Final Evaluation Report

Your Details	
Full Name	Moses Mutungi
Project Title	Evidence-Based Conservation of Threatened Medicinal Plants in Dry Lands of Kenya: Community Awareness, and Mass Propagation
Application ID	37278-1
Date of this Report	24/04/2023

1. 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 undertake ethnobotanical survey within 6 selected Makueni dryland hilltop forest fragments				Six target sites (Nzaui, Nzueni, Kwa Matheka, Matooi, Kenze and Kiou hills) within Mukaa and Makueni sub-counties were surveyed to map and document the medicinal value/potential of the remnant dryland hilltop forests by targeting, among others, species of *Capparis tomentosa* Lam, *Maytenus putterlickoides loes* (A. Rich), *Dorstenia arachniformis* Malombe, Matheka, T. Mwadime & Mwachala, *Terminalia brownii* Fresen, and *Fuerstia africana* T.C.E. Fries. A total of 139 medicinal plant species were documented within the study sites including one critically endangered, three vulnerable, one endangered plant species listed in the IUCN Red List of Threatened Species. Several others such as *Osyris lanceolata* and *Aloe* sp. were locally threatened and even protected under Appendix II of CITES. Twenty-nine sub-populations of *C. tomentosa*, 69 for *M. putterlickoides*, three for *D. arachniformis*, 41 for *T. brownii* and 31 for *F. africana* were successfully identified and mapped, so are other scarce medicinal plants in the study sites that includes - *Fagaropsis hildebrandtii* (Engl.) Milne-Redh., *Zanthoxylum chalybeum* Engl., *Aloe secundiflora* Engl., *Ximenia americana* L, *Dalbergia melanoxylon*, *Securidaca longipedunculata* Fresen among others. Among the six localities, Kiou and Matooi hills had the highest number of medicinal plants species documented with 41 and 35, respectively. Matooi and Nzaui hills had the highest number of species of

				conservation concern (SCC) as compared to the rest. Similarly, they hosted all the target threatened medicinal plant species. Among the target medicinal plants species, *D. arachniformis* was the rarest with less than 100 mature individuals. *D. arachniformis* is recently described and known to occur from one locality globally thus critically endangered based on IUCN criteria. Further, eight local traditional medicine practitioners were interviewed. From the interviews, both *T. brownii* and *C. tomentosa* had the highest medicinal uses among the targeted species, and *D. arachniformis* the least number of uses probably as a result of its rarity. Five commonly used plant parts used to extract medicine identified during the study included twigs, leaves, fruits, roots, and stem barks; although some preparations entailed or required mixing of more than two plant parts. Stem barks were the most used plant parts. It is important to note that, seeds and other plant materials for propagation were collected during our botanical surveys.
To establish two (2) tree nurseries and a medicinal plant garden to propagate the target species and other medicinal plants in large scale within the study area				We engaged the locals and established two tree nurseries (non-mist propagators), each in Mukaa and Makueni sub-counties for the propagation of the targeted and other medicinal plant species. Further, a medicinal plant garden was established to serve as center for conservation, education (training), and demonstration. A total of 100 people from local community, were selected from each of the four localities; and trained on ways of undertaking a successful propagation exercise. There were two training sections conducted in both Mukaa and Makueni sub-counties; where emphasise on seed collection, choice of seed sources (mother plants) as a way of ensuring viability and diversity training was given.

				During seed collection, well-performing mother plants were chosen for seed collection at least at an interval of 100 meters apart. The cutting test was used in determining the health and maturity of the seeds. Both crown and ground seed collection methods were used. Propagation of some targeted medicinal plants such as *Maytenus putterlickoides*, realised some gemination challenges; and therefore, cuttings were used to propagate this species. Rooting hormone was used to enhance the rooting efficiency. Plant cuttings were also used in instances where the mother plant did not have enough seeds that could be collected. A total of 1424 trees were realised as follows: 296 *C. tomentosa*, 155 *M. putterlickoides*, 103 *D. arachniformis*, 197 *T. brownii* and 253 *F. africana*. Having matured, the seedlings were transferred to the wild to boost the in-situ populations within the six study sites. Other medicinal plants seedlings transplanted included 207 *Croton megalocarpus*, 193 *Moringa oleifera*, and 20 *Aloe secundiflora*. In addition, 12 species (for 86 individuals) of rare local medicinal plants were also planted in the medicinal plant garden for education and demonstration purposes.
To create conservation awareness among the local community within the study area				After gathering substantial information from field and local traditional medicine practitioners to serve as evidence of the potential of the remnant dryland hilltop forests, two workshops were conducted at every site. These workshops were used to create awareness on the great medicinal value or potential of the species in the hilltops. Further threats profile for the medicinal plants, was highlighted during the workshops. Moreover, 200 locals were sensitised on the importance of conserving biodiversity including the five targeted medicinal plants species. During the training, sustainable ways, or approaches of harvesting medicinal

				plants were encouraged among the traditional medicine practitioners included harvesting plant parts instead of the whole plant. Although traditional medicine is becoming increasingly unpopular among the youth, environmental/ biodiversity conservation was encouraged amongst them as they contribute to habitat destruction and degradation within the study area.

2. Describe the three most important outcomes of your project.

a). Ethnobotanical potential of the six-remnant dryland hilltop forests within both Mukaa and Makueni sub-counties was determined. The results showed that such hilltop forests hold great potential/value not only in terms of biodiversity but also plant of high medicinal value. This therefore informs how critical these habitats are and the need for conservation measures to be put in place to guarantee their integrity, as well as ensure that local communities benefit long-term from the ecosystem services that includes herbal medicine.

b). A total of 1424 indigenous medicinal plants, including the five targeted threatened medicinal plant species propagated and restored in the wild. Most of the propagated seedlings were restored in the wild as a way of boosting the in-situ populations. Similarly, 86 individuals (12 species) were transferred to the established medicinal plant garden as ex-situ form of conservation. The established medicinal plant garden will be used for educational and demonstration purposes.

c). Capacity building: over 200 local members of the community including traditional medicinal practitioners, schoolchildren and farmers sensitised on the importance of conserving environment and biodiversity; even though most locals perceived such drylands as waste lands, they hold great potential in terms of rare, threatened, and medicinal plants and animals. In this regard therefore, local community awareness on the need to conserve biodiversity including threatened species with medicinal properties was enhanced. Moreover, the locals and traditional medicine healers benefitted with training on plant propagation and importance of sustainable harvesting of medicinal plants in advocacy to domesticate some of rare species.

The findings of this study are of great importance and relevance to the conservation of Kenya's dry lands. The knowledge of the medicinal value/potential of the six dryland hilltop forest fragments realised from the study underscores this significance and importance among the local community and policy makers. This achievement serves as evidence for initiating conservation measures or interventions not only for threatened medicinal plants in Makueni but biodiversity conservation elsewhere in arid and semi-arid areas of Kenya which have for long been perceived as "wastelands".

This knowledge is also important for the Makueni County Government in their conservation of water towers. Further, our study reveals that these hills hold great potential or value in terms of medicinal plants, they are also water catchment areas for the local communities not only in the county but also elsewhere downstream of the rivers in other counties. Therefore, conservation of the medicinal plants on the hills translates to the conservation of water sources and hence sustainable water supply for the county which is in line with the Makueni County Vision 2025. This vision is a long-term development blueprint for the county that is aimed at socio-economic transformation by 2025. It aims to achieve, among others, an improved access to quality water.

The locals were trained on setting up propagation nurseries, propagation of rare species medicinal garden, and encouraged on domesticating some rare indigenous and other threatened species. Locals were addressed on sustainable harvesting of medicinal plants and the socio-economic importance linked with domestication of threatened rare medicinal plants.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

Some traditional medicine practitioners within the study area expressed great reluctancy in telling us the different medicinal plants and their uses for various reasons. Firstly, they feared that by telling us we might engage in the practice and offer lethal dose or decoction to people. Secondly, they were not aware of our motive and thus feared that were undertaking a business with little or no proceeds going back to them.

To dispel all these fears, prior the commencement of the project activities, we introduced the project to the locals and allowed them to take part, willingly. We also engaged them right from the project inception to dissemination of the project results to stakeholders.

Another unforeseen challenge included inadequate and delayed rainfall within the study sites. We addressed this challenge by buying storage drums and storing water for supplemental irrigation of the raised seedlings.

Also, some targeted plant species such as *M. putterlickoides* and *T. brownii* presented challenges during germination. During seed collection, the team was unable to collect enough seeds for propagation and worse still the collected seeds showed low germination rate. To address this seed scarcity and germination difficulty challenge, the species were propagated vegetatively, by use of cuttings. Rooting hormone was used to enhance rooting in the cuttings.

4. Describe the involvement of local communities and how they have benefitted from the project.

Involving the local communities in a project such as studying local medicinal plants can help build relationships, promote economic development, and preserve traditional knowledge and biodiversity. Therefore, local communities within the study

area were actively involved in the project right from its inception to the dissemination of project findings. Some of the ways in which the local communities were involved and/or benefited from the project include:

1. Local knowledge and participation: We engaged them by consulting local healers, herbalists, and traditional medicine practitioners to gather information about the plants and their uses. These members of the local communities offered valuable information on identification and medicinal uses, preparation and dispensing medicinal drugs from plants. Further, this helped build trust and respect between the project team and the local community.

2. Economic benefits: The study offered economic benefits to the local communities. For example, some locals were offered casual jobs in the implementation of project activities which provided a source of income for them. Additionally, the project materials, food and accommodation were bought or sought from local businesses.

3. Educational opportunities: The study offered educational opportunities to the locals especially the youth and schoolchildren. We held workshops or training sessions to teach them about the plants and their uses, which served to help in the preservation of traditional knowledge and promoting interest in local biodiversity. Interaction of the local community members with the researchers facilitated knowledge transfer and more importantly encouraged them to undertake domestication of medicinal plants in their farms, setting up propagation nurseries and propagating species.

5. Are there any plans to continue this work?

Yes, there are plans to continue with this work. Five medicinal plant species locally threatened were target of the present study, however, during the project cycle, *D. arachniformis*, which was previously assessed as critically endangered was officially listed as critically endangered in the IUCN Red List of Threatened Species. Therefore, based of its rarity and threat profile, urgent conservation measures for the species are needed and that serves as the source of motivation to continue with this work.

Some of the target medicinal plants such as *M. putterlickoides* and *T. brownii* presented challenges in germination and therefore there is the need to develop germination protocols together with the local community members.

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

The results of the concluded project were shared to all the stakeholders in the organised workshops and seminars. Ethnobotanical data was collected on the remnant dryland hilltops, and we are planning to publish such information in a research article (peer-reviewed journal) for easy public access.

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

Looking ahead, I feel the continued conservation of *D. arachniformis*, which is currently listed as critically endangered under the IUCN Red List of Threatened Species, is of great importance. This species is only found in a restricted area within the study area which is undergoing rapid habitat loss and degradation. Also, the rarity of this species and its medicinal potential deserves an urgent conservation measure especially in this period of changing climate and exponential population growth. Importantly, *D. arachniformis* is shade-dependent and thus heavily relies on shade from larger woody plant species which are unfortunately being targeted by the local communities for wood and non-wood purposes. There is also the need to develop propagation protocols for some of the plant species that presented germination challenges such as *T. brownii* and *M. putterlickoides*.

Further, the knowledge gap between generations complicates conservation of indigenous medicinal plants as youth attach no great benefits to them. Therefore, there is need for enhanced awareness among the youth especially the school-going children.

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

Yes, we used the Rufford Foundation logo in all materials produced and also mentioned it throughout those project activities. The public were made aware of the foundation through promotional materials such as branded t-shirts, banners, certificates, and brochures. Similarly, The Rufford Foundation was acknowledged during awareness creation meetings and workshops.

9. Provide a full list of all the members of your team and their role in the project.

Mr. Moses Mutungi (Lead Investigator) – Involved in general project management including seed collection, propagation, and conducting community outreach. Also involved in final report writing for the completed project and submission to the stakeholders.

Dr. Cornelius Kyalo (plant taxonomist, citizen scientist) - He was involved in plant identification, propagation techniques, working with local communities, establishment of two nurseries, and design of the medicinal plant garden. He was also involved in interview moderation (including video recording).

Mr. Shadrack Ndolo (Natural Resources Management scientist) – He led the training of local communities on sustainable utilization of natural resources including the target threatened medicinal plants as well as mobilizing them on mechanisms of sharing natural resources and advocating for non-destructive farming systems. Similarly, led the community outreach workshops and meetings.

Mr. Mutuku Katiso (Local environmentalist) - He was involved in nursery establishment, seedlings propagation and training on the nursery management

procedures among the local communities. He was instrumental in training the locals on seed collection, processing and nursery management including environmental conservation.

Ms. Mary Nzyuko (administrator and communication expert) - She was involved in data collection (designing data forms and entry in the field). Also played a crucial role in uploading project content on social media forums, and report drafting.

10. Any other comments?

I greatly thank The Rufford Foundation for the funds to undertake the project and the local communities for their efforts as well as sharing medicinal knowledge and information to us. I also thank the project team members for proper coordination throughout the project and lastly the National Museums of Kenya for hosting the project. Our team extends gratitude to Dr Paul Musili for providing guidance and technical support to achieve the objectives mandated.

Dorstenia arachniformis © Itambo Malombe.

Photos showcasing some of the achievement in our project

Figure 1: Some of propagated target medicinal plants in the nurseries

Figure 2: Locals participating in tree planting in the established medicinal plant garden

Figure 3: Some locals awarded with certificate after participating in workshop trainings/seminars

Figure 4: Locals participating in restoration activity in one of study site