

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	Ravi Madhav Jambhekar
Project title	The influence of landscape composition and resource distribution on butterfly populations in human-dominated tropical grassland-forest landscapes
RSG reference	18470-1
Reporting period	December 2016 – December 2017
Amount of grant	£4900
Your email address	ravijambhekar04@gmail.com
Date of this report	30 th March, 2018

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. To study the influence of local resource distribution on butterfly behaviour and movement				We found strong evidence that butterfly behaviour and movement is affected by resource distribution. The spatial scale of the distribution of resources affects butterfly foraging and oviposition behaviours. At a spatial scale of 5 x 5 m, butterflies tend to forage in resource rich plots as compared to resource poor plots. Butterflies prefer to oviposit in resource rich areas where both larval and adult resources are abundant as compared to resource poor areas. The resource use behaviours of butterflies have implications for the population density and also for their phenotype, such as body size and condition. These findings were presented at an international conference, BEHAVIOUR 2017, Estoril, Portugal.
2. To study the influence of ecological factors at a larger spatial scale, specifically habitat fragment size and composition of the matrix surrounding habitat fragments, on butterfly population density and movement				The field data was collected successfully. We monitored 18 grassland patches of different sizes and connectivity to each other in the landscape to study the size of populations and dispersal of the grass-dependent butterfly <i>Ypthima huebneri</i> . We successfully carried out mark recapture at a large spatial scale to study population connectivity and how landscape factors such as patch size and connectivity can affect butterfly populations. The preliminary data indicated that smaller habitat patches have highly closed populations as compared to larger habitat patches. Indicating that

			such populations might have a higher risk of extinction. The study species seemed to have a good dispersal capability but rigorous statistical analysis for this part is yet to be completed.
3. To study the influence of landscape composition and species traits on butterfly populations and species distribution in a larger landscape; To use this information to predict species vulnerability to land-use change			A total of 153 transects were laid in three different kinds of habitat to study butterfly populations and species distributions in the landscape. We mapped the species distributions of over 100 species and found that they varied from common and widespread to rare and restricted to only a few habitat patches. We found that species traits play an important role in species distribution. Smaller sized butterfly species showed restricted distribution in the landscape. Butterfly species distribution was highly correlated with host plant habitat. We were broadly able to classify species to the habitat types.
4. Outreach Activities			I had initially thought of conducting workshops on butterfly life history and ecology with local stakeholders but the best I could do was to engage with local stakeholders and show the different life stages in natural habitats and highlight the importance of these different life stages in the ecology of butterflies and the conservation implications for butterflies. I regularly engaged with members of the local community, college students and tourists and conducted nature walks very successfully to instil interest in biodiversity and importance of conservation of grasslands and other habitats. I designed and produced posters of common butterflies seen in the area and distributed these to local nature centres and to local schools to highlight the diversity of butterflies in the study area.

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

Overall there were no difficulties in carrying out the project. The study area was a bit remote and hence it was a bit difficult to find transport and field assistants. But apart from this all the project activities were carried out smoothly.

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

The three most important outcomes of the project are as follows:

1. This project achieved its primary objective to study the influence of landscape composition and resource distribution on butterfly populations. We were able to map species distributions in the landscape of over 100 butterfly species. We were successfully able to characterise the habitat preferences for these butterfly species, which will help in making informed conservation decisions. Many of the habitat patches comprised of laterite plateau grasslands and ridge grasslands which are generally overlooked as waste habitats. This survey highlights these habitats as important butterfly habitats and we have prepared a detailed checklist of butterflies using the laterite plateau and ridge grasslands.

2. We were able to link species traits to environmental variables and predict which species might be more vulnerable to habitat fragmentation and habitat loss. We found that butterflies with small body size, weak flight and restricted diet breadth are affected by habitat fragmentation and habitat loss.

3. Adult resources and larval nectar resource distribution at small and large spatial scales affects butterfly behaviour differently. At larger spatial scales low resources affected the foraging behaviour, butterflies spent more time foraging in resource poor patches as compared to resource rich patches. At smaller spatial scales butterflies spent more time in general in resource rich patches and foraging in resource rich patches as compared to resource poor patches. Butterflies seemed to oviposit in resource rich plots at a larger spatial scale and at smaller spatial scale they preferred to oviposit in plots which were rich both in terms of adult and larval resources. These behavioural strategies of resource use have implications for population density and for butterfly phenotype, such as body size and condition.

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

Local communities were not directly involved in the project but a detailed checklist of butterflies with important habitats was shared with the local stakeholders to help in butterfly conservation. Tourism is one of the important businesses in the study area and local residents were taken on nature walks to sensitise them about the importance of butterflies in the study area and to show them the important butterfly habitats and host plants. This information can be directly used by them when they take tourists on biodiversity walks to talk about the importance of butterflies and conserving butterflies habitats.

5. Are there any plans to continue this work?

Yes, this project establishes a broad baseline about butterfly distributions and how resource distribution might affect butterfly behaviour in a poorly studied set of tropical habitats. This information can be expanded to answer more detailed questions studying butterfly communities in fragmented habitats in the tropics. We plan to continue the work in future. We plan to try and connect how habitat fragmentation and edge effects affect butterfly communities. We plan to conduct genetic work on a few of the butterfly populations in the landscape to study the effects of dispersal in maintaining butterfly populations in a fragmented landscape.

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

I plan to publish these results in leading scientific journals. I have already submitted detailed reports documenting the butterfly diversity in the study area with local stakeholders. I have presented the preliminary findings at an international conference, BEHAVIOUR 2017, Estoril, Portugal. I have also presented the work in seminars organised at my current institution, Centre For Ecological Sciences, Indian Institute of Science. I have printed posters highlighting the butterfly diversity in the study area and shared them with local schools and NGOs.

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 grant was used during the first seven to eight months of the project when the field work was carried out. We had estimated to wrap up the project in a year and hence I think we used the grant as anticipated.

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
Filed assistant salary	1000	800	-200	We were not able to find field assistants regularly, sometimes the field work was carried out without any field assistants, hence the entire amount was not utilised.
Food and Lodging	1600	1600	0	This amount was fully utilised.
Travel	500	500	0	This amount was fully utilised.
Local Travel	800	500	-300	We were not able to use the full amount as many a times local transport was not

				available readily. Part of the difference was used for food and lodging and filed equipment.
Fuel	300	300	0	
Poster printing	100	100	0	
Field Equipment	600	600	0	

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

This project is important as it is the first of its kind in mapping distributions of butterflies in a naturally fragmented landscape in the tropical forests in India.

Looking at the population level patterns I feel we can now investigate detailed processes such as meta-populations or meta-communities for these butterfly communities in the landscape. Understanding these processes will help to identify species that are likely to be particularly vulnerable to any loss in habitat connectivity, and will also help to identify the processes that affect butterfly species diversity and the dynamics of butterfly communities in space and time.

We plan to conduct genetic work to study how habitat fragmentation affects butterfly populations.

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 Rufford Foundation logo on the posters which were printed as a part of this project to be distributed in schools, highlighting the diversity of butterflies in the study area. I used the Rufford logo on images that were posted on social media. I used Rufford Foundation logo on scientific posters describing the work carried out in the study area at International and national conferences. I have used the Rufford Foundation logo in my presentations which were given as a part of the talks about this work.

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

Ravi Jambhekar (Graduate student, Team leader) I co-designed this study, carried out the field work and took care of field logistics during the study duration. I was involved with all the data collection and analysis during the course of this study.

Dr. Kavita Isvaran (Advisor) helped with study design and data analysis.

Meenakshi Poti and **Shalini** were volunteers who contributed to field data collection substantially.



Blue Oak Leaf



Blue Tigers



Laterite Plateau grasslands