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	Devcharan Jathanna
Project title	Ecology and conservation of small carnivores in the Western Ghats
RSG reference	14498-1
Reporting period	December 2014 to February 2016
Amount of grant	£6,000
Your email address	devcharan@gmail.com
Date of this report	16th February 2016

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
1. To characterise ranging, habitat use, activity patterns, social organisation, breeding biology, diet of the study species, and identify factors that influence these attributes;		√		I managed to successfully and safely carry out the first ever live capture, chemical immobilisation, radio-tagging and radio-tracking of the endemic brown mongoose, which provided valuable glimpses into the ranging and movement behaviour of this hitherto poorly known species. However, this part of the project was limited by several unforeseen constraints: a) Processing of the permits for live capture and radio-tagging was subject to inordinate delays in paperwork, including for grant of the initial permit (3.5 years), for shipping and obtaining customs clearance for telemetry equipment (2.5 months) and for renewal of the permit once the study had commenced (7.5 months, causing the project to be suspended during this time, and delaying start of the Rufford-supported work to December 2015). The permits were issued only for a year at a time, disallowed radio-tracking at night (even for a fairly nocturnal species such as the brown mongoose), and permitted live capture of just two individuals. b) The two radio-tagged brown mongooses retained the radio-collars for just 40 and 9 days, and slipped the collar over their heads (collars were recovered intact immediately on detecting that they had remained stationary for over 12 hours). This is well known to be a problem with radio-collaring mongooses, which have thick necks and narrow heads. However, other types of radio-transmitter attachment such as ear tags, backpacks and implants are known to negatively affect tagged individuals, while neck collars are very safe provided protocols are

				carefully observed. Since I only had permits to tag two individuals, and given the inordinate delays in obtaining the initial permit and for its renewal, I decided not to attempt to obtain permits to tag additional individuals. c) I was unable to capture and radio-collar individuals of the other two study species (stripe-necked mongoose and Nilgiri marten). d) I had hoped to study breeding biology if I was able to radio-tag females with young. However, both individuals radio-tagged were young males. e) I was unable to home in on individuals and observe them during radio-tracking as the two individuals tended to move through cane and reed thickets, and would move away if I tried to approach them (which would defeat the purpose of radio-tracking). Due to this, I was not able to observe the individuals, nor collect scats during such observation. Although I did collect several small carnivore scats opportunistically during fieldwork and store these in ethanol, there is no way to assign these scats to carnivore species in any reliable way based on scat morphology. I was therefore unable to assess diet of the species based on verified scats and observations of foraging behaviour. Due to these limitations, I have marked this objective as 'Partially achieved'.
2. To understand the interaction of key human impacts (hunting, prey depletion, habitat loss or habitat fragmentation) with the above aspects of the species' ecology, and examine the consequences for species' persistence;		√		As part of this project, I was able to investigate the role of anthropogenic disturbances on different small carnivore species. While the radio-telemetry data provided some of this understanding (e.g. use of and movement through human-dominated areas by the radio-tagged individuals), my analyses of patterns of habitat by nine small carnivore species (see point 3. Below) using my own camera trap data supplemented by data from across a *c*. 38,000 km^2 landscape has provided valuable insights into how different species respond to human disturbance. These analyses of observational (as opposed to

				experimental) data were not able to separately estimate the effects of different human impacts (such as hunting, prey depletion, habitat loss, or habitat fragmentation) as originally intended, but assessed species' responses to surrounding human density and proximity to non-forest areas. Because of this reason, I have marked this objective as 'Partially achieved' relative to my original objective. Based on my understanding of the status of small carnivores, much of it based on this project, I was able contribute to the IUCN Red List Assessments for brown mongoose and Nilgiri marten (Mudappa & Jathanna 2015; Mudappa, Jathanna & Raman 2015).
3. To construct and validate predictive models of species occupancy at the scale of the distributional range. The model will help both predict and understand current patterns of persistence, and identify areas for species-based conservation.			√	My analysis of patterns of habitat use by nine small carnivore species (three viverrids, three herpestids and three small felids) is the most comprehensive assessment to date of the distribution of small carnivores in the Western Ghats, in relation to climatic, topographic, habitat-related and disturbance gradients. I supplemented my own camera trap data from Talacauvery with Centre for Wildlife Studies' camera trap photo-captures of small carnivores across the Western Ghats of Goa, Karnataka and northern Kerala. From this enormous dataset (700,000+ photo-captures), I separated over 4,500 small carnivore photo-captures, and collated these (matched simultaneous captures from pairs of camera traps; corrected date and time; identified species; retained only independent capture events) to yield 3,459 independent capture events from 566 locations across the central Western Ghats. Using a modelling framework that explicitly accounts for observation processes such as imperfect detection and uneven sampling across space (both of which can seriously vitiate inferences if ignored), I assessed the role of different climatic, topographic, habitat-related and disturbance predictors in driving patterns of habitat use by

				small carnivores. This assessment has yielded reliable and clear insights on factors driving patterns in habitat use by a range of small carnivore species, allowed model-averaged predictions of species responses to ecological and anthropogenic factors, and identified areas for species-based conservation in the case of threatened species that are sensitive to human pressures.
4. Capacity building			√	During the time the project was supported by Rufford, I trained four local field assistants, two field research assistants, two technical assistants and several (>10) frontline forest department staff in various aspects of field research including: conducting camera trap surveys; pre-baiting, live trapping, live capture, chemical immobilisation and radio-collaring; radio-tracking in the field; use of GPS, compass and other field equipment; analysis of radio-telemetry data; collation of camera trap data; statistical modelling of species distributions. Two of the field assistants and the two technical assistants are now continuing fieldwork in other field research and conservation projects.
5. Increased awareness on small carnivores and other wildlife			√	One of the most striking outcomes of the project is the interest it has generated on small carnivores (particularly endemic species) among local communities in the rainforests along the western border of Kodagu district, Karnataka. This applies to forest department staff at all levels (from forest watchers to the Chief Wildlife Warden of Karnataka state), local planters (coffee-cardamom), beekeepers and other forest interior or forest-edge communities. Forest department staff now record and map sightings of species such as the Nilgiri marten and brown mongoose (earlier, few other than the frontline field staff even knew of these species), while members of forest edge communities (even persons I have not actually met) continue to send me mobile phone messages about sightings of these species and other wildlife: a welcome

				change from first pulling out their guns, which was the standard response to Nilgiri martens raiding bee boxes!
6. On-going engagement with local communities and forest department staff towards biodiversity conservation.		√		In addition to helping us gain an understanding of how species respond to human pressures, the project allowed me to build a strong rapport with local communities and forest department staff at different levels (see 5. above). Even though I have been away from the field site over the last several months to collate the camera trap data, carry out statistical analyses, and to complete my PhD thesis, I have maintained contact with local communities and forest staff, and plan to return to the field site for further research and conservation activities. Since this was not a specific project objective, and no funds were utilised specifically for towards engaging local communities, I have marked this as 'Partially achieved'.

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

a) As explained above, paperwork for the radio-telemetry caused inordinate delays. The choices I faced were i) to give up on the permits and change my project questions, or ii) to persevere and follow up with various departments and offices till I obtained the permits, the customs clearances and subsequent renewal of the permit, while carrying out other activities that did not require forest department clearances (e.g. camera trap surveys on plantations adjoining forest areas). I chose option ii).

b) The radio-tagged brown mongooses only retained the collars for 40 and 9 days, respectively. Unfortunately, there is no way to overcome this problem that does not also risk the health and well-being of the radio-tagged individuals. While radio-collaring is known to have this problem in the case of mongooses (A. P. Jennings, pers. comm., based on his experience in Malaysia), it remains the only way to investigate the basic biology of elusive rainforest species without individually identifiable pelage markings.

c) Because of the behaviour of the individuals during radio-tracking, the fact that both were young males, and permit restrictions, I was unable to carry out direct observations after homing in, to study diet based on observations and verified scats, to study breeding biology or to radio-track the individuals at night.

d) I was unable to capture and radio-collar my other two study species (Nilgiri marten and stripe-necked mongoose). I was only able to obtain one photo-capture of the Nilgiri marten, which did not enter the box trap during pre-baiting. I obtained no photo-captures of the stripe-necked mongoose during the study during pre-baiting despite having located box traps and camera traps specifically for the species. However, I did sight the species once within Talacauvery Wildlife Sanctuary (WLS), and on four occasions in plantation areas adjoining Talacauvery.

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

a) Greatly improved understanding of the ecology and conservation of small carnivore species, in and around Talacauvery WLS, as well as across the central Western Ghats of Karnataka, Goa and northern Kerala.
b) Greatly increased awareness of small carnivores as well as other wildlife among local communities and forest department staff at various levels. Continued engagement with these different groups towards site-based conservation.
c) Substantial capacity building of field assistants, field research assistants, technical assistants, forest department staff (please see 1.4 above).

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

As mentioned above, local communities were closely involved in the project activities in several ways:

a) Project field assistants were all from forest-interior and forest edge communities, and they were trained in various aspects of field research, as described in 1.4 above.
b) Frontline forest department staff were closely involved with the field research and were trained in various aspects of fieldwork such as conducting camera trap surveys, pre-baiting, live trapping, live capture, chemical immobilisation and radio-collaring, radio-tracking in the field. Forest guards and forest watchers have now started setting up camera traps in Talacauvery WLS, to record and monitor different species of wildlife.
c) I carried out camera trap surveys as well as pre-baiting in several coffee/cardamom plantations (typically, small holdings ranging from < 1 ha to a few ha) adjoining Talacauvery WLS. This generated considerable interest among the planters and their families, and I always made sure to show them pictures of wildlife species photo-captured on their properties. This generated considerable interest locally on the study species and soon led to an informal information network, wherein members of forest edge communities would inform me of sightings of small carnivores and other wildlife through mobile messages and calls. Even persons I had not met would obtain my mobile number from my acquaintances and get in touch with me. This helped me select some of the camera trap and pre-baiting locations during fieldwork. This engagement with local communities in and around

Talacauvery WLS continues, and will provide a strong foundation for future research and conservation work. However, there is no tangible way in which local communities can be said to have benefitted from my project.

5. Are there any plans to continue this work?

Although I will not attempt another radio-telemetry study in this or other areas, I certainly intend to return to Talacauvery and nearby areas to carry out research, to continue my (informal) engagement with local communities and to more formally put in place conservation interventions (with the active participation of local communities) to address some of the most severe threats to wildlife, including hunting, illegal developmental activities, over-grazing in forest areas by domestic cattle and human-wildlife conflict.

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

I am currently writing up several manuscripts describing my field research, for submission as research papers to peer-reviewed journals. I also plan to present talks and posters at conferences highlighting findings and insights related to methodological, ecological and conservation-related aspects of my research. I regularly provide advice to field ecologists on various aspects of field research, particularly on statistical analysis, application of field methods, and identification of species from signs, camera trap pictures or direct sightings, among others. I may also write a few popular articles in the print and internet media on different, interesting aspects of my field research.

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

Because of delays in obtaining renewal of the radio-telemetry permit, the project was suspended from May 2014 to December 2014. As a result, the Rufford grant was used only starting from December 2014, till March 2016. Previous work under the project (supported by small grants from CEPF, NGS/Waitt, MBZSCF and Zoo Heidelberg) was carried out from January 2010 to January 2012 and from July 2012 to May 2014.

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
Veterinarian consultancy fee	177	0	177	Payment declined by project veterinarian
Field assistants' salaries	2118	926	1192	

Insurance	328	0	328	Vehicle, laptop and personnel insurance not purchased
Equipment	0	713	-713	PI's laptop crashed during project work, beyond repair; purchase of new laptop approved by Rufford (via email dated 29 June 2015).
Vehicle repair & maintenance	319	146	172	
Field station supplies, food & per diem for field team	0	3126	-3126	Food expenses and field station supplies for field team; per diem for PI approved by Rufford (via email dated 29 June 2015) as student fellowship expired in February 2015.
Field consumables	235	182	54	
Immobilisation drugs	98	0	98	
Communication (phone & internet)	115	1	114	
Fuel + local travel	2265	549	1716	
Overnight travel	157	171	-14	Includes economical hotel stay during overnight travel
Couriers	59	8	51	
Rent (field station)	0	58	-58	Monthly rent for field station @ INR 2000/month (~GBP 19.41/month)
Miscellaneous expenses	129	13	116	Bank fees, field station electricity bills
Total	6000	5893	107	

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

Because small carnivores as a group have had little research attention focussed on them, they have remained poorly known in terms of basic biology, ecology and conservation. I therefore focussed my research mainly within protected areas, both for the intensive study on the brown mongoose as well as for the extensive assessment of distribution across the central Western Ghats. I did carry out some camera trapping in plantation areas, but these were all immediately adjacent to forests. As such, my study was not set up to answer questions of how small carnivores fare in completely human-dominated landscapes, which species are only found in plantation areas adjacent to forests and which ones persist in fully human-dominated areas with no forests nearby. It would be of great conservation value to understand how forest species drop out with increasing distance to forest, increasing agricultural intensification or increasing urbanisation, and which species actually fare better in human dominated areas, perhaps at the cost of forest-obligate species. A study to answer these questions would have to be designed appropriately, should cover the full gradients of proximity to forests, agricultural intensification and urbanisation, and needs to employ appropriate field sampling and analytical frameworks.

In addition, I am keen to set up formal conservation interventions in and around Talacauvery WLS to address key threats to small carnivores and other wildlife (formal in the sense that the project would explicitly include activities to address key threats, as opposed to the opportunistic and sporadic engagement with local communities during my field research). These threats include illegal hunting, human-wildlife conflict (especially between beekeepers and Nilgiri martens, paddy cultivators and elephants, wild pigs), overgrazing of montane grassland areas by domestic cattle, illegal developmental and civil engineering activities within forest areas, among others. Interventions to address these would only work if carried out with the close participation of local communities, with whom I have managed to build a strong rapport during the last five years of field research.

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?

No, I have not used the Rufford Foundation logo in any materials yet. It will be included in my detailed final report to the Karnataka Forest Department, and Rufford Foundation will be acknowledged in all peer-reviewed publications (currently in prep.) based on work supported by the foundation.

11. Any other comments?

I must mention that it has been a pleasure to be supported by Rufford Foundation! I found Rufford Foundation to be supportive, flexible, accommodating and always prompt in responding to my queries, even when I have been rather tardy (e.g. with this report) myself! Jane Raymond, in particular, has always been extremely helpful. I sincerely thank Jane and Rufford Foundation for all the help and support.