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	Stacy Lindshield
Project title	Assessment of Mercury Contamination in the Drinking Water Supply of Senegal's Endangered Chimpanzee Population
RSG reference	17060-2
Reporting period	December 2015 – May 2016
Amount of grant	£5000
Your email address	slind@iastate.edu
Date of this report	May 12, 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
Determine if drinking water sources are contaminated with mercury			■	Elemental mercury (Hg) levels in all water samples were below the EPA limit for human consumption of 2 ppb but two drinking water sources used by chimpanzees were above the 1 ppb threshold set by the Council for the European Union.
Raise awareness within mining communities to the problem of mercury contamination		■		Initiated a discussion about the dangers of unsafe mercury handling and mercury pollution in two mining communities.
Broadcast findings to national and international conservation communities		■		The Senegalese Direction of Water, Forest, and Soil Conservation is aware of this study. Chimpanzee conservation leaders at the two mining sites are aware of our findings. We will broadcast results to a larger audience in 2016-2017.

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

It was challenging to build a robust sample of drinking water sources for elemental mercury (Hg) testing because we sampled water during the final weeks of the 2015 dry season and the seasonal rains arrived about one month later than usual. Thus, we did not collect as many surface water samples as originally planned. However, due to the lower than expected number of surface water samples, we included well (ground water) samples from three villages into the study (see Item 4).

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

1. Identified the background level of Hg in the environment.
Elemental Hg is naturally found within the environment. Therefore, it is critical to determine the normal, "background" level of Hg in surface water in order to contextualize and identify abnormal Hg levels associated with anthropogenic activities, such as the burning of mercury-gold amalgams by small-scale artisanal gold miners. We established this baseline by sampling drinking water within a remote area of Niokolo-Koba National Park without a recent history of small-scale artisanal gold mining.

2. Determined Hg concentration in chimpanzees' drinking water sources.
Overall, total elemental Hg levels were lower than anticipated at the two gold mining study sites and none of our samples exceeded the U.S. Environmental Protection Agency's contamination threshold of 2 ppb. However, two water sources, one from each study site with mining activity, exceeded the 1 ppb safety standard established by the Council of the European Union. These contaminated water points comprised 6% of the water sources in our sample that were used by chimpanzees. To the best of our knowledge, people do not drink from these two water points.

3. Identified additional hazardous waste risks to chimpanzee health.
Residents from the largest small-scale artisanal mining community within our study reported that cyanide is sometimes used to extract gold. We neither directly observed this practice nor intensely pursued this problem during our field season. Cyanide is extremely hazardous to wildlife and human health, thus a deeper investigation into its possible use should be pursued in south-eastern Senegal.

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

Several residents of local communities voluntarily participated in informal interviews about mining practices and allowed Massylla Ndiaye to observe their work (see Item 11). Our interview protocol was reviewed and approved by the Institutional Review Board Committee at Iowa State University.

We measured Hg concentration in several village wells and determined that Hg levels at these wells were considered safe for human consumption. Such results should be well-received by these communities.

5. Are there any plans to continue this work?

We are conducting a pilot study to test for Hg contamination in soil and soil-feeding termites. Soil is a core component of Hg cycling and soil-feeding termites are a key food source for chimpanzees. We will conduct a more thorough investigation of Hg contamination should our preliminary soil and termite samples exhibit high concentrations of Hg (see Item 9).

We plan to return to the communities in our study area to engage in discussions with community leaders about our study results.

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

We aim to report our findings at the local, regional, national, and international levels. Locally, we will discuss our study results with community leaders (see Item 5). We will reach regional- and national-level audiences through distributing our report to the Direction of Water, Forest, and Soil Conservation, the Direction of National Parks, and the Ministry of Health and Social Action. Furthermore, we will discuss these findings with the directors of the national chimpanzee conservation action plan. We expect

to reach an international audience through presenting this study at professional conferences and publishing in a peer-reviewed journal.

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

Project expenditures occurred between May and October 2015. The study began three months later than anticipated in order to make academic accommodations for Massylla Ndiaye, a graduate student at Cheikh Anta Diop University who is advised by Dr. Papa Ibnou Ndiaye. Massylla finished obligatory coursework before initiating his field work. The ending date matched our anticipated timeline.

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.

Iowa State University managed the funds in U.S. Dollars. The average exchange rate between USD and GBP between May and October 2015 was 1.56 USD to 1 GBP. The average exchange rate between GBP and XOF between during this time was 909 XOF to 1 GBP.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Travel	1162	2361	(1199)	Additional travel between Dakar and Kedougou for Papa Ibnou and Massylla was required. Other expenses omitted from original budget: diesel fuel, baggage fees for equipment
Meals & lodging	323	516	(193)	Additional lodging and meals were needed while waiting for research authorization from the Direction of National Parks to access Niokolo-Koba National Park, and during the Ramadan-end holiday when it was not possible to work in the park.
Lab fees	2601	1164	1437	Collected 30% less samples than expected due to water scarcity; received a 20% discount on lab fees at ITA
Supplies	695	717	(22)	--
Wages	219	214	5	--
Other	0	28	(28)	Wire transfer fees to send money to Senegal were omitted from the

				original budget
Total	5000	**5000**	0	

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

1. *Continue to improve our understanding of the mercury problem in order to better protect chimpanzees*
We recommend additional testing for Hg pollution in chimpanzee habitat, particularly in case our team discovers that elemental Hg in soil and/or termites exceeds the contaminate-level threshold (see Items 5 and 11). Minimally, we recommend the testing of:

i. Plant and animal tissues in the chimpanzee diet
ii. Water, water sediments, and termites for methyl-mercury, the most toxic form of mercury
iii. Chimpanzee hair for evidence of mercury bioaccumulation

2. *Support efforts to reduce Hg pollution*
An important next step is to coordinate with NGO and governmental agencies that have developed programs to reduce Hg contamination. Increasing awareness about the hazards of mercury to human and wildlife health should be one major component of this plan. In addition, we need to seek out simple and cheap but effective technologies that miners can use to improve Hg capture during the amalgam burning procedure. Furthermore, we recommend a phasing out of Hg and other harmful substances from goldmining all together, in favour of gravitational methods as well as research and development into new extractive technologies that do not involve hazardous materials. Finally, reducing gold mining ought to decrease Hg contamination activity in south-eastern Senegal.

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?

Team members have acknowledged the Rufford Foundation in oral and written reports, and the foundation will continue to be acknowledged in future reports. The RSGF logo will be displayed in future podium or poster presentations at professional conferences.

11. Any other comments?

Local residents were overall supportive of our efforts to understand how gold mining activities might affect chimpanzee drinking water sources. The Fongoli Savanna Chimpanzee Project, under the direction of Dr. Jill Pruetz, Professor of Anthropology at Iowa State University, has developed an overwhelmingly positive relationship with residents of several villages that live alongside the Fongoli chimpanzee group. Our team was warmly welcomed by these communities as we sought to collect water samples. Kelly Boyer-Ontl, who is a Ph.D. Candidate at Iowa State University, has a long-standing and friendly relationship with village leaders at the largest mining

community in our study. Our ability to discover the potential presence of cyanide waste was due, in large part, to the friendships that she developed over the past six years while conducting chimpanzee conservation fieldwork in the Faleme region. Massylla Ndiaye, a graduate student from Cheikh Anta Diop University in Dakar, successfully completed informal interviews with community members who were engaged in artisanal small-scale gold mining, and Massylla developed a congenial rapport with several of his informants. We are pleased to announce that he successfully defended his thesis, “Impacts de l’exploitation artisanale de l’or sur la conservation du chimpanzee au Senegal” on March 8, 2016.

RSGF funds supported a Senegalese service lab at the Institut de Technologie Alimentaire (ITA) in Dakar. The ITA had the capacity to test for total elemental Hg in water with atomic absorption spectrophotometry.

Although RSGF funds were not used to sample or analyse soil and termites, the foundation’s investment in this study on water pollution contributed to synergistic activities among team members that resulted in a diversified sampling strategy and a continuation of the Hg study.

We thank the Rufford Foundation for its continued interest and investment in conservation and research on West African chimpanzees (*Pan troglodytes verus*) in Senegal.