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	Talemos Seta Shanka
Project title	Floristic Diversity and Carbon Stocks of Montane forest in Gurage Mountain Chains, Ethiopia
RSG reference	14589-1
Reporting period	February 2014 to February 2015 (the edited final Report will be sent in later as I mentioned in application template)
Amount of grant	£ 5430
Your email address	talemos.seta@yahoo.com
Date of this report	18/6/2015

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
1. To determine the floristic diversity and composition of the Biteyu Forest patch of Gurage Mountain chain			x	Specimen identifications are not yet finished.
2. To estimate the total carbon stocks in soil, aboveground biomass and belowground biomass			x	Litter biomass is ignored as the forest floor is empty because of grazing and browsing.
3. To identify potential threats to forest loss and degradation			x	
4. To aware the forest dependent people about the forest ecosystem services during data collection			x	

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

I gave an awareness /made discussion with /for the forest dependent people about the importance of forest for the environmental sustainability (see photos taken during the discussion). However, the great challenge for me during the data collection for the project was that people were coming with the axes to cut trees from the forest for the household fuelwood collection, fodder, house construction in addition with letting their cattle and goat for grazing and browsing freely in the forest. This is very complex problem to tackle about unless we find alternative livelihood mechanisms for the local forest dependent people in the Gurage mountain chain.

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

- In order to determine the floristic diversity of species in study area, the plant specimens were identified in national herbarium (ETH), Addis Ababa University, Ethiopia. It was found that the total of 179 species in 135 genera under 71 families were recorded from the *Biteyu* forest patch of *Gurage* mountain chain. Asteraceae was the family with the highest number of species (27 species, 15.08%) represented by 19 genera followed by Lamiaceae (11 species, 6.14%) represented by 10 genera and Rubiaceae (8 species, 4.5%) represented by 7 genera. A small number of trees and shrubs dominate this forest vegetation. About 53.3% of the total abundance is contributed by only five species, namely *Olinia rochetiana, Maytenus addat, Ilex mitis, Maesa lanceolata* and *Vernonia rueppellii* and a relatively small number of species were widespread in the forest with only nine species occurring in more than 80% of the plots sampled.

- All plant species from the *Biteyu* forest patch of the Gurage mountain chain was categorised into seven major growth forms (Figure 1). Analysis of the growth form data showed that herb, tree and shrub altogether accounted for 84.91% of the total species richness. The growth form classification here was done based on the information obtained from fieldwork and Flora of Ethiopia and Eritrea.

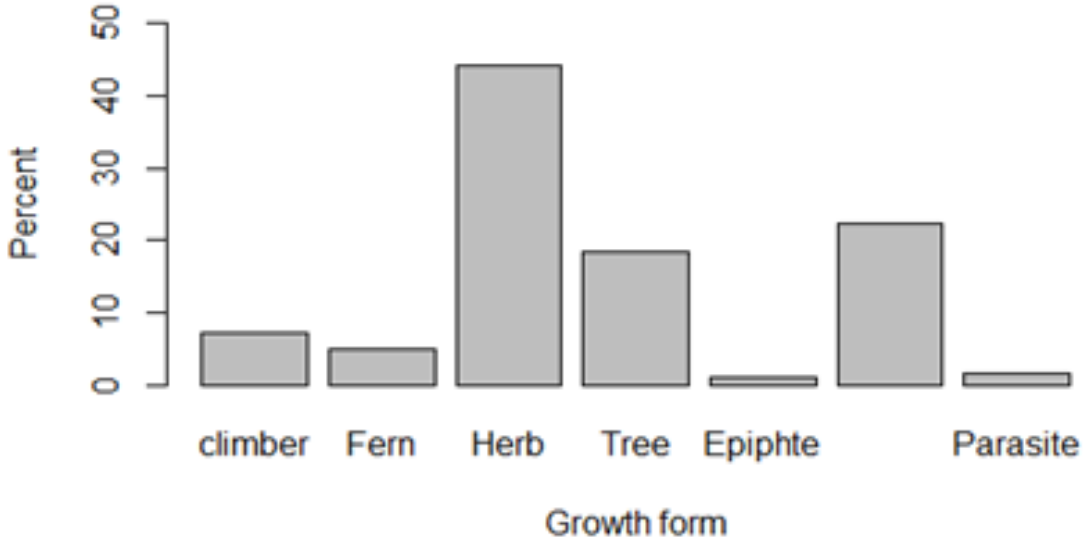

Figure 1. Growth form of all the species identified from the forest patch

- **Endemic Taxa identified from *Biteyu* forest and their habits**
  Eighteen species (10%) of 179 identified from Biteyu forest patch of the Gurage mountain chain were found to be endemic taxa to the Flora Area (Table 2). Family Asteraceae accounted for 8 species (44.4%) of the endemic taxa followed by two species contributed by family Lamiaceae. This forest patch is relatively rich in endemics compared to the moist Afromontane forests of the country. Each of these endemic taxa has different IUCN Red List Category starting from least concern to vulnerable.

Table 2. Endemic Taxa identified from *Biteyu* forest and their habits

No.	Endemic species	Family	Habit
1	*Cerastium octandrum*	Caryophyllaceae	Herb
2	*Chiliocephalem tegetum*	Asteraceae	Herb
3	*Cirsium dender*	Asteraceae	Herb
4	*Clutia abyssinica*	Euphorbiaceae	Shrub
5	*Crassocephalum macropappum*	Asteraceae	Herb
6	*Cynoglossum coeruleum*	Boraginaceae	Herb
7	*Inula confertiflora*	Asteraceae	Shrub
8	*Kalanchoe petitiana*	Crassulaceae	Succulent herb
9	*Laggera tomentosa*	Asteraceae	Herb
10	*Lotus corniculatus*	Fabaceae	Herb

11	*Maytenus addat*	Celasteraceae	Tree
12	*Mikaniopsis clematoides*	Asteraceae	Climber
13	*Peperomia fernandopoiana*	Piperaceae	Herb
14	*Phagnalon abyssinicum*	Asteraceae	Herb
15	*Rhus glutinosa* A. Rich.subsp. *glutinosa*	Anacardiaceae	Shrub
16	*Satureja paradoxa*	Lamiaceae	Herb
17	*Thymus schimperi*	Lamiaceae	Herb
18	*Vernonia rueppellii*	Asteraceae	Shrub

- Indigenous and characteristic tree species for dry montane forests of the mountain chain have selectively been logged for various purposes in the forest and the study recommends that the species need priority for conservation program. These are *Juniperus procera, Podocarpus falcatus*, *Prunus africana, Croton macrostachyus, Olea europaea* ssp. *cuspidata, Hagenia abyssinica, Ekebergia capensis* and *Euphorbia obovalifolia.* The bigger trees of these species are very rare in this forest of the mountain chain despite very few small sized trees recorded for determining forest structure of the study area.

- Regarding species important values, 30 woody species with highest IVI values of the Biteyu forest patch of the Gurage mountain chain were identified. Among which *Olinia rochetiana, Ilex mitis, Maesa lanceolata and Maytenus addat* followed first, second, third and fourth respectively based on IVI value.

- **Stem Density:** The number of individual counts from nine diameter classes showed that the smaller size classes (DBH <20 cm) held 71% of the total counts for tree species of the forest patch (Fig. 2). Diameter at breast height between 20 to 70 cm held 26.95% of the total counts of tree species. On the other hand, the larger tree species with DBH greater than 70 cm held very small portion (only 2.05%) of the total individuals of tree species in the forest patch. The following five species contributed 53.3% of the total tree densities in the forest patch. The species are *Olinia rochetiana, Maytenus addat, Ilex mitis, Maesa lanceolata* and *Vernonia rueppellii* which individually contributed 20.81%, 5.42%, 4.09%, 16.16% and 6.70% to the total tree densities of the forest patch.

- **Height Class:** The tree species collected from Biteyu Forest patch was classified into six major height classes. These are 2.0-5.0, 5.01-10, 10.01-15.0, 15.01-20.0, 20.01-25.0 and greater than 25 m (figure 3). The first height class contributed 53.8% followed by the second height class which contributed 33.74% of the total tree density. Similarly, the third, fourth and fifth height class contributed only 12.46% of the total tree density of the forest patch. The density of each height class decreases with increase in height and reaching the total absence of trees above 25 m in the forest patch showing the selective cutting of large sized trees for timber and house construction.

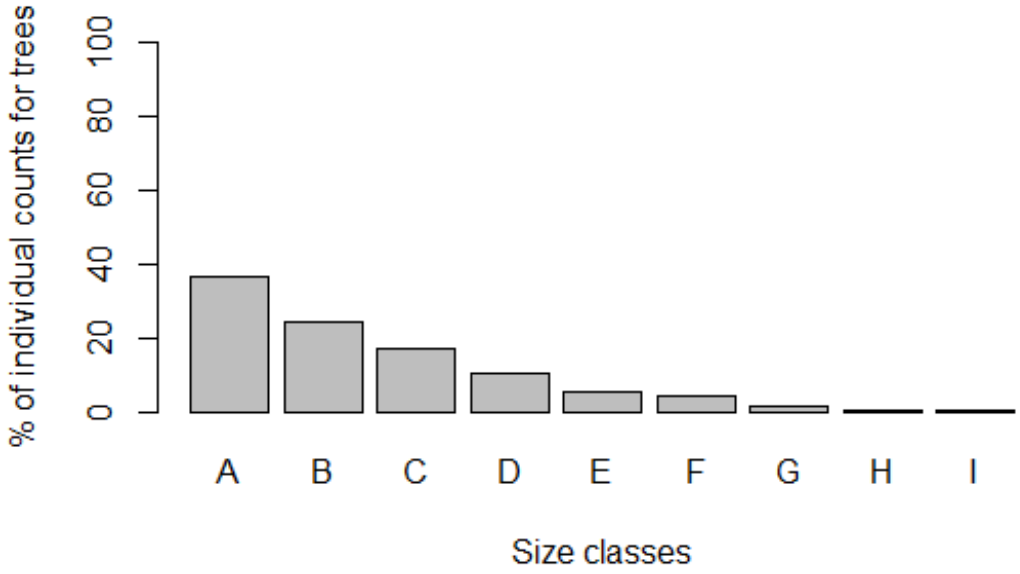

Figure 2. Percentage of individual counts in different Size class distribution of tree species (A= 2.5-10, B=10-20, C=20-30, D=30-40,E=40-50,F=50-70,G=70-90, H=90-110, I= >110)

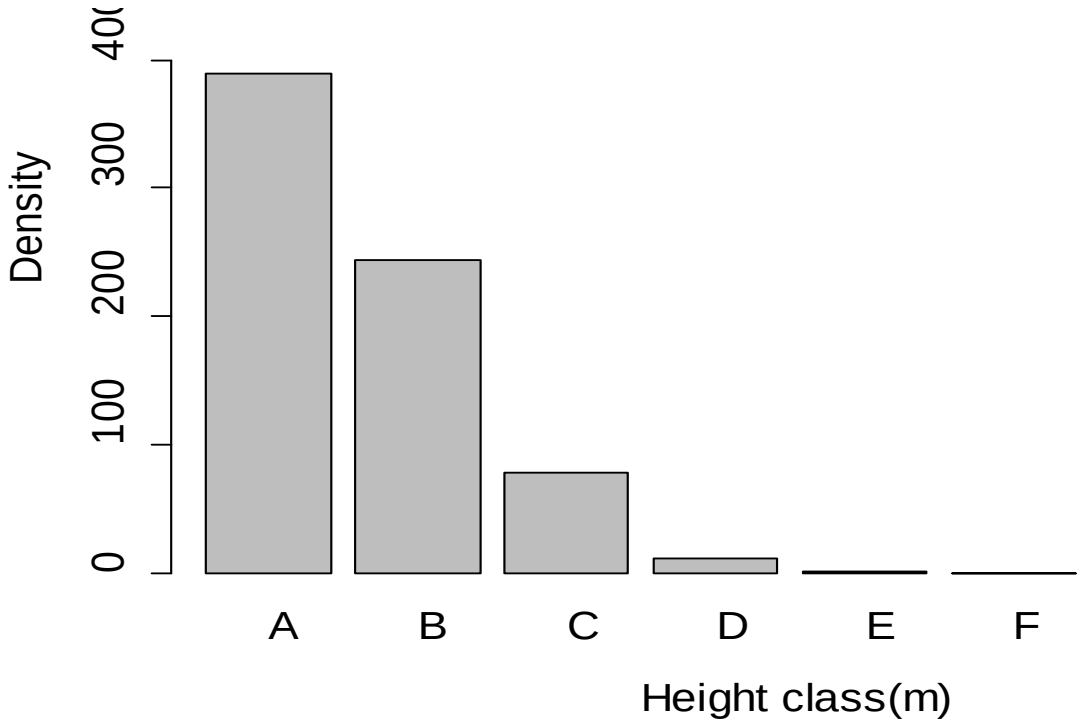

Figure 3. Height class distribution of tree species in the Biteyu forest Patch.

- **The major threat factors responsible for the forest loss and degradation in the area were identified and ranked as follows.**

  1. The greatest deforestation driver obtained from this study through questionnaire, semi-structured interview and group discussion was expansion of subsistence farmland. This was due to the fact that they have very small plot of land which is in average less than 0.5 ha not enough to fulfil the livelihoods of the family by traditional agriculture.

  2. **House construction**: the only source for the local people to construct their local house is mainly from the surrounding forest. According to the information obtained from the respondents, 100% of local people use the indigenous trees such as *Podocarpus falcatus, Juniperus procera* and *Olea europaea* ssp. *cuspidata.*

  3. **Unsustainable use of Fuelwood**: The major source of energy for household consumption in the study area is fuelwood. Therefore, this study showed that all the local people surrounding the forest area collect fuelwood from the forest leading to forest loss and degradation.

  4. **Fodder**: the local people entirely depend on the forest for the fodder where there is shortage of rainfall in the area. They leave their cattle in the forest in every day as they have no grazing land around in addition with collecting fodder to feed them at home.

- The mean carbon stock of the Biteyu forest patch of the mountain chain was estimated using Chave *et al*. (2014) equation for the aboveground biomass and Cairns *et al*. (1997) equation for the belowground biomass. It was found that the mean soil organic carbon, above ground biomass carbon stock and belowground biomass carbon stock were 56.37±9.46, 101.38±56.25 and 45.73±16.68 ton C ha^{-1} respectively which were quite smaller than the carbon stock estimated in tropics due to the high deforestation and degradation of the Biteyu forest patch. The only five woody species with DBH of greater than 90 cm (*Podocarpus falcatus*, *Ilex mitis, Hagenia abyssinica, Juniperus procera* and *Maytenus addat*) account for more than 75% of the mean AGBC of the whole forest patch whereas 25% of the mean AGBC of the total is comprised by all the plant species with a DBH< 90 cm. This shows that the forest patch is nearly devoid of the larger trees because of the selective logging of trees for fuel, grazing, fodder and local house construction purpose by the nearby community as confirmed by the interview and questionnaire analysis. Therefore, this is the major forest site where significant carbon conservation or forest management projects should be sought in the future.

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

Before the commencement of the project, the communities were given a one day awareness creation training in their local kebele with the woreda experts on the importance of the forest and its ecosystem services to the livelihood, environment and how to conserve it for the environmental sustainability. All the forest dependent community members from the study sites were raised their own ideas on the historical aspects of this forest area coverage comparing it with the past and present situations. The training has at least given them clue how important the forests are ecologically and environmentally. In addition, with the local community involvement in the training,

the field guides and field assistances were recruited and paid for the data collection they have been made. Moreover, the two kebele leaders were assigned for the training facilitation and paid for what they have served throughout the training period. Therefore, the local community were very happy with the training that has been given during the project time and even requesting me to establish a permanent project to ensure their livelihood and environmental sustainability either. Therefore, this is even a good green light for the grant providers and the project owners to continue this work and solve the local community's problem in particular.

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

Since this project is to find out how diverse the species of the forest patch along the mountain chain and how it has been affected by the effect of human elements, the mitigation strategy is waiting for as the extension of this project. From this study, we have identified the drivers of the forest loss and forest degradation and its effect on the carbon stocks of the forest patch. From the carbon inventory, the carbon stock estimated was relatively very low compared to other studies done in tropics because of those drivers. On the other hand, the study area would be one of the major watersheds where a number of small perennial rivers flow from it but now almost drying. Thus, it calls for further intervention finding out the appropriate mitigation strategies with the involvement of the forest dependent local people.

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

Discussion with policy makers, woreda agricultural offices, presenting the study results in national symposium and publication of the papers.

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

Over 14 months starting from March 2014 to May 2015. The actual length of the project is 21 months (up to Nov.2015)

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
Topographic map	16	16	0	
Plastic bag for soil and specimen collection	86	86	0	
Duplication, printing and stationery materials	75	102	-27	
Digital camera	393	120	273	
Motorcycle rent	120	350	-230	It costs £5/ trip for a total of 70 trips
One field guide accommodation and food	900	900	0	
Accommodation and food of three team members	900	900	0	

Accommodation and food for One field assistance	900	900	0	
Accommodation and food of principal researcher	1260	810	450	
Per diem of one lab technician in the soil laboratory of AAU	630	630	0	
Fuel cost	150	150	0	
Per diem for two kebele leaders for facilitation the training program on the importance of forest ecosystem services	0	450	-450	
Field per diem for researcher to re-check and collect the missed data from the field	0	16	-16	
Total	5430	**5430**	0	

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

The important next step is to continue this project in order to find locally appropriate mitigation strategies for the already identified problems from this project.

10. Did you use The Rufford Foundation 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 the Rufford Foundation Logo during the preliminary result presentation in University of Oxford, School of Geography and Environment, staff members of Ecosystem Lab, UK.
- I publicized the foundation during the course of training and data collection.

11. Any other comments?

I would like to thank the Rufford Foundation so much for granting me to carry out this project. I also hope that I would get the chance to get the next grant to extend this project at least to alleviate the livelihood problems of the forest dependent community.