Final Evaluation Report

Your Details	
Full Name	Rudi Crispin Swart
Project Title	Resource and Landscape use of insects pollinating trees in natural forest fragments
Application ID	33850-1
Date of this Report	31 March 2023

1. 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
Assess tree interspecific flower resource use by insect pollinators				This has been successfully achieved and we are busy completing a manuscript to be submitted to an international journal for publication.
Assess pollinator diversity patterns in relation to forest fragments versus continuous forest				This has been partially achieved – the data has been successfully collected, but we are still busy with the sorting and identification of insect specimens in the lab. This will take another 6 months – no extra funding is required and Rufford will be acknowledged in all articles emanating from this.
Document the different insect pollinator species involved in pollinating indigenous forest trees				This has been successfully achieved and we are busy completing a manuscript to be submitted to an international journal for publication.
Measure pollination success rate of indigenous trees using seed germination rates as indicator				This has not yet been achieved due to time constraints. We hope to apply for further funding in order for us to complete this crucial step of the project, which will see the restoration of an indigenous nursery on the university campus to conduct seed germination experiments.

2. Describe the three most important outcomes of your project.

a) Southern Afro-temperate forest trees are pollinated by generalist insects of which many species are undescribed.

b) Despite being generalist, each tree species has unique assemblages of pollinators that show strong preferences for respective tree species.

c) The conservation value of southern Afro-temperate forest trees is immense, supporting a rich diversity of insect species.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

Firstly, we realised that indigenous forest tree flowering period is difficult to track, and it can not be acquired from books. To overcome this, the PI had to conduct months of field observations to ensure that focal tree species' flowering is finely monitored. This proved successful, and we ended up incorporating four different species of tree which we could study when in full bloom.

Secondly, our initial methodology suggested the use of elevated pan traps. However, we came to realise that in order for us to truly associate an insect pollinator with a species of tree (thus ensuring the baseline data of the project is as robust as possible), we needed a more direct method of observation. We decided on conducting tree climbing and observing pollinator activities at canopy level – while also collecting pollen from stamens and insect flower visitors. Rufford funding made it possible for me, as PI, to do a training course in tree climbing and to acquire all the necessary equipment. The method proved highly effective, and we are in the process of writing up our results for publication in a journal article.

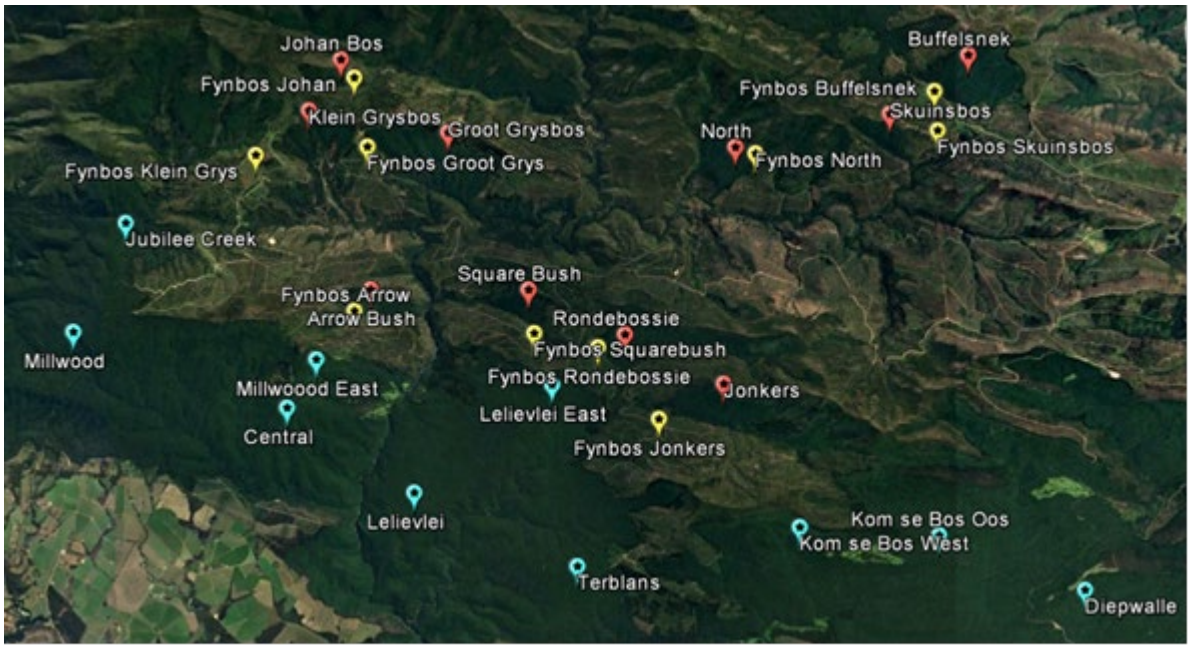

Figure 1: Layout of sampling sites include continuous forest (blue), fragmented forest (red) and clear felled / recovering fynbos areas (yellow). Pollinators have already been sampled in different canopy layers, including understory, subcanopy and canopy levels. The next step is to qualify seed viability of forest trees in these same sites.

Thirdly, although not necessarily a difficulty, was the timeline for the study. Flowering of forest trees is mostly during the spring to summer months, essentially leaving us with one season per year to conduct pollination research. The first season saw us doing the direct pollinator observations at canopy height via tree climbing. The second season saw us placing 700 elevated pan traps, over 4 months, in forest fragments and continuous forests to assess the effect of forest size and isolation in pollinator

diversity and distribution (Fig. 1). In the 2 years since funding commenced, thus, we completed two very important data collecting seasons. This unfortunately left no time to also conduct the seed germination experiments, seeing that trees only fruit ca. 6 months post flowering. It was decided to link the seed germination experiments up with pollinator diversity indices across the transformed landscape – thus, our seed germination work will only commence in mid/late 2023 for which we will write a new grant application.

4. Describe the involvement of local communities and how they have benefitted from the project.

Throughout the project, I have done public talks to advertise our research and the importance thereof. I always use the Rufford logo during my talks. The main aim of these talks is to promote the sustainability of the southern Cape landscape. For farmers, I propose planting indigenous species of tree to attract native pollinators on the premise of having increased yield in orchards. For residents, I propose planting indigenous species of tree to attract native pollinators on the premise of attracting local biodiversity back to people's gardens. Talks that I have already gave include:

1) Dendrological Society of Southern Africa – research results and encouraging indigenous planting.

2) Touw River Conservancy – research results and encouraging indigenous planting to create conservation corridors.

3) Constantia Kloof Conservancy – research results and encouraging indigenous planting to attract local biodiversity to gardens.

4) Portland Manor Farm – encouraging indigenous planting to increase pollinator diversity and Macadamia nut yield.

5) Idille Farm – encouraging indigenous planting to rehabilitate portions of farm.

Apart from public talks, I have established a non-governmental organisation, Forests for Schools, that aims to do environmental education and tree planting at local schools. We have identified 10 schools from underprivileged backgrounds across the southern Cape. We plan to conduct the school visits during arbour week (4-8 September), and I am busy obtaining donations through my talks to buy indigenous trees to plant. During these talks, I will highlight the importance of South Africa's biodiversity, the state of our ecosystems, the importance of indigenous trees in supporting local biodiversity and career options after school in the field of ecology and environmental science.

I have also voluntarily joined the George Municipality's tree advisory panel as an external expert, using results from my research to guide decision making.

When the data sorting has been done for the second field season's field work, I will report the findings to South African National Parks.

5. Are there any plans to continue this work?

We are definitely continuing this research to determine if seed viability is linked to pollinator diversity indices in the forest fragments versus continuous forests.

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

Firstly, we are publishing all results from the research in peer-reviewed journals.

Secondly, I give regular public talks where I share my research results and the implications thereof.

Thirdly, I have presented my research results at a local conference where SANParks managers and scientists were present (Garden Route Interface and Networking Meeting, October 2022) and outlined a vision for conservation corridors across the transformed southern Cape landscape. This year will see me attend and present at least one local (Entomological Society of Southern Africa) and one international conference (SCAPE).

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

The next steps are to:

1) Finalise the sorting and identification of insect pollinators sampled from continuous forest and forest fragments and write up the results for publication in a journal (in which Rufford will be acknowledged as funder).

2) Publish our results of the first field season (in which Rufford is acknowledged as funder).

3) Publish our review paper on Afro-montane forest tree reproductive traits (in which Rufford is acknowledged as funder).

4) Initiate the seed germination and viability experiments through the restoration of our campus nursery and the collection of seeds from the fragmented forest landscape (to form part of a new Rufford proposal).

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

Yes, I used the Rufford Foundation logo in all presentations given, both to the public and at conferences.

Also, Rufford is acknowledged in at least one article under review in Annals of Botany (Afro-montane review paper), a second article stemming from the first field work season that will be submitted before end of April 2023 (tree-pollinator interactions via direct observations) and a third and possibly fourth article stemming

from the current insect sorting and identification of the second field work season (pollinator diversity in relation to forest size and isolation).

During outreach to schools, the Rufford logo will also be used.

9. Provide a full list of all the members of your team and their role in the project.

Dr Anina Coetzee – host at Nelson Mandela University

Prof Sjirk Geerts – advisor at Cape Peninsula University of Technology

Mr Matthew Kingma – assistant during data collection

Miss Sinayo Lungile – assistant during data collection

Mr Zwelakhe Nkuna – assistant during data collection

Miss Flora Versteels – assistant in the laboratory

10. Any other comments?

I want to thank The Rufford Foundation. The funding availed to me through the Rufford Small Grants has significantly changed the course of my career. Through the fund, I have further pioneered canopy science in the southern Afro-temperate forests. This is a very strong motivator for me to continue along this novel path of forest canopy science. I am grateful beyond words.

One important thing to note: of my four objectives, only two are listed as fully achieved. The others are listed as 'partially achieved' and 'not achieved'. The objective listed as 'partially achieved' is still underway to be completed: Rufford will be fully acknowledged throughout the process, either when giving presentations or when publishing in peer-reviewed journals. Thus, although I submit this report as a final evaluation, exactly 2 years since funding commenced and having spent all the funds, the project is technically still ongoing. The objective listed as 'not achieved' will be the next point of focus – this will be completed during the course of the next 2 years.