

Understanding Elephant Disturbance in Human-Elephant Conflicts : Complaints and Patterns in South Peninsular Malaysia

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Abstract

The mobility and behaviour of Asian elephants regularly cause disruptions to local residents and agriculture, making human-elephant conflicts (HEC) a major problem in South Peninsular Malaysia. With a focus on two main goals, this thesis attempts to investigate the dynamics of elephant disturbances and spot trends within these disputes. Analysing Asian elephant movement data in southern Peninsular Malaysia and comparing movements' temporal and spatial patterns to human activity areas is the primary goal. The goal of this study is to identify patterns that lead to disturbances, including property destruction or crop raiding. In order to comprehend how elements like seasonal variations, habitat loss, and human encroachment impact the severity and distribution of conflicts over time, the second goal is to examine the relationship between the frequency and kind of disturbances and the year. This study provides important insights into the causes and trends of HEC in the area by combining movement analysis and disturbance data, and it makes suggestions for better management techniques to lessen conflicts and encourage coexistence between people and elephants.

1. Introduction

Conflicts between people and elephants have long happened in Peninsular Malaysia, particularly in the south, where human settlements meet elephant natural habitats [6]. According to the Wildlife Conservation Society in 2007, HEC is becoming more common worldwide. This is primarily due to habitat degradation, fragmentation, and an increase in the number of people moving into elephant regions. Getting rid of HEC is critical for numerous reasons. To begin, elephants are keystone species that are required to maintain the balance of ecosystems in their habitats [7]. Their presence helps distribute seeds, establish habitats, and enhance the variety in general.

Getting rid of HEC is critical for numerous reasons. To begin, elephants are keystone species that are required to maintain the balance of ecosystems in their habitats [9]. Their presence aids in the dispersal of seeds, the formation of habitats, and the general increase in variety [10]. As a result, avoiding confrontations between humans and elephants is critical for long-term protection of elephant habitats [2]. To effectively reduce confrontations between humans and elephants, an understanding of Asian elephant movement patterns and

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behaviours is necessary. Local communities, policymakers, and conservationists can develop targeted plans to reduce conflict and promote elephant-human coexistence by learning about the factors that influence elephant migration patterns, such as preferred habitats, food sources, and seasonal changes [3].

Advances in remote sensing and GPS monitoring have made it possible to collect comprehensive movement data for animals such as elephants [11]. Researchers can utilise satellite imagery and geographic information systems (GIS) to track elephant movements in real time and analyse geographical and temporal patterns more precisely by fitting the animals with GPS collars [4]. Human-elephant conflicts (HEC) are an ongoing issue in Peninsular Malaysia's southern region. These confrontations occur when elephants enter people's yards, destroy property, devour crops, and kill people. Even if efforts are being made to address the problem, the increasing quantity and intensity of HEC complaints illustrate how crucial it is to quickly recognise the underlying dynamics that produce elephant disturbance in the study region.

2. Objectives

The following objectives aim to decrease human-elephant conflict (HEC):

- 1) To Clean and prepare the collected information on human-elephant conflict.
- 2) To analyse the movement data of the Asian elephant at south
- 3) To analyse Human Elephant Conflict data.

3. Methodology

3.1 Research Area

Fig. 1 shows that the map of location that involve in Johor region especially at several districts such as *Kota Tinggi*, *Mersing*, *Kluang* and *Segamat*. *Kota Tinggi* located at the estuary of *Sungai Johor* and is roughly 40 kilometer from Johor Bahru, the state capital. *Kota Tinggi* district is located to the south of Peninsular Malaysia and is the biggest district in the Johor with an area of 3,500 square miles. There are 10 small towns in this district with a population of 200,000; and made up of 26 main traditional villages with 117 linking villages, 29 Felda settlements and 5 new KEJORA townships (MDKT ,2022)

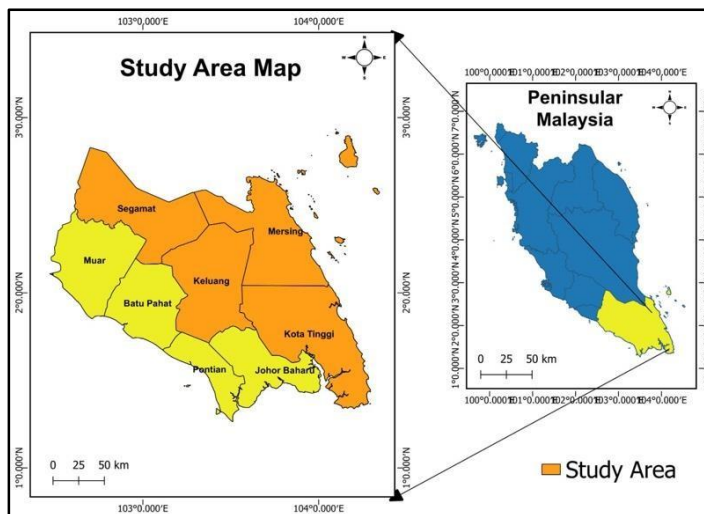


Fig. 1 Study Site

3.2 Data Acquisition

Fig. 2 shows the procedures involved in this research to collect one type of data, namely raw data. The raw data is data that was collected by other parties, for example Jabatan Perhilitan Kuala Lumpur.

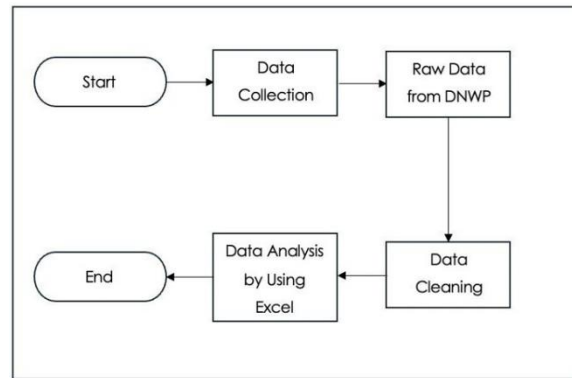


Fig. 1 Flowchart for Data Acquisition

3.3 Data Cleaning

In this study we need to use the data cleaning method due to we only given the raw data from Jabatan Perhilitan. For the first step in data cleaning is we need to delete the duplicate or unrelated data. Next step is we need to stabilize the errors, after that clean the rejected data and fix the lost data.

3.4 Construct Graph by Excel

Data in columns had been organized by, placing variables (such types of disturbance: RT, BK, MK, RH, BM, LL) in next columns and categories (like years) in a single column before creating a graph in Excel. Chart type had chosen based on the data (such as a scatter, line, or column chart) after selected the whole data range and selected the Insert tab. Use the choices in the Chart Design and Format tabs to personalize the graph by adding titles, axis labels, and changing the chart style.

3.5 Analyse Data by Excel

Totals, averages, and trends across time were computed using Excel functions like SUM, AVERAGE, and COUNTIF. The pertinent data was chosen for graphical representation, and graphs, such as line or bar charts, were created using Excel's charting features to show the patterns in disturbances over time. These graphics facilitated the comprehension and study of the data by highlighting trends, highs, and lows in various conflict types

4. Result and Discussion

With the Department of National Wildlife Protection (DNWP) supplying statistics on various disturbances caused by elephants, human-elephant conflict (HEC) has grown in importance in areas where human settlements overlap with elephant habitats. In order to identify important conflict trends, such as crop destruction (RT), roaming elephants (BK), fear-inducing episodes (MK), property damage (RH), public disturbances (GK), and miscellaneous disturbances (LL), this study examines data from 2015 to 2021. The investigation intends to investigate the root causes of these disruptions, evaluate the efficacy of mitigating techniques, and provide guidance for future regulations to support sustainable human-elephant coexistence.

Table 1 Table Number of Elephant in Each District based on Year

Year/District	<i>Kluang</i>	<i>Kota Tinggi</i>	<i>Segamat</i>	<i>Mersing</i>	<i>Johor Bahru</i>	<i>Batu Pahat</i>	<i>Kulai</i>
2015	57	107	103	157	0	0	0
2016	90	107	26	121	0	0	0
2017	101	164	14	100	0	0	0
2018	49	163	44	159	0	0	0
2019	20	19	3	38	0	0	0
2020	91	142	39	117	5	2	0
2021	103	149	50	181	5	0	1

The number of disturbances reported in Kluang, Kota Tinggi, Segamat, Mersing, JB (Johor Bahru), BP (Batu Pahat), and Kulai districts between 2015 and 2021 is displayed in Table 1. The biggest number of disturbances was constantly reported in Mersing, reaching a peak of 181 occurrences in 2021. Kota Tinggi followed, showing an increasing tendency from 107 in 2015 to 164 in 2017 before stabilising at 149 in 2021. Kluang likewise fluctuated, falling sharply in 2018 before rising to 103 in 2021. Fewer disruptions were reported by Segamat; there was a notable decline in 2017 (14 instances), but by 2021, there had been a minor uptick to 50. With a few isolated

incidents in 2020 and 2021, other districts, such as JB, BP, and Kulai, reported little to no disruptions. According to the data, some areas remained relatively less affected throughout time, whereas Mersing and Kota Tinggi were the most affected.

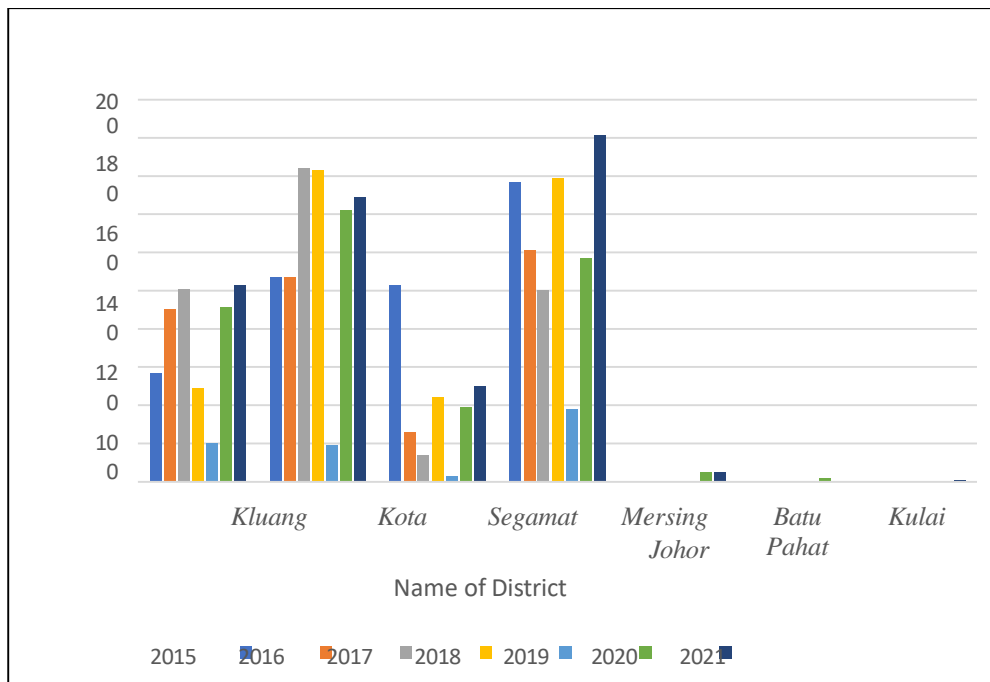


Fig. 2 Graph Number of Elephant in each District based on Year

Fig. 3 shows the number of disturbances in several districts, including Kluang, Kota Tinggi, Segamat, Mersing, Johor Bahru (JB), Batu Pahat (BP), and Kulai, between 2015 and 2021. While Kota Tinggi also had notable numbers, especially in 2017 and 2021, Mersing continuously had the most disruptions, reaching a peak of 181 in 2021. Kluang fluctuated, dropping in 2018 before rising to 103 in 2021. Overall, there were less disruptions in Segamat, which saw a low point in 2017 before rising. Only a few isolated cases were reported in 2020 and 2021, and there was very little activity in JB, BP, and Kulai. Over time, Kota Tinggi and Mersing were the areas most impacted, with other districts experiencing very little disruption.

Table 2 Frequency of Disturbance in South Peninsular Malaysia

District/Disturbance	RT	BK	MK	RH	GK	LL
<i>Kluang</i>	59	252	2	0	184	0
<i>Kota Tinggi</i>	254	543	55	2	12	0
<i>Segamat</i>	181	9	29	58	2	0
<i>Mersing</i>	818	0	0	3	34	4
<i>Johor Bahru</i>	2	2	0	0	7	0
<i>Batu Pahat</i>	0	2	0	0	0	0
<i>Kulai</i>	0	0	0	0	1	0

Data on incidents in several districts of Johor, Malaysia, are included in Table 2 and are grouped under the following six labels: RT, BK, MK, RH, GK, and LL. Mersing is the only district to report LL instances (4) and has the highest RT count (818). Kota Tinggi exhibits the largest BK count (543) and a noteworthy MK count (55), suggesting that these categories are where the activity is concentrated. Segamat has relatively low figures in other areas, but a noteworthy RH count of 58. In contrast to Johor Bahru, which exhibits very little activity just two occurrences of RT and BK and seven for GK. Kluang has a high BK count (252) and GK count (184). There is very little activity in most categories, as seen by the fact that Batu Pahat only reports two BK instances and Kulai only registers one GK case. This data shows a great deal of variation, with some districts reporting little to no occurrences and others showing intense activity in particular categories.

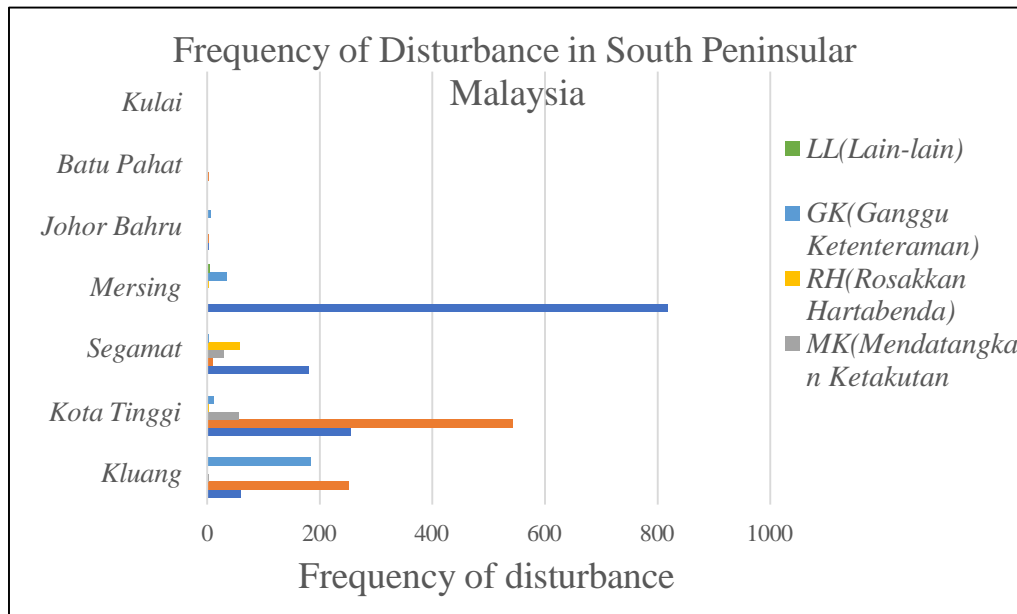


Fig. 4 Frequency of Disturbance in South Peninsular Malaysia

Under the six variables (RT, BK, MK, RH, GK, and LL), the bar graph displays the distribution of occurrences throughout seven districts in Johor, Malaysia. Significant differences in the frequency of occurrences between districts and categories are highlighted by the study. The district with the most RT occurrences (818) is Mersing, indicating a significant problem or incident related to this category. Following this are Segamat (181) and Kota Tinggi (254) whereas Johor Bahru, Batu Pahat, and Kulai have very few RT occurrences (2 or less). Kota Tinggi (543), where BK is most prevalent, is followed by Kluang (252) at a significant distance. However, a number of districts, such as Mersing, Kulai, and Batu Pahat, record little no BK incidents. Kota Tinggi (55) and Segamat (29), where the MK category is most prevalent, record few or no occurrences. Segamat (58) exhibits a significant increase in the RH category, whereas Mersing (3) and Kota Tinggi (2) are barely represented. Mersing (34), Kluang (184), and other districts report single-digit counts or none at all, whereas GK, which is typically lower across most districts, rises in Kluang. Finally, the uniqueness of this variable in the district is demonstrated by the fact that LL occurrences are only observed in Mersing (4). However, the absence of major events in districts such as Batu Pahat and Kulai in the majority of categories can be a result of their situational, demographic, or geographic circumstances. This variation emphasises how crucial it is to use customised approaches to address the fundamental problems in every district.

Table 2 Data Number of Disturbance based on Year

Year/Disturbance	RT	BK	MK	RH	GK	LL
2015	267	26	72	33	26	0
2016	162	104	5	26	47	0
2017	152	186	0	2	39	0
2018	263	116	0	1	34	0
2019	44	25	1	1	8	1
2020	168	173	5	1	48	1
2021	251	186	1	1	49	1

Patterns of human-elephant conflict (HEC) throughout different districts and years are revealed by the data presented in Table 3. While Kota Tinggi has remarkable amounts of crop destruction (RT, 254) and wandering elephants (BK, 543), Kluang has the highest frequency of both public disturbances (GK, 184) and crop destruction (RT, 59). Despite having few stray elephants, Mersing has considerable agricultural damage (RT, 818) and sometimes disturbances among the public (GK, 34). Segamat exhibits a combination of property damage (RH, 58) and crop devastation (RT, 181), with very few straggling elephants. While Kulai reports few incidents, Johor Bahru and Batu Pahat have comparatively low disruption levels. The data exhibits erratic trends over time, with BK gradually increasing after 2015 and reaching its highest point in 2017 (186), whereas RT peaked in 2015 (267) and 2018 (263).

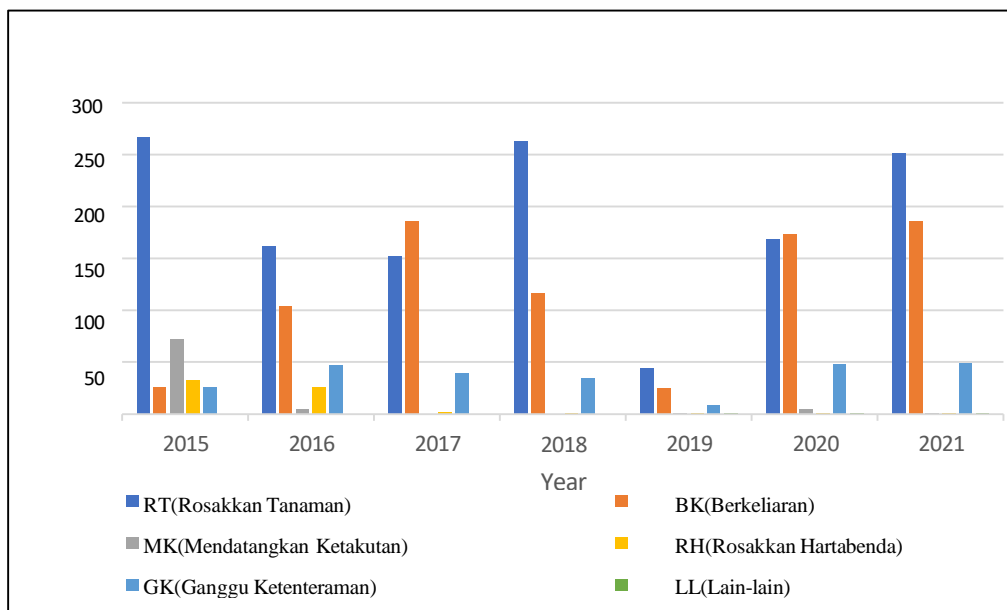


Fig. 3 Graph of Number of Disturbance based on Year

5. Conclusion

In conclusion, by utilising Excel to analyse data gathered from the Department of National Wildlife Protection (DNWP), this study offers a thorough understanding of human-elephant conflicts (HEC) in South Peninsular Malaysia. Key tendencies in a variety of conflict types, such as crop loss, roving elephants, property damage, frightening episodes, and public disruptions, are revealed by the research. Even while mitigating techniques have had some success in lowering certain disturbances, like frightening events and property damage, the continuous rise in stray elephants and public disruptions emphasises how difficult it is to manage HEC. The analysis emphasises how crucial it is to manage conflicts holistically, encompassing community-based interventions, the creation of conflict-free corridors, and habitat conservation

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm their contribution to the paper as follows: **study conception and design:** Nur A'alia Atierah Bakri, Nazirah Mohamad Abdullah; **data Collection:** Nur A'alia Atierah Bakri; **analysis and interpretation of results:** Nur A'alia Atierah Bakri; **draft manuscript preparation:** Nur A'alia Atierah Bakri. All authors reviewed the results and approved the final version of the manuscript.

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