ASSESSMENT ON WILDLIFE DISTURBANCE AT AGROPARK, UMK JELI CAMPUS.

by

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DECLARATION

I declared that this thesis entitled “Assessment on Wildlife Disturbance at Agropark, UMK Jeli Campus” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree.

Signature : …….

Name : …….

Date : …….

APPROVAL

"I/ We hereby declare that I/ we have read this thesis and in our opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Applied Science (Geoscience) with Honors"

Signature	:	……..
Name of Supervisor	:	……..
Date	:	……..

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Assessment on Wildlife Disturbance at Agropark, Umk Jeli Campus

ABSTRACT

The study entitled 'Assessment on Wildlife Disturbances at Agropark, Umk Jeli Campus' was conducted in order to identify the species that were present or causing disturbance at the area as the change of land-use has caused the loss of habitat for wildlife there. Agropark is located near the Jeli Permanent Forest Reserve, one of fragmented forests as the area is partially cleared for development and partially reserved for biodiversity conservation. The data on wildlife disturbances were obtained from the staff of Agropark, with additional of camera trapping in the study area. Through these methods, the species that are present and causing disturbances were identified. The most common disturbance was caused by the wild boars, where they preyed on the livestock and damaged the crops in the area. Other species that are not harmful are also caught in the camera traps. Some factors have greatly influenced the result of this study and limit the deeper research on the consequential damages caused by the wildlife attacks. This study can be improved by adding the number of camera trap, changing the time of sampling and obtaining the latest updated reports from the staff. In conclusion, this study has the potential to provide the information on wildlife disturbances and estimation on risks for wildlife attacks at Agropark.

Penilaian Terhadap Gangguan Haiwan Liar Di Agropark, Umk Kampus Jeli

ABSTRAK

Kajian yang bertajuk ‘Penilaian Terhadap Gangguan Haiwan Liar di Agropark, UMk Kampus Jeli’ ini dijalankan dengan tujuan untuk mengenal pasti spesies haiwan liar yang terdapat di sekitar kawasan Agropark serta gangguan yang terjadi disebabkan oleh haiwan liar apabila berlaku perubahan dalam penggunaan tanah yang mengakibatkan haiwan liar di kawasan tersebut kehilangan habitat mereka. Agropark terletak berhampiran dengan Hutan Simpan Kekal Jeli, iaitu salah satu hutan yang terbahagi di mana sebahagian kawasan dibersihkan untuk pembangunan dan sebahagian lagi disimpan sebagai langkah memelihara biodiversiti. Maklumat berkaitan dengan serangan haiwan liar diperoleh daripada staf Agropark, dengan penambahan kaedah perangkap kamera di kawasan kajian. Melalui kaedah-kaedah ini, spesies yang ada serta menyebabkan gangguan dapat dikenal pasti. Gangguan yang biasanya terjadi adalah disebabkan oleh babi hutan, di mana mereka memburu ternakan dan memusnahkan tanaman di kawasan itu. Terdapat beberapa spesies lain yang tidak berbahaya tertangkap oleh kamera perangkap. Beberapa faktor telah memberi kesan yang besar kepada hasil kajian dan membataskan penyelidikan yang lebih mendalam mengenai kerosakan susulan daripada serangan haiwan liar. Kajian ini mampu ditambah baik dengan menambah bilangan kamera perangkap, mengubah masa persampelan, dan mendapatkan laporan yang terkini daripada pihak pengurusan Agropark. Kesimpulannya, kajian ini berpotensi untuk memberi maklumat mengenai gangguan haiwan liar dan membuat anggaran terhadap risiko serangan haiwan liar di Agropark.

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LIST OF ABBREVATION AND SYMBOL

a.s.l : above sea level

DWNP : Department of Wildlife and National Parks

EN : Endangered

FDPM : Forestry Department Peninsular Malaysia

IUCN : International Union for Conservation of Nature

JPSM : Jabatan Perhutanan Semenanjung Malaysia

LC : Least Concern

m : meter

NT : Near Threatened

PERHILITAN : Jabatan Perlindungan Hidupan Liar dan Taman Negara Semenanjung Malaysia

PRF : Permanent Reserved Forest

SFDs : State Forestry Departments

UMK : Universiti Malaysia Kelantan

VU : Vulnerable

WWF : World Wildlife Fund

CHAPTER 1

INTRODUCTION

1.1 Background of study

Malaysia is one of the countries that lies on the Earth's Equator. Due to this geographical location, the season is the same throughout the year, that it is always hot and humid. This climate has become the reason for the presence of tropical rainforest in Malaysia. According to the Forestry Department Peninsular Malaysia (FDPM) official website, the forestry statistic in 2016 shows that the permanent reserved forest (PRF) covers an area of 4.92 million hectares, from 13.18 million hectares of Peninsular Malaysia land cover.

The forested area statistics for Peninsular Malaysia have been published by the FDPM with the initial base information of the forest areas extracted from the topography maps of the Land Survey Department and the Standard Sheet maps of the Land Offices. Then, the State Forestry Departments (SFDs) will update the maps and statistic information in form of deductions on the statistical information whenever a forest area is approved for conversion to non-forest use or development or de-gazettement of a Permanent Reserved Forest (PRF). While the maps and statistic information will be updated in form of additions on the statistical information whenever a gazettement is made for a new Permanent Reserved Forest (PRF).

However, the growth in human population has led to the depletion of natural resources. Natural resources are useful materials which occur naturally that are available in Earth. Wildlife has also been beneficial to human through sustaining food supplies, maintaining ecological balance, providing recreational outdoor activities and helps developing meaningful bonds between human and nature. Human explores these resources to fulfil their needs for space, food and water supplies, economical activities.

Without sustainable practices, these resources are declining for over the century. In instance, the forests are cleared for urbanization, agriculture and timber products (Gane, 2007). This matter subsequently causes the loss of habitat for wildlife due to rapid and large-scale changes to the landscapes and ecosystems.

Agropark of Universiti Malaysia Kelantan (UMK) Jeli Campus is located near the Jeli Permanent Forest Reserve, which is included in one of the Tanah Merah's 12 permanent reserve forests (PRF). A few studies have been conducted in this area, which provide beneficial information on the wildlife that can be found in Agropark and Jeli Permanent Reserved Forest (JPRF). Attributable to the institutional development and the opening of agricultural land, the area of forest was approved for conversion to non-forest use and cleared for the expansion of campus area. This matter may lead to the decreasing population of wildlife and conflicts may occurred when wildlife roamed or trespassed into developed area.

The growth of institutional land and loss of wildlife habitat have brought them into contact with one another. Human-wildlife intersection has significant possibilities that lead the wildlife to cause disturbances such spreading of diseases, predation of livestock, crops or property damage and injury resulting from direct attack (Woodroffe, Thirgood, & Rabinowitz, 2005). Thus, for these reasons, this study is conducted. This study relied on the reports and information from interviews to obtain data on wildlife disturbances. The species residing the area around Agropark were observed using camera traps.

1.2 Problem Statement

The development of facilities and buildings in UMK Jeli Campus has caused a part of the forest to be cleared. The expansion of campus area with the addition of infrastructures such as building and roads causes a part of the forest to be cut down. Due to this change of land-use, the land cover of forest is significantly reduced. As the consequences, wildlife in that area had had lost their habitat and lead to the trespassing into the campus area. The disturbances cause by the wildlife mainly occur in Agropark area since it is near to the forest. These animals can easily access to the area as there are no fence or other facilities built to prevent the animals from trespassing.

The coexistence of wildlife and human within the forest area in Agropark has led to a few discomfort situations such as disturbances, predation on livestock, and crop damages. By analyzing the reports and camera trapping, the animals that caused disturbances or present at Agropark area were identified.

1.3 Objectives

The objectives of this study are to identify the species of wildlife that roam within the forest area at Agropark. In addition, this study was proposed to determine the disturbances involving wildlife around that area, in which they may disrupt the human activities there.

1.4 Scope of Study

This study focused on the species of wildlife within the selected study site with the purpose of identifying the wildlife species present at Agropark and the disturbances occurred within the area. The data about disturbances collected for this study is limited to the information from interviews and reports. This study also was supported with the wildlife images from a series of camera traps. Through this method, the species of wildlife present within Agropark area were identified. This study also assessed the risks on wildlife disturbances to estimate the monetary loss based on the market prices.

1.5 Significance of Study

This study is important for determining the species of wildlife that roam around the Agropark area. The data from this study is beneficial as a reference for the students and authority to recognize any animals they may encounter when visiting or working in the area. This information also can help increasing the awareness among students to prioritize their safety while conducting field works at Agropark as some of the species could possibly attack human.

Hence, all of these results will be able to provide baseline data to aid the conservation efforts for wildlife and assessment on risks of wildlife disturbance Agropark UMK Jeli Campus.

CHAPTER 2

LITERATURE REVIEW

2.1 Malaysian Rainforest

The countries, including Malaysia, that lie on the equator receive more sunlight. The amount of sunlight and intensity of the sunlight the tropics receive do not varies much in comparison to other parts of the globe. As more sunlight received, the temperature in Malaysia is relatively hot and warm throughout the year. The high temperature means that evaporation occurs at a fast rate, resulting in frequent rainfall. Therefore, the climate is often hot and humid, which contribute to the growth of the tropical rainforests. The amount of rainfall and the amount of sunshine that Malaysia receives are the factor of healthy growing forest.

The natural forest area that is located in a protected area determined the species richness and composition in the protected area. Biological communities differ depending on the habitat quality (Laidlaw, 2000). Some of the species can quickly adapt in disturbed area with less vegetation while some other species can only strive in area of forest cover with dense vegetation. Preserving small undisturbed areas can effectively conserve certain biological communities in a disturbed landscape. However, some of mammal species, including the largest carnivores and herbivores, can only strive in the forest area as whole, where any slight change of forest landscape will be impactful on their being.

Forests plays an important role in providing environmental protection such as maintaining environmental stability, storing water supplies, becoming the main source of genetic diversity, preventing landslides and erosion, and regulating the global climate (García Chevesich et al., 2017). Forests also serve as a one of the main components in ecological cycles, which are essential for sustainable ecosystem.

2.2 Deforestation

Some developed countries have generally stopped from opening their remaining forests due to their economic prosperity. As a developing country, Malaysia is rich with natural forests and the exploitation of the natural resources has become an important source of its economic growth towards realizing the vision in becoming developed country. The increase in human population causes the increase in demand for food supply, living space and other necessities. One of the major factors in forest clearance is the need for land conversion into development areas, residential areas and for economic returns.

Deforestation is one of the major factors contributing to climate change (Wan Abdul & Shukri, 2016) and loss of biodiversity. Malaysia is one of the countries that rich in timber resources. The high price of timber in market lead those greedy loggers to illegally cut down the valuable trees. Human exploit timber products for their economic values. Other than that, forests are cleared for development of commercial plantations such as rubber and palm oil (Pimm, 2018). The demand for food also leads to the conversion of forest into agricultural land.

Nowadays, a lot of efforts are done by various parties on the forest management, protection, and restoration of forests. The forests that are inhabit by important wildlife species are reserved and prohibited from any development for conservation. Rehabilitation are done by replanting the trees to build the forest up instead of cutting them down, though it takes a very long time to develop the forest with same vegetation like previous generation (Pimm, 2018).

2.3 Camera Trap as Wildlife Monitoring Method

Camera trapping method are widely used for wildlife conservation. It refers to a method of capturing the images of animals passing in front of them using remotely triggered cameras (González Talaván et al., 2014). It is an approach of monitoring wildlife without involvement of human-wildlife intersection. Monitoring wildlife enable the identification of species that are most likely to be affected by environmental change, and determine those changes with the strongest impacts, so that the authorities are able to

target efforts in conserving vulnerable species and eliminating significant threats to these species (Pettorelli et al., 2010).

The detection of animals by camera traps is affected by ecological and observational processes occurring at both the smaller frame of the camera trap detection zone and the broader scale of the surrounding landscape (Burton et al., 2015).

Deploying a camera trap need be done with good strategies. Different types of cameras have different performances. This factor should be considered when publishing and analyzing the results from camera traps. Other factor is the differences of installment methods in the fields. In addition, the technology is rapidly improving, resulting a more advanced camera traps with wider range of device settings. Using better camera traps will enhance the detection of wildlife (Meek et al., 2014).

2.4 IUCN Red List

International Union for Conservation (IUCN) has established the Nature's Red List of Threatened Species or also well-known as IUCN Red List, in 1964. It has evolved as time passes to become the world's most reliable source of information on the global conservation status of flora, fauna and including fungi species (IUCN, 2016). It serves as an important conservation tool, in which it provides up-to-date data on the range, population size of species, their distribution around the globe, habitat and ecology, and the threats faced by those species. IUCN Red List has become the center of knowledge, collected continuously with the collaboration of IUCN Global Species Program staff, partner organizations and experts in the IUCN Species Survival Commission (SSC) and partner networks who compile the species information (IUCN, 2016).

It is the online platform where all data are easy to access by everyone. The government agencies, wildlife departments, conservation-based non-governmental organizations (NGOs), educational societies, institutions, students, and the business community use this list as a guidance for research and conservation. With the IUCN Red List as reference, the authorities and related agencies are able to catalyze action for biodiversity conservation and policy change.

IUCN Red List is one of the major factors that influence the achievement of sustainable development nowadays. The information on habitats and threats to species is used in countless biodiversity management and site rehabilitation planning processes in many countries. It contributes to the gazettement of important natural area that rich in biodiversity and inhabit by vulnerable species, either for short term or long term. For example, Ramsar sites are banned from any development as these areas are important for migratory birds of various species, including the threatened ones.

The industries are able to discover more alternatives and opportunities through the combination between their conservation planning analyses and the information on threats from The IUCN Red List in the effort to reduce the negative impact on biodiversity and promote more sustainable production.

The information on status of wildlife is used to enact policies and law legislation especially for wildlife trading or hunting. Thus, the enforcement of policies and laws are able to bring an end the cases such as illegal hunting, trophy games and illegal pet trading. This also rises the awareness among people about the animals that are not supposed to be kept as pets, hunted or traded.

CHAPTER 3

MATERIALS AND METHODS

3.1 Materials

Reports

The data on wildlife disturbance for this study is obtained from the Agropark staffs in form of reports. These reports contain information about the species that disturb the area, the results of the attacks and the control measures done to reduce the pest population.

Camera traps

Three camera traps were used to capture the images of wildlife present around the study area. The model of these cameras is Bushnell.

GPS

The model of GPS used was Garmin 72H. The locations of camera traps were determined using this instrument and the coordinates of camera traps were recorded.

Reference Materials

The results obtained were analyzed by referring the previous studies. Reference books are also used to identify the species involved in the attacks. Articles that are related this study were also referred to make further analysis on the wildlife disturbances that happened in Agropark.

Table 3.1 Reference books used for species identification.

No	Title	Year
1	A Field Guide to the Mammals of South-East Asia	2008
2	A Field Guide to the Reptiles of South-East Asia	2010
3	Helm Field Guides to the Birds of South-East Asia	2015

3.2 Methods

3.2.1 Study Area

This study is conducted at both old Agropark and new Agropark areas which are located near Jeli Permanent Forest Reserve. The 3,649 hectares of Agropark is managed by Jabatan Perhutanan Semenanjung Malaysia (JPSM), Kelantan Barat, Tanah Merah (Fatin N., 2018).

Figure 3.1 Site of old Agropark with the locations of camera traps.

(Source: https://earthexplorer.usgs.gov)

Table 3.2: List of camera traps location at old Agropark.

Point	Coordinate	Elevation
1	N: 05° 44’ 49.1’’ E: 101° 52’ 06.1’’	43 a.s.l
2	N: 05° 44’ 49.2’’ E: 101° 52’ 07.0’’	45 a.s.l
3	N: 05° 44’ 48.2’’ E: 101° 52’ 06.7’’	42 a.s.l

The coordinates of camera traps are recorded and translated into a map using an online mapping website which is EarthExplorer. This method is used for the purpose of locating the species with the coordinates of the camera traps that they are photographed.

Figure 3.2: Area of new Agropark with the locations of camera traps

(Source: https://earthexplorer.usgs.gov)

Table 3.3: List of camera traps location at new Agropark.

Point	Coordinate	Elevation
1	N: 05° 44’ 41.7’’ E: 101° 52’ 15.5’’	64 a.s.l
2	N: 05° 44’ 51.7’’ E: 101° 52’ 19.4’’	48 a.s.l
3	N: 05° 44’ 51.9’’ E: 101° 52’ 25.1’’	50 a.s.l

3.2.2 Secondary Data

A few reports related with wildlife disturbance in Agropark were obtained from the staffs. These contents of these reports were analyzed and discussed further in the next chapter. However, all the reports were recorded in 2015. There was no report on recent wildlife attack recorded.

3.2.3 Surveys

By visiting the study site, the signs of animals were observed. This method was used to determine the suitable location before deploying the camera trap in that area. The areas that are chosen are the hotspot for the animals to get source of food and water. The survey also important in deciding the lens position in order to get a full view of the selected site.

The rainy season and heavy rain have greatly affected the recognition of these footprints. Some of the footprints are not able to be seen clearly. The images on the animal footprint are collected with the help from Mr. Hilman and are presented in Appendices section.

3.2.4 Interviews

The staff and worker at Agropark were interviewed. A set of simple questions was asked to the staff named Mr Hilman Hamidi and master student named Mr Sharif. They have shared various and useful experience regarding the wildlife disturbance that happen since they started working there. The species mentioned and disturbances that happened in the study area were recorded.

3.2.5 Camera Traps

Three camera traps were used in this study. The model of these camera traps is Bushnell with 14MP of high definition full color resolution. The photo quality is set to 24 HR in day or night mode, with 0.5-second pre-triggered speed. This model was set to capture 1 or 3 images per trigger. The PIR sensor is activated so that it can sense motion activated out to 60ft. With adjustable belt, these cameras were deployed by tying at objects

of any sizes, such as trees and bamboo stems. The images that have been captured were stored in SD card.

The first two weeks, the cameras were deployed at the old Agropark. Bamboo stems were planted into the ground and the cameras were tied at each stem of different location. The cameras were set at knee-level height, as the wildlife were assumed to be present in the old Agropark area are not big. The camera lens was set to face the path connecting the forest and Agropark Area to increase the detection of wildlife trespassing into the area. Dead fishes were used as bait to lure the animals to cross in front of the camera traps.

The next four weeks, the cameras were relocated and deployed at the new Agropark. Three location that were chosen based on the information given by the staff. These locations are known to be the hotspot for wildlife to wander and scavenging. The cameras were tied at suitable tree trunks with knee-level height. The total time of sampling is six weeks.

3.2.6 Identification

Three reference books were used to identify the species caught in the camera traps. The titles of the books are as stated in Table 3.1. Thesis from past researches were also used as reference materials to identify the species of wildlife captured by the camera traps. The website of IUCN Red List was referred to know the status of animals and their other information such as habits, diet and the morphological characteristics.

A few articles were referred to obtain information about related issues and the identified species from this study. These past researches help in better understanding of the species and the disturbance of wildlife, which can help explaining possible factors that lead to these issues.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

4.1.1 Results Summary

The data wildlife species presented in Agropark are summarized according to their species, class, source of data and the disturbances by each species.

Table 4.1: List of animals, their class, data sources and type of disturbance caused.

No	Species	Common name	Source of data	Disturbances
1	*Helarctos malayanus*	Sun bear	Survey and Interview	Foraging
2	*Sus scrofa*	Wild boar	Reports and camera trap	Crop damage and predation
3	*Varanus salvator*	Water monitor lizard	Interviews and camera trap	Predation
4	*Chalcophaps indica*	Emerald dove	Camera trap	No disturbance
5	*Acridotheres tristis*	Common myna	Survey and camera trap	No disturbance
6	*Acridotheres fuscus*	Jungle myna	Survey and camera trap	No disturbance
7		Eagle	Interview	Predation
8		Otter	Interview	Predation
9	*Viverra zibetha*	Large Indian Civet	Camera trap	No disturbance

10		Wild cat	Reports and interview	Predation
11	*Prionailurus bengalensis*	Leopard cat	Camera trap	No disturbance
12		Cobra	Reports	Predation
13	*Macaca fascicularis*	Long-tailed macaque	Survey, Interview and camera trap	Foraging and crop damage
14	*Macaca nemestrina*	Southern pig-tailed macaque	Camera trap	No disturbance
15	*Tupaia glis*	Common treeshrew	Camera trap	No disturbance
16	Unknown species	-	Camera trap	No disturbance

Table 4.2: Species present at Agropark UMK Jeli Campus from the images captured by camera traps.

Species	Old Agropark			New Agropark		
	Point 1 N: 05° 44' 49.1" E: 101° 52' 06.1" 43 m	Point 2 N: 05° 44' 49.2" E: 101° 52' 07.0" 45 m	Point 3 N: 05° 44' 48.2" E: 101° 52' 06.7" 42 m	Point 1 N: 05° 44' 41.7" E: 101° 52' 15.5" 64 m	Point 2 N: 05° 44' 51.7" E: 101° 52' 19.4" 48 m	Point 3 N: 05° 44' 51.9" E: 101° 52' 25.1" 50 m
Prionailurus bengalensis					√	
Sus scrofa			√		√	
Macaca fascicularis					√	
Viverra zibetha					√	
Varanus salvator	√	√				
Tupaia glis					√	
Acridotheres fuscus			√			
Acridotheres tristis	√					
Chalcophaps indica					√	
Macaca nemestrina					√	
Unknown species					√	

The following figures are the images of animals caught by the camera trap at each point in both old and new Agropark.

Point 1 (Old Agropark)

Figure 4.1: Common myna.

Figure 4.2: Water monitor lizard eating the fish that used as bait.

Point 2 (Old Agropark)

Figure 4.3: The head of water monitor lizard was captured at fish pond area in old Agropark.

Point 3 (Old Agropark)

Figure 4.4: Wild boar roams at old Agropark when there is no presence of human.

Figure 4.5: Jungle myna.

Point 2 (New Agropark)

Figure 4.6: Adult male wild boar.

Figure 4.7: A troop of pig-tailed macaques.

Figure 4.8: Large Indian civet.

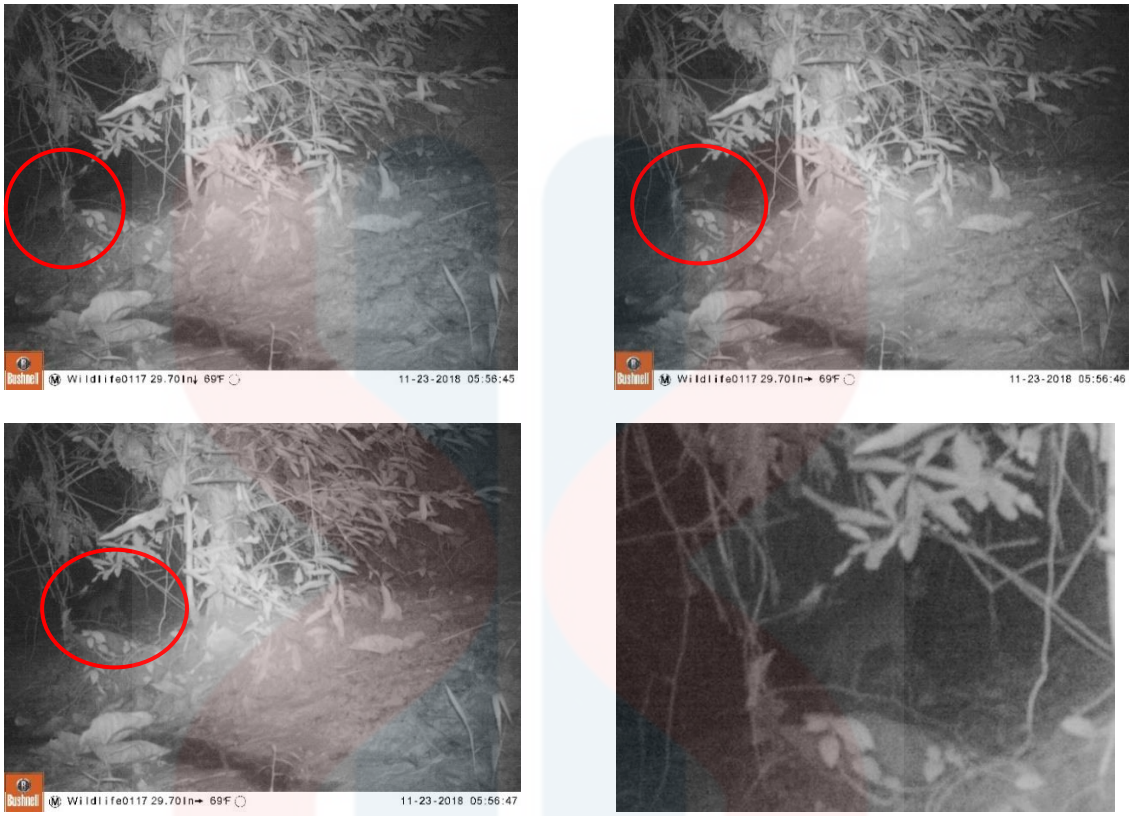

Figure 4.9: A series of leopard cat images.

Figure 4.10: Common treeshrew

Figure 4.11: Emerald dove.

Figure 4.12: Long-tailed macaque

Table 4.3: Detection of animals in camera traps

Date	Species	Number of detections based on time blocks				Total number of detections
		Morning	Noon	Evening	Night	
24/10/2018	Common myna	1	0	0	0	1
	Water monitor lizard	0	1	0	0	1
25/10/2018	Common myna	1	0	2	0	3
26/10/2018	Water monitor lizard	0	1	0	0	1
28/10/2018	Wild boar	0	0	0	1	1
30/10/2018	Jungle myna	1	0	0	0	1
1/11/2018	Wild boar	0	0	0	1	1
2/11/2018	Wild boar	0	0	1	1	2
3/11/2018	Wild boar	1	2	0	1	4
5/11/2018	Wild boar	0	0	0	1	1
6/11/2018	Wild boar	0	1	2	0	3
7/11/2018	Wild boar	1	0	2	2	5
8/11/2018	Wild boar	1	1	1	0	3
9/11/2018	Wild boar	2	1	2	1	6
10/11/2018	Wild boar	1	1	1	1	4
11/11/2018	Wild boar	2	0	1	1	4
12/11/2018	Wild boar	0	0	1	1	2
13/11/2018	Long-tailed macaque	0	1	0	0	1
14/11/2018	Wild boar	0	1	0	1	2
15/11/2018	Wild boar	2	1	1	0	4
16/11/2018	Wild boar	0	1	0	0	1
	Emerald dove	0	0	1	0	1
17/11/2018	Wild boar	0	1	2	0	3

18/11/2018	Common treeshrew	1	0	0	0	1
19/11/2018	Wild boar	1	0	0	0	1
21/11/2018	Long-tailed macaque	0	1	0	0	1
	Wild boar	0	0	0	1	1
22/11/2018	Wild boar	0	1	0	0	1
	Unknown species	0	0	0	1	1
23/11/2018	Leopard cat	0	0	0	1	1
	Wild boar	3	0	2	2	7
25/11/2018	Wild boar	1	1	1	1	4
26/11/2018	Wild boar	0	2	0	0	2
	Large Indian civet	0	0	0	1	1
27/11/2018	Long-tailed macaque	1	0	0	0	1
	Wild boar	0	0	1	0	1
28/11/2018	Wild boar	1	1	0	1	3
1/12/2018	Wild boar	1	0	0	1	2
	Pig-tailed macaques	1	0	0	0	1
2/12/2018	Emerald dove	0	1	0	0	1
	Wild boar	0	1	1	1	3

Table 4.4: Probability of detections according to species.

Species	Number of detections	Percentage, %	Probability
Wild boars	71	80.68	0.807
Long-tailed macaques	3	3.41	0.034
Common myna	4	4.54	0.045
Water monitor lizard	2	2.27	0.023
Emerald dove	2	2.27	0.023
Southern pig-tailed macaques	1	1.13	0.011
Jungle myna	1	1.13	0.011
Large Indian civet	1	1.13	0.011
Common treeshrew	1	1.13	0.011
Leopard cat	1	1.13	0.011
Unknown species	1	1.13	0.011

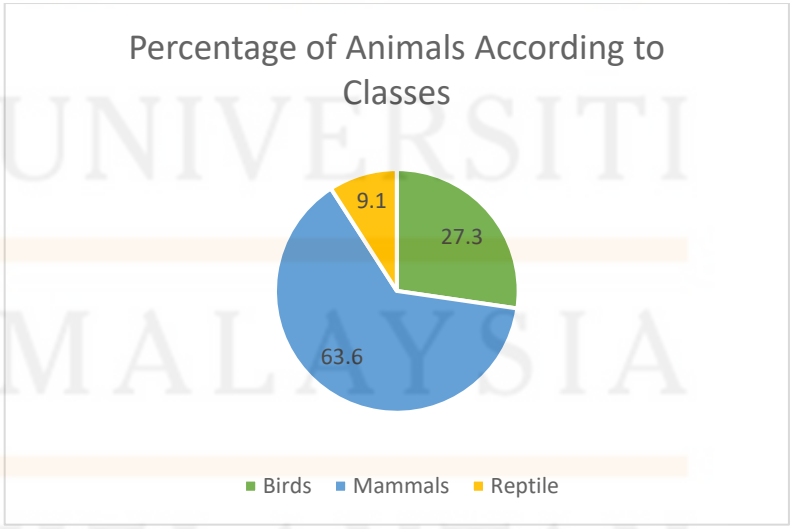

Figure 4.17: Percentage of Animals According to Classes

The following table shows the valuation of risks due to wildlife disturbances in Agropark. The data on risks of wildlife attack help in estimating the monetary loss resulting from wildlife attacks.

Table 4.5: Evaluation of risk from wildlife disturbance.

Wildlife	Type of damage	Actual value, in RM per attack	Probability	Risk
Wild boar	Crop damage	0-50	0.807	0-40.35
		50-100		40.35-80.70
		100-150		80.70-121.05
		150-200		121.05-161.4
		>200		>161.6
	Predation on livestock e.g lamb, catfish	Lamb: 600-800	0.807	484.2-645.6
		Catfish: RM6-10 per kg		4.84-8.07
Long-tailed macaques	Crop damage	0-50	0.034	0-1.7
		50-100		1.7-3.4
		100-150		3.4-5.1
		150-200		5.1-6.8
		>200		>6.8
Southern pig-tailed macaques	Crop damage	0-50	0.011	0-0.55
		50-100		0.55-1.10
		100-150		1.10-1.65
		150-200		1.65-2.2
		>200		>2.2
Water monitor lizard	Predation on catfish	RM6-10 per kg	0.023	0.138-0123

4.1.2 Agropark Reports

Only the reports of wildlife disturbance that occurred in 2015 were recorded. There is no recent wildlife attack has been recorded by the Agropark Management. The animals were not identified at species level due to lack of knowledge and insufficient information on that animals.

Figure 4.13: Scattered lamb corpse due to attack of wild boar.

Figure 4.14: Cobra skin found at pond area with 2.16 meters long

Figure 4.15: Tree bark was torn by unknown species.

Table 4.6: Loss for quail's death per attack of wild cats

Animal	Death per attack	Price for one quail, in RM	Loss in RM
Wild cats	18	2.5-3.0	45-54

Results based on interviews

Table 4.7: List of animals and their disturbances based on interviews

No	Animals	Disturbance
1	Sun bear	Trespassing and foraging
2	Otter	Predation
3	Eagle	Predation
4	Wild cat	Predation
5	Water monitor lizard	Predation

4.2 Discussion

4.2.1 Animals Background

Sun Bear

Sun bear *Helarctos malayanus*, the smallest bear among the eight species of bear (Ursidae) is least studied and least known (Linkie et al., 2007). It is listed as Vulnerable and the habitat ranged throughout Southeast Asian with tropical forests, including montane forest, tropical evergreen rainforest, swamp forest. Sun bears have V or C shaped mark on the upper chest that is normally prominent and occasionally very faint (Francis, 2008).

Sun bears inhabit extensive forest areas but sometimes trespass into gardens and plantations. They are distributed throughout South-East Asia which includes Myanmar, Thailand, Laos, Cambodia, Vietnam, Peninsular Malaysia, Sumatra and Borneo (Francis, 2008).

Wild Boar

Sus scrofa or wild boar is categorized as least concern LC by the IUCN Red List. They are widely distributed around the world, and the range is still expanding. In Malaysia, the population of these species inclined due to the reduction in number of predators. Their main predators are tiger and leopard (Guo, Cao, & Quan, 2017). The wild boars are important prey for, predator but, with the decreasing predators, the wild boar population has been fluctuating.

It was difficult to estimate the abundance of wild boar in an area because of their predominantly nocturnal activities. Wild boars also avoid the contact with human and hid themselves in dense vegetation, especially when they are hunted (Massei et al., 2018). Thus, these complicate the process of managing the wild boar population and their impacts, since the data on local abundance and trends of their population is required.

The effectiveness of human intervention to control the population size or impact, such as culling, can be measured based on the local abundance estimates (Massei et al., 2018).

This determine whether the efforts done are able to reduce the population size or impact at specific time duration.

Southern Pig-tailed macaque

Southern pig-tailed macaques *Macaca nemestrina,* live in lowland and hilly primary rainforests and can also be found in swamp and secondary forests . They prefer undisturbed forests with highly dense in vegetation rainforests (Lang, 2005).

Pig-tailed macaques diet consists of fruit, but they also consume a wide variety of foods including insects, seeds, young leaves, leaf stems, dirt, and fungus. Pig-tailed macaques spend most of their time on the ground foraging, they are particularly adept at raiding agricultural fields and obtaining coconuts from oil palm plantations, papaya, corn, and cassava (Lang, 2005). In some areas of the Malay Peninsula, people in countryside keep and train pig-tailed macaques to pluck coconuts and fruits from trees.

Long-tailed macaque

Long-tailed macaque or *Macaca fascicularis,* is the most common primate of disturbed and secondary forest in the lowlands to about 1,300m in the mountains (Phillipps & Phillipps, 2016). Long-tailed macaque is 30% smaller in size compared to Southern pig-tailed macaque, the hair is greyer instead of brown and has a longer straighter tail compared to the latter species (Francis, 2008). This species is listed as Least Concern (LC) by IUCN Red List.

The conversion of their natural habitat into lands of human use is the major threat for this primate (Lee & Priston, 2005). Originally, the natural habitat for macaques is the jungle river banks, but they now have become common in developed areas, recreational parks and public beaches. The increasing number of them and quick adaptation to the surrounding have caused nuisance to human within the area they live. Macaques often raid orchards and steal food from houses and tourists.

Macaques are the most omnivorous primate as their diet consist of fruits, seeds, leaves, insects and any available small animals. This primate moves together in a group

of 20 to 30 individuals, with a dominant alpha male leading the foraging activities (Francis, 2008).

Wild Cats

The species that has been caught in the camera trap is leopard cat, *Prionailurus bengalensis.* This species has orange to yellowish coat, with black spots vary from small to large and round to large and irregular. It has medium-length tail. Leopard cats are grouped under the status least concern (LC) by IUCN Red List.

Through a report of wildlife attack in 2015, unidentified species of wild cat has caused the death of livestock at the Agropark. It was confirmed by the footprints left at the scene.

Wild cats are able to survive in a vast range of habitat around the world due to their capability to evolve and adapt in diverse environments. About seven wild cats species are confirmed to exist in Peninsular Malaysia (Gumal et al., 2014). Excluding *Neofelis nebulosa*, *Panthera tigris* and *Panthera pardus,* four species of smaller cats that are residing in Peninsular Malaysia are Asian golden cat *Catopuma temminckii*, leopard cat *Prionailurus bengalensis*, flat-headed cat *Prionailurus planiceps*. and marbled cat *Pardofelis marmorata* (Francis, 2008). All species, except for the leopard cat, are considered threatened or near-threatened in various categories of IUCN Red List (Kitchener et al., 2017).

Otter

Through interviews, otters were claimed to prey on the catfish in old Agropark. Lack on information and knowledge has hindered the identification at species level.

There are four out of thirteen known species that have been identified to be residing in Peninsular Malaysia (Abdul-Patah et al., 2014). They are Asian Small-Clawed Otter *Aonyx cinereus* (VU), Smooth-Coated Otter *Lutrogale perspicillata* (VU), Hairy-Nosed Otter *Lutra sumatrana* (EN) and Eurasian Otter *Lutra lutra* (NT) (IUCN, 2016).

Mustelidae is a semi-aquatic, where the habitat range is wetland area including rivers, lakes, and marshes. A few species of this family eat plant and some are strictly carnivorous (Lariviere, 2015). They can travel for a long distance in search of food.

Smooth coated otter, is considered primarily piscivorous (fish-eaters). Second species is small-clawed otter. They feed on invertebrates. They forage largely in aquatic habitats and also consumed terrestrial preys. Although Smooth-Coated Otter were found to be fish-eaters, they also eat frogs, crabs, shrimps, birds and small mammals. All species of otters are opportunistic and able to eat any available of prey species.

Asian Small-Clawed and Smooth-Coated Otters cover a large region of Southeast Asia but the data on their distribution in Peninsular Malaysia is yet to be discovered (Abdul-Patah et al., 2014).

Water monitor lizard

Two individuals were spotted at two points around old Agropark respectively on different days. Water monitor lizard is one of the most common monitor lizards in Asia. It is listed under Least Concern, LC, by the IUCN Red List. The scientific name of this species is *Varanus salvator* (Das, 2010).

It is categorized as large species of monitor lizards. It has round or oval shaped nostril which is twice as far from orbit as from snout-tip, compared to the other species in family Varanidae (Das, 2010). At juvenile stage, this species has yellow spots or with ocelli in transverse series on their body (Das, 2010). This coloration was clearly seen in Figure 4.2. Their diet consists of large invertebrates and small vertebrates such as insects, arachnid, shellfishes, fishes, amphibians, other reptiles, birds and also mammals.

Water monitor lizard is semiaquatic species, where it inhabits land and aquatic environment. In addition, they are a strong swimmer, able to adapt quickly and strive in disturbed areas such as plantation sites, fishery areas and cities.

Birds

Chalcophaps indica or emerald doves are common bird and distributed widely around the world (Robson, 2015) and this species is grouped by IUCN as Least Concern. They occur singly, pairs or in small flocks (Forshaw & Cooper, 2015). Their diet includes seeds and fruits of a wide variety of plants and often searching for fallen fruit on the ground. Male emerald doves have metallic green mantle and wings, blue-grey crown and nape, white forehead and eyebrow and dark vinous-pinkish lower head-sides and underparts. Females are much browner, paler and no white on wing (Robson, 2015).

Common myna, *Acridotheres tristis* is omnivorous and the diet mainly includes fruits, grains, insects and arachnids. They are opportunist feeder as they also scavenge at rubbish dumps, on animal food and waste at farms, and carcasses. This species is listed as least concern by IUCN Red List. The common myna is very similar to jungle myna but it has warmer brown upperparts, lower breast and belly and yellow facial skin around its eyes (Robson, 2015).

Jungle myna, *Acridotheres fuscus* is least concern species in throughout the globe, that can easily be found in Malaysia. The myna is predominantly black and grey feathered, and small white patch on the wings, has prominent yellow eyes, and lack of yellow facial skin (Robson, 2015). The feathers on its forehead can rise into a crest (Craig et al., 2010).

Large Indian civet

Hunter and Barrett (2018) stated through their book that large Indian civet or *Viverra zibetha* has five or six broad black bands separated by narrow but complete white rings on the tail, which make them different from other species under family *Viverridae* in South-East Asia (Francis, 2008). The small interconnected spots give this civet a mottled or marbled appearance.

It occurs throughout evergreen and deciduous primary and secondary forests from South and East China to Peninsular Malaysia. Even though this species cannot tolerate heavily disturbed habitat, they might occur near human residential area in countryside in

search for food. Large Indian civet is a nocturnal animal and omnivorous. IUCN listed this species as Least Concern.

Common treeshrew

This small mammal is native in Malaysia, Thailand and Indonesia. It is highly adaptable in various habitat and listed as Least Concern. Common treeshrew *Tupaia glis* has a pale stripe on each shoulder, hairs on upperparts banded dark and pale, appeared finely speckled with strong reddish tint (Francis, 2008). Their diet consists of sweet and oily fruits and insects. They are diurnal and mostly active around fallen trees and branches, in low woody vegetation or on the ground (Francis, 2008).

4.2.2 Reports of Wildlife Attacks

The animals that were enlisted for causing disturbance to Agropark were identified by analyzing the reports from the staff. Through these reports, the type of damage or disturbances were stated clearly.

Three animals were identified based on the report. They are wild boar, cobra and wild cat. The data about these animals are limited as there are only footprints, dead preys and skin of the snake were found at the attacked area. These animals except wild boar, were unable to be identified at species level due lack of information and knowledge.

As reported in 2015, wild boar has caused the death of lamb. The internal organs were eaten and the corps were scattered on the ground.

On the same year, an attack involving wild cat was reported. The details showed that the number of quails decreased due to several factors including the attack of wild cat. From 120 four-weeks-old quails, 18 were found dead as the result of the attack.

Another report in 2015 involved a snake, which is believed to be cobra, in fish cage area. The skin shed by the cobra has proven that it was roaming in that area.

4.2.3 Information based on interviews

Predation activities at Agropark

Predators function at the top of the food pyramid, and important in controlling the population of prey within the area they inhabit, in which they help maintaining the health and dynamic balance of ecosystems (Tang et al., 2017). Most predators are territorial and rely on dominance in securing their own survival.

A project of cage fish is developed at old Agropark, in which the species selected for breeding is African catfish or locally called ‘keli’. The student that work at cage fish project stated that the common predators around the area are wild cat, eagle, otter, and monitor lizard. The species of wild cat, eagles and otter were unable to be identified due to lack on information and knowledge. The attacks of these predator however did not contribute major loss of fishes in the cage.

Sun bears foraging on 'kelulut' honey

Although there is no official report, based on the staff's experience, the sun bear foraged for honey at the new Agropark area. While surveying study site, the footprints that belong to sun bear were observed.

Wild boar raids

Wild boar is known to be existed in large population in the forest near UMK Jeli Campus. This species scavenges in a big group. The raids usually occur during night time and the attack were realized by the staff on the next morning. The attack has caused damage to the crops, such as fallen tree, eaten fruit, dead young plant and shoots. Wild boars' disturbances are the most frequent event that occur in the Agropark.

4.2.4 Wildlife Caught in Camera Trap

A total of 11 species were caught in the camera trap throughout the six weeks of sampling. Seven species under Mammalia, three under Avian and one under Reptilia. From the total number of species, 63.6 % is mammals, 9.1% is reptiles and 27.3% is birds.

Images of four species were caught at old Agropark area which are wild boar, jungle myna, common myna and water monitor lizard, while seven species were recorded at new Agropark which are wild boar, Asian emerald dove, pig-tailed macaques, long-tailed macaques, Asian leopard cat, unknown species, and common treeshrew. The species from the images that are believed to have relation with the disturbances are wild boar, long-tailed macaque, pig-tailed macaques and water monitors while other seven species do not cause any disturbance around Agropark.

There is no attack reported throughout the sampling time. Thus, the relationship between the species caught in camera and their attack is unable to developed in more details.

It is almost impossible to determine the number of individuals of wild boar as the differences of each individual are unable to be distinguished. Overestimation due to multiple detection of the individuals of a species will occur when the same individual is

counted twice. Therefore, instead of focusing on the individual count, The species composition is calculated by the percentage of wildlife detection by the camera traps (Jambari et al., 2015). Images of one or more individual of the same species in one image was counted as a single detection. An interval of 30 minutes is applied, to avoid multiple counting of the detections. Images of human and without the detection of wildlife are excluded.

From a total of 2,734 images are collected from camera traps, 1809 images of human and no detection of wildlife are excluded. From 925 images, 88 detections are recorded. The percentage of detection according to species is calculated by dividing number of detections of a species with total number of detection and multiply with 100%. The number of detections, species and the percentage are as in Table 4.4.

Based on results, the frequent cases of wild boar disturbance can be influenced by their activity in that area. The detection of camera traps indicate that wild boar are the most active species roaming in Agropark. The series of images show the wild boars' activity occurs throughout the day and night time. Even though the number of individuals of wild boar are not possible to be estimated precisely, the events counted include the large group of wild boars with piglets, an individual male and a small group of subadults. Their large in number also contributes to the frequent attacks in Agropark.

4.2.5 Types of Disturbance

In this study, disturbance of wildlife refers to the activities of wildlife that give negative impacts on human when trespassing into Agropark.

These attacks have caused loss in many aspects such as livestock's life, crop productions, monetary loss, and disrupt the research projects conducted by students. However, there is not enough data for valuing all the damage caused from these wildlife disturbances.

The animals are considered not to cause disturbance when they trespassed without damaging or causing any impactful side effects to human and Agropark area. These animals may enter the area to search for food, which are not livestock or crop products.

Thus, these disturbances are classified based on reports animals either they cause crops damage, predation or foraging.

4.2.6 Risks of Wildlife Disturbances

By estimating the price in current market, the risk of wildlife disturbances was able to be quantified.

The price was set to range from minimum price to maximum price of the products such as livestock and crops because the actual price may not be consistent, depending on the demands from consumer and supplies from other farms.

The camera trap data is used to analysis the risks of wildlife. The risks were quantified by multiplying the probability of wildlife detection in camera traps with the actual value of the risk. The actual value of the risk refers to the current market prices, in Ringgit Malaysia (RM) of the livestock and crops. The wild boar has the highest risk, where great loss occurred per attack with the highest probability of detection in camera traps.

However, the probability of wild cat detection cannot be determined as there is no data on wild cat in camera trap. The loss from wild cat's attack can be estimated by referring the report from staff. According to the report, 18 quails died per attack of wild cats. With the range of RM2.50 to RM3.00 for one quail, the monetary loss is about RM45 to RM54 per attack.

4.2.7 Mitigation Measures

Effective options against the pest species can be implemented as soon the understanding of the animal has been developed (Hill, Osborn, & Plumptre, 2002). Ecological information of the pest species involved should be referred before starting any intervention. Understanding the reason of the raids is useful when developing controls of reducing crop damage.

Determining factors such as seasons, feeding, breeding and movement patterns can help build up a useful behavior profile of the species concerned. This information can

then be used when designing the intervention programs to facilitate the development of effective intervention options.

After receiving complaints on wild boar attack, the Security Unit of UMK Jeli Campus, with the cooperation of PERHILITAN Jeli participated in hunting programs to control the population of wild boar. Hunting is the most efficient way to reduce the number of wild boars in that area. The large population of wild boar in the area and their frequent attacks result in drastic action by the authorities.

However, this action is not able to completely stop the wild boars from trespassing into Agropark area. Lethal control or removal of pest species is not an only option in most situations. Implementation of more than one method can be more effective in controlling the disturbances caused by wildlife. Some of the methods may be useful against particular pest species, but new research needs to be carried out to find other methods useful for other crop pests such as primates.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study has provided the information of wildlife present at Agropark and the disturbances occurred after the forest was cut down for institutional development. The clearance of forest near UMK Jeli Campus has caused habitat loss for various wildlife that reside in the area. As the result, the wildlife in that area are forced to adapt and strive in disturbed areas and the fragmented forests. The clearance of forest also increases the chance of intersection between human and wildlife as the space for wildlife are reduced.

This study reveals the disturbances that happened at Agropark, by analyzing the reports from the Agropark Management Unit. The interviews conducted also has provided the information on the wildlife disturbances and the animals that are roaming around Agropark area.

The reports and interviews have provided the general information about the animals and the disturbances caused by the them. Sun bear, otter, eagle, wild cat and cobra were involved in trespassing and disturbances at Agropark. The information is limited as some of the animals cannot be identified at species level. Some cases are not serious as the animals do not bring major impact on the Agropark. Most of the disturbances were caused by wild boars, in which they prey on livestock and damage the crops. The large population of wild boars also contribute to the attack on livestock and crops. The wild boar disturbances have the highest risk and their attacks can contribute to great monetary loss.

The camera trapping method has provided images of eleven different species. This indirect method helps in monitoring the presence of wildlife in Agropark. Due to technical failure, two of the camera traps that were relocated at new Agropark did not capture any

image during the sampling time. These animals were able to be identified as the information on morphological characteristics can be observed through the images of camera traps.

Some mitigation controls were done to reduce the attack of wildlife. Hunting was introduced to reduce the population size of wild boar in the forest near Agropark. But, the effectiveness of this method is yet to be known because there is no data on wild boar population around the area.

5.2 Recommendation

The results from this study can be used as a baseline data for deeper study on the wildlife disturbance issues at UMK Jeli Campus. Some improvement can be made for this study such as adding the numbers of camera traps deployed in the selected area. Using more camera traps will enhance the detection of wildlife and more species will be able to be discovered. The duration of camera trapping or sampling should be longer so that, whenever an attack occurred, it can be related to the time when the animals are captured in the camera trap. This will give more details to support the estimation of real time of the attacks. To add, each camera trap should be properly checked and installed to avoid any failure during its operation.

Other than that, most of the reports obtained from the staff are outdated, where the wildlife attacks happened in 2015. Hence, the reports cannot be used to analyze any recent attacks that happened in Agropark. The specific species that caused the attacks also cannot be identified due to lack of information. However, the data from these reports has proven the existence of wildlife disturbances around the study area. The Agropark Management Units should take the matter involving wildlife disturbances as a priority and actively updating the reports regarding these issues. This will help improving the management around the area.

Some other methods can be applied in order to capture the animals that trespassed into the study area. For example, cage traps can be installed to capture the medium-sized animals such as felids (Silvy, 2012). This method can help the identification process easier as the morphological characteristic of the animals can be observed directly. There is lack of data in valuing the damages as the consequential effect of the disturbance.

Lastly, this study will be able to help increasing the awareness among students to prioritize their safety while conducting field works at Agropark as some of the species could possibly attack human. Other than that, the information on the species identified and disturbances caused by them can be referred before selecting the suitable mitigation control to be applied by UMK and other responsible agencies. This study also disclosed the consequences when wildlife habitat was destroyed due to the institutional development of UMK Campus Jeli.

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APPENDICES

Bilangan puyuh/ayam yang mati

1. Puyuh umur 2 minggu

Bil. Puyuh yang digunakan	Bil. Puyuh yang mati	Bil. Puyuh yang hidup	Catatan
383	**22**	**361**	**Mati kesejukan**

2. Puyuh umur 4 minggu

Bil. Puyuh yang digunakan	Bil. Puyuh yang mati	Bil. Puyuh yang hidup	Catatan
120	**18**	**102**	**Kucing hutan**

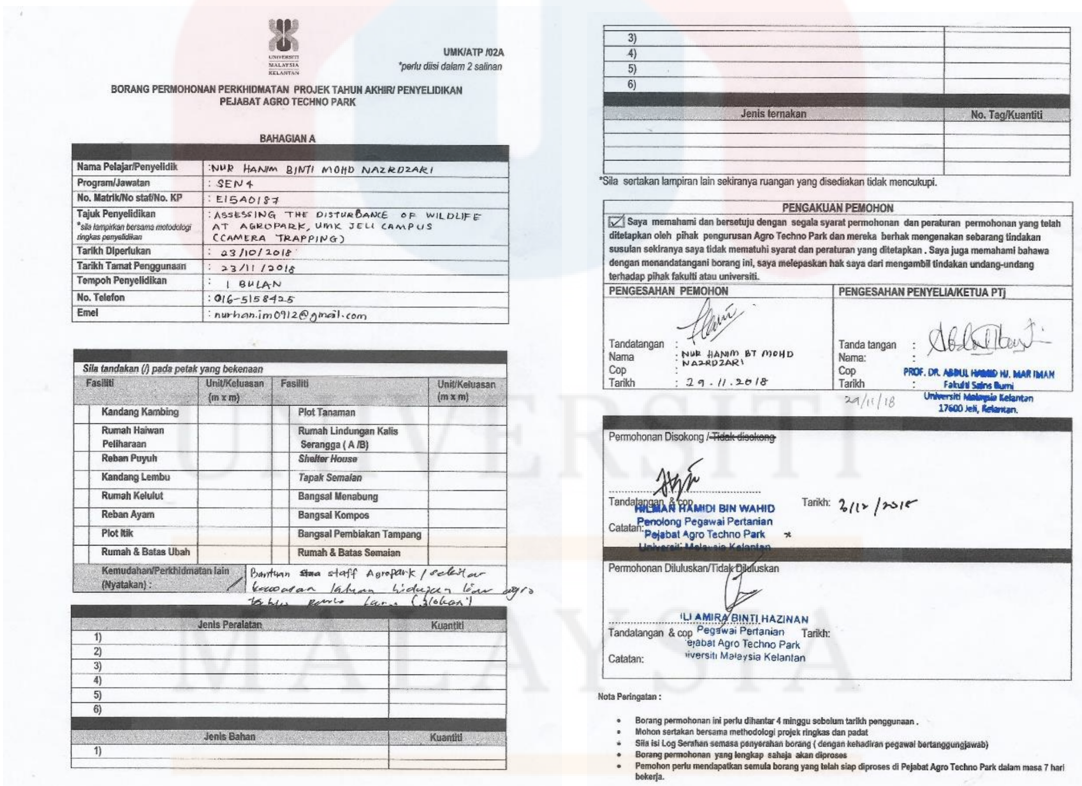
3. Ayam

Bil. Ayam yang digunakan	Bil. Ayam yang mati	Bil. Ayam yang hidup	Catatan
100	**66**	**34**	**Sejuk, cuaca dan tempat**

Figure a.1: Report on attack of wild cat

Figure a.2: The sun bear's footprint

Figure a.3: Pig-tailed macaque



UNIVERSITI MALAYSIA KELANTAN

UMK/ATP /02A
*perlu diisi dalam 2 salinan

BORANG PERMOHONAN PERKHIDMATAN PROJEK TAHUN AKHIR/ PENYELIDIKAN
PEJABAT AGRO TECHNO PARK

BAHAGIAN A

Nama Pelajar/Penyelidik	: NUR HANIM BINTI MOHD NAZRDZARI
Program/Jawatan	: SEN 4
No. Matrik/No staf/No. KP	: E15A0187
Tajuk Penyelidikan *sila lampirkan bersama metodologi ringkas penyelidikan	: ASSESSING THE DISTURBANCE OF WILDLIFE AT AGROPARK, UMK JELI CAMPUS (CAMERA TRAPPING)
Tarikh Diperlukan	: 23/10/2018
Tarikh Tamat Penggunaan	: 23/11/2018
Tempoh Penyelidikan	: 1 BULAN
No. Telefon	: 016-5158425
Emel	: nurhan.im0912@gmail.com

Sila tandakan (/) pada petak yang bekenaan

Fasiliti	Unit/Keluasan (m x m)	Fasiliti	Unit/Keluasan (m x m)
Kandang Kambing		Plot Tanaman	
Rumah Haiwan Peliharaan		Rumah Lindungan Kalis Serangga (A /B)	
Reban Puyuh		*Shelter House*	
Kandang Lembu		*Tapak Semaian*	
Rumah Kelulut		Bangsal Menabung	
Reban Ayam		Bangsal Kompos	
Plot Itik		Bangsal Pembiakan Tampang	
Rumah & Batas Ubah		Rumah & Batas Semaian	
Kemudahan/Perkhidmatan lain (Nyatakan) : /	Bantuan ~~staa~~ staff Agropark / sekitar kawasan latihan hidupan liar agro [illegible]		

Jenis Peralatan	Kuantiti
1)	
2)	
3)	
4)	
5)	
6)	

Jenis Bahan	Kuantiti
1)	
2)	
3)	
4)	
5)	
6)	

Jenis ternakan	No. Tag/Kuantiti

*Sila sertakan lampiran lain sekiranya ruangan yang disediakan tidak mencukupi.

PENGAKUAN PEMOHON

☑ Saya memahami dan bersetuju dengan segala syarat permohonan dan peraturan permohonan yang telah ditetapkan oleh pihak pengurusan Agro Techno Park dan mereka berhak mengenakan sebarang tindakan susulan sekiranya saya tidak mematuhi syarat dan peraturan yang ditetapkan . Saya juga memahami bahawa dengan menandatangani borang ini, saya melepaskan hak saya dari mengambil tindakan undang-undang terhadap pihak fakulti atau universiti.

PENGESAHAN PEMOHON	PENGESAHAN PENYELIA/KETUA PTj
Tandatangan :	Tanda tangan :
Nama : NUR HANIM BT MOHD NAZRDZARI	Nama: :
Cop :	Cop : PROF. DR. ABDUL HAMID HJ. MAR IMAN, Fakulti Sains Bumi, Universiti Malaysia Kelantan, 17600 Jeli, Kelantan.
Tarikh : 29.11.2018	Tarikh : 29/11/18

Permohonan Disokong / ~~Tidak disokong~~

Tandatangan & cop: HILMAN HAMIDI BIN WAHID, Penolong Pegawai Pertanian, Pejabat Agro Techno Park, Universiti Malaysia Kelantan

Tarikh: 3/12/2018

Catatan:

Permohonan Diluluskan/Tidak Diluluskan

Tandatangan & cop: ILI AMIRA BINTI HAZINAN, Pegawai Pertanian, Pejabat Agro Techno Park, Universiti Malaysia Kelantan

Tarikh:

Catatan:

Nota Peringatan :

- Borang permohonan ini perlu dihantar 4 minggu sebelum tarikh penggunaan .
- Mohon sertakan bersama methodologi projek ringkas dan padat
- Sila isi Log Serahan semasa penyerahan borang (dengan kehadiran pegawai bertanggungjawab)
- Borang permohonan yang lengkap sahaja akan diproses
- Pemohon perlu mendapatkan semula borang yang telah siap diproses di Pejabat Agro Techno Park dalam masa 7 hari bekerja.

Figure a.4: Document required for conducting research in Agropark

Table a.1: Planning of FYP I and FYP II (2018)

FYP I		FYP II	
Discussion on project title with supervisor	√	Data Collection and Analysis	9/11
Proposal submission	√	Discussion with supervisor	29/11
Proposal defend	√	Submission of thesis	18/12
Field works	√	Colloquium	19/12

Table a.2: Fieldwork conducted throughout the study.

Activity	How many times?
Field Works	4 times

Table a.3: List of questions

No	Questions
1	What animals that you know, trespassing and causing disturbance at Agropark?
2	What kind of disturbance / damage done by the wildlife in this area?
3	Have you encountered any animals you have stated in the Question 1?
4	Other than encounter, how do you detect the presence of wildlife around the area?
5	Is there any effort to address the problems caused by wildlife?