Final Evaluation Report

Your Details	
Full Name	Bishnu Maharjan
Project Title	Assessment of Suitable Habitat of Common Leopard (Panthera pardus) and its conflict with Human in Shivapuri Nagarjun National Park using Geographic Information
Application ID	21719-1
Grant Amount	£4950
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Date of this Report	

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
To identify the potential habitat parameter Common Leopard (Panthera Pardus) in Shivapuri Nagarjun National Park.				During the field visit, some of its parts were left because of steep torsion mountains ahead. Instead of this, GPS of leopard presence points were captured by interrogating local villagers as well as initiating their local knowledge in it. On top of that, it took series of time to classify land use and land cover and its accuracy assessment of national park.
To prepare habitat suitability map for Common Leopard (Panthera Pardus) in Shivapuri Nagarjun National Park.				Basically, this predicting suitability was analysed by series analysis (image processing, image classification, NDVI, MaxEnt Modelling) of satellite imagery acquired from Indian Space Research Organization (ISRO) and introduced into the prediction model. As in this algorithm, a habitat suitability map was prepared on the basis of threshold value but there are other methods too for predicting habitat suitability of species. I plan to use these methods in article publication of this overall project. This will open the new avenues in the field of research by observing this predicting map of common leopard in Shivapuri Nagarjun National Park (SNNP). The suitability map resulted from the modelling was useful to delineate the sites that required specific planning and management interventions.
Human Leopard Conflicts (HLC)				The interview/questionnaire survey was used to find the cause and mitigation measures for human- leopard conflict (HLC) in SNNP. Through this method, key informants of the HLC were identified in different places of the study site. With the help of these key informants it got easier to ensure information regarding causes of

				conflict and its mitigation measures to be endorsed to reduce the increasing HLC situations of SNNP. Altogether 90 individuals were questioned/interviewed from different community sites from SNNP. Through the casual interviews and discussions with victim's family members, we collected detailed information regarding where, when and how the incident took place followed by recording the GPS coordinates and capturing the photographs from all victim's houses. At that time, we observed some scar in hands of men and cattle during the leopard attack. From this on conflict study, further research on the availability of natural prey species in the leopard habitat is essential.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

Yes, the most striking feature was the heavy concentration of damage in the steep and erosive processes in the forested areas as the field was after devastating earthquake stuck. Likewise, topography of SNNP is mostly mountainous with steep slopes of >30 % at least in 50% of the total area of the park. Because of the steep topography and the nature of soil, soil erosion is very high particularly in the northern part of the park (Samundradevi, Sikre and Talakhu villages). Landslides, gullies, sheet erosion in the sloping terraces, and stream bank erosion are common in northern slope of Shivapuri block. Major causes of such hazards include construction of road on steep southern and northern slopes, seasonal excessive forest fire and deforestation. It created some problem to field to get some conflict as well as leopard presence point data. To overcome this delinquent, we used top sheet map of Department of Survey (DoS) to retrieve some of these data.

3. Briefly describe the three most important outcomes of your project.

1. The habitat suitability map which was generated from the MaxEnt Species distribution modelling software which was classified on the different species occurrence probability threshold class. By using specific probability thresholds, it classifies suitability map into different suitability classes viz, unsuitable, least suitable, moderately suitable, suitable and more suitable. It shows major suitable patches around SNNP and suggests that increasing number of agricultural land, bush and forest helps in increasing suitable habitat of common leopard. The suitability which was generated as an excellent model because of the value more than 0.9. Therefore, this presence distribution prediction was suitable for common leopard. On this model, variables which

were represented by environmental layers showed its contribution percentage. Among the six variables which have been deliberately chosen, the most important variables of this model consist of settlement area, forest, bush, sparse forest and roads. The potential threat in terms of land use which might be faced by the settlement area become the most serious threat to conservation and sustainable development in general.

2. The human-leopard conflict became a major threat around the buffer zone as well as in settlement areas inside park. Most of the respondents replied the major cause of leopards visiting the human settlement was due to lack of prey species in forest and public disturbance was also a serious case. On top of that while visiting park office adopting strategy of human-wildlife co-existence to prevent the conflict. Relief scheme and buffer zone programmes are being launched and systematised.

3. While observed time series land use and land cover change forest changed into settlements, limited prey species in forest and insufficient awareness level of local communities were found to be the major causes of HLC in the SNNP. Local education awareness campaigns, habitat restoration, and enhancement of wild prey populations hold much promise for reducing and better managing conflicts. There needs public awareness with sufficient information on leopard behaviour and rescue techniques in conflict prone areas in the SNNP.

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

Local people involved in this project were found very supportive. They helped during the field visit, participating in the field sampling, extended their knowledge for finding out leopard presence points. For field visits, data capture and sampling a few forestry students from Institute of Forestry (Pokhara) including few youths were mobilised and supported us throughout the project. They also helped to maintain the data /records of number of cattle killed and rescued and the proximity of these sites where the conflict occurred in order to analyse human-leopard conflict patterns in the SNNP. This project pronounces to the local people that how common leopards are important to the local community. Regarding this, we conducted informal village group discussion, interaction with the local people, describing the role leopard in the nature, etc. that was helpful to the local community.

5. Are there any plans to continue this work?

Nowadays the issue of human-leopard conflict (HLC) is frequently in news and other communication sources also depict this issue from time to time. Some of the other researchers also did the HLC issues in Kathmandu Valley. These are the emerging issues right now at Kathmandu Valley due to deterioration of forest, increasing settlements and major threat include unmanaged road construction in between the forest. All collected data indicated that there is a need in special surveys in environmentally sensitive areas that to identify the correct locations for placement of common leopard. During informal meetings with staff of SNNP, there was bit

disturbance of human influence in this park rather than other and unmanaged growth of settlements near buffer zone. In considerations to all issue, conflict and measures we are very much interested to conduct similar research in Kathmandu Valley as well as buffer zones of parks in near future too.

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

After completing the detailed technical report, we will share it with different stakeholders including district forest office and sector forest offices in Kathmandu district. Based on the findings of this project, we have planned to publish peer-review journals for publication.

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

The project was approved in April 2017and the entire grant amount was used during that period. Although most of the field activities were completed as planned.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Overall Field Visit and Conservation Program	1050	1100	+50	During field visit including me hired 4 forestry and 2 Tribhuwan University students. There was very less access of public transport there and cost increased as expected.
Lodging and Meals	900	960	+60	All the dinner and lunch were taken in village inside park. As this is one of the tourist destinations places which is nearby capital city Kathmandu and the charges for lodging and food quite high as expected. The budget was increased rather than allocated.
Travel, Communication	950	1010	+60	Some students had their own bikes which worth more as expected. The hiring costs and the fuel for these motorbikes increased the travel expenses.

				Similarly, all field mobilizers needed frequent calls in order to took updates as well as convey messages to them. So, it increased extra £60.
Equipment	850	820	+30	We purchased 2 set of hand GPS device, binocular with 1 digital camera which worth more £30 than estimated budget.
Awareness Program	750	460	290	For awareness the expenditure was less as estimated budget. Pamphlets and T-shirts were not printed so that why in this case the fund reduced by £290.
Miscellaneous Expenses	450	600	+150	The miscellaneous expenses were increased which was compensated by awareness program.
TOTAL	**4950**	**4950**		

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

As my thesis belongs to "Geo-spatial Analysis of Habitat Suitability for Common Leopard (*Panthera pardus Linnaeus*, 1758) in Shivapuri Nagarjun National Park, Nepal" identified and mapped as 166km^2 which occupies 54% of the total area. Agricultural Land, forest, bushes areas are occupied by the common Leopard which are predicted as suitable habitat for leopard. The leopard prefers to habitat type of agricultural land until bush and forest as these areas have greater affinity towards prey base that serves as food for them. The potential threat in terms of land use which might be faced by the settlement area become the most serious threat to conservation and sustainable development in general. The prediction at the national park boundary can be regarded as the potential distribution as well as the prone area for conflict between the leopard and humans (and their cattle).

Delimiting human access to particular zones which are restricted to any disturbances and intensify the survey of wildlife can be the noticeable action to conserve common leopard. Meanwhile, local government, particularly the Kathmandu district, can take this issue of connecting ecology into account on its spatial planning. In order to make sure the prediction of common leopard's presence in SNNP deploying several camera traps within the areas denoted as presence would be beneficial for the next level of wildlife management. By using camera traps, either common leopard or other wildlife can be recorded as the main attention in managing the park. Conducting presence–absence survey of common leopard in SNNP will give another option of species distribution modelling such as GLM, GAM, and BRT, etc. As the prominence of land cover, environmental layer, NDVI and satellite imagery, applying very high resolution of remotely sensed imagery to obtain more detailed land cover information will produce more precise results in predicting common leopard distribution and connects human wildlife welfare

scenario. Habitat encroachment is one of the main reasons for the leopard to turn its attention towards human settlements that results in livestock depredation. Therefore, deforestation and encroachment of the leopard habitat must be discouraged properly. A database must be prepared and maintained by conducting a detailed study about the leopard in the area by the concerned authority which contains everything about the leopard's situation/condition in the area. For example, it's potential and actual habitat, its natural prey base, prey – predator relationship and so on.

10. 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, during the project, the different community outreach programs were able to circulate information about the contribution of the Rufford Foundation in supporting such essential project with funds.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

The list of team members and their roles and responsibilities are listed below.

Names	Roles and Responsibilities in Project
Bishnu Maharjan	➢ Team Leader ➢ Major roles in all project activities from the starting to the end of the project ➢ Updating the progress report as well as update of the project to the Rufford Foundation ➢ Coordination and cooperation with field colleagues, professors and referees regarding to this project for guidance and suggestions. ➢ Monitoring the project activities and mobilizing funds ➢ Coordination and consultation with the local stakeholders including the government bodies for discussing the relevant issues and the findings of this project ➢ Field work designs, sampling designs, geographical analysis, data analysis, report preparation and submission
Aashish Kumar Joshi	➢ Helping in finding geo-location of common leopard ➢ Preparing necessary arrangements for field visit ➢ Collect data and other information relevant to conflict and report accordingly from the field
Suraj Bista	➢ Travels to field sites to collect and record data and/or samples as appropriate to the specific objectives of the study

	➢ As appropriate to the specified position, codes and verifies data in accordance with specified research protocol and coding procedures, and enters data into a computer database and/or spreadsheet application for subsequent analysis
Pradeep Dangal	➢ Reviews and edits data to ensure completeness and accuracy of information; follows up with subjects to resolve problems or clarify data collected ➢ Conducts and records face-to-face and/or telephone interviews with subjects, in accordance with predetermined interview protocol, data collection procedures, and documentation standards
Tejab Pun	➢ Assisting in collecting information from each victim's households regarding human as well as cattle injuries ➢ Assisting in arranging food and accommodation places in the study area
Purna Man Shrestha	➢ Thinking Creatively - Developing, designing, or creating new applications, ideas, relationships, systems, or products, including spatial thinking contributions. ➢ Resolving Conflicts and Negotiating with Others - Handling complaints, settling disputes, and resolving grievances and conflicts, or otherwise negotiating with others
Menuka Shrestha	➢ Assisting in preparing questionnaires and checklists for key informant's survey and group discussions ➢ Identifying objects, actions, and events - Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events

12. Any other comments?

As a principal investigator in this project we tried best to address the human-leopard conflict (HLC) in SNNP. The potential threat in terms of land use which might be faced by the settlement area become the most serious threat to conservation and sustainable development. The prediction at park boundary can be regarded as the potential distribution as well as the prone area for conflict between the leopard and humans (and their cattle) because of human activities influence. Delimiting human access to particular zones which are restricted to any disturbances and intensifying the survey of wildlife can be the noticeable action to conserve common leopard. There had been little scientific research conducted in SNNP about common leopard. The various methods like camera trapping, DNA sequencing analysis, and other available methods can be applied for estimation of common leopard in SNNP.

Conducting presence–absence survey of common leopard in SNNP will give another option of species distribution modelling such as GLM, GAM, and BRT, etc. As the prominence of land cover, environmental layer, Normalized Difference Vegetation Index (NDVI) and satellite imagery, applying very high resolution of remotely sensed imagery to obtain more detailed land cover information will produce more precise result in predicting common leopards' distribution and connects human wildlife welfare scenario. Meanwhile local government particularly Kathmandu, Nuwakot, Sindhupalchowk and Dhading district can take this issue of connecting ecology into account on its spatial planning. So, we are very grateful towards the Rufford Foundation and hope for the continuous support in the future too. Finally, we would like to thank a lot for the Rufford Foundation for supporting this project.

Left: Wound healing after leopard attacked on cattle during grazing near forest of park. Right: Scat of common leopard on the way to Jamacho of SNNP.