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	Sailendra Dewan
Project title	Distribution pattern and conservation of butterflies along the elevational gradient in Rangeet Valley, Sikkim, Eastern Himalaya.
RSG reference	20758-1
Reporting period	1November 2016, February 2017
Amount of grant	£ 4919
Your email address	dewansailendra1992@gmail.com
Date of this report	February 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
Butterfly community along the elevational gradient in Rangeet valley.				Total sampling effort made during the project period was 1136 point counts in 16 elevational site (300 m to 3500 m) covering three major seasons: pre-monsoon, monsoon and post-monsoon. Altogether 2138 individuals representing 248 species and six families of butterflies were recorded in Rangeet valley during the study. Family Nymphalidae consisted of highest number (106 species) representing 43% followed by 43 species belonging to Lycaenidae (17%), 35 species belonging to Hesperiidae (14%), 31 species belonging to Pieridae (13%), 27 species belonging to Papilionidae (11%) and finally six species belonging to Riodinidae (6%). Threespot grass yellow *(Eurema blanda*) was very common in Rangeet Valley with maxium number of individuals. Other two top most common species were red Helen (*Papilio helenus*) and glassy tiger (*Parantica aglea*). The linear regression model showed that butterfly species richness decreased linearly with increase in elevation in Rangeet Valley. Similar pattern of decrease was observed in butterfly diversity and abundance. The low elevation sub-tropical semi-deciduous forest (300 – 900 m) had the maximum butterfly species richness, diversity and abundance.
Understanding the biotic and abiotic factors responsible for				Species richness, abundance and diversity showed significant positive correlation with climatic variables;

influencing butterfly diversity pattern.				mean annual temperature (MAT) and mean annual precipitation (MAP). Species richness of butterflies showed positive correlation with tree species richness (TSR) and shrub density (SBD). Abundance showed positive correlation with shrub density (SBD). Diversity showed positive correlation with tree species richness (TSR), tree density (TD) and shrub density (SBD). Host plant species richness decreased with increasing elevation. Butterfly species richness, diversity and abundance were all positively correlated with host plant species richness.
Conservation status of butterflies in Rangeet Valley.				Of the total butterfly species recorded in Rangeet Valley, 41 were federally protected under Schedule I (part IV), Schedule II (Part II) and schedule IV of Indian Wildlife (Protection) Act 1972. The elevation range between (300 - 900 m) had the highest number of federally protected butterflies.
Outreach activities involving students and local citizens.				Several outreach activities were undertaken as a part of this project. Brief details of the activities are given below. 1. Poster Presentation at YETI (January 2017): Poster on the current work was presented at the Young Ecologist Talk and Interact 2017(National Conference) held at Tezpur University, Assam, India. Trends in the distribution of butterflies and prioritising area for conservation were highlighted in the poster. Participants including ecological scientists, researchers, nature enthusiasts, students were part of the event. 2. World Environment Day (June 5th 2017): World Environment Day was celebrated in Sakyong Chisopani School, Singtam, Sikkim in collaboration with the Butterfly and Moths of Sikkim Nature Conservation Society (BAMOS NCF). The programme was conducted as a part

				of present project supported by the Rufford Foundation. Along with my talk, the BAMOS team also interacted with the students. Host plants of butterflies were planted and details of butterflies were shared with the students in the event. 3. Wildlife Week (October 9th 2017): WWF hosted a biodiversity fair at Gangtok, Sikkim on the occasion of wildlife week on October 9th 2017. Several organisations and schools participated in the event. Sikkim University and BAMOS collaborated in the event by keeping stalls related to butterflies and herpetofauna of Sikkim. Posters that had been made with the support of Rufford Foundation was distributed to citizens and representative from different schools. 4. Poster Distribution: Poster's made with the support of Rufford foundation was distributed to several schools, NGOs, colleges and various department of Sikkim University. The poster was also gifted to Mr Issac Kehimkar, renowned lepidopterist and author of book "The Book of Indian Butterflies''. Posters were also gifted to participants of North-Eastern Butterfly Meet held at Dzongu during September 2017.
Interaction with the policy makers				The findings of the report have not been shared formally with the policy makers. However, we interacted with several field officials including block officer, and forest guards of Khanchendzonga National Park during the course of the project.

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

There were only few difficulties that we experienced during the project.

1) Trekking through Khanchendzonga National Park took extra effort both in terms of money and manpower. Six sampling sites had been established in the trail. The actual amount spend was higher than the estimated amount.

2) Monetary controls were announced by Government of India on 8th November, 2016. It became really difficult to change cash required for the field visit. Hence, work had to be halted for some period of time. Nevertheless, the work was completed within time putting extra effort after the normalisation of cash flow.

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

Three most important outcome of the study are-

1) **Identification of butterfly diversity hotspot:** Butterfly species richness, diversity and abundance declined with increase in elevation with highest values below 500 m in Rangeet Valley. Suitable climatic condition and diverse habitat in the lower sub-tropical valleys of Rangeet supports high diversity of butterflies making it the hotspot of diversity. The lower valleys in Sikkim are ideal for butterfly gardens which will ensure long term conservation of butterflies. The lowland forest in Himalaya and elsewhere, however, experiences immense anthropogenic pressures. In Sikkim, 31% of the total geographical area is under protected area network but most of the protected areas are located above 1500 m. The forest cover in lowland areas below 500 m in Sikkim is only 37 km². Prioritising the remaining forest tract is essential for conservation of butterflies as well as lowland tropical ecosystem. Also, in the lowland area which is dominated by humans, potentiality of agricultural landscape in conserving diversity of butterflies as well as other life forms can be assessed and conservation goals can be achieved with the support of local communities.

2) **Baseline data for butterfly diversity trends:** This study have aided in providing a general understanding of trends in butterfly diversity and distribution along the elevation gradient in eastern Himalayan landscape along with its causal mechanisms. The data generated in this study will serve as baseline for comparison of range shifts and extinction risks of butterflies of the Himalayan region in the face of global climatic change.

The study has also rediscovered a species of very rare butterfly *Lethe nicetella* which is endemic to Nepal, Sikkim and Bhutan. This is the first sighting of this rare and lesser known butterfly after a century in India. Since updated details of this butterfly are very scanty, we prepared a research communication on this butterfly and communicated to scientific journal for publication consideration.

3) **Step towards community conservation practices:** The outreach and awareness programme conducted during the project in collaboration with Butterfly and Moths of Sikkim Nature Conservation Society (BAMOS NCS) has been able to generate keen interest on butterflies among local communities and students. Information on butterfly diversity of Sikkim and its conservation importance has been shared during the programmes. The awareness of the students and local communities would be crucial milestone in promoting community conservation practices and would be fruitful with continuity of such measures in future.

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

Local communities have been involved at various levels in this project; as NGO associaite, as participant of outreach programme, as field assistant and field staff. Butterfly and Moths of Sikkim Nature Conservation Society, which is a local NGO dedicated in conservation of butterflies has been an important partner in this project. Various outreach and awareness programmes were conducted jointly with the society. Butterfly posters that were distributed in those programmes were supported by this project. The outreach programme has been able to create awareness among the local students and local community. Approximately 60 students from 12 schools were communicated during the project period. Due to increased interest on butterflies, students from Sikkim University volunteered in the project and have included the part of their work in Msc dissertation as well. Students have been trained to conduct similar works in future. The project through outreach programme has helped the people to understand the importance of protecting the landscape in order to conserve butterflies and other associated biodiversity components. Field assistant and staff employed in the project were mainly local and unemployed youths. Field assistants were trained to indentify butterflies, survey plants and handle GPS. As a trained human resource they would be quite eligible to work in other related projects and can be an eco-friendly tourist guide in the high demand tourism industry in Sikkim.

5. Are there any plans to continue this work?

Yes. The work will be continued in by looking at following prospects:

1) The project was limited to study of butterflies between 300 m to 3100 m. Several rare and endemic butterfly species are known to occur above 3500 m in high alpine zones. Information on ecology of highland species is scanty and not much is known about their ecology. Studies in highland areas especially along the Tibetan plateau in the north Sikkim would contribute to the better understanding of species assemblage and ecology of lesser known montane species.

2) The current project mainly focused on natural forest areas. Significant proportion of land in Sikkim is human dominated which includes urban areas, industrial zones, open agriculture landscape and agro-forestry landscape. While urbanisation may have negative effect on biodiversity, traditional agro-forestry landscape has been deemed to have high potential for biodiversity conservation. Projects undertaking comparative studies on different landscape on butterfly diversity are necessary to understand the potentiality of these landscapes in conserving butterfly diversity.

3) We detected many cryptic species of butterflies during the survey. Such butterflies mainly belonged to genus *Arhopala*, *Celastrina*, *Lethe*, *Neptis* and *Potanthus*. Identification of such butterflies through morphological characters is very difficult. Misidentification of species often leads to statistical errors and misinterpretation of distributional ranges. Techniques involving molecular barcode and phylogenetics approaches are being used worldwide to tackle these errors. We have been

working to establish a systematic approach of taxonomy using molecular techniques in identification of the cryptic species present in the region. .

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

The partial report of the study has already been presented in the Young Ecologist Talk and Interact 2017(National Conference), Tezpur University, Assam, India. The finding of the project was shared with faculties, scholars and students of the Department of Zoology, Sikkim University. The final report would also be submitted to Forest Department, Government of Sikkim.

Two research articles are expected from the project results of which one is under review and the other one under preparation. Since the study was a part of my PhD research, the findings would be compiled in thesis, published as research articles in referred journals as well as popular articles in periodicals.

The details of outreach and awareness programmes were shared in local newspaper and social media.

Our main aim is to share our outcome with the policy makers in Sikkim. The report would be crucial in undertaking conservation measures.

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

I received the grant on 1st November 2016. Prior to receiving grant I had visited the study area and identified the sampling sites. Hence, we saved time which would have been required for identifying areas for conducting survey and arranging logistics. The project was immediately initiated in November 2016 and was continued up to October 2017. The grant was used especially for fieldwork (logistics and travel) which we conducted continuously for one year while only halting during January- February 2017. Field assistant were paid on daily basis.

Some amount of grant was used in outreach and awareness programme conducted during 5th June 2017 and 9th October 2017, however, the budget required was lesser than the anticipated amount. Poster on butterfly of Rangeet Valley was continuously printed and distributed throughout the tenure of the project.

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. 1 Pound Sterling (GBP) = 89.32 Rupees (INR) as on 3 August 2016 (When the application was submitted) 1 Pound Sterling (GBP) = 81.68 Rupees (INR) as on 1 November 2016 (When the grant was received.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Accommodation and food (£ 8 * 200 days *2 person)	2800	2900	+100	The budget went high as expected because trekking through Khanchendonzga National Park was expensive. This included hiring of tent, gas stoves, buying kerosene, foods and fee for laying tents.
Travel	1000	1000		Amount was sufficient to undertake surveys and field study
Field Assistant	400	400		Paid as proposed in the proposal.
Outreach Program	600	500	-200	The budget for outreach material was lower because the venues for program did not require any charge and we also did not provide meals to the participants. The remaining amount was used to compensate the increase in accommodation budget.
Outreach materials	200	120	-80	The charge of print material was low from what we had expected. Since we printed posters and banners in bulk the rate of the materials was reduced by the printing press. The remaining amount was used to compensate the increase in accommodation budget.
Total	**5000**	**4920**	-80	The total amount received 1st November 2016 was £4919. The amount received was lower than the actual grant of £5000 pound as the bank charged an amount of £81 as a transaction tax.

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

Publication and communication of our findings. Few publications are expected from this project. We have submitted one manuscript on the rediscovery of *Lethe nicetella* to Journal of Threatened Taxa and is under review. Presently we are preparing a draft manuscript on butterflies of Kitam Bird sanctuary and would be submitted for publication soon. The main manuscript will be on trends in diversity and distribution of butterflies along the elevational gradient on Rangeet Valley. The work will also presented in seminars and conferences.

The study has helped to identify elevation below 500 m as butterfly 'hotspot' area. The forest cover in Sikkim below 500m is only 37 km². Kitam Bird Sanctuary with an extent of 6 km² is the only protected area in this elevation. As a follow-up of this project we have already conducted a survey in order to assess the diversity of butterflies and their relative host plants within the sanctuary. Documentation and diversity assessment will help understand the potentiality of the sanctuary in conserving butterflies.

Species accumulation curve showed sharp increase even after intensive sampling. This suggests that several species remains to be detected. Further survey will help reveal more rare species from the region. Hence, the work will be continued further since many aspects also (mentioned in section 5) needs to be addressed.

Main step that needs to be taken is to enhance capacity of local communities and local institutions to document and monitor butterflies in order to encourage community conservation practices.

10. Did you use The Rufford Foundation 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 was used in:

1) Poster presentation presented at Yeti 2017.
2) Poster of butterflies of Sikkim.
3) Banners used in outreach programmes.
4) PowerPoint presentation delivered at Department of Zoology, Sikkim University.

The details of outreach programme conducted was published in local newspaper such as 'Summit Times', 'Sikkim Chronicle' etc. RF got good publicity among various young researchers in Sikkim through this project. As a result, several young scholars from this region applied and were successful in receiving the grant while many are in the process of application.

11. Any other comments?

My team and I are very thankful to the Rufford Foundation for providing us an opportunity to implement this project. The project has helped to gain deep insight on species assemblage pattern, distribution and limiting factors of butterflies along the elevational gradient in Rangeet Valley.

I am extremely grateful to my research guide Dr Bhoj K. Acharya, Assistant Professor Department of Zoology for his professional guidance, encouragement, supervision and remarkable interest which made this study successful. I am thankful to Nawangla Bhutia (President) and all the members of BAMOS NCS for helping me to in outreach and awareness program. I would like to thank Forest department of Sikkim for providing me with the permit to conduct this study. This project would not have been successful without the participation of students and people of Sikkim. I

would like to extend my sincere gratitude to all of them. I would also like to thank all the local field guides who helped me in the survey of butterflies, survey and identification of plants.

Eurema hecabe laying eggs on Albizzia tree