PROJECT UPDATE: July 2025

Project: Genetic, Phenotypic Characterization and Factors Affecting Regeneration of Endangered Tree Species *Gigasiphon macrosiphon* (Harms) Brenan in Tanzania

1. Project Summary

This project assessed the population status, spatial distribution, regeneration potential, and threats affecting the rare, nitrogen-fixing tree *Gigasiphon macrosiphon* (Harms) Brenan in two forest reserves in southeastern Tanzania. Despite being listed as *Endangered* on the IUCN Red List, the species' status in Tanzania was previously undocumented. The study also evaluated phenotypic and genetic variation across populations to confirm species identity and inform targeted conservation actions. The project aligns with the Convention on Biological Diversity (CBD), Aichi Target C:12, Sustainable Development Goal 15.2, and the Post-2020 Global Biodiversity Framework Goal A, Target 4, which prioritize halting species extinction and conserving genetic diversity through in situ and ex situ interventions. Key outputs include updated population data, identified regeneration constraints, and recommendations for effective species recovery strategies. These findings provide essential evidence to support a reassessment of species on the IUCN Red List and contribute to broader forest biodiversity conservation priorities in Tanzania.

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Gigasiphon macrosiphon

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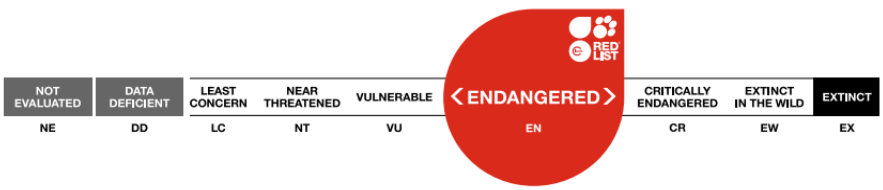

2. Project Objectives

2.1 To assess the population status of the *Gigasiphon macrosiphon* species at selected forest reserves in southeastern Tanzania

A preliminary survey was conducted before data collection to identify the appropriate sampling design for this project. All *G. macrosiphon* individuals encountered during field surveys were georeferenced using GPS; other parameters were also measured and recorded.

Photo 1: Tree identification, measurement, and data recording in the field

Status: Research activities for this objective have been **completed**.

- Through field surveys, data were collected, analysed, and the results were interpreted
- A **manuscript** developed from these results has already been submitted to the publisher.

2.2 To investigate the natural regeneration potential of *Gigasiphon macrosiphon* within its native habitat (in situ) at selected forest reserves in southeastern Tanzania

Fencing was established around selected *G. macrosiphon* mature trees to protect the experimental area, with the fenced area sized according to each tree's canopy spread. Other mature trees were identified and left unfenced to allow for a comparative assessment of seed germination,

seedling growth, and survival under natural, unprotected conditions. This experimental setup was designed to evaluate regeneration differences between protected and open environments.

Photo 2: Fencing materials, construction stage, and the completed fence surrounding the experimental tree plot in one of the study areas

Status: Research activities for this objective have been **completed**.

- Monitoring of natural germination performance, seedling growth, and survival was carried out over six months from January to June 2025.
- A **draft manuscript** presenting these findings is currently in preparation and will be submitted for publication upon completion.

2.3 To examine natural and anthropogenic pressures attributable to the current population status of *Gigasiphon macrosiphon* species at selected forest reserves in southeastern Tanzania

To complement data from field observations, a structured household questionnaire and discussion guides for Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were used, including open-ended questions. In addition, seeds collected during surveys and photographs of *G. macrosiphon* leaves, a flower, and a stem were also shared with participants to support species identification. These tools not only raised awareness among

community members but also facilitated the collection of qualitative data while encouraging open dialogue and active participant involvement.


Photo 3: Data collection through household questionnaire and KII checklist

Status: Research activities for this objective have been **completed**.

- Data collection has been finalized, and analysis and interpretation of the results are currently underway.
- A **draft manuscript** incorporating these findings, along with those from Objective 2.2, is in preparation and will be submitted for publication upon completion.

2.4 To examine the phenological, phenotypic, and genetic variation of *Gigasiphon macrosiphon* species at selected forest reserves in southeastern Tanzania

a) Phenotypic traits intended for this study were assessed, and measurements were taken from the *G. macrosiphon* trees **identified and selected** from all *G. macrosiphon* individuals encountered during field surveys.

b) Direct observation, photographing, and recording of each phenological event of the **selected** *G. macrosiphon* trees at study sites is conducted once per month for twelve consecutive months from December 2024 to November 2025.

c) Young leaves (3- 5) were collected from the **selected** *G. macrosiphon* trees at the study sites for DNA extraction

Photo 4: Monthly observation of phenological events on selected trees

Photo 5: Laboratory procedures for DNA extraction from the leaf samples

Status: Research activities for this objective have been **partially completed**.

- Data collection for the assessment of phenotypic traits has been finalized, and analysis and interpretation of the results are currently underway.

- Data collection for the assessment of phenotypic traits has been completed, with data analysis and interpretation currently in progress.

- Data collection for the monitoring of phenological events in selected trees is ongoing and is expected to continue until November 2025.

- DNA extraction from collected samples has been completed; however, further molecular analysis is constrained by the high costs of procedures such as Whole Genome Sequencing (WGS).

- A draft manuscript incorporating findings from the phenotypic and phenological assessments is in preparation, though it remains incomplete as phenological data collection is scheduled for completion in November 2025.

3. Remaining Activities, Strategies to accomplish, and Time frame

The following are the ongoing research activities, some of which are supported by the current Rufford Grant (42956-1):

3.1 Activities covered by the Rufford Grant (42956-1)

a) Complete data analysis and interpretation of results on the natural and anthropogenic pressures affecting the current population status of *Gigasiphon macrosiphon* at selected forest reserves in southeastern Tanzania by the end of July 2025.

b) Finalize and submit a manuscript presenting findings on the natural regeneration potential of *G. macrosiphon* within its native (in situ) habitat at selected forest reserves by August 2025.

c) Finalize and submit a manuscript presenting findings from the phenological and phenotypic assessment of *G. macrosiphon* populations at selected forest reserves by December 2025.

3.2 Activities not covered by the Rufford Grant

a) Conduct seed pre-treatment trials to assess the germination performance of *G. macrosiphon* seeds under nursery conditions.

- This activity was initiated at the end of June 2025 to investigate the effects of different seed pre-treatments on germination rates and success.

- Five pre-treatment methods were applied to seeds collected from the study sites before sowing in polythene bags.

Photo 6: Cold and hot water pre-treatments of *G. macrosiphon* seeds

b) Monitor and evaluate the growth performance of seedlings developed from the seed pre-treatment trials.

- Germination has not yet commenced, though initial signs of emergence are expected within the next one to two weeks.

- Following germination, seedlings will be monitored over **three to four months** to assess their growth, survival rates, and overall health before they are distributed for planting.

- Continuous monitoring and evaluation will help identify the most effective seed pre-treatment method for *G. macrosiphon* germination

under nursery conditions. The optimal approach identified will be recommended for broader application in future conservation and restoration programs.

Photo 7: Germination trial of pre-treated seed under nursery environment

4. Future Plans

The project team intends to apply for an additional grant to support the following three research and conservation activities. These efforts aim to protect *Gigasiphon macrosiphon* populations from extinction while contributing to the conservation of Tanzania's lowland and coastal forest ecosystems.

4.1 Local community involvement and establishment of nurseries for ex-situ conservation

a) Engage local communities to raise awareness about the conservation importance of *G. macrosiphon* and the protection of its habitat.

b) Establish community-managed nurseries adjacent to forest reserves to provide a reliable, sustainable source of planting material, supporting species recovery, habitat restoration, and reintroduction programs.

c) Foster a sense of ownership and responsibility among local communities, encouraging their active participation in protecting remaining populations and conserving forest resources.

d) Create opportunities for integrating *G. macrosiphon* into agroforestry systems, promoting ex-situ conservation while contributing to local livelihoods and environmental sustainability.

4.2 Verification of the Presence or Absence of *G. macrosiphon* in other lowland and coastal forests of Tanzania

a) Carry out targeted surveys to verify the current presence or absence of *G. macrosiphon* in other potential habitats within Tanzania's coastal and lowland forests.

b) This activity will improve species distribution data, identify possible population losses or range contractions, and strengthen the evidence base needed for effective conservation prioritization, recovery strategies, and policy interventions in the country.

4.3 Genetic analysis of *G. macrosiphon* populations across different sites

a) Conduct genetic analyses to confirm species identity, assess evolutionary relationships, and evaluate genetic diversity within and between populations across different sites in Tanzania.

b) This information will inform species conservation planning, guide habitat management, and support the long-term survival of this highly threatened and ecologically significant tree species.