

Understanding the Drivers of Losses in Carbon Storage Ecosystem Services Provided by Tropical Forest Fragments in India's Western Ghats (RSG 11086-2)

Progress Report I

I have now completed 12 months of my project which commenced on 1st April 2012. I have received a six-month no-cost extension of the project to complete a few pending tasks by October 2013. In the following paragraphs, I summarise my main activities during the period from 1st April 2012 to 31st March 2013.

1. Plant functional traits data collection

6 month update (14th October 2012): We have so far been able to gather data on seed, wood and leaf traits for around 300 individual trees covering 80 tree species. Field work to boost this dataset is in progress. The major field component of the project has been severely delayed because, in spite of our best efforts, the local Forest Department has not yet approved of our proposal to conduct our fieldwork. Such delays are quite frequent, and we are working hard to make sure we have our permits in hand at the earliest. Fieldwork was also suspended during the southwest monsoon between July and September.

12 month update: We carried out intensive fieldwork in forest sites between October and December 2012 to collect data on seed, wood and leaf traits of native tree species. We now have data on 90 species from 720 individual trees. The plant traits dataset is nearly complete, with respect to the targets set at the beginning of the project.



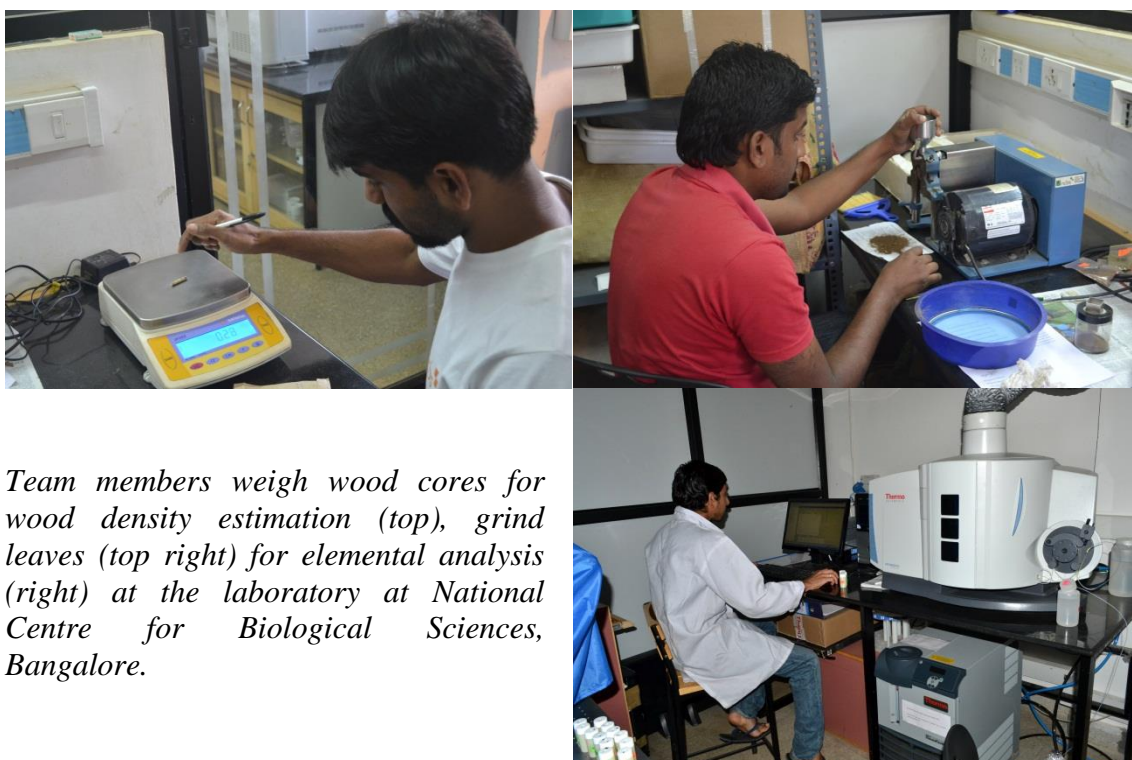
Team members collect of fresh leaves from a canopy species (top) at a forest fragment site in Kodagu, India, process the leaves for transport to field station (top right) and create scanned images at field station to estimate leaf area (right).



2. Laboratory work to characterize biophysical traits of leaves and wood

6 month update: The laboratory work to characterize plant functional traits such as wood density, specific leaf area (SLA), leaf carbon, leaf nitrogen and other nutrients has been completed for all samples that have been collected so far. Some preliminary analyses of the data have also been completed – however the completion of the functional trait dataset (which is around 50% complete) is essential before any meaningful results can be presented.

12 month update: Between January 2013 and March 2013 all plant material that was collected during field campaign were processed and data on wood density, specific leaf area (SLA), leaf carbon and leaf nitrogen were obtained. The sample extraction procedure for leaf phosphorus content and other leaf nutrients is currently underway.



Team members weigh wood cores for wood density estimation (top), grind leaves (top right) for elemental analysis (right) at the laboratory at National Centre for Biological Sciences, Bangalore.

3. Field work for soil carbon pools and fluxes

6 month update: Beginning mid-October 2012, we will initiate fieldwork to monitor relationships between tree species composition, abiotic conditions and soil carbon storage. This will involve field observations and experiments involving leaf litter fall, decomposition, microbial activity and soil carbon.

12 month update: During November-December 2012 we installed 20 leaf litter-fall traps across two forest fragment sites to monitor seasonal patterns in leaf litter quantity and quality in the study system. We also collected samples of freshly fallen leaf litter from 130 trees spanning 61 species. In the likely event of research permits being available to us from April 15th 2013, a field campaign to collect leaf litter and soil samples from across our study sites is planned for April-May 2013.



Team members install litter-fall traps at a forest fragment site in Kodagu (left). At right, a sample of fresh leaf litter of *Elaeocarpus serratus*, a common forest species in the study site.

4. Interview surveys to characterize local peoples' impact on tree species composition in forest fragments

6 month update: As this survey is in many ways linked to the plant fieldwork, it too has faced unscheduled delays. This survey will be conducted alongside the upcoming field campaign described above. So far, we have had held discussions with local conservationists in order to structure the surveys and identify informants.

12 month update: We have been preparing background material and complementary analyses to accompany the interview data collected in the field. The fieldwork for this is slated to coincide with the upcoming soils/litter fieldwork described above.

5. Project outcomes

Preparation of scientific manuscripts

Three scientific manuscripts based on data collected during this and our previous RSG are in preparation, with two nearing completion. The first, titled "*Altered stand density and tree allometry reduce carbon storage in evergreen forest fragments in India's Western Ghats*" will shortly be submitted to an international peer-reviewed scientific journal specializing in issues of forest management and conservation science. This manuscript not only documents 40% less carbon stored per area in fragmented forests compared to contiguous forests, but also explores the changes in habitat structure and species composition that drive these carbon losses.

A second manuscript on the ecological processes that filter tree communities in fragmented forests and the resultant impacts on carbon storage is in preparation and likely to be ready for submission by May 2013. This manuscript will be submitted to an international peer-reviewed ecology journal that deals with conservation topics.

A third manuscript which presents a method and a software tool to rapidly estimate leaf area is nearing completion and will shortly be submitted to an international peer-reviewed journal specializing in ecological methods. The software tool, which will be made freely available on the internet shortly, is likely to be quite useful to people researchers collecting data on plant functional traits.

In addition, we plan to prepare at least one-two more manuscripts from the data collected during this project, the details of which will be provided shortly. We will keep RSG informed and share copies of manuscripts as and when they're published.

Training workshop of forestry postgraduates

We conducted a two-day training workshop titled "*Field techniques for forest biodiversity and carbon estimation*" on 16th and 17th March 2013. The workshop was attended by postgraduate students in Forestry from the State-run College of Forestry, which trains a number of local students to be forest administrators and conservationists. The workshop was conducted by our team along with other biodiversity experts working in the region. Topics covered during the workshop included techniques for field identification of trees, vegetation plot establishment, inventory and estimation of forest carbon stocks. Students were also introduced to techniques such as transect walks for other biodiversity groups.

6. Future directions

Of the remaining six months of this grant, April, May and June will be devoted to completing all field- and laboratory-related components of the project. The remaining time will be dedicated to finalizing project deliverables, including technical and non-technical material for dissemination of project findings to key stakeholders. Our plans for the same are in the process of being developed and I will provide more information on this shortly.