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. The Final Report must be sent in **word format** and not PDF format or any other format. 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. Please note that the information may be edited for clarity. 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	Bharat Budhathapa
Project title	Distribution modelling of snow leopard (*Uncia uncia*) in Midwestern trans Himalayas of Nepal
RSG reference	14.11.09
Reporting period	03.2010-11.2011
Amount of grant	£ 5,200
Your email address	basantibharat@yahoo.co.uk
Date of this report	22.11.2011

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
Spatial distribution of snow leopard presence and its prey species and of livestock				
Determination of relative abundance of its prey species and of livestock depredated				
Creating spatial models using GIS and logistic regression models				

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

The major challenge of the project was remoteness of the study area. The other major problem which is not technical but related to health was altitude sickness when crossing high altitude pass of > 5600m to move from one survey site to another. Fortunately, we had some locals in our research team and thought how to deal with this sickness.

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

3.1. Prey density and distribution

Though, snow leopard fulfils its food requirements from different prey species in study area, we counted blue sheep population as it is the principal prey species of snow leopard. However, we also recorded livestock depredation from snow leopard. Altogether, 25 herds of the blue sheep were observed with the size ranging from 3 to 52 individuals/herd. In all surveyed blocks covering a total area of 196.34 km^2, a total number of 407 blue sheep were found (Figure 2). The average density of blue sheep is estimated about 2.07 individuals per km^2 based on the size of the area surveyed.

Figure 1: A herd of Blue sheep in study area

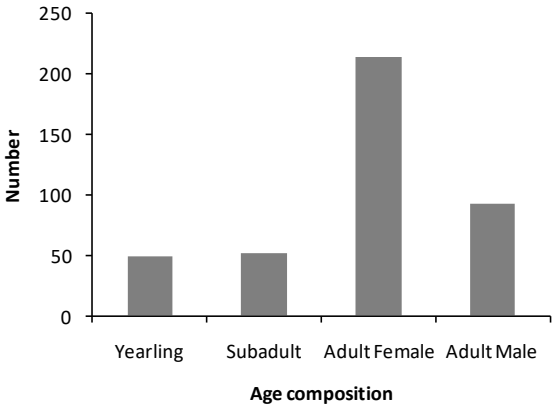
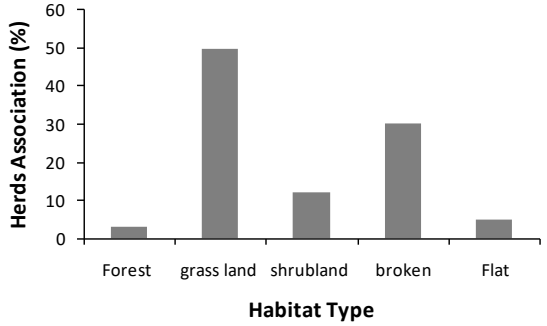
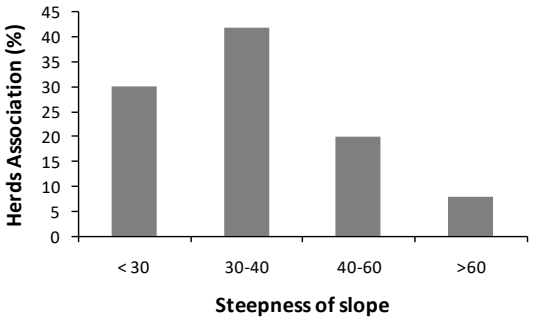


Figure 2: Blue sheep population in surveyed block Yearling=1 year old; Subadult= 1 to 2 years old male/female; Female =More than 2 years old; Male=More than 2 years old

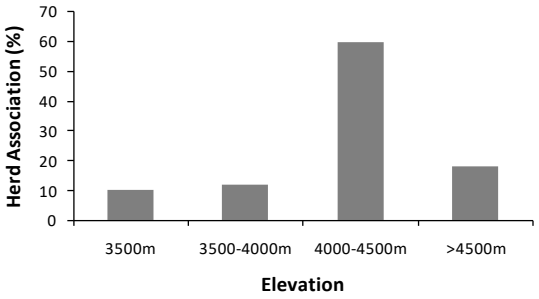
The association of blue sheep with habitat variables (vegetation type, slope, altitude,) was assessed and shown in (Figure 3 a,b,c).



a)



b)



c)

3.2. Status of livestock and depredation

People living in Dolphu, Phoksundo, Vijer and Saldang village development committee (VDCs) keep yak, horse and sheep/goat as major livestock for different purpose. 340 households of these four VDCs owned 10,793 livestock. The livestock holding ranged from one animal/household (Vijer) to 178 (Saldang) animals/household. Goat/sheep was the majority forming 65.23% of the total livestock. Figure 6 illustrates more about the status and composition of live stock in study area.

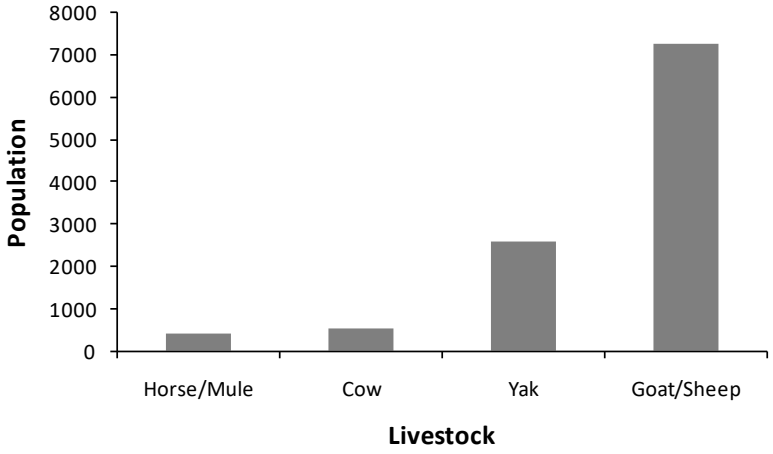


Figure 4: Status of livestock in study area

3.2.1. Livestock depredation and caused conflict between snow leopard and local people

Villagers of the study area mostly blamed snow leopard for killing their livestock, even if pugmarks near the carcass were the only evidence to substantiate predation. Kill remains were rarely properly examined in order to verify predation as the cause of death. Although the degree of error could not be quantified, there was little doubt that villagers perceived snow leopard as major threat to their livestock. It was observed that the mortality due to the predation was about 54.88% from major predators and snow leopard alone was responsible of killing 47.33% livestock in the study area. This shows that the major cause of livestock depredation in study area is snow leopard (Table 1). Predation of adult yak number was found to be less than the sub-adult yak whereas the number of sheep/goats killed by predators did not differ significantly from overall herd age composition. In case of horse, more female horses were killed by predators than males.

Table 1: Livestock mortality in study area

Number and Reason of livestock mortality					
Type of livestock	Number of livestock loss year-1	Disease	Snow leopard	Other predator	Accident
Yak	25	7	13	3	2
Horse	35	6	25	4	0
Cow	36	11	16	6	3
Goat/Sheep	447	196	203	48	0
Total	543	220	257	61	5

This has created a serious conflict between local headers and snow leopard (Figure 7). See this link how two snow leopards were killed and thrown to cave just to take revenge of killing their livestock (http://www.youtube.com/watch?v=9PBGU_tAZt8). We found that the killing of livestock mostly occurs in spring and winter. Though, the loss of livestock is not same for all household but each house hold blamed Snow leopard for as main reason of losing their live stock.

Figure 5: A heard man showing a poison used in carcass to kill snow leopard

3.3. Model development and snow leopard distribution mapping

The main reason behind variable selection is to enhance the predictive performance of predictors. The snow leopard distribution modelling using logistic regression was started by fitting the best predictive variables to the model. So, subset variables resulted from stepwise selection strategy and AIC (Akaike Information Criterion) criteria supported not only to keep model less complex but also to

reduce computational efforts. The first order interaction between selected variables were checked and found not to be significant except the relationship between AMT and Elevation was found to be strong (Table 2). Finally, the subsets selected from whole set of predictive variables and snow leopard distribution model was built based on these selected variables (Table 3).

Table 2: Correlation matrix between independent variables

	Elevation	Vegetation	AMT	Precipitation	Aspect	Slope
Elevation	1	0.16	-0.92	-0.31	-0.31	0.15
Vegetation	0.16	1	-0.19	0.35	0.20	-0.03
AMT	-0.92	-0.19	1	0.28	0.31	-0.34
Precipitation	-0.31	0.35	0.28	1	0.36	-0.06
Aspects	-0.31	0.20	0.31	0.36	1	-0.18
Slope	0.16	-0.03	-0.34	-0.06	-0.18	1

Table 3: Results from multiple logistic regression

Variable	Estimate	Std. Error	P(>|t|)
Intercept	1	0.98	0.002
Elevation	0.792	0.29	0.007
Vegetation	0.765	0.21	0.009
Annual mean temperature	0.429	0.26	0.008
Precipitation	0.331	0.25	0.002
Aspects	0.675	0.2	0.007
Slope	0.202	0.22	0.036

The spatial distribution of Snow leopard in terms of predictive probability map was created using logistic regression to represent the range of its distribution in the study area (Figure 6).

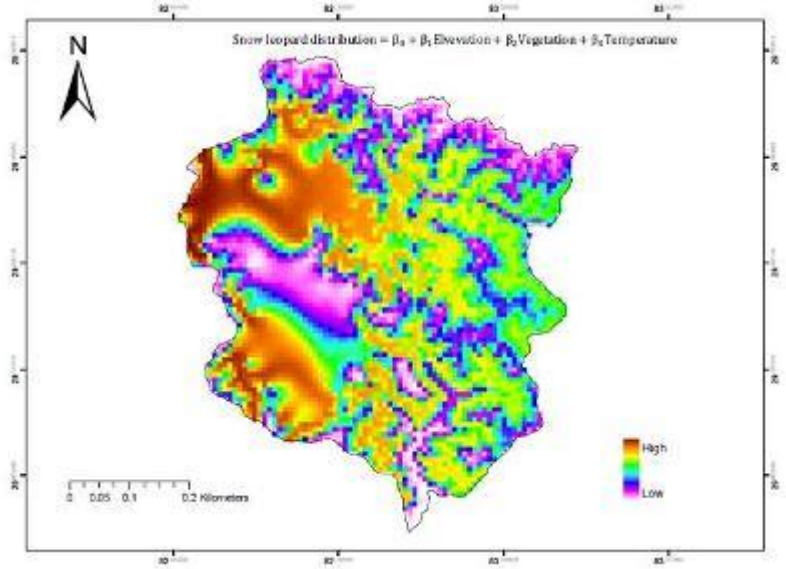


Figure 6: probability of occurrence Snow leopard in study area using logistic regression

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

As it was pure scientific work so there was no direct involvement of local people in the project. But, this project could not be successfully accomplished without their support in terms of Snow leopard related information and logistics.

5. Are there any plans to continue this work?

Yes, I would like to continue my work not only in scientific aspect of Snow leopard but also into the aspect of conflict minimisation between Snow leopard and local people through involvement of local people to achieve synergetic impact toward the conservation this beautiful alpine cat.

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

I am working on an article to publish in an international journal to share my result to scientific community who are working to conserve endangered wildlife. At the same time I have already shared a short clip via you tube regarding the threat to the snow leopard. The results can also be shared to the concerned Department of National Park and Wildlife Conservation (DNPWC), Ministry of Forest and Soil Conservation (MOFSC), INGOS like WWF Nepal, IUCN Nepal.

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

The project was anticipated for 12 months and RSG was used for that period. It took longer to accomplish the project than anticipated time period. We missed the first best time for filed survey as the field area was not accessible due to heavy snow on the way. So we had to wait for another survey period from September to November. Hence, it took 8 months more to accomplish project due to short breaks in between in project period but duration of time period was same as mentioned in proposal.

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
Transportation -Only Air transportation is possible to district Headquarter (4 persons Two ways) Hiring porters to supply necessities to site	£750.00	£750.00		
Equipment (Compass, altimeter, GPS, measuring Tapes, camera, binoculars, scoop telescope, range finder, satellite images)	£1800.00	£1800.00		
Lodging and Food (4 persons x 150 days)	£1800.00	£1800.00		
Renting field gears (Sleeping bag, back pack, Machetes, First Aid supplies, Tents,)	£550.00	£550.00		
Stationeries	£200.00	£200.00		
Miscellaneous	£100.00	£100.00		
Total	£5200.00	£5200.00		

Note: No remarkable difference was found in estimated budget and items

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

During our field work and taking interview with local herders, we found serious conflict between snow leopard and local headers due to losing their livestock. So, conservation education can be one important step to minimise this conflict and minimise the livestock depredation as well. Moreover, the regular monitoring of snow leopard and its prey species should be conducted by establishing permanent transect. Additionally, Advanced study for example use of camera trap to know the actual status of Snow leopard is necessary for its conservation and management.

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?

Not yet.

11. Any other comments?

I would like to acknowledge RSG foundation for funding my project and providing me this opportunity to work on this endangered alpine cat.