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	Francisco E. Fonturbel
Project title	Effects of habitat degradation on the monito del monte (*Dromiciops gliroides*) and its consequences on the seed dispersal interaction with an endemic mistletoe
RSG reference	10621-1
Reporting period	September 1st 2011 to September 1st 2012
Amount of grant	£ 5745
Your email address	fonturbel@ug.uchile.cl
Date of this report	September 1st2012

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
Determine *Dromiciops gliroides* abundances through live capturing at native and degraded habitats		X		Despite having a total effort of 1,530 trap-nights, live trapping yielded only six captures, three at the native habitat and three at the degraded habitat. However, I have compensated such low capture success with photographic monitoring. Using 25 camera traps, I have a cumulative monitoring effort of 2,464 days (98.5 monitoring days per camera on average), which have registered 164 *D. gliroides* photographs. *In situ* structural and microclimate measurements have been taken but the low capturing numbers precluded conducting further analyses with such data.
Quantify frugivory interaction through visit and removal rates at native and degraded habitats			X	Visit rates were quantified using trap-cameras in video mode. A total of 3,024 hours of monitoring have been conducted for 63 mistletoe plants, yielding 79 videos evidencing fruit consumption by *D. gliroides*. Removal rates were estimated from marked fruits and seed viability trials were made upon germination rates. Also, 40 bird censuses were conducted, registering 25 species (four frugivorous) in the study area, but no bird was registered consuming mistletoe fruits.
Estimate linear and non-linear selection gradients on fruit traits, related to the selection exerted by *D. gliroides* on native and degraded habitats			X	A sample of 10 fruits was taken from each monitored mistletoe. Shape, weight and sugar content traits were measured for each fruit. As a fitness proxy, I used the product of the fruit removal rate and the seed germination rate. I have determined significant linear and non-linear selection gradients, but there was no habitat effect (native vs. degraded) on the selection gradients estimated.
Generate habitat management criteria derived from the eco-			X	The results I have obtained so far showed that habitat degradation (in this particular case, the replacement of

evolutionary knowledge of the interaction marsupial-mistletoe as a model				native forest by eucalyptus plantations with a developed native understory) has a less disruptive effect than was previously determined for habitat fragmentation. Both *D. gliroides* and the mistletoe *Tristerix corymbosus* are able to thrive in such degraded stands and the seed dispersal interaction is present but reduced to ca. 25% compared to those frugivory rates obtained at the native habitat. With that information plus the results of the second year of monitoring, I intend to submit a set of management guidelines to the field site administration by June 2013, with practical recommendations in order to improve biodiversity conservation and maintaining key ecological interactions such as seed dispersal.

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

During the fieldwork, I have encountered three difficulties. (1) I was unable to define areas of native or degraded areas as a dichotomous variable since the study area presented a complex habitat mosaic of native and eucalyptus plantation (i.e., degraded) vegetation. To overcome this problem, I have registered the geographic coordinate of each mistletoe at the study area and determined the proportion of native habitat in a 250 m radius buffer using GIS and satellite imagery; the estimated native habitat proportion variable was used as a covariate on further statistical analyses. (2) Despite having installed a total of 125 live traps distributed on five 5x5 grids throughout the study area, with a cumulative capturing effort of 1,530 trap-nights, I have captured only six *D. gliroides* individuals, perhaps due to the great fruit offer in the environment that potentially have discouraged them entering into the traps. Considering that such low capture success is not enough to make any inferences about *D. gliroides* abundances and taking advantage of the camera traps bought, I conducted a photo monitoring survey at both native and degraded habitats, with a cumulative effort of 2,464 days (98.5 days per camera on average), which have yielded robust and reliable relative activity measurements used as a proxy of *D. gliroides* abundance. (3) Due to the occurrence of the El Niño Southern Oscillation (ENSO) phenomenon during late 2011 and early 2012, unusual temperature and precipitation regimes might have been responsible to delayed flowering and fruiting seasons. To overcome this situation, I had to make additional visits to the field site and reschedule my initial field dates.

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

First, my project gave new insights about the Near Threatened marsupial *Dromiciops gliroides*, which is the sole extant living species of the Microbiotheria order, and it was considered to be a habitat specialist. Live trapping may underestimate *D. gliroides* abundances or even report false negatives since many individuals are reluctant to enter into the cages. However, the trap-camera based

approach that I have used here partially overcomes such problem and gives a more accurate representation of the presence and abundance of this species, especially in habitats that were degraded due to human activities. Those findings are relevant for its conservation, since many productive areas could be managed to maintain this species, and it will also benefit the plant species that this marsupial disperse.

Second, I was able to quantify the seed dispersal interaction using video monitoring, making a more reliable estimation of actual fruit consumption. As the abundance estimations, video monitoring has the advantage of avoiding the observer's interference into animal's behaviour. In this sense, reporting the maintenance of the seed dispersal interaction at degraded sites provides a restoration opportunity for those lands degraded by human action via promoting frugivory.

Third, my results suggest that the effects of habitat degradation are less disruptive than the effects of habitat fragmentation (as was reported for Rodriguez-Cabal *et al.* in 2007, Biological Conservation 139: 195-202) in terms of *D. gliroides* abundance and its interaction with the mistletoe *Tristerix corymbosus*. Those findings also represent a restoration opportunity if we are able to manage and connect the extant temperate forest fragments, making the surrounding matrix less hostile, and promoting native vegetation recovery through frugivory.

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

Local park rangers were involved into this project, aiming to build capacities of conducting monitoring surveys based on both live and camera trapping. Additionally, park rangers are members on the communities that surround the study area and constituted an important link to them. One initial talk has been given to the children of the elementary school of Chaihuín (the municipality neighbouring the study site) regarding the diversity and importance of local fauna, and I intend to continue with talks and other outreach activities in rural schools of the influence area.

5. Are there any plans to continue this work?

Yes, I have scheduled a second year of data gathering. Fieldwork for the second year is expected to start in November 2012 and be finished in April 2013. Further, I intend to continue this research through new project in the future, examining habitat degradation consequences using molecular tools and conducting regular monitoring aiming to construct a long-term database.

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

I intend to publish at least two papers in edge-leading journals, to give at least two talks (or posters) at national / international events, and to continue with outreach talks in urban and rural schools.

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

The grant provided by RSG was used to start this project, funding an important part of the field equipment required as well as the fieldwork expenses. Despite the fact that this project was anticipated to be a 2-year research, the contribution of RSG was crucial to set the operative conditions that will allow me to gather the data of the second year. Despite the difficulties

encountered (described above in section 2), the project was coherent with the timescale originally proposed.

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
Field assistant [1]	240	100	140	I got practising students, which reduced the expenditure in field assistant salaries. I have spared £ 120 for 2012-2013 fieldwork field assistant salaries
Camera traps [2]	2500	2750	-250	Shipping and customs fees represented an extra cost for getting the cameras into the country
Memory cards [1]	200	30	170	Most cameras included a free memory card. I had to bought only four extra memory cards
Capturing traps [1]	525	510	15	Since I got five old traps repaired, I bought less new traps than initially expected
Articulate ladder [1]	100	70	30	It resulted to be less expensive than I previously have considered, due to currency exchange rates differences
Notebook [1]	1000	1300	-300	The residue was covered with additional resources
Waterproof clothes [1]	130	400	-270	The residue was covered with additional resources
Transportation [1]	240	800	-560	I had to make more trips to field than expected, spending more money in bus tickets
Food in field [1]	660	350	310	I reduced costs in field by purchasing food in the city for the whole field season, at lower prices. Differences in currency exchange rates also contributed to spend less money than was previously considered
Desk supplies [1]	50	50	0	–
Consumables [1]	100	120	-20	I have spent additional resources for buying extra batteries for the cameras
Total	**5745**	**6480**	**-735**	

Notes to budget:

1. Items spent in Chilean pesos (CLP). Exchange rates varied from 767 to 825 CLP per sterling pound during the project execution period.2. Items spent in US dollars (USD). Exchange rate used: 1.57 USD per sterling pound, when cameras were bought.

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

I consider important to study genetic diversity aspects related to habitat disturbance, using the available molecular tools (e.g., microsatellite markers, PCR, sequencing) aiming to establish whether gene flow is affected by habitat degradation. At fragmented landscapes, gene flow are expected to be reduced according to the isolation degree of the extant habitat patches, but we virtually do not have any information about what happens at degraded habitats, where there are no physical barriers such as a non-forested matrix, but there are important habitat quality and structure differences that might modify *D. gliroides*' behaviour and its willingness to move through degraded areas, also producing a genetic structuration at the mistletoe local populations.

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?

Yes, I have used the RSGF logo in a poster presented in the Annual Meeting of the Chilean Society of Biology in 2011, and it will be also used in the forthcoming publications and presentations. RSGF is acknowledged as funding source at my project's website:

http://sites.google.com/site/ecoevolutionary

11. Any other comments?

As this project is part of my PhD dissertation, I intend to have it completed by June 2013. From November 2012 to March/April 2013 I will be in field gathering additional data, which will complement the data that I already have gathered and analysed. Consequently, I expect to finish writing my dissertation chapters by May/June 2013.