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	Francisco E. Fontúrbel
Project title	Tracking the monito del monte (*Dromiciops gliroides*) on native and transformed habitats: consequences for seed dispersal
RSG reference	14669-2
Reporting period	January 16th 2014 – January 16th 2015
Amount of grant	£ 5,600
Your email address	fonturbel@gmail.com
Date of this report	January 16th 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
Capture *Dromiciops gliroides* in native and transformed habitats and fit captured individuals with telemetry transmitters			X	I needed at least 10 *Dromiciops gliroides* individuals (five at each habitat type) to conduct the telemetry tracking. With a sampling effort of 576 trap-nights, I captured 12 individuals, five at the transformed habitat and seven at the native habitat, reaching the required capture quota, and allowing to install the telemetry transmitters as planned.
Track transmitter-fitter individuals in native and transformed habitats			X	Intensive tracking was successfully performed for 12 days (from February 12th to 24th) during the whole night (23 to 05 h). I obtained 1,042 fixes at the native habitat and 1,166 at the transformed habitat; from those I obtained 244 reliable locations at the native habitat (37 to 71 locations per individual), and 316 reliable locations at the transformed habitat (43 to 72 locations per individuals). In both cases, total error ellipses were < 1.25 ha (mean ± 1SE error ellipse = 0.36 ± 0.13 ha).
Quantify resource (i.e., fleshy fruits) abundance and diversity in native and transformed habitats			X	I mapped, identified (to species level) and quantified the number of ripe fruits of 113 plants, 110 at the transformed habitat (comprising eight species) and only three at the native habitats (all corresponding to *Mitraria coccinea*; *Lapageria rosea* plants had no ripe fruits at the sampling time).
Estimate *Dromiciops gliroides* home ranges and core areas in native and transformed habitats			X	I estimated mean home ranges (using a fixed kernel estimator at 90%) to be 0.71 ± 0.26 ha at the native habitat and 0.76 ± 0.31 ha at the transformed habitat. Core areas (fixed kernel at 50%) were estimated to be 0.19 ± 0.08 ha at the native habitat and 0.20 ± 0.09 ha at the transformed habitat. There were no significant differences in any case.
Assess the spatial aggregation degree of mistletoes in native and transformed			X	I conducted a point-pattern analysis using the approach of Wiegand & Moloney (2004), considering a Poisson heterogeneous model and comparing

habitats				the observed *Tristerix corymbosus* aggregation at both habitats with a null model. Despite mistletoes were aggregated at both habitats (as expected for parasite plants), aggregation at the transformed habitat was more conspicuous.
Determine the correspondence of resource location and animal movement			X	I determined that *Dromiciops gliroides* locations tracked the resource (i.e., plants with ripe fleshy fruits), this was performed by comparing the average distance and the distance to the nearest plant from each actual telemetry location and from a set of random points (in equal number than the locations). In both cases, the distances to the resource were significantly lower in both cases when compared to random points. As there were only three plants with ripe fruits in the native habitat at the time of the sampling, I have conducted this analysis only for the transformed habitat data.
Share the information with the community			X	The educational programme was an important part of this project. Altogether with the fieldwork and data analysis, I prepared a set of educative materials about plant-animal interactions, which were distributed in those elementary schools where I gave talks about plant-animal interactions, their importance, and the main threats that they are facing.

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

Fortunately, I had no major difficulties during the fieldwork or data analysis. The major risk was not capturing enough individuals to conduct the telemetry assessment, but based on previous experiences on the same study site, I have enlarged trapping grids to cover a larger area, pre-baited the traps (while closed) a month before starting the captures, and monitored *D. gliroides* responses to the live traps using camera traps. Using those improvements, the required number of animals was reached without problems. From that, I learned an important lesson: in remote places such as the Valdivian Coastal Reserve, where human activity is minimum and sporadic, capture success could be influenced by the daily activity of the researcher (there is a short note about this under review in the Bosque journal). A minor difficulty was found when assessing the resource offer at the native habitat: there were too few plants with ripe fleshy fruits. As old-growth native forest stands are dominated by large *Nothofagus* spp. trees and sub-canopy Lauraceae trees, fleshy-fruited plants are

less abundant than in disturbed or second growth stands. Therefore, my team and I spent many hours conducting the resource offer assessment in this kind of habitat and we only found three *Mitraria coccinea* plants with ripe fruits. The most abundant fleshy-fruited plant in native forest stands is the vine *Lapageria rosea*, which is consumed by *D. gliroides* (in a previous assessment, I have found seeds of this species in *D. gliroides*' faeces) but at the time of the sampling their fruit were unripe. In consequence, I was able to conduct the spatial association tests for the transformed habitat only.

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

First, my telemetry results showed no behavioural changes of *D. gliroides* in transformed habitats, contrarily to what was initially expected. Home range and core areas were very similar between habitats, and they were also similar to those estimated for another locations in Chile and Argentina. Therefore, the mistletoe aggregation pattern detected at the transformed habitat is not emerging from changes in the disperser movement behaviour, as predicted by the Morales et al.'s (2012) model. This open new questions about the ecological factors determining mistletoe success in transformed habitats, which may be related to host quality (I am currently working to answer this question).

Second, I found a relationship between *D. gliroides* locations and fleshy-fruited plants, which was significantly different from a random process. When compared to a set of random points (with the same sample size than actual telemetry locations), both mean and nearest neighbour distances were significantly lower, suggesting that movements on the tracked individuals are determined, at least in part, by the resource distribution. We also took some telemetry fixed during the day to determine where tracked individuals were sleeping and those locations were always on native vegetation. Based on that evidence, I propose that *D. gliroides* is playing a major role as a regeneration agent of the native vegetation in native habitats. Further, as those *Eucalyptus globulus* plantations are unmanaged from ca. 20 years, our transformed system (i.e., abandoned *E. globulus* plantations + secondary native understory vegetation + biological invasions such as *Ulex europaeus, Vespula germanica, Rubus ulmifolius* and *Rattus rattus*) met all conditions to be considered as a novel ecosystem (after Seastedt *et al.*, 2014 definition), particularly on being a self-sustaining system, where the relict and near-threatened marsupial *D. gliroides* seems to be playing a key role, relevant for recovery and management plans.

Third, based on my research results, the mutualistic triad composed by the mistletoe *Tristerix corymbosus*, its pollinator the hummingbird *Sephanoides sephaniodes*, and its seed disperser *Dromiciops gliroides*, have been included as conservation object and ecological indicator in the new management plan of the Valdivian Coastal Reserve (ca. 50,000 ha), which currently protects about the half of the Valdivian rainforest in southern South America. This is a major advance in transferring research results to public policies, particularly considering that the Valdivian Coastal Reserve works together with the Chilean Park Administration bureau (CONAF) through a partnership that allowed creating the Alerce Costero National Park.

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

As in my first RSGF project, park rangers were involved in this project, aiming to build capacities and to be a link with the local communities. As a continuation of our previous work, I also conducted

extension and outreach activities by giving talks at elementary schools and socialising the educative materials produced in this project; more details, pictures, and downloadable materials could be found at: http://sites.google.com/site/ecoevolutionary/community-involvement.

5. Are there any plans to continue this work?

Yes, I am still working on this system. Currently, I have a postdoctoral project (funded by the Chilean government) that pursues the development and standardisation of molecular markers (i.e., microsatellite markers) for *Tristerix corymbosus*. Such molecular information will provide the link between the animal movement patterns observed here, and the plant spatial arrangement. Once molecular markers are ready, I intend to expand the sampling area covering a wider part of *T. corymbosus* and *D. gliroides* distribution range. Such geographical expansion will allow me to compare the system's response to other anthropogenic disturbances such as fragmentation or intensive silvicultural practices.

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

During the project execution I have been sharing my results through extension and outreach activities, which comprised talks in elementary schools and the production of educative materials (charts, posters, fridge magnets, cups) that were given to the children that attended the talks. Also, I gave a seminar at the Universidad Austral de Chile in Valdivia, and I have presented two posters (one in a meeting at our university and another one at a symposium in Brazil). As part of this project, the undergraduate dissertation of Daniela Salazar will be presented in March-April 2015. I also expect to publish at least two papers in edge-leading journals.

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 grant provided by the RSGF covered the entire project timescale, since it was supported only by this grant. As I was able to achieve all my objectives, the actual length of the project matched my initial expectations, having completed in one year all the tasks related to fieldwork, data processing 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
Telemetry receivers X2 (1)	1000	991	9	There was a little price difference due to USD-GBP exchange rate variation
VHF transmitters X10 (1)	1500	1450	50	There was a little price difference due to USD-GBP exchange rate variation
GPS Garmin Map 62s (2)	320	245	75	I found another Garmin dealer with a good discount
Bus tickets (2)	330	618	-288	Bus ticket costs raised considerably during the summer

				season
4x4 vehicle rent [2]	1500	1225	275	I got a discount for booking the vehicle for two weeks
Fuel [2]	100	94	6	Within the expected cost
Food in field [2]	100	205	-105	Two additional students joined the telemetry tracking work, increasing food in field costs but improving the quality of the data gathered
Acrylic glue [2]	20	22	-2	Within the expected cost
Waterproof notepad X2 [2]	50	50	0	Within the expected cost
Field consumables [2]	100	80	20	I used some consumables that were left by another project of my lab, saving some money
Head flashlight [2]	20	19	1	Within the expected cost
Safety vest [2]	10	10	0	Within the expected cost
LOAS software [1]	100	50	50	This software was less expensive than I was initially considered
Biotas software [1]	100	105	-5	Within the expected cost
Desk supplies [2]	50	71	-21	I spent a little more money than initially considered, but the difference was covered by my own funds
Educative materials and workshops [2]	300	396	-96	I made educative materials for children and gave talks at elementary schools to socialize the information
Total	**5600**	**5631**	**-31**	

Notes to budget:

(1) Items spent in US dollars (USD). Exchange rate used: 1.53 USD per sterling pound when telemetry equipment has been bought.
(2) Items spent in Chilean pesos (CLP). Exchange rates varied from 863 to 986 CLP per sterling pound during the project execution period.

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

I think that merging ecological data (as those collected here) with molecular data would be extremely valuable to understand the ecoevolutionary dynamics underlying this study system in a changing world facing many anthropogenic disturbances. Currently I have an advance of 75% in the development and standardisation of microsatellite molecular markers for *Tristerix corymbosus*. Such molecular information will provide valuable information about genetic diversity, gene flow, population status and connectivity at landscape level. Linking that information with the telemetry and spatially explicit resource maps generated here it will be possible to depict the big picture to understand the actual threats and opportunities that the mistletoe-monito del monte interaction

faces in anthropogenic habitats. More appropriate management and conservation guidelines would be derived from such ecological-molecular integration.

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 RSGF logo in a poster presented in Brazil, a poster in a scientific meeting in our campus, and a seminar in the Universidad Austral (Valdivia), as well as in the talks and educative chart distributed in the schools. Also, RSGF has been acknowledged as funding source in my website (http://sites.google.com/site/ecoevolutionary), in Daniela Salazar's undergraduate dissertation (which was conducted in the frame of this project), and it will also be acknowledged in the papers that we are currently writing.

11. Any other comments?

This project continues the research of my first RSGF grant (10621-1). This project supported Daniela Salazar's undergraduate dissertation, which is currently in its final draft and it is expected to be presented in March-April 2015. There is one short manuscript under review in Bosque (a local ISI journal), and I intend to write and submit two additional papers during 2015. Two undergraduate students (Javiera Malebrán and Francisco Lucero) participated in the telemetry fieldwork, learning how to apply this technique to wildlife studies.