

Human–Elephant Conflict: A Workshop on Solving Problems of Managing Thailand’s Wild Elephants

The Asian elephant is the symbol of Thailand. Fortunately, Thailand still has healthy wild elephant populations: at least half of the elephants in Thailand—about 3,000 animals—roam wild in its national parks and wildlife sanctuaries. The remaining animals in captivity were, ironically, once employed in the logging trade, destroying their own forest habitat, but they are now mostly unemployed. Compared with their captive kin, wild elephants are truly impressive animals—healthy, powerful, and socially highly intelligent. Seeing a social group of elephants in the wild is a rewarding and memorable experience.

The largest wild population of elephants occurs in Thailand’s Western Protected Area (PA) Complex, a group of contiguous protected areas containing about 18,000 km² of habitat. PAs include national parks and wildlife sanctuaries, both of which by law provide complete protection of the fauna, flora, and the habitat. National parks are designed to promote tourism and enjoyment by the public in addition to wildlife protection. Additional viable elephant populations survive in other, more isolated, PAs such as Kaeng Krachan, Kui Buri, Khao Yai, Tab Lan National Parks, and in Khao Ang Ru Nai and Khao Soi Dao Wildlife Sanctuaries in Southeast Thailand. A forest complex of six contiguous PAs totalling about 4,600 km² occurs in peninsular Thailand. Numerous smaller protected conservation areas still have wild elephants, but due to their smaller size, the future viability of most of these populations is in doubt unless they are contiguous with larger PAs.

Most species of animals survive in conservation PAs without requiring any special attention by PA managers, but elephants, because of their need for a variety of habitats and wide-ranging habits, and their distain for motor vehicles, have been creating management problems. Elephants in at least six PAs have been increasingly crossing PA borders and invading human-use areas, mainly to search for more food. Local farmers and park personnel usually respond by attempting to chase the elephants back into the PA, and a considerable amount of research and management effort has been devoted to devising fences that prevent elephants from crossing PA borders and preventing them from entering crop fields. However, elephants are too powerful to be easily constrained and have outwitted virtually every method or device invented to prevent them from entering a field. Attempts to repel elephants from agricultural areas, at worst, have turned them into belligerent enemies which has resulted in the deaths of many villagers.

The problem of controlling elephants that leave PAs and cause “human-elephant conflicts,” or HEC, has been regarded with so much concern that Prime Minister Prayut Chan-Ocha, on 21 October 2022, appointed a Committee on Conservation and Management of Elephants to deal with the problem. The Secretariat of the Committee decided that it was time to take action by collecting facts and data in order to construct a master plan for the management of wild elephants. The first step in this regard was to conduct a workshop in which all relevant agencies, NGOs, and representatives of local communities were invited to present their knowledge and experiences concerning wild elephants, with the objective of making recommendations for a master plan. This plan would result in measures to be integrated into the workplans of all relevant official agencies and civil authorities that must deal with problems caused by elephants.

The workshop, sponsored by the Department of National Parks, Wildlife and Plant Conservation (DNP) with help from the Amata Foundation, Wildlife Conservation Society–Thailand (WCS) and a few other agencies, was held during 22–24 March 2023, at Khao Yai National Park. It was well attended and regarded as a great success. The authors (WYB and CRB) were invited to attend and were amazed by the variety and number of instances of elephants leaving PAs, resulting in HEC (see the figures). Many recommendations and solutions were proposed, many of them based on expert opinion but some of them naïve and less useful. Here we report on the proceedings of the workshop, based on what we saw and heard, and also on a draft report of the workshop released recently by the DNP. We cannot vouch for or verify the accuracy of the information presented at the workshop and are conscious that some of the information presented was inconsistent. This often resulted from speakers presenting information from different sources or time frames, but also from real disagreements over the facts.

At the end of this report, we will present our own ideas concerning the sustainable management of wild elephants in Thailand, which differ from some of the management recommendations made by various sorts of experts attending the workshop. There is also a need to benefit from the experiences and practices of other countries such as India, Sri Lanka, Malaysia, Indonesia, China, and Bangladesh (Figs. 8, 9), which also have Asian elephant populations, and which have also experienced HEC. The problems of wild elephants leaving PAs and of HEC experienced in Thailand are virtually the same as those experienced in many other countries within the range of the Asian elephant (e.g., DE LA TORRE *ET AL.*, 2021).

A WORKSHOP ON CONSERVATION AND MANAGEMENT OF WILD ELEPHANTS, KHAO YAI NATIONAL PARK, 22–24 MARCH 2023

Opening ceremony:

The workshop was opened by the Deputy Governor of Nakhon Ratchasima Province, who welcomed all participants. His presence underscored the importance of the workshop to the country.

Opening speech:

The opening speech was delivered informally from the stage by Dr. Theerapat Prayurasiddhi, former Permanent Secretary of the Prime Minister’s Office, who thanked all participants taking part in the workshop. He underscored the importance that the Ministry of Interior and other government sectors have given to wild elephants. He thanked the Amata Foundation for sponsoring and helping to fund the workshop. Appreciation was also expressed to the foreign experts taking part in the meeting for their observations and useful suggestions.

Dr. Theerapat explained that the Department of National Parks, Wildlife and Plant Conservation is already responsible for management of elephants and for solving problems created by elephants all over the country. The Department has developed improved ways of sustained management. However, there are increasing numbers of wild elephants and other wild animals all over the country. As a consequence, wild elephants have increasingly caused damage to villages and injured villagers, who have started to appeal to the government for help. Problems caused by wild elephants worry His Majesty, particularly when compensation



Figure 1. Elephants forage in grasslands in Khao Yai Park but most grassland has now grown back into forest. Photograph by Kulpat Saralamba.



Figure 2. Elephants like to forage along the roads in Khao Yai Park. Photograph by Kulpat Saralamba.



Figure 3. Bull elephants often cause traffic jams along roads. Photograph by Kulpat Saralamba.



Figure 4. Elephants are popular attractions for tourists in Khao Yai Park, and are not usually dangerous if not harassed or chased. In this picture, the people are approaching too close and risking death or injury. Photograph by Kulpat Saralamba.

paid for the damages caused by wild elephants has not covered all injuries. This situation has led to this meeting.

Lectures:

The next part of the workshop consisted of a series of lectures given by various officials and experts on various aspects of elephants and their management.

1. Policy on Conservation and Management of Wild Elephants in Thailand, by Mr. Padej Laithong, Director of the Office of Wildlife Conservation

Wild elephants create national problems, so a Committee for Conservation and Management of Wild Elephants was appointed, chaired by General Prawit Wongsuwan, Deputy Prime Minister. Many directors of other government agencies and sectors joined as committee members. Two subcommittees were set up, one responsible for domestic elephants and the other for wild elephants. They were assigned to develop policies and directions for management, with appropriate budgets.

Thailand has increasing populations of wild elephants because of decreasing numbers of predators such as tigers, caused by poaching by hunters. Analysis of research findings shows that there are 450–650 wild elephants per 6,155 sq.km of habitat distributed in eight conservation forests. [The speaker may have been referring to the Dong Phrayayen forest complex which includes PAs stretching from Khao Yai Park eastward along the Cambodian border.—*Authors*] Management of wild elephants varies from forest to forest. Each area applies methods that they believe appropriate to the local area. The DNP has insisted that the methods include villagers, to form networks for management of wild elephants in their area. About 200 networks need to be formed. Each network will receive 50,000 baht to study HEC in order to prevent severe incidents, i.e., how to keep elephants from injuring villagers or damaging farm products. When damages occur, villagers must be appropriately compensated.

There are 91 protected forest areas in Thailand which contain wild elephants. Among these areas, 46 are national parks, 36 are wildlife protection areas and nine are non-hunting areas. There are an estimated 4,013–4,422 elephants in these 91 forests. A fund of 70 million baht is allocated for managerial expenses. Activities are planned to implement protection measures in the near future in line with results of research, such as:

- 1) Vaccination of elephants for population control
- 2) Establishment of temporary resting areas for stray elephants, already on-going in some areas such as Phu Thai, Tha Takiap, Khlong Roi, in Chachoengsao
- 3) Behavior of wild elephants
- 4) Comparison was made with the elephants in other Asian countries such as India and Sri Lanka that have 20,000 elephants altogether, but they can live alongside humans because their behavior and movements have been well studied. China uses drones to establish the movement patterns of wild elephants and conserve those areas where elephants move around.

5) Technology and innovative measures for conservation and management of wild elephants. In Thailand, fences with electric current, as well as wire fence with beehives, have been used to keep wild elephants within the park area. Various kinds of signals are used to warn farmers or villagers to stay away from elephants or to chase elephants away from their farmland. However, elephants have quickly learned and developed the skills to overcome these obstacles.

2. Conservation Status and Ecology of Wild Elephants, by Dr. Ronglarp Sukmasuang, Associate Professor of Forest Biology, Faculty of Forestry, Kasetsart University

Dr. Ronglarp explained that it is essential to use data from the study of the biology of wild elephants as basic knowledge is needed to create directions for management of HEC. Wild elephants use their behavior to live safely, search for food, reproduce and give birth. This is how they maintain their species and increase their population. Wild elephants live in large herds. They communicate to inform each other where food and salt licks are. Wild elephants communicate using low-frequency sounds. They can detect such low-frequency vibrations in the ground with their feet as far as 32 km away. Wild elephants are attracted to salts in garbage disposed in village dumps. This results in accidents and injuries by wild elephants, resulting in demonstrations by villagers against the elephants.

Analysis of the land of the whole country shows that only 0.1% is used by wild elephants. [The 0.1% figure in the DNP report is surely a typo; the percentage of area used by wild elephants must be close to 10% of the kingdom. —*Authors*] Khao Yai National Park has an area of 2,600 sq.km. [The area of the park is usually reported as 2,168 km², but is given as 2,196 km² on the DNP's website listing all PAs. —*Authors*] This means that the carrying capacity of Khao Yai NP is 260 wild elephants. There are 3,000 wild elephants in the whole of Thailand, the highest number in Southeast Asia. Observations on wild elephant behavior in Thailand include communication behavior, learning ability, habituation, and ability for reasoning.

Studies show that demographic structure of wild elephant populations has changed very little over time. Changes of major farm crops has not caused more or less attraction for wild elephants to leave forests. So far, only about 118 research projects have been carried out in Khao Yai Park, and very few have been concerned with HEC.

3. Wild Elephant Conservation and Management: The Royal Project, by Mr. Thamanoon Themchai, Forestry Expert, Wildlife Conservation Area, Khao Ang Ru Nai WS, Prachinburi Province

One successful project to keep wild elephants from entering farms or villages is the Royal Project Patcharasudhakachanurak at Khao Ang Ru Nai WS in Prachinburi Province, headed by Princess Bajrakitiyabha and Queen Suthida. The buffer zone around the sanctuary is used with good effect. Areas within it near the sanctuary border are converted into ponds, an artificial salt lick, and grassland planted with fast-growing grass species that are nutritious for elephants. Elephants are free to leave the sanctuary to enjoy this open grassland. Some areas are planted with trees that bear their favorite fruits, such as mango, jackfruit, and cashew nut. Bushes and vines that elephants dislike are planted at the outer boarder of the buffer zone adjacent to the villagers' farmland, including lime, pepper, basil, kaffir lime, lemon grass, galangal, ginger root, and climbing wattle vine. This vine makes a unique natural fence when planted with close spacing. It can strengthen wire fencing. This wattle not only repels the elephants, but it can be considered a useful farm product as it contains valuable nutrients for human consumption. In fact, it is a popular vegetable in the Thai cuisine. Elephants are observed to leave the sanctuary, enjoy the buffer zone open grassland, relax at the pond, use the salt lick, and walk back into the sanctuary. The results of this royal-conceived project are inspiring, and the project can serve as a model for buffer zone development around all PAs.

4. Wild Elephant Behavior, by Mr. Pitak Yuenyong, DNP

Wild elephants are difficult to control. Male elephants in rut usually stay alone, but sometimes they remain in their herds and try to force other male elephants to leave. A few



Figure 5. Elephant feeding visiting a private garden at night, in Huai Sadyai, Prachuap Khiri Khan. Photograph by Thongbai Charuendong.



Figure 6. A wild elephant relaxing at a resort in Prachuap Khiri Khan. Photograph by Thongbai Charuendong.



Figure 7. An elephant invading a workshop in Prachuap Khiri Khan. Photograph by Thongbai Charuendong.



Figure 8. A large elephant group encroaching paddy fields in Sherpur, northern Bangladesh. These elephants visited regularly from Meghalaya, India, but Indian authorities have fenced them off, and they are now confined to an area too small to support them. Photograph by Mostapha Feeroz.



Figure 9. Bangladeshi farmers try to repel the elephant group by setting fires. Photograph by Mostapha Feeroz.

males may form a group to wander out of the PA and into villages in search of food. Adult wild elephants have been seen teaching others to steal sugar cane stalks from trucks that they stop on the highway. Nowadays they walk to farmers' houses, schools, and factories, not different from stray dogs. Lone males that travel about can send messages to the herds in the PA to leave the forest and come to feed in garbage dumps or crop fields. Humans living in villages near forests that have wild elephants must understand wild elephant behavior and their communication patterns, and decide together how to handle HEC.

5. Technology and Innovation for Conservation and Management of elephants, by Mr. Bruce Jones of the Earthranger Association

Mr. Jones described technological advances that have helped in the management and protection of wild elephants and other wildlife in South Africa and other parts of the world. He described a system of monitoring devices that take remote photos and videos and collect various other data, and send them over the internet in real time to one or more central monitoring units. Wildlife conservation biology is keeping pace with attempts to monitor activities of ourselves all over the world!

Seminar:

This part of the workshop consisted of a large panel of persons who made relatively brief presentations on the topic: “Lessons Learned from Wild Elephant Management in Conservation Areas.” The speakers represented PA offices, NGOs and local villagers. The panel was moderated by Dr. Boripat Sirianoonrat, who has held a variety of positions as a conservation biologist and veterinarian. Below are summaries of some of the presentations, mostly by PA officials, that have been copied and edited from the DNP report.

Chief of Khao Ang Ru Nai WS, Southeast Thailand. The sanctuary area is mostly flat land, 80% of which had previously been within logging concessions. The general vegetation of degraded areas is mostly climbers and bushes. The wild elephants regularly leave the sanctuary. There are 1,000 houses around the area. There is no good habitat for elephants to live in. There are constant changes of weather and the surrounding human community. There are no plans to improve the water resources, grassland or forage for the elephants. If improvement of the habitat results in increase in the elephant population, birth control should be implemented in an appropriate way. Another idea is to let the elephants become extinct in areas where they cannot survive.

Chief of Huai Kha Khaeng WS, part of the Western Protected Area Complex. The wildlife sanctuary has many kinds of animals including banteng, elephants, and tigers. Recently, a tiger killed and ate a goat that belonged to a villager. Monkeys, wild boar, and wild elephants roam into surrounding villages. The sanctuary borders many human communities located within the buffer zone. The sanctuary has appointed rangers to move quickly to drive wild elephants away from villages. There is a natural grassland used by stray elephants which will not go into the forest. We are formulating a management plan for managing wild elephants.

World Wildlife Fund–Thailand (WWF) staff member who works at Kaeng Krachan NP. This park has a large area which can support 250 wild elephants. There are five herds. Wild elephants started to leave the park in 2004. Presently, we are collecting detailed information on population size, and we are investigating areas and factors that cause elephants to leave the forest. Management efforts are divided into three categories: 1) zoning of the forest; 2) safety; and 3) making villagers understand the nature of wild elephants and support for them in choosing the right profession. Damages done to villagers are compensated properly. We encourage Khao Yai staff who work with wild elephants.

A Wildlife Conservation Society–Thailand staff member who works at Kui Buri NP. He stated that “Here at Kui Buri NP we have solved HEC problems by following the suggestions of HM King Bhumibol.” These include improving the habitat for wild animals, making grasslands, artificial salt licks and a water supply with the help of villagers. We have surveyed the elephants using camera trapping. Fifty wild elephants have been individually identified from photos. HEC will not go away quickly. We still need more cooperation from the villagers.

Chief of Wildlife Research Station, Phu Luang NP. This is the main station that collects data on characteristics of individual wild elephants, carries out knowledge transfer to other units and publicizes the data to the local community. It is necessary that local villagers learn about wild elephants.

Chief of Nern Hom Subdistrict Administrative Organization, Prachinburi Province. He emphasized the importance of compensation when wild elephants cause damages to the villagers. A committee at the subdistrict level is appointed to register complaints or receive petitions from villagers. The damage will be thoroughly inspected by knowledgeable staff and an estimate of the amount of compensation is made. Urgent help is carried out within 15 days of the complaint, such as a supply of seed or grain to replant or replace the damaged crops. However, there are no such committees or compensation activities in neighboring subdistricts. This has created dissatisfaction among villagers in other subdistricts, a problem which needs to be solved quickly.

Dr. Boripat concluded the talks by stating that the problems of stray wild elephants and problems of damage compensation should be submitted as a resolution of this workshop to the National Committee on Wild Elephants, in order to find solutions and set suitable and consistent standards of response.

Special lecture:

A lecture on “The Importance and Direction of Knowledge Development by Research on Conservation and Management of Wild Elephants” was given by Dr. Chution Savini, Department of Hospitality and Tourism Management, International College of Sustainability Studies, Srinakharinwirot University, Bangkok. Some major points made in her talk:

Research on wild elephants has many aspects. There are problems with wild elephants in many parts of the world. Dr. Chution’s experience in working on gibbon research in Khao Yai NP as well as her collaboration with WCS International reveals that there are many small populations of wild elephants in the world. Whereas the population in Thailand is relatively large and is causing problems, the population in Vietnam is declining. Wild elephants in Borneo may be in danger of extinction. Although the population of elephants in Khao Yai NP may appear to be increasing, they may just be more visible and detectable than previously. Our current study site is in the Kaeng Krachan Forest Complex which includes Kaeng Krachan and Kuiburi National Parks. A review of elephant and human deaths during the past 30 years indicates that both may be increasing. There have been some incidents that have helped control the elephant population in Khao Yai, such as accidents in which elephants have fallen over Heo Narok waterfall while attempting to cross during the flooding season. We do not have an accurate estimate of the real number of elephants in the park because of a lack of good research. Moreover, captured wild elephants are sometimes registered as domestic elephants to replace dead domestic elephants. Thailand is the only country in which the size of the wild population is about the same as the domestic population.

We must establish careful priorities in research and policies in order to solve HEC problems given our small budgets. HEC mitigation methods can be identified into short term and long term measures. Should we first construct barriers to keep wild elephants inside the parks, set up a network to compensate villagers for the damages caused by wild elephants, persuade farmers to plant other cash crops, or manage elephants in buffer zones around the park? Khao Yai National Park needs to solve such problems urgently because land around

the park is being changed rapidly into expensive resorts and other uses incompatible with elephant conservation.

Dr. Chution introduced Joshua Plotnik's research on elephant knowledge and behavior to better understand elephant behaviors at the sites of conflict in Salak Phra Wildlife Sanctuary (part of the Western PA Complex) which has long experienced conflicts between elephants and villagers). Wild elephants develop habits which they repeat. They communicate using sounds in recognizable patterns. Study of the behavior of individuals is carried out using remote "camera traps" that take pictures of elephants leaving the sanctuary, walking along the border, or roaming around the buffer zone. The students have collected data from 213 elephants and compiled them into a special database program designed in collaboration with a German research group. The study has revealed that individual elephants learn new things at different rates. Some elephants learn to solve problems quickly whereas others learn more slowly.

Dr. Chution emphasized strongly that it is very important to have enough knowledge of the elephant population in each HEC site, and that knowledge should be applied to elephant conservation management. There have been many misguided management actions at HEC sites which have sometimes worsened the conflicts. Many people have claimed that elephant populations have been increasing although there is not enough data to prove this. It is important to know whether the greater incidence of HEC is due to increasing elephant populations, or just their higher visibility. Study of the local communities at Kaeng Krachan and Kuiburi NPs indicates that the villagers still have positive attitudes toward elephants and their problems.

Dr. Boripat added that more research work is needed for the management of Khao Yai's elephants. Researchers should collaborate with people in the local community so it will cover as many aspects as possible. If the results cannot be applied to solve HEC, the direction of the research must be modified. For example, the method of hanging boxes that contain beehives along the fence of the PA should be attempted. Bees can keep elephants away because they annoy the elephants by stinging the soft skin around their eyes, the tip of the trunk or small veins of the ears. Villagers can also benefit from selling honey for income.

Group discussions:

The longest part of the workshop was the establishment of four groups of participants to meet separately to discuss different aspects of HEC and to devise solutions in their particular area of interest. Each group then reported its recommendations to the meeting at large. This part of the workshop was not included in the draft DNP report. We attempt to provide an overview of the group reports, but for some groups it is very sketchy because we did not attend all the group discussions or record all of their presentations.

Group 1. Monitoring the wild elephant population

The group recommended carrying out long term studies to determine how the elephants in Khao Yai Park and vicinity achieve population equilibrium that adjusts to the carrying capacity of the habitat without interference by humans. This is consistent with the management of other important wildlife in the park such as hornbills and gibbons and animals that use grassland. It is essential to manage the grassland areas outside the park and to study the responses of wild animals. It is recommended to carry out studies of forest ecology on long-term plots.

Group 2. Finding ways of keeping wild elephants separated from human communities

Possible ways of preventing elephants from encroaching on human communities include:

- 1) Studying the potential carrying capacity of the forest for elephants
- 2) In cooperation with human communities, determine the best methods of driving wild elephants out of villages
- 3) Develop an efficient protection plan so that elephants do not leave the park or do damage outside the park
- 4) Develop an effective method for the community to observe and monitor elephants that leave the park

Group 3. Study of forest and wildlife interactions

- 1) Study of the value of the forest as a carbon sink, and carbon credit value
- 2) Study of the biodiversity of forest at the edges of the park, and its effects on elephant movements
- 3) Study of infectious disease transmission, particularly between domestic livestock to wild elephants and bovinds

Group 4. Elephant behavior and population ecology

This group, attended by Dr. Ronglarp, Dr. Boripat, Mr. Bruce Jones, Mr. Andy Smith (Thailand Project Coordinator of the IFFC Conservation Corps), and WYB, expressed concern about the lack of accurate data on the numbers of elephants in Khao Yai Park and other places, their rates of increase, and pattern of movements throughout the park. The group recommended concerted research efforts to obtain better data on the following aspects:

- 1) Use or updated technologies, including DNA analysis, camera trapping and (possibly) LiDAR, to determine the number of elephants in the park and their movements and use of habitats
- 2) Effects of ecological changes and humans on the individual behavior and movements of elephants, including climate change, forest succession, human recreation, road traffic and other stress factors
- 3) The population changes of elephants in other PAs that connect with Khao Yai Park in the Dong Phrayayen Complex

Observations of local engagement by villagers and other observers:

In addition to the group reports, opportunities were provided for villagers, local officials, and other observers to relate their experiences with HEC and propose solutions. This resulted in a monitoring plan to record instances of elephant incursions into villages and a system of compensation for damages. We report some of these experiences and observations:

- 1) The attitudes of local people towards wild elephants is very important. Elephants like to roam to the edge of the forest to look for plant food and water. If they meet strong resistance or are chased, they may react very strongly. Areas should be established for wild elephants to rest and roam around. For example, in 2017, elephants came out of the forest and walked around the Mission Hill Golf Course in Nakhon Nayok Province. The owner let them walk around freely and drink water, and then they returned to the park. Artificial ponds and a salt lick have been provided for the elephants to use. Previously, there was sufficient food in the park as grassland was selectively burned each year to allow new grass shoots to grow which elephants fed on.

2) From 2015, elephants were seen often in San Kampang Village in Wang Nam Khieo District, Nakhon Ratchasima Province, near Khao Yai Park, sometimes feeding on corn and other cash crops. Villagers called on the Khao Yai Park staff for help in making the elephants return to the park. Village volunteers were tasked with contacting park rangers whenever elephants left the park. It was proposed that an official task force be formed by the village head man to drive elephants away from the village. They also proposed that village volunteers and park staff hold workshops to learn how to observe elephants to determine their customary routes, preferred plants and times of feeding, and preferred resting areas. Park staff should train villagers how to persuade elephants to return to the park by studying their psychology and behavior. Such methods should be publicized at district offices, schools, reporters, and tourist facilities.

3) Villagers and researchers agreed that compensation for elephant-caused human injuries and damage to crops should be standardized at the province level, using the budget from the Office of the Prime Minister and the Department of Disasters. The suggested rate was 30,000 to 50,000 baht, equivalent to the compensation paid to park rangers when injured or killed while on duty.

Conclusions:

The reports of villagers, local officials and various experts resulted in a series of recommendations on how to solve human–elephant conflicts, which can be summarized as follows:

1) We must improve our knowledge of elephant behavior, population sizes in PAs, demographic changes, and the carrying capacity of the forest for elephants.

2) We should instill a good attitude toward elephants in the Thai people, and admire elephants as our national animal.

3) We should establish networks of volunteers to monitor and report on elephants leaving PAs and communicate with responsible park officials.

4) We must establish oases or roaming areas for elephants near villages where they can feed and rest without being chased by villagers.

5) Villagers should stop expanding their farms and encroaching in buffer zones near PAs or in conservation forests.

COMMENTS ON THE WORKSHOP AND RECOMMENDATIONS FOR SOLVING HEC PROBLEMS

We believe that the workshop on HEC in Khao Yai Park was a valuable exercise, particularly because the organizers were able to bring together so many kinds of people who have a stake in the conservation and management of wild elephants: protected area officials, NGOs, wildlife researchers, villagers, and other government representatives. There is ample material to enable the National Committee on Conservation and Management of Elephants to formulate an overall management plan for dealing with human–elephant conflict in Thailand. In fact, the committee may feel overwhelmed with recommendations and unable to carry out all of them. They must distribute responsibility for carrying out the recommendations wisely and monitor their implementation. We suggest that additional workshops should be planned to deal in more detail with specific problem areas. These might include, for example,

research activities, protected area adjustments and policies, creating and managing buffer zones, organizing local village efforts, educational activities, etc.

While we agree with nearly all the recommendations made at the workshop, we believe that, in general, many do not go far enough in breaking from tradition and current practice, and tend to concentrate on the symptoms of the problem rather than the basic causes. Below we comment on specific issues that we think need particular attention.

1) The elephant population in Khao Yai is not known with sufficient accuracy to determine if it exceeds the carrying capacity of the forest. There is an almost unanimous belief that the Khao Yai population is increasing, but we find no reliable evidence to support this claim. Long-term monitoring data are not available. The increase in elephants leaving the park has other possible causes, such as changing climate, disturbance by humans, and decrease in foraging areas.

2) The decline in prime foraging area within Khao Yai Park is likely being caused by ecological succession of the vegetation. The highest quality feeding areas for elephants are disturbed areas such as grasslands that were created by human inhabitants before the park was declared, largely maintained by fire. Most such patches of grassland are now rapidly growing back into canopy forest (JHA *ET AL.*, 2020). Many areas at the periphery of the park were encroached during the 1970s and 1980s, and are now regenerating back into forest due to border demarcation and better enforcement. This has resulted in a reduction of the best foraging areas, because the dense canopy forest has lower productivity that elephants can reach. There is growing evidence that Asian elephants require open, disturbed vegetation located mostly at the periphery of PAs for feeding (DE LA TORRE *ET AL.*, 2022). The loss of many such areas in Khao Yai Park has likely induced elephants to leave the park in search of better feeding areas.

3) Terrestrial protected areas in Thailand include almost exclusively forest areas, and boundaries mark the transition between conservation forest and farmland. Elephants are expected to respect these boundaries, and those that cross the boundaries are treated as illegal trespassers and animal lawbreakers of a sort. However, elephants never agreed to respect these boundaries and it is now increasingly in their interests to search for food outside some protected areas. We must understand that elephants require larger ranges and foraging areas than are available in many PAs. How can we solve this problem? We believe that we must learn to live with elephants that encroach on human use areas, and attempt to create buffer zones that allow elephants to visit without human interference. This will require altering some of our own landuse patterns and habits, and perhaps changing the borders of some PAs. This has already happened in Kui Buri National Park, where some pineapple farmland has been abandoned and returned to the elephants. Another precedent is the areas created for use by gaur (*Bos gaurus*) that strayed out of the northeast part of Khao Yai Park in search of grazing areas.

4) The creation of “buffer zones” is regarded as one solution to wildlife encroachment problems and HEC. We are not clear about what exactly a buffer zone is, as the designation appears to have no legal status as a land classification or conservation area. Therefore, the DNP has no authority to compel private landowners on the border of Khao Yai Park or other PAs to do anything to benefit wildlife. The DNP needs to seek some legal status for buffer zones that allows elephants to use them, or else must seek voluntary cooperation of the landowners, perhaps using incentives. As pointed out above, we believe that another workshop should be convened to establish policies regarding buffer zones and methods of dealing with or

convincing private landowners, many of whom, as pointed out by Dr. Chution, are wealthy resort owners that can afford to thumb their noses at the DNP. But other landowners, in contrast, are dedicated conservationists.

5) During the workshop a special report by the WCS (2022) on their project in Kaeng Krachan NP was distributed to participants. This report graphically illustrates with maps and photos the attempt to fence off from wild elephants an enclave of settlements and agriculture almost entirely within the boundaries of the park, approximately 70–80 km² in area. This area clearly should have been included within the national park, but because it had been settled by landowners with deeds before creation of the park, the area was excluded. Consequently elephants living in forest on nearly all sides of the enclave constantly attempt to invade the area and feed on crops and other foods. Most likely, they once bathed regularly in the Pranburi River which runs through the center of the enclave. The response of the national park, and the WCS, has been to spend large amounts of effort and funding constructing elephant-proof fences of cement posts and heavy wire. No type of fence has been 100 percent effective in restraining the determined elephants from breaking through, but the officials with the help of villagers have devised a warning system that allows quick responses by the villagers to come and scare the elephants and chase them back into the park when they attempt to penetrate or step over the fence. Likewise, efforts to repel elephants at the edges of their commercial crop fields are ongoing, but have been only partially successful.

We believe that the attempt to keep elephants from entering the enclave in the southern part of Kaeng Krachan NP may be a losing battle and not sustainable in the long run. Elephants clearly need this area for foraging and are struggling to get into it. Much effort has been made by authorities to minimize the damage that elephants make to crops and reduce HEC—by itself a laudable objective. Looking at the big picture, however, we believe that more effort now should be made to bring an end to commercial farming in the enclave. This objective might be accomplished without evicting the farmers or seizing their legally-held land. We suggest the following general steps:

- a) Declare the entire enclave a park buffer zone, and cease all efforts to fence off the area and exclude the elephants. Such an action, although it would be unpopular with the farmers, would help reduce their incentives to continue farming.
- b) Continue efforts to offer aid and incentives to human residents to plant elephant-resistant crops, change their occupations, or be resettled outside the enclave and be compensated.
- c) Establish a foundation along the lines of the Nature Conservancy to raise money from affluent conservationists and establish a fund to buy out the landowners in the enclave and turn their holdings into conservation areas, perhaps non-hunting areas managed by the DNP, or areas managed by a foundation promoting special projects and activities compatible with nature conservation.

If these steps were carried out, the enclave could become a world-class wildlife viewing and research area and a prime area for outdoor recreation, nature study, and nature education, surrounded by a largely pristine national park. Kaeng Krachan is one of the most biodiversity-rich PAs in the region, and promoting conservation activities in the enclave would truly raise its reputation and give it world-class status as a conservation management and research area.

6) The conclusions that elephants should be treated with more respect and understanding cannot be overemphasized. Elephants have a high social IQ and are able to distinguish friends

from foe. Experiences from several areas reported on during the workshop indicate that wild elephants that are not harassed or chased are less dangerous to humans. This is not to say that wild elephants can all be approached safely, but that a more friendly and respectful treatment would in all likelihood make them less belligerent and reduce human fatalities in HEC. We should cease efforts to frighten foraging elephants away or chase them back into protected areas. We are entering a new era in which we will have to learn to share our living space with them, while minimizing dangerous interactions.

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