

MITIGATION EFFORTS AND STRATEGIES FOR MANAGING HUMAN-ELEPHANT CONFLICT IN BUKIT BARISAN SELATAN NATIONAL PARK, INDONESIA

Indra Gumay Febryano^{1,2,3}, Popy Pratiwi¹, Dian Iswandaru^{1*}, Rudi Hilmanto^{1,2}

¹Department of Forestry, Faculty of Agriculture, University of Lampung, Bandar Lampung, Indonesia

²Graduate Program of Forestry, University of Lampung, Bandar Lampung, Indonesia

³Graduate Program of Environmental Science, University of Lampung, Bandar Lampung, Indonesia

* Email: ndaruforest57@gmail.com

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ABSTRACT

This study aims to determine the conflict mitigation efforts that have been carried out and analyze strategies for managing human-elephant conflicts in the Bukit Barisan Selatan National Park. The research data was collected by focus group discussion and observation. The collected data were analyzed descriptively based on the factors of strength, weakness, opportunity and threat analysis to determine the strategy for managing human-elephant conflict. The results of the study indicate that several efforts have been made to reduce the incidence of conflict through patrols, monitoring, and dispelling and escorting using firecrackers. The strategy supports an aggressive growth policy (growth oriented strategy). It is hoped that the incidence of human-elephant conflict can be reduced or suppressed through a holistic and integrative approach. Mitigation of human conflict with elephants that can be done in the long term is by making special interest tourism programs and increasing human resource capacity.

Keywords: *conflict, conflict management, elephant, mitigation strategy*

INTRODUCTION

The existence of protected animals such as elephants is increasingly threatened because of the many human activities in the forest. Elephants must try to survive in conditions of degraded habitat and other threats such as poaching, poison, and snares. This condition results in elephants being trapped in small blocks remaining in the forest and unable to support the elephants' needs in the long term (Xie *et al.*, 2020). Elephants will continue to walk in their home range or even leave the forest area and enter plantations or residential areas to find food sources. The movement of elephants into community areas resulted in human-elephant conflict (BBTNBBS, 2018; Shaffer *et al.*, 2019).

The exit of elephants from forest areas has resulted in conflicts between elephants and humans potentially increasing and causing people to have a bad view of elephants (Pratiwi *et al.*, 2022).

People assume that the existence of elephants is detrimental because they eat and damage plants so they tend to be hostile to them (Abdullah *et al.*, 2017). The decline in crop yields due to being eaten or damaged by elephants has made people regard elephants as pests around forest areas (Li *et al.*, 2018; Mustafa *et al.*, 2018). Several studies reveal damage to agricultural and plantation commodities up to 24.6% (Rianti & Garsetiasih, 2017), losses to agricultural land up to 73% (Pratiwi *et al.*, 2020), crop damage of 0.25 ha of corn, coffee, cocoa and bananas (BBTNBBS, 2018). The damage that occurred to each crop commodity resulted in socio-economic losses of the community and gave rise to different damage values in each region, in line with the area of land owned and the economic value of the community according to the value of agriculture in rural areas (Evans *et al.*, 2020). This causes the community to have a fear of elephant attacks and only make efforts to evict them to minimize conflicts.

Conflicts that occur will be detrimental to both parties (Suksavate *et al.*, 2019). Conditions and threats due to the conflict that occurred resulted in losses for both humans and elephants, both property and life. The behavior of elephants as well as the low ability of elephants to reproduce naturally combined with the wide habitat requirements make elephants very vulnerable to extinction (Utami *et al.*, 2015). Periodic movement of elephants in their homerange and then turning into plantations, agriculture, settlements or even transmigration areas can threaten human existence and disrupt development activities (Fishlock *et al.*, 2015; Febryano *et al.*, 2019; Compaore *et al.*, 2020). Human-elephant conflicts also occur because various development, agriculture, and plantation development problems have not been properly resolved because they still focus on protection aspects and do not take into account the various interests of communities in conflict-prone areas (Berliani *et al.*, 2016).

METHOD

The research was conducted at the Pemerihan Resort, National Park Management Section Region II Bengkunt, National Park Management Division Region I Semaka, Bukit Barisan Selatan National Park/BBSNP (Figure 1) in September 2020-March 2021. The time of this study was based on the planting and harvesting season calendar from ongoing local community agricultural commodities so that there is a correlation with the time of the elephant attack (Rinati & Garsetiasih 2017; Febryano *et al.*, 2018). This research was conducted using the Focus Group Discussion (FGD) method and observation. The FGD implementation used semi-structured interviews where the FGD participants in the strategy for managing human-elephant conflict were as many as 10 people from managers (BBSNP and Wildlife Conservation Society), community leaders or village institutions, as well as elephant experts in BBSNP.

Formulation of strategic directions for managing human-elephant conflict using a SWOT (Strength, Weaknesses, Opportunity, Threat) analysis approach, where this analysis is a systematic analysis of various internal factors (strengths, weaknesses) and external factors (opportunities, threats) to formulate development strategies (Rangkuti, 2006). Strategic plan in the management of human-elephant conflict through situation analysis. This is done as an effort to minimize losses or casualties in the conflict based on the conditions that occur. Data were collected, processed, and analyzed descriptively by adopting and adapting the SWOT analysis model which is a qualitative analysis by examining internal and external factors.

RESULT and DISCUSSION

1. Human-elephant conflict mitigation efforts

Efforts made by the community around the Pemerihan Resort in overcoming human-elephant conflicts are still traditional and only temporary. These efforts are made to reduce the number of conflicts that occur and maintain community-owned agricultural land or plantations. The community will protect and defend their agricultural land from attacks by wildlife including elephants (Nyirenda *et al.*, 2018). Countermeasures are carried out to scare elephants away from the disturbance site (Garsetiasih *et al.*, 2018).

Expulsion of elephants to re-enter their habitat is a way that is always done by the community to avoid conflict. Anticipatory efforts to dispel the presence of elephants in farming areas that have been carried out by the community are by burning bonfires, turning on lights and even dispelling them by using sharp bamboo and sharp weapons which are not recommended because they have a high risk of falling victim (Neupane *et al.*, 2018). Efforts and methods in dealing with elephant-human conflicts must be adapted to the situation and conditions in the area concerned (site specific). Efforts have been made in mitigating human-elephant conflict, namely by utilizing patrolling elephants, monitoring the presence and movement of elephant groups, removing and herding elephants, and socializing about mitigating human-elephant conflicts.

1) Patrol by elephant

Patrol using elephants is one of the routine activities carried out by the elephant patrol team to mitigate elephant-human conflicts. The elephant patrol team is a team that is operated to handle human and elephant conflicts in BBSNP, especially in the Pemerihan area. Patrols in mitigating human conflict with elephants are mostly carried out in primary forest and secondary forest habitat types. This routine patrol will be carried out every day if it has entered the harvest season in February-April. Elephant disturbance to community plants follows the culture and pattern of the harvest season by the community (Febryano *et al.*, 2018). Patrols are more optimally carried out in February, March, April, June and July because rainfall has a significant effect on increasing elephant conflicts (Charles, 2017). This patrol activity is carried out to overcome conflicts in the short term. The elephant patrol team conducted surveillance on the boundaries of the Pemerihan Resort BBSNP area using elephants with a distance of 15-20 km.

Elephant patrols are carried out by paying attention to signs of the presence of elephants, including the direction of footprints, feces, snatches, broken or fallen trees that the elephants pass through. Efforts to handle conflict by BBSNP are to operate a patrol team unit to bring wild elephants back to their habitat. This team uses five assisted (tame) elephants to mitigate conflict and secure the area. Monitoring the movement and recording of the period or season of release of the Sumatran elephant (*Elephas maximus sumatranus*) from the forest also needs to be done, so that the route of movement of the Sumatran elephant and how long it stays in a place can be predicted. Mitigation is carried out in the form of prevention and herding of wild elephants approaching residents' plantations to re-enter the forest area.

2) Monitoring the Presence and Movement of Elephant Groups

Monitoring is carried out to determine the position of the elephant's presence so that it can anticipate conflicts. This monitoring is carried out using a Global Positioning System (GPS) collar

that is attached to the group of elephants causing the conflict. This GPS collar installation is carried out on elephants who are considered the leaders in their group (Khrisnan *et al.*, 2019). The installation of tracking aids based on this satellite navigation system will facilitate the handling of conflicts. The Head of the Pemerihan Resort said that the GPS Collar was an early detection tool for the possibility of such an incident. This tool can work well because it is able to monitor the movement of groups of elephants in their roaming path and the data is displayed in real time in 3-dimensional form. The use of a GPS collar is carried out to monitor the movement of elephants and become a preference in the daily roaming of Sumatran elephants with respect to the distance to human settlements. Through the GPS Collar, BBSNP managers and the community can observe elephant movement patterns and determine the distance between the elephant group and the outer boundary of the national park. If the distance between the elephant and the BBSNP boundary is close to a polygon of about 2 km, the GPS Collar will send a signal so that it can immediately be repelled or blocked. However, the weakness of the GPS collar is that when the elephant group disperses, the BBSNP management and the community do not know the existence of individual elephants. If the direction of the elephant's movement is towards the village or plantation population, then the trail will continue to be traced until an elephant is found, either single or in groups, which will then be escorted. As another anticipatory measure when the elephant group disperses, the BBSNP manager and the community will conduct monitoring from the monitoring post.

3) Repelling and Herding Wild Elephants

Repelling and herding of elephants by the manager of the patrol team and the community is a short-term countermeasure. The strategy to repel Sumatran elephants is carried out based on information about the presence of Sumatran elephants, either from the results of patrols with elephants or by vehicles, as well as community reports. Furthermore, a sweeping of the trail is carried out to ensure that the elephant's position is known. The herding of elephants using patrolling elephants is done by observing the position and movement of the elephant group.

If the position and direction of movement are known, then it can be carried out using patrol elephants to guide the elephants away from the boundaries of the area and can return to their habitat. When the mahout takes place on the elephant, it is intended that the elephant's presence is not known, because his eyesight is not good and the elephant only relies on his smell. The equipment used in elephant repelling activities consists of firecrackers (fireworks) or jeduman, GPS and lighting (if at night). Firecrackers (fireworks) is used as a means of communication between mahouts and elephants. The sound of firecrackers is a signal so that the elephant does not go towards the source of the sound. Repelling is carried out when elephants leave the area towards plantations or settlements. Firecrackers or jeduman serve to frighten elephants from approaching the direction of the sound and elephants returning to the area (out of plantations or settlements).

The driving of groups of conflicting elephants to return to their habitat by BBSNP managers and the community has not been fully resolved. Conflict resolution carried out by the patrol team and the community by expulsion and escort has not been effective. Mahot at Pemerihan Resort said that dispelling and driving can reduce the level of damage to plants and the success of the treatment reaches 60%. Independent success through elephant repelling can reduce half of the damage (Febryano *et al.*, 2018). However, the elephant herding carried out is only temporary and does not cause a deterrent effect for the elephants so that the elephants will come back (Mumbi & Plotnik, 2018). Herding and expulsion of elephants can cause elephants to become stressed and increasingly aggressive towards humans (Gurnayadi *et al.*, 2017). This is because the conflict resolution efforts have not addressed the root of the problem.

2. Strategy for management of human-elephant conflict

Conflict management strategies need to consider the factors of conflict in Pemerihan Resort. The handling of this conflict is based on the ecological, social, and economic factors of the community around the area. Management of national parks to overcome human conflicts with elephants, it is necessary to create a management system with a collaborative approach. Collaborative management must involve stakeholders such as communities around the area, managers of areas around National Parks, NGOs and relevant local governments (Wibowo *et al.*, 2017).

The identification of strategic factors in implementing each activity program is carried out by a SWOT analysis. The strategy to be carried out is known based on internal factors (strengths and weaknesses) and external factors (opportunities and threats). The formulation of a strategy with stakeholders by considering related factors must be strategic and can affect the management of human-elephant conflicts. Some indicators of strengths and weaknesses that are considered in the internal strategy factors can be seen in Table 1.

Table 1. Internal strategy factors (IFAS)

Internal Strategy Factors	Weight	Rating	Score
Strength (S)			
Legal area status	0.09	3	0.27
The potential of natural resources is quite high in the Utilization Zone	0.09	3	0.27
Sufficient human resources	0.08	4	0.32
Adequate technology/experience	0.09	4	0.36
Regional authority	0.08	3	0.24
Conflict mitigation efforts	0.10	4	0.40
People are aware that elephants are protected animals	0.10	4	0.40
Total	0.63		2.26
Weakness (W)			
Long term planning not yet available	0.07	-3	-0.21
Low coordination	0.08	-3	-0.24
Limited funds	0.05	-4	-0.20
Inadequate facilities and infrastructure	0.08	-4	-0.32
People live on the border of BBSNP	0.09	-4	-0.36
Total	0.37		-1.33

Source: Primary Data

Various problems that exist must be resolved in an effort to sustain human or elephant life. Based on Table 1, there are seven strength factors and five weakness factors. The results of the internal factor analysis show that the strength factor with indicators of conflict mitigation efforts and people aware of elephants as protected animals with a score of 0.40 is the highest value. This shows that respondents consider this factor to be the most important strength compared to other strength factors.

Internal factors also show that the main weakness for the management of human-elephant conflict is the high number of people living on the border of BBSNP with a score of -0.36. Based on the results of the analysis, the overall score for the strength factor is 2.26, while the score for

the weakness factor is -1.33. Strategy formulation in the management of human-elephant conflict is also carried out by analyzing external factors which can be seen in Table 2.

Table 2. External strategy factors

External Strategy Factors	Weight	Rating	Score
Opportunity (O)			
Support from other sectors and local government	0.08	4	0.32
The market is quite potential for special interest tourism	0.10	4	0.40
As a research and education location	0.09	4	0.36
Access to location available	0.09	3	0.27
Community institutions function	0.07	2	0.14
Still believe in local wisdom and ancestral culture	0.06	3	0.18
Total	0.49		1.67
Threat (T)			
Disturbance to the area	0.08	-3	-0.24
Hunt for elephants	0.10	-4	-0.40
Low socio-economic community	0.08	-3	-0.24
Changes in the spatial arrangement of the buffer area	0.09	-2	-0.18
Invasive plant species	0.08	-3	-0.24
Slow government assistance in handling conflicts	0.08	-2	-0.16
Total	0.51		-1.46

Source: Primary Data

Table 2 shows that there are six opportunity factors and six threat factors in external conditions (EFAS). The main opportunity for mitigating human-elephant conflict is that this location can be a potential market for special interest tourism with the highest score of 0.40. This condition shows that respondents consider that this factor is a very important opportunity. However, the main threat faced is poaching of elephants with a score of -0.40. The total score obtained by the opportunity factor is 1.67 and the threat factor is -1.46.

The results of the analysis of the factors that will be used to determine the strategic position in the management of human-elephant conflict, it is known that the value of $IFAS = S - W = 2.26 - 1.33 = 0.93$, while the value of $EFAS = O - T = 1.67 - 1.46 = 0.21$. A positive IFAS value indicates that if cumulatively the strength factor is greater than the weakness factor, the EFAS value is also positive indicating that the opportunity factor is greater than the threat. Based on the IFAS and EFAS values, the SWOT analysis diagram obtained is as shown in Figure 2.

The strategy for managing human-elephant conflict obtained from Figure 2 is the Strength and Opportunities (SO) strategy in Quadrant I, namely by reducing and maximizing existing strengths and opportunities. SO strategy is carried out by using all strengths to obtain and take advantage of existing opportunities. The cut point obtained is in quadrant I, which supports an aggressive growth policy (growth oriented strategy). This strategic position supports all aggressive stages to continue to develop all aspects that exist in the management of human-elephant conflict because it is considered to bring optimal benefits if making the right strategy.

Alternative strategies that need to be carried out in implementing human-elephant conflict management activities are (SO): using strength (S) to take advantage of opportunities (O). This strategy can be carried out through the following activities: (1) Build cooperation with the community in the utilization of forest areas in the utilization zone supported by existing markets, culture and community institutions. (2) Optimizing intensive conflict mitigation efforts by patrolling, monitoring, dispelling and socializing. (3) Conducting research on sumatran elephants in BBSNP. (4) Using human resources, technology, available access and local culture for ecotourism development involving support from other sectors and local governments.

This gives an indication that the development of strategies in conflict handling has a high enough power in internal factors. The strategy that must be applied is to use strengths by taking advantage of opportunities in the long term. Strategic factors that can affect collaborative management of human-elephant conflict management that will be implemented at the Pemerihan Resort are compiled using a SWOT matrix. Alternative strategies are prepared based on the situation, conditions and needs for handling conflicts that occur. The strategies resulting from the SWOT analysis for the human-elephant conflict management program are presented in Table 3.

The high diversity of flora and fauna in BBSNP forest areas can be utilized to build cooperation between BBSNP managers, NGOs and the community. This is done in order to realize the sustainability of ecosystem functions and biodiversity as well as provide management benefits for human welfare. Optimizing the use of areas such as environmental services, nature tourism, water or carbon with strategic targets can contribute to mitigating human-elephant conflicts without creating new spaces for their use. Management of conservation areas by improving regional governance can reduce human-elephant conflicts (Sukarman, 2018). Utilization of this area can be done collaboratively with the strategic goal of instilling awareness and generating active community participation in the management of BBSNP in a fair and responsible manner, supported by existing institutions for conflict mitigation.

Optimizing the management of human-elephant conflict can also be done intensively with persuasive and preventive safeguards such as forest security patrols, monitoring and repelling elephants as well as outreach and training to the community. Increasing the intensity of forest security in BBSNP requires efforts to optimize strengths and take advantage of existing opportunities. Preventive forest security efforts can be carried out through increasing the intensity of forest security patrols, outreach and training to the community as well as establishing a communication forum between BBSNP forest managers and communities around the forest.

The extent of the BBSNP forest area that must be secured and the high number of human-animal conflicts and the large number of community interactions with the area, must increase the intensity of patrolling the BBSNP area. Security patrol activities are carried out through patrols and identification of area potentials and problems, guarding at certain places, counseling, car patrols, and selective patrols. Security patrols are carried out with the aim of minimizing conflicts that often occur. The implementation of patrol activities is carried out jointly between resort officers and the Community of Ranger Partner (*Masyarakat Mitra Polhut*/MMP) and BBSNP partners. In addition, preventive efforts are made to mitigate human-elephant conflict in the form of socialization and training to the community.

Table 3. Analysis of human-elephant conflict management using the SWOT matrix

IFAS	Strength (S) S1 Legal area status S2 Natural resources potential is quite high in the Utilization Zone S3 Human resources is quite adequate S4 Technology or sufficient experience S5 Stakeholder authority S6 Conflict mitigation efforts S7 People are aware of elephants as protected animals	Weaknesses (W) W1 Long term planning not yet available W2 Low coordination W3 Limited funds W4 Inadequate facilities and infrastructure W5 People living on the border of BBSNP
EFAS	SO Strategy	WO Strategy
Opportunity (O) O1 Support from other sectors and local government O2 The market is quite potential for special interest tourism O3 Research and education sites O4 Access to location available O5 Community institutions are functioning O6 Still believe in local wisdom and ancestral culture	<ol style="list-style-type: none"> 1. Build cooperation with the community in the utilization of forest areas in the utilization zone supported by existing markets, culture and community institutions. 2. Optimizing intensive conflict mitigation efforts by patrolling, monitoring, dispelling and socializing. 3. Conducting research on Sumatran elephants in BBSNP 4. Using human resources, technology, available access and utilizing local culture for ecotourism development involving support from other sectors and local governments. 	<ol style="list-style-type: none"> 1. Improve coordination and equalization of perceptions among stakeholders and support from other sectors as well as culture and community institutions for ecotourism development 2. Increase the availability of funds, facilities and infrastructure by utilizing the support of other sectors and market potential 3. Prepare long-term strategic plans in the development of special interest tourism for conflict mitigation.

Threat (T)	ST strategy	WT Strategy
T1 Disturbance to area	<ol style="list-style-type: none"> 1. The use of elephants as tourism objects in buffer areas is in accordance with the existing authority of regional stakeholders to reduce elephant poaching. 2. Use of human resources and technology to prevent disruptions that occur. 3. Carrying out activities for fostering and expanding feed habitats as well as controlling invasive species attacks. 	<ol style="list-style-type: none"> 1. Develop long-term plans to minimize threats that may occur. 2. Improved coordination and shared perceptions for market promotion. 3. Increase community involvement in tourism and infrastructure management for minimize the threat to the elephant population that may occur.
T2 Elephant hunting		
T3 Low socio-economic community		
T4 Changes in the spatial arrangement of the buffer zone		
T5 Invasive plant species		
T6 Slow government assistance in handling conflicts		

Source: Primary Data

Socialization and training are carried out to provide understanding to the community about the methods or steps that must be taken when dealing with wild elephants or dealing with ongoing conflicts. This activity can be a facility in increasing the knowledge of the people living around Pemerihan Resort. Socialization and training regarding human-elephant conflict is very important because in conflict management one must consider threats to human safety and the risks to elephant safety. The selection of methods for dealing with human-elephant conflict is strongly influenced by the character of each conflict that is different from one another, so that the selection of actions to overcome human-elephant conflict must pay attention to the situation that exists in each incident. Therefore, it is necessary to strive for the prevention and management of dynamic conflicts in a unified landscape.

A holistic and integrative approach between the ecological, economic and social aspects of the community is expected to reduce human-elephant conflicts. Ecologically, elephants as protected animals can be preserved and on the other hand there are socio-economic interests of the community which are guaranteed to be protected from possible damage to their cultivated plants. This problem requires the role of the parties as well as the people who live around or in the forest area (Qurniati *et al.*, 2017). More broadly, that this strategy does not only answer the problem of elephant conservation, but at the same time is a solution to the community's economic problems related to conflict proportionally (Herwanti *et al.*, 2019). However, the community's efforts to control conflict have not yet produced an effective and efficient solution in the long term (Maulana *et al.*, 2021). This is because the community tends to make partial mitigation efforts, does not touch the ecological, socio-economic aspects of the community and aims to keep elephants away from cultivated plants.

The strategy in implementing ecotourism activity programs, namely improving coordination and equalization of perceptions between stakeholders and support from other sectors as well as culture and community institutions for ecotourism development needs to be developed immediately (Febryano & Rusita, 2018;). Coordination and equalization of perceptions need to be built because so far coordination between stakeholders, especially those related to the management of human-elephant conflicts, is almost never done so that misunderstandings often occur between stakeholders. The management of the national park area, including species management, has not been running well due to a lack of coordination, socialization, and program

synchronization between related institutions or stakeholders in ecotourism development (Tohir *et al.*, 2018).

Programs of ecotourism development activities can be made a priority in managing human-elephant conflicts by utilizing the support of other sectors and local governments. The community has a bigger role than the government to manage the ecotourism object (Febryano *et al.*, 2021). The community can provide input to formulate a policy to the government because it is more aware of the conditions on the ground (Krexner *et al.*, 2021). The policy from the government to make special regulations as an effort to conserve elephants is also not in accordance with the facts on the ground (Wibowo *et al.*, 2017; Rianti & Garsetiasih, 2017). Especially at this time the government is aggressively promoting social forestry which is not in accordance with the preservation of elephants. The government has more policies, while prevention has not been maximized. The role of the government is more to assist the community or provide advocacy to the community about what they will do to mitigate human-elephant conflict (Ekapaksi, 2019). People assume that elephants do not provide benefits for life. This is because elephants are protected animals so that people cannot use them. The community hopes that elephants can be used as ecotourism objects and they want to be involved in these activities (Dobrikj *et al.*, 2022). The role of the community is needed in developing participatory nature tourism (Dans *et al.*, 2017). Nature tourism activities can be a solution in the management of conservation areas, especially national parks (Iswandaru *et al.*, 2016). Utilization of elephants as ecotourism objects can be used as income for the community. Elephant activities can attract both domestic and foreign tourists to travel (Marcelina *et al.*, 2018).

The management of human-elephant conflict at Pemerihan Resort becomes a special interest tour that can be packaged based on the elephant's life behavior and the culture of the community with its civilization. Elephants that come out of the forest area to look for food can be the main attraction for tourists to see wild elephants firsthand. The release of elephants from the forest is based on the harvest season calendar or when the rainfall is high so that tourism managers can already determine when this special interest tour can be carried out. In addition, this can also improve the community's economy by planting plants that elephants like to sell to tourists. Tourists can also follow the herding and monitoring process to improve conservation education for the wider community. The gains obtained from this special interest tourism are also given to elephants as compensation for the survival of elephants through planting elephant food plants at the boundaries of the BBSNP area with the community so that elephants no longer leave the area.

Ecotourism activities at Pemerihan Resort can be carried out in the Pekon Pemerihan area. In addition to elephants, this location also has other tourist attractions. Pekon Pemerihan has a fairly high tourism potential, because not only elephants can be used as tourist attractions, but there are also parks, tree houses and kelanceng honey bee tours which are managed by the community as advanced tourist attractions. This can be done to increase the availability of funds, facilities and infrastructure by utilizing other sectors and market potential. The Government of Pesisir Barat Regency through the tourism office can also contribute by coordinating and synchronizing programs with ecotourism activities in the forestry sector. BBSNP as the holder of the mandate in elephant management in its territory must provide understanding to other stakeholders regarding the requirements for infrastructure development in ecotourism development so that the existing natural resources remain sustainable.

CONCLUSION

The strategy for managing human-elephant conflict is through the Strength and Opportunities (SO) strategy in quadrant I, namely maximizing strengths by taking advantage of opportunities. The strategy implemented is to support a strategy that supports an aggressive growth policy (growth oriented strategy) through (1) building cooperation with the community in the use of areas supported by existing markets, culture and community institutions, (2) optimizing intensive conflict mitigation efforts by patrolling, monitoring, dispelling and socializing, (3) conducting research related to Sumatran elephants in BBSNP, and (4) using human resources, technology, available access and local culture for the development of special interest ecotourism involving support from other sectors and local governments. A holistic and integrative approach between the ecological, economic and social aspects of the community is expected to reduce human-elephant conflict. Programs of ecotourism development activities can be made a priority in managing human-elephant conflicts by utilizing the support of other sectors and local governments. This special interest ecotourism can be a solution in dealing with human-elephant conflicts because it can improve the community's economy and elephants can still get their food without leaving the forest area. In addition, it is necessary to increase the capacity of human resources around.

REFERENCE

- Abdullah, Ali, M. S., & Hilmayanti, P. (2017). Persepsi masyarakat sekitar kawasan konflik gajah dengan manusia terhadap konservasi gajah dan habitatnya di Kecamatan Lembah Seulawah, Aceh Besar. *Jurnal Biologi Edukasi*, 19(9),16-19.
- Balai Besar Taman Nasional Bukit Barisan Selatan [BBTNBBS]. (2018). *Deskripsi kawasan Taman Nasional Bukit Barisan Selatan*. Balai Besar Taman Nasional Bukit Barisan Selatan.
- Berliani, K., Alikodra, H. S., Masy'ud, B., & Kusriani, M. D. (2016). Social, economy, cultural and community perception on sumatran elephant (*Elephas maximus sumatranus*) conflict area in Aceh Province. *International Journal of Sciences: Basic and Applied Research*, 27(2): 170-181.
- Carlstead, K., Paris, S., & Brown, J. L. (2019). Good keeper-elephant relationships in North American zoos are mutually beneficial to welfare. *Applied Animal Behaviour Science*, 211,103–111. <https://doi.org/10.1016/j.applanim.2018.11.003>
- Charles, Y. (2017). *Analisis Konflik Gajah Manusia sebagai Landasan Strategi Pengelolaan Mitigasi di Resort Pemerihan*. Program Pascasarjana, Universitas Lampung.
- Compaore, A., Sieima, D., Hema, E. M., Doamba, B., Ajong, S. N., Vittorio, M. D. & Uiselli, L. (2020). Correlation between increased human-elephant conflict and poaching of elephants in Burkina Faso (West Africa). *European Journal of Wildlife Research*, 66(24), 1-9. <https://doi.org/10.1007/s10344-019-1329-8>
- Dans, S. L., Crespo, E. A., & Coscarella, M. A. (2016). Wildlife tourism: underwater behavioral responses of south american sea lions to swimmers. *Applied Animal Behaviour Science*, 188(3), 91-96. <https://doi.org/10.1016/j.applanim.2016.12.010>

- Dobrikj, E., Ilieski, V., Ilievska, K., & Kjosevski, M. (2022). Using species-specific protocols for the welfare assessment of elephants in the Skopje Zoo. *Macedonian Veterinary Review*, 45(2), 1-8. <https://doi.org/10.2478/macvetrev-2022-0019>
- Ekapaksi, B.Y. (2019). *Implementasi kebijakan penanggulangan gajah liar di Taman Nasional Way Kambas*. Fakultas Ilmu Sosial dan Ilmu Politik, Universitas Lampung.
- Evans, L. J., Goossens, B., Davies, A. B., Reynold, G. & Asner, G. P. (2020). Natural and anthropogenic drivers of bornean elephant movement strategies. *Global Ecology and Conservation*, 22(e00906), 1-11. <https://doi.org/10.1016/j.gecco.2020.e00906>
- Febryano, I.G., Winarno, G.D., Rusita, & Yuwono, S. B. (2018). *Mitigasi konflik manusia dan gajah di Taman Nasional Way Kambas*. Aura Publishing.
- Febryano, I. G., & Rusita. (2018). Persepsi wisatawan dalam pengembangan wisata pendidikan berbasis konservasi gajah sumatera (*Elephas maximus sumatranus*). *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan*, 8(3), 376-382. <https://doi.org/10.29244/jpsl.8.3.376-382>
- Febryano, I. G., Rusita, Banuwa, I. S., Setiawan, A., Yuwono, S. B., Marcelina, S. D., Subakir, Krismurniati, E. D. (2019). Determining the sumatran elephant (*Elephas maximus sumatranus*) carrying capacity in Elephant Training Centre, Way Kambas National Park, Indonesia. *Forestry Ideas*, 25(1), 10-19.
- Febryano, I. G., Harum, O. M. A., Wulandari, C., Hidayat, W., Banuwa, I. S., Prasetya, H., Iswandaru, D., Novriyanti, N., Duadji, N., Tresiana, N., Zulfiani, D., Ichsan, A. C., & Salampessy, M. L. (2021). Raw material of Basemah traditional house construction in Indonesia. *Folia Forestalia Polonica, Series A*, 63(1), 74-80. <https://doi.org/10.2478/ffp.2021-0008>
- Fishlock, V., Caldwell, C., & Lee, P. C. (2015). Elephant resource-use traditions. *Animal Cognition*, 19(2), 429-433. <https://doi.org/10.1007/s10071-015-0921-x>
- Garsetiasih, R., Rianti, A. & Takandjandji, M. (2018). Potensi vegetasi dan daya dukung untuk habitat gajah sumatera (*Elephas maximus sumatranus*) di areal perkebunan sawit dan hutan produksi Kecamatan Sungai Menang, Kabupaten Ogan Komering Ilir. *Jurnal Ilmu-Ilmu Hayati*, 17(1), 49-64.
- Gurnayadi, D., Sugiyo & Hedges, S. (2017). Community based human elephant conflict mitigation: the value of an evidence-based approach in promoting the uptake of effective methods. *Plos One*, 12(5), 1-14. <https://doi.org/10.1371/journal.pone.0173742>
- Herwanti, S., Febryano, I. G., & Zulfiani, D. (2019). Economic value analysis of community forest food products in Ngarip Village, Ulu Belu Subdistrict, Tanggamus Regency (a case from Indonesia). *Forestry Ideas*, 25(2), 314–328.
- Iswandaru, D., Kuswandari, A. & Fandeli, C. (2016). Studi implementasi standar sistem manajemen lingkungan (ISO 14001:2004) dalam pengelolaan wisata alam di Taman Nasional Bromo Tengger Semeru (Studi kasus pelaksanaan sertifikasi dalam pengelolaan wisata alam). *Jurnal Hutan Pulau-Pulau Kecil*, 1(2), 117-127. <https://doi.org/10.29303/jbl.v1i2.60>

- Khrisnan, V., Kumar, M.A., Raghunathan, G., & Vijayakrishnan, S. (2019). Distribution and habitat use by asian elephants (*Elephas maximus*) in a coffee-dominated landscape of Southern India. *Tropical Conservation Science*, 12, 1-12. <https://doi.org/10.1177/1940082918822599>
- Krexner, T., Kral, I., Gronauer, A., Jimenez, F. J. M., & Bauer, A. (2021). Comparison of a system expansion and allocation approach for the handling of multi-output processes in life cycle assessment – a case study for nano-cellulose and biogas production from elephant manure. *Journal of Land Management, Food and Environment*, 7(3), 113-121. <https://doi.org/10.2478/boku-2021-0012>
- Li, W., Liu, P., Guo, X., Wang, L., Wang, Q., Yu, Y., Dai, Y., Li, L. & Zhang, L. (2018). Human-elephant conflict in Xishuangbanna Prefecture, China: distribution, diffusion, and mitigation. *Global Ecology and Conservation*, 16(e00463), 1-13. <https://doi.org/10.1016/j.gecco.2018.e00462>
- Marcelina, S. D., Febryano, I. G. & Setiawan, A., & Yuwono, S. B. (2018). Persepsi wisatawan terhadap fasilitas wisata di Pusat Latihan Gajah Taman Nasional Way Kambas. *Jurnal Belantara*, 1(2), 45-53. <https://doi.org/10.29303/jbl.v1i2.60>
- Maulana, I. R., Safe'i, R., Febryano, I. G., Kaskoyo, H., & Rahmat, A. (2021). The relationship between the health of mangrove forests and the level of community welfare. *TREPSEA*, 1027, 1-15. <https://doi.org/10.1088/1755-1315/107/1/012033>
- Mumby, H. S. & Plotnik, J. M. (2018). Taking the elephants perspective: remembering elephant behaviour, cognition and ecology in human-elephant mitigation. *Frontiers in Ecology and Evolution*, 1(122), 1-8. <https://doi.org/10.3389/fevo.2018.00122>
- Mustafa, T., Abdullah & Khairil. (2018). Analisis habitat gajah sumatera (*Elephas maximus sumatranus*) berdasarkan software Smart di Kecamatan Peunaron Kabupaten Aceh Timur. *Jurnal Biotik*, 6(1), 1-10.
- Neupane, B., Subash, B. & Khatiwoda, B. (2018). Human-elephant conflict and mitigation measures in Jhapa District, Nepal. *Journal of Forest and Livelihood*, 16(1), 103-112. <https://doi.org/10.3126/jfl.v16i1.22885>
- Nyirenda, V. R., Nkhata, B. A., Tembo, O. & Siamundele, S. (2018). Elephant crop damage: subsistence farmers' social vulnerability, livelihood sustainability and elephant conservation. *Sustainability*, 10(10), 1-19. <https://doi.org/10.3390/su10103572>
- Pratiwi, P., Rahayu, P. S., Rizaldi, A., Iswandaru, D. & Winarno, G. D. (2020). Persepsi masyarakat terhadap konflik manusia dan gajah sumatra (*Elephas maximus sumatranus* Temminck 1987) di Taman Nasional Way Kambas. *Jurnal Sylva Lestari*, 8(1), 98-108. <http://dx.doi.org/10.23960/jsl1898-108>
- Pratiwi, P., Iswandaru, D., Hilmanto, R., Febryano, I.G., Ismanto, Sugiharti, T. & Subki. (2022). Analisis konflik manusia dengan gajah berdasarkan persepsi masyarakat di Taman Nasional Bukit Barisan Selatan. *Jurnal Belantara*, 5(1), 106-118. <https://doi.org/10.29303/jbl.v5i1.813>

- Qurniati, R., Febryano, I.G., & Zulfiani, D. (2017). How trust influence social capital to support collective action in agroforestry development? *Biodiversitas*, 18, 1201–1206. <https://doi.org/10.13057/biodiv/rd1844>
- Rianti, A., & Garsetiasih, R. (2017). Persepsi masyarakat terhadap gangguan gajah sumatera (*Elephas maximus sumatranus*) di Kabupaten Ogan Komering Ilir. *Jurnal Penelitian Sosial dan Ekonomi Kehutanan*, 14(2), 83–99.
- Shaffer, L. J., Khadka, K. K., Hoek, J. V. D. & Naithani, K. J. (2019). Human-elephant conflict: a review of current management strategies and future directions. *Frontiers in Ecology and Evolution*, 6(235), 1-12. <https://doi.org/10.3389/fevo.2018.00235>
- Sukarman. (2018). Partisipasi Masyarakat Mitra Polhut pada upaya perlindungan dan pengamanan hutan di Taman Nasional Way Kambas. *Jurnal Sylva Lestari*, 6(1): 85-98.
- Suksavate, Q., Duengkae, P., Chaiyes, A. (2019). Quantifying landscape connectivity for wild Asian elephant populations among fragmented habitats in Thailand. *Global Ecology and Conservation*, 19(e00685), 1-13. <https://doi.org/10.1016/j.gecco.2019.e00685>
- Tohir, R. K., Mustari, A. H. & Masyud, B. (2018). Feed diversity, palatability and carrying capacity of sumatran elephant (*Elephas maximus sumatranus*) flying squad in Tesso Nilo National Park. *Journal of Natural Resources and Environmental Management*, 8(3), 339-346. <https://doi.org/10.29244/jpsl.8.3.339-346>
- Utami, D. F., Setiawan, A. & Rustiati, E. L. (2015). Kajian interaksi gajah sumatera (*Elephas maximus sumatranus*) dengan masyarakat Kuyung Arang, Kabupaten Tanggamus. *Jurnal Sylva Lestari*, 3(3), 63-37. <https://doi.org/10.23960/jsl3363-70>
- Wibowo, A., Ayu, I. G. K. R. H. & Sudarwanto, A. S. (2017). Implementasi kebijakan dalam penanggulangan konflik antara manusia dan satwa liar di Provinsi Jambi (ditinjau dari hukum dan kebijakan publik). *Prosiding SnaPP 2017 Sosial, Ekonomi, dan Humaniora*, 7(2), 256-274.
- Xie, Y. (2020). Ecological labeling and wildlife conservation: citizens' perceptions of the elephant ivory-labeling system in China. *Journal Science of the Total Environment*, 702(134709), 1-9. <https://doi.org/10.1016/j.scitotenv.2019.134709>