by forest, and less than 3% is agriculture. The rest is cleared areas (<0.5%) and water bodies (nearly 5%). BTFC consist of an integrated ecology landscape which is rich in biodiversity. The area is a reservoir of rich natural heritage estimated to be 130 million years old - older than the well-known Amazon and Congo forests in Africa. This area has also been recognised as an Environmentally Sensitive Area under Malaysia's National Physical Plan 2005 and is home to at least 14 globally threatened wildlife species. It is a unique forest with a mixture of Malaysia and Thai-Burma forest types, mainly Sundaic lowland and hill dipterocarp forest. The forest consists of 3,000 species of flowering plants, including 3 species of *Rafflesia*, the world's largest flower that can be found. The Belum Forest is rich with rare rainforest hardwood species such as Meranti, Cengal, Keruing and Merbau. These large hardwoods have survived 500-600 years of poor soil conditions, lack of nutrients and weather changes. Many globally threatened species of flora and fauna have been recorded. The area remains a last refuge for large mammals such as the Asian Elephant *Elephas maximus*.

RESULTS AND DISCUSSION

If the habitat of the wild elephants, usually the forests, is disturbed, these animals, confined to the small home range and insufficient food, will leave the forests and enter those villages fringing the forests in search of food. Thus, leads to direct contact with humans. Crop raiding is a major problem in cultivations abutting elephant habitats. Cultivated

crops worth millions of dollars are destroyed yearly, and small farmers may lose an entire year's provisions in a single night's raid. Conflict is acute in areas with large, high-density elephant and human populations. Community participation and well-maintained electric fences are barriers against elephants. These animals will enter plantation areas and traditional villages to search for food supply and new home range. Thus, it will create a human-elephant conflict.

The losses computed from damaged crops could occur per four sources. The first is from the effects of stunted growth, even though the crops are not destroyed. A typical example is eating the young shoots and barks of the planted rubber seedlings. The growth of the trees would be affected for a couple of months but would eventually recover. There would be a temporary decline in yield. A second source would be the destruction of the crops resulting in a permanent loss of future yields and revenues until the replanted crop reached latex tapping ages. In this case, there will be another source of losses from the cost of replanting. The fourth source of losses is the loss of future income when the crops are destroyed, and the farmers have given up and do not attempt to do any replanting. This occurs when the elephants continuously eat the young planted trees.

On average, the mean economic values of damage were dominated by losses from damaged rubber trees valuing RM1,309 per affected villager or 50.8% of the mean economic loss by a villager affected by the HEC incident (Table 5). The estimate included current losses and future losses of latex until the tree reaches maturity. These values were high if no replanting was undertaken or if the villagers had given up hope that any replanting effort could survive future elephant attacks. If replanting were undertaken and the trees survived, the losses were small, covering only the losses in yields until the replanted trees could be tapped. The other major crop losses were from damages to *Cempedak* fruit trees worth about RM359 or 13.9% of the total economic loss per villager and from damage to tapioca cultivation valued about RM291 per villager or 11.3%, and to durian trees valued at RM282 or 10.9% of the total loss per villager. The other crops often attacked were 'duku', coconut, 'rambutan' trees, and bananas.

Table 5. Mean economic values of crop damage per villager affected by the HEC incident

Crop losses	Present value losses (RM)	Percentage (%)
Rubber	1,309	50.8
Tapioca	291	11.3
Banana	13	0.5
Durian	282	10.9
Coconut	1	0.0
Cempedak	359	13.9
Rambutan	122	4.7
Duku	200	7.8
Total	2,577	100.0

Table 6. Sources of average economic losses incurred by villagers from HEC incidents in Belum District (RM/villager affected by HEC incidents)

Sources of economic losses	Value (RM)	Percentage (%)
Total discounted loss from agricultural crops	2578	86.6
Loss from damaged property	377	12.7
Loss from expenditures on night sentry	0	0.0
Foregone revenue from trauma	8	0.3
WTP to avoid future HEC	14	0.5
Loss from injury	0	0.0
Loss from death	0	0.0

Agricultural crop losses dominated the average loss incurred from HEC incidents, with RM2,578 or 86.6% of the losses (Table 6). The next loss was that from damaged properties, estimated to average RM377 per villager affected by the incident, contributing 12.7% of the total loss. The damaged properties were mainly the water piping system and the repair cost. Another loss is the psychological fear of facing an incident of an elephant intrusion into the village. The monetary value of this fear is difficult to estimate directly. However, there is an indirect approach to gauging this value by assessing the cost that a villager is willing to incur to take away the source of the fear. This was measured by the willingness to contribute to a fund that could facilitate the relocation of errant elephants to a larger sanctuary to avoid future HEC incidents. This study found that affected villagers would be willing to pay RM14 towards a fund that could be used to relocate the errant elephants.

Other losses incurred are expenditures incurred by the villagers on night sentry activities and foregone revenues from fear and trauma incurred during HEC incidents that prevent early morning tapping of rubber trees during the days of the incidents (RM8). There were no cases of death or health effects.

Table 7. Cost of capture and relocation

Sources of economic losses	Value (RM)	Percentage (%)
Ammunition and darting equipment	1200	2.9
Drugs	1150	2.8
Elephants securing utensils	1580	3.9
Fuel and vehicle maintenance	1432	3.5
Staff allowances	12600	30.8
TOTAL COST OF CAPTURE	17962	43.9
Food supplies for 2 working elephants	2800	6.8
Fuel and vehicle maintenance	4064	9.9
Drugs	1168	2.9
Ammunition and darting equipment	1500	3.7
Elephant securing utensils	2980	7.3
Cost of hiring tug boat to National Parks per trip	1900	4.6
Staff allowances	8540	20.9
TOTAL COST OF RELOCATION	22952	56.1
GRAND TOTAL	40914	100

The process of capturing and relocating wild elephants in Peninsular Malaysia is handled by the Elephant Capture & Translocation Unit (ECTU) under the supervision of the Department of Wildlife and National Parks (DWNP). The funding of ECTU is from the Federal Government, supported by additional financial assistance from the Elephant Trust Fund set up in the states of Pahang, Johor, Perak, Negeri Sembilan, Perlis and Terengganu. Some big players such as the plantation companies, private sectors, and individuals affected also contribute towards the Trust Fund for the management and conservation of their habitats.

Prior to any capture and relocation operations, a detailed study and survey will be carried out by ETCU. This ensures that only elephants with insufficient habitat and being left in pocketed forests causing disturbances and damage to crops and infrastructures are involved in such operations. These elephants will then be captured and relocated to a safer habitat in protected areas for future survival. However, control techniques such as building electrical fences, elephant trenches, making noises through shooting, burning firecrackers or carbides and carrying flame torches are some ways to scare them away. Captured elephants are usually relocated to bigger forest areas, such as those adjacent to National Parks.

Table 7 shows the total cost of capturing and relocating a wild elephant. The total amount of RM40,914 is divided into the cost of capture with RM17,962 (43.9%) and the cost of relocation with RM22,952 (56.1%). The bulk of the cost of capture goes to staff allowances, which accounted for 30.8% of the total cost. Although the number of staff required is 8, the number of man-days spent in monitoring the target elephant is 21 days. For the cost of relocation, staff allowances which amounted to RM8,540, accounted for 20.9% of the total cost, followed by fuel and maintenance of vehicles used in the relocation (9.9%) and elephant securing utensils such as high tensile chains and u-shackle (7.3%). The high fuel and maintenance bill is the result of the ferrying of two working elephants to the site as two 10-wheel lorries are used. The total number of manpower required is also 8, but the number of the man-days required is shorter, 7 days. A tugboat is usually used to ferry the wild elephant to the new area to be released.

Table 8. Losses from elephant encroachment at Tali Kail Island, Banding

Losses from cancelled reservations from (October 17 – November 05 08)			
No	Booking/reservation form	No days	Cancelled revenue collections (RM)
1	Border 303 Regiment Camp Pengkalan Hulu	3	690
2	Youth Office Batu Gajah	3	735
3	State Secretary Perak Office	3	480
4	Contractor Services Centre Perak	3	735
5	Syariah Court Ipoh	2	320
6	Secondary School Teluk Bahang	3	440
	Total Losses		3400

In October 2008, the Tali Kail Island Resort, Banding, was encroached on by a herd of elephants that destroyed the kitchen portions of several chalets. The costs of repairs are being estimated. Several chalet bookings had to be cancelled or deferred. There were losses in foregone revenues from rental amounting to RM3,400 during that period

(Table 8). The cost of repairs on the chalets is estimated to range from RM15,000 to RM51,750 (Table 9). The total loss that could have been avoided if there had been no conflict with the elephant would be ranged from RM38,400 to RM55,150. Similar incidents may repeat every year in the future whenever an attack occurs.

Table 9. Damaged properties at Tali Kail Island, Banding

No	Properties and repairs	Loss (RM)	1%	2%
1	Infrastructural repairs, including Chalet A and village house walls, kitchen broken doors, toilet walls	6090	11.8	40.6
2	Replacement of water tanks	1485	2.9	9.9
3	Replacement of toilets	5775	11.2	38.5
4	Replacement of lamps and wiring installation	1650	3.2	11.0
5	Permanent loss of one village house (foregone rentals)	36750	71.0	
Total 1		51750	100	
Total 2		15000		100

¹Total cost including permanent loss of village house

²Total cost of direct property damage and repairs

If the forest is being established as a protected area that can be a habitat for the elephants, the aggregate value of potential avoided losses from HEC could be estimated. The aggregate value for this protected area could be estimated by multiplying the average annual value of avoided economic losses per villager (RM2,977) by the number of villagers routinely affected by HEC incidents. According to the villagers surveyed at Kampung Banun, the majority of them have been affected by HEC incidents. Using an estimated number of 150 households, the estimated aggregate value is RM0.45 million per year. This aggregate value could be added to the avoided cost or cost saving from a capture and relocation operation of RM40,614 and the avoided loss on Tali Kail Island of RM55,150 to give a total value of RM0.54 million per year.

CONCLUSION

The purpose of this study is to estimate the economic value of damages incurred in Human Elephant Conflict (HEC) using various types of economic valuation. This study illustrates how economic valuation can estimate the aggregate value of HEC and how this data can help reinforce the idea of establishing protected areas as habitats for elephants. The outcome of this study is believed to support the Sustainable Development Goal (SDG) 15 (Life on Land) that protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. At this point, the fact that protected areas need to be established has been proved. However, to ensure this happens, land use policies in elephant habitats must be made clear to prevent further habitat fragmentation or escalation of elephant-human conflict.

The policies should be pragmatic enough to allow smaller fragmented forest patches to be taken up for development to maintain larger habitats intact. Efforts should be taken to protect corridors / traditional migratory routes of elephants. Corridors play a crucial role in maintaining elephant habitats and their interconnections, which would ensure

minimum viable elephant populations. Wherever needed, land should be purchased or notified to augment existing corridors. This paper also suggests that the local community should be involved in corridor conservation by providing them incentives for maintaining their lands as corridors. This is because habitat conservation was critically important and would require cross-sectoral land use planning supported by a clear national policy. The use of elephant-specific EIA would help to stop or minimise the adverse impact of development on elephant habitats.

Policymakers also should develop national policies and strategies for elephant conservation and captive elephant management. Initiate surveys to gather baseline data for conservation planning and monitoring. Improve information sharing with relevant departments within the government. This study is limited in ways that suggest opportunities for future research. This study is specific to only one Belum-Temenggor Forest Complex. It might not be reasonable to conclude that this study is a general statement on the Human Elephant Conflict in Malaysia. The results of this study cannot be generalised beyond Belum-Temenggor Forest Complex due to the relatively small sample size. Future studies should adopt the proposed research model to generalise the findings. It would be an excellent idea if a new study could be based on the other type of economic valuation, such as a choice experiment.

AUTHOR CONTRIBUTIONS

Azniza Ahmad Zaini: Conceptualization, Data Collection, Methodology, Funding Acquisition, Writing-original draft, Writing-review and editing. **Mohd Iqbal Mohd Noor:** Conceptualization, Data Collection, Methodology, Funding Acquisition, Supervision, Writing-original draft, Writing-review and editing. **Badli Esham Ahmad:** Supervision, Funding acquisition, Writing-original draft, Writing-review and editing. **Amira Mas Ayu Amir Mustafa:** Conceptualization, Data Collection, Methodology, Writing-original draft, Writing-review and editing.

All authors have read and agreed to the published version of the manuscript. **William V. Eylen:** Conceptualization, Supervision.

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DATA AVAILABILITY

Not applicable.

COMPETING INTEREST

The authors declare that there are no competing interests.

COMPLIANCE WITH ETHICAL STANDARDS

Not applicable.

SUPPLEMENTARY MATERIAL

Not applicable

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