

## The Rufford Foundation

### Final Report

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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**

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Grant Recipient Details	
Your name	Darshanaa Chellaiah
Project title	Response of Stream Functioning to the Replacement of Natural Forests by Exotic Trees - An Assessment of the Impacts of Buffer Zones in Oil Palm Plantations in Borneo
RSG reference	17634-1
Reporting period	1 <sup>st</sup> October 2015
Amount of grant	£4525
Your email address	dche57@student.monash.edu
Date of this report	18 October 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
To compare litter quality of <i>Macaranga tanarius</i> (control sp.) to oil palm leaves.			✓	We found that oil palm leaves were tougher and generally higher in nutrients compared to the control species that had higher secondary compounds.
To characterise vegetation structure and stream geomorphology of the different buffer types compared to natural streams			✓	We found that vegetation density followed the disturbance gradient being lowest in buffer type with the most disturbance and highest in natural forest. This in turn reflected in higher plant foliage coverage, morphospecies diversity, instream litter substrate and shading and lower water temperatures in naturally forested streams.
To identify stream leaf litter decomposition rates in oil palm plantations compared to natural streams			✓	Data showed that <i>Macaranga tanarius</i> leaf species decayed significantly faster than oil palm leaves in plantations streams across different buffer zones.
To identify microbial communities present in plantations streams of different buffer types compared to natural streams.		✓		Data have been obtained, analysis is now underway.
To identify shredder communities present in plantations streams of different buffer types compared to natural streams.		✓		Data have been obtained, analysis is now underway.

To identify how different buffer types affects water chemistry and water quality of streams.			✓	A PCA analysis revealed that about 60% of the variation between streams of different buffer types can be attributed to the water chemical data that we obtained.
To increase awareness among plantation operators and the general public on suitable mitigation methods for healthier stream ecosystem functioning.			✓	I have and will still be presenting the results of my study in international and local conferences and workshops.

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

Given the smaller extent of acacia plantations in Borneo, I decided to change my project to focus only on oil palm plantations and extend my research to include varying stream management strategies (buffer zones) in other plantation companies to measure changes to stream litter decomposition and decomposer communities.

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

My project helps us identify how and if the different buffer types help mitigate impacts of oil palm streams onto stream ecosystem functioning. Firstly, we found that vegetation density followed the disturbance gradient being lowest in buffer type with the most disturbance and highest in natural forest. This in turn reflected in higher plant foliage coverage, morphospecies diversity, in-stream litter substrate, shading and lower water temperatures in naturally forested streams. We also found that *Macaranga* leaves that were used as a native reference species decomposed significantly faster than exotic oil palm leaves. The impact of invertebrate shredder on rates of decomposition were minimal in plantation and forest streams studied thus most of the decomposition is by bacteria and fungi present in the streams. There was also significantly faster leaf decay rates in oil palm streams compared to naturally forested streams that can mostly be attributed to increased temperature and increased nutrient levels that speeds up microbial metabolic processes.

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

Plantations workers and managers were involved in my data collection throughout the decomposition experiments. I will also be giving more talks and presentations highlighting key results and its implication on healthy streams ecosystem functioning after a complete analysis of data I have collected.

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

Yes, I will be completing analysis for data collected until early next year.

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

By presenting the results of my study in conferences, workshops and to oil palm plantation companies.

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

Over a period of 1 year as indicated in the application.

**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
Flights, ground transport	1436	1560	+124	Flight price difference
Accommodation, food	889	801	-88	Cooked my own meals
Research facilities, guide, conservation fee, miscellaneous	690	690		
Ethanol	225	225		
Water analysis +collaborator	423	423		
Next generation sequencing	862 (previously)	767	-95	Changed the direction of my project to include NGS

	for air freight)			analysis. Used money to buy reagents and kits needed.
<b>TOTAL</b>	4525	4466	-59	

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

It is important for me to reach out to more stakeholders, NGOs and other scientists to foster collaborations and to ensure that data obtained from my research is used to make important legislative decisions when proposing sustainable oil palm management plans.

**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?**

Yes, I used and will use the RSGF logo in local (Monash University, FRIM workshop, Newton Ungku-Omar workshop on oil palm sustainability and international (ATBC conference, Montpellier) presentations.

**11. Any other comments?**

I appreciate the RSGF funding that was given to me. This funding has helped me tremendously with completing the objectives of my research. I look forward to working again with The Rufford Foundation in the future.