The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole

Grants Director

Grant Recipient Details

Your name	Lhendup Tharchen
Project title	Towards an evidence-based human-carnivore conflict mitigation strategy in Bhutan: Identifying drivers of livestock vulnerability to carnivore depredation
RSG reference	11812-1
Reporting period	August 2012-February 2014
Amount of grant	£5282
Your email address	lhenduptharchen@gmail.com
Date of this report	28th February 2014

1. Please 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
1. Digitise national records of carnivore attacks on livestock			X	We fully digitised all the paper records of carnivore depredation on livestock (n=937) collected across Bhutan between 2003 and 2012, developing the first digital (and therefore easily searchable) database of carnivore predation on domestic stock in the country. In addition, a geographic information system (GIS) was produced, incorporating information on the main landscape and environmental features related to carnivore and livestock distribution in Bhutan at 1 km^2 resolution. Each recorded livestock depredation site was georeferenced (via a field site visit when the records had only locality names), which enabled the patterns of livestock predation by large carnivores to be analysed. We also developed an MS Access-based database were future depredation records can be directly input in the future.
2. Produce national/regional livestock depredation-risk maps using this database and species distribution model algorithms			X	A series of Maxent models of "livestock-risk of attack" by tigers or leopards were developed, taking into account 24 covariates at multiple scales (1, 2, 4,8,16 km radius). The result was the first map of the potential distribution of tiger and leopard attacks on livestock across Bhutan, based on habitat similarities with the reported predation points. An atlas containing maps of each province and the associated areas with increased livestock vulnerability to predation (attack risk) was produced, and distributed to the Wildlife Conservation Division. The digital versions of each map were also shared with the environmental agency, as were all the GIS layers.

3. Identify from models environmental and/or human-related parameters associated with livestock vulnerability to carnivore attack			X	The models allowed identification of the main environmental features associated with increased livestock vulnerability to tiger/leopard attacks. For tigers, attack risk was mainly associated with areas with 1000 to 3000 m elevation, with high settlement density (at 1 km radius), and within a mosaic landscape (at 16 km radius) with some natural meadows (<15%), with medium levels of tree cover (30-55%) and a lot of edges between forested and natural meadows/agricultural fields. Punakha and Trongsa were identified as the main hotspots of potential livestock depredation by tigers. For leopards, livestock vulnerability to carnivore attacks was mainly associated with areas of similar elevation range, human settlement density and tree cover at the landscape level as tigers, but also with areas of high terrain ruggedness and slightly higher number of forest-meadow/agriculture edges. Trashigang and Yangtse provinces showed the highest probabilities of livestock predation by leopards. The identified landscape-level variables (elevation, TRI, VCF) describe the typical rural, mountain communities of Bhutan, where grazing and predator habitats overlap. Though the findings are not necessarily surprising, they do highlight the point that high-risk areas need to be considered at the landscape level (and our approaches should probably be at that scale if they are to make a difference). Moreover, we were able to identify high risk areas within the known range of these two species in the country, where attacks are likely to happen even though we have had few or no records from these areas. Identified high risk areas can be the focus of large scale management projects (e.g. areas to target for awareness raising projects; land zoning).

				The identified local scale covariates (mosaic of edges between forest/open areas, and areas away from large human settlements) help identify areas to focusing on actual conflict mitigation measures, that focus on communities/individual farmers and their livestock husbandry techniques (e.g. improve in husbandry practices; changes in herding behaviour; limiting grazing livestock inside protected areas).
4. Produce evidence-based management recommendations for consideration by the Department of Forests and Park Services of Bhutan			X	An intensive 2-day training workshop, organised by Jijme Dorji National Park, Department of Forests and Park Services, Bhutan, was held at the Park headquarters (4th-5th February 2014), presented and discussed the main findings of the project with 26 environmental agency's staff with hands on experiences from throughout the country. Workshop participants were trained on interpreting the predictive modelling maps, understanding the model limitations, and enabled further discussion on the selection of potential areas to be prioritised for implementation of human-carnivore conflict mitigation strategies in the country. The participation of the environmental agents was invaluably beneficial, as first-hand ground-based information was used to validate the results of the project, and test the accuracy of the models. Potential flaws in the project were identified and amended, and the final model output was developed taking into consideration the points raised during the meeting. In addition, following the final discussion, a report was produced to be shared within other divisions of the environmental agency. The potential for a follow-up project aiming human-carnivore conflict mitigation in the most problematic areas identified in this project was discussed, and will be put implemented as soon as enough funds are secured.

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

There was an unforeseen delay in gathering the hard copies of the depredation reports, which affected in turn timing of all following scheduled project activities. We are grateful for the extension granted to us by Rufford Foundation for the first project report. As soon as the data were compiled and digitised, no further problems were experienced.

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

a) Digitised existing database of records and set up a system for digitising all future records, permitting their use in monitoring trends of livestock-predator depredation incidents throughout the country and the design of targeted human-wildlife conflict mitigation measures. This database on its own (especially if properly maintained) is an asset for conservation in Bhutan, without even any of the predictive models that we developed using it. Until now, it was theoretically possible but practically unattainable to find out where and when and what kind of attacks had taken place. The records existed but were unusable.
b) Developed livestock depredation risk maps at relatively high resolution (1 km^2) that can help predict areas of future conflict between livestock and the culturally and conservation important species – tiger and leopard, and identify areas where mitigation measures can focus at.
c) Identified large, medium and small scale environmental and human-related parameters that are associated (and possibly drive) carnivore-livestock conflict, permitting the development of focused awareness raising (landscape level) and mitigation (individual/community level) measures.

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

At the present stage, the project identified areas at the level of provinces most affected by livestock predation by large carnivores in Bhutan, and mapped those showing increased risk for carnivore attacks on domestic stock, based on landscape features. The local communities of these areas will benefit from these results, as soon as implementation of contextualised human-carnivore conflict mitigation strategies (e.g. raising awareness about risky areas for livestock grazing; improvement on livestock enclosures) are been put into place. Local communities were not directly involved in the development of these project's deliverables, beyond reporting initially the attacks (2003-2011) which we then digitised and used for our predictive models of livestock risk of attack.

5. Are there any plans to continue this work?

Yes. The findings of the present study set the baseline for understanding the environmental and human-related factors associated with and possibly driving human-carnivore conflict in Bhutan, and identified high-risk areas which should be prioritised for conflict mitigation strategies. We plan to work with the management team of Jigme Dorji National Park (north-west Bhutan) to pilot awareness raising programmes at the landscape level, and individual farmer level conflict mitigation measures that can then be expanded to the rest of the country.

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

The Bhutanese Jigme Dorji National Park, Department of Forests and Park Services will share the final report produced during the training workshop with other divisions of the environmental agency, whilst a research paper will be submitted for publication in an international peer-reviewed journal on conservation sciences, focusing both on the methodologies used (so that similar analysis can be undertaken in other areas; emphasis on the importance of using different scale of covariates in modelling) and the actual findings on the parameters associated with leopard and tiger livestock attacks. The digitised database and the GIS files gathered and developed during the project were handed to the Jigme Dorji National Park during the training workshop, and they are now in charge of updating and maintaining it. The livestock depredation risk Atlas of Bhutan is also with Jigme Dorji National Park and it will be shared with the other districts, territorial forest divisions and protected area offices along with the report.

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

The confirmation of funds from the RSG for this project was received on 16th August 2012. This grant was supposed to be used between August 2012 and August 2013. However, as mentioned above, due to the unforeseen difficulties encountered whilst collecting the depredation forms, a 6-month extension was required to allow finalising the database.

8. Budget: Please 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.

Item	Budgeted amount	Actual amount	Difference	Comments
Salary for assistant who digitised the carnivore attack records	938	930	8	Difference used for training workshop expenses
Salary for field assistant who collected GPS coordinates of attack sites, when accurate information was not available from the records	625	620	5	Difference used for training workshop expenses
Expenses for fieldwork (fuel, hotel, provisions)	625	625	0	
Consumables (GPS, batteries, torches, maps, etc.)	438	413	25	Difference used for training workshop expenses
Printing of final report/maps for distribution to regional forestry offices	375	375	0	
Training workshop for park staff and stakeholders on map interpretation, Maxent use and development of a plan of action for HCC in Bhutan. This includes the UK-Bhutan return airfare, hotel, meals and the expenditure of the training workshop	2031	2169	-138	Met from other savings from differences

Miscellaneous/Contingency which was used for incidental cost during the workshop and also the field trip.	250	150	100	Difference used for training workshop expenses
	5282	**5282**	**0**	

Exchange rate is Nu. 87 per GBP as of 12.09.2012.

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

In the short term, these are the important next steps:

a) We want to conduct field site visits at areas that have been identified as being of very high risk of livestock attacks from leopards/tigers but in which we had actual no (or few) records of such attacks, to see whether there are indeed no attacks reported there (in which case we need to examine why this may be the case – what animal husbandry methods are used) or if there are attacks but they were just not reported (in which case we would like to know why).
b) Similarly, we want to visit areas which were identified as being of very high risk of livestock attacks from leopards/tigers and for which indeed we had a lot of attacks reported. In these areas, we would like to study the animal husbandry and livestock grazing habits of households that have and have not been affected by livestock depredation incidents by large carnivores, to identify possible husbandry measures that can be adopted/improved and promoted more widely.
c) The Government of Bhutan is contemplating the adoption of an insurance scheme to replace the now stopped compensation scheme that was in place for livestock depredation victims. We would like to be involved in the pilot phase of such a scheme, advising areas where it can be introduced (high risk areas) and monitoring closely its efficacy by comparing depredation rates in these areas to similar control sites.
d) We would like to visit high elevation settlements within the snow leopard range to collect more data on livestock depredation events by this species, as we did not have enough data to develop livestock depredation risk maps for snow leopards during this project. Snow leopards are a species of conservation concern globally and nationally, and therefore mitigating conflict with humans and snow leopards is a priority. Our target area will be the northern part of Jigme Dorji National Park.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

Yes, the logo of the Rufford Foundation and RSGF were used in all the presentations during the training workshop, and included in the official written material resulting from the meeting. In addition, the research team verbally acknowledged the RSGF for supporting the research.

11. Any other comments?

We would like to use this opportunity to thank the RSG application committee for recognising the value of our project, committing to support us, and showing understanding when field difficulties delayed our original time schedule of activities.

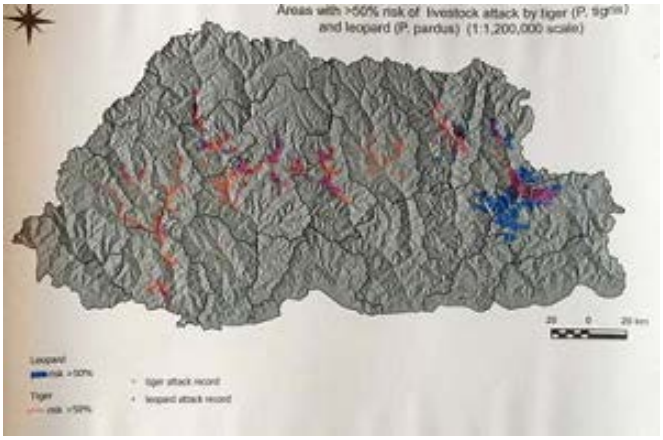
Appendix

Presentation slide during the training workshop on the Project

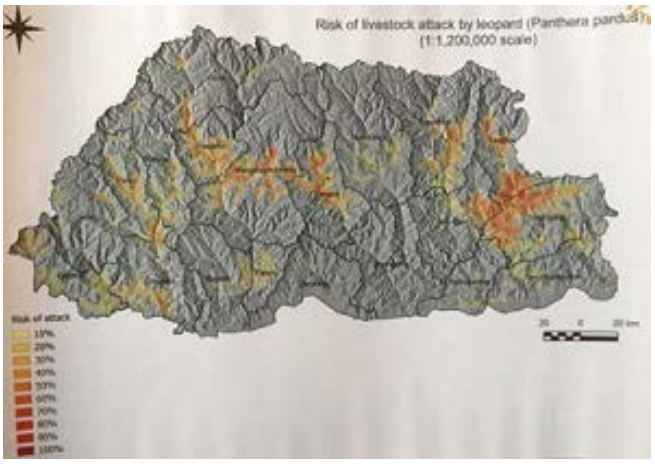
Mr Leandro giving the introduction of Maxent modelling

Presenting our findings through the project

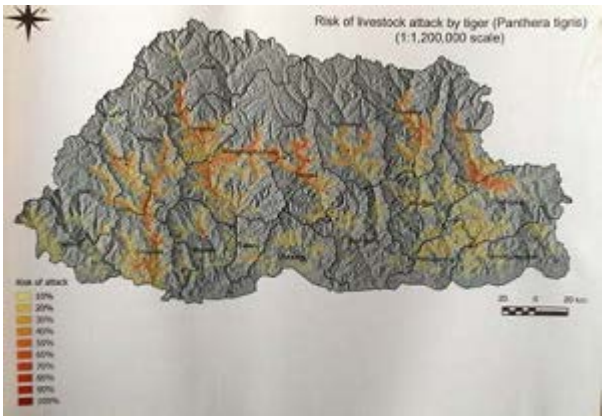
Left: Participant sharing his views on the findings presented. Right: Training workshop participants



Map 1. Areas with > 50% risk of livestock attack by tiger and common leopard



Map 2. Risk map for the livestock predation by common leopard for Bhutan



Map 3. Risk map for the livestock predation by tiger for Bhutan