

## The Rufford Small Grants Foundation

### Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. 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. 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>	Rachael Carrie
<b>Project title</b>	The Development of Freshwater Bio-Monitoring in Belize, Central America
<b>RSG reference</b>	11376-2
<b>Reporting period</b>	March 2012- March 2013
<b>Amount of grant</b>	£6,000
<b>Your email address</b>	<a href="mailto:r.carrie@lancaster.ac.uk">r.carrie@lancaster.ac.uk</a>
<b>Date of this report</b>	March 5 <sup>th</sup> 2013

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
Experiential Capacity Building and Results Dissemination			√	<p><b>Results Dissemination</b> Findings from research supported by the first Rufford grant was well received internationally at the 1st Congreso Latinoamericano sobre Macroinvertebrados de Agua Dulce', Universidad de Costa Rica in February 2012. Details of this research are soon to be submitted for publication: Carrie, R.H., Dobson, M.D. &amp; Barlow, J. (in prep). Effects of geology and season on macroinvertebrates in lowland Belizean streams: implications for tropical bio-assessment.</p> <p>Nationally, findings were disseminated at the 6th Natural Research Management Symposium at the University of Belize in March 2012 and to staff at Ya'axche, the supporting NGO.</p> <p><b>Capacity Building</b> Four staff members completed a 6-day taxonomy workshop where they learned family level macro-invertebrate identification for the most commonly encountered taxa in small lowland streams in Belize. All participants became proficient at identification and the management of taxonomic samples. This training builds on that provided during the first Rufford grant. Field skills were refreshed and enhanced during the current project. As a result of this training, the freshwater team initiated their own project to experientially continue their skills building. They have applied to present details at the 7th NRM conference at the University of Belize. That the freshwater team have joined external researchers in conducting their own research and taken their place to present outcomes at the national NRM conference is testament to the value and success of the two Rufford grants associated with this project. Furthermore, the knowledge learned during the taxonomy workshop is currently being used to produce a short</p>

				<p>picture guide of important taxa for their colleagues.</p> <p>We were also able to contribute again to the University of Belize Field Methods module teaching the 2012 cohort about methods and metrics for stream bio-assessment.</p>
<p>Wide scale survey of minimally disturbed sites for macro-invertebrates and environmental information</p>		√		<p>Weather and staff limitations prevented the collection of sufficient samples to undertake a useful biological classification. Consequently, the project was adapted early in the season to explore macro-invertebrate response to anthropogenic disturbance (see revised 3<sup>rd</sup> objective). This objective reflects an equally valuable stage in the process of developing freshwater bio-assessment in Belize, because the robustness of commonly used metrics has not been tested locally. Controlling for major sources of natural variation (identified during the first Rufford funded project), 39 forested sites and sites subject to a range of agricultural and residential activities were sampled for biological and environmental information.</p>
<p>Classification of Reference Sites and Model Building Revised: Identification of biotic metrics able to discriminate disturbance in small lowland Belizean streams</p>			√	<p>We identified that family level metrics were sensitive to change at our putatively most impacted sites – those influenced by banana cultivation and sand and gravel mining. These findings indicate commonly used tolerance and compositional metrics are able to discriminate anthropogenic disturbance in Belizean streams. However, none of the metrics tested detected significant change in areas characterised by low intensity activities, despite evidence of environmental impacts. Accurate assessment of low-level effects requires attention to be focussed on alternative approaches, such as finer taxonomic resolution and a better understanding of the confounding effects of natural variation.</p> <p>As a direct result of this work macro-invertebrates have been adopted as indicators to address a number of objectives in the current revision of the National Biodiversity Monitoring Plan of Belize.</p>

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

The dry season in 2012 was wetter than anticipated which delayed the start of our sampling season. In addition, staff changes meant that one team member who had been trained previously was no longer available. These circumstances made it unrealistic that we would collect the number of samples required to undertake a useful biological classification. Rather than risk this outcome, we changed our objective early in the field season to address research questions equally as necessary to the development of stream bio-assessment in Belize.

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

1. **A skilled team of freshwater staff.** There now exists a team of four freshwater staff in southern Belize who are able to collect, process and identify macro-invertebrate samples to family level. This team have applied their skills to complete their own project that sought to continue building their capacity and investigate the question of seasonal variability in environmental and biological factors in one stream in southern Belize. The team are now presenting their own work to their peers and have been requested to undertake a number of field surveys. In the near future we hope to build data analysis and wider aquatic ecological knowledge to enhance the skillset of this team.
2. **Wider local and international knowledge of tropical stream macro-fauna and bio-assessment.** There exists a wider awareness about the need for stream bio-assessment and the ways in which it can be done in Belize as a result of presentations and continued participation in the University of Belize Natural Resource Management field methods module. Scientifically, we have contributed knowledge about bio-assessment in small tropical streams and tropical stream macro-invertebrate fauna. During our first Rufford grant we collected specimens that were initially believed to be a new species belonging to the Naucoridae. A further specimen collected by the freshwater team has resulted in a revision of this identification and the specimens are now believed to be a new species belonging to a different family of Hemiptera: Potamocoridae. Our collection represents a range extension of this family, which has been extremely rarely recorded. Subsequently, little is known of its ecology. A formal manuscript describing this species is pending!

**3. Macro-invertebrates have been officially adopted as indicators in the National Biodiversity Monitoring Plan.**

We have demonstrated the effectiveness of macro-invertebrate metrics for discriminating high level impacts in Belizean streams and have highlighted the need for further work to enable the assessment of low-level effects. As a direct result of these findings and the relative ease with which NGO rangers have taken up and applied their new skills, macro-invertebrates have been adopted as indicators of biodiversity change.

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

We did not work directly with any one local community. However, this project was undertaken in partnership with the Ya'axche Conservation Trust – a local community-oriented NGO. Staff comprising core freshwater team live in the rural communities of our study area. The training and experience received has enabled them to develop technical skills and expertise lacking locally.

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

Yes! Now that macro-invertebrates have been formally recognised in the National Biodiversity Monitoring Plan, we hope to explore biological classification at a national scale and metrics reflective of the land-use and in-stream threats that characterise Belize.

We intend to further build the capacity of the core team, particularly their data analysis skills and wider aquatic knowledge and to extend training to other recipients. Part of this will include the publication of a guide to macro-invertebrates for stream bio-assessment in Belize.

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

The freshwater team will present their work at the 7th Annual NRM Symposium, Belmopan, Belize. April 17th, 2013

Findings from 2012 fieldwork are shortly to be submitted for publication: Carrie, R.H., Dobson, M.D. & Barlow, J. (in prep). Are family-level biotic indices a useful measure of human influence in moderately disturbed tropical streams? An assessment from lowland Belize. This work will also be presented at the 2013 Society for Freshwater Science Annual Meeting in Florida, May 19th-23rd 2013

It is anticipated that findings will be disseminated locally in the summer.

## 7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project?

The RSG grant was utilised as anticipated between March 2012 and February 2013.

## 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
Ranger and field support	3656	4000	-344	Difference reflect monies paid for local assistance in areas we had not planned to sample initially and that were unfamiliar to the project team
Operational Support Utilities (incl fuel)	954	787.33	+166.67	Fuel costs were lower because of the difference in number sites sampled
Equipment	1390	1286.47	+103.53	Fewer preservatives etc. were needed because fewer sites than planned were sampled
<b>TOTAL</b>	6000	<b>6073.80</b>	-73.80	This budget is based in the exchange rate of £1.00:\$Bz3.20

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

1. Development of local data analysis skills and aquatic ecological knowledge and expansion of training nationally.
2. Production of national taxonomic material.

3. Characterisation of a national biological reference and identification of metrics that can be used to detect the types and scales of disturbance across Belize.

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

The RSGF logo was used in presentations made in Costa Rica in 2012 and will be used in all presentations made in 2013. The RSGF will be acknowledged in all forthcoming publications.

**11. Any other comments?**

This project represents a key step in facilitating sustainable stream management in Belize, has contributed to the development of local capacity to monitor streams and revealed important taxonomic information. This would not have been possible without the support of the RSGF, for which we are extremely grateful.