

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	Ronita Mukherjee
Project title	Assessing the scope for pollinator-friendly agriculture in the peri-urban landscape of Bangalore, India
RSG reference	13472-1
Reporting period	June 2013 to December 2014 (18 months)
Amount of grant	£6000
Your email address	ronita.mukherjee@atree.org
Date of this report	08/12/2014

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 determine the commercially predominant pollinator-dependent crop of the study region.				Using extensive field survey and questionnaire method.
2. To determine whether the study species is pollinator dependent or not.				Using ecological experiments both field and laboratory.
3. To identify the potential pollinator guild of the study species.				Using field observations and then further identification in the laboratory using microscope.
4. To determine whether distance from natural areas play a role in the pollinator flow as well as the production of the farmlands.				Using ecological experiments and spatial analysis. To confirm the pattern over a temporal scale, ecological experiments need to be conducted for 2 years (1 year of data has been collected, replicate is required for another year).
5. To determine the gradient of pollination service across the landscape.				Ecological experiments have been conducted along with the partial spatial analysis. But detailed spatial analysis (understanding the matrix quality of the farmlands) along with temporal scale ecological data needs to be collected to fully achieve the objective.

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

All the ecological experiments and field observations were conducted in the peak flowering season, to avoid biases in the sampling design. Owing to unfavourable monsoon condition of this year, the peak blooming period was delayed, consequently all the project targets could not be completed within the anticipated time.

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

- I. A. The pollinator dependence of the study species (Chayote squash) have been demonstrated. Pollination treatments showed that pollinator visit is essential in setting fruit set for this particular species (No/Negative control treatment vs Open/Positive control treatment; $p < 0.01$). Further treatments confirmed that the study species is cross-pollinated in nature (Cross vs Open; $p = 0.28$, Self vs Open; $p = 0.0013$, Self vs Cross; $p = 0.017$).

B. Pollen tube analysis have been standardised to confirm the pollination type of this particular species through field as well as laboratory techniques. Sample size needs to be increased to better predict the pollen tube formation pattern across treatments.

- II. Pollinators visiting the study species across the entire landscape have been observed. The bees observed in the field were brought back to laboratory for identification and a bee key was generated for field use. Four species of bees; *Apis dorsata*, *Apis cerana*, *Apis florea* and *Trigona* sp have been observed to visit the plants across the entire landscape (**Fig:1**)

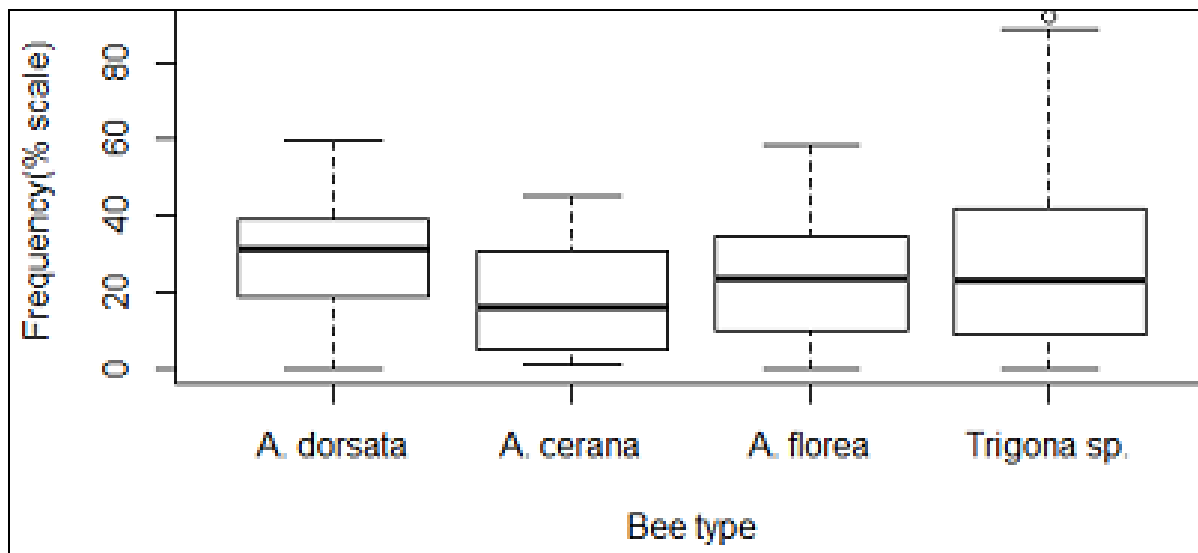
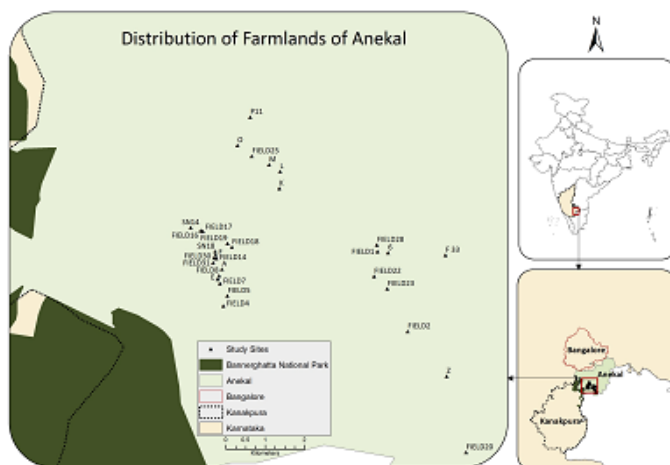


Figure 1: Distribution of bee abundance across the sampled farmlands in Anekal taluk, Bangalore, India

- III. Distance from natural area might play a role in the visitation pattern of the bees across the sampling sites have been demonstrated by this year's field observations (**Map:1** showing Bannerghatta National Park along with the distribution of farmlands across the entire landscape). Further sampling (in the same sites for another year) needs to be done to determine if there are inter-year variations across the sampling sites. Visitation of bees per flower across the study area have been demonstrated to be decreasing with distance from the natural area ($p=0.03$) (**Fig:2**)



Map 1: Distribution of farmlands (Chayote Squash) across Anekal taluk, Bangalore, India

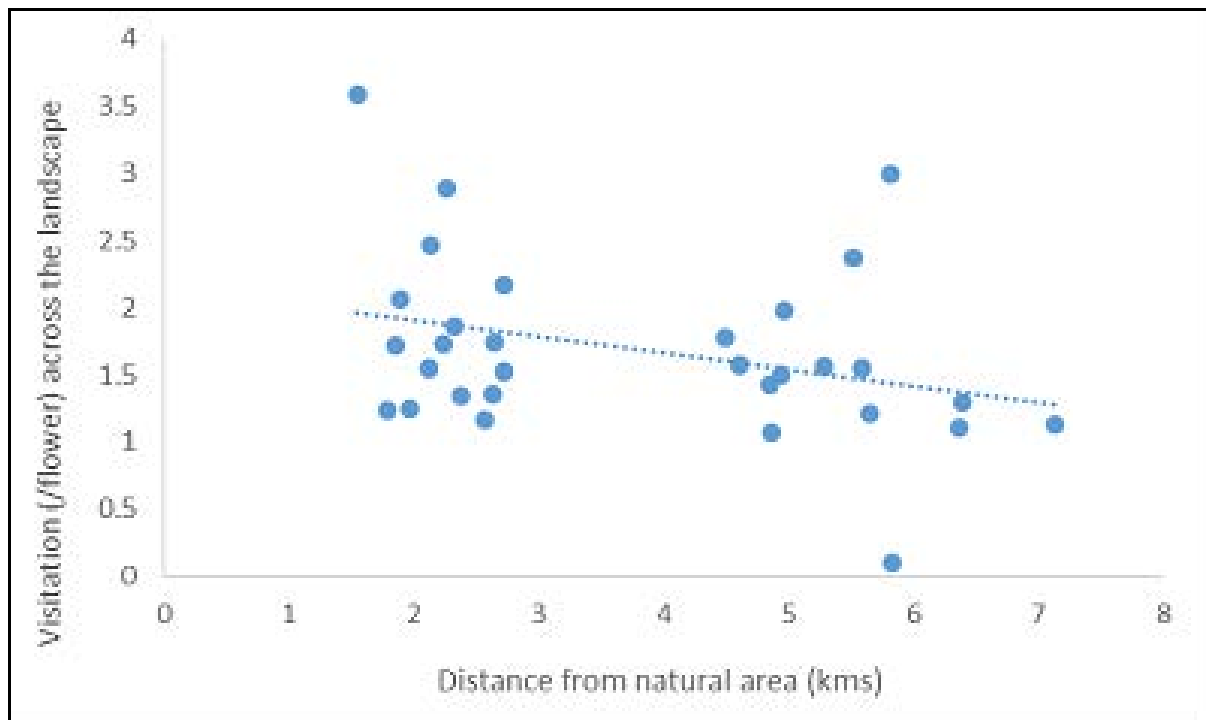


Figure 2: Relationship between distance from natural area and bee visitation patterns across farmlands, Anekal taluk, Bangalore, India

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

I have interacted with almost 40 farmers across the landscape and shared with them the significance of pollination to the productivity of crops. They are now better aware of the pollination service and also the bee species that help in this process. I have also used the bee key (made in local language) to help the farmers identify these bees and their hives.

5. Are there any plans to continue this work?

Yes, I am planning to continue the work for another year, to determine whether the results are consistent across years. Moreover, to get an idea about the effect of visitation on production of the farmlands, I am planning to look at other local factors which might be playing a crucial role to come up with a model explaining the key factors affecting the production pattern.

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

I have written a popular article to raise the issue in the public forum (<http://jlrexplre.com/explore/from-the-field/the-homo-citians-story-of-a-marauding-species>). I have presented my research problem to local audience to explain the significance of pollination process. Furthermore, I have presented my idea to the scientific community to get critical comments on my work.

I am planning to give presentations at international conferences. Results of the findings will be published in peer reviewed journals to reach out to a larger audience after collection of one more year of field data.

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 project was continued for a stretch of 18 months. The project was extended by 6 months (over and above the 12 months) from the anticipated time schedule because of the unpredictable field conditions. The detailed time schedule is given below in a tabular format.

Year	Activities	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2013	Reconnaissance Survey												
2013	Secondary Data Collection												
2013	Field work												
2014	Field work												
2014	Lab work												
2014	Spatial Analysis												
2014	Report Writing and Data 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
Per diem and wages	3530.00	3508.49	21.51	
Travel	1220.00	1149.20	70.80	
Equipment	330	301.38	28.62	
Miscellaneous Items	920.00	1040.91	-120.91	1. Extra chemicals (apart from the ones budgeted) had to be purchased for pollen tube standardisation process. 2. Bulk photocopies of bee key had to be done to circulate among the farmers for bee identification. 3. Ribbons and tags had to be purchased in bulk amount to mark the flowers at each site for fruit scoring.
Total (Rate per GBP= 90.698)	6000.00	5999.98	0.02	

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

The next important steps that need to be done to develop a comprehensive understanding of the project are:

- a. The visitation observations should be conducted for at least one more year to confirm the pattern over both spatial as well as temporal scales.

- b. The local drivers such as plot size, on-farm management practices, and proximity of semi-wild areas should be looked at to develop a model to understand the important factors affecting the visitation pattern as well as the production of farms.
- c. Spatial analyses including, fragmentation analysis at multiple time periods, land use land cover map, should be performed to get a better picture at the landscape level.
- d. The livelihood dependencies of the local communities should also be looked at to get a comprehensive picture of the effect of pollination service.

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, I have used Rufford Foundation logo in all my presentations. During my field work I had to interact with a local NGO (NWCC) at Anekal to develop my contacts. I have publicized about RSGF during my interactions. Moreover, I have publicised about RSGF during my discussions and interactions with the scientific community in Bangalore, especially in Centre for Ecological Sciences, Indian Institute of Science.

11. Any other comments?

First of all, my heartfelt thanks to Josh Cole and Jane Raymond for extending the tenure of the project so that I could finish my fieldwork to achieve my goals. Secondly, I would like to apply for the 2nd round of Rufford Foundation Grant to continue my work and get a comprehensive account of my problematic. Hope Rufford Foundation will consider my application for the 2nd round.