

# 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	Carrie Seltzer
Project title	Disrupting dispersal? Consequences of seed harvesting for natural regeneration of an economically important tree in the East Usambara Mountains, Tanzania
RSG reference	9309-1
Reporting period	January 2011- January 2012
Amount of grant	£5996
Your email address	<u>carrieseltzer@gmail.com</u>
Date of this report	6 January 2011



**1.** Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not	Partially	Fully	Comments
	achieved	achieved	achieved	
Establish experimental plots			x	Twelve 50 x 50 m plots with at least four fruit-bearing Allanblackia trees were established in the Amani Nature Reserve. GPS coordinates were recorded and corners were marked with flags.
Manipulate seed/fruit abundance		X		Fruit abundance among plots was highly variable, so our movement of fruits did not result in clear high, medium, and low densities among plots.
Tag and track the fate of seeds		x		1152 seeds were tagged and followed as long as possible. Unfortunately, more seeds than expected were separated from their tags resulting in unknown fates.
Use cameras to record seed dispersers			X	Bushnell Trophy Cams were used to photograph animals that dispersed a subset of the tagged seeds.
Support a Tanzanian Masters student to study Allanblackia		x		Beatrice Amosi, a MSc student in Biodiversity Conservation at the University of Dar es Salaam, Tanzania, was recruited to work on Allanblackia. She will be doing a demographic study instead of seed trials, and will do field work Jan-Mar 2012.
Make management recommendations		Х		We will be able to do this with our data, but analysis must be completed before recommendations can be made.

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

There were many logistical lessons learned from this project that are worth sharing.

Number of blocks- Each block consisted of three 50 x 50 m plots, and blocks were separated by at least 700 m. All plots in each block needed to be visited frequently to follow seed fate, especially just after the seeds were put out. We realised that it would be nearly impossible to revisit more than one block per day to check seed fate. If we did six blocks, seeds could be revisited at most every six days. We reduced the number of blocks to four so that each could be visited every four days.

Establishing plots- The original plan was to randomly locate plots within blocks. However, this was not possible because female, fruit-bearing *Allanblackia* trees are not evenly distributed in the forest. Each plot had to have at least four *Allanblackia* trees with fruit to ensure that there was some natural fruit fall for us to manipulate. Instead of using random points, we walked on random bearings until we found an area with enough fruiting *Allanblackia* trees to establish a plot. During this process, we found that the ratio of fruitless to fruiting trees is approximately 2:1, which was



corroborated by other *Allanblackia* researchers as the typical ratio of male to female trees in the forest.

Number of seeds per plot- The proposal was to have 100 seeds per plot simultaneously in four arrays of 25 seeds each. First we realised that 25 seeds per array is too many, as the threads get tangled and crossed which makes it difficult to remove the threads from eaten or lost seeds. Secondly, it would take more than one day to locate and record fates on 300 seeds in one block (100 per plot was just too many to do simultaneously). We revised the methods to do two rounds (one in March and one in April) of 16 seeds per array with three arrays per plot. This resulted in 48 seeds per plot per round, for a total of 96 seeds per plot and 1152 tagged seeds total for the experiment. It took 50-60 person hours to prepare 576 seeds before putting them in the field.

Manipulation of seed/fruit abundance- Each block had three plots that were supposed to represent low, medium (control), and high fruit/seed abundance by moving all ripe fruits from the "low" plot to the "high" plot every four days. We carried out this plan, but the natural variation in fruit fall among plots meant that our manipulations did not at all result in clear low, medium, and high fruit/seed abundance. For example, some control plots had very low fruit fall. We recorded the number of new ripe fruits added to each plot on each visit and will use this information in the analysis, but it means that fruit abundance cannot be treated categorically as originally planned.

Seeds and tags- Seeds were tagged and tracked by drilling a small hole (avoiding the embryo), securing a short length of wire, affixing a fluorescent yellow Tyvek wristband near the end of the wire, and tying the end of a thread from a bobbin buried in the ground. The wires did not break. Instead, at some sites the rodents broke the seed in order to separate it from the tag. We know that these seeds were not necessarily eaten, and seeds with minor damage are still able to germinate. Therefore, we could not assume that tags found without seeds were instances of seed predation, and have designated the fates as "unknown". We may be able to estimate the proportion of these "unknown" seeds that were cached, re-cached, or eaten based on the seeds for which fate is known. Additional experiments- In addition to the proposed method, two complementary projects were also done. The first compared removal of tagged and untagged seeds (50 each), and was done before the large-scale experiment. The second was done concurrently with the large-scale experiment with tagged seeds in the same plots. Forty untagged seeds were shallowly planted in each plot to determine the potential for direct sowing programs in the forest to offset heavy human harvest.

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

1) *Cricetomys gambianus,* the giant pouched rat, was the species most commonly recorded removing *Allanblackia* seeds (79% of 1514 photos) in Amani Nature Reserve. Further analyses will link the fate of individual seeds to their dispersers to quantify the effectiveness of different animal species.

2) Based on preliminary analysis, larger *Allanblackia* seeds were more likely to be cached (saved for later) compared to smaller seeds. Further analysis will allow management recommendations to the Amani Nature Reserve and other stakeholders.

3) We established plots and a protocol to enable this experiment to be repeated in other years.



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

This project financially benefited several people who live near Amani Nature Reserve. I employed two local field assistants full-time who I have worked with since 2009. Additionally, I hired another local villager on a temporary full-time basis to assist with the project (he went on to find full-time employment with a biodiversity project on Mt. Kilimanjaro), and had a handful of people who I employed for a few of days to help prepare seeds for the experiment. These individuals have experience that will help them find employment again with this project when it continues, or with similar projects.

The long-term plan is for this research to benefit the local communities by resulting in management strategies for the Amani Nature Reserve that ensure the sustainability of *Allanblackia* seed harvest, but recommendations have not yet been made.

## 5. Are there any plans to continue this work?

Beatrice Amosi (Masters Student, University of Dar es Salaam, Tanzania) is planning to complete her field work January-March 2012. The initial plan was for her to do her field work in September-November 2011, but for family reasons the start of her field work has been delayed. She will be doing a demographic survey of *Allanblackia*, which is an important complement to work on seed dispersal.

Due to the inter-annual variation in *Allanblackia* fruit production, it is important that this project be repeated in other years. Since I am nearing the end of my PhD, I do not plan to have another field season. However, most of the equipment necessary to repeat the project remains at the field site, so only a modest amount of additional funding would be required for a Tanzanian student to continue and repeat the project. I will gladly assist any Tanzanian student in the logistics of repeating this project, and will work with Dr. Henry Ndangalasi (Botany, University of Dar es Salaam, Tanzania) to recruit students.

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

I have plans in place for these results to reach a scientific audience, *Allanblackia* managers, undergraduate students, and the general public. I presented preliminary results as a poster at the 96<sup>th</sup> Annual Meeting of the Ecological Society of America (ESA), and will give a talk at the 97<sup>th</sup> ESA meeting in August 2012. We plan by that time to have the results submitted to a journal for publication. I will send a copy, along with a more targeted summary, to the conservator of the Amani Nature Reserve and the *Allanblackia* project team from the World Agroforestry Institute. I am scheduled to give a talk about my research to undergraduates at Earlham College, Indiana (USA) in March. While there, I will work with Earlham students to perform a dance depicting dispersal of *Allanblackia* seeds by a giant rat. The dance will be videotaped, edited, and submitted to the 2012 Dance Your Ph.D. contest (see <a href="http://gonzolabs.org/dance/">http://gonzolabs.org/dance/</a>).

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

Most of the funds were used in the first 3 months of the project, because that was the time when all of the equipment was purchased and when the bulk of the field work was completed. The seeds were monitored monthly until September, when monitoring switched to bi-monthly. At present,



only nine tagged seeds remain (three have germinated). Seeds will be checked again in January and March of 2012. At that point, we will assess whether or not to continue monitoring. The seed tagging was not repeated in Oct-Nov because we realized there would be very, very few ripe fruits (indeed, none were observed in the field). The seed monitoring period has been extended about 3 months past what we originally intended. The data analysis will continue into 2012.

We anticipated that Beatrice Amosi would have completed her field work by the end of 2011, but it has been delayed. Her plan is to complete data collection from late January to March 2012.

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	Actual	Difference	Comments
	Amount	Amount		
Airfare from Chicago to Tanzania	1013	900	+113	Cheaper airfare was found.
Amani Nature Reserve fees	728	639	+89	I spent fewer days in the forest than expected.
Field assistant salaries	763	1156	-393	Salaries were originally calculated for 5 months, but 11 months were needed. Some of the difference was made up by lower costs for additional labour.
Motorbike hire	949	755	+194	Only one motorcycle instead of two was needed during months when I was not present for seed monitoring.
UDSM student fees, living expenses, transportation	801	823	-22	A lump sum of \$1300 has been given to Dr. Ndangalasi for Beatrice Amosi's field work.
Motion-sensitive cameras	1519	1065	+454	A superior and less expensive type of camera was purchased instead, and only 10 cameras were needed because of reducing the number of plots.
Camera batteries and charger	225	104	+109	AA batteries instead of D batteries were needed, which are less expensive.
Misc supplies (camera locks, memory cards, thread, flags, etc)	0	580	-580	Savings on the cost of cameras and batteries allowed us to purchase many important miscellaneous items to secure the cameras (i.e. locks) and tag the seeds (e.g. wire, flags, threads, planting tags, etc).
Total	5996	6022	-26	

1 GBP = 1.58 USD = 1490 TZS

Expenses in excess of 5996 GBP were covered by funds from a US National Science Foundation Integrative Graduate Research Traineeship.



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

A large amount of time-series data were collected, so completing the analyses is the most immediate next step. The goal is to have the analyses finished and a manuscript submitted in April or May. These results will be presented at the August 2012 meeting of the Ecological Society of America. Beatrice Amosi (MSc candidate, University of Dar es Salaam, Tanzania) will be doing her field work in early 2012. Her results will determine whether or not Allanblackia recruitment has been affected by harvesting.

The variability of ecological interactions across time makes it important to repeat the seed removal experiment in other years. For example, 2011 was a low fruiting year for *Allanblackia* with a drought at the beginning of the year, followed by heavy rains at the end of the year. These conditions inevitably influenced our results, but only after several seasons of data will we begin to understand how. I plan to work with Tanzanian colleagues to help them continue the project.

This project also made me realize how little is known about *Cricetomys* spp. in their natural habitat. For example, basic biology such as foraging ranges are not published. Since *Cricetomys* are the most common disperser of *Allanblackia*, understanding more about their behaviour (such as the scale at which they perceive food abundance and make foraging decisions) will enable even better experimental design in the future. So far the project has only focused on what happens to *Allanblackia* from *Allanblackia* harvesting, but there is potential for it to affect recruitment of other plant species that fruit at the same time if rodents shift to other food sources when *Allanblackia* is scarce. There are numerous possibilities for developing related projects to investigate the impacts of seed harvesting.

# **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?

I used the RSGF logo on the poster I presented at the Ecological Society of America meeting in August 2011 (submitted separately as a pdf). RSGF is also mentioned on my website and will be acknowledged in all subsequent presentations and publications.

### 11. Any other comments?

I am immensely grateful to the Rufford Small Grants Foundation for supporting this research. I look forward to continuing the collaborations that this grant facilitated, and to encouraging Tanzanian students to consider RSGF for funding to support their work in conservation.