

## 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](mailto:jane@rufford.org).

Thank you for your help.

**Josh Cole, Grants Director**

---

Grant Recipient Details	
<b>Your name</b>	Timothy Kuiper
<b>Project title</b>	Improving Elephant Monitoring and Management in Closed Protected Systems in South Africa. With a case study of Hluhluwe-iMfolozi Park.
<b>RSG reference</b>	20964-1
<b>Reporting period</b>	January to June 2017
<b>Amount of grant</b>	£4911
<b>Your email address</b>	timothykuiper@gmail.com
<b>Date of this report</b>	11 December 2017

**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
<p>Improve elephant population size estimation in closed protected systems in South Africa</p>				<p>We were able to profitably apply the novel spatial capture-recapture population estimation analysis method to the field data collected on Hluhluwe-iMfolozi Park (HiP) in 2016 (which consisted of a capture history of locations, dates and identities of individual elephants photographed during 6 months of vehicle monitoring). We are currently in the process of organising a repeat population survey on HiP using this method for 2018, and also a similar survey on an additional reserve, Tembe Elephant Park. This is thanks to the success of the first attempt supported by Rufford. The visit of Dr Gopalaswamy (statistical expert) to the field site was particularly helpful and I continue to collaborate with him as we seek to finalise the scientific publication arising from the analysis. One unforeseen challenge has been that the spatial capture recapture model has struggled to account for very wide elephant movements in the Park (we often recaptured an individual more than 30 km from where it was first seen). We have made recommendations on how to deal with this in future surveys. This has however slowed the process and we are only now in December 2017 finalising the analysis.</p>
<p>Develop a rapid system for identifying individual elephants from field photographs</p>				<p>An initial version of this software application has been successfully created and is working well. It has already been used by field staff to speed up individual identification of elephants from field photographs. The application has been successfully transferred to other PCs and is easy to install and set up. We envisage that this application will be helpful for future elephant population surveys on HiP</p>

				that depend on identification of individual elephants.
Create a set of tools to aid reserves in developing sound contraception strategy and implementation				A full set of tools was developed to guide elephant contraception on Hluhluwe-iMfolozi Park, highlighting the number of adult females that needed to be darted with the contraception vaccine in order to achieve a desired long term population size and growth trend, under multiple scenarios. Additional tools included a rapid method for population growth estimation from data on the proportion of infants in the population, and a tool for measuring the likely reduction in vegetation impact in the long and medium term given a set rate of contraception. These tools were successfully used by Park management to re-adjust the targets for contraception during the September 2017 operation on Hluhluwe-iMfolozi Park. The report on these tools is available here: <a href="http://bit.ly/2Aalr8z">http://bit.ly/2Aalr8z</a> .
Conduct baseline analysis of the data collected on HiP. (Not an explicit objective of the original proposal)				The baseline analysis on the social dynamics, population growth and age class break down of the HiP elephants is complete and written up in the form of a scientific manuscript. I wrote this article while supported by this Rufford Grant and it is excitingly now under revision at the prestigious Journal of Applied Ecology.

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

One difficulty has been the short project period and all the extra and future work I would have liked to have done on this project. I opted to start my PhD elsewhere, but this was a difficult decision and I would have loved to stay in Hluhluwe-iMfolozi Park. It feels like there is great potential in the future of this project (see answer to question 9) and I hope others will take this work forward.

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

- a. A demonstrated standard of using capture-recapture models to estimate elephant population size on small to medium sized reserves.** Our project demonstrated the data collection procedures and analytical methods for estimating elephant population sizes from ground based vehicle surveys. We learnt a great deal from the challenges faced and were able to identify areas for improvement in future surveys. We are excited about the repeated use of this method on Hluhluwe-iMfolozi Park and are indeed in the process of arranging a survey for 2018. Repeat surveys using the same method will allow for estimation of vital parameters such as the intrinsic growth rate. We hope this will develop into a standard for other reserves too.
- b. A suite of computer models and tools to aid managers in applying and evaluating elephant contraception to meet set objectives.** As discussed in the objectives table, we developed these tools and they have already been used to influence contraception strategy on Hluhluwe-iMfolozi Park. Specifically, the number of females selected to be darted in the September 2017 contraception operation (reproductive females darted from helicopter) was determined using the tool that forecasted elephant population growth under differing levels of contraception. This decision was also influenced by the tool/model that showed that higher levels of contraception only reduce vegetation impact by elephants in the very long term. These tools are available at <http://bit.ly/2Aa1r8z>. It is hoped that these tools will continue to be used on HiP.
- c. An adaptable tool for animal identification from field photographs – ‘Pachyidentify v1.0’.** The novelty and value of the tool is that it is a blend of computer functionality and the use of the power of the human senses to detect key identification features. The user specifies key identification features ‘manually’ by ticking boxes (e.g. ticking the box of large notch in right ear) and then the program filters for matches and rapidly displays them for consideration. The programme becomes stronger as a database of already identified individuals is built of for comparison to newly taken photographs. We found this method circumvents the challenges of identification via artificial intelligence and machine learning, which depend on good quality photos taken at the right angle and do not always give 100% reliable results. Pachyidentify engages the user’s skills and senses and simply speeds up and simplifies the process of reviewing potential matches. We envisage this tool will

help enormously with future population surveys on HiP and elsewhere which rely on identifications from photos. The main point of the application is to drastically reduce the time and effort from new photo to positive identification (which was taking me up to an hour when looking through potential matches manually from scratch).

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

NA

**5. Are there any plans to continue this work?**

Since project completion, I have started my PhD in the UK and I am no longer focussing on elephant management on small to medium reserves. For my PhD I am researching monitoring programmes for the illegal killing of elephants and working under Professor EJ Milner-Gulland through the Interdisciplinary Centre for Conservation Science at Oxford (<https://www.iccs.org.uk/person/tim-kuiper>). I have partly this Rufford supported project to thank for inspiring me to continue work with elephants.

I am however involved in plans for a repeat elephant population survey on HiP (see above) and in ongoing research and evaluation of elephant contraception on the Park.

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

We have submitted the results of the baseline sociology and population growth analysis to a journal for publication. We are also in the process of preparing the results of the population estimation analysis on HiP for publication. The photo ID application has been shared with members of staff responsible for elephant research on Hluhluwe-iMfolozi Park.

**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 was used for the specified period January to June 2017, but some of the outputs are still in process (particularly the two scientific publications highlighted above). I did not expect the time for write up and analysis to take as long as it did and I have learned from this useful experience.

**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.**

\*The exchange rate at the time of the proposal was ZAR 17.75 to £1, and at the time funds were transferred to the Conservation Outcomes NGO account it had lowered to ZAR 16 to £1 (this is the exchange rate we used to convert the £ amounts below). This left us with less funds then expected, but we were able to make up for this through an extra source of funding for Dr Gopalaswamy's flight (see below).

Item	Budgeted Amount	Actual Amount	Difference	Comments
Professional fees for Principal Investigator	£2700	£2700	£0	NA
Consultation fees Dr Gopalaswamy	£575	£575	£0	NA
Flight Dr Gopalaswamy	£563	£0	+£563	Funds for flight sourced from a different funder
Daily stipend Mr Whitaker (5 days at 43 pounds per day)	£215	£215	0	NA
Travel Mr Whitaker (Return flight from University of Cape Town to KZN province)	£141	£158	-£17	Flight price fluctuations
Professional Fees for Project Manager Mr Galliers (2 days at 115 pounds per day)	£230	£230	0	NA
Conservation outcomes NGO audit (1% of budget) and management (10%)	£487	£487	0	NA
Extra sanctioned work carried out by Mr Kuiper	£0	£225	-£225	The exchange rate fluctuation from ZAR 17.75 to ZAR 16.00 to the Pound reduced MR Kuiper's

				salary from an expected R15 975 to R14 395.00 per month. In part to offset this, and in part to pay Mr Kuiper for 5 days of extra work carried out in July 2016 (after the project period), an amount of £225 (R3 600) was paid to Mr Kuiper.
Fuel and subsistence costs for the Project Manager Mr Galliers to visit project site (Two separate visits were conducted between March and July 2017)	£0	£321	-£321	The surplus on the Rufford Budget was used to contribute towards this expense, which was not foreseen and not originally budgeted for.

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

The results of this project were presented by Dr Dave Druce (the senior ecologist at Hluhluwe-iMfolozi Park) at the September 2017 Symposium on Contemporary Conservation Practice in Howick, KwaZulu Natal. In the short term, we look forward to publishing the two scientific manuscripts mentioned above.

In discussion with HiP management and Ezemvelo ecological sciences staff, we hope to conduct repeat elephant population surveys on HiP every 2 years. The current analysis (reported above) is based on 2016 data, and so we hope to conduct the next vehicle and photograph survey in 2018. This survey will involve 3-4 months of field monitoring. Data on population size at a point in time is useful, but even more important is how population size changes over time. Knowing how population size changes over time helps us measure the health of the population, and get at vital rates such as death rate and birth rate. In the context of HiP, future changes in population size will help management measure how well contraception is working and allow for evaluation of current strategy.

We are also excited to test our survey methods and analytical models to elephants on additional reserves. To start out, we have earmarked Tembe Elephant Park as a potential project site. The elephant population size on Tembe is well known from years of monitoring (in which almost all elephants and family groups are individually known). Reliable counts are also derived from helicopter censuses over waterholes during the heat of the day. This would provide the ideal context to test the accuracy of our SECR population model results against an elephant population of known size.

One challenge to these plans is that I (Mr Kuiper the Principal Investigator) am no longer actively involved in the project (having started my PhD on elephant poaching elsewhere). I am hopeful however that there is an opportunity for others to take this forward, especially given all the knowledge and tools that have already been developed.

**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?**

The logo was used in the report on contraception tools handed to HiP Management. The Rufford Foundation was also acknowledged in the presentation by Dr Druce at the conference mentioned under the above question, and in the scientific publication on the baseline analysis mentioned above, submitted to the journal of applied ecology.

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

**Dr Dave Druce** – Provided supervision as the senior ecologist of Hluhluwe-iMfolozi Park and ensured the project helped meet the objectives of Ezemvelo KZN Wildlife (the government authority responsible for the Park) in managing and conserving elephants. He provided weekly supervision of Mr Kuiper at the research base and helped meet the 'population estimation' and 'contraception tools' objectives by commenting on drafts and engaging in fruitful discussion.

**Mr Chris Galliers** – provided oversight and management of finances channelled through the Conservation Outcomes account. Helped develop the vision and objectives of the project. Secured the MOU with Ezemvelo KZN Wildlife. Commented on and guided project progress. Helped the Principal Investigator with meet up with key elephant researchers at two elephant management workshops during the project period.

**Dr Arjun Gopaldaswamy** – provided professional statistical insight to guide the application of spatial capture-recapture methods to our 2016 field data. He continues to provide oversight for the final stages of the analysis and has helped with the writing of the scientific manuscript.

**Mr Jonathan Whitaker** – Spent a full week intensively developing the software application for the rapid identification of individual elephants from field photos, in collaboration with Mr Kuiper. This involved substantial computer coding and refinements.

**12. Any other comments?**

I am the team I worked with are very grateful to the Rufford Foundation for making this project possible. It was such a personal confidence boost for me to lead the proposal and then have a successful outcome. It has been a rewarding experience planning this project and learning many lessons. The report back above presents a very successful project, but there are many more things I would have liked to have done and I certainly did not do everything well. I have grown enormously as a result of this project and it helped me see that my strength is in conservation science and research as opposed to conservation practice. This project also lit my passion for

elephants and has encouraged me to pursue a PhD looking into their exploitation for ivory.

