

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	Gebremicael Fisaha
Project title	Natural Regeneration Status of Indigenous Trees and Anti-microbial test of Traditional medicinal plants in Menz Gera District, Highlands of Central Ethiopia
RSG reference	26182-2
Reporting period	September 2018 to August 2019
Amount of grant	£5000
Your email address	gmicael29@gmail.com
Date of this report	March 03, 2020

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
Assess natural regeneration status of indigenous tree species in remnant natural forests of Menz Gera District, in the highlands of Ethiopia				In the study area, 26 tree species were identified with the density of 2,722 seedlings ha ⁻¹ , 390 saplings ha ⁻¹ and 458 adult trees ha ⁻¹ . Out of the 26 species, 13 were not represented in the seedling class and 11 were not represented in sapling class.
To test the healing potential of disease-causing microbes from the extracts of traditional medicinal plants of Menz Gera District				From the total 156 traditional medicinal plants, eight plant species for nine plant parts extraction were selected and tested against five pathogens.
To produce the threaten species of indigenous trees and important medicinal plants of the District.				Almost all of the traditional medicinal plants and indigenous trees were under threat especially <i>Inula confertiflora</i> <i>Laggera tomentosa</i> from endemic medicinal plants and <i>Juniperus procera</i> , <i>Hagenia abyssinica</i> and <i>Olea europaea</i> subsp. <i>cuspidata</i> from indigenous trees.

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

It was too difficult to collect the knowledge of traditional medicinal plants from the local community since they transfer orally only for selected family members. But we have started by creating awareness among the local community elders of our research targets with the help of district administrative bodies and experts then gradually they share their accumulated experiences on traditional medicinal plants and associated indigenous knowledge. During the assessment of natural regeneration status of indigenous trees, it was very tough since, as the remnant natural forest is found in inaccessible areas. it was quite difficult to put sample plots, but I have successfully done using my life and research experience.

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

Natural Regeneration Status of Trees Species of Menz Gera Forests

The composition and density of seedlings, saplings and mature trees are indicators of future regeneration status of any forest. In this study, the total density of seedlings, saplings and adult trees were 2,722 ha⁻¹, 390 ha⁻¹ and 458 ha⁻¹ respectively from 26 tree species. Out of the 26 tree species, 13 species were not represented in seedling

class and 11 species were not represented in sapling class. Five species contributed 79.85% and 80.91% of the total seedling and sapling count respectively - *Erythrina brucei*, *Galiniera saxifrage*, *Myrica salicifolia*, *Ficus sur* and *Croton macrostachyus*. The regeneration status of the study forests was evaluated based on the following regeneration categories based on their seedling, sapling and mature tree abundance:

- a. 'Good', if presence of seedling > sapling > mature strata (Figure 11-a): This pattern was exhibited by *Erythrina brucei*, *Myrica salicifolia*, *Ficus sur*, *Croton macrostachyus*, *Rhus quartiniana* var *quartiniana*, *Rhus natalensis* and *Pittosporum viridiflorum*.
- b. 'Fair', if presence of seedling > sapling < mature strata (Figure 11-b): This pattern was exhibited by *Galiniera saxifrage*, *Buddleja polystachya*, *Juniperus procera*, *Ekebergia capensi*, *Podocarpus falcatus* and *Euphorbia abyssinica*.
- c. 'Poor', if a species survives only in the sapling stage but not as seedlings (even though saplings may be less than, more than, or equal to mature) (Figure 11-c): this category was represented by *Allophylus abyssinicus* and *Olea capensis* subsp. *Macrocarpa*.
- d. 'None', if a species is absent both in sapling and seedling stages but present as mature (Figure 11-d): this category was represented by *Hagenia abyssinica*, *Olinia rochetiana*, *Olea europaea* subsp. *Cuspidata*, *Bersama abyssinica*, *Prunus africana*, *Nuxia congesta*, *Canthium lactescens*, *Polyscias fulva*, *Celtis africana*, *Euphorbia ampliphylla* and *Rhus glutinosa* subsp. *neoglutinosa*.
- e. 'New', if a species has no mature strata, but only sapling and/or seedling stages: this category was not represented in this study forests.

Antimicrobial Activity of Selected Traditional Medicinal Plants

From the traditional medicinal plants in Menz Gera District eight plant species for nine plant parts extraction were selected. *Inula confertiflora*, *Urtica simensis*, *Osyris quadripartita* and *Satureja abyssinica* were extracted their leaf only and *Solanum incanum*, *Kalanchoe marmorata* and *Minuartia filifolia* were selected for their root extraction whereas, *Laggera tomentosa* was selected for both roots and leaf extraction. The percent yield (on dry weight basis) using ethanol 80% as a solvent was calculated. *Osyris quadripartita* leaf has the highest yield 19% followed by *Laggera tomentosa* leaf 16.6% and *Inula confertiflora* leaf 14% whereas, from *Minuartia filifolia* root was harvested the least yield which is 2.2%.

Those extracts were tested for antimicrobial activity of gram-positive bacteria (*Listeria monocytogenes* and *Staphylococcus aureus*), gram-negative bacteria (*Escherichia coli* and *Salmonella typhimurium*) and fungus (*Candida albicans*). All of the plant extracts showed antimicrobial activity at the concentration of 100 mg/ml or below, against one or more of the five microbes. Extracts of *Inula confertiflora* (leaf), *Laggera tomentosa* (root), and *Satureja abyssinica* (leaf) showed the broadest spectrum of action as they inhibited growth of all the pathogens with MICs of 100 mg/ml. Extracts of *Kalanchoe marmorata* (root) and *Laggera tomentosa* (leaf) shows the highest spectrum of inhibition against *Staphylococcus aureus* with MICs of 12.5 mg/ml to 100 mg/ml. On the other side, extracts of *Inula confertiflora* (leaf) showed the widest inhibition action against three pathogens (*Listeria*

monocytogenes, *Staphylococcus aureus* and *Candida albicans*) at the MICs of 25 mg/ml to 100 mg/ml.

From the antimicrobial activity extracts of *Solanum incanum* (root), *Urtica simensis* (leaf), *Kalanchoe marmorata* (root), *Laggera tomentosa* (leaf) *Minuartia fillifolia* (root) *Osyris quadripartita* (leaf) does not show any inhibition effects against the fungus pathogen *Candida albicans*. On the other side, *Inula confertiflora* (leaf), *Laggera tomentosa* (root) and *Satureja abyssinica* (leaf) are the only plant extracts, which shows inhibition against *Candida albicans* at MICs of 25 mg/ml, 50 mg/ml and 100 mg/ml respectively. The selected pathogens of gram-negative bacteria and fungus were generally found more resistant against to the extracts than gram-positive bacteria especially at lower concentrations of the extracts.

Threats for indigenous trees and traditional medicinal plants

The finding of this report shows a poor natural regeneration mainly due to illegal grazing and human interference, which confirms the hypothesis of this research.

Therefore, it is important to minimise the pressure of cattle grazing and other anthropogenic influences in the forest and promote natural regeneration of the plant species. The propagation of illegal logging and farming activities must be managed to restrict further habitat fragmentation and thus, reduce isolation and disturbance effects. Reforestation activities must be done to connect isolated patches that serve as important habitat for vulnerable species. However, it must be implemented in a manner that sufficient interior core areas are created. The ability to provide such options depends on an understanding of landscape processes and the ability to use this understanding to develop appropriate strategies. If the remnant forests continue being fragmented, there will be an increase of edge related habitats, which will cause structural and floristic composition changes due to increased edge effect and the forest will face a great threat of losing its original biota especially the rare species. The remnant natural forests are the main sources of traditional medicinal plants for the community, but it is facing high pressure of Anthropogenic interferences like agricultural expansion, house construction, firewood collection, timber extraction, unwise traditional medicinal plant collection and free grazing. In addition to this frequent drought and highly sloppy nature of the area leads to create a lot of small fragmented natural forests from the large Menz Guassa community conserved area. Scientific study for sustainable management and intervention is very important.

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

The local community actively participated throughout the data collection as traditional medicinal plants assessment informants specially the key informants, field guides and data collectors. The administrative officials of the district were very committed to provoke the work by initiating the experts and introducing the objective of the study to the local community. The experts were mobilising and creating awareness for the local communities to participate at different activities of the research project. As a result, all stakeholders participated by felling belongingness. Then finally accepted and confirmed with stamp by Debre Berhan

University and Addis Ababa University will be made available to the community for implementation of the recommendations and to use for their policy developments towards the sustainability of the remnant forests, medicinal plants and indigenous knowledge. So far, four presentations with stakeholders were done. The presentations were at Menz Gera District, Debre Berhan University, Addis Ababa University and Rufford at Ethiopia which helps to address the community.



Figure 1: Progress presentation for the local community at Menz Gera District. Figure 2: Data collection Key informants.

5. Are there any plans to continue this work?

Yes, we have a plan to continue with a research data-based project of intervention for conservation of threatened indigenous trees and traditional medicinal plants of Menz Gera District. The research data of this project sponsored by Rufford 1 and 2 will be used as a baseline for the development of the project. So, all stakeholders will be invited for the sustainable conservation of those patch forests which are the main homes of traditional medicinal plants with their associated indigenous knowledge, homes of wild animals and sources of different water catchments for the local community and abroad. Therefore, we plan to continue with the following objectives:

- Community awareness on status and conservation strategy of forest and medicinal plants status and importance.
- Strengthening community held nurseries to produce and distribute targeted seedlings.
- Improving natural regeneration of plants in the natural forests by area enclosure.

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

We have planned to share the findings basically by presenting in symposia, workshops, publications, sharing the papers in print form and presenting in every formal and informal communications among all stakeholders. To achieve this one journal is already accepted for publication by The Journal of the Drylands, Mekele University, Ethiopia. Other two articles are under review.

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

The project was implemented from September 2018 to August 2019 according to the time allowed by The Rufford Foundation. But we were a few months late to submit the final report due to longer laboratory work which are very important data for this report. I hope it will be considered since experimental and field work needs patience to produce scientific data which is very important for project development.

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
Batteries for light and GPS	20	20		
Pressing and specimen collection materials (metal press ends, blotters, and Mounting hard sheet for herbarium)	510	510		
Stationery items (pen, fixer, fixer lid, waterproof field not book, A4 paper)	650	660	+10	Per-diem increment
Printing of relevant literatures and final paper (printer ink, A4 paper, binding)				
Purchasing relevant books				
Driver per-diem and transportation Fuel cost and Bike rental for multiple visit of study site	1200	1200		
Accommodation and subsistence for researcher	2300	2360	+60	Field work extended for few days
Field guides and assistants				
Plastic Petri Dish, Transparent Sterilized Petri Dishes, Bacterial Culture Bowl with Lid for Laboratory Culture Bacterial Yeast (90 mm)	120	130	+10	Increment in cost of materials up on time
Extraction solvents (chloroform, 80% concentrations of acetone and methanol or ethanol) from local market 1 litter each				
Laboratory assistant fee	200	250	+50	Per-diem increment
Total	5000			

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

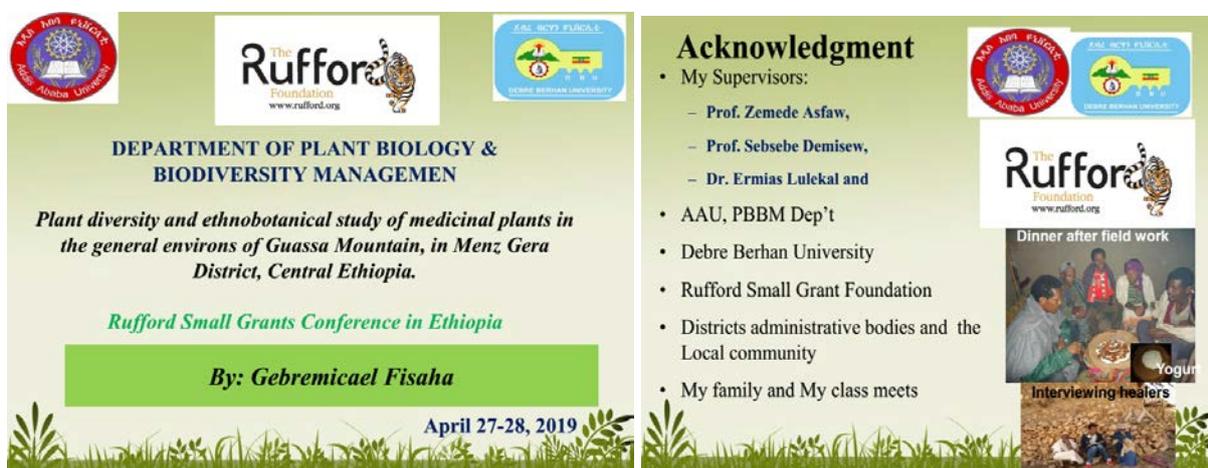
Yes, definitely it is important, and I hope we will go next steps with Rufford for nature conservation. As stated by M.S. Swaminathan said, *"If conservation of natural resources goes wrong, nothing else will go right"* and I always say to my students *"Let's have Green and Clean-Living Environment"* which is our common lung insurance. So, biodiversity conservation research is not one-time research for conservation and sustainable management, so we planned to do a lot of research continuities in case of:

- Conservation of threatened indigenous trees and medicinal plants which will have a magnificent implication for the conservation of life at all. The project will invite all stakeholders from the community, governmental and non-governmental organisations. I hope Rufford will play a great role for the success of this project.

Conserving natural forest especially in this study area have a great role for the livelihood of the community since their life is directly or indirectly attached with plants. It is a conservation of indigenous knowledge; it is conserving wildlife especially the threatened once like red fox and others. It is sustaining of Nile and Awash rivers since the forest is one of the watersheds for both rivers which plays a great role nationally and internationally.

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

Yes, I used The Rufford Foundation logo in all my presentations. Such as Rufford Conference at Addis Ababa, Ethiopia, Debre Berhan University Research Conferences, Addis Ababa progress report presentations and presentations for local community at Menz Gera District as shown below by the screenshot pictures. In addition to this I have used as a background picture during my interview at the Rufford conference Ethiopia to which I was the facilitator, chairperson, presenter and field visit coordinator at Addis Ababa.



DEPARTMENT OF PLANT BIOLOGY & BIODIVERSITY MANAGEMEN

Plant diversity and ethnobotanical study of medicinal plants in the general environs of Guassa Mountain, in Menz Gera District, Central Ethiopia.

Rufford Small Grants Conference in Ethiopia

By: Gebremicael Fisaha

April 27-28, 2019

Acknowledgment

- My Supervisors:
 - Prof. Zemedu Asfaw,
 - Prof. Sebsebe Demisew,
 - Dr. Ermias Lulekal and
- AAU, PBBM Dep't
- Debre Berhan University
- Rufford Small Grant Foundation
- Districts administrative bodies and the Local community
- My family and My class meets

Dinner after field work

Interviewing healers

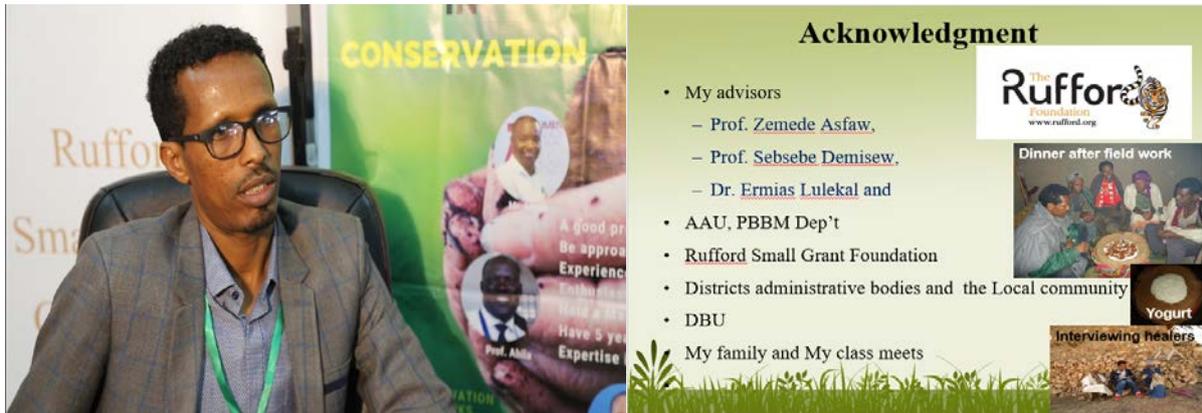


Figure 3: Photo Gallery of using Rufford Logos at different presentations and interviews

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Gebremicael Fisaha (MSc, PhD Candidate) --- Main Researcher for PhD Dissertation; Responsible for Proposal development, proposal defence, data collection, data analysis, writing up of scientific papers and finally addressing the finding to stakeholders.

Supervisors: They have guided me in all round of the project work

Professor Zemed Asfaw - Main supervisor

Professor Sebsebe Demsew- Co-supervisor

Doctor Ermias Lulekal - Co-supervisor

12. Any other comments?

I went to thank exceptionally to Rufford Foundation, for financial support in addition, Addis Ababa University and Debre Berbre Berhan University for their guidance and logistic support and hopefully we will work together until the coming research-based projects. I appreciate Rufford's help especially Jane Raymond, Grants Administrator, for her help joining us in the RUFFORD CONFERENCE ETHIOPIA, unreserved assistance during the whole project starting the approval of the proposal, financial transfer, progress report receiving notification and fast and kind responses for any communication.



Above: Gajilo Natural Forest. Below: DBH Measurement of trees.





Above: Data collection with key informant. Below: Specimen collection for extraction.





Above: Seedling of *E. capensis*. Below: Seedling of *J. procera*.





Above: Drying specimens at room temp. for extraction. Below: Inhibition zone of code 63.

