

REPORT

ASSESSMENT THE HUMAN-ELEPHANT CONFLICT IN DONG NAI BIOSPHERE RESERVE AND PROPOSE MANAGEMENT SOLUTIONS

Nguyen Thuy Linh

Phung Thi Tuyet

**With the contribution from staff of Cat Tien National Park
and Dong Nai Biosphere Reserve**

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EXECUTIVE SUMMARY

It is sadly recognized that the elephant numbers have fallen dramatically, and elephant-human conflict is one of the most pressing problems in Vietnam, however, there has been very little research on this issue. According to the report of Dong Nai's Forest Protection Department in 2018, the elephant-human conflict remains pervasive and causes great damage to the property or loss of human life. The conflicts that happen frequently will lead to the negative attitudes of local people toward elephants and is one of the causes leading to the decline of wild elephant populations in Dong Nai and in Vietnam as the whole. In order to support the effectiveness of elephant conservation, we implemented a study to provide a comprehensive assessment of elephant-human conflict in Dong Nai and give solutions to protect the endangered elephant population in this area. In this research, we used structured and semi-structured interviews and field surveys some areas that recorded the presence of elephant and conflict-affected areas to collect information, comments and suggestion of local people, hunters, forest rangers, local government of Cat Tien National Park and Dong Nai Culture and Nature Reserve to manage this issue.

The results of this study indicate that local people have used some simple tricks to scare off elephants (example: make the loud sound; shining a bright...), but when it does not work, they do not know what to do next. Some modern conflict mitigation methods have been taken by the government: constructed electric fences in areas where conflict frequently occur; raising community awareness about the importance of elephant conservation; grew crops that are favored by elephants – such as sugarcane and banana – inside forests, established field response teams to deter elephants when they raid crops. By applying these measures, especially the areas that installed electric fences, the appearance of the elephants is markedly reduced. From 2019 to present, 3 communes including Ta Lai, Phu Ly and Ma Dai have been successful in implementing electric fences. The elephant-human conflict in these areas has significantly decreased in comparison with Thanh Son communes where has not installed electric fences, the conflict occurs more frequently, and the appearance of elephants increases in the harvested seasons from December to July.

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1. INTRODUCTION

The Asian elephant (*Elephas maximus*) is a large mammal and is the only living species belonging to the family of elephants (Elephantidae), which is included in the mammal order Proboscidea. Asian elephant has been listed as endangered on the IUCN Red list (EN, IUCN, 2019), and critically endangered in Vietnam's Red Data Book (Vietnam's Red Data Book, 2017). In addition, this species is strictly protected and ranked as Group IB (Decree 06/2019/NĐ-CP and decree 160/2013/NĐ-CP).

In Vietnam, Asian elephant distributed in some province: Son La, Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Nam, Kontum, Dak Lak, Binh Thuan, Dong Nai (Department of Nature Conservation, 2015); in the world, this species is recorded in some countries: India, Sri Lanka, Myanmar, China (Yunna), Thailand, Laos, Cambodia, Malaysia, Indonesia (Department of Nature Conservation, 2015). In previous years, Asia elephants had a fairly wide distribution from Lai Chau along the Truong Son range to Tay Ninh and some provinces in the South Central Coast including Binh Thuan, Ninh Thuan, Ba Ria-Vung Tau (Department of Nature Conservation, 2015). According to the outcomes survey in period 2001-2002, Asian elephants were no longer recorded in Lai Chau, Thanh Hoa, Quang Tri, Thua Thien – Hue, Ninh Thuan, Binh Thuan, Ba Ria-Vung Tau, Gia Lai, Lam Dong. Despite being fully protected by Vietnamese law, the Asian elephant population is continuously declining, and considered extinct in some localities. The number of wild elephants was estimated to be about 7.000 to 10.000 individuals and more than 100 individuals in Vietnam, concentrated mainly in Yok Don national park (more than 70 individuals), and 30 individuals are found in Dong Nai Culture and Nature Reserve and Cat Tien National Park (WWF-Việt Nam, 2015).

Due to the forest degradation, the wild elephant habitats are utilized in a narrower range and fragmentation, thus leading to the encroachment into forest areas for agriculture and damage large areas of crops, destroy property, and cause injury and death (for example: Xuyen Moc, Ba Ria-Vung Tau province, Tanh Linh, Duc Linh, Binh Thuan, Dinh Quan, Tan Phu, Dong Nai province, Ea HLeo-Dák Lak province..) (Department of Nature Conservation, 2015). Because of these conflicts, in 1993 and 2001, the government decided to relocate elephants in Xuyen Moc, Duc Linh to Yok Don National park. Dak Lak province was home to 500 domesticated elephants, but the number has increased to approximately 100 individuals (Vietnam's Red Data Book, 2017).

Currently, the wild elephant population is estimated less than 100 individuals and mainly distributed in the Central and South regions, most concentrated in Dak Lak and Dong Nai. From 2019 to present (2015), at least 29 elephants have been killed or in danger. According to the “An overview of conservation status of wild Asian Elephant *Elephas maximus* in Vietnam report” of WWF-Vietnam and Department of Conservation- Vietnam Administration of Forestry (2015), at least 4 individual elephants are killed each year or in danger.

Elephant-human conflicts are widespread and take their toll both on human lives and property as well as elephant populations. Therefore, we implemented research activities that focus on assessing the current status of elephant-human conflict in Dong Nai Biosphere Reserve (including Cat Tien and Dong Nai Nature Reserve. This study results will update and supplement necessary information on human-elephant conflict, record, report and analysis of conflict incidents, assess applied measures and give suitable recommendations to effectively manage and mitigate this conflict.

2. OBJECTIVES AND STUDY FOCUS

2.1. Objectives

- Collect secondary data on elephant population and human-elephant conflict in Dong Nai;
- Receive comments and suggestion of local communities and stakeholders of national park and nature reserve on how to manage and minimize the conflict to ensure the peaceful coexistence of humans and elephants;
- Propose conflict resolution.

2.2. STUDY FOCUS

- Collect and analyze secondary data on elephant population and human-elephant conflict in Dong Nai;
- Gather information by interview local people and staff of national park and nature reserve;
- Synthesize the conflict situations and the suggestions of local people and stakeholders to manage and mitigate effectively this issue;
- Give recommendation to ensure the peaceful coexistence of humans and elephants;
- Share the survey's results with stakeholders.

3. RESEARCH METHOD AND SITE STUDY

3.1. Methodology

Structured interview: Interviewees are local people, forest rangers in conflict areas. The goal of interviews is to deter the presence of elephants; distribution and threats to their population and habitats.

Inherited methods: Research team collect the data, documents, statistics on wild elephant activities; the damage caused by elephants to local people. All this information was supplied by forest rangers in research areas.

3.2. Site study

This study was conducted in Dong Nai Biosphere Reserve (Dong Nai's Forest Protection Department, 2018). Dong Nai Biosphere Reserve was established in 2011 and covers an area of 1,000,000ha. Dong Nai Biosphere Reserve encompasses provinces of Dong Nai, Lam Dong, Binh Duong, Binh Phuoc, and Dak Nong. The core zone is two special-use forests including Cat Tien national park and Dong Nai Culture and Nature Reserve with a total area of 173.073 ha (Silvicultural Research Institute, 2018). According to Dong Nai's Forest Protection Department, the habitats of Asian elephants are mainly in the core zone of Cat Tien national park and Dong Nai Culture and Nature Reserve, thus, our surveys were implemented mostly in 2 areas. Specifically, we focused on gathering information in 4 communes: Thanh Son, Dinh Quan, Ta Lai, Ma Da, where the elephant raided.

a. Geography

Dong Nai province is seated in the Southern key economic region and is among the most dynamic economic regions of Vietnam., with a total area is 5.907,2 km². Geographic coordinates from 10°30'03"N to 11°34'57"N latitude and longitude from 106°45'30"E to 107°35'00"E. It borders with Binh Thuan province in the east, Binh Duong province and Ho

b. Natural feature

Dong Nai is situated on the economic hub of southern Viet Nam, with an area of 5,894.73 km², accounting for 1.76% of the nation natural area or 25.5% of the South - eastern natural area. The land for agriculture occupies nearly 49,1% of total natural area, forestry land accounts for 30.4%, land for specific purpose accounts for 13%, residential land areas account for 2.1% and Unused land area accounts for 5.4%.

Dong Nai Province has topography of a plain and flat land with rare scattered mountains and a gradual declivity in the southward direction. The terrain can be distinguished into plain terrain, Low-lying coastal swamps terrain, wavy hills terrain, lower mountain, alluvial, sandy soil and flat terrain, many areas are flooded throughout the year.

Dong Nai climate is a tropical monsoon climate with two contrasting seasons: dry season and rainy season. The rainy season lasts from May to November and the dry season runs from December to April of the following year. The end of the rainy season ranges from early October to December. Average temperature goes between 25– 27 °C, the highest temperature is about 40 ° C and the lowest of 12.5 ° C. The average annual number of sunshine hours is 2.500-2.700 hours, the average humidity is quite high 80-82%.

Forests in Dong Nai Province have basic characteristics of tropical forests with many varied species of animals and trees, as represented by Cat Tien National Park and Dong Nai Cultural and Nature Reserve. The total forest area is 178.643 hectares, including 110.678 hectares of natural forest and 39.596 hectares of plantation forest; forest cover approximately 28% of the total natural forest.

4. RESULTS

4.1. The results of the past conflict analysis

Dong Nai province recorded 1 population of Asian elephants including 2 groups with 15 individuals and one big male. First group includes 1 adult female, 1 adult male, 2 semi-mature females, 1 juvenile male, 1 juvenile female; the ratio male/female of the group is 2/4. Second group includes 3 adult females, 2 adult males, 1 semi-adult female, 1 semi-adult male, 1 juvenile female; the ratio male/female of this group is 3/5 (big male 2 often goes with the herd). big male 1 is frequently seen alone with grey scar on his back at Dat Do of La Nga Forestry Limited Liability company. The population consists of 3 adult males; 4 adult females; 1 semi-mature male; 3 semi-mature females; 2 juvenile males; 2 juvenile females accounting respectively for 20%, 26.6%, 6.7%, 21%, 13.3% and 13.3%. There is no old elephant recorded (Dong Nai Forest Protection Department, 2018).

According to the report of damage caused by the appearance and destruction of elephants in some Districts belonging to Dong Nai province in 2018 (Dong Nai Provincial Forest Protection Department), the elephant herd currently active mainly in Vinh Cuu and Dinh Quan District. In the first months of 2018, wild elephants appeared in Vinh Cuu District and hardly showed up in the remaining months because of electric fences. They also appeared from 3 p.m to the next morning in hamlet 5 and 7 of Thanh Son Commune, Dinh Quan District which did not have electric fences. When the electric fences were put into operation, crops and people's property were protected. However, some households still have some fruit-growing areas which do not have the fence (forest side) that are still destroyed by elephants.

According to the most recent statistics in 2018, elephants appeared quite often, mainly in the forests and fields of households in the two nature reserves mentioned above (Dong Nai Forest Protection, 2018):

In Vinh Cuu District, wild elephants appeared 42 times (from one to ten each) causing damage to 74 households.

In Dinh Quan District, wild elephants appeared 77 times (from one to ten each) causing damage to 104 households.

In Tan Phu District, about 2 individuals passed through each month from May to August without causing damage to households.

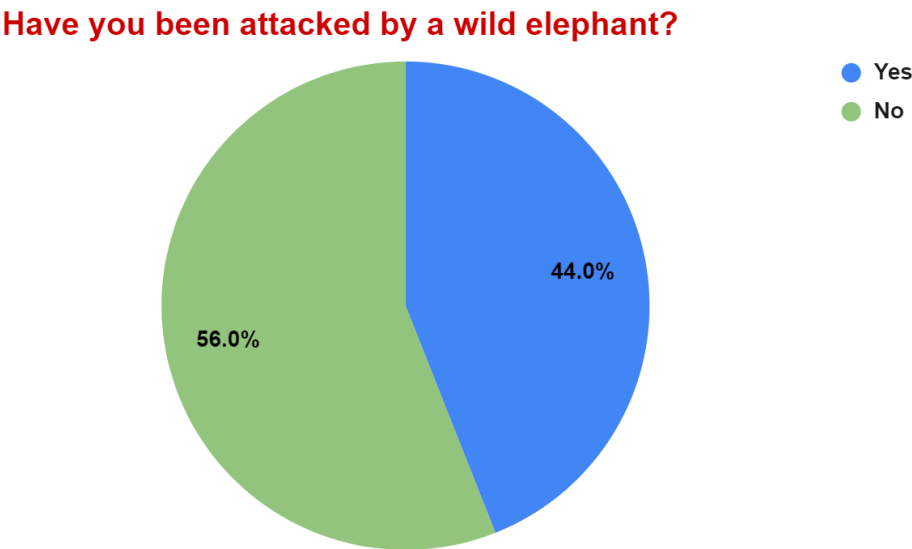
4.2. Results of interview

We conducted 40 different interviews with 15 rangers, and 25 local people who have been associated with the forest for generations and talked directly with the management boards belonging to Cat Tien National Park and Dong Nai Cultural and Nature Reserve. The interview results are given corresponding to the questions below:

Question 1: Have you ever met an elephant?

100% of the interviewee saw elephants, of which 16.1% met and found traces (footprints, feces marks, tree trunk marks, traces of destruction), 83.9% had met elephants but had not seen any traces. The villagers said that they often meet wild elephants when farming, and when elephants destroy crops. The results are shown in the chart:

Question 2. Have you been attacked by a wild elephant?



In 25 interviewees, 11 have been attacked by an elephant and 14 have not.

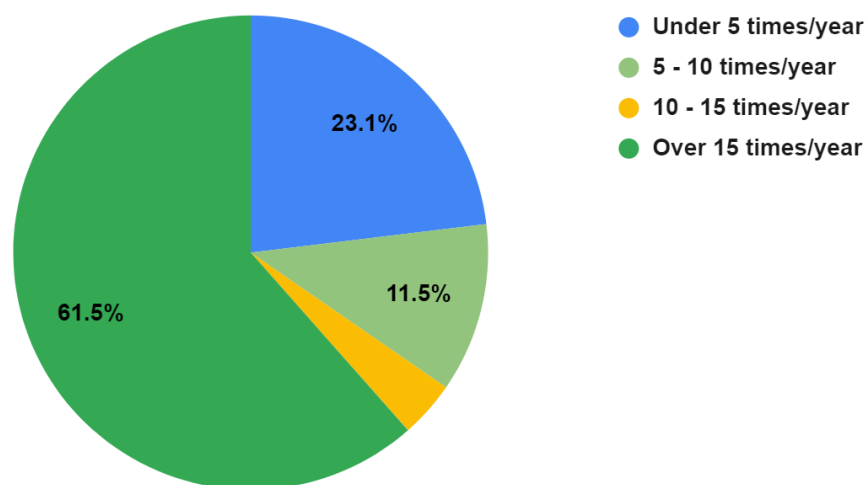
People were attacked mainly during the time in the forest and harvesting time. Elephants attack when people are harvesting crops account for 73.3%, when they are destroying crops, houses account for 13.3% and when people are in the forest account for 13.3%. According to the owner of cashew rows near the edge of the forest in Ta Lai Commune, elephants love to eat cashew and often eat the biggest, ripe, and delicious one.

In the situation of being attacked by elephants, when seeing elephants appear near the working area, most of the people choose to drive the elephant away, make noise then run. They try to keep a safe distance and avoid human and elephant conflict. 100% of interviewed households had destroyed crops, fields and houses by elephants, same as the recorded cases.

Question 3. How many times a year has your field been destroyed by wild elephants?

Elephants often come in to destroy people's fields, crops and houses. The research team has given the estimated ranges: less than 5 times/year, 5-10 times/year, from 10-15 times/year, over 15 times. The survey results are shown in the chart:

How many times a year has your field been destroyed by wild elephants?



From the chart above, the opinion that wild elephants destroy crops over 15 times accounts for 62%. Thus, it is possible to estimate the damage that people have gone through in the past.

Question 4. What time of the year do elephants usually destroy fields and houses?

People in Ta Lai Commune, Tan Phu District, Dong Nai Province make their living mainly on upland fields, growing cashew, corn, and sugarcane. Wild elephants usually appear from December of previous year to July of the following year to eat cashew and corn near the edge of the forest. In three Communes Thanh Son, Ma Da, Phu Ly, elephants usually appear from December of the previous year to June of the following year. This is during the corn and mango season in the region. Especially in the season of ripe mangoes, they usually show up from about 6 p.m. to 6 a.m., enter the garden, choose big, delicious and ripe mangoes to eat regardless of the people's screams and chasing.

Question 5. What damage have your family experienced in recent years?

Since 2017 when the electric fences have put into operation, the conflict between elephants and people in Ta Lai Commune, Tan Phu District has decreased significantly. But there are still some cashew fields inside the electric fence, which is within the reach of elephants, so they broke branches, knocked down cashew trees, and ate cashew fruit. In particular, we recorded the loss of Mr. Tran Tuan Hoang's family. At the end of 2017, the elephant destroyed 0.5 ha of corn, 2.8 ha of cotton. And in 2018, the elephant destroyed a corner of Hoang's house and he had to rebuild.

In Phu Ly and Ma Da Commune, where the electric fences have been built and put into operation, there is no conflict between elephants and humans but when wild elephants appear inside the electric fence. Records from previous years show that some households lose 3 to 4 ha of sugarcane per year, people can collect 40-50 cashew nuts from each manure pile of

elephants, Elephants destroyed 0.5 ha of corn and 1.3 ha of cotton of Mr. Tran Dinh Hoang's family in 2017. One night of the following year, the elephant broke out a corner of his house, fortunately his son who slept in the house was not injured, then his family had to rebuild a new house. In Phu Ly Commune, there are policies to compensate people for damage depending on the level of destroyed casualties by elephants.

In the season of mango and cashew, elephants continue to eat and destroy crops, causing serious damage to Thanh Son Commune that has not had an electric fence. Some damages must be mentioned such as: with Nguyen Van Dieu's family, 31 mango trees were lost, and more than 1 ton of mango was eaten and destroyed by elephants in 2018. With Pham Ngoc Tu's family in 2017, elephants destroyed 1.5 acres of Taiwanese mangoes. People in the Commune are very frustrated when elephants destroy their wealth, but there is no policy to support them.

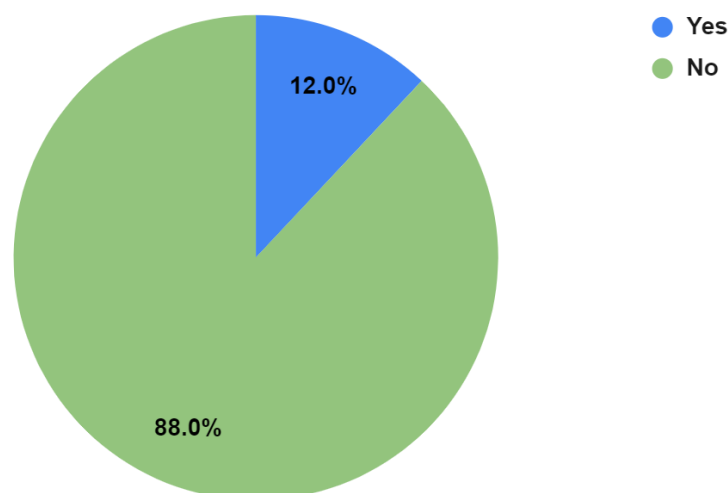
Question 6. When elephants destroy crops, fields and houses, what will you do?

When elephants come to destroy people's fields, the first thing they do is run away and avoid contact with elephants. Some people chase them away with bright light on, stoning, and burning calcium carbide. Survey results are shown in the chart:

There are many ways to chase elephants away taken by the people. When those solutions are no longer effective, people just leave elephants on their own. To minimize the conflict between elephants and humans, the rapid response teams have been established in some communes of Dong Nai Province. These teams help locals in repelling, quickly handling conflicts and recording the damage caused by wild elephants.

In 25 respondents, only 2 people said that wild elephants did intentionally attack the residential area, 23 others said that wild elephants did not. The survey results are shown in the chart below:

Did elephants intentionally attack the residential area?

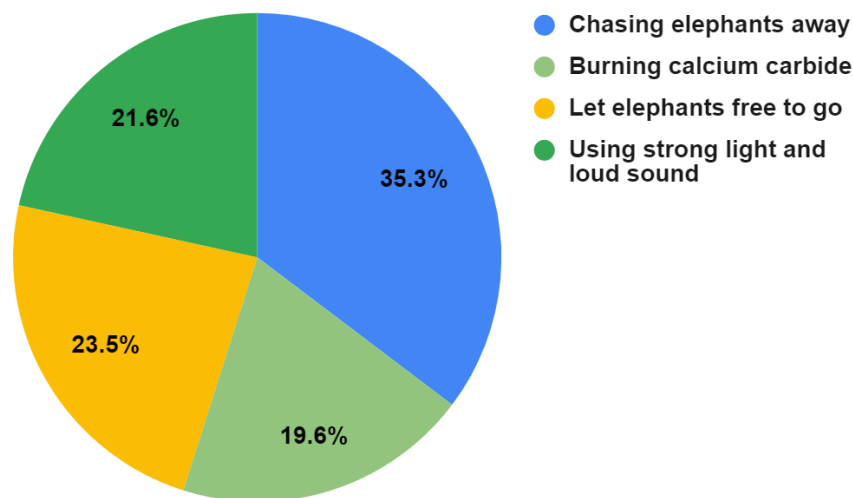


Question 7. In your opinion, what is the cause of the conflict between elephants and humans? And what should be done to avoid these conflicts?

There are two causes of conflict. Accounted for 72% is the reason that elephants did a huge damage to the people overall. The second one accounted for 12% is that humans have encroached on elephant habitat. 16% of interviewees agree with both of the above reasons leading to conflicts.

There are many ways to limit the conflicts such as: chasing away, lighting on, using loud sounds and even letting the elephant free to go. Survey results are shown in the chart:

What should be done to avoid the conflicts between humans and elephants?

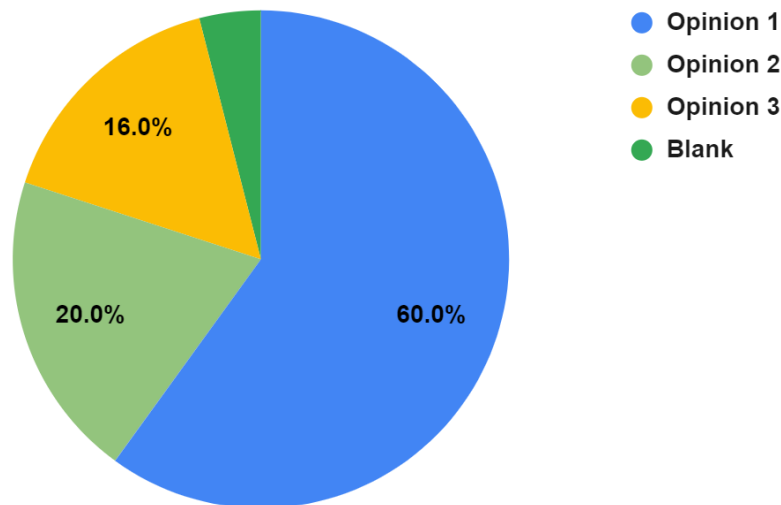


Survey results show that chasing them away is the method that people use the most, accounting for 35.29%. When the most effective methods no longer work, people are helpless and let the elephant go, this idea accounts for 23.53%. The solution of lighting and using loud sounds accounts for 21.57%. People usually use flashlights with strong light or use motorcycle lights directly on the elephant's face. The types of sounds used such as knocking pots, motorbike horn, or using sirens... Elephants often appear suddenly so there is no time to make a fire. So, burning is usually only used to keep elephants away at night.

Question 8. What is your opinion on solutions to handle conflicts between elephants and humans? Do you want to preserve Asian elephants?

100% of the respondents want to conserve Asian elephants. They want to take action to protect forests and live harmoniously with elephants without affecting their living (opinion 1), which accounts for 60% of the total opinions. 20% of respondents wish to move elephants to another area from the residential area (opinion 2). Some respondents wish to isolate elephants, accounting for 16% (opinion 3). There is 1 blank vote in this question, accounting for 4%. The survey results are shown in the chart:

What is your solutions to handle conflicts between elephants and humans?



Question 9. What are the conditions needed to reduce conflict? How can we minimize elephant-human conflict while protecting elephants and without affecting human lives?

In four interviewed Communes, elephants are continuing to eat and destroy mango gardens in Thanh Son. Even though people really want to live in harmony with elephants and protect them, elephants did a huge loss to the locals' finances especially when growing mango is the main occupation of people here. The research team shows opinions that have been collected before to interviewees. 42.9% of the interviewees said that all of the solutions are appropriate to minimize the conflict between 2 sides. Dealing with material damage issues such as providing compensation for crop damage to the people is an idea that many people care about, accounting for 28.6%. 11.9% of the opinion that it is advisable to plant additional food in the forest for elephants and plan on the agriculture land to avoid the reach of elephants. As at present, some Communes have built electric fences, so the next step is planning on upland areas outside the fences. 4.8% opinions showed that local authorities should establish protection groups, quick response teams to assist the people in repelling elephants, quickly noted the damage in where elephants usually active. 2.4% people said that it is advisable to manage and protect forests and plan a stable habitat for elephants. One person has no opinion in this question.

Question 10. What is the current situation of the elephant population in the national park?

Currently, the elephant population in Dong Nai Culture and Nature Reserve and Cat Tien National Park has about 14 to 15 individuals, divided into two or more small groups. Each group has 6 to 7 individuals, sometimes up to a dozen.

Forest management and protection along with advocates on non-hunting wildlife have been promoted and attracted huge attention. Staff of the national park and the nature reserve are very active in patrolling and sanctioning violators leading to hunting is significantly decreased. However, hunting still exists due to local custom of forest-dependent living.

In the past, there was not much research related to elephants in Dong Nai. Currently, 2 projects are running including the conservation of elephants in the period 2014 - 2020 by the Dong Nai

Forest Protection Department and a project to build electric fences. Both projects are financed by the Vietnamese government.

Question 11 Which area in the NR or National Park should I go to observe elephants? What are the elephant's favorite foods?

Wild elephants usually appear from December of the previous year to July of the following year. At Cat Tien National Park, it is recorded that elephants often appear in early morning or late afternoon along the 323 road, cashew hills around Dat Do and Sa Mach stations. At Dong Nai Cultural Nature Reserve, elephants often appear in upland fields and mango gardens around sub-area 76, 77, 78 of Suoi Kop forest ranger station. The favorite foods of elephants are mango, sugarcane, rice, wild banana, papaya, bamboo, cashew, corn ... which are the main agricultural crops of the locals. Due to the need for food, elephants often go to people's fields. Currently, there is a project to plant additional food in the forest for elephants and build electric fences in the remaining Communes.

Question 12. Have Asian elephant conservation activities been organized in Dong Nai ?

Conflict between elephants and humans is an issue of great concern by the management of the National Park, the Nature Reserve and Dong Nai Provincial People's Committee. Therefore, quick response teams were formed to assist villagers in repelling elephants and preventing conflicts. Currently there are many groups, teams involved in elephant conservation such as: rapid response team, elephant repellent team, electric fence security team, green club and forest rangers teams. These received positive feedback from the local people, the leaders of the Communes and Districts. Therefore, the communication was promoted to raise awareness aimed directly at the locals - the first one that had contact with the elephant before the conflict occurred.

4.3. Conflict situation and proposed conflict management and mitigation

Thanks to the electric fences being erected and putting into operation effectively, the human - elephant conflict now in Dong Nai has softened. However, due to the electric fences in Thanh Son Commune not being built yet, elephants keep destroying people's crops and burnt-over lands. The people here are aware of elephant conservation, nevertheless, if there is no remedy for reducing the casualties to the residents, a conflict may arise. These conflicts are not only the likelihood of causing casualties but also the likelihood of leading to the extermination of the elephant if the conflict occurs regularly without being managed.

So as to effectively reduce conflicts, comments from the staff of the National Park and the Nature Reserve have been made to effectively manage and minimize conflicts. They are:

- Create more habitat for elephants to live and plant additional food sources in the forest for elephants:

The main cause of the elephant - human conflict is the shortage of food for the elephants in the forest. That leads to the elephants entering the burnt-over lands to seek food. Therefore, when implementing a supplementary planting plan for elephants in the forest, this will limit the situation of elephants lacking food sources.

- Change the plant structure, sow plant species which are not elephant's favorite food. Currently, people are planting crops which are mainly the elephant's favorite food: sugarcane, mango, cashew,... This leads to the situation that when these crops are harvested, elephants will set foot in the burnt-over lands to search for food and destroy the crops. Therefore, when there is a plan for changing species which are not the preferred food of the elephants, the situation of elephants ruining the burnt-over lands to look for food sources will be minimized.

- Construction of additional electric fences in Thanh Son Commune.

The effectiveness of electric fence construction in minimizing the elephant - human conflicts is most apparently represented in the situation of the conflict during the pre- and post-construction of electric fences. Before project implementation in 2014, the phenomenon of the elephant - human conflict often occurs in the Ta Lai Commune, Tan Phu District; Phu Ly Commune, Ma Da Commune of Vinh Cuu District; Thanh Son Commune, Gia Canh Commune of Dinh Quan District. The destruction level is negligible due to the small area of cultivation, nonetheless, there are other places damaged often by the elephants such as houses, huts because of looking for salt and food. There is 1 of being killed and 2 of being injured from the elephant damages. The decline in the number of the elephant herd reached the highest point in 2009, with 06 dead ones. There were 01 dead elephant in 2010, 01 dead elephant in 2011 and in early 2012, an elephant body was found shot dead at Tan Phu Protective Forest Managing Board. From 2015 to 2018, the phenomenon of the elephant - human conflict still occurs frequently in Thanh Son Commune, Dinh Quan District; Phu Ly Commune, Ma Da Commune, Vinh Cuu District which cause damage to crops and property of the local people. Fortunately, there was no human casualty but an elephant, about 80 kilograms, was found dead due to being trapped in a ditch in Thanh Son Commune, Dinh Quan District on March 23rd, 2015. (Report on the Implementation Results of Decision No. 763 / QD-TTg dated May 21st, 2013 of the Prime Minister approving the Project "Conservation Elephant in Vietnam 2013-2020", Ministry of Agriculture and Rural Development, 2018).

Strengthening communications. According to the Report in implementing Prime Minister's Decision No.763/QD-TTg dated May 21, 2013 in approving the project "Overall Vietnam elephant conservation period 2013-2020". By effectively carrying out communications plans, conflicts between elephants and local people have reduced. People were educated to behave properly to avoid rousing elephants that helps minimizing negative consequences. Authorities have been timely involved in preventing and dealing with casualties caused by elephants.

During the survey, the team also interviewed a number of people in Thanh Son commune (an area without electric fences), Phu Ly and Ma Da Communes (with electric fence) and from forest rangers belonging to the nature reserve. The results show that about 14-15 elephants have appeared, often in herds of 6-7 individuals and sometimes up to 10, in this area. Their food is mangoes, sugarcane, wheat, wild banana, bamboo, rattan, corn, etc. In September 2017, local people recorded a video capturing a herd of 14 elephants in which there were 4 young elephants. They destroyed crops, burnt-over land and people's houses. The period, which the elephants appeared in, was from December of the previous year to July of the next year. According to forest rangers in the area, conflicts between elephants and local residence mainly occurred in the area without electric fences. Manual measures were carried out to drive elephants away to other areas to ensure security and avoid crop damage.

5. CONCLUSION

The wild elephant population in Dong Nai are mainly recorded in the core zone of Cat Tien National Park and Dong Nai Culture and Nature reserve. These areas have 14-15 individuals, divided into two or small groups and often move into upland fields of local people.

In the core zone of Cat Tien national park, elephants are mainly encountered in cashew and corn harvest season: From December to July of the following year; Elephants love a wide variety of foods such as rattan, bamboo, cashew, mango, jackfruit, banana, fishtail palm, sugar cane.... There are some recorded incidents of elephant attacks on people in the area, Elephants also frequently raid and destroy crops but there were not many reported cases of elephants destroying people's houses.

This study results showed that the human-elephant conflicts have significantly reduced recently. When local people detect elephants, they will use some harmless way to scare elephants away like: making loud sounds, using flashlights... and then inform the forest rangers to solve the damage that is caused by elephants. We did not record any cases of elephants being injured or killed by humans.

The project “Elephant conservation in Vietnam for the 2013 - 2020 period” was implemented by The Ministry of Agriculture and Rural Development. 30 km fixed electric fences and 20 km mobile electric fences have been constructed in Cat Tien national park and Dong Nai culture and nature reserve to manage human-elephant conflict, maintain a stable elephant population. In 2018, these areas had one herd with 14 elephant individuals and split into 2 smaller groups. In September 2017, a video recorded one herd with 14 elephant individuals, strikingly, this herd had 4 calf and this population structure was different from previous study.

Community-based education activities are regularly carried out such as: design booklet to advocate for human-elephant conflict prevention; the husbandry guidelines for elephants in human care; organize elephant parade to raise awareness of elephant conservation,... Thank to the cooperation among the staff of Dong Nai Biosphere, these activities have successfully helped people to understand the reason of human-elephant conflict.

Conserving Asian elephants is the responsibility of not only staff of reserves but also of the local community. Government should apply some measures to control and compensate farmers for damages caused by wild elephants.

6. RECOMMENDATION

The Asian elephant population that was recorded in Dong Nai provinces has sharply reduced recently, and is listed in Vietnam's Red Data Book so they need urgent protection. However, elephants also cause damage to property, human life so to ensure the peaceful coexistence of humans and elephants, we propose some recommendation to solve this issue:

- The local governments should construct more electric fences to separate cultivation from elephant areas to reduce human-elephant conflict.
- Establish Rapid Response Teams and local inter-agency including forest rangers, local communities, local government to handle any emergencies arising and in areas that recorded the appearance of elephants and help farmers to prevent crops from wild animals.
- Develop communications and awareness programs for local people to protect this critically endangered species; stop poaching; habitat enrichment; Elephant-food crops can be planted within forests to lure elephants away from plantations.
- Government should apply suitable measures to control and compensate farmers for damages caused by wild elephants. Farmers may be made more tolerant of elephants on agricultural land if they are insured or compensated for farm damages caused by these animals.
- Call for inclusive Asian elephant conservation with the participation of all stakeholders including organizations, individuals,... who care and want to protect this species.

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APPENDIX

APPENDIX 1: COMMUNITY SURVEY QUESTIONNAIRE

COMMUNITY SURVEY QUESTIONNAIRE

1. Personal Information

Name: Age: Gender:

Ethnic: Occupation:

Address:

2. Questionnaire

1. Have you ever seen a wild elephant?

Yes ☐ Seeing traces ☐ Never ☐

2. Have you ever been attacked by an Elephant?

Yes ☐ No ☐

3. When did elephants attack you?

When you are in forest ☐ When you are harvesting crops ☐

When elephants are destroying crops ☐

4. (If yes) What have you done to deter elephants??

Drive them away ☐ Run away ☐

Make noise (Make loud sound, use flashlight..) ☐

5. Have your crops, houses ever been destroyed by elephants?

Yes ☐ No ☐

6. How many times a year has your field been destroyed by wild elephants?

0-5 times ☐ 5- 10 times ☐ 10-15 times ☐ Over 15 times ☐

7. What time of the year do elephants usually destroy fields and houses?

.....
.....

8. What damage have your family experienced in recent years?

.....
.....

9. When elephants destroy crops, fields and houses, what will you do?

- a. Burning calcium carbide
- b. Stoning
- c. Running away
- d. Lighting on the elephants

10. Which authorities do you report the damages that caused by elephants?

- a. Rapid response team
- b. Forest rangers
- c. Local people

11. Did elephants intentionally attack the residential area?

- a. Yes
- b. No

12. What should be done to avoid human-elephant conflict?

- Chasing elephants away ☐ Burning calcium carbide ☐ Let elephants free to go ☐
- Using strong light and loud sound ☐ Others ☐
-
-

In your opinion, what is the cause of the conflict between elephants and humans?

13. And what should be done to mitigate these conflicts?

- Protect forest and live in harmony with elephants ☐
- Move elephants to another area from the residential area ☐
- Isolate elephants ☐

Other opinions:

.....

.....

14. Do you want to conserve Asian Elephants?

- Yes ☐ No ☐

15. (If yes) What are the conditions needed to reduce conflict? How can we minimize elephant-human conflict while protecting elephants and without affecting human lives?

- ☐ Manage and protect forests and plan a stable habitat for elephants.
- ☐ Establish protection groups, quick response teams to assist the people in repelling elephants, quickly noted the damage in where elephants usually activ.
- ☐ Plant additional food in the elephant areas and plan on the agriculture land to avoid the reach of elephants.
- ☐ Providing compensation for crop damage to the people
- ☐ All of the above opinions

Other opinions:

.....

.....

.....

.....

Thank you guys for participating in the survey

Appendix 2: Questionnaire for National park and Nature Reserve staff

Questionnaire for national park and nature reserve staff

1. Personal Information

Name: Age: Gender:

Ethnic: Station:

Work

unit:

2. Questionnaire

1. How many elephants are there in the National park? And What is the current situation of the elephant population in the national park?

.....
.....

2. Is hunting decreasing or increasing after establishing a nature reserve? Why

Decrease ☐ Increase ☐

Reason:

.....
.....

3. Do you know any project or program to conserve elephants have been implemented before?

.....
.....

4. Is the poaching still popular in the reserve? And what are the solutions for this issue?

.....
.....

5. What programs, seminars have been carried out to raise awareness of local people on elephant conservation and mitigate conflict?

.....
.....

6. What are the plans of the Nature Reserve to conserve elephants and mitigate human-elephant conflict?

.....
.....

7. Which areas in the NR or National Park should I go to observe elephants?

.....
.....
.....

8. What is the season that you frequently see elephants?

.....
.....

9. What are the elephant's favorite foods?

.....
.....

10. When did the elephant conservation patrol start? And who is currently participating in conserve elephants?

.....
.....

11. Is it easy to encounter elephants? In which regions can you easily meet Elephants? What time of day? What are their characteristics (number, size, color, shape of ears, shape of tusks, etc.)? Can you identify their gender?

.....
.....

12. Which members of the community are involved in elephant conservation?

.....
.....

13. What are the roles of community in elephant conservation?

.....
.....

14. Do you regularly communicate with people about the importance of Elephant conservation?

Yes ☐ No ☐

Communication methods:

.....
.....

15. What are the advantages and disadvantages in the process of advocating and mobilizing people to participate in the conservation of Elephants and their habitats?

.....
.....

16. What was the situation of human-elephant conflict in the NR and the National Park in recent years?

.....
.....

17. What are your recommendations to mitigate human-elephant conflict?

.....
.....

Thank you guys for participating in the survey

Appendix 3: List of national parks and NR staff participating in the interview

No	Full name	Address
1	Nguyen Van Tuan	Bau Dien Forest Protection Station - Dong Nai Culture and Nature Reserve
2	Pham Ngoc Quang	Bau Dien Forest Protection Station - Dong Nai Culture and Nature Reserve
3	Tran Van Thanh	Bau Dien Forest Protection Station - Dong Nai Culture and Nature Reserve
4	Nguyen Ngoc Que	Bau Dien Forest Protection Station - Dong Nai Culture and Nature Reserve
5	Nguyen Xuan Thuy	Forest ranger - Dong Nai Culture and Nature Reserve
6	Nguyen Van Hanh	Forest ranger - Dong Nai Culture and Nature Reserve
7	Ho Dien	Suoi kop Forest Protection Station - Dong Nai Culture and Nature Reserve
8	Thai Ngoc Duc	Suoi kop Forest Protection Station - Dong Nai Culture and Nature Reserve
9	Tran Khac Hoang	Sa Mach Forest Protection Station-Cat Tien National Park
10	Dang Xuan Cong	Dat Do Forest Protection Station-Cat Tien National Park
11	Nguyen Van Hoang	Dat Do Forest Protection Station-Cat Tien National Park
12	Ta Thuc Binh	Dat Do Forest Protection Station-Cat Tien National Park
13	Bui Van Long	Dat Do Forest Protection Station-Cat Tien National Park
14	Hoang Van Tam	Dat Do Forest Protection Station-Cat Tien National Park
15	Thai Binh	Tan Phu Forest Protection Station

Appendix 4: List of people participating in the interview

No	Full name	Address
1	Nguyen Van Hin	Group 6, Hamlet 7, Ma Da Commune, Vinh Cuu District
2	Nguyen Hung Cuong	Group 4, Hamlet 7, Ma Da Commune, Vinh Cuu District
3	Nguyen Dac Tru	Group 6, Hamlet 7, Ma Da Commune, Vinh Cuu District
4	Phan Thi Hoi	Hamlet 1, Phu Ly Commune, Vinh Cuu district
5	Nong Van Nghia	Hamlet 1, Phu Ly Commune, Vinh Cuu district
6	Bui Thi Hoa	Hamlet 1, Phu Ly Commune, Vinh Cuu district
7	Do Van Thuan	Hamlet 1, Phu Ly Commune, Vinh Cuu district
8	Pham Ngoc Tu	Thanh Son Commune, Dinh Quan District
9	Ho Dang Thuy	Hamlet 2, Thanh Son Commune, Dinh Quan District
10	Tran Hoang Phi	Hamlet 5, Thanh Son Commune, Dinh Quan District
11	Dang Ngoc Huy	Hamlet 5, Thanh Son Commune, Dinh Quan District
12	Nguyen Ngoc Le	Hamlet 5, Thanh Son Commune, Dinh Quan District
13	Nguyen Cong Pha	Hamlet 5, Thanh Son Commune, Dinh Quan District
14	Pham Van Loi	Hamlet 7, Thanh Son Commune, Dinh Quan District
15	Nguyen Xuan Quang	Hamlet 5, Thanh Son Commune, Dinh Quan District
16	Nguyen Van Dien	Hamlet 5, Thanh Son Commune, Dinh Quan District
17	Tran Tuan Hoang	Hamlet 4, Ta Lai Commune
18	Dieu K Cai	Hamlet 4, Ta Lai Commune
19	Nguyen Ngoc Tuan	Hamlet 4, Ta Lai Commune
20	K' Sanh	Hamlet 4, Ta Lai Commune
21	Ka Muot	Hamlet 4, Ta Lai Commune
22	Lu Van Teo	Hamlet 4, Ta Lai Commune
23	K Nguyen	Hamlet 4, Ta Lai Commune
24	K' Vot	Hamlet 4, Ta Lai Commune
25	Le Van Rai	Hamlet 4, Ta Lai Commune

Appendix 5. Some photos of survey activities



Photo 1: Wild elephants raid local crops (Source: Nguyen Manh Ha)



Photo 2: Elephants destroy cashew of local people (Source: Phung Thi Tuyet)



Photo 3: Elephants destroy mango garden in Thanh Son commune (Source: Nguyen Thuy Linh)



Photo 4: Electric fences in Cat Tien National park (Source: Phung Thi Tuyet)



Photo 5: Interviewing local people in Phu Ly (Source: Nguyen Thuy Linh)



Photo 6: Flashlight that people use to scare of elephants in Ta Lai (Source: Phung Thi Tuyet)