The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford 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	Munib Khanyari
Project title	Assessing Health Impact of Livestock Grazing on Two Ungulate Species in Kedarnath Wildlife Sanctuary, Uttarakhand, India: An Ecological Review
RSG reference	18997-1
Reporting period	February 2017 – March 2017
Amount of grant	£5000
Your email address	munibkhanyari@hotmail.com
Date of this report	16-03-2017

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
Mapping extent of livestock overlap with areas of Himalayan serow and Himalayan tahr populations				See Comment 1 below
Comparing health of Himalayan serow with Himalayan tahr between grazed and un-grazed areas				See Comment 2 below
Collecting and comparing baseline natural history data of these two ungulates between grazed and un-grazed areas				See Comment 3 below
Training of State Forest officials, interested student volunteers and community members (a step to ensure long-term monitoring of ungulate health)				See Comment 4 below
Recording of the local community's knowledge of habitat importance of livestock, the two ungulate species and their views on conservation				See Comment 5 below

Comment 1

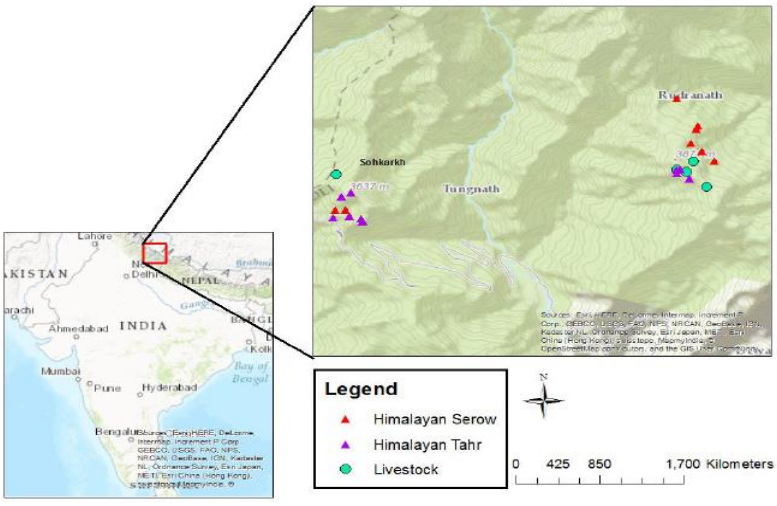

Figure 1. Map displaying the spatial and numeric proximity (overlap) between livestock and wild ungulates in Rudranath and Shokarkh. Higher number of symbols for each species represents higher abundances.

Figure 1 below shows the areas of overlap between Himalayan tahr, *Hemitragus jemlahicus* (hereafter also referred to as tahr), Himalayan serow, *Caprcornis thar* (hereafter also referred to as serow) and livestock. Though we didn't do any quantitative measurements or indices to really understand the level of overlap, it is evident visually from the map that there is a higher proximity of these two wild ungulates to livestock in Rudranath. Also the number (represented by the higher individual number of symbols) of livestock in proximity to wild ungulates is

much more in Rudranath. This is very important information as these areas fall within the protected boundaries of the Kedarnath Wildlife Sanctuary, where livestock grazing is not allowed. We also know from various previous researches that competition with livestock is highly detrimental both for the individual health and populations of the wild ungulates (Prins, 2000; Mishra et al., 2004 & Dave & Jhala, 2011). Thus, this confirms a greater spatial and numerical overlap between wild ungulates and livestock in Rudranath than in Shokarkh.

In addition to this we saw another interesting overlap. In all the areas where we spotted serows or their faeces, we also spotted Sambar, *Cervus unicolor* and/or its faeces. This suggests a direct habitat overlap. This is interesting as sambar is a slightly larger ungulate which has very similar feeding habitats as that of the serow (Padmalal et al., 2003; Giri et al., 2011). This perhaps suggests increased competition and coupled with livestock competition does have the potential to outcompete serow populations. This thus has both research and conservation implications.

Comment 2

We collected and analysed a total of 189 different faecal samples from across the two sites. Table 1 below shows what constituted these samples.

Species	**No. of samples: Rudranath**	**No. of samples: Shokarkh**
Himalayan tahr	40	50
Himalayan serow	10	4
Livestock (sheep/goat)	50	35
Total	**100**	**89**
Grand Total	**189**	

Table 1. Representing the division of the 189 total faecal samples analysed for parasites.

As seen in Table 1, the number of samples analysed at each site (Rudranath- heavy livestock grazing) and Shokarkh-low livestock grazing) were roughly equal. It is important to note that Shokarkh isn't an 'ungrazed' area as proposed by the project, rather does have some livestock grazing, though much lesser in magnitude to Rudranath. In addition to tahr and serow samples, we also analysed livestock samples to compare both with species within sites and across sites. We didn't intend to analyse livestock faecal samples for parasites at the start of the project but then decided to add them as that provided a better control and a point of comparison for the two species in question.

2.1 Overall Results

Using the Chi-squared test and Mann-Whitney U test we tested for prevalence and intensity of parasites respectively. Overall livestock had significantly more prevalence of parasites than the other two species ($p = 1.10\ e\text{-}15 < a = 0.05$). This can be seen in the PCA chart in figure 2 below.

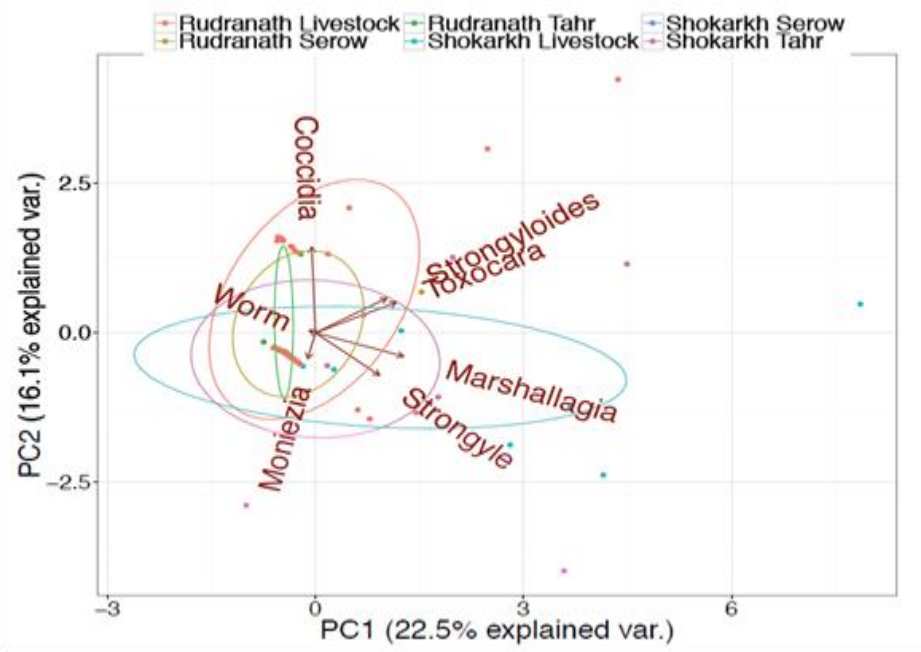

Figure 2. A PCA showing the presence and intensity of different types of parasites in Himalayan tahr, Himalayan serow and livestock, both in Rudranath and Shokarkh

Additionally, in terms of prevalence, perhaps surprisingly there was much higher prevalence of parasites in Shokarkh's livestock (18 eggs/sample) than in Rudranath's livestock (11 eggs/sample). This is surprising as many studies suggest that areas that are highly grazed (which generally means there is much higher numbers of livestock) tend to have livestock with much higher parasite prevalence. The average herd size in Rudranath was around 550, whereas in Shokarkh was around a 250 (personal observation Munib Khanyari). At a given time, there were about two herds of livestock at both sites, thus clearly Rudranath was more heavily grazed. This seeming anomaly is perhaps present because of the heterogeneity of the sites. Rudranath is much higher (average height is 3500 m) and has much more grass and herbs (personal observation Munib Khanyari) than the lower (average height is 2500 m) Shokarkh which has comparable grass cover, but much lesser herb content. Many studies have shown species to self-medicate and usually they feed on herbs to do so (de Roode et al., 2013). Higher intake of herbs in general contributes to better health in livestock. Additionally, a higher proportion of the sampling period in Shokarkh was during the monsoon, than in Rudranath. Parasite levels are said to spike with increasing wetness (Poulin 2011; Chapman et al., 2010). Even when all the three species are considered Shokarkh (14 eggs/samples) as a site has statistically higher prevalence of parasites ($p = 2.39\ e\text{-}17 < a = 0.05$) than Rudranath (7 eggs/sample). The above discussed point could be in contribution for this. Therefore perhaps it would be more informative to look into site-level covariates in addition to just intensity of livestock grazing to determine what exact affects these parasite's prevalence.

In terms of intensity interestingly, there was no statistically significant difference between livestock parasites between the two sites. This perhaps again is counter-intuitive for the reasons explained above. So the intensity and prevalence results,

especially for livestock suggests that other covariates of site should be investigated, as factors more than just the intensity of livestock grazing seem to be contributing to their parasite levels.

2.2 Himalayan tahr

In terms of prevalence, there is no statistical difference in parasite load between Rudranath and Shokarkh. This suggests that prevalence of parasites between the two sites was very similar. This is because there were very similar kinds of parasites (namely strongyles, toxocara and monieza) in tahr across the two sites (see figure 2). In both Rudranath and Shokarkh, livestock (11eggs/sample in Rudranath and 18 eggs/sample in Shokarkh) had statistically higher ($p = 5.50\ e\text{-}16 < a = 0.05$ and $p = 7.70\ e\text{-}13 < a = 0.05$ respectively) prevalence of parasites than tahr (1eggs/sample in Rudranath and 11eggs/sample in Shokarkh). This is an interesting finding as it confirms that even though we sampled in areas of differing livestock intensity, there stills remains a trend of livestock having higher prevalence of parasites than tahr. This is especially interesting as tahr, like livestock are ungulates that live in large group which facilitates parasite transfer (Poulin 2011). However, tahr group sizes are far smaller than that of livestock (personal observation Munib Khanyari) which perhaps doesn't allow transfer or persistence of parasites as much as in livestock. Also, tahr are very comfortable in traversing sheer cliffs and rock face and many a times graze on them in addition to the rolling alpine meadows. Livestock in general are restricted to the rolling alpine meadows, so perhaps tahr have access to resources that livestock can't attain. This too could impact parasite load and transfer, though would need far more in depth research.

In terms of parasite intensity, there is a significant difference between intensities of livestock and tahr. There is far higher and statistically significant intensity of parasite in livestock across both sites than in tahr. (z-score = 3.63, $p = 0.00028 < a = 0.05$ for Rudranath and z-score = -3.97, $p = 0.00008 < a = 0.05$ for Shokarkh). Thus, considering the statistically significant parasite prevalence and intensity data, we can conclude that tahr are much healthier than livestock in both site, but tahr are equally healthy between sites, perhaps suggesting that there are factors other than just intensity of grazing that are in play here. It is important to acknowledge that "health" is referred to in terms of gastro-intestinal parasites here.

2.3 Himalayan serow

We found very limited fresh samples of serow faeces (10 in Rudranath and only four in Shokarkh) hence doing the same analysis for them as the written in 2.2 for tahr wasn't possible. Nonetheless, we did include their data in the overall parasite comparison between the two sites discussed in 2.1. Also, the total parasite counts for the serow were very low anyways, averaging less than 1 egg/sample for Rudranath and 0eggs/samples in Shokarkh.

However, through the course of this project, we confirmed 12 deaths of adult serows due to sarcoptic mange. This is a disease caused by a mite, *Sarcoptes scabiei* (Pence & Ueckermann, 2002). A number that according to the local community was higher than ever before for a given year. These accounts are the first confirmed records of deaths in serow due to this disease.

During the above mentioned study, direct habitat overlap was noticed via camera trap images between serow and livestock, at a region called Panchaganga (N 30o 29' 53.36'' E79o 20' 03.80'', elevation 2849 m). Anecdotally, there are several other places within the Kedarnath Wildlife Sanctuary with such overlap. Therefore, it is of high value to analyse skin samples from livestock and serow infected with sarcoptic mange from the area, to understand if the same mite is infecting both the domestic and the wild ungulates. Cross transmission, if occurring is important to document and study as it has conservation implications.

Additionally, environmental factors such as winter intensity (particularly winter snow depth), rainfall and mean temperatures should be modelled to understand their potential to provide favourable condition for mite propagation, hence increasing infection intensity and probability. Lastly, the presence and persistence of such mites in the environment should be studied and quantified.

Comment 3

In total, across all age-sex classes 109,328 seconds (30.4 hours) and 54,612 seconds (15.2 hours) of observational data was collected from Rudranath and Shokarkh respectively. This data was divided in 66,523 (18.5 hours) and 28,814(8 hours) seconds of scan sampling in Rudranath and Shokarkh, and 42,805 (11.9 hours) seconds and 25,798 (7.2 hours) seconds of scan sampling from Rudranath and Shokarkh respectively. The activities recorded are defined in appendix 1 below. Figure 3 and 4 represent the breakdown of these activities in a pie-chart below. Also, because of a lack of sightings of serows this section wasn't possible for them, hence all the following analysis is only applicable to tahr.

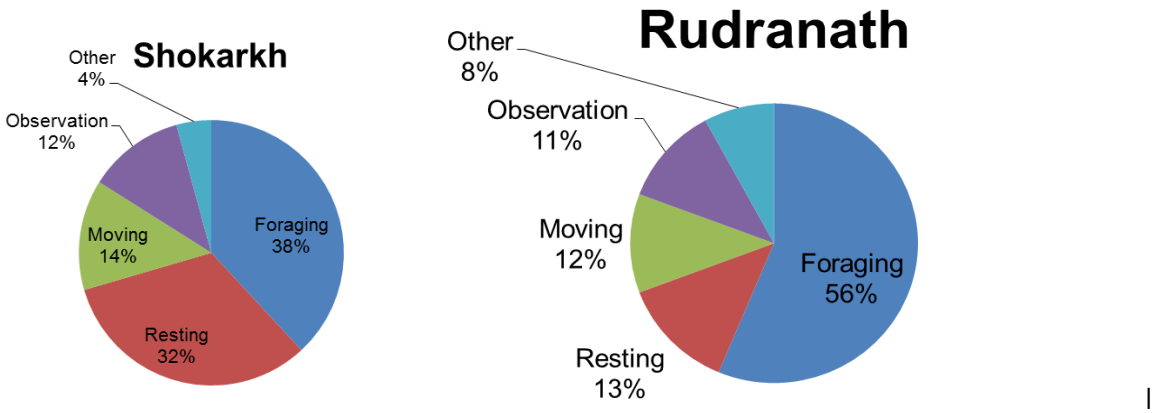

Figure 3. Pie-chart displaying the % time spent on each activity by Himalayan Tahr at Rudranath and Shokarkh using scan sampling.

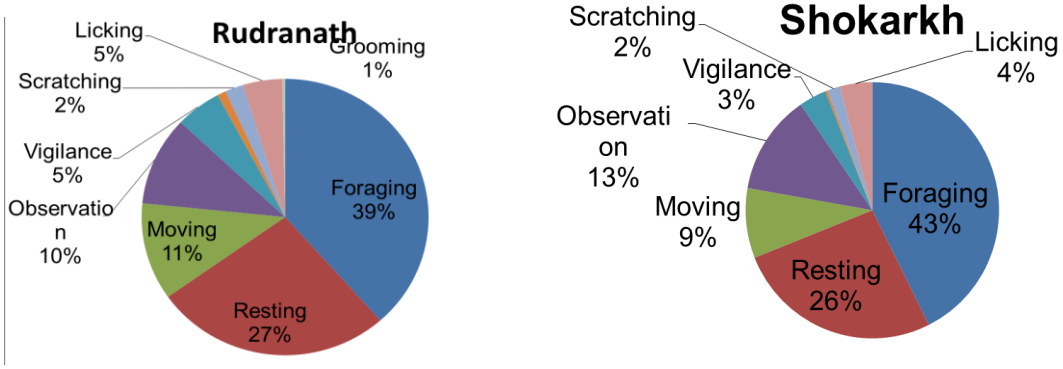

Figure 4. Pie-chart displaying the % time spent on each activity by Himalayan Tahr at Rudranath and Shokarkh using focal sampling.

3.1 Tahr groups (Rudranath vs. Shokarh)

Using the Kruskal-Wallis test, we found that there was no statistical difference in time spent foraging by tahr in the two sites. But interestingly, there was a statistical difference in time spent in resting ($p=3.84 < \chi2 = 2447$), moving ($p=3.84 < \chi2 =249$), observing ($p=3.84 < \chi2 =249$) and others ($p=3.84 < \chi2 =186$) activities. In Rudranath, the tahr moved, observed and did "other" activities more, whilst in Shokarkh they rested more. At this stage of the research we can't attribute this entirely to parasite load and diversity, as we do have some contrary evidence for this as seen in section 2. However, this is extremely important and interesting base information to have, as it helps us establish a basal activity pattern for tahr groups in these sites, for which further research can be aimed at understanding exactly why these patterns are true. Future research should address aspects such as extent of competition from livestock, productivity of the sites and other such factors.

3.2 Age-Sex patterns

We found some subtle patterns when considering activity budgets of adult female between Rudranath and Shokarkh. Females rested ($p=3.84 < \chi2 =795$), were vigilant ($p=3.84 < \chi2 =1086$), groomed ($p=3.84 < \chi2 =155$) and licked ($p=3.84 < \chi2 =2750$) (both themselves and rocks) more in Rudranath. Alternatively, they observed ($p=3.84 < \chi2 =9$) and foraged ($p=3.84 < \chi2 =286$) more in Shokarkh. Time spent moving and scratching didn't differ significantly.

On the other hand, for adult males they spent more time resting ($p=3.84 < \chi2 =2204$) observing ($p=3.84 < \chi2 =531$) and licking ($p=3.84 < \chi2 =45777$) in Rudranath than in Shokarkh. Alternatively, they foraged ($p=3.84 < \chi2 =288$) and moved ($p=3.84 < \chi2 =60$) more in Shokarkh than in Rudranath. There was no statistical difference in scratching however.

Lastly, for juveniles they rested ($p=3.84 < \chi2 =586$), observed ($p=3.84 < \chi2 =682$) and groomed ($p=3.84 < \chi2 =1407$) more in Shokarkh. In Rudranath, they foraged ($p=3.84 < \chi2 =1486$) more. Moving wasn't statistically different between the two sites.

As a conclusion, it is imperative to continue such surveys for a year or two to come to perhaps understand temporal trends (especially weather factors such as climate)

and to actually rectify if this is an inherent trend in these age-sex classes. Only once that has been established can we then research further as to why. We believe that patterns from a one year study are too short to assume as general, hence long-term monitoring is extremely key.

Comment 4

We held a workshop in June 2016 in the forest department headquarters of Kedarnath Wildlife Sanctuary in Gopeshwar town near the wildlife sanctuary. This was mainly for the forest department officials, where in we discussed how to identify different faeces of ungulates in the area and also did hands-on demonstration of the flo-tac method of observing and counting parasites.

We were successful in setting up an in-field laboratory in both our base camps in Rudranath and Shokarkh (see figure 5). Here periodically we had volunteers, both Indians and foreigners who not only helped us collect data, but were also taught how to analyse faecal samples for parasite, especially using the flo-tac method. Initially, we had suggested we would use a different method. However, upon my interactions with renowned wildlife veterinarian Dr Richard Kock (Royal Veterinary College-London) and Dr Eric Morgon (Bristol University), I learned the field friendly, yet highly under-used flo-tac method (Cringoli et al., 2010). Figure 5 shows a rather raw version of what the field set-up looked like. In total, we trained six Indian masters' students and three foreign bachelors' students in this technique, along with focal and scan sampling in the field. Four of them wish to continue using these techniques in their personal research and two wish to continue working on tahr and serow in the area.

We unfortunately, didn't manage to have a workshop with the community due to various logistical reasons.

Figure 5. The field set-up of a flo-tac based parasite analysis lab in one of the tents.

Comment 5

We interviewed all the members involved in livestock herding in and around Rudranath and Shokarkh. In fact, we also interviewed herders from villages near Rudranath, namely Dummak to get a more holistic perspective.

The interviews revealed that average livestock herd sizes in and around Rudranath were 550 and around Shokarkh were 250. Diseases such as foot & mouth outbreaks, manage and pneumonia are prevalent especially in sheep. Interestingly, only 50% of the herders vaccinate or use anthelmintic on their livestock. This is very crucial information as disease transfer from livestock to wild ungulate has devastated many population across space and time (Martin et al., 2011; Miller et al., 2013).

Conversation also revealed that the main problems that the herders in the region face is depredation by leopards, their livestock getting caught in snares laid out by poachers for musk deer, and the lack of land rights for grazing. Interestingly, a lot of them also said that the major changes they have witnessed is that now there is a lot more grass and rain than before. Some also suggested that the quantity of *Rhododendron* has increased, rendering some pastures inaccessible. Unfortunately, some also suggested that poaching for musk-deer has increased drastically. We also found evidence of this, as we came across 11 snares plotted in *Rhododendron* thickets near our survey sites (see figure 6 below). We have informed the Kedarnath Forest Department about it (GPS locations included), and the official have intensified patrols.

Figure 6. A set of snares found along a *Rhododendron* thicket in one of our field sites.

Collectively, all of this is important so that the mind-set and problems of herders are better understood as they are important stakeholders in the conservation conversation. These interviews also help determine priority areas for conservation interventions in the future.

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

Ours was perhaps the first ever project that studied tahr and serow even during the monsoon months. May (Shokarkh), June (Shokarkh) and July (Rudranath) were particularly challenging, as it would rain heavily each day and the fog was very thick, making it hard to navigate in the mountains and even harder to find our study species. Also, in Shokarkh the leaches were particularly bad. We tried to partition this time between the two sites so as to not skew the data massively. Also, we spend more time in the field in early mornings as they would be relatively fog-free compared to the midday and evenings.

Additionally, we found it much harder than we anticipated to find serow, both live sighting and their droppings. This could be perhaps due to the higher than usual death toll that sarcoptic mange is causing in their populations this year. We dealt with this by engaging more with the forest department, gaining more information about this disease in serow and writing about it in platforms such as the IUCN Caprinae newsletter to get the word out. Currently, I am in communication with Dr Richard Wall from Bristol University, who is an expert in ectoparasites, especially mites, to try and device steps to study transmission of this disease in serow.

Thirdly, due to heavy snowfall in November, December and January we couldn't do any fieldwork for tahr and serow. So, we spent most of that time doing interviews and analysis.

Fourthly, twice we had our camp raided by rats that destroyed a lot of our rations. We were forced to make trips that took us 2 days (one way down) to the nearest town to restock the same.

Lastly, we had chosen the two sites, primarily because they had two varying levels of livestock grazing whilst other factors were relatively similar. However, seeing some of the results in the above section (Comment 2 and 3) it becomes apparent that perhaps there are other inherent site-level covariates that are co-founding our treatments, rather than being controls. Hence continued research in these two sites and inclusion of other sites will help create a more informed picture.

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

1) Factors in addition to the two treatments of intense grazing and minimal grazing are affecting parasite load/diversity and activity budgets of wild ungulates in Kedarnath Wildlife Sanctuary. The relative contribution of these unknown factors to the two said variables need further research, which needs to be validated across multiple sites.

2). Sarcoptic mange is present in the region and has caused at least 12 mortalities in adult serow, which is the highest number of deaths recorded in this species, in this area ever. There also is a direct overlap between livestock herds and the serow, which raises questions of cross-transmission and spread. It is imperative that we study

the pathway of transmission and the extent of this disease in this ecosystem and perhaps understand mitigation measures.

3) Not all livestock herds are vaccinated. In fact 25% of the herds we surveyed don't get any vaccines or anthelmintic at all. 50% herders also said that diseases such as foot & mouth, sarcoptic mange and pneumonia were common in their herds. In addition, all herds had partial or complete overlap in grazing areas as wild ungulates. This invokes questions of competition and potential disease transmission. They too suggested that poaching in the recent years (5-10 years) has intensified, with much more snares especially in the *Rhododendron* thickets. This is also the region where we found a lot of signs and sightings of musk deer sp. (*Moschus* sp.) and serow.

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

This project would be mere words without the involvement of the local communities. For my entire field session, I employed three locals, two as field assistants and one as a camp manager. All three individuals belonged to economically challenged families and were able to earn an income from this project. In fact one of them, Vijay, aged 21, was so intrigued by our work that he has chosen to pursue a BSc in Zoology in a regional university and hopes to work towards the conservation of Kedarnath's mammals. Another, Harish, 32, has taken inspiration from our experience and now left his job as a mobile technician and takes people on birding tours around the wildlife sanctuary. Therefore, at least for these individuals, this project helped create a very positive wildlife conservation environment and livelihood alternative.

Additionally, during our several months camping in Rudranath and Shokarkh, we shared living space with a total of 12 different herders at various times. We had many meaningful interactions and conversations with them. Through our engagement, we talked about the link these people have with nature, the importance of having a healthy wild ecosystem and how to better equilibrate livestock grazing and wild ungulate populations. These conversations, though not hard core conservation interventions, did a lot in terms of relationship building and showed the herders that it isn't a fight between them and the conservationist, rather a search for a common compromise.

5. Are there any plans to continue this work?

Yes, I plan to soon start a PhD which will hopefully look at this system more holistically. I wish to work in the larger area connecting the Kedarnath Wildlife Sanctuary and Nanda Devi National Park. I wish to (i) set-up a long-term population monitoring of the tahr, (ii) study direct and indirect overlap with livestock herd throughout this extended region, (iii) engage with herder in setting livestock free zones and (iv) also try and do some epidemiology work with the sarcoptic mange in serow. Specifically for the latter I would love to get fresh tissue samples, both from livestock, serow with mange and serow without mange, and analyse them for what the exact strain

infecting the species is, pathways of cross-transmission and environment vectors for the same. I also wish to engage with local communities, especially livestock herders who share their home with these ungulates and other wildlife, in order to educate them about their natural resources so that they can channel their interactions with it in a sustainable manner. Having spent almost a year here now, I have experienced first-hand some of the issues faced by livestock herders in particular, which are conservation concerns. Therefore, I wish to engage with these issues and explore ways to deal with them, which clearly require more long-term and in depth studies.

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

I think it is imperative that results of such a study be shared with the larger common and scientific public to know and understand. I have already published a popular article on the deaths due to sarcoptic mange in serow in India's leading wildlife magazine, *Sanctuary Asia*. The link to this article in on my Rufford webpage. A more scientific short note on the same is soon going to be published in IUCN Caprinae newsletter shortly. Also, I am in the process of writing two papers, one on the parasite load and diversity in livestock and wild ungulates within two sites in Kedarnath and another about activity budget difference in tahr in sites with high and low livestock grazing. These papers will hopefully be published in peer-reviewed scientific journals. Additionally, we have also compiled a confidential report, with photos and GPS locations of snares put out by poachers to poach musk-deer. We also encountered a potential poacher camp within the high altitude region of Rudranath. This camps' location is in the report as well. We have submitted this report both to the Kedarnath forest division and the Uttarakhand forest's department main office in the capital Dehradhun. Lastly, I hope to take part in the Mountain Ungulate conference later this year and other such conferences. Here I plan to present my work, get feedback on the same and refine my future research and conservation direction

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

The timeline of the project went very much as anticipated. Field work started as soon as March (upon receiving the funds) and continued until around October ending. November and December were primarily when the interviews were done and January and February were utilised for analysis.

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
Field Assistant Salary(80 per month x 2 x 7 months) 1120 0 1120	1120	1120	0	
Airfare between Mumbai/Bangalore and Delhi (65 x 4)	260	260	0	
Bus transport between Delhi and Mandal and within KWS	252	280	28	Prices were higher than usual in July, as because of the monsoon there were far more landslides along the road this year
Boarding and Lodging (3/person/day x 270 x3)	2430	2430	0	
Porterage and Pack Animal	240	420	180	The extra charges were incurred in the two additional trips that we needed to make to get more ration. This amount was used to hire horses.
Solar lamps (38.3/lamp & Charger x 5)	192	192		
Electric vortex	108	0	0	We didn't need this as we used the Flo-tac instead
Hand centrifuge	64	0	0	Same as above
Equipment for faecal sample collection (tubes, vials, etc.)	216	300	84	Everything cost as budgeted for, however, the additional 134 was incurred due to buying and shipping of the flo-tacs from UK.
Consumables (formaldehyde, distilled water, etc.)	165	165	0	
Miscellaneous (notebooks, first-aid kit, etc.)	324	300	-24	
TOTAL	5371	5467	268	

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

Perhaps the most important next step is not only to continue collecting such data so the comparisons can be made across the year, but also to extend the area of survey and the complexity of the covariates in researching the health impact of livestock grazing on wild ungulates. In addition, it is extremely critical to engage with

the herders on the issues they face and they may impact on the natural habitats, as these hold immense conservation implications. In particular, understanding movement patterns of the wild ungulates, direct/indirect overlap with livestock, stocking densities of livestock and cause and transmission of diseases such as sarcoptic mange, all at a landscape level, are specific priority areas. I hope to spend some months in the coming year travelling with some livestock herders and their herds, to observe herding practices and conflicts with wild ungulate first hand.

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

I used the RSGF logo in the presentations I made about my work at the Nature Conservation Foundation (NCF) office and the National Centre for Biological Sciences (NCBS) in Bangalore, India and to the Forest department of Kedarnath Wildlife Sanctuary. Here I specified how without Rufford's support, now of what I did would be possible. My work and the fact that it was supported by Rufford was acknowledged by Sanctuary Asia when they published my article on the sarcoptic mange in serow. Same will be done in the IUCN newsletter piece and any scientific publication that gets published.

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

12. Any other comments?

I would like to heartily thank Rufford for this amazing opportunity and entrusting me with this grant. This ecosystem and its species are highly understudied and are at the forefront of conservation issues in the region. Therefore working here is enriching both in terms of ecology and conservation. These issues need further exploration, research and implementation and I hope that the Foundation will continue its generous support for my research. This will help breed sound science upon which sustained conservation can be based.

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Appendix 1

This is a break-down of each activity which was accounted for in the focal and scan sample:

1) Foraging: feeding at any height which might include movement
2) Vigilance: scanning, observing
3) Resting: standing and lying idle
4) Moving: directional movement, including walking, jumping, running
5) Vocalizing: grunting or producing a sound (generally audible) with their mouth
6) Other: Including but not limited to activities like suckling, mating, grooming and fighting