

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. 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. 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	Aline Cavalcante de Souza
Project title	The distribution and abundance of the keystone palm <i>Euterpe edulis</i> along an altitudinal gradient in the Atlantic Forest hotspot
RSG reference	13864-1
Reporting period	2 May 2014/ 2 May 2015
Amount of grant	£5286
Your email address	cs.aline@gmail.com
Date of this report	12 May 2015

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
Population dynamics along an altitudinal gradient			X	In the beginning a total of 1459 individuals were censused. The density of <i>Euterpe edulis</i> in the high altitude is lower, so we need to use more plots to have a representative sample.
Reciprocal sowing experiments			X	We used a total of 1600 seeds of <i>E. edulis</i> to do this experiment. But we have to collect around 2000 seeds, because some seeds are not viable. We had to collect the seeds on the ground, because some reproductive individuals are very tall, reaching 15 m of height.
Seed addition experiments			x	In each seed addition experiment we used a total of 400 seeds of <i>E. edulis</i> in each area. But we have to collect around 600 seeds, because some seeds are not viable. We had to collect the seeds on the ground, because some reproductive individuals are very tall, reaching 15 m of height.

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

At the beginning of the experiment, we were aware that we would deal with seed predators, because many experiments with seeds in the field reported this problem. Therefore, we decided to use both buried and not buried seeds in the seed addition experiments and in the reciprocal transplant. For not buried seeds, we used a cage and mesh to protect the seeds against seed predation. In two areas, at Reserva Ecológica de Guapiaçu and at Parque Nacional da Serra dos Órgãos in the low altitude, we observed that some not buried seeds were predated. At Reserva Ecológica de Guapiaçu, the predator is a very small beetle, so it is very difficult to avoid seed predation, even using a mesh. In the other area, the predator is a small rodent. Thus, the solution that we have found was use the data from buried seeds, since these seeds were protect against predators.

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

We verified in the reciprocal transplant experiment that there is no influence of the seed origin, maternal effect and genetic difference, in the seedling establishment in the two locations for both populations of *Euterpe edulis*. Thus, was observed non evidence for local adaptation in the two populations of *Euterpe edulis* located at different altitudes. Otherwise, we verified that the local where seeds were sowed influence the seedling establishment of both populations, since the seedling emergence was higher at the higher elevation. Probably this result is due because at higher elevation the temperature is lower and the precipitation is higher, providing a higher water availability to seedlings than the lower altitude. Through this experiment, was possible to verify a low performance of both populations at *E. edulis* in the lower altitude where the temperature is higher. Thus, this result suggest that with global warming, the persistence it will depend primary on the migration of populations of *E. edulis* to higher altitude, since was not observed any evidence of local adaptation e/or plasticity that provide a high performance for both populations in the lower altitude where the temperature are higher.

In the seed addition experiments at different times in the two populations of *E. edulis* located in different altitudes, we observed that at higher elevation the time of seed dispersal not affected the seedling establishment of *E. edulis*. The seedling emergence and seedling survival were similar across the different times of seed addition in this location. Probably this result is due because at higher elevation the temperature is lower and the precipitation is higher almost the entire period of seed dispersal, thus providing a higher water availability to seedlings for a long period of time. In the other hand, we verified that in the lower altitude an opposite pattern. The time of seed addition, affect the establishment of seedling of *E. edulis*, since we verified that the emergence and survival of seedlings were different across the different times of seed sowing. Besides, the seed addition with the highest emergence and survival of seedlings were at the end of the dry season. Probably this pattern is due because in the lower altitude the period of high water availability is shorter that at higher elevation. In other words, the environment is more variable in the lower altitude, since we not observed a high precipitation during the entire period of seed dispersal. The highest emergence of seedlings from the seed addition during the end of the year, probably is because seedlings were expose to a higher period of water availability, since they were exposed to the entire rainy season.

The study of population dynamics of the two populations of *E. edulis* along a short altitudinal gradient in the first transition years, showed that the population growth rate determined by the matrix population model were not different from unity ($\lambda=1$). However, on the next year, the seedling recruitment rate was much higher in the lower elevation where the density of *Euterpe edulis* is higher than in the high altitude with a low density of this species. However, seedling mortality rate not differed between the two populations. The mortality rate of individuals of *Euterpe edulis* was lower in the later ontogenetic stages in the two populations. Thus, a lower fecundity was the only vital rate that decrease at the upper elevation limit of this species. Other process can be involved in the creation of the elevation limit of *E. edulis*, like dispersal limitation. Another factor can be that extreme conditions that exceed the tolerance of *E. edulis* may occur in few years, so it is necessary a longer period of study to observe a decrease of performance at its elevation limit.

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

Since the beginning of the fieldwork, we interact with common local people, manager and employees of the reserves. However, for me, my involvement with the common local community was more important than with the managers and employees of the reserves, since they do not know how important *Euterpe edulis* is to the ecosystem function. This is a huge problem in Brazil, since many local people still with the practice of illegal logging of this palm just to eat the palm heart. Besides that, my interaction with the local people was very important to the realization of my work, since they know the location of the populations of *Euterpe edulis*, and the period of fructification, so they work with us during the whole project as field guide. Thus, we interact in each area with a local field guide. The important information that we taught to these field guides was that they were supporting a study with an endangered species that has a very important ecological function, because its fruits are a key resource in Atlantic Forest hotspot. Thus, was possible to them understand why it is important to conserve this palm and pass this information to the local community. Besides the field guide, we interact with the managers and employees of the two reserves (Ecological Reserve of Guapiaçu and National Park of Serra dos Órgãos), since they were always interested about our work in the reserve, and they were always supporting us in many stages of the project. Besides that, the managers always invite us to present our work during conferences at the reserves. I intend to present my final report at the end of this year at the annual meeting of researchers at National Park of Serra dos Órgãos.

5. Are there any plans to continue this work?

Yes. We will continue to sample the two populations for the study of population dynamics, and we will continue to check the seed addition experiment and reciprocal transplant until the end of this year. Currently, I am analysing the collected data, and starting to write my PhD thesis. Later I will start to write the papers and the final work it will be to publish this work as papers in scientific journals.

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

I intend to share my results as a poster this year at Ecological Society of America meeting, to be hold in Baltimore in August 9th - 14th 2015. Besides, the results of my work will be share through my PhD thesis on March 2015. Later, I will publish my results through scientific papers.

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

The RSG will be use as I planned from the beginning.

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
Subsistence / Meals for researchers needed monthly for	2.880,00	2.500	380,00	The difference will be used during this year at the last

field work				fieldwork.
Accommodation/ Accommodation for researchers for field work for each month in Serra dos Orgãos National Park	192,00	140,00	52,00	The difference will be use during this year at the last fieldwork.
Accommodation/ Accommodation for researchers for field work for each month in Reserva Ecológica de Guapiaçu	432,00	390,00	42,00	The difference will be use during this year at the last fieldwork.
Transportation / Bus transportation of researchers between the cities of Rio de Janeiro and Teresópolis, Brazil, for each month	816,00	680,00	136,00	The difference will be use during this year at the last fieldwork.
Transportation / Bus transportation of researchers between the cities of Rio de Janeiro and Cachoeiras de Macacu, Brazil, for each month	768,00	640	128,00	The difference will be use during this year at the last fieldwork.
Expendable supplies	198,00	198,00	0	
TOTAL	5.286,00	4.548,00	738,00	

Currently local exchange rate: 1 Brazilian Real = 0, 21 £ sterling

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

The final and more important steps that I wish from my project is publish these results as scientific papers. Besides, I had a good experience with this project, professional and personal, that I intend to use in the next scientific projects of my career. However, as I worked with an endangered and important ecological species, and it has a significant personal meaning to me, I wish to share with the local communities how important is the conservation of this species.

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?

Not yet. However, I intend to use the RSGF at Ecological Society of America meeting, to be hold in Baltimore in August 9th – 14th 2015

11. Any other comments?

We want to thank the Rufford Small Grant for the financial support. We are very grateful to Rufford, since thanks to this support was possible to accomplish this project! I am very proud to interact with the amazing Rufford Foundation. Congratulations for your care about the conservation of biodiversity around the world. Cheers!!