Final Evaluation Report

Your Details	
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Project Title	Evaluating the Efficacy of Beehive Fences in Mitigating Human-Elephant Conflicts and Improving Farmers' Income around the Digya National Park of Ghana
Application ID	39738-1
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1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Model the effects of beehive fence and farm characteristics on the probability of farm visitation by elephants, and extent of damage caused per visit.	×			A 500 m beehive fence consisting of 50 beehives was installed at the forest-farm interphase near Nsogyaso. The probability of farm visitation by elephants was lower where the beehive fence was installed compared to areas that had no beehive fences. However, the number of observations (incidents) was not high enough for statistically modelling the effects of beehive fence and farm characteristics on the probability of farm visitation by elephants. This was because the frequency of farm visitation by elephants in the project community was quite low during the implementation period. Only two incidents of farm visitation by elephants were recorded in the project community. These incidents occurred in areas where no beehive fence was installed. In contrast, the frequency of farm visitation by elephants in neighbouring communities like Sarbuso and Aguom, as reported by wildlife management staff, was very high. Ancestral history tellers, elderly farmers and wildlife officials explained that crop-raiding incidents in the area has been fluctuating. Thus, the pattern has changed from seasonal to cyclical, and is

				becoming difficult to predict. One of the sub-chiefs revealed that the elephants disappeared from the area in the 1950s but returned after 30 years, and became more destructive and unpredictable than before. Local accounts emphasise the influence of landuse changes in the cyclical nature of crop-raiding by elephants in the area. Periods of high incidence were generally associated with increased availability of elephant-loving plants such as yam, mango, Borassus palm, and banana passionfruit. On the other hand, low incidence was mainly linked to rampant felling of mango and Borassus palm (especially for charcoal production) and excessive noise from chainsaw machines used in felling those trees. The key lesson learned was that, in areas characterised by cyclical patterns of crop-raiding incidents, short-term studies may be inappropriate for modelling the effects of beehive fence and farm characteristics on the probability of farm visitation by elephants and extent of damage caused per visit. Longitudinal studies that are conducted for several years would be most appropriate in such contexts.
Assess the effects of beehive fence on farmers' income.		×		A 19-member local committee was formed in January 2024 to steer the affairs of the project during and after the implementation phase. Ten of the committee members were self-selected to manage the 50

				beehives as an alternative income-generating venture. Honey production in the 2023/2024 season was, however, disrupted by the invasion of reddish bees that were notorious for attacking and killing honeybees. The invasive bees were eliminated by the local committee members and beeswax was reapplied inside the hives to reattract the honeybees. However, the honeybees did not reoccupy hives probably because the hive occupation period had elapsed. Beehive occupation period in the area spans from September to December. In the 2023/2024 season, the beehives were established in early part of December 2023. To minimise the risk of the reddish bee invasion in the future, local beekeepers recommended early hive establishment. Accordingly, hive establishment for the 2024/2025 season commenced in September 2024. The reddish bee invasion has so far not reoccurred. Based on experiential knowledge, committee members have estimated that each beehive could produce approximately six litres of honey per annum for the 2024/2025 season, with a corresponding income of GHC 240 (£17.65) per hive per annum. Based on experiential knowledge, the committee members have further projected that honey production

				could double, i.e. increase from six litres to 12 litres per hive per annum, from the 2025/2026 season onwards. Thus, from the 2025/2026 onwards, each beehive will be expected to yield an income of GHC 480 (£35.29). Cumulatively, the local committee members could earn an additional income of GHC 12,000 (£882.35) from honey in the 2024/2025 season; and GHC 24,000 (£1764.71) from the 2025/2026 season onwards.
Build farmers' capacity to install and maintain beehive fences.			×	This objective was achieved by strengthening farmers' knowledge and hands-on technical expertise. First, an interactive training workshop was organised to educate community members on a wide range of pertinent topics, which included: (i) the causes of human-elephant conflicts (ii) using sustainable intensification to mitigate agricultural expansion into the habitat of elephants (iii) key benefits of elephants to mankind (iv) anti-crop raiding measures that can be adopted at the farm level (v) description and efficacy of a beehive fence (vi) beehive and beehive fence maintenance (vii) strategies for quality honey production, honey branding and marketing and (viii) ecological concerns on beekeeping and their mitigation measures. The workshop was attended by 109 community members, which comprised of 75 men and 34 women.

				The interactive workshop was followed with hands-on training of 14 community members and three forest guards on beehive fence installation at the forest-farm interphase. In addition, key messages from the interactive workshop and hands-on training and other lessons learned from the project were broadcasted on Nkwa FM to reach a wider audience. The radio station was estimated to have a listenership base of over 90,000 farmers.

2. Describe the three most important outcomes of your project.

a). The project has helped to change community members' negative perceptions of elephants. A baseline survey conducted at the beginning of the project showed that 34% of farming households perceived elephants not to be important. This percentage was drastically reduced to 16.67% after the interactive training workshop. Six participants were randomly selected after the workshop to quickly assess the impact of the training on community members' perceptions of elephants. They were asked whether elephants were beneficial to mankind. Five out of the six participants, i.e. 83.33% indicated that elephants were beneficial to mankind. Thus, only one participant (16.67%) still held the perception that elephants were not beneficial. Interestingly, three of the five participants (60%) attributed their positive responses directly to knowledge gained from the workshop. They echoed the importance of elephants in ecotourism, and in seed dispersal (through their dung) for forest regeneration and climate change mitigation as highlighted during the workshop. The positive perceptions created could contribute positively to elephant conservation efforts in the area.

b). The project has also strengthened local knowledge and technical expertise on the use of honeybees to deter crop raiding elephants. Prior to the project, community members and forest guards had not even heard of a beehive fence let alone the idea that it could be used to deter crop-raiding elephants. Through an interactive workshop, informal conversations, and radio education, this project has enhanced awareness of beehive fence as a potentially effective strategy for deterring elephants. In addition, 14 community members and three forest guards have been given hands-on training on beehive fence installation. Trainees admitted having been technically equipped to provide technical assistance to farmers who may want to install beehive fences around their farms in the future.

c). Through household surveys and personal communications with ancestral history tellers, elderly farmers, and wildlife management staff, this project has generated a promising dataset on the dynamics of human-elephant conflicts at the household and community levels and their underlying factors. That dataset came up as explanations were sought for the cyclical nature of crop-raiding by elephants in the

area. Although not initially intended, this dataset could lead to a journal article that may contribute new knowledge by highlighting the role of socioeconomic factors and landuse changes in vulnerability to human-elephant conflicts at the local level.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

(i) Initially, the project area was not accessible due to flooded roads. Several attempts to organise an inception meeting with the project community therefore proved futile. Torrential rains caused streams and rivers in the area to overflow their banks, thereby flooding and blocking all access roads. This led to a delay in the commencement of the project. The roads were also in very poor condition even after the floods, which impeded access to the project site. I tackled these challenges by waiting patiently and using the waiting period to acquire all the needed materials, including the beehives. In addition, I engaged the services of more field assistants so that more work could be done in less time.

(ii) Honey production in the 2023/2024 season was disrupted by the invasion of reddish bees that were notorious for attacking and killing honeybees. The invasion caused honeybees to abandon the hives. The invasive bees were eliminated by the local committee members by applying an insecticide and manually destroying their combs. Subsequently, beeswax was reapplied inside the beehives to reattract the honeybees. The honeybees, however, did not reoccupy hives probably because the hive occupation period had elapsed. To minimise the risk of the reddish bee invasion in the future, local beekeepers recommended early hive establishment. Accordingly, hive establishment for the 2024/2025 season commenced in September 2024. The reddish bee invasion has so far not reoccurred.

(iii) Another challenge encountered was the misconception among many community members that elephants were not afraid of bees and could not therefore be deterred using honeybees. Some community members maintained that elephants of the area are known for extracting honey from trees even in the presence of honeybees. It became necessary to clear up this misconception right at the onset, in order to boost community members' interest in the project. Using visual aids (videos and photos), success stories from India, Kenya, and Liberia on beehive fence as a solution to crop-raiding elephants were presented to community members during the interactive training workshop. In addition, it was clarified that honeybees from beehive fences, because of their large numbers, stand a higher change of stinging the sensitive spots of elephants such as the eyes, mouth, and nose. While few community members remained sceptical, most of them bought into the idea that honeybees could be used to deter crop-raiding elephants. Many community members therefore supported field activities on several occasions by voluntarily providing labour.

4. Describe the involvement of local communities and how they have benefitted from the project.

A 19-member local committee was formed in January 2024 to steer the affairs of the project during and after the implementation phase. Local committee members were directly involved in the installation of the beehive fence and beehive maintenance activities. Ancestral history tellers and elderly farmers from the

Nsogyaso community were also consulted for indigenous knowledge of the reasons behind the cyclical nature of crop-raiding incidents by elephants in the area. Moreover, the project tapped into the experiential knowledge of local beekeepers and engaged a local beekeeper as a facilitator for the training on beekeeping.

Community members have benefited in several ways. The project has strengthened community members' knowledge of the following: (i) the causes of human-elephant conflicts, (ii) using sustainable intensification to mitigate agricultural expansion into the habitat of elephants, (iii) key benefits of elephants to mankind, (iv) anti-crop raiding measures that can be adopted at the farm level, (v) description and efficacy of beehive fence, (vi) beehive and beehive fence maintenance, (vii) strategies for quality honey production, honey branding and marketing, and (viii) ecological concerns on beekeeping and their mitigation measures. Knowledge gained by community members could strengthen their capacity to adopt sustainable agricultural practices. Besides, 10 of the 19 local committee members were self-selected to manage the 50 beehives as an alternative income-generating venture. These committee members could earn an alternative income of GHC 12,000 (£882.35) from honey in the 2024/2025 season; and GHC 24,000 (£1764.71) from the 2025/2026 season onwards.

5. Are there any plans to continue this work?
Yes. There are plans to shift from a communal approach to a targeted approach that would build individual and highly vulnerable farmers' capacity to install beehive fences around their farms.

6. How do you plan to share the results of your work with others?

Plans are underway to prepare a research paper titled "*Dynamics of Human-Elephant Conflicts and their Underlying Factors around the Digya National Park of Ghana*". This paper is intended to be presented at an international conference before subsequently being published as a peer-reviewed journal article. In addition, a final project implementation report will be prepared and shared with the Wildlife Division of the Forestry Commission of Ghana. Three copies will be sent to the Wildlife Division as stipulated in the permit that was granted.

7. Looking ahead, what do you feel are the important next steps?
Individual farmers were urged to install beehive fences around their farms. Looking ahead, it would be necessary to monitor the dynamics of crop-raiding incidents and income generation from the beehives, and whether/how they may influence farmers' decisions to install beehive fences around their farms.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

Yes, and the Foundation did receive publicity. The Rufford Foundation logo was imbedded in the PowerPoint slides that were used for the interactive training workshop. The workshop began by introducing participants to The Rufford Foundation; acknowledging the financial support received from the foundation;

and projecting the logo boldly on the screen. The logo was also used in the training manual that was prepared. In addition, the financial support received from the Foundation was acknowledged during the radio programme, thus making the Foundation visible to thousands of listeners.

9. Provide a full list of all the members of your team and their role in the project.

(i) Agyeman Kofi: Supported in community mobilization, facilitation of training workshop, and field data collection.
(ii) Emmanuel Kyei: Supported in community mobilization, facilitation of training workshop, and field data collection.
(iii) Adofo Evans: Supported in community mobilization, facilitation of training workshop, and field data collection.
(iv) Augustine Iree: Supported in the acquisition and transportation of field materials.
(v) Mohammed Yussif: Supported in the acquisition and transportation of field materials.
(vi) Amos Ansong: Provided technical training and advice on beekeeping; and liaised between the Principal Investigator and the project committee members.

10. Any other comments?

The exchange rate used throughout this report is £1 = GHC 13.6, which is the exchange rate at which the grant was received. Because the exchange rate keeps changing, this rate was used in order to ensure consistency.