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	Annesha Chowdhury
Project title	Biodiversity, Ecosystem Services and Human Wellbeing in the Darjeeling tea-forest social-ecological Landscape
RSG reference	19027-1
Reporting period	March 2016 – March 2017
Amount of grant	£4910
Your email address	Annesha.chowdhury@atree.org
Date of this report	1/5 /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
Reconnaissance survey				Tea estates were visited in February and April 2016 for site sampling. Estates were selected based on their management practices (organic vs conventional), certifications adopted (Rainforest Alliance vs. organic vs. not certified), ownership (government owned, corporate large tea estates and small tea growers) and proximity to protected area and reserved forests.
Standardization of sampling framework				The entire Darjeeling tea landscape was stratified into 2 X 2 km grids. Only those grids within which the estates selected through the reconnaissance survey and under different management regimes. Biodiversity assessments were carried out only in the selected sites. Based on elevation, slope and vegetation type, a 500m-1km trail was selected inside every tea estate area where there was maximum bird activity and mammal movement as identified by community. All bird, arthropod and mammal sampling was conducted at every 250m on the trail. Most assessments were conducted inside tea growing areas of the tea estates where the major understory vegetation type was *Camelia sinensis*. In all 14 trails on which a total of 45 sampling points were conducted between summer 2016 and fall 2016.
Faunal survey to assess whether the tea landscape				58 point counts of birds were conducted across 14 pre-identified trails inside the tea growing areas. A

supports biodiversity movement and refugium.				total of 524 birds were recorded in summer whereas 957 birds were recorded in fall (post monsoon). Sign surveys along the same trails revealed 15 species of mammals including the Vulnerable binturong (*Arctictis binturong*) and the Critically Endangered Chinese pangolin (*Manis pentadactyla*). 12 species of small, medium and large mammals were recorded on Camera traps. Soil arthropod sampling across 52 sites were sorted into1663 specimens across 20 orders,
Vegetation Survey				58 vegetation plots, 5 X 5m were laid to enumerate all tree, shrub and herbs species. Most understory species were dominated by *Camelia sinensis* (Chinese tea bush) with and over story of either *Cryptomeria japonica, Streblus asper, Albizia* sp., *Erythrina aborescens* or *Castnanopsis* sp. As many as 54 different species of trees were identified across the study landscape. Habitat characterization is still underway.
GPS points of sampling units and creation of distribution maps				GPS locations of all sampling points have been collected and a distribution maps is being developed

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

The biggest challenge was sampling during monsoons which lasted for longer than we had predicted and hence hampered with our sampling dates. This combined with bad roads sometimes increased our cost of travel to many sites. However, these conditions did not deter us from sampling and we maintained sampling time.

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

- The number of individuals recorded in trails within Rainforest Alliance certified estates was higher (n=603) as compared to individuals that were recorded (n=354) in estates that are not Rainforest Alliance certified.
- The most abundant soil arthropods across the tea landscape are the Hymenoptera (ants) followed by Collembola (springtails).
- Tea estates act as a refugia for critically endangered mammal - the Chinese pangolin (*Manis pentadactyla*).

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

Community level group discussions were held in each of the 13 study sites. A preliminary analysis of the discussion revealed that communities living inside tea estates do depend on their surrounding forest ecosystems for fuelwood, fodder, clean and safe drinking water and NTFPs such as edible wild vegetables and medicinal plants. I was able to highlight how the management is mandated to maintain the forests inside tea estates from which the communities are also derive benefits.

5. Are there any plans to continue this work?

Yes there are plans to continue this work in order to get a better idea about trends and patterns of biodiversity responses to different management practices. More sampling will help us predict future scenarios with respect to the ability of different taxa of biodiversity to move and reside, within areas outside protected areas such as the tea landscape in Darjeeling.

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

The outcome of the analysis of this project will be disseminated via popular articles and peer reviewed journal publications for wider outreach. Also, community appraisal meetings are also planned.

Additionally outputs of preliminary analysis have been shared through:

- A presentation at the ATREE@20 Conference on Conservation Science and Sustainable Development, 24-25 January 2017, Bengaluru (https://www.youtube.com/watch?v=SBkhBCCbyWM)
- An article in www.earthamag.org titled "***What going organic means for biodiversity conservation and human wellbeing in Darjeeling's tea estates"*** (http://www.earthamag.org/stories/2017/3/8/biodiversity-conservation-human-wellbeing-darjeeling-tea-estates?rq=Annesha)
- An article in Down to Earth Magazine titled "**Tea tag takeaway**" (http://www.downtoearth.org.in/news/tea-tag-takeaway-55105)

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 Rufford Foundation grant was used from March 2016 till March 2017. The actual length of the project was till February 2017, however, we required some more time to complete our village level interactions and data collation.

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
Bushnell Binocular -1	128	62.52	-65.48	
Nikon Camera		304.72	+304.72	Had not budgeted for this but since it was an urgent requirement, the camera was bought using RSG funds.
Garmin GPS Map - 1	270	311.60	+41.60	The additional cost was due to shipping and customs duty charges
Range Finder - 1	166	220.57	+54.57	The additional cost was due to shipping and customs duty charges
Clinometer - 1	140	200.49	+60.49	The additional cost was due to shipping and customs duty charges
Flagging tape - 7	11	12.83	+1.83	
GBH Tape - 2	64	44.95	-16.56	
Densiometer – 1	71	89.31	+18.31	Additional cost included taxes
Soil sampling kit – 1	646	105.64	-540.36	

Soil testing kit – 1	22	98.61	+76.61	Additional cost was due to the model of kit and extra testing solutions that was bought along with the kit
Soil pH meter -1	22	0	0	Not purchased
Snake Gaiters – 2	71	101.15	-30.15	
Fieldwork accommodation and food	1200	872.46	-327.54	
Travel	800	1177.66	+377.66	
Field consumables and miscellaneous	339	933.98	+594.98	Batteries, collection bags etc had to be purchased frequently and cost more than what was budgeted
Field assistants – 2	795	366.71	-428.29	Only one was hired using RSG grants
Total	**4910**	**4910**	**0**	

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

The next important steps are to conduct more in-depth analysis to assess how different levels of management practice are reflected in different taxa's responses to those practices. Additionally, it is important to continue to disseminate the outcomes through various popular and newspaper articles for awareness as the region is under tremendous pressure from development and tourism related activities.

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?

The Rufford Foundation logo has not yet been used however, the support of the Rufford Foundation was mentioned in all communication material to the West Bengal Directorate of Forests, The Darjeeling Tea Association and the Indian Tea Association.

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

The research team comprises me and my supervisor Dr. M Soubadra Devy who is a fellow at the Ashoka Trust for Research in Ecology and the Environment. We were responsible for designing the study and engaging with the conceptual and philosophical underpinnings of the project. Additional team members were Dr. T Ganesh, who provided critical inputs regarding the sampling strategy, vegetation and mammal surveys, Dr. N. A. Aravind Madhyastha who provided inputs regarding sampling, bird assessments and soil surveys and Dr. Siddhartha Krishnan who provided inputs and guidance regarding community meetings and wellbeing

assessments. Furthermore the field team comprised Samir Biswakarma who was the vehicle driver and field assistant in the project along with Gyabo Sherpa. Both accompanied me to all field sites where we conducted vegetation, soil, bird and mammal assessments in addition to setting up camera traps and monitoring them.

12. Any other comments?