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	Juan Sebastián Vargas Soto
Project title	Dispersal of parasites of mammals in a conservation corridor in Southern Costa Rica
RSG reference	20c8be-1
Reporting period	May 2018-May 2019
Amount of grant	£4984
Your email address	juan.vargassoto@mail.utoronto.ca
Date of this report	May 27th 2019

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 parasite prevalence and distribution in wild and domestic host species				This element will be completed with molecular analyses of scat samples in July 2019.
Determine the density of wild and domestic host species				
Characterize habitat use patterns to find areas of host overlap				This element will be explored further using mathematical models to get more insight from the data

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

The original dates for the field components had to be modified to accommodate the schedule of the researchers, as well as to keep a consistent sampling season between years. We had planned to set up two different camera-trap grid designs, one immediately after collecting the other. This had to be changed and the second camera-trap grid was set up 6 months later. This change forced to push other elements back as well, which is why there are still some analyses to be finalised.

The time we had budgeted for sampling with a trained scat-detecting dog was not enough to get appropriate spatial coverage. Instead of sampling for only 5 days, we sampled using this method for 15 days, which increased our costs. Nevertheless, the modification allowed us to obtain a more satisfactory number of samples from several different locations.

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

Using camera-trap records, we were able to obtain valuable information about the spatial overlap of wild felines and domestic cats and dogs in the Osa peninsula. Given the possibility of parasite transmission between them, this information will be useful not only to study the parasites I am interested in but others as well. By analysing the data using an occupancy model framework, we will be able to assess which factors predict the co-occurrence of both types of hosts, and find areas of high risk of disease transmission for the wild felines.

The camera-trap data also allowed us to accurately estimate the relative abundance of the different host types in a region of high overlap. The population density is a major determinant of disease dynamics, and greatly influences the

transmission of the parasite within and among species, so this is a key piece of information to understand how parasite are being shared.

Finally, we were able to collect scat samples from wild hosts in areas with high and low overlap with domestic species. Once the molecular analyses are completed, these samples will allow us to determine prevalence of different intestinal parasites, determine the similarity between the parasites of wild and domestic hosts, and to contrast the prevalence in sites of high and low contact with humans and their pets.

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

In the field I collaborated with a local NGO dedicated to conservation. They helped with the deployment and collection of camera-traps, as well as with data sorting and analysis. Through our collaboration, the research team has learned about the issues of wildlife disease.

I was also invited to give a workshop during a course with local university students. I led them in finding and collecting scat samples and conducting parasitology analyses. They learnt about parasite biology in general, and about methods in parasite sampling.

I have collected information that is useful for dog owners in the region about the health status and the parasites that their animals have, and the risk that this might present if left untreated. The information about areas of species overlap can also be used to avoid these areas and prevent wildlife conflict.

5. Are there any plans to continue this work?

We are very interested in continuing this work, to answer similar questions with other species. Here we focused on parasites of felines and dogs, but similar situations of parasite transmission in and around protected areas could be happening with cattle and wild herbivores such as tapirs. Similarly, there could be parasite transmission between wild rodents and human-associated mice and rats. Studying parasites and infectious disease in rodents is particularly important for human health given the potential for zoonoses, in rural areas especially. The project developed was part of my PhD thesis, these extensions would come in the future, led by another graduate student in my laboratory, or by myself as a postdoctoral researcher.

In addition to expanding the scope of the work, the same protocol could be applied to continuously monitor the health of wild feline populations. The sampling can be more cost-effective now that we know the locations where it is most likely to find scat. An established monitoring protocol could also benefit from using molecular analyses more consistently, to detect parasites not seen in microscopic analyses.

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

I will present the results of this work in conferences and publish them in peer-reviewed journals. This work is of interest in several fields: conservation, wildlife health, disease ecology, landscape ecology. I will take advantage of this to present my results to a variety of audiences. I will present first in July at the meeting of the Latin American Chapter of the Wildlife Disease Association. Thereafter I will present at general ecology meetings.

I expect to publish results from this work in three different papers, one looking at the prevalence of parasites in wild and domestic hosts, one analysing the areas of species overlap, and how they relate to environmental and anthropogenic factors, and one combining these and other data sources into a single mathematical model to infer the relative role of each host species in the persistence of the parasite in the environment.

In addition to academic conferences and papers, I will write a technical report for the Osa Conservation Area – the government institution in charge of protected areas in the region – presenting the main findings.

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 is being used over a 1-year period. Field work was conducted in June 2018, and between December 2018 and March 2019. Laboratory work will be conducted in July 2019. Sampling had to be postponed, which extended the anticipated length, but the effort, in terms of time in the field, remained similar.

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
Air fares	1400	1014	-386	I got better rates than I had budgeted originally
Fuel	658	531	-127	We were able to stay closer to various sampling sites, which reduced transportation costs
Room and Board	1429	1614	+185	I stayed longer than expected at the main station
Sampling equipment	26		-26	We were able to use the equipment that had been previously purchased

Parasitology reagents	74		-74	We used existing reagents, and the number of samples did not require us to buy any more
Molecular analyses	653	193	-460	We will focus only on DNA analysis, not RNA, which reduced the equipment we needed to purchase
Scat dog sampling	744	1774	+1030	We sampled for longer with the dog, to get more samples and greater spatial coverage
TOTAL	**4984**	**5126**	**+142**	Exchange rate used: 0.7713 GBP/USD

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

The first step will be to communicate my results broadly to conservation institutions, and government agencies. I expect to get in contact with relevant stakeholders at the Wildlife Disease meeting in Costa Rica the coming July where I will present my results.

Considering the threat that parasite transmission could represent for wildlife populations, I believe a monitoring programme should be established to continuously assess the presence of parasites in wild felines. The methods that I have used are non-invasive, and relatively low cost. The most expensive pieces of equipment, a centrifuge and a microscope, can be substituted with economic alternatives like the mini-FLOTAC apparatus, and a handheld microscope. Faecal samples are collected for different ecological studies, the government agency granting collection permits could require a sample to be submitted to them to conduct a routine parasitology test. I would be happy to teach the research personnel there the procedure and care in analysing these samples.

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

I have used the logo in oral presentations given at a graduate student conference at my university, and another presentation to researchers at the field station. I will continue to present results from this research throughout the rest of my PhD, until next year, and I will include the Rufford logo in any presentation I give at conferences and department talks. The Rufford Foundation will also be acknowledged in published papers that come from these data.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Peter Molnar, Ph.D., had a supervisory role, overseeing the plans for the field work, and advising about the conceptual framework of the research.

The research team at Osa Conservation were instrumental in carrying out the field work, for the camera-trap element in particular. **Andy Whitworth**, Ph.D., and E**leanor Flatt** were the ones I collaborated with the most. They led the design and coordinated the larger camera-trap network, which involved several different institutions. They were an immense help in setting up and collecting the second – smaller – camera-trap grid. We are collaborating closely in the organization of the data and will continue to work together for the analysis and publication of the results.

Carlos Araya, owner of 'Hablemos de Perros', a dog training company, helped with the scat-detecting dog and handler. This method was essential to optimize sampling for feces in dense forest environment.

I am also collaborating with the Conservation Genetics Laboratory, led by **Gustavo Gutiérrez** at the University of Costa Rica. They have experience extracting DNA from feline scat samples and are advising me with the molecular analyses I will conduct.

The final stage of the molecular analyses will be conducted in August 2019 at the Donnelly Sequencing Centre of the University of Toronto.

12. Any other comments?

I am extremely grateful to the Rufford Foundation for making this research possible. The small grants programme is an excellent resource for projects like mine, and I will advise anyone I can to look into it and apply for their own research. Mostly I hope to apply again soon to continue expanding this project.