

## The Rufford Foundation Final Report

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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**

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Grant Recipient Details	
Your name	Sonam Norbu
Project title	Cave Biodiversity Conservation; Documenting Cave-Dwelling Invertebrates and Capacity Building in Khoma, Bhutan
RSG reference	21540-1
Reporting period	28 Feb 2017 to 28 Feb 2018
Amount of grant	£5000
Your email address	<a href="mailto:cave.norzang@gmail.com">cave.norzang@gmail.com</a>
Date of this report	28 Feb 2018

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>Evaluate and document the composition of the cave invertebrate assemblage in the caves of Khoma.</p>				<p>The project team has been able to document the composition of the cave invertebrate assemblage in the caves of Khoma along with their habitat conditions. The project team explored 16 small caves (mostly talus and fracture caves) and documented cave invertebrates belonging to eight orders excluding two unidentified orders. All the specimens collected are stored in 70% ethanol solution and family and species level identification is ongoing with the help of experts.</p> <p>Out of eight identified orders of invertebrates, Dictyoptera dominated all 16 explored caves followed by Hymenoptera, Araneae and Achatinoidea.</p>
<p>Assess potential conservation threats to cave invertebrates and generating understanding of their status.</p>				<p>Evaluation of threats to cave biodiversity was conducted through direct observations and analysing the magnitude of anthropogenic activities around the study area and their consequences to cave biodiversity conservation. The threats such as waste disposal and landslides due to road construction were found in numerous sampling site.</p> <p>Moreover mining, timber extraction, firewood collection, quarry, over grazing, and Non Wood Forest Product (NWFP) extraction were recorded in the area. The team has also notified concerned professional to strictly monitor and manage the waste properly to conserve and manage environment and ultimately to conserve cave biodiversity. Furthermore, research team has</p>

			carried out focus group discussions with the local leaders to prevent such conservation threats as far as possible through incorporating conservation actions in strategic Local Area Plan in future.
Accumulating information on habitat environment of cave invertebrates.			Chemical analysis of soil was conducted and recorded moisture content and water holding capacity. Slope, temperature and humidity of caves where invertebrates resides were recorded successfully. Humidity and temperature of caves that the team has explored ranges from 30.21% to 74.2% and 16°C to 43.2°C respectively. The study found that cave invertebrates were present more in caves with temperature range from 20°C to 31°C and humidity from 40% to 60% but the project team could not record those parameters thrice (morning, noon and evening) instead we have recorded once in every cave during noon. In addition, the research team has documented disturbances inside the cave and other potential pressures yet to come.
Creating environmental education and conservation outreach program.			The research team has decided and conducted the awareness campaign to the people of local community with the special focus to minimise the dumping of waste in those habitat areas. The conservation awareness was also targeted in two selected educational institution in the country i.e. Lhuentse Higher Secondary School and Khoma Lower Secondary School. The awareness and consultative meetings were also conducted with the students of BSc Environmental Studies and Climate Change and BSc Sustainable Development of the College of Natural Resources. Those meetings were principally aimed at publicising the few documented cave invertebrates of Khoma. Findings such as probable conservation threats to cave

			<p>invertebrates were also presented to the audience to create better understanding of conserving cave invertebrates in future. Comparable awareness campaigns were also initiated with the students of Tangmachu Central School.</p>
<p>Contributing more generally to knowledge of the hitherto largely neglected invertebrate biodiversity of Bhutan.</p>			<p>As mentioned in the comment section of first objective, the project team was successful in documenting diverse cave invertebrates and generating new information of cave invertebrates in Bhutan, which is first of its kind. This project has deployed various fieldworkers including students from Sherubtse College, College of Natural Resources, forestry staff from park, range office, communities and village people. Fieldworkers were trained on different methods of studying cave invertebrates, field data collection and analysis, thereby developed capacity to carry individual research in the field of cave biodiversity conservation which in turn will contribute in generating more information regarding cave biodiversity in near future. Research articles will be prepared to outspread in freely accessible online journals and make available conservation baseline spontaneously with needed information in hand.</p>

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

The data collection period scheduled on monsoon season was quite a daunting task for the team. The data collection were hampered by heavy rainfall and had to be carried out in muddy and slippery area considering the accelerating financial implication if prolonged for longer duration.

The ants and other insect disruption of baits were also prominent constraints. The field worker had to place baits time and again as cheeses, meats and sugars used as bait were easily consumed by those insects before the other cave insects falls into the trap. Therefore, constant monitoring was very challenging, while the team on the other hand seeks to looks for diversity of species within that stipulated period of time.

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

Following are the three most important outcomes of this research project:

1. Different composition of cave invertebrates were documented through this study. In this study cave invertebrates belonging to eight orders excluding two unidentified orders were enumerated for the first time in the history of Bhutan. Therefore, this study has helped in generating enough scientific baseline information on cave invertebrate diversity in Bhutan.
2. The potential conservation threats to cave invertebrates were also assessed. The irresponsible dumping of waste by the local community posed a serious threat to cave invertebrate conservation. The local community and forestry officials are of view that there is decreasing trend of cave dwelling species due to rapid socio-economic developmental activities. Hence, the team has also notified concerned professional to strictly monitor and manage the waste properly to conserve and manage environment and ultimately to conserve cave biodiversity.
3. Created environmental education and conservation outreach programme on importance of conserving cave invertebrates. Two phases of cave invertebrate conservation awareness programme were initiated. Local communities were thoroughly convinced to protect their cave habitat to reduce the disposal of garbage wherever possible and to collaborate with conservationists to protect the cave dwelling invertebrates. The outreach programmes were also conducted in educational institutes to foster the sense of conserving cave invertebrates equally to flagship species that were given due importance in recent years.

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

This research project has benefitted local communities by involving them directly or indirectly and some are discussed below:

- a) The two residential houses were rented for about 2 weeks and eventually they were benefitted out of home stay and other necessary logistic arrangements.
- b) The foods were ordered from nearby cafeteria for our team and huge share of budget were incurred in meals thereby hugely benefiting the local businesses.
- c) The few local communities were deployed initially to spot the field and later for baiting and they were paid handsome wages for their tiring jobs.

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

Yes, the conservation efforts will be continued. The project is first of its kind in Bhutan and there are lots of areas left uncovered in the first project. The cave invertebrate studies has just laid the foundation and taken a single step to explore in Bhutan. There are miles to go as there is huge gap of data base and information pertaining to cave invertebrates.

I am planning to further raise conservation of cave dwelling fauna through detail and rigorous outreach programmes, trainings, lectures and workshops in coming years. Obtaining red list status for the most threatened cave invertebrate and vertebrate species will be of utmost priority in upcoming projects as well. Prevention of habitat destruction/ obliteration and pollution of caves nearby human settlements will be my primary aims and will provide a basis for implementing waste management practices framework for biodiversity conservation as a whole.

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

A scientific paper will be published on importance of conserving cave invertebrates and on documented diversity of cave fauna in freely accessible journals (national/ international). Further, two phases of outreach programme i.e., in local community and educational institution of Bhutan has been already completed were the team has shared the findings of the project.

Leaflets, posters, pamphlets have been distributed to wide range of people in the study area locality, schools and colleges of Bhutan. For wider publicity and to generate positive conservation implications, the final detailed report will be published and made available in Ministry of Agriculture and Forests website.

**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 fund was used from March 2017 to February 2018, for about 12 months as outlined in the proposal. The project had to make little adjustments during data collection phase due to heavy rainfall and landslides only. In overall, the project was a great success due to timely release of fund from the organisation.

**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
Wages for field Assistants	645	697	-52	During rainy days we have increased wages for field assistants

				so as to embolden and enhance their energy to work effectively and efficiently for attaining an anticipated outcome.
Transportation Cost	145	140	5	Budget for transportation was slightly overestimated.
Dissecting scope	345	368	-23	Due to change in market price within short duration of time we have paid £23 more than what we have projected initially.
Digital Camera	235	243	-8	Budget for camera was underestimated.
Food during the survey	250	250	0	Cost of food remains same as what we have predicted and hence budget estimated was adequate.
Safety & Extension gears, Field equipment and preservation solution	1360	1310	50	Budget for safety and extension gears, field equipment and preservation solution was sufficient from what we have estimated. Vials cost is generously supported by a friend who is owner of medical store in Thimphu City.
Garmin GPS	225	197	28	Encountered a retailer who sells at cheaper rate than what we have estimated in the beginning.
Trainings/workshops, Education campaigns and advocacy program; Pictorial guidebook and brochure printing	1530	1530	0	The team was not successful in printing guidebook but a budget allocated for this was successfully used in printing brochures which was distributed in many schools, colleges, government organizations and NGOs. Trainings, awareness campaigns and workshops were conducted at the exact cost of what we have estimated.
Data processing, report preparation, poster presentation and information dissemination	220	220	0	Actual amount that we have spent for data processing, preparation of reports, presentation of posters and information dissemination was there or thereabouts same as what we have budgeted in our proposal.
Stationery	45	45	0	Team has used this amount generally for communication purposes.
<b>Total</b>	<b>5000</b>	<b>5000</b>	<b>0</b>	<b>Total amount of £5000 generously financed by the Rufford Foundation was entirely used for the completion of this biodiversity conservation project.</b>

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

With much experience and knowledge gained from this project, now I am confident enough to take up studies in other unexplored areas across Bhutan. The project on cave invertebrates has just begun and there is much to do in terms of large scale advocacy program.

Obtaining red list status for threatened species is prerequisite in future studies as there is huge gap of baseline data currently in the country. Therefore the project will be continued in the coming years to extend the survey to cover wider areas.

**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?**

Yes, the Rufford Foundation logo has been used in presentation at College of Natural Resources, Khoma Lower Secondary School and Tangmachu Central School. Outreach programme were conducted to convince the audiences on cave conservation by initially introducing the sole funding agent with words of acknowledgement along with logo depiction on the presentation slides.

The Rufford Foundation logo has been used in posters and leaflets during information dissemination and awareness programme which has drawn attention of many future researchers to be aware on the existence of such biodiversity conservation grants from the Rufford Foundation.

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

**Mr Karma Gyeltshen, Ms Sonam Choden, Mr Yeshi Rinzin, Mr Dorji Norbu & Mr.Yeshi Dorji:**

They were field assistants and their main role was to collect data from every sampling point. They are involved in preliminary visit, field survey, trapping activities and marking, habitat assessment, recording of data in every field visits, data compilation, and analysis and monitoring of the project.

**Mr Sherab Dorji:**

He worked as a programme manager. His was a main person behind all the promotional activities along with educational advocacy and campaigning that the team has conducted.

**Prof. Dr. Edmund Gittenberger:**

Professor is a cave invertebrate expert with a large international network of colleagues, specialists in various taxa. He is and has assist and guide the team in identification of specimens.

**Mr Karma Dorji:**

He worked with the team as a Field supervisor. He was involved in locating the study area with the assistance from local heads. Most of the time he has contributed in baiting activities and its monitoring.

**Ms Jamyang Norbu:**

He is general Manager. He was usually involved in logistics and meals arrangements for the Team.

**Tashi Dendup:**

He is Field Supervisor and helped us in locating the cave areas, baiting, species collection and other monitoring activities.

**Mr Jigme Sherab:**

He is team member and assisted two of our field supervisor for proper coordination, monitoring and species collection in the field.

**Mr Tawpo:**

He is village head man who has contributed in transportation of field equipment from one place to another, like cameras, laptops, spade, knife etc...

**Mr Ugyen Kelzang:**

He has equally contributed in data collection in the field as well as identification in the later parts of our study.

**Mr Sonam Norbu:**

Myself being the leader of the project, I had generally been involved in overall planning, coordination, monitoring and execution of the planned activities.

**12. Any other comments?**

Bhutan's development philosophy is guided by the vision of Gross National Happiness of which conservation of natural environment has been firmly constructed as the third pillar to realise nation's goals and aspiration. Bhutan is in pursuit of protecting environment and given due importance but only to few governmental and NGOs as of today. Therefore it's difficult for those handful of institution to capture and cover the species data on diversity, endangered species, habitat threats, outreach program etc. The conservation fund is still limited to few interested conservationist only and not yet been decentralised to individuals for smooth and effective conduct of research. So I feel the grants provided by the Rufford Foundation is instrumental in realization our national goals and also to protect and conserve our mother earth collectively.

Most importantly, I am very much thankful to the Rufford Foundation for being the first grant recipient on cave invertebrate's project in Bhutan. I have developed a genuine interest and gathered huge knowledge and information to continue the study both in depth and scope given similar funding supports in the future.

