

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.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	M.O. Anand
Project title	Conservation implications of fragmentation and logging impacts on carbon storage ecosystem services in the Western Ghats, southern India
RSG reference	8386-1
Reporting period	1 st October 2010 to 30 th September 2011
Amount of grant	£5895
Your email address	moanand@gmail.com
Date of this report	30 th September 2011

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>To characterise and compare the tree communities and above-ground carbon stores of fragmented and logged forests as well as pristine contiguous forests in the mid-elevations rainforests of central Western Ghats (By sampling square vegetation plots of 30 m side for all tree stems over 10 cm girth at breast height and applying general allometric equations to estimate carbon stored)</p>			+	<p>60 vegetation plots covering 5.4 ha across 20 sites were sampled. Roughly 50% in contiguous and fragments. Over 8755 stems of at least 228 species were enumerated. Contiguous forests (165.2±40.9 (mean±1 SD) tonnes carbon/ha) stored significantly higher levels of carbon than fragmented forests (119.8±43.2 tonnes carbon/ha). These differences arose mainly from differences in habitat structure, but there were also marked changes in species composition. As expected, more heavily-disturbed (logged) sites stored less carbon than less-disturbed ones. However, unavailability of logging records limited the analysis of interactive impacts of fragmentation and logging.</p>
<p>To test theoretical predictions of changes in above-ground carbon storage in forests affected by fragmentation and selective logging (Prediction: Fragmentation and logging primarily affect forests by isolating habitats and altering micro-habitats through edge effects and biomass removal. Tree species that are either dispersed by wind or small vertebrates, and fast-growing, light-loving species would be expected to do better than large-seeded animal</p>		+		<p>Large-seeded and shade-loving species declined in abundance from contiguous to fragmented forests. In contrast, smaller-seeded light-loving species did better in fragments than in contiguous forests. Larger-seeded species tended to grow bigger and shade-loving species tended to have denser wood. One would expect that, as time progresses, there would be further reductions in above-ground carbon storage in these fragments. At the moment though, there appears to be some functional compensation taking place within the tree community of fragmented forests, wherein a few large-seeded and large-stature hardwood species are highly abundant. Interestingly, these are mostly commercially and culturally important species. Are</p>

<p>dispersed species and slow-growing shade-loving species. The relationships between plant functional traits such as fruit size, growth rate, adult tree dimensions and wood density would eventually determine the resulting changes in above-ground carbon storage)</p>				<p>they deliberately planted here by people or spilling over from nearby shade coffee plantations? Why they are so common in the fragments needs to be better understood for the conservation of above-ground carbon storage ecosystem services.</p>
<p>To engage with stakeholders to communicate project goals, results and recommendations</p>			<p>+</p>	<p>1. The principal investigator and project team presented a poster on the economic values of forests in agricultural landscapes at the CAFNET MELA on 14th and 15th April 2011. The event was attended by several hundred agriculturalists – primarily coffee farmers – who are important stakeholders in the forests being studied. The poster, presented both in English and local languages – Kannada and Kodava – drew on case studies from elsewhere to give a general introduction and examples of ecosystem services provided by remnant forest fragments in agricultural landscapes. During this presentation we also spoke to several agriculturists and conservationists about our project. No project data itself were presented, however, because the event took place before project data collection had been completed.</p> <p>2. The principal investigator made a presentation to Nature Conservation Foundation titled “Functional shifts in tropical forest fragments: impacts on above- and below-ground carbon storage” on 29th July 2011. The presentation covered all the major research findings of the project. Nature Conservation Foundation has a number of projects working towards integrating rainforest conservation</p>

				<p>and restoration into sustainable agriculture. A number of useful discussions and opportunities for collaboration emerged from this meeting.</p> <p>3. Detailed reports of the study findings and recommendations have been prepared and will be submitted to forest administrators and local conservation groups. A copy of this detailed report will also be submitted to the Rufford Small Grants Foundation.</p>
<p>To conduct pilot studies for other important pieces of the forest carbon story, including collecting data on plant functional traits and soil carbon storage. (Leaf and soil carbon and nitrogen concentrations were estimated through dry combustion of leaf and soil samples at our laboratory at National Centre for Biological Sciences.)</p>			+	<p>We conducted a small project to characterise species traits relevant to tree species response to fragmentation as well as species contribution to carbon storage (e.g. specific leaf area, leaf C:N ratio, wood density, maximum tree height, seed size). These data were obtained both from primary fieldwork as well as from secondary data sources.</p> <p>We also conducted a short project to characterise soil carbon storage across the study sites.</p> <p>These pilot studies generated a lot of important information. Plant functional trait data were very useful in the analysis and interpretation of the data (see results above) and highlighted the scope for more detailed studies. Preliminary data on soil carbon too showed some very interesting patterns of soil carbon losses in forest fragments ($2.95 \pm 0.8\%$) compared to contiguous forests ($1.85 \pm 0.5\%$). Interestingly, at any given basal area, contiguous forests stored over 1.5 times as much soil carbon as fragmented forests, suggesting the contributions of species composition (possibly acting through leaf C:N ratios) and other micro-habitat conditions in sustaining higher levels of carbon in contiguous forest soils.</p>

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

The project largely progressed as planned and on schedule and all objectives were at least satisfactorily achieved.

During the early stages of the project, the biggest challenge faced was in finding suitable sites for the research component of the project. Despite several visits to, and inquiries at, local forest department offices, we were unable to obtain any useful data on logging histories of different sites. We were therefore forced to review our research design to focus less on logging impacts, and to use basal area as a surrogate for logging intensity wherever possible.

Another challenge during site selection was in finding comparable sites between contiguous and fragmented forests. In general, fragments were more heavily used and disturbed by people than contiguous forests. Because of these unexpected challenges, site selection took up far greater time and effort than originally planned.

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

a. Generation of baseline data on changes in tree communities and above- and below-ground carbon storage ecosystem services in response to forest fragmentation

The extensive field campaign resulted in a comprehensive assessment of tree community composition in contiguous and fragmented forests and the differences in tree communities between these two habitats at the study site. Assessments and similar comparisons of above- and below-ground carbon storage across these habitats were also carried out. These data generated important and reliable baselines for all further assessments, conclusions and recommendations from the project.

b. Insights into the mechanisms and ecosystem consequences of forest fragmentation impacts on tree communities.

Preliminary assessments of plant functional traits were also initiated during this project. Along with data from a. above these functional trait data were analysed to investigate and better understand the underlying mechanisms driving tree community change in fragmented forests, and the consequences of these changes for the future of carbon storage ecosystem services that these forests provide. The results are presented in a detailed report that will be submitted to forest administrators and local conservationists in the near future. This report has also been submitted to RSGF. In the longer term, after collecting some more data to address a few remaining data gaps, these results will be written up as up to two technical articles for scientific peer-reviewed journals as well as a non-technical technical article in the popular media. The time frame for achieving this is 12-18 months, starting October 2011.

c. Interactions with important stakeholders to improve awareness of ecosystem services provided by natural forests

At the end of its first year, our project has begun to generate some insights into challenges and opportunities for conservation of trees and carbon storage services. Still, we are keen to collect some more data to better understand and interpret our results before promoting our conservation recommendations. In the past year, therefore, we concentrated largely on getting to know the stakeholders (land owners and conservationists) and getting them to know more about us and our work. Efforts were made throughout the project to engage with these stakeholders on topics of

ecosystem services and conservation. Through these interactions (detailed in the table above in response to section 1), we have established a visible presence and strong rapport with a wide section of important stakeholders in the conservation problem. This will be immensely helpful as the project develops and begins to generate actionable recommendations. Further, through these interactions, we have begun to uncover many of the challenges that lie ahead in linking carbon storage ecosystem services and biodiversity conservation in the study landscape (e.g. most of the forest land is owned by the government, but is largely affected by the local communities. This creates challenges for identifying beneficiaries of payments for ecosystem services).

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

There were several types of interactions with local communities such as meetings and presentations (detailed in section 1 above) and informal interactions at the various field sites during fieldwork. Perhaps the greatest level of involvement with local communities came through the participation of local undergraduate students and aspiring young conservationists in the research project, both as project employees and volunteers. Fifteen such young participants were trained in a variety of field and laboratory techniques related to ecological research and brought in contact with numerous leading conservationists through this project.

5. Are there any plans to continue this work?

Yes, there are plans to continue this work. The work implemented through this first RSG led to the identification of several priority areas for future research and conservation. These include both extensions of the work being currently carried out as well as new independent, but related, projects. We intend to systematically pursue these topics over the coming years through more projects, with an emphasis on developing a more holistic understanding of the conservation problem. More details on what we propose to do are provided in section 9, and in the detailed project report.

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

Technical papers and reports – a technical report has been prepared which provides a complete project summary, including some conservation implications and recommendations that emerged from the work. This report will be submitted to key members of the forest administration as well as local academic/conservation institutions. Copies of this report will be handed over to these people, at which time we will initiate detailed discussions with them about the project and the next steps. Further, we are in the process of preparing at least two scientific manuscripts based on the project results which will be submitted to reputed international peer-reviewed journals. While this first RSG has contributed significantly to the development of these manuscripts, we feel the need for some more data collection in a few key areas before the manuscripts can be completed. This data collection will be our priority for the coming months.

Meetings and presentations – We participated in a meeting and made a presentation of our project at the CAFNET Mela, a widely-attended meeting involving local communities, conservationists and forest administrators. The PI also presented the project results at the annual meeting of Nature Conservation Foundation, an NGO that is deeply involved in rainforest conservation in the Western Ghats. In the coming few months, we plan to present our results and recommendations at other meetings and conferences.

Non-technical report – In the coming months, we also plan to write and publish non-technical articles in the popular media about conservation challenges in the sacred forest landscape we worked in. We will target media in both English and local languages.

Plant functional trait database – The PI is a part of a larger team working to build an open-access Internet plant functional trait database over the coming 12-24 months. All relevant data collected during this project (e.g. leaf chemical composition, specific leaf area) will eventually be submitted on the database and freely accessible to anyone.

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

The RSG was used over a period of one year from October 2010 to September 2011. Nearly all RSG tasks were completed by August 2011. This is roughly a third the anticipated length of the project, which began in April 2010 and is expected to continue till the end of 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
Field coordinator fellowship	1247	1242.20	4.8	
Field assistant fellowship	1092	1091.58	0.42	
Part-time field assistants	76	80.56	-4.56	
Professional services	60	60.21	-0.21	
Field station rent and upkeep	403	393.02	9.98	
Food during fieldwork	375	218.06	156.94	Quite simply, the project team ate out less and cooked their own meals at the field station much more often than initially planned. These meals were not paid for from project funds – hence the underutilisation of this budget head.
Travel and local transport	115	71.09	43.91	Fewer trips were made between the field site and office than planned and hence the unspent money under this budget head.
Vehicle hiring charges	1044	757.29	286.71	The underutilisation of this budget head largely resulted from the project team getting better deals on vehicle hire than

				the usual operating rates.
Fuel	610	544.72	65.28	Shared fuel costs with other projects on a few instances; hence spent less on fuel than budgeted.
Hardware and computer supplies	75	72.40	2.6	There were some contributions from the PI's host institution
Office supplies and stationery	60	34.52	25.48	There were some contributions from the PI's host institution
Field and office equipment	200	187.88	12.12	There were some contributions from the PI's host institution
Vehicle maintenance	86	73.69	12.31	
Meetings and training	150	119.57	30.43	Shared costs with other projects.
Postage and delivery	23	0	23	There were some contributions from the PI's host institution
Telecommunications; Voice	30	5.32	24.68	The project team took advantage of some good packages offered by mobile phone operators, and hence greatly reduced the cost of voice telecommunications.
Telecommunications; Data	98	87.95	10.05	There were some contributions from the PI's host institution.
Printing services	15	4.69	10.31	
Publications	135	34.15	100.85	The final project report was the only expense claimed from this head. The project team had originally planned to also prepare pamphlets/posters communicating the results of our project in an easy-to-understand language. We now feel that such an exercise would be much more worthwhile once we can tell a more complete story and link it to actionable conservation interventions – something that would take another year or two of work. Hence the underutilisation of this budget head
Laboratory analysis for soil and leaf carbon and nitrogen	0	794.68	-794.68	These activities were not a part of the original proposal, but were carried out to address some concerns that were raised by one of the proposal reviewers. The adjustment to the budget was made following consultation with RSG administrators.

TOTAL	5895	5873.58	21.42	
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9. Looking ahead, what do you feel are the important next steps?

The immediate next steps of this project are work towards building on and substantiating some of the project findings. This would involve another few months of primary data collection at the study site, focussing on collecting leaf and wood samples for a large number of species in order to build a more complete plant functional trait database and studying dynamics of forest soil carbon, both through experiments and field observation. Further, we plan to conduct interviews with local communities to better understand the impacts of their forest use on vegetation and carbon dynamics. We are also exploring the possibility of collaborating with policy experts to understand the challenges to implementation of conservation incentives such as payments for ecosystem services, and work out how best to overcome them. More information on next steps is provided in the detailed report.

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 on all presentations and posters made in connection with this project. The logo also appears on the report for stakeholders. Further, the RSGF will be prominently acknowledged on any publications that emerge from this project.

11. Any other comments?

I am very grateful to the RSGF for supporting my work. I thank the grant administrators for assisting and advising me at various stages of the project. It has been a wonderful experience working with the RSGF.