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	Gloria Molina Gaytán
Project title	Analysing water pollution using aquatic macroinvertebrates in Oaxaca, including Participatory monitoring and Environmental Education Programs
RSG reference	22298-1
Reporting period	15th June 2017 to 15th June 2018
Amount of grant	£5000
Your email address	biogloga@hotmail.com
Date of this report	29 June 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
To develop a monitoring system with macroinvertebrates to measure water quality				The monitoring programme began in June 2017 and concluded successfully in June 2018. However, we will continue monitoring the Atoyac River and we will include rivers from other areas from July 2018.
To contribute to the knowledge of the aquatic macroinvertebrates				We already have the lists of taxonomic families of aquatic macroinvertebrates. However, we need to continue with the identification to genus or species (if it is possible) level to know if we have collected an important species (endemic, vulnerable, etc.)
To identify aquatic macroinvertebrates as indicators of water quality in the Atoyac River				We elaborate an inventory of these indicator organisms from the Atoyac River.
To calibrate a biotic index to Atoyac River Sub-basin to determine water quality				We are waiting that CONAGUA gives us the last results of physicochemical analysis of water. Also, it is necessary to generate more data doing biomonitoring in reference sites (with cleaner water) to calibrate index.
To develop a participatory monitoring and evaluation program of water quality				We already started to promote the participatory monitoring with municipality authorities and local people, in several municipalities of Oaxaca through of participatory workshops
To provide a complementary tool to evaluate water quality to CONAGUA				We are elaborating a methodological guide to teach how to do the biological monitoring in rivers, and evaluate the water quality
To teach to students of different grades sampling methods, fieldwork and the identification of macroinvertebrates				Due to our successful work and the approbation of municipalities, and schools, we have taught this technique to some groups from high school and college students

To divulge the importance of the conservation of biodiversity, and of aquatic ecosystems				I have participated in the Oaxacan Water Forum, in the Civil Organization "Laboratorio del Pueblo" (People's Laboratory), and other Assemblies on favour of the Atoyac's rescue, to inform about the research and disseminate the importance of biodiversity conservation, and aquatic ecosystems. In addition, we have collaborated with an NGO to elaborate a documentary about our investigation with macroinvertebrates and its importance.
To strengthen synergies of work that we have with governmental, and non-governmental organizations				This strengthening was achieved with CONAGUA, three civil associations, the municipal authorities, and schools.
To serve as a model for the establishment of a water quality monitoring system for different regions from Oaxaca				At the moment, we are the only biomonitoring team of Oaxaca's Valley. However, I have advised to biology students at the state university, about the monitor rivers with macroinvertebrates in the course research methodology.

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

We had a big difficulty with the Tropical Storm "Beatriz", which brought heavy rains to Oaxaca, so, the access to the Atoyac River was very dangerous, therefore, in those days, we went to work to small water streams and we waited for the non-rainy days to go to work.

In a different occasion, it started pouring rain at the time that we were working in the river. Our vehicle was stuck in the mud, so, we ask for help from the municipal authorities and to the civil protection team. They helped us to out of that place. After this, there was no major problem.

We noticed that during the rainy season, we need waterproof waders to enter the riverside because the rivers were very depth and the boots were insufficient to isolate us from the water. To be able to work we use a long-handled net.

Equally, in the first months of the project, the multi-parameter equipment was damaged. It was necessary to take physical-chemical field parameters, so we had to ask for equipment to a Civil Association. In addition, many expensive vials and reagents were needed for a chemical analysis parameter (Total Organic Carbon).

Fortunately, CONAGUA donated all this material to the project. It should be noted that all this was necessary to complement the biological analyses.

During environmental education activities and participatory monitoring, several stereoscopic microscopes were required to work on the taxonomic determination of macroinvertebrates. This activity is very attractive to people and everyone wants to observe the organisms in the microscope. To solve this problem, we used a digital microscope to project the image through the camera of a laptop and a beamer. In addition, we buy magnifying glasses. However, the use of microscopes can be more significant for the learning.

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

The first important result is a taxonomic list of the aquatic macroinvertebrates indicators of water quality for the Atoyac River that we have obtained as part of our monitoring system. Besides, we had found different macroinvertebrates that have not been considered yet as indicators, but that are also important for the ecosystem.

The second is the collaboration with authorities from different sectors: government organisations, NGOs, schools, and municipalities that provided the facilities to do this research and carry out participatory monitoring and environmental education programmes.

Another important result is the people's training: authorities and citizens who learned this scientific technique, the importance of the conservation of rivers and their biodiversity.

I had several social service and intern students in this project. For the moment, two of them, are doing their undergraduate thesis as a part complementary to my project, and one student more has finished his degree, and he concluded his scientific report.

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

Dozens of people, such as students, professors, municipal authorities, public workers, and citizens, have benefited from participating in activities that allowed them to learn about macroinvertebrates (biology and ecology), their habitats (aquatic ecosystems) and the importance of their conservation. All this with the environmental education and participatory monitoring activities. In addition, they have learned a scientific tool (easy to use) to evaluate the water quality of rivers and take precautionary measures for their use, making decisions more informed.

In some municipalities, people have expressed interest in exploring other rivers and to learn about other macroinvertebrates that are indicators of clean water.

Academically, several biology and agroecology college students have been benefited from learning about the biology and ecology of macroinvertebrates, as well as their potential as a water quality indicator group. This has been possible thanks to the courses and training that I have given at the state university. Proof of this is that they have made (or are doing) theses, research projects as part of their methodology courses, social service, and internships where they have the opportunity to learn about any biological group of their choice and to investigate strategies for their conservation.

5. Are there any plans to continue this work?

Yes, definitely. From the beginning, I proposed to carry out this project in 2 years. I finished recently the fieldwork related to the monitoring of macroinvertebrates; therefore, I need to identify these macroinvertebrates, especially the organisms that belong to families that have been registered as vulnerable, according to the existing literature.

Although in August 2018, I was committed to develop the participatory monitoring, I started already and I have observed that the work with municipality's authorities, such as "regidores", as well as local people, can work very well. Therefore, I will continue to establish work strategies and training workshops.

Additionally, I started to work with environmental education activities. The reason was that some authorities requested to carry out the project promptly. However, I will continue working in the following months.

It is important mentioning that I am going to request the support of this foundation again, to continue with the fieldwork in the next year. Regarding the monitoring with macroinvertebrates, I need to include reference sites, from excellent and regular quality, with the aim to have all the ranges of quality and being able to calibrate, the BMWP index.

The training to authorities in participatory monitoring is not finished yet. Likewise, the impact of this project on schools has been very high, therefore, it is necessary to continue it.

In addition, authorities have requested training for students and teachers in other regions, outside of my study area. Since we are the only group that performs biomonitoring in Oaxaca, it is very important to consider these requests.

I will continue working on this project because Oaxaca is one of the most biodiverse states of Mexico; its freshwater fauna is poorly known. Therefore, I do not doubt that relevant information can be founded. Finally, to include the participation of academics, authorities, and citizens, is very important to manage resources and conserve biodiversity.

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

Schools: I have shared the information in two college courses during the work sessions with my students, as well as in groups of high school students. The information was presented through video clips, PowerPoint presentations, fact sheets, local news analysis, and the participatory biomonitoring.

Municipalities: I carried out training (theoretical-practical) to teach the topics of study. For these cases, I used manuals, didactic guides, PowerPoint presentations and preliminary results of my research. In addition, I carried out participatory monitoring with municipal authorities and citizens.

It should be noted that in both cases (schools and municipalities), I applied the biological monitoring as an integrating activity, where all the people had the opportunity to go into a river; to put into practice the sampling techniques; to do the collection and taxonomic determination, calculate the quality of the water and the degree of organic contamination. Additionally, they observed various groups of macroinvertebrates, stages of development (larva or adult), locomotion systems, eating habits, etc., and finally (in some cases), released the organisms at the end of this practice.

This exercise has proved to be very enriching, motivating, interesting, and effective for their learning.

In addition, we have participated in local interviews, dissemination conferences and a short documentary (promoted by a Civil Association) to publicise the study and the importance of macroinvertebrates.

Academy: I have presented the advances of my research, particularly the preliminary results of insects, in the National Congress of Entomology and the Polytechnic Seminaries, both in Oaxaca.

In July 2018, my students and I are going to Quito, Ecuador, to share the information of our researches in the Congress AQUATROP: Tropical Aquatic Ecosystems in the Anthropocene.

Finally, as a researcher, all the information will be written in scientific papers and divulgation articles.

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

It was used from June 2017 to June 2018. The Rufford Foundation grant was used according to the length of the project requested.

In July 2018, we are going to go to Mountain Rivers and streams that belong to the physiographic northern region of Oaxaca. This will be with the goal to do biomonitoring in reference sites (cleaner sites) and to generate more data in order

to calibrate the BMWP index for Oaxaca. Additionally, it is part of the thesis of one of my students.

I will try to continue with the fieldwork, environmental education in schools and participatory monitoring but I already have not resourced, therefore I need to request extra funding to continue with the project.

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
Food, water, and accommodation	2100	2045	55	Many students participated in the fieldwork. There were minimum expenses for the lodging. Most of the visits were from entry to exit
Subsistence payments for local team	400	350	50	Not at all sites was necessary to pay local guides to enter the river
Petrol	1500	1370	130	When conditions allowed it, we worked in two places per day to save time and gasoline.
Material to collect	500	680	-180	The amount requested was insufficient. More material and equipment were needed to provide to the people in workshops and training. In this case, I used money from petrol and payments for local team.
Chemical reagents	500	555	-55	It was necessary a larger amount for the purchase of reagents, and to pay for their transfer to Oaxaca since some reagents were bought in Mexico City.

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

To do biological monitoring in reference sites that include good, and excellent water quality; to identify all the indicator aquatic macroinvertebrates in these sites, in order to obtain more data and be able to calibrate the BMWP index for the Atoyac River sub-basin.

To train the authorities and volunteer monitors in other municipalities of my study area.

To finish the environmental education activities with high school students, in order to inform them of the importance of the conservation of macroinvertebrates and their habitat.

Additionally, I will continue to train and teach my university students (of biology classes) about biomonitoring and macroinvertebrates, in order to encourage them and investigate into the study of these wonderful and little-known organisms.

To achieve all this, I will need to ask for more financing. I am really interested in completing this project in the best way, and subsequently, give it continuity as part of my research line.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did The Rufford Foundation receive any publicity during the course of your work?

Yes. The Rufford Foundation logo is in a guide of "Aquatic macroinvertebrates of Atoyac River Sub-basin", which we use in workshops, and training sessions. It was presented in the talks that I gave in the National Congress of Entomology and the Polytechnic Seminaries, both in Oaxaca. Also, the logo has been presented in the presentations that we gave in workshops and environmental education activities.

Additionally, we will present the logo in two posters during the AQUATROP Congress (in Quito, Ecuador). It will continue to appear in all the divulgation and scientific materials where we present results, such as thesis, articles, and other formats.

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

Dr. Manuel Astudillo, Dr. Matthias Rös, and **Dr. Laura Barraza** are experts in the areas of Macroinvertebrates, Ecology and Environmental Education respectively, for which they contributed with great ideas to enrich the work, as well as advice for specific situations.

Gabriela Santiago, Mariela Méndez, and **Santiago Hurtado** are thesis students and they are monitoring rivers in reference sites. Gabriela, Mariela, and Edith have participated in the participatory biomonitoring and environmental education activities.

Edith Melchor, Karen Martínez, Victoria Santiago, Magdalena López, Lorena Bautista, Magdalena Cortés, and **Alanna Rodríguez** were intern students and social service providers. All of them worked hard on the biomonitoring and the identification of macroinvertebrates.

Emmanuel Ramírez facilitated some links with municipal authorities and public officials.

Dr. Ernesto de los Santos has documented some activities during monitoring, participatory workshops and educational activities.

12. Any other comments?

I really appreciate the grant that The Rufford Foundation gave me to carry out this great project.

With this research, it has been generated a baseline information about macroinvertebrate diversity that inhabits the rivers of the Atoyac sub-basin. Undoubtedly, the results that we have obtained are very important. These will have a high impact in order to establish strategies for the biodiversity conservation and their habitat.

This support really allowed us to perform a research that is absolutely necessary, which has allowed to start the development of an emerging research line, in one of the state's most biodiverse from Mexico.

We hope to be able to reward us again with the support of The Rufford Foundation and to continue with this important project.


Left: Presentation of macroinvertebrates. Right: Presentation of BMWP index to authorities.

Left: Taxonomic determination of macroinvertebrates in a workshop. Right: Environmental education activities.

Left: Educational research with students. Right: Students with protection equipment.

Left: Biomonitoring with high school students. Right: Biomonitoring with college students.

Left: Participatory monitoring with authorities. Right: Sampling and collection of macroinvertebrates.

Giant water bug male. ©Victor Manuel Ortiz Cruz.