Final Evaluation Report

Your Details	
Full Name	Bismay Ranjan Tripathy
Project Title	Assessment of human-elephant conflict (HEC) using geostatistical approach and development of community-based mitigation strategy
Application ID	29746-1
Date of this Report	20th April 2022

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
Establish HEC baseline i. characterises the cost of various forms of HEC during 2001 and 2018 ii. derive the annual trend of various conflicts iii. assess differences in HEC intensity in all the forest ranges iv. seasonal association of maximum conflict occurrence				We figured out that approximately 200 villages in the Keonjhar forest division have been affected. We carried out informal talks to people from various socio-economic class of people regarding conflict and their attitudes towards elephants. We were trying to find out the positive aspect of elephant presence for the local people in the locality. We documented more than 300 human death and injury incidences, 4200 incidents of damage to houses and 12,800 acres of cropland damage during the time period. All the data were collected from various resources (survey, compensation report, news and ministry report, etc.). We will continue documenting and making a baseline of HEC. Also, we are planning to target the victims and try to analyse their sentiments. Our objective was not to address the hidden impact of conflict (we were not even aware of that) but during our survey, we figured out few impacts or cost of HEC which are not commonly publicised and reported. So, we are planning to address it in future and assess the effectiveness of compensation process and the sufficiency of the compensation amount for their losses.
Spatial pattern of HEC i. derives spatial occurrence of HEC and locate hotspot villages ii. evaluate the number of people under the threat				Local indicator of spatial association was used to locate hotspots where HEC cases are extreme and geographically homogeneous. The hotspots during 2001-06 were mainly identified in Keonjhar and Ghatgaon, while during 2007-12 the hotspots were found in

				Keonjhar and Champua. But during 2013-18, HEC incidences spread all over the study area, but northeast region of study area was highly impacted with greater areal extent. Spatial scan statistic was used to characterise HEC clusters by scanning with circular windows of minimum 30% population at risk. Number of people under risk escalated severely from 14,724 in 19 villages during 2001-06 , 34,288 people in 29 conflict prone villages during 2007-12 to 65,444 people in 45 villages during 2013-18. We observed that conflicts were concentrated in the central part which shifted towards the northeast region of the study area with a greater areal extent. Keonjhar and Ghatgaon forest ranges remained hotspots throughout the study time period, whereas the Champua forest range first became a prominent hotspot in 2007.
Elephant location database				We have collected and maintained 1 year of elephant location in a geo-database. We are planning to maintain this database further to understand the utilisation of elephant space and available resources.
Demography of conflict prone villages				We evaluated the demographic situation of conflict prone villages, where the average HEC incidence for each village was around 55 cases per year and they were mainly located in the Champua forest range, while a majority of these incidences involved crop-raiding, followed by house damage. We observed that around 60% of the residents were literate (58% male; 42% female) and nearly 45% of them engage in livelihood activities (60% male; 40% female), of which over 70% were involved in farming as their primary occupation, which included cultivators and agricultural labourers who worked year-round and marginal cultivators and agricultural labourers who worked seasonally.

Community outreach i. Identify the vulnerable community and share knowledge				We shared some knowledge among college students about the current status of elephant by conducting several seminars and also discuss management challenges. We tried to explain the local farmers about the importance of elephant to our society, as majority of them were having negative sentiments. School students in the conflict prone regions have been educated to increase their interest on elephant through several activities. It is difficult to convince the farmers for elephant conservation support as they are suffering a lot in the winter season in HEC. We inquired about their interest in switching crop pattern that are not palatable to elephant and can keep them away from crop land. We also motivated the farmers to cultivate honeybee nearby their farms. We trained some local teachers, also discussed and presented various educational material on elephant, their ecological significance and some drills to deal with elephant while interaction. However, our plan is to expand this experience to several other village. However, most of the communities we worked with, lost their houses and they were not enthusiast to discuss or talk about any other issue. However, we have their compromise to continue with the project in the near future.

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

a). The first major objective was to prepare a baseline of conflict occurrence since 2001 to 2018. We obtained HEC data for the villages impacted by elephant attacks from Keonjhar Forest Department, Wildlife Conservation in Odisha, Ministry of Environment, Forest and Climate Change and published reports and news along with some of the current data from the survey. However, we managed to collect 18 years of data on human death, injury, and house damage, along with 13 years (2005-2017) of data from crop raiding reports. HEC in this region has escalated to an extreme level, taking more than 300 human lives, and damaging12,700 acres of cropland and 4100 houses between 2001 and 2018. Overall, we found a decrease in the number of human deaths annually. The maximum number of total human deaths in the study area was 23 reported for 2001, and by 2018 the number had

decreased to eight annually. The intensity of human injury was also reduced. Similarly, the maximum number of houses damaged annually by elephants was 515 in 2001, which notably decreased to 100 incidents by 2018. Nearly 27% of the houses were damaged completely by elephant attack, while rest partially. But a reverse trend in crop raiding was observed, which has been rising every year since 2010. The average frequency of annual crop raiding was 2810 times/year between 2010 and 2018, which was only around 610 times/year during 2000 and 2009. The frequency of crop raiding increased nearly 300% from 2010 to 2012 and remained high through 2018, clearly indicating increased interactions of elephants with humans during that time period.

Overall, 18% of the forest cover throughout the study area have been majorly converted to cropland and settlements fragmenting habitats which elephants continue to use for their sustenance because of their firm loyalty to their traditional home ranges. Cropland is dominant over other land use types in the hotspots, which are highly preferred by elephants over natural forage due to its easy accessibility, nutrition and palatability. Also, we noticed that house damage cases were majorly closer to the forest border, farmland and/or water source and those are frequently raided due to the availability of stored grains and foods.

During 2001 and 2006, the conflict incidences were concentrated to a few regions in the central part, where ~15,000 people suffered from damage caused by elephants. It increased during 2007 and 2012 and spread all over the landscape, putting nearly 34,000 people in high HEC risk, especially from the Champua and Keonjhar forest ranges. During 2013 and 2018, Champua forest range became the largest area under high risk during HEC3, where ~45,500 vulnerable human population to elephant attack. The highest human casualties were reported from the Keonjhar forest range and its border to Ghatgaon and Champua ranges. The house damage incidences were spread all over the study area and spatially concentrated in Keonjhar and Champua forest ranges. Moreover, crop damage was the most challenging issue in the study area and the intensity of crop damage was also very high in comparison to human death and house damage. Champua forest range was the most susceptible to crop damage followed by Telkoi, Keonjhar and BJP forest ranges. Around 35 villages were found to be highly impacted by crop raiding in the Champua forest range, followed by around 25 villages in the Telkoi forest ranges. The Barbil forest range bordering the Champua range recorded the lowest crop raiding incidents.

b). We had a team of four members initially who went to Barbil forest range and we started field survey subjecting the farmers as well as agricultural labourer to the customised survey questionnaire along with some open-end questions. We assessed their level of awareness about the status, presence and importance of elephant and threats towards them. We added questions about the landform change and about any evident change in elephant activities according to them. We came to know about that majority are farmer community and they are more threatened to the annual elephant movement. They do not like elephant in their community, but however they have a soft corner for elephant. We also asked them about the techniques to protect their crops from wildlife, as we were concerned about their

prevalence of the techniques and its effectiveness. Besides this, our team also decided to survey various the project site for assessing the forest degradation.

We roamed along the habitat core that we estimated from the GIS techniques using their presence data and checked for harmful factors. The first factor we came across was cropland expansion. This is a major challenge here as majority of the people are depending on agriculture for their economic development. So, striking a balance in between this development and managing the human-wildlife interaction. These people also depending on forest for various region, (agriculture, livestock grazing and fuel wood gathering) and their degree of dependence on forest is increasing the anthropogenic pressure and results in frequent interaction with wildlife. In Barbil and Champua forest range, mining activities (explosion, transportation and mining waste) is harming elephant space-use/habitat as well as impacting their movement. We created 2 km buffers surrounding each village to evaluate the composition of the landscape to analyse the dominant land type in the conflict prone regions. We estimated that cropland (41.13%) was the dominant land use type followed by vegetation (29.64%) and built-up (18.25%) in the HEC hotspot regions. A higher HEC occurrence was observed when the presence of forest cover was between 15-20% and croplands between 40-55%. At a higher expanse of forest cover i.e., around 30%, the probability of HEC actually decreased to a moderate level. HEC was also low in isolated or small-scale fields and crops grown over a smaller area with less than 20% crop cover.

c). We were also interested in people's perception, where questions are formed keeping the social and cognitive behaviour of a local community in mind. Knowing perception of local community along with farmers was very vital since monitoring elephant behaviour is very complex and lengthy. Any help obtained from the people perception study was welcomed. We conducted these studies at community centres, local hangouts, academies and at farmlands. People were aware about their suffering in some regions. We found out many other hidden impacts of conflicts (fear for personal safety, cost of crop guarding, dealing with the aftereffects of HEC damages and problems of accessing compensation, etc.). Despite both hidden as well as physical-economical costs of HEC, people still have positive attitudes towards elephants and willingness for coexistence except few farmers community. This is closely related to religious traditions and mythologies and because elephants are sometimes revered as sacred animals and deities. Some of the interview respondents stated that they had come to know how the Asian elephant was a protected animal and how their suitable habitats were being reduced, through the educational and public awareness programmes. In addition, the compensation scheme continues to help retain people's tolerance and lenience towards elephants by reimbursing the monetary costs of those affected by HEC.

We made our intentions clear and explained them about the importance of elephants in their locality. In return they were more than willing to participate in our activities. We listened to some victim's experience and showed empathy towards them to mingle with their society. We were also able to locate conflict prone areas where we were able to assess threats with supports received from the locals. Building trusting relationship between more people and creating rapport between them

yields several advantages to the conservation measure and one of them is community participation. During this process conservationists impart their knowledge to the local communities, and they carry forward the executed mitigation measures even after the completion of the project.

Although we could not gather many people and make arrangements effectively due to the Covid restrictions, we conducted in nearly 16 different regions. People were actively responsive towards our goals during the awareness programmes and talks. This time we focused more on the college students to increase their interest in the native wildlife and their importance as well as conservation. We also gathered feedback from the undergraduate students during our talks. We found some enthusiastic students for our projects to help us carried our objectives.

d). We have collaborated with the forest patrolling staff and protection squad, who are assigned to control human wildlife conflict. Locational data were collected through direct sightings as well as indirect observations such as foot marks, fresh dung, feeding signs, broken branches, and conflict incidences. One year of locations were collected and maintained in a geo-database. We observed that effects of variables such as open forest, precipitation, cropland and rural settlement are the driving factors behind the elephant space-use in the study area. We estimated that about 43% (about 2710 km^2) of the study area are used by elephants. We extracted five core regions that are frequently used by elephants, which are important in keeping the connectivity for their movement. Ghatgaon, BJP, Teloi and Champua forest ranges represented a higher potential of elephant occupancy.

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

The first major difficulties to carry out our objective was Covid. We were not allowed to various activates with the locales as well as with the students. Majority of the institution were closed, and we were not allowed in many regions due to the restrictions. The collection of elephant locations in the remote region was more complex than it was expected, which was also very time consuming for us, as this is a large mammal, and they travel far overnight. We believed that there was some lack of prior proper planning on tracking elephants. But thanks to the forest department for helping in this objective. We used cameras to detect their presence, movement and herd structure in few villages. We faced few complications as some of the cameras were stolen. Major issue was elephants are wide-ranging species and their space-us pattern is huge as compared to other mammals, so it was really difficult to capture them and track their activities using lesser number of cameras. However, most of the communities we worked with, lost their houses and initially they were not enthusiast to discuss or were not willing to share their experience with elephant as they were frustrated with elephant raiding. Farmers were not at all supportive initially. It was really tough for us to convince them about the objective of our work.

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

Communities were not directly involved but have been involved indirectly via various programmes where they were visited and informed about the main objectives of the project. We started with small workshops and a series of educational campaigns. Two community members (Barbil forest range) are more involved with the project by participating actively. We taught them about the honeybee fencing, which is a long-term project and locals will benefit by using the various products from bee. As found that few of the farmer community are using communal crop guarding and carefully mass howling in the study area to successfully control the conflict, we also suggested to do so. However, people were advised to inform the range-officers as soon as they cite elephant, and the nearby squad team will come and try to chase elephant back to forest. If they find any elephants in their locality, they are voluntarily sharing the elephant activity with us.

5. Are there any plans to continue this work?

Our major objective is to control the interaction, which we have not resolved yet or finalised a better solution. Next plan is to implement honeybee fencing in some conflict prone villages, especially near the farmlands to keep the elephants away from these zones (as a trial basis). Beehive fences not only kept large groups of elephants from invading the farmland plots, but the farmers also benefited financially from the different its products, which can gather community participation. Understanding the response of elephants to the beehive fences, the seasonality of crop raiding, and the willingness of the community to engage with the mitigation method will help to contribute future management in the hotspot regions.

We have extracted some potential least-resistance pathways for elephant movement based on the landscape and HEC occurrence. So, we think the extracted the pathways can act as a suitable corridor for elephant to control further interaction with human society as well as vital for maintaining the connectivity among their fragmented habitats. We will discuss this with forest administration to restore ecologically and protect these regions. We are also planning to target the victim's sentiment and will try to assess the underlying reasons behind their difficulties in sharing space with elephant. Finally, we are planning to extend our study area by including two more conflict prone districts to analyse the issue at a broader aspect.

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

We have shared the population status, presence and importance of elephant and threats to them in the locality, among the villagers through discussion, talks and visual presentations. I have also given talks in high-schools (number of school children reached: 166) and colleges (number of college students reached: 57) by presenting various images, videos and presentations, also did activities among the college students to help them understand the present challenge we faced and the threats to both elephants and rural communities. I am also planning to share some major reasons of conflict and the ways of handling these interactions through programme on radio, as majority of rural people follow this media. We have also

collaborated with the teachers to share this among the students as an example of species significance to environment and its threats.

I have shared this work in national and international talk programmes and presentations. I was very much grateful to share my work at Rufford conference India – 2021 organised by Foundation for Ecological Research, Advocacy and Learning (FERAL). I have already published few of my work in the popular conservation journals like 'Frontiers of Ecology and Evolution', 'Remote sensing' and 'Diversity' along with a e-news article. I am trying to draft more e-news articles, so that it can be reached to audience about the ongoing challenge and struggle between rural and elephant, though Twitter and Facebook media.

7. Looking ahead, what do you feel are the important next steps?

Next step is to implement honey been fencing in some conflict prone villages to control elephant movement towards croplands. We are also planning to assess victim's sentiment and map it to assess their willingness to coexist with elephant and will try to analyse their difficulties (physical and hidden) in sharing space with elephant. We have made a group of people from the vulnerable community, which we will be developing further to work along with us in controlling the interaction.

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?

However, by following the government rule-regulation on COVID. Considering the restriction and rules, we finished all work by gathering mass less than 20 each time. Also, we conducted the programmes in very few schools and colleges by keeping the social distancing. So, we did not have many posters, but there were many presentation and other visuals presentation and talks for teaching and awareness, where RF received lots of publicity. Many interviewees were interested about our background, and they were very much happy and amazed to know about an UK foundation supporting us. We used Rufford logo in all of five conferences, talks and three research papers.

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

Mr. Bismay Ranjan Tripathy (Myself); [Project leader]

Mr. Kirti Kumar Mahanta; [Local, GIS analyst, Surveyor]

Mr. Aurobindo Samal; [Beehive expert, human wildlife conflict, survey designing and CEO of Earth Crusaders Organisation NGO]

Mr. Rasananda Behera; [Local, outreach, community initiatives and CEO of Native voice Odisha NGO]

Mr. Khitish Mahanta; [Local, tracking and Surveyor]

10. Any other comments?

Even though we are at the early stage of our career in conservation, we were able to fulfil several of the objectives and have some significant results. We thank the Rufford Foundation for its generous support, to raise the untouched scenario of this remote regions, which has still had the potential to support a significant amount of wildlife. Being an early career research we expect support to broaden our aspects to deal with this complex issue, where there is difficulty in making a strike between rural development and elephant conservation. I also grateful for the supervision and monitoring of the project by the mentors (Dr. Liu, Dr. Das and Dr. Verma). Finally, we thank Santosh Joshi (Indian Forest service), District Forest Officer Keonjhar and his team for allowing us to work in the landscape.


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