

The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants 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	Alfan Abeid Rija
Project title	Seed Predation and Plant Recruitment in an Endangered Coffea Kihansiensis
RSG reference	12773-1
Reporting period	April 2013-September 2014
Amount of grant	5984
Your email address	al.rija10@gmail.com
Date of this report	29/9/2014

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
Generate information on effects of parasites on seed formation and maturity in <i>C.kihansiensis</i> population			✓	Data have been collected and some analysed. Other data still await analysis
Collect data to measure seed survivorship and postdispersal seed predation			✓	Data have been collected and analysis for seed survivorship is completed. Data analysis for postdispersal seed predation is still ongoing
Establish relationships between seed predation and plant recruitment		✓		Germination experiments have been set at only one site instead of four sites as initially planned. This is due to an unexpectedly very low seed yield recorded during the study period. We initially intended to carry out experiments in all four species sites to investigate possible effects of local habitat conditions on germination. The experiments are still being monitored until when seeds recruit into seedlings.
Statistical analysis of the data to understand patterns and relationships between various factors investigated			✓	Majority of the collected data have been analysed, but some await analysis. Seed survivorship and effects of predation on seed maturity as well as patterns of fruit removal have been completed. Data for post-dispersal predation and from the germination trials are yet to be completed.
Writing of project report and prepare manuscripts for sharing with the scientific and non-scientific communities			✓	Project report has been prepared and submitted to project funders and a detailed report is under preparation for the same. One article for sharing locally has been completed and a brochure and manuscripts for peer-reviewed

				journals are under preparation.
Disseminate information about the target species to the various stakeholders			✓	One article detailing threats facing the target species has been submitted to a popular local conservation magazine (KAKAKUONA) published by the Ministry of Natural Resources and Tourism. The ministry is responsible for making important conservation decisions in the country. Further communication of results will be done when writing is completed.

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

Largest proportion (>60%) of mature *C.kihansiensis* stems did not produce many flowers or bypassed flowering (i.e. did not produce flowers) during the 2012/2013 reproductive season which was unexpected. As a result, the very low seed yield was not sufficient to conduct field predation experiments. We instead used sterile seeds of a surrogate species (*Coffea arabica*) to test predation effects during this period so that we could avoid much delaying of the project activities. The use of *C.arabica* seeds revealed important results which could not be different when *C.kihansiensis* seeds were used. There was clear evidence that predation pressure by various animals (rodents, land crabs, insects and snails) greatly reduce potentially available seeds for plant recruitment.

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

1. There was a significant low fruit set in *Coffea kihansiensis* (Fig 1a), a phenomenon likely to limit high yield in Kihansi gorge forest.

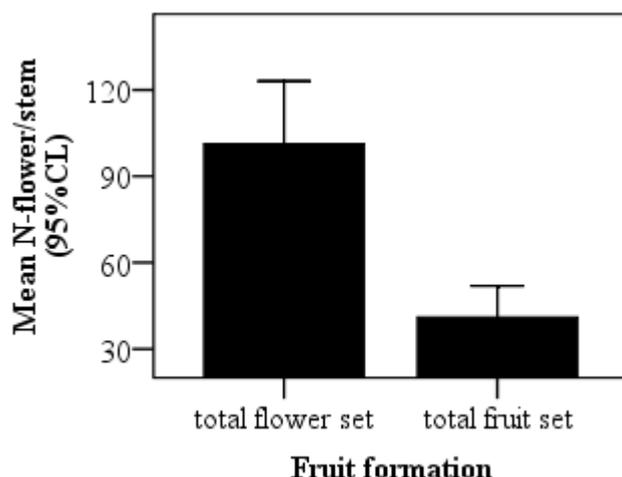


Fig 1a: The pattern of fruit development from flowers in a critically endangered *C.kihansiensis* showing significantly lower fruit set (Wilcoxon W= 6412, Z = - 5.808, p = 0.0001) from flowers during the first two months of monitoring in Kihansi gorge. These data are based on 92 coffee stems across the species range collected during the 2013/2014 flowering season.

Also, seed survivorship (Fig 1b) showed that only about 5% of the monitored coffee stems were able to produce mature fruits suggesting further that recruitment as well as range expansion by this species is partly constrained by factors affecting reproduction the most.

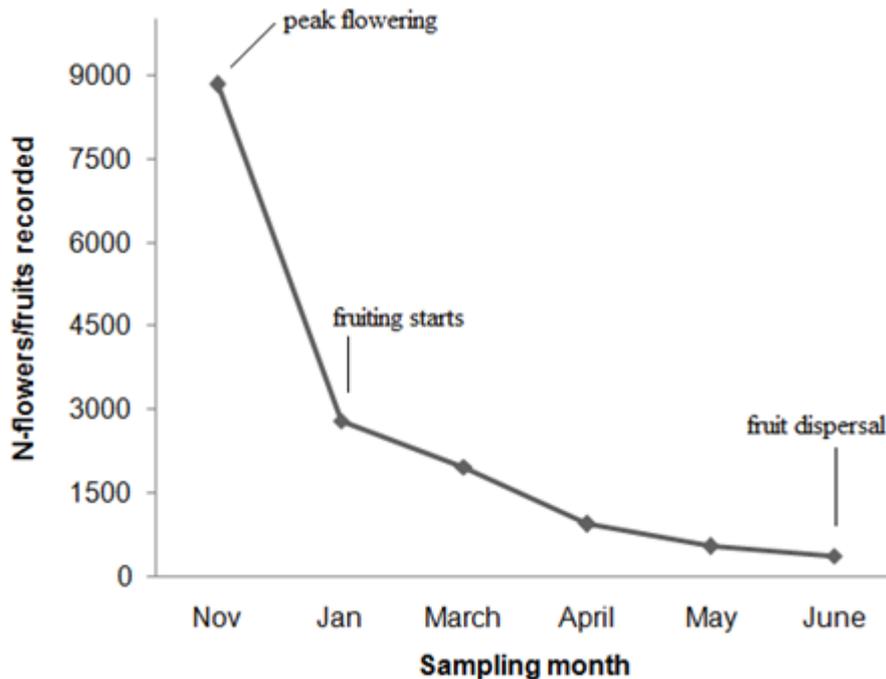


Fig 1b: Survivorship curve for the *C.kihansiensis* fruits monitored over a seven month period in the Kihansi gorge forest. Over 65% of the set flowers aborted while an additional >50% of developed fruits failed to reach maturity.

2. A significant treatment effect was evident on the fate of mature and ripening fruits, with a majority fruits under control treatment experiencing high level of seed fall or removal by predators (Kruskal-Wallis $\chi^2 = 8.234$, DF= 2, $p = 0.016$, Fig 2 a & b).

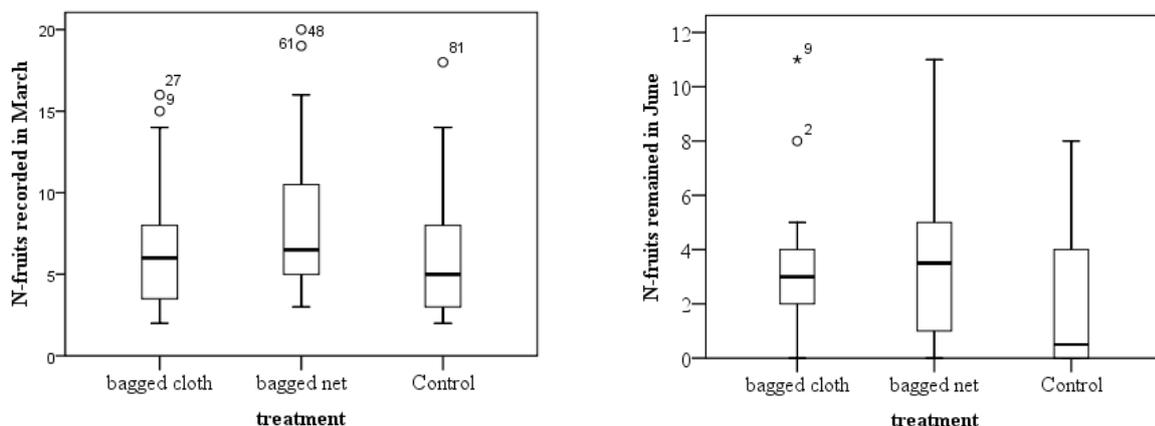


Fig 2 a&b: Recorded number of coffee berries at start of the experiment in March 2014(a-left) and corresponding number of berries remained during dispersal (b-right) in June 2014 based on sixteen monitored *C.kihansiensis* stems.

3. A generalised linear mixed model test revealed significant seasonal and habitat influences on seed predation in Kihansi gorge forest, suggesting that population decline of *C.kihansiensis* is contributed by high seed removal prior to the seeds getting favourable conditions to germinate.

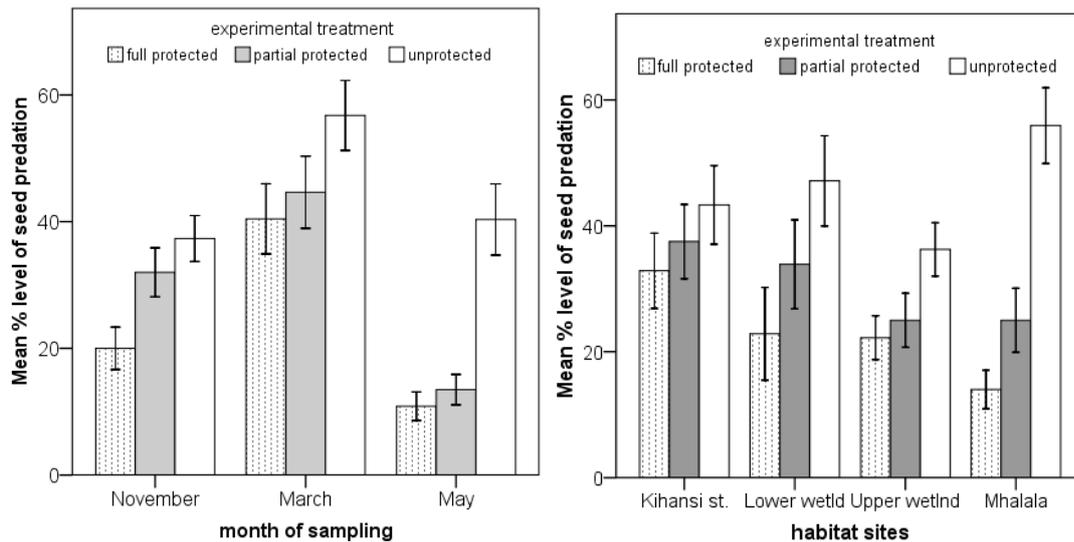


Fig 3. Patterns of post-dispersal seed predation in the Kihansi Gorge forest showing a significant seasonal (left fig; Wald $\chi^2 = 325.054$; DF = 1; $p = 0.0001$) and habitat (right fig; Wald $\chi^2 = 3179.114$; DF = 3; $p = 0.0001$) influences on predation of *Coffea* seeds. These results are important especially when planning for species restoration in the area.

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

All field work was conducted with the help of local field biologists funded by this research grant. Mr Person Kalenga is resident from Chita village located nearby Kihansi gorge forest and was trained in field methods and data collection in this project. Person will be instrumental in future conservation research work in this area. Also two Tanzanian fresh graduates, Mr. Gaudence Munga (Bsc Forestry-Sokoine University of Agriculture) and Mr. Abubakari Said (Bsc Wildlife Management-Sokoine University of Agriculture) were hired by the project and learned important practical skills related to the management of threatened species. Abubakari has recently been awarded a TROPIMUNDO fully-funded scholarship to pursue master degree course in Italy and Belgium. Mr Munga has also recently secured permanent employment as forest officer with the Ministry of Natural Resources and Tourism. Munga will use acquired skills to foster biodiversity conservation in his new area of work. The skills learnt by both whilst funded by RSGF have been instrumental in the success of their applications.

5. Are there any plans to continue this work?

Yes. This preliminary research work has revealed that the endangered *Coffea kihansiensis* is presently under increasing threats affecting important plant's life cycle stages from seed germination, tree growth to plant reproduction. Analysis has shown that high pre-and-post dispersal seed predation contributes significantly to reducing potentially available seeds for self-propagation by this species. Further field observations confirmed high floral and fruit abortions (fig 1 in # 3 above) but the causes of this are still unclear. Also, it is not clear about what factors regulate pollination in this critically endangered species, and whether or not declined environmental conditions such as water and nutrients limitations may be regulating reproductive performance in *Coffea kihansiensis* population. It is anticipated that the completed work will catalyse the start of a much greater funding investment to investigate these questions. Therefore it is hoped that future research will provide broader understanding of the factors limiting pollination and reproductive performance in this species to foster appropriate decisions to ensure long-term survival of this critically endangered species.

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

Results from this work will be communicated to the public, decision makers and scientific community through: (i) published articles in popular publications. One article with a title 'Uncovering threats to enlighten the future of an endangered Kihansi wild coffee *Coffea kihansiensis* in Southern Udzungwa Mountains, Tanzania' has been submitted and is presently under consideration for publication in a popular local Wildlife and Nature Conservation Magazine, KAKAKUONA in Tanzania. The paper is published by the Ministry of Natural Resources and Tourism (MNRT) and is read countrywide and abroad; (ii) Presentation at a scientific conference in Cambridge, UK in March 2015; and (iii) through peer-reviewed journal to reach a wider scientific community. Further a brochure prepared in Kiswahili language (currently under preparation) is intended for the local government offices to raise conservation awareness in the villages surrounding the Kihansi gorge ecosystem.

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

The duration of this project was 18 months which is beyond the 12 months initially planned. This is because the start of the funding (April 2013) did not coincide with the flowering season for *Coffea kihansiensis* (September through December). Thus we had to wait until then to start field experiments.

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
Travel from Morogoro to Kihansi as well as fuel cost for running vehicle during field data collection	1093	1177	84-	Two field trips involved buying fuel to ferry field equipments from Morogoro (base station) to Kihansi using vehicle provided by Sokoine University of Agriculture.
Purchase materials for field experiments	740	740	0	Budget used as planned.
Project running materials(rim of paper, communication, field note books, pen/pencil printing/photocopy, rain coats and safety boots for forest research work	420	500	80-	Purchased rain coats and safety boots for field assistants as most of the work was done during rainy season. These were not included in the original budget
Accommodation in the field	1817	1817	0	Budget used as planned
Printing reference materials (journal articles)	50	50	0	Budget used as planned
Report Production and dissemination of results	300	110	190+	This balance will be used to complete the remaining work to produce three articles and brochure are still in preparation and for result dissemination
Field allowances for field assistants(two research assistants and camp attendant)	1024	1310	286-	Cost of camp attendant was higher than initially budgeted. We also paid porters during each field trip to help carry supplies as it involves significant hiking to rich a project site.
Publication cost	200	0	200+*	*This money will be used to cover for some costs of publication as manuscripts are still in preparation.
Travel to organise for outreach programme with relevant stakeholders	340	80	260+	A meeting was held in Dar es Salaam to discuss about project results with Kihansi forest Management authority. The balance was used to cover extract costs used for Kihansi field trips in item one.

Total	5984	5984	
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9. Looking ahead, what do you feel are the important next steps?

The next step is to continue analysis of remaining data and preparation of project results for sharing with various stakeholders. Additionally, the current research has revealed high floral and fruit abortion in the study population. More research funding is required to investigate further into the reproduction process of this species. It appears that the population dynamics of the endangered Kihansi coffee is most likely regulated by factors limiting reproduction. Applications are underway for more funding to investigate into the pollination functions and establish predispersal floral mortality and fecundity rates in *Coffea kihansiensis*.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

No, but RSGF funding has been fully acknowledged in an article currently under consideration for publication as mentioned in # 6 above. The RSGF logo will be used in other resulting publications which include a brochure, conference presentation as well as in peer-reviewed publications.

11. Any other comments?

We greatly acknowledge the funding support from the RSGF to conduct a conservation research in Kihansi gorge forest. The generated data will guide informed decisions for long-term conservation plans. We would like to continue collecting more data to investigate the factors causing high floral and fruit abortions observed during this research. We hope for RSGF's continued financial support to collect more information about this critically endangered species. Appropriate conservation measures for this species and threatened Kihansi ecosystem will most certainly rely on these data.