

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	Kinley Wangchuk
Project title	Macro-invertebrates Diversity and Water Quality Assessment in four streams that join Mo Chhu River, Punakha
RSG reference	17510-1
Reporting period	Final Report
Amount of grant	£5000
Your email address	Gasebkinley30@gmail.com
Date of this report	29/7/2016

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
Investigate the diversity and richness of macroinvertebrates in individual streams			√	The diversity survey and richness was completed covering two streams which falls inside the protected area and two streams outside the protected area which helps in documentation of the macroinvertebrates species. A total of 14,038 of macroinvertebrates belonging to 34 families and nine orders were recorded from the study sites. The most dominated family is Lepidostomadidae followed by Baetidae and Hydropsychidae. There was significant differences in Shannon-Weiner diversity within 3 months period, however, there was no significant differences in species richness and abundance. The samples were collected from different habitat such as run/riffle, pool, cascade, vegetative edge and from coarse particle organic matter to see the diversity differences.
Compare the differences in diversity among the different streams by means of environmental variables			√	Diversity comparison among the four streams were completed using environmental variables such as geographical elements (altitude, latitude and longitude), hydrological elements (temperature, pH, and electrical conductivity) and physiochemical elements (width and depth of

				stream). The diversity is high in the streams which falls inside the protected area where there is pristine environment and at higher altitudes. The diversity increases as we go higher and decreases as we climb down.
Assess the water quality of different streams by monitoring its macroinvertebrate community.			√	The water qualities in all the streams were found in profile condition and degree of organic pollution was absent indicating no organic pollution. The family Biotic Index ranges from 2.033 to 3.484. The highest FBI was recorded in Woku Chhu and the least in the Zhoshi Chhu.

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

The uneducated farmers were totally nil in the topic and found very difficult to join in the project. They were not aware of what is there in the streams and rivers. They thought fishes, octopus, crocodile are only living things in the river. So later through repeated public awareness, meeting and participatory involvement of the communities solved the problem. During the awareness campaign, park residents as well staffs were made clear about the objectives of the project, non-invasive data collection techniques and importance of exploring the important insects, which is rarely concerned by many people.

One thing is I took the project during winter months starting from December to February which is very cold in the study area, where the team need to get inside the stream during data collection. The data collecting team were tortured by severe cold and some even became sick. Moreover the sample was too big, I took 80 samples per stream. In total 80 samples x 4 streams x 3 months = 960 samples. To overcome the problem we used different methods like making fire in every station, serving the team with hot drinks, good meals and high payments. Though we suffered while collecting field data but the outcome of the project is very much successful.

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

Baseline library:

A total of 14,038 macroinvertebrates belonging to 34 families and nine orders were recorded from the study area which were rarely known to the Bhutanese conservationists and researchers. The species list of the project will be reliable for scientific information and which is available from College of Natural Resources, which will help the students of colleges as well. Moreover, the project paper will be used by various organisations, researchers, students and basic information to explore further about macroinvertebrates kingdom to achieve long term conservation goal. It will be used for onwards monitoring of nature's diversity, stream and river health in relation to biotic and natural factors for integrative river ecosystem assessment based on macroinvertebrates.

Establish the permanent sampling points for future monitoring of four streams

The geographical elements like altitude, latitude and longitude are recorded in the field using Global Positioning System (GPS). In each stream we took eight sampling points keeping the distance of 100m interval. From all eight sampling points we have recorded GPS coordinates and mapped. Keeping this coordinates points as baseline date and do sampling at any time and see whether the health of the stream is getting deteriorate rated or not. If water quality deteriorate that meant the water is not drinkable, if it happens there is high chances of disease outbreak to the human beings, therefore the health of stream and river are important as the human being and animals depend on river and streams for survival.

Preservation of specimen

The specimens were stored in four percent formaldehyde solution and taken to the Laboratory, where they were sorted and identified with the help of Hindu Kush Himalaya identification key. After being identified, each specimen were conserved in 70% alcohol and deposited in the Laboratory at the CNR for future reference for educational purpose.

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

Scientific investigation was not my sole objective of the project, people from different community groups were invited during the awareness meeting and provided opportunity to discuss on their social and cultural beliefs, and their opinions. We have been involved starting from preliminary site selection, field data collection and end result hearing of the project outcome.

To overcome the project objectives, five research experts were also involved starting from field data collection till data analysis.

As an outcome of the project, the local communities had achieved basic knowledge about the project and how macroinvertebrates are important to see the health of streams and rivers. The participants are served with special fooding, lodging and monitory support as payment for their work which also contribute to socio-economic.

5. Are there any plans to continue this work?

With 1 year project funded by your foundation I got huge knowledge in research particularly on macroinvertebrates, therefore I would like to continue the same work in future to disseminate my knowledge to protect wild animals and insects which has their own ecological role in the nature. Particularly I am interested in water quality assesment using macroinvertebrates using family biotic index, which is simple but effective to see the health of the rivers and streams. To assess the health of the rivers and streams are important as many see animals and insects are living and their life depend on the quality of water. Moreover we the human need water in daily life for many purposes.

The current project and others have covered western and southern part of Bhutan only but left out in central part especially in Wangchuk Centennial National Park. The assesment of health of the streams and rivers in the protected areas are seen more important as to create baseline data for future monitoring. It is because in the protected areas, the environments are pristine, developmental activities are minimised, there are less settlements, using of chemical fertiliser and pesticide are minimum which are the main threats to deterioration of water quality. Therefore, if we study and keep data of such areas, it can represent for the nation rather than creating baseline data from already affected areas. Since Wangchuk Centinnial National Park (WCNP) was declared in 2008 as a tribute to the visionary, selfless leadership of the Wangchuk dynasty. It is located in north-central Bhutan. It is also the country's largest park, covering 4,914 square kilometres. The four major river systems Punatsangchu, Mangdechu, Chamkharchu and Kurichu flow through the park and eventually become confluent with the Manas River in the south. There are several mountains such as Gangkhar Puensum, Rinchen Zoegila and Jajayla that are under permanent snow cover. Almost 85% of the park remains under snow cover for about 4 months during the winter. The water towers, rivers and supporting watersheds in the park that feed the four major river systems are vital for hydropower generation, thus Bhutan's economic development will depend to a large extent on ecosystem conservation in the park.

Wangchuck Centennial Park covering an area of 4914 square kilometres connects Jigme Dorji National Park in the west to the Bumdeling Wildlife Sanctuary in the east, thus, ensuring a biological connectivity in the northern highlands of Bhutan. The park among others has a very rich floral, faunal and cultural heritage represented by 693 vascular plants, 41 mammal species, and 231 bird species, and 46 species of butterfly, practice of transhumance and agro-pastoralism. Being a newly gazetted protected area and having a sparse population, there is better opportunity for WCNP and also donors for conservation in WCNP. The mammal fauna includes several charismatic species such as tiger, snow leopard, Tibetan wolf, Bhutan takin, Himalayan black bear and red panda beside others. All above directly or indirectly depend on the streams and rivers mentioned. Therefore, to maintain the water health inside the park is more important.

Therefore, I look forward for a similar grant from RSGF, however this time the grant will be utilised exclusively for the field work and payment for community involvement as I have already procured all necessary equipment form the first RSGF grant. The study will be conducted with similar objectives and I expect more number of species will be discovered and at the same time education outreach will promote understanding among different groups of people about the conservation of macroinvertebrates as well as local biodiversity.

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

This project would be made available to various relevant research institutions, like Ugyen Wangchuk Institute for Conservation and Environment, College of Natural Resources and National Biodiversity Centre. Similarly, the information established by this project will be used by non-governmental organisations and government agencies such as Department of Forest and Park Services, Wildlife Conservation Division, and National Environment Commission.

In addition, the findings of this project will be made available to park managers, foresters, schools, and mostly importantly to policy makers of the home country and abroad therefore, the research will provide critical information to conservationists, decision makers and implementers, which will help them frame plan and policies that take in to mainstream even the macroinvertebrates. In addition, currently there is an acute lack of baseline information on macroinvertebrates in Bhutan. Except for few sporadic studies done in the past, but no serious has been conducted. Hence, the project findings will be the baseline information, which will be useful to other researchers in future, who plan to undertake similar studies at large.

Two presentations were already made at the College of Natural Resources. One to the students and staffs of College of Natural Resources and one during RSG

conference to the researchers how are the aid receivers from RSG foundation, where we had an exchange knowledge program on different research. During this presentation we got chance to interact with Josh Cole, Grants Director at College of Natural Resources, Bhutan.

The vouchers specimens collected during the project period will be displayed in Park laboratory and made accessible to park staffs, school children, teachers, researchers, general public and any other interested individuals.

Moreover, will create account in Facebook, we chat and other social medias for easy accessibility in nation as well as worldwide.

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

As soon the grant is approved by the RSG foundation, I made schedule and carried out activities in order to complete the project in time. As the project time allocated by the RSG which is only for 12 months, I strictly followed the schedule prepare by self. All the planned activities were carried out as follows.

1. Procurement of study equipment (August 2015).
2. Public awareness meeting (October 2015).
3. Training to field helpers (November 2015).
4. Data collection (December 2015 to February 2016).
5. Awareness meeting to educational institutions (October 2015).
6. Species identification (December to March 2016).
7. Data compilation (March-April 2016).
8. Data analysis (May 2016).
9. Draft write up and recommendation by expertise (May 2016).
10. Incorporation of recommendations and final report writing (June 2016).
11. Final project finding presentation to public (July 2016).
12. Final report submission to the RSG foundation (July end 2016).

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
Purchase of camera	200	300	100	Increase in exchange rate
Dissecting scope	1300	1200	100	Difference in dollar

				exchange rate
Garmin GPS	500	400	100	Difference in dollar exchange rate
Purchase of safety gears, tent, boots, compass, touches	800	800	800	Sufficient
Daily allowance	700	800	100	Inflation rate
Stationaries & field equipment's sample Jar	300	200	100	Data recording & sample storing
Hiring of vehicle during field data collection	500	500	500	Transportation of data collectors to study sites
Food & refreshments for data collectors	300	200	100	Food and lodging for data collectors
Porter charges	200	200	200	Carrying charges during field data collection time
Public awareness meeting	0	200	200	Food & refreshments
Publications	300	300	300	Printing and binding
Total	5000	5000	0	The fund was sufficient

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

The next and immediate action would be the documentation of macroinvertebrates and strengthening public understanding on importance of macroinvertebrates in the river ecosystem through participatory approach, particularly in north-central of Bhutan because of following reasons:

- The previous studies on macroinvertebrates conducted in western and southern merely explore the water quality and macroinvertebrates diversity of southern and western region of the country.
- In Wangchuk Centennial National park, the vegetation ranges from warm broadleaf forests to alpine meadows, spanning an altitudinal range from 2,500 to 5,100 m (Map 2). Over 693 species of vascular plants, 41 mammal species, and 250 bird species, 46 species of butterfly and have been recorded from the park and its buffer zone. The mammal fauna includes several iconic species such as the tiger (*Panthera tigris*), snow leopard (*Uncia uncia*), wolf (*Canis lupus*), Bhutan takin (*Budorcas taxicolor whitei*), Himalayan black bear (*Ursus*

thibetanus), and red panda (*Ailurus fulgens*) which directly depend on the health of the water.

- No adequate studies on macroinvertebrates diversity and water quality assessment had been conducted so far in this area. To carry out conservation to endangered wild animals listed above which are there in the park, their lives depend on the water. Most of the water birds and fishes feed on macroinvertebrates, therefore to survive threatened and endangered bird and fish species, there is need to study the health of the streams and rivers.
- Macroinvertebrates diversity is equally important to birds and fishes for survival as most of them feed on macroinvertebrates.
- The presence of Lepidostomadidae and Hydropsychidae family species of macroinvertebrates are the indicators of good water quality.

Therefore I felt the important to continue search research in protected areas in Bhutan is most as the communities and students are not aware of the water ecosystem. The macroinvertebrates living in the water plays vital roles in the water ecosystem, so I felt very important to continue such research in all parts of the country. It is felt that such study should continue not only in polluted areas and near settlements but equally important in protected areas so that comprehensive scientific facts would be established to address the existing problems as well as in achieving long term conservation goal.

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?

RSGF logos were used while making presentations in colleges and schools. Staffs, local people and participants were also informed about the support of RSGF for my present project. The logos were familiarised to the communities and students. I even shared too many friends regarding the RSG grant and support. RSG has been prominently acknowledged in the reports submitted for publications.

11. Any other comments?

Indeed, I am very much thankful to Rufford Small Gants Foundation for providing financial support to complete my project successfully. Although we may have novel plan for protecting and conserving our fast depleting environment and its biological assets but lack of fund is major problem faced by individuals, groups or country particularly in developing nations. Considering the above fact, I truly appreciate the role the RSGF has been playing in nature conservation all-over the world. Since the RSGF support field oriented activities, the information generated by individuals and small groups would be most reliable resources to established scientific facts to address present problems as well as develop future biodiversity action plan.

Once more heartfelt gratitude for the grant support and more over if the foundation could support the second grant of the project, the findings of the second project would be more beneficial as the study site is completely different inclusive of environmental variables such as altitude, latitude, longitude and the environment conditions. Moreover the study site is inside the protected area commonly known as Wangchuk Centennial National Park insisted during the 100 year celebration of Wangchuk Dynasty and also the largest protected area of Bhutan.