



Darwin Initiative Main: Final Report

To be completed with reference to the “Project Reporting Information Note”:
(<https://www.darwininitiative.org.uk/resources-for-projects/information-notes-learning-notes-briefing-papers-and-reviews/>).

It is expected that this report will be a **maximum of 20 pages** in length, excluding annexes.

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Darwin Initiative Project Information

Project reference	26-017
Project title	Maximising community and conservation benefits from plants of Mount Mulanje
Country(ies)	Malawi
Lead Partner	Botanic Gardens Conservation International (BGCI)
Project partner(s)	Mulanje Mountain Conservation Trust (MMCT), Forest Research Institute of Malawi (FRIM)
Darwin Initiative grant value	£338,252
Start/end dates of project	1 April 2019 – 31 March 2023
Project Leader name	Kirsty Shaw / Alex Hudson
Project website/blog/social media	https://www.bgci.org/our-work/projects-and-case-studies/save-our-cedar/
Report author(s) and date	Alex Hudson (BGCI) and Ibrahim Mitole (MMCT); July 2023

1 Project Summary

Mulanje Cedar, *Widdringtonia whytei*, Malawi’s national tree, is found naturally only on Mount Mulanje, but is now almost extinct in the wild because of uncontrolled logging. The Malawian project partners, Mulanje Mountain Conservation Trust (MMCT) and the Forestry Research Institute of Malawi (FRIM) have been working in the Mount Mulanje reserve for over 20 years. The partnership between Botanic Gardens Conservation International (BGCI) and these two partners began in Darwin Initiative project 23-026, which ended in March 2019. This successfully established ten community nurseries around Mount Mulanje and initiated a large-scale restoration programme for Mulanje Cedar, continued with further financial support from WeForest since then. The project also created a local and national market for cedar seedlings, improving the income of >600 people from rural communities around Mount Mulanje.

Project 23-026 demonstrated that livelihoods can be improved through sustainable utilisation of plant resources, rather than short-term gains through unsustainable exploitation, and instilled pride in the cedar amongst local people growing and planting it back onto the mountain. However, successful re-establishment of the cedar, and continued demand for cedar seedlings, is not assured until optimal protocols for cedar establishment on Mount Mulanje have been developed. Community nurseries will then continue to benefit from seedling sales.

Furthermore, human population pressure remains high around Mount Mulanje, employment opportunities are limited, and other tree species are being targeted by loggers instead of Mulanje Cedar leading to a greater impact on the mountain’s unique biodiversity. Communities are planting Mulanje Cedar within their homesteads, however this will not yield harvestable timber for c.30-40 years. Additional, short-term sustainable businesses that improve livelihoods and take pressure off the mountain are needed.

This project aimed to expand opportunities for short-term community benefits from Mulanje Cedar by establishing sustainable cedar essence enterprises, harvested from cedar hedges, and based on a precedent developed by The Body Shop in South Africa for a closely related species. This will increase the number of people benefiting directly from sustainable utilisation of Mulanje Cedar. The conservation-commerce model developed for Mulanje Cedar will then be applied to other identified over-exploited plant species found on Mount Mulanje, maximising conservation and community benefits.

The project is taking place on and around the Mulanje Mountain Forest Reserve (see figure 1). This is a massif in South Malawi that rises from the lowlands (c.1,000m) up to the plateaux region (c.2,000m) and on to mountain peaks (the highest, Sapitwa, is 3,002m). The project incorporates communities from the two lowland districts around the mountains: Mulanje (south side) and Phalombe (north side). These are broken down into 7 and 6 Traditional Authorities respectively, each with their own local leadership, socioeconomic context, and relationship with the mountain. There are over 30,000 households within these districts.



Figure 1: Mulanje Mountain Forest Reserve

2 Project Partnerships

The project established a project Steering Committee (SC) in the first implementation year where the main project partners (BGCI, MMCT and FRIM) with other project advisors (e.g., from National Herbarium and Botanic Gardens of Malawi, Environmental Affairs Department, African Parks Network, Chancellor College, Mulanje District Council, Traditional Authority leaders) met twice every year during the implementation period of this project. During these meetings project progress was discussed and decisions for adaptive management were made (See example Steering Committee minutes in Annex 5).

MMCT led on organisation and implementation of project activities in Mulanje, through their Project Manager, Ibrahim Mitole. Activities included restoration fieldwork, monitoring nurseries and their sales, and supporting the ethnobotany survey, and the training courses – i.e., hedge planting and management, and business skills and marketing.

BGCI led the project's direction and ensuring support from international expertise (e.g., Ecological Restoration Alliance of Botanic Gardens – ERA - advisors) and equipment (e.g., distillation equipment) that could not be sourced internally in Malawi. BGCI developed new data capture methods using electronic data collection forms on the Open Data Kit software / app that has been used in data collection for Mulanje Cedar restoration trials. BGCI also organised the provision of tablets and power banks to run the tablets in the field. BGCI also engaged with the project essence marketing and use consultants. BGCI has been sharing information on target flora to help plan seed collection and propagation for the rest of the year.

The MMCT and BGCI Project Managers tried to communicate with each other every week via emails, Whatsapp and/or calls during the implementation of the project.

FRIM provided local expertise on forest flora, seed collection and propagation to the project. MMCT and FRIM jointly managed fieldwork expeditions to Mount Mulanje for restoration activities, to collect seeds for propagation and to collect materials for the essential oils research. The Mulanje District Forestry staff also took part in these activities. BGCI and ERA experts participated in the design and implementation of restoration trial fieldwork activities. During COVID19 travel restrictions, BGCI and ERA contributed to fieldwork organisation remotely at online meetings. Fieldwork took place in:

- September 2019 – To assess sites for setting up Mulanje Cedar restoration trials and contribute to the design of the restoration trials. 8 possible sites were identified on Mulanje Mountain (With ERA expert involvement).
- December 2019 - To set up monitoring plots at 4 sites planted in the previous project (With ERA expert involvement).
- November 2020 – To complete initial site assessments for feedback to ERA group meetings and to select 4 sites for further detailed assessments.
- December 2020 – To complete detailed assessments of the sites selected by ERA group, collect seeds of Mulanje Cedar and other target species for propagation, and materials for essential oil surveys.

- January 2021 – To plant new trial plots. This fieldwork was cancelled last minute because COVID-19 cases and deaths significantly increased in the country in early January, including unfortunate deaths of MPs in Lilongwe and a Traditional Authority leader in Mulanje.
- March 2021 – To re-assess the sites established in December 2019. It was too late in the year to plant the new trial plots because the rainy season was coming to an end, and it has been shown previously that survival of planted seedlings drops significantly after planting in January (With ERA expert involvement).
- January 2022 – To establish Mulanje Cedar restoration trials in 4 sites on Mulanje Mountain. This was delayed to early February 2022 due to cyclone Ana which made rivers flood and not possible to cross (With ERA expert involvement).
- March 2022 – To collect data in Restoration trials in 4 sites on Mulanje Mountain (With ERA expert involvement).
- March 2023 - To collect data in Restoration trials in 4 sites on Mulanje Mountain.

The ERA experts, MMCT, FRIM, and BGCI have collaboratively worked together in planning and data collection throughout the implementation period of the project. These led to the design and establishment of restoration trials (see restoration trial design in Annex 6).

Local communities were continuously involved in various components of the project: propagation of Mulanje Cedar and companion species; hedge planting, management, and aftercare; attending business skills and marketing training; engaged for ethnobotany study (including Traditional Authority leaders); nurseries sold seedlings for hedge planting and restoration on the mountain.

Mzuzu University, Essential Distillation Equipment (EDE) and the essence marketing and use consultant (Arthur Stevens), in collaboration with the main project partners, worked in the Mulanje Cedar essential oils development. Research on Mulanje Cedar essential oil was conducted (See report in Annex 7) and Distillation equipment procured and installed at MMCT office in Mulanje (See section 3.1 figures 2 and 3 below). A Non-Disclosure Agreement (NDA) was developed and signed between MMCT, and BGCI and all parties to ensure the knowledge of the project and information gained through the research is not used for private gain elsewhere taking benefits away from communities around Mount Mulanje (see example NDA in Annex 8).

Beyond the project, MMCT will continue to work towards full utilisation of the Essential Distillation Equipment to support communities managing hedges, supporting further hedge planting when demand is sufficient. MMCT will continue to work with communities around Mulanje Mountain Biosphere Reserve in other activities and BGCI will continue to support MMCT in its programs.

WeForest has continued to support restoration activities on the mountain planting in the 2020/2021, 2021/2022 and the 2022/2023 rainy seasons. MMCT, BGCI, WeForest and FairWild have begun a partnership in Darwin Initiative project 29-014 “Improving community sustainable natural resource management of Mount Mulanje” - this is looking at miombo restoration and farmland rehabilitation and developing natural resources business opportunities for communities using native plants.

In the final year, the project manager at MMCT announced he was leaving his position, and this made reporting, particularly in relation to finances, a challenge. This has highlighted the importance of having a champion working on the ground to manage a project. In future work with these partners, we will also put in place more regular financial reporting between teams to ensure that this is managed throughout the year, involving finances departments.

3 Project Achievements

3.1 Outputs

Output 1. Improved restoration protocols developed for Mulanje Cedar on Mount Mulanje, resulting in continued demand for seedlings for restoration.

Indicator 1.1: Ten nurseries, established and certified in project 23-026, continue to produce a minimum aggregate total of 400,000 Mulanje Cedar seedlings in years 1, 2 and 3 for restoration, commercial sales (timber and essence) and community cedar hedge plantations, benefiting 150 community nursery workers

Eight Community Cedar Nurseries established and certified in project 23-026 (two closed down following that project’s conclusion), continue to produce Mulanje Cedar seedlings throughout the implementation period of the project. A total of 493,873 Mulanje Cedar seedlings were propagated by community nurseries in Mulanje and Phalombe. 254,482 Mulanje Cedar seedlings were sold for restoration on Mulanje Mountain by WeForest and Mulanje Mountain Conservation Trust (MMCT) and 37,065 trees in hedges around communities benefiting 98 nursery workers. The remaining trees are in nurseries with

MMCT aiming to plant 26,003 on the mountain in restoration efforts during the 2023/2024 season at 8 sites across 4 planting locations. Nursery workers (98) have also been supported to propagate and raise other target companion species in the project.

Table 1: The project community nurseries, their numbers of members, number of Mulanje cedar seedlings propagated from 2019 to 2023.

Nursery	No. of members		No. seedlings produced			
	Male	Female	2019-2020	2020-2021	2021-2022	2022-2023
Kadewele	5	9	11,100	26,450	26,858	26,495
Lomoliwa	3	13	3,541	24,450	2,700	17,750
Makolera	1	15	14,200	31,627	6,573	10,704
Chole	5	10	6,800	15,200	9,408	8,700
Kazembe	6	6	7,950	13,821	12,000	15,374
Nankhonyo	4	5	7,443	18,564	18,330	20,138
Nessa	9	3	13,437	31,860	11,150	11,274
Gambeya	1	7	11,229	34,314	11,067	13,362
Total	30	68	75,700	196,286	98,086	123,801

Indicator 1.2: FRIM and restoration experts from BGCI's network design and implement planting trials at 8 sites on Mount Mulanje by end of year 1, benefiting 80 additional community members employed to transport and plant seedlings on Mount Mulanje.

Restoration Trials were designed in year 1 through fieldwork and meetings among the project partners with support from the ERA (see Annex 6). These started in September 2019 where it was agreed that the restoration trials would investigate the impact of planting Mulanje Cedar with companion species, which may help seedlings to grow and thrive, and the impact of using fire resistant species in planting regimes to see if they protect seedlings from fire. It was noted that soil microbiota could be important to plant health and vigour and that soil communities found at sites most naturalised to Mulanje Cedar (i.e., where populations were found most recently) were not found in previously planted sites and in potted seedlings in nurseries - linked to plants from the families Asteraceae, Fabaceae and Ericaceae (discovered from research in project 23-026 by Louise Egerton-Warburton).

In December 2019, the first plots were established in sites planted in the previous project (Upper Nathaka, Lower Nathaka, Lichenya and Malevoni). These recorded data on the local context of individual plants, including what companion species were growing naturally nearby.

For newly planted restoration trial plots, the first site assessment led by FRIM was done in 2020 where eight sites were identified across Mulanje Mountain. The sites were selected based on criteria discussed and agreed upon by the ERA, BGCI, FRIM and MMCT. Site reassessment was done after considering that it was not possible to propagate and plant the companion species due to the time needed to identify, collect and successfully propagate, including providing training support to collectors and propagators and with COVID-19 impacts in 2020/2021. It was therefore recommended to set up the trials in sites where companion species already exist - plants from the families Asteraceae, Fabaceae and Ericaceae. Four sites were confirmed that were planted in January 2022.

Over 500 community members received incomes from the transporting of seedlings onto the mountain as well as the preparation, planting, and ongoing monitoring of the sites.

Indicator 1.3: Improved planting protocols for Mulanje Cedar developed by FRIM and restoration experts in BGCI's network by end of year 3.

Survival data on the plots established in 2019 was collected in March 2021 and March 2022 (see results in table 2). At each site, clearance was also investigated by one plot being cleared of vegetation surrounding the Mulanje Cedar plants and 1 plot being left. This suggests that the vegetation clearance done under the project had little impact on survival, although only in Lichenya was survival 0 when clearance was not done. As the worst performing site Lichenya was dominated by bracken fern (*Pteridium aquilinum*) with minimal tree cover on quite shallow, clay soil (See site conditions in table 3).

Table 2: Yearly survival data of Mulanje Cedar trees in plots established in 2019.

Site	Orig. number of trees in plot	2019 Mulanje Cedar tree survival	2021 Mulanje Cedar tree survival	2022 Mulanje Cedar tree survival	2022 % survival
Lichenya - cleared	52-53	48	15	7	13
Lichenya - not cleared	36	35	3	0	0
Lower Nathaka - cleared	55-56	38	22	20	36
Lower Nathaka - not cleared	43	39	30	36	84
Upper Nathaka - cleared	50	26	8	8	16
Upper Nathaka - not cleared	45	13	11	9	20
Malevoni - cleared	57-58	47	37	33	57-58
Malevoni - not cleared	52-53	48	39	42	79-81

Table 3: 2019 plot conditions.

Site	Slope aspect	Slope angle	Soil type (cm)	Soil depth (cm)	Tree cover (%)	Shrub cover (%)	Herb cover (%)
Lichenya - cleared	South West	30	Clay loam	28	5	60	20
Lichenya - not cleared	West	28	Clay loam	41	0	20	84
Lower Nathaka - cleared	East	24	Loamy	25	65	30	65
Lower Nathaka - not cleared	East	30	Loamy	25	20	30	50
Upper Nathaka - cleared	North	14	Sandy	98	60	30	30
Upper Nathaka - not cleared	North	14	Sandy	98	40	20	40
Malevoni - cleared	West	40	Sandy loam	80	3	20	35

Malevoni - not cleared	West	4	Clay loam	96	5	83	65
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Data was collected from the newly planted sites in March 2022 and March 2023.

As described in Annex 6, new planting methods were trialled in the 2022 plots: planting around target companion trees in 5 directions at the canopy edge; planting in clusters of 3 and testing clearance of all companion plants close to the planted trees against no clearance. The more consistent and mostly improved survival rates (except for comparing against one site in Malevoni and one in Lichenya) could be due to factors in this new protocol. Further data collection 2024 will be used to further confirm this.

Indicator 1.4: Mulanje Cedar seedling establishment and survival rates increased throughout life of the project

Survival rates of the trees planted in 2022 in 4 sites (Kangazani, Chinzama, Chanzama and Thuchira) on Mount Mulanje, when reassessed in March 2023, were between 51% and 65%. These are all better than 5 of the plots established in 2019 (which were planted in 2017/2018 using standard forestry practices). It will be important to monitor these sites further over the next 2 to 3 years to gain a better insight into longer term survival of these trees and to get more of a comparison with standard practice. The project partners will continue to collect data from the trials to inform survival and growth of Mulanje Cedar on the Mountain. The Malawi project manager has received funding through the EDGE fellowship programme under the Zoological Society of London which will support further data collection in the restoration trials for the next 2 years.

For two years in a row, the mountain has been hit by serious cyclones and resultant flooding and erosion has impacted some sites, washing away clusters of the planted trees. It was also reported in May 2023 that one of the 2019 plot sites was completely washed away, Lower Nathaka, to be confirmed.

Output 2. Conservation-commerce model developed and documented for Mulanje Cedar

Indicator 2.1: Expert consultants appointed and project steering committee established by end of year 1, to guide and monitor project progress and development of conservation-commerce model

A project Steering Committee was established in Y1 of the project with a representation from the BGCI, MMCT, FRIM, NHBG, University of Malawi-Chancellor College, African Parks, Traditional Authorities, Environmental Affairs Department, District Forest Offices, and Malawi University of Science and Technology (MUST). The committee has been meeting twice every year throughout the project implementation (See Annex 5, example meeting minutes).

Indicator 2.2: Feasibility study commissioned to improve understanding of Mulanje Cedar potential uses and markets, including identification of local and international commercial partners and quantifying potential income from essence manufacture, complete by end of year 1

A Natural Product Marketing and Use Consultant (Mr. Arthur Steven) was recruited to conduct a study to improve understanding of Mulanje Cedar potential uses and markets, identify commercial partners and quantify potential income. The consultant conducted a desk review and a visit to meet commercial partners. The study indicated that the characteristics for Mulanje Cedarwood oil had been previously assessed in 1935 and 1987 as being deficient in odour due to low cedrene levels which made its use as perfume or in soap less desirable than other sources of cedarwood oil. However, its higher levels of thujospene/widdrene as well as cedrol could give the oil relatively good qualities for medicinal as well as pesticide/insect repellent uses. It provides an estimate for potential essential oil income stating, "A cautious wholesale pricing level of around US\$15-18/kg". It also outlined protocols for essential oil research, reports on interest of potential commercial partners and provides initial summaries of 8 other potential economic species. It also established that local market interest in Mulanje Cedarwood oil was generally high – although clearly such interest would need to be converted into realistic sales once availability in reasonable quantities can be assured (See feasibility report in Annex 9).

In a follow up report in 2021, looking at the results of the essential oil research undertaken in the project, the consultant suggested opportunities for domestic, regional, and international market opportunities, as well as describing steps for a way forward (see report in Annex 10). This included further characterisation research of the oils coming from plants from different areas to confirm quantities and quality in different contexts as well as further investigations on harvesting methodologies that area sustainable from the hedges that were planted in the project.

Following the passing of Arthur Stevens in 2021, in the extended year a further consultant was engaged from South Africa, Karen Swanepoel (Southern African Essential oil producers Association - SAEA) to assess opportunities in South Africa based on the project results and the consultants experience with *Widdringtonia cedarbergensis* - see indicator 3.5 below.

Indicator 2.3: Workshop held in year 1 involving the Union for Ethical BioTrade and TRAFFIC to determine Nagoya Protocol implications and requirements regarding access and benefit sharing in preparation for international trade of certified essence product and assess whether wild harvesting might be appropriate in future. Potential international purchasers engaged in years 2 and 3.

The workshop on the Nagoya Protocol implications and ABS requirements for international trade was held in January 2020. 30 people attended from Malawian businesses, the Environmental Affairs Department, BGCI, MMCT. In August 2019, Mulanje Cedar was listed on Appendix II on CITES. A presentation by the ABS Focal point, Ms Mphatso Kalemba was given on ABS in Malawi. A consultant, David Newton, from TRAFFIC International led activities on the use of the Non-Detrimental Findings (NDF) process as the starting point for implementing FairWild standards. This included initial NDF assessments of other Mulanje Mountain species and more detailed assessments of the Mulanje Cedar (A report from the workshop is in Annex 11).

Through the consultant, Karen Swanepoel, some potential international purchasers in South Africa were engaged in 2022/2023 - see indicator 3.5 below.

Indicator 2.4: Public outreach campaign in years 2 and 3 to grow demand for purchase of Mulanje Cedar seedlings (for timber and essence extraction) and essential oil.

Kondwani Chamwala, MMCT Environmental Education & Communications Specialist, established an engagement plan including a Knowledge, Attitudes and Perceptions (KAP) survey of the general population around Mulanje (See activities planning in Annex 12). This was delivered in year 3 and the extended year 4 of the project. Four community awareness meetings, five signposts, one radio advertisement, and one TV advertisement were completed (adverts submitted with report to Darwin Initiative team as mpeg and mp4 files). A report for the Knowledge, Attitudes and Perceptions survey undertaken in March 2022 has also been completed - See Annex 13).

Five demonstrations of the distillation equipment were held with 210 community members from around Mount Mulanje to see the equipment in action. This produced a total of 110ml of essential oils from approximately 400 kg of branch and leaf materials that were harvested from the hedges. This was not a large amount, potentially partially due to the storage problem explained below, but may also be an impact of the month harvested. Five demonstrations were also done within communities (at Nessa, Gambeya, Kadewele, Nakhonyo and Makolera) using the smaller and mobile gas-powered distillation kit with 330 members attending. Of all those that attended demonstration, roughly 65% were female.

Indicator 2.5: MMCT and FRIM monitor nursery certification scheme and Cedar Growers and Planters Association (CGPA) established in project 23-036, which becomes fully inclusive of planters for essence extraction by end of year 3.

A Nursery Certification and Accreditation Scheme was introducing the first implementation year of the project to promote growing of high-quality planting stock of Mulanje Cedar for restoration on Mulanje Mountain and across Malawi. The scheme follows the standards set by the Government of Malawi through the Forestry Research Institute of Malawi (FRIM) and the World Agroforestry Centre in 2015 to advance minimum technical standards for the nursery operators raising indigenous and selected agroforestry tree seedlings for sale in many parts of the country. In each year FRIM inspected the eight Community Cedar nurseries for certification and accreditation based on source of planting stock, nursery management practice and morphological quality of current planting stock as criteria for voluntary accreditation and certification. In 2019, only Nakhonyo and Kadewere Community Nurseries were accredited and certified as the only nurseries with high-quality Mulanje Cedar seedlings. Technical support was enhanced in the following years to increase the number of certified nurseries, this was evident in 2021 where all the nurseries received accreditation (See assessment report in Annex 14).

With essence extraction business opportunities not yet operational, the planters of hedges have not yet been formerly incorporated into the CGPA.

Indicator 2.6: Training delivered in business and marketing skills and Nagoya compliance to Mulanje Cedar essence producers in year 2.

Training was going to be delivered by a team from the Environmental Affairs Department, however it was not possible to deliver this before the project conclusion due to conflicting schedules and management issues.

Indicator 2.7: Model conservation-commerce project for Mulanje Cedar documented and published by end of year 3.

With the industry from essential oils not having developed any incomes within the project lifetime, a final conservation-commerce model has not been produced. However, documentation of some of the key project developments has been recorded in various reports (e.g.:

- Research results in Annex 7,
- Market development consultancy reports in Annex 10 and 15,
- Hedge establishment and trial information in sections above (Output 1) and below (Output 3)

Output 3. Manufacture of products from sustainably sourced Mulanje Cedar essence generates income for additional local households in the short-term and results in a larger market for cedar seedlings.

Indicator 3.1: Optimal sustainable extraction techniques for Mulanje Cedar essence are identified in year 1.

An essential oil analysis consultant (Dr. John Kamanula) was recruited to investigate optimal sustainable extraction techniques for Mulanje Cedar essence. This aimed at quantifying and qualifying oil produced by different parts of Mulanje Cedar (leaves, twigs, waste produce etc.), understanding how the quantity and quality of oil changes across different sites, and understanding how essential oil production changes over the course of a Mulanje Cedar tree's life. A research application was made to the National Commission of Science and Technology (NCST) to allow Access and Collection to Genetic Resources. This was accepted and the researcher collected specimens from Zomba and Mulanje for analysis.

The study fulfilled four objectives:

- Determination of optimal requirements for extraction of essential oil from Mulanje Cedar,
- Assessment of the quantity and quality of oil produced by different parts, including a critical analysis of the profiles found and their chemical and/ or biological composition,
- Determination of the quantity and quality of oil changes across different sites and localities', and
- Establishment of how essential oil production changes over the course of a Mulanje Cedar tree's life.

The research showed that the distillation of Mulanje Cedar essential oil took 3-4 hours from leaves and twigs took, and 5-6 hrs from old dry wood (logs). The amount of oil varied significantly with respect to provenance (locality) and plant part. Chinzama and Ex-Thuchila Mulanje Cedar dry wood (logs) produced significantly higher oil yield (2.06% and 1.96%, respectively) than old wood from Mulanje Lichenya (0.93%). Furthermore, leaves and twigs from Mulanje Mountain produced more oil than those from Zomba Mountain. Comparison of the oil yield from the same age of plant material, showed that Mulanje Mountain Cedar from Thuchila (20-30 years old leaves) produced more oil (0.55 %, dry matter) than the Zomba leaves (0.21 %, dry matter) of a similar age (21-40 years old).

The Gas Chromatography-Mass Spectrometry (GC-MS) results of the Mulanje Cedar oils' compositions showed a distinct difference in the chemistry of the oils from the two geographical localities. Oils from Mulanje Mountain were characterised by the high content of cis-Thujopsene while those from Zomba were dominated by α -Pinene and β -Pinene. Mulanje Cedar oil from Zomba Mountain was extracted from different ages of the plant, however, no clear trend was observed. For example, juvenile leaves from a 2017 trial plot produced the highest amount of oil (1.04 %) compared to trees between 21 and 100 years old, however, the oldest trees (>100 years old) produced more oil again (0.46 %), although not as much as the young trees (See Annex 7 Mulanje Cedar essential oil analysis report).

Indicator 3.2: Samples sent to potential national and international purchasers by end of year 1, with continued engagement in years 2 and 3.

MMCT has tested oils produced in soap manufacturing processes and plans to build a local industry with a local co-operative. A potential international client has also been engaged as a consultant in the project to provide analysis of opportunities and support options in the future (see section xxx above). Beyond the project MMCT will seek CITES clearance to transport some of the produced oils to South Africa, via the SAEA contact for some business tests to be completed.

Indicator 3.3: 150 people (60% women) from ten communities around Mount Mulanje are identified with help from Traditional Authorities, and ten trial cedar hedge plantations are planted at sites around the base of Mount Mulanje for essential oil extraction by end of year 1 and ten community cedar essence extraction enterprises fully equipped at start of year 2.

255 (156 women) community members voluntarily took part in hedge planting and management training within the project. 185 hedges were planted with community members in 2020 and 2021. About 55 % of Darwin Initiative Main Final Report Template 2023

the hedges have survived to date. The rest of the hedges were affected by extreme heat experienced from September to November 2020, livestock encroachment and termite attacks. Some community members did not have the water resources to adequately look after them through this. MMCT and the Forestry Department have continued to support the hedge planters to improve survival and growth throughout the project.



Figure 2: The larger distillation equipment (100kg - right) with project manager, Ibrahim Mitole, explaining how the oils are produced (left)



Figure 3: The smaller distillation equipment (10kg) for tester production of oils from plant materials

The essential oil distillation equipment was delivered to MMCT in 2021 - this included a 10kg mobile unit and a 100kg unit – see figures 2 and 3 below. MMCT constructed a building that houses this. The equipment was installed and has been used to conduct distillation training for MMCT staff and community demonstrations on how to produce essential oils (see indicator 2.4 above). A trainer from the

provider, Essential Distillation Equipment (EDE), Werner Besner, travelled to Malawi from South Africa to help complete the equipment set up and run the training in November 2021.

Consumables have also been imported from South Africa in 2022/2023, including: glass bottles (various), jars, beakers, caps and lids, pipettes, plastic bottles, buckets, syringes, funnels, dip sticks and atomisers.

Indicator 3.4: 150 people (60% women) from ten communities around Mount Mulanje are trained in planting and management techniques for cedar hedge plantations by end of year 1, sustainable harvesting techniques, processing, business skills and marketing.

From November to December 2020 a local trainer, Mr. Kingsley Mulekano, was recruited and trained 200 community members (with over 60% women representation) in business skills and marketing. 94 came from the nurseries, 86 were new hedge planters, and 20 were representatives from the Cedar Growers and Planters Association. The training was specifically designed to equip the nursery caretakers and hedge planters to have relevant basic knowledge and skills in how to run the nurseries and hedges as a business enterprise and generate income for local households (See consultant report in Annex 16).

Within the hedges that were planted, different harvest regimes (some harvested above 1m, others with the lower branches harvested only) have been tested to provide materials (leaves and twigs / small branches) used to produce essential oils in the project (see indicator 2.4 above). There are no specific data available on the trial results, however it has been anecdotally reported that too much material was harvested and the trees with materials harvested over 1m have been more impacted.

Indicator 3.5: 150 people selling essential oil and earning at least USD250/year from sale of Mulanje Cedar essential oil by end of year 3

The project has not progressed to the point of producing sales from essential oils for the hedge growing community members to receive income benefits. However, with the recruitment of Kate Chanthunya in September 2022 (through the new Darwin Initiative project 29-0174), MMCT have developed a soap with Mulanje Cedar essential oils as an ingredient and plans to establish a soap making group within the local Likhubula Cooperative Society that will be trained to produce the soaps, providing an initial local market.

The consultant employed in the extended year, Karen Swanepoel (SAEA), from South Africa will also be further engaged by MMCT to develop international opportunities for essential oils use once production quality and quantity can be confirmed. Karen has experience with similar developments around the Clanwilliam Cedar (*W. cedarbergensis*) in South Africa and has agreed to share experiences on that industry with the team.

A baseline socio-economic survey was undertaken by a consultant in 2020, which was repeated in 2022 by MMCT's Monitoring and Evaluation Officer (See the reports in Annex 17 and 18).

Output 4. Conservation measures in place for other over-exploited plant species on Mount Mulanje and conservation-commerce model replicated for five important plant species on Mount Mulanje

Indicator 4.1: Survey conducted to identify other plant species of Mount Mulanje and their potential uses and commercial value in year 1.

A consultant Raheela Ahmed was recruited to conduct an Ethnobotanical survey (see full report in Annex 19). The report recommends 12 other species for use in natural product developments: *Mondia whitei*, *Tamarindus indica*, *Aframomum angustifolium*, *Aloe arborescens*, *Annona senegalensis*, *Fadogia aencylantha*, *Flacourtia indica*, *Myrianthus holstii*, *Oxytenanthera abyssinica*, *Raphia farinifera*, *Saba comorensis* and *Uapaca kirkiana*. It also highlights nine native species that can be coppiced and are fast growing, which could be useful in diverse management systems providing potential options for more sustainable firewood and charcoal production systems.

To protect the traditional knowledge and intellectual property of local plants and their uses from being exploited, this study followed the protocols of the national Access and Benefit Sharing (ABS) legal framework established within the guidance of the Convention on Biological Diversity (CBD) Nagoya Protocol. Between February- April 2021, consultations took place with the EAD, Forestry department, BGCI, MMCT and participating traditional authorities to develop Prior Informed Consent (PIC) agreements. Negotiations for Mutual Agreed Terms (ABS contract) will then be developed when specific plant species are identified for natural product development. Non-Disclosure Agreements (NDAs) have been signed between project partners and research agencies (see example NDA in Annex 8).

In April 2021, data collection was conducted in five villages over five days. Five research assistants provided support in data collection. Research methods consisted of questionnaire-based surveys with

key informants such as artisan crafts people, traditional healers, and other primary forest resource users; household questionnaires; and semi-structured focus group discussions. A total of 131 surveys were completed (5 focus groups, 54 household questionnaires, and 72 key informant interviews). Translation of plant names from local languages (e.g. Chichewa) to Latin names was done in collaboration with Hassam Patel from National Herbarium & Botanical Gardens, and available literature. A comprehensive literature review was also conducted for all the plant species identified throughout the survey.

Indicator 4.2: Seed collected from all over-exploited rare and threatened plant species on Mount Mulanje (estimated 10 additional species) in years 1 and 2, stored at FRIM and distributed to at least ten botanic gardens for *ex situ* conservation.

FRIM carried out seed propagation tests on 14 other target native plants species from Mount Mulanje (see Annex 20). BGCI & MMCT supported the collection and transport of 3kg Mulanje Cedar seeds from Malawi to the UK, for some seeds to be stored at the Royal Botanic Garden Kew's Millennium Seed Bank and for some to be distributed to other gardens to be grown for conservation, including the Eden Project (UK) and Inala Jurassic Garden (Tasmania). This included funding and administrative support to CITES permit applications.

Further important species have been identified, including other miombo species important for fuelwood (in research undertaken by a Master student, Samantha Hasek from University of Kent - see report in Annex 27) and providing edible fruits (research by MMCT staff). Further analysis of the resource availability, current use practices and known biological factors important for sustainable use of the species to understand the conservation and sustainable use needs is going to be undertaken for 4 target species in the new Darwin Initiative funded project (29-014).

Indicator 4.3: Propagation protocols developed by FRIM, tested by community nurseries and published for all collected species by end of year 3.

Seeds of the nine Mulanje Cedar companion species were collected in July 2021 and 5 during seed collection training with local communities in January 2022. These were: *Erica benguelensis*, *Dodonaea viscosa*, *Diospyros whyteana*, *Pittosporum viridiflorum*, *Maytenus acuminata*, *Podocarpus milanjanus*, *Rawsonia lucida*, *Erica nyassana*, *Myrsine* sp., *Macaranga capensis*, *Myrica pilulifera*, *Apodytes dimidiata*, *Dracaena steudneri* and *Cussonia arborea*. Propagation trials for the companion species were established at six sites in August 2021; three on Mulanje mountain (Sombani, Thuchira and Lichenya); two in community Mulanje Cedar nurseries (Nessa and Nakhonyo); and in FRIM offices in Zomba. The Lichenya site was lost in a fire later in the year. The initial results from the propagation trials in Zomba are in Annex 21, whilst the report from the seed collection training can be found in Annex 22. Further propagation data and final protocols from the tests started in various sites has not been submitted by the project conclusion.

Indicator 4.4: Pilot studies for at least 3 other over-exploited plant species with commercial potential on Mount Mulanje, diversifying income streams by end of year 3 and helping ensure the conservation of those species. Candidate enterprises include propagation of *Kniphofia mulanjeana* and *Eucephalartos gratus* (Vulnerable) for sale as ornamental plants (matched funding dependent).

A new project looking at commercial and livelihoods opportunities from numerous miombo woodland species began in 2022, supported by the Darwin Initiative (29-014). This builds on the ethnobotanical work to investigate the species use in restoration (including agroforestry on degraded farmland) with support to community co-operative and a local social enterprise creation. The latter will support research development and advertisement for value added products and access to different markets, including through use of the FairWild certification standards. This has selected 4 target plant species and chanterelle mushrooms for further developments.

Further training on resources assessment that incorporates local communities was delivered by two staff from Bio Innovation Zimbabwe (BIZ), from Zimbabwe in September 2022 (see figure 4 below). A total of 12 trainees took part from 3 organisations (WeForest, MMCT and FRIM)



Figure 4: trainees doing practice sessions with local community groups to learn about the resource assessment methodology (left) and the 12 trainees and 2 trainers (right)

No projects have been developed and funded that focus on *Kniphofia mulanjeana* or *Encephalartos gratus* as ornamentals.

3.2 Outcome

Indicator 0.1: Restoration protocols developed for Mulanje Cedar on Mount Mulanje improve survival rates by 30% compared to project 23-026 baseline, resulting in continued demand for seedlings for restoration.

The updated restoration trials were established in January with data collected from them on survival and growth, with data also collected from the 2019 plots. Further data is need in the next two years (funded by the EDGE fellowship) to confirm best practices for restoration protocols. Those data will be used to assess longer term survival under different conditions, including the impact of other native plant species, of the Mulanje Cedar trees planted. Initial survival rates of the plots planted in 2022 is better than those of the worst performing plots planted pre-2019, although those have seen drop offs throughout the project at 2-4 years following planting (see section 3.1 indicator 1.3). Trial establishment was impacted by COVID-19 in this project, so that new planted trials could only be done in January 2022. To recover from these impacts, funding was moved to year 3 to cover restoration activities so that ERA experts could join fieldwork in January and March 2022.

A continued demand for seedlings for restoration has been produced through partnership with WeForest and further fundraising done by MMCT in the 2022/2023 season. MMCT will continue to fundraise in future years (see section 3.1 indicator 1.1 above and in-kind funds raised in section 12.2).

Indicator 0.2: Documented example of the conservation-commerce model for Mulanje Cedar developed by end of year 3.

As in section 3.1 indicator 3.7, it has not been possible to publish a final conservation-commerce model for the Mulanje Cedar in the project lifetime, despite an extended fourth year. The impacts of COVID-19 were a big contributing factor to this; however these were compounded in the extended year by staff time contributes to the project followed by personnel changes at MMCT. As project lead, BGCI has maintained communication with the MMCT team and supported the progression of some elements of the project.

Indicator 0.3: Optimal extraction techniques identified for Mulanje Cedar essence by end of year 1 and essential oil produced and sold by communities, resulting in benefits for 150 local community members (60% women) and a market for Mulanje Cedar seedlings for essence extraction by end of year 3.

Whilst the market is not yet established with local community members as beneficiaries, the initial research into the oils was completed (see section 3.1 indicator 3.1). The capacity to grow Mulanje cedar hedges for any essential oil industry and to produce essential oils locally has also been increased in the project (see section 3.1 indicator 3.3 and 3.4). Due to the amount of oil that has been shown to be produced so far, it has also been noted that, at least initially, Mulanje Cedar oil only may not be sufficient for products and so mixed produce might be best.

Final connections to specific value chains or industries have not been concluded as expected, despite the extension for a fourth year. Staffing problems in the extended year have contributed to this, and stalled progress, however the employment at MMCT of Kate Chanthunya under project 29-014 has progressed some local and international opportunities since September 2022 (see section 3.1 indicator 3.5). Due to the relatively late time in the year of her employment and considering her time needed to

settle and work on the new project, has meant progress by the end of the project has not been able to produce specific incomes, however, developments are continuing.

Harvesting trials have also not produced sufficient results to suggest a best method for sustainably growing hedges in the project, despite the trials mentioned in section 3.1 indicator 3.4. MMCT will continue to follow up on these to ensure any developments do remain sustainable.

Indicator 0.4 Over-exploited plant species of Mount Mulanje are investigated for potential sustainable use by end of year 3.

The ethnobotanical study highlighted other useful plants from Mount Mulanje, with others highlighted by a Master student from the UK (see section 3.1 indicators 4.1 and 4.2). Resource assessment training, to understand the current situation of plant resources and to create baselines for monitoring against into the future, was delivered that aligns with the FairWild Standards (see section 3.1 indicator 4.4). Local staff will be able to use this to monitor exploitation on target species in the future, and to ensure any developments are sustainable and fair to local people.

3.3 Monitoring of assumptions

Assumption 1: Continued participation of local communities

Comments: This is still true with communities engaged by MMCT on a regular basis, including in the established nurseries and the completed ethnobotanical survey. Nursery groups have grown other native species in their nurseries. Community members also came to see the demonstrations of the distillation equipment producing essential oils in the extended year. Additional community members seeing the project activities and developments have also request to have Mulanje Cedar trees to plant in their own hedges.

Assumption 2: Local politics and ethnic differences do not hinder progress of project activities

Comments: This did not cause any issues in the project.

Assumption 3: Income obtained from seedlings and essential oil replaces income from illegal exploitation activities and is regarded as an alternative, not an additional activity

Comments: It was not possible to confirm if the incomes earned competed enough to cease illegal exploitation activities in any groups. It has been noted during fieldwork that logging of other species on the mountain has still continued at pace, despite Mulanje Cedar trees no longer being available.

Assumption 4: Technical expertise is available to solve planting issues

Comments: Project partners at FRIM, the National Herbarium and Botanic Garden of Malawi, the Department of Forestry and the ERA have continued to ensure that the right expertise, nationally and internationally, has been on hand to provide technical guidance to the project. This has included providing support to communities with hedges to help them to look after them and to deal with “pests” as they occur (e.g. livestock and termites). MMCT have provided regular communication and support to community members to deal with these issues as they arise, requesting help from partners as needed. In the final year resource assessment expertise was also included in the project through engagement with FairWild and BIZ.

Assumption 5: Enough seed is produced from FRIM stands to continue to supply nurseries with sufficient seed

Comments: Enough seed was collected this year to provide seeds for propagation and conservation work. However, in March 2022 it was learnt that one of the two remaining stands (in Zomba), that act as seed sources for the Mulanje Cedar, was illegally clear cut, leaving only one seed source left. Harvesters took advantage of a temporary legal change to allow the harvest of standing dead trees and pine trees to clear all of the remaining trees and hide the logs in the amongst the other harvested wood. This significantly hampers seed collection options in the future. On learning of this, BGCI organised a seed collection trip to the last source in April 2022 to provide seed for future conservation work in Malawi but also to send some seeds to the UK that can then be distributed on to other botanic gardens around the world. This will also link into a Global Botanic Garden Fund project to provide seeds to Inala Jurassic Garden in Tasmania. BGCI supported the CITES permits and transported seeds during some legs of the journey (to Zomba from the source site, and from Malawi to the UK).

Assumption 6: Communities continue to be interested in nursery work

Comments: The remaining eight operational Nurseries have continued to propagate high numbers of seedlings and received incomes from their sale. A continued market for seedlings that they produce is important to keeping them engaged beyond the project.

Assumption 7: Restoration and commercial market for seedlings is maintained

Comments: The market for seedlings has remained from the project and another organisation, WeForest, buying seedlings for restoration on Mount Mulanje. WeForest have supported the planting of 70,179 seedlings in 2022 and 15,000 in the 2022/2023 rainy season. Markets for seedlings to plant hedges

outside of the project within other communities is still dependant on the essential business developments, however other community members have request seedlings to plant separate from the project because of the project activities.

Assumption 8: Malawians will continue to respond to public outreach campaigns

Comments: The public outreach campaign concluded in 2023. Certain elements of the local communities have continued to be engaged and attended activities like the demonstrations of the distillation equipment. It has been noted in the project that within the wider community, people would appreciate more information and engagement in activities to understand what is going on, currently they feel information is too restricted to those direct beneficiaries.

Private individuals and organisations previously engaged about the essential oils developments still need to be provided with oil samples to test for use in their products, following NDAs being agreed and signed.

Assumption 9: Local politics and ethnic differences not inimical to creating a cohesive and representative essence producer association

Comments: No issues were seen in the project.

Assumption 10: Expertise is available to optimise extraction techniques and develop essence products

Comments: The expert from EDE was able to travel to Mulanje from South Africa in November 2021 to support the distillation equipment set up and provide training on its use. The essential oils researcher from Mzuzu University produced initial test results, that need to be confirmed by industry experts (in South Africa) if possible beyond the project.

Assumption 11: Communities are receptive to new business establishment

Comments: Hedge planters have remained engaged at looking after their hedges to varying degrees – some better than others.

Assumption 12: Seed is available for collection from target species within the project timeframe

Comments: This has remained true this year, with seed collected from Mulanje Cedar trees and other native plant species from Mount Mulanje. The availability of Mulanje Cedar trees in the future is more in question.

3.4 Impact: achievement of positive impact on biodiversity and poverty reduction

A key impact of the project is to expand opportunities for short-term benefit to communities by establishing sustainable cedar essence enterprises. This will increase the number of people benefiting directly from sustainable utilisation of Mulanje Cedar, providing employment opportunities that increase income and reduce poverty, but it has been significantly delayed by COVID-19 impacts on the project. Despite an extended fourth year, this has still not come to fruition.

Distillation equipment has been set up and tested at MMCT. Engagement with business is ongoing (see section 3.1 indicator 3.5).

With Mulanje Cedar trees no longer available on the mountain, loggers are removing other species for timber from the mountain including *Podocarpus* spp. and miombo woodland species like *Uapaca kirkiana*. This is exacerbating the detrimental effect that people are having on forests, biodiversity and the local watershed. These other species are likely to go locally extinct too without good alternative sources of income for people. The planting trials have included planting trees next to other Afromontane evergreen Mulanje Cedar forest species, to investigate the value to Mulanje Cedar survival and growth of including other native species in restoration strategies that would add value to the wider biodiversity on Mount Mulanje.

The partnerships created between BGCI, MMCT and other supporting partners have continued to jointly seek funds for related projects (e.g., successful EDGE Fellowship for Ibrahim Mitole and see section 12.2 below). These will include expanding restoration on Mount Mulanje as well as implementing restoration of other important and useful habitats of the mountain, such as the Miombo woodlands on the lower slopes. A new Darwin Initiative funded project (29-014) will support this in the Miombo specifically.

98 members (68 women) of the 8 community nurseries have continued to receive incomes from the purchase of seedlings to use restoration planting undertaken by WeForest (see Table 1 in section 3.1). A further 16 community members (8 women) have been trained how to collect and process other native plant seeds. The continued inclusion of women in this project is increasing the recognition that women can bring income to households, making control over assets more balanced as a result. 12 staff from 3 local institutes have also received training in resource assessment using a method that is collaborative with local communities.

The second socio-economic survey was completed in the first three months of 2022 comparing back with the baseline done in the first year (see Annexes 17 and 18).

4 Contribution to Darwin Initiative Programme Objectives

4.1 Project support to the Conventions or Treaties (e.g. CBD, Nagoya Protocol, ITPGRFA, CITES, Ramsar, CMS, UNFCCC)

Project activities have been supporting Malawi with CITES and Nagoya Protocol compliance. For seed collection and conservation of Mulanje Cedar seeds in the UK and Tasmania, the team has ensured CITES permits have been secured from Malawi, the UK and Australian governments for their safe transfer for long term conservation in the Royal Botanic Garden, Kew's Millennium Seed Bank as well as for living collection conservation at Bedgebury Pinetum and the Eden Project in the UK; and the Inala Jurassic Garden (matched funding supported some of this work).

For sustainable use developments and ABS, throughout the project, the team has been in communication with the Malawi ABS focal point, Ms Mphatso Kalemba. She has particularly advised on the creation of a Prior Informed Consent and Mutually Agreed Terms system for the ethnobotany survey. All activities for developing essential oils from the Mulanje Cedar have included NDAs being signed when external parties have needed to be involved. The process following will ensure any developments that come out of the project in relation to Mulanje Cedar essential oils or other species, will meet objectives related to CITES and ABS.

CBD Aichi target 7 is being supported by establishment of new restoration trials and data collection from all restoration trial sites, with further data collected in 2023 (see section 3.1 indicators 1.2-1.4 above). The ABS developments (see section 3.1 Output 4) will support Malawi to stick to CBD Aichi targets 3 and 4.

4.2 Project support to poverty reduction

The project contributed to a reduction in poverty by providing incomes directly to local community members living around Mount Mulanje Biosphere Reserve where employment opportunities are minimal (see table 4 below). For those involved in plot transportation and plot clearance, over 500 people were involved, with WeForest support, surpassing the project target of 80 individuals.

Table 4: Project beneficiaries and monetary benefits they received each project year.

Beneficiary group	Monetary benefits received			
	2019-2020	2020-2021	2021-2022	2022-2023
8 community nursery groups (70% of women)	9,084,000 MK received from 75,700 seedling sales.	12,370,440 MK received from 94,512 seedling sales.	8,421,480 MK received from 70,179 seedling sales.	4,524,912 MK received from 67,321 seedling sales for restoration and to private (10,000)
Seedling transporters for restoration and hedges	1,500 MK/person/day was paid for transporting 10,000 saplings for restoration on the mountain	1,500 MK/person/day was paid for transporting 79,162 saplings for restoration on the mountain	1,500 MK/person/day was paid for transporting 70,179 saplings for restoration on the mountain	1,500 MK/person/day was paid for transporting 57,321 saplings for restoration on the mountain
Community members involved in plot clearance and preparation activities		1,350 MK / person / day was paid for the plots planted on 32 sites	1,995 MK/person/day was paid for planting activities on the mountain	2,300 MK/person/day was paid for planting activities on the mountain

The project has also provided access to training to community members, on how to run business as well as environmental management skills (seed collection, propagation and plant management) so that people might be able to set up their own businesses in the future as well as manage their own farmsteads and surrounding areas better for improved subsistence production (continued support

beyond the project will be useful – see table 5 below). At least 200, more than the target 150, community members benefitted from training with 12 staff from 3 local conservation institutes also receiving technical training.

Table 5: Project beneficiaries and non-monetary benefits they received each project year.

Beneficiary group	Non-monetary benefits received			
	2019-2020	2020-2021	2021-2022	2022-2023
8 community nursery groups (70% of women)		94 (over 60% women) trained in business skills and marketing	16 (8 women) trained how to collect and process other native plant seeds	Some attended distillation equipment demonstrations
Community hedge planters / owners (% of women)	255 (156 women) trained in hedge planting and management	86 (over 60% women) trained in business skills and marketing 80 (66% women) trained in hedge planting & management		Some attended distillation equipment demonstrations
CGPA members		20 (over 60% women) trained in business skills and marketing		Some attended distillation equipment demonstrations
Staff from 3 project partner institutes (25% women)				12 staff (3 women) received resource assessment training

4.3 Gender equality and social inclusion

98 nursery workers (68 women) benefited from the restoration work carried out on the mountain. Four of the nurseries have a female manager and 6 have female nursery secretaries. This means that women are receiving more equitable responsibilities in the management of the nurseries and are represented in the CGPA, making the decisions more gender inclusive.

8 of those trained to collect seeds (50% of those trained) were also female participants in January 2022. 103 women were trained to plant and manage hedges (61% of trainees) in the first year with a further 58 trained in the second year. 200 women received further training on business management and marketing skills in the second year.

In demonstrations of the distillation equipment in action, roughly 65% of attendees were women, with support given to marginalised communities to attend. Smaller mobile distillation equipment was also used to take the technology into the field to reach groups that were unable to travel to MMCT offices for the demonstrations.

Please quantify the proportion of women on the Project Board ¹ .	15%
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¹ A Project Board has overall authority for the project, is accountable for its success or failure, and supports the senior project manager to successfully deliver the project.

Please quantify the proportion of project partners that are led by women, or which have a senior leadership team consisting of at least 50% women ² .	33%
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4.4 Transfer of knowledge

Throughout the project workshop and training exercises have been undertaken to transfer knowledge to practitioners and policy makers in Malawi

- Nagoya Protocol workshop (2020) - National platform - See Annex 11
- Cedar hedge planting and management (2020/2021) - See section 3.1 indicator 3.3
- Essential oil distillation equipment training of MMCT staff (2021/2022) - see section 3.1 indicator 3.3
- Business skills training (2020/2021) - See Annex 16
- Community demonstration workshops on the function of the distillation equipment (2022-2023) – see section 3.1 indicators 2.4 and 3.3
- Television and radio campaign (2022-2023) – see section 3.1 indicator 2.4
- Wild resource assessment training by BIZ from Zimbabwe (2023) -see selection matrix used in Annex 23

This has included regular engagement and inclusion in the project Steering committee of representatives of the Department of Forestry and the Environmental Affairs Department.

4.5 Capacity building

The project manager, Ibrahim Mitole (male), received EDGE fellowship award from the Zoological Society of London to be a fellow on the programme from 2023-2024 (see <https://www.edgeofexistence.org/fellow/ibrahim-mitole/>). He receives training and support for ongoing work to continue to investigate the best options for restoration of the Mulanje Cedar tree. He will continue the project work for this, despite having left MMCT in March 2023.

In the Forestry Research Institute of Malawi, Innocent Taulo (male), took over as the National Coordinator of the Mulanje Cedar in Malawi.

Raheela Ahmed (female), has moved from voluntary and consultancy positions at MMCT to take up the role of restoration ecologist for MMCT in 2022.

5 Monitoring and evaluation

The most major change to the project was to extend the project for a fourth year due to delays to business development elements of the project. This was a no cost extension. It was also noted at the start of the project that 2 of the 10 community nurseries established in project 23-026 ceased to operate, but it was decided that this project did not have funds to establish two new nurseries, despite the logframe indicator 1.1 describing “Ten nurseries, established and certified in project 23-026, continue to produce a minimum aggregate total of 400,000 Mulanje Cedar seedlings...” Funds were also moved between years to combine budgets stretched over two years to be used in one for:

1. Socio-economic assessment consultant costs from split across 3 years to focused on year 1 to create a baseline, from which MMCT agreed to carry out a final survey internally instead of through a consultant.
2. Purchase of distillation equipment in year 2 from £12,000 to £17,000, with the £5,000 budget removed from year 3. This was because the quotes surpassed the available budget without the change.

The core project team, with support from the Steering Committee (SC), are responsible for the M&E of the project. The SC members' role was to analyse the progress of Activities and Outputs towards the project Outcome and to deal with issues that arise and suggest adaptive management options when needed to keep the project on track. The SC met 6 times in total (10/07/2019; 29/09/2020; 22/03/2021; 7/10/2021; 2/09/2022; 7/03/2023- see example minutes in Annex 5). This was a good way to update the project, especially when combined with regular management meetings between the project managers from BGCI and MMCT, including production and agreement of more detailed yearly Gantt charts of activities to be done.

² Partners that have formal governance role in the project, and a formal relationship with the project that may involve staff costs and/or budget management responsibilities.

The wider socio-economic impact of the project has been assessed in a socio-economic survey in the final year of the project as a comparison to the survey completed in the first year (see Annexes 17 and 18). These provided some good summary information of the socio-economic situation, however economic changes within the 3 years of the project are negligible over the course of 3 years and so they show limited use for evaluation purposes in the end. It may also have been better to ensure the final survey was undertaken by the same external consultant, however it was realised funding was not sufficient for this once the consultancy was advertised and had applicants with budgets.

6 Actions taken in response to Annual Report reviews

In 2022, One of the main reviewer's comments was "It is likely that for outputs to be achieved – given so much has been left to the final year – an extension will be necessary. Without that likelihood of contribution to Outcome level changes is less likely." For this reason, the team submitted a change request before the end of 2021 that was accepted by the Darwin Initiative to extend the project for another year with £26,000 moved to carry out essential oils business research and development activities.

The reviewer also commented that "it would seem sensible to get as much propagation of Mulanje cedar as possible for restoration on the Plateau." Seed collection from the remaining seed source site has been undertaken in each season (February to April), including other funds being raised by BGCI to fund collection in April 2022. This was done to align with another project that aims to propagate Mulanje Cedar trees in Tasmania, where the team at Inala Jurassic Garden has success in propagating and growing other threatened *Widdringtonia* tree species from South Africa (*W. schwarzii* and *W. cedarbergensis*).

A further comment from the reviewers was on the need to ensure seedlings are not lost because of water shortages through drought periods. Two of the nurseries (Kazembe and Lomoliwa) that struggled most with this, were moved closer to water access points following this.

In the review of the 2021/2022 annual report, a further comment was "For the companion species, have you considered wildling transplanting or production closer to the restoration areas?". For use of wildlings, BGCI has a policy of not uprooting and translocating wildlings because the process often has low survival rates and plants may therefore have a better chance *in situ*. A part of the reason for initially moving propagation to communities was that losses were seen in the past in nurseries on the plateau, because of frosts and droughts, with management not sufficient. However, Mulanje Mountain Conservation Trust did revitalise some nurseries on the mountain, to grow companion plants as well as Mulanje Cedar seedlings. They provided training and support to the hut watchmen to maintain the plants growing there and some were planted as part of MMCT's own Mulanje Cedar restoration planting programme in the 2022/2023 season and will provide stocks again in 2023/2024. However, these were not always maintained well with plants lost. It is worth noting that MMCT also plans to move towards planting an even share of Mulanje Cedar versus companion plants when doing restoration planting, which may require multiple sources, that could include some better run nurseries on the mountain as well as community nurseries.

Another reviewer comment referred to nurseries growing "a wider range of species is to be propagated and managed, ... introduces complexity – each species may have different propagation and management needs, including how seeds are germinated, necessary soil inoculants and so on, multiplying the level of skills and training needed. Then there's the challenge of carrying these seedlings up to the plateau for planting. Separating out what might be needed from an ecological perspective from what is realistic to introduce as a community/individual enterprise exercise needs to happen. It's important that – as part of the exit plan – protocols and requirements for these companion species to be used as part of restoration are properly documented." Thus far, the nurseries have been able to produce stocks of 7 other species (*Faurea racemosa*, *Macaranga capensis*, *Dodonaea viscosa*, *Dracaena* sp., and *Pittosporum viridiflorum* - See stocktake done in 2023 in Annex 24). This built on the trials carried out by FRIM in their laboratory and nursery (See Annexes 19 and 20). Further propagation training and nursery management delivered to MMCT and WeForest staff will allow them to better manage their own nurseries and to continue to support the community nurseries into the future, whilst the FRIM team in Zomba will also be able to continue to support where needed into the future.

Finally, a comment was made that "A theory-of-change type exercise would be useful to help the team extract themselves from activities/ operations and look at the bigger picture." For this, the project manager from BGCI, Alex Hudson, travelled to Malawi in October 2022 to facilitate a Visioning exercise between the key partners of a new project (29-014) - See Annex 25.

7 Lessons learnt

Regular catch-up meetings of the Project Managers have kept activities going well and allowed us to ensure budgets were kept to, adaptively managing activities on a regular basis. We began planning for important events with emails and meetings over Skype/Zoom early enough to ensure they were implemented as early as possible (Restoration trip with ERA experts and fieldwork in September, December, and March). This has meant that despite some delay activities were often caught up on.

With regards to research, for the ethnobotanical section of the project, it took longer than expected to get official responses from government institutes from applications that ensure research sticks to Malawi legislative frameworks and guidelines (e.g., to NCST and EAD). This is the normal processing time for these applications, but the full extent of what was needed only became understood at the Nagoya Protocol workshop was held in January 2020. For other similar projects it is recommended to engage with more parties early in project proceeds to understand the government processes in more detail. We would particularly recommend engaging with government National Focal Points as early as possible to ensure national legislation and perspectives on Nagoya Protocol and CITES are understood and incorporated without delay.

Propagation of a diversity of other native species for use in the restoration proved difficult in the final project years, with a need to carry out collection and propagation. The initial target list was finalised in April / May 2020 so for some species the seed collection period for the year was missed. For other species, germination failed without time for investigation into other propagation methods. Finally, for many of those collected and propagated, the seedlings were not sufficiently strong to be transplanted onto the mountain for the rainy season after their collection. For collection and propagation to be undertaken well, requires a fast species selection and collation of relevant information to leave at least a year to carry out collection and propagation of sufficient stocks to carry out multi native species restoration trials.

The local seasonal cycles are also important to fit into planning. This is also important in contexts where prolonged drought can be impactful on nurseries and plantation activities. Including support options for access to water for nurseries or plantations (including site selection close to good water sources) can be very important to local successes. Other site challenges included livestock impacts, and pests, like termites for which specific support is needed - like fencing around the planted sites or creating access to pest controls options like orange oil, apple cider vinegar and/or wet cardboard. Active management is also needed, so selection of participants with drive to do this is important - in the project those that were active saw the worst survival results. For dealing with challenges seen, MMCT has been an important resource to community members, sharing knowledge they have on them and sharing experiences between community groups as needed.

To deal with propagation issues we held knowledge exchange workshops with plant experts from South African National Biodiversity Institute in South Africa and staff from MMCT and FRIM in Malawi. This positively allowed methodologies on how to propagate wild seeds were swapped along with relevant biological and ecological characteristics to pay attention to and factors to incorporate into propagation trials when investigating difficult species. These region cross exchanges of information are highly recommended.

Through the project, we learnt that essential oils research and development requires continual assessment and further research with various factors potentially influencing quantity and quality of oils. As well as initial factors considered (plant part) the location grown (altitude), local environment and time in year of investigations can all impact the results.

8 Risk Management

Since this was a fourth extended year to the project with a small proportion of the overall funds for the project and funding for extra staff time not included completing activities has been challenging. The difficulty in transporting any parts or derivatives from Mulanje Cedar trees, as restricted by the CITES designation, has meant a challenge in the past 12 months for transporting seeds for conservation and essential oils for further analysis for international business opportunities. This makes potential essential oil opportunities slower to develop.

9 Sustainability and Legacy

Project staff at MMCT in Malawi and BGCI in the UK, have continued at their respective institutes, despite staff funding not continuing in the extended fourth year of the project. The project manager at MMCT decided to leave the organisation to focus on other projects and has been replaced. The equipment provided to MMCT (to support fieldwork, like tablets for data capture, and the distillation equipment for essential oil production) will be maintained and used by them following the project. Training and resources have been provided, as well as continued contact with EDE the provider of the Darwin Initiative Main Final Report Template 2023

distillation equipment, so that staff can continue to use the equipment easily beyond the project. This can be used to produce oils from other plants beyond the Mulanje Cedar tree as well.

MMCT also plan to engage further with business opportunities in South Africa, including organising the transport of Mulanje Cedar oils for further industry tests. MMCT will also continue to fund raise for planned Mulanje Cedar planting on Mount Mulanje, with support from WeForest and the Darwin Initiative concluding - this was done successfully in the 2022/2023 season. This will continue to support the purchase of seedlings from the nurseries, of both Mulanje Cedar and companion species, and fund community members to undertake the planting activity.

Although all the hedges that were planted have not survived, this was largely due to lesser engagement and protection provided by some groups. For those that put more effort in, e.g. with fencing to protect from livestock, watering in the dry season and protection from pests – the trees appear much healthier and some have grown considerably in only a couple of years (see figure 4).

Figure 4: Mulanje Cedar hedge trees after 2 years, with fencing to protect the trees from livestock damage

10 Darwin Initiative identity

During the Nagoya Protocol workshop and the initial steering committee, the Darwin Initiative logo was used on presentations alongside the partner institutes. Darwin Initiative was always mentioned as the funding supporter of the project as well. This will have spread the knowledge of the Darwin Initiative in Malawi.

A project webpage on the BGCI website also explains the project (<https://www.bgci.org/our-work/projects-and-case-studies/save-our-cedar/>) and explains the funder with the logo on the page. A couple of blog posts about the project have also been published by the BGCI Project Manager, which mention the Darwin Initiative as the funder:

- <https://www.bgci.org/news-events/new-value-for-an-endangered-tree-to-serve-mulanje-mountain/>
- <https://www.bgci.org/news-events/world-soil-day-digging-plant-conservation/>

The MMCT project manager, Ibrahim Mitole, presented the project at Kew's Conference on Reforestation for Biodiversity, Carbon Capture and Livelihoods in February 2021. This was done remotely through a recorded presentation. The Darwin Initiative was noted as supporting the project, with the logo included. This can be viewed online (From minute 36:00 - <https://www.youtube.com/watch?v=eSGIIL-eaLI>) and the presentation slides can be viewed in the Annex 26.

At the Southern African Mountain Conference, in 2022, the support of the Darwin Initiative was mentioned during presentations with the logo displayed – Alex Hudson (BGCI), Louise Egerton-Warburton (Chicago Botanic Garden), Innocent Taalo (FRIM), Carl Bruessow (MMCT) and Raheela Ahmed (ethnobotany consultant). It was also shown as a sponsor of the whole conference on their website (<https://www.samc2022.africa/#>) and during sessions.

The project is also promoted through the @BGCI and @globaltrees Twitter accounts (the latter has now been closed with the formal closure of the Global Tree Campaign partnership between BGCI and Fauna and Flora earlier this year.

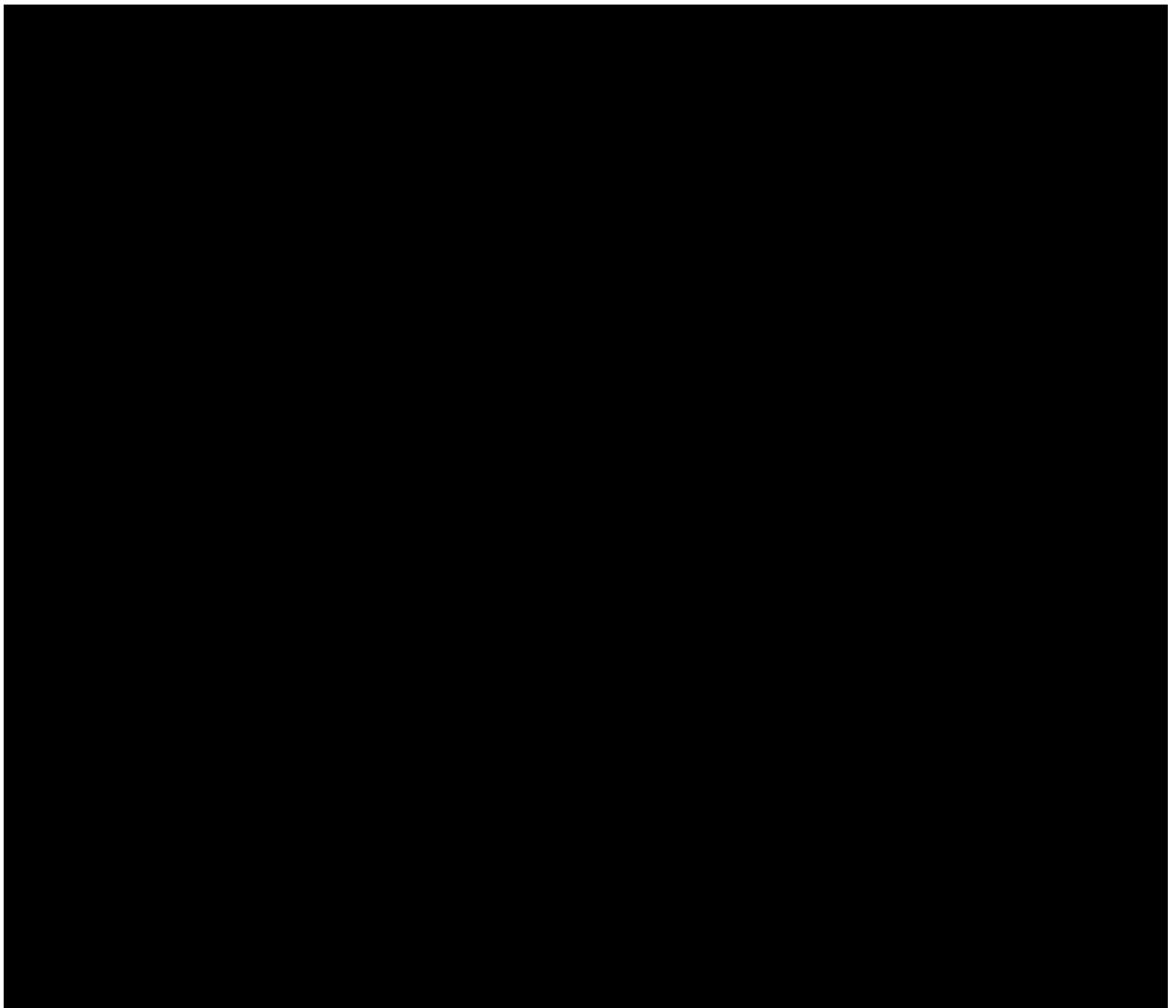
11 Safeguarding

Has your Safeguarding Policy been updated in the past 12 months?	No
Have any concerns been investigated in the past 12 months	No
Does your project have a Safeguarding focal point?	No
Has the focal point attended any formal training in the last 12 months?	No
What proportion (and number) of project staff have received formal training on Safeguarding?	Past: 0% [and number] Planned: 0% [and number]
Has there been any lessons learnt or challenges on Safeguarding in the past 12 months? Please ensure no sensitive data is included within responses.	

12 Finance and administration

12.1 Project expenditure

Project spend (indicative) since last Annual Report	2022/23 Grant (£)	2022/23 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
TOTAL				



12.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)

Source of funding for additional work after project lifetime	Total (£)

12.3 Value for Money

Within the project expertise from across the globe has been brought to bear on challenges associated with the Critically Endangered Mulanje Cedar tree, from the economic and ecological perspectives. Restoration Ecologists from South Africa, Australia and the United States have helped to design and implement new restoration trials. Researchers and industry experts from the UK, Malawi, Zimbabwe and South Africa have supported new essential oils developments. These achievements have been made despite the impacts of COVID-19 causing delays to many activities in years 1-3.

The project has also acted as a catalyst for a fund to support MMCT develop new enterprises further from the BRIDGE fund, for almost US\$. This includes construction of a new factory and associated equipment, in which the essential oils equipment will be a part.

Connections in the project lifetime have also been made with important government actors and companies and industries in Malawi and internationally that have shown interest in market opportunities from Mulanje Cedar essential oils. These will be built on further beyond the project.

Throughout the project, with challenges inflicted by COVID-19 some international travel expenses have been unable to be spent each year and we have always aimed to use these funds in Malawi to extend activities and to increase the project final impact.

13 OPTIONAL: Outstanding achievements of your project (300-400 words maximum). This section may be used for publicity purposes.

I agree for the Biodiversity Challenge Funds Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here).

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Note: Insert your full logframe. If your logframe was changed since your Stage 2 application and was approved by a Change Request the newest approved version should be inserted here, otherwise insert the Stage 2 logframe.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>Impact: The Mulanje cedar is a sustainably managed commercial product, generating income for local households and the Malawian economy, and no longer threatened in the wild.</p>			
<p>Outcome: Communities living around Mount Mulanje receive short-term benefits from sustainable utilisation of Mulanje Cedar and opportunities are identified for sustainable commercial use of other over-exploited plant species of Mount Mulanje</p>	<p>0.1 Restoration protocols developed for Mulanje Cedar on Mount Mulanje improve survival rates by 30% compared to project 23-026 baseline, resulting in continued demand for seedlings for restoration.</p> <p>0.2 Documented example of the conservation-commerce model for Mulanje Cedar developed by end of year 3.</p> <p>0.3 Optimal extraction techniques identified for Mulanje Cedar essence by end of year 1 and essential oil produced and sold by communities, resulting in benefits for 150 local community members (60% women) and a market for Mulanje Cedar seedlings for essence extraction by end of year 3.</p> <p>0.4 Over-exploited plant species of Mount Mulanje are investigated for potential sustainable use by end of year 3.</p>	<p>0.1 Planting protocols published. Seedling survival rates. Records of seedling sales from nurseries.</p> <p>0.2 Written record of model project methodology.</p> <p>0.3 Extraction methods published. Training course attendance figures and certificates. Socio-economic survey reports. Essence producers sales figures. Records of seedling sales.</p> <p>0.4 Seed collection and ex situ collection records. Mount Mulanje annual report and accounts. Funding applications.</p>	<ul style="list-style-type: none"> • Continued participation of local communities. • Local politics and ethnic differences do not hinder progress of project activities. • Income obtained from seedlings and essential oil replaces income from illegal exploitation activities and is regarded as an alternative, not an additional activity. • Technical expertise is available to solve planting issues.
<p>Outputs:</p> <p>1. Improved restoration protocols developed for Mulanje Cedar on Mount</p>	<p>1.1 Ten nurseries, established and certified in project 23-026, continue to produce a minimum aggregate total of</p>	<p>1.1. Nursery sales records. Register of commercial planting sites.</p>	<ul style="list-style-type: none"> • Enough seed is produced from FRIM stands to continue to supply nurseries with sufficient seed

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Mulanje, resulting in continued demand for seedlings for restoration	<p>400,000 Mulanje Cedar seedlings in years 1, 2 and 3 (seedling production figures have not increased compared to project 23-026 due to limited seed availability) for restoration, commercial sales (timber and essence) and community cedar hedge plantations (output 3), benefiting 150 community nursery workers.</p> <p>1.2 FRIM and restoration experts from BGCI's network design and implement planting trials at 8 sites on Mount Mulanje by end of year 1, benefiting 80 additional community members employed to transport and plant seedlings on Mount Mulanje.</p> <p>1.3 Improved planting protocols for Mulanje Cedar developed by FRIM and restoration experts in BGCI's network by end of year 3.</p> <p>1.4 Mulanje Cedar seedling establishment and survival rates increased throughout life of the project (target 30% improvement against baseline by end of project 23-026).</p>	<p>1.2 Trial plot records.</p> <p>1.3 Planting leaflets.</p> <p>1.4 Planting and survival figures, MMCT annual report.</p>	<ul style="list-style-type: none"> Communities continue to be interested in nursery work. Restoration and commercial market for seedlings is maintained.
2. Conservation-commerce model developed and documented for Mulanje Cedar	<p>2.1 Expert consultants appointed and project steering committee established by end of year 1, to guide and monitor project progress and development of conservation-commerce model.</p> <p>2.2 Feasibility study commissioned to improve understanding of Mulanje Cedar potential uses and markets, including identification of local and international commercial partners and</p>	<p>2.1 Steering Committee minutes. Consultant contracts. Monitoring and evaluation reports.</p> <p>2.2 Published feasibility study.</p> <p>2.3 Minutes and guidance produced from workshop.</p> <p>2.4 Leaflets, newspaper articles, radio and TV shows.</p>	<ul style="list-style-type: none"> Malawians will continue to respond to public outreach campaign. Local politics and ethnic differences not inimical to creating a cohesive and representative essence producer association

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	<p>quantifying potential income from essence manufacture, complete by end of year 1.</p> <p>2.3 Workshop held in year 1 involving the Union for Ethical BioTrade and TRAFFIC to determine Nagoya Protocol implications and requirements regarding access and benefit sharing in preparation for international trade of certified essence product and assess whether wild harvesting might be appropriate in future. Potential international purchasers engaged in years 2 and 3.</p> <p>2.4 Public outreach campaign in years 2 and 3 to grow demand for purchase of Mulanje Cedar seedlings (for timber and essence extraction) and essential oil.</p> <p>2.5 MMCT and FRIM monitor nursery certification scheme and Cedar Growers and Planters Association (CGPA) established in project 23-036, which becomes fully inclusive of planters for essence extraction by end of year 3.</p> <p>2.6 Training delivered in business and marketing skills and Nagoya compliance to Mulanje Cedar essence producers in year 2.</p> <p>2.7 Model conservation-commerce project for Mulanje Cedar documented and published by end of year 3.</p>	<p>2.5 Nursery certification register. CGPA register. Essential oil producer certification scheme developed and certification register.</p> <p>2.6 Training course attendance figures and certificates.</p> <p>2.7 Published report.</p>	

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>3. Manufacture of products from sustainably sourced Mulanje Cedar essence generates income for additional local households in the short-term and results in a larger market for cedar seedlings.</p>	<p>3.1 Optimal sustainable extraction techniques for Mulanje Cedar essence are identified in year 1.</p> <p>3.2 Samples sent to potential national and international purchasers by end of year 1, with continued engagement in years 2 and 3.</p> <p>3.3 150 people (60% women) from ten communities around Mount Mulanje are identified with help from Traditional Authorities, and ten trial cedar hedge plantations are planted at sites around the base of Mount Mulanje for essential oil extraction by end of year 1 and ten community cedar essence extraction enterprises fully equipped at start of year 2.</p> <p>3.4 150 people (60% women) from ten communities around Mount Mulanje are trained in planting and management techniques for cedar hedge plantations by end of year 1, sustainable harvesting techniques, processing, business skills and marketing.</p> <p>3.5 150 people selling essential oil and earning at least USD250/year from sale of Mulanje Cedar essential oil by end of year 3.</p>	<p>3.1. Scientific papers. Manuals for extraction.</p> <p>3.2 Partnerships with national and international purchasers.</p> <p>3.3 Essence enterprise member records. Cedar hedge plantations in place. Equipment and consumables in place.</p> <p>3.4 Training course attendance records and certificates.</p> <p>3.5 Sales records. Socio-economic surveys.</p>	<ul style="list-style-type: none"> Expertise is available to optimise extraction techniques and develop essence products. Communities are receptive to new business establishment.
<p>4. Conservation measures in place for other over-exploited plant species on Mount Mulanje and conservation-commerce model replicated for five important plant species on Mount Mulanje.</p>	<p>4.1 Survey conducted to identify other plant species of Mount Mulanje and their potential uses and commercial value in year 1.</p> <p>4.2 Seed collected from all over-exploited rare and threatened plant species on Mount Mulanje (estimated 10 additional species) in years 1 and 2, stored at FRIM and distributed to at</p>	<p>4.1 Survey report.</p> <p>4.2 Data capture forms from seed collection. FRIM records. Material Transfer Agreements. BGC's PlantSearch database of ex situ collections.</p> <p>4.3 Published protocols.</p>	<ul style="list-style-type: none"> Seed is available for collection from target species within the project timeframe.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	<p>least ten botanic gardens for ex situ conservation.</p> <p>4.3 Propagation protocols developed by FRIM, tested by community nurseries and published for all collected species by end of year 3.</p> <p>4.4 Pilot studies for at least 3 other over-exploited plant species with commercial potential on Mount Mulanje, diversifying income streams by end of year 3 and helping ensure the conservation of those species. Candidate enterprises include propagation of <i>Kniphofia mulanjeana</i> and <i>Encephalartos gratus</i> (Vulnerable) for sale as ornamental plants (matched funding dependent).</p>	<p>4.4 Enterprise model project concepts and funding applications.</p>	
<p>Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)</p>			
<p>Output 1</p>			
<p>1.1 Ten nurseries, established and certified in project 23-026, produce a minimum aggregate total of 400,000 Mulanje Cedar seedlings in years 1-3, benefiting 150 nursery workers.</p>			
<p>1.2 Design and implement planting trials at 8 sites on Mount Mulanje by end of year 1, benefiting people employed to transport and plant seedlings.</p>			
<p>1.2 FRIM and restoration experts from BGCI's network monitor planting trials in years 1, 2 and 3.</p>			
<p>1.3 FRIM and restoration experts from BGCI's network publish improved restoration protocols for Mulanje Cedar by end of year 3.</p>			
<p>1.4 Publish a review of survival rate improvements (target 30% improvement from Darwin project 23-026 baseline) by end of year 3.</p>			
<p>Output 2</p>			
<p>2.1 Write contracts for consultants by end of year 1.</p>			
<p>2.1 Establish project steering committee to guide and monitor project progress and development of conservation-commerce model.</p>			
<p>2.2 Commission study to improve understanding of Mulanje Cedar potential uses and markets, identify commercial partners and quantify potential income, complete by end of year 1.</p>			
<p>2.3 Workshop involving UEBT and TRAFFIC, determining Nagoya Protocol implications and ABS requirements for international oil trade, assessing whether wild harvesting might be appropriate in future.</p>			
<p>2.4 Run a public outreach campaign in years 2 and 3 to grow demand for purchase of Mulanje Cedar seedlings for timber and essence extraction.</p>			

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>2.5 MMCT and FRIM monitor nursery certification scheme and CGPA (established in project 23-036) which becomes fully inclusive of planters for essence extraction by year 3.</p> <p>2.6 Provide training in Nagoya compliance to Mulanje Cedar essence producers in year 2.</p> <p>2.7 Model conservation-commerce project for Mulanje Cedar documented and published by end of year 3.</p>			
<p>Output 3</p> <p>3.1 Identify optimal sustainable extraction techniques for Mulanje Cedar essence by end of year 1.</p> <p>3.2 Send samples to potential national and international purchasers by end of year 1.</p> <p>3.2 Continue to engage potential purchasers to expand markets in years 2 and 3</p> <p>3.3 Work with Traditional Authorities in year 1 to identify 150 people (60% women) from ten communities around Mount Mulanje to form essence extraction enterprises.</p> <p>3.3 Communities plant ten trial cedar hedge plantations using established seedlings at sites around the base of Mount Mulanje by end of year 1.</p> <p>3.3 Equip communities with essence extraction equipment at start of year 2.</p> <p>3.4 Train 150 people (60% women) in planting and management techniques for cedar hedge plantations by end of year 1.</p> <p>3.4 Train 150 people (60% women) in sustainable harvesting techniques and processing, business skills and marketing by end of year 2.</p> <p>3.5 Essential oil sold to commercial buyers for product manufacturing in years 2 and 3.</p> <p>3.5 Carry out socio-economic study in years 1, 2 and 3 to monitor income obtained by essence extraction enterprises.</p>			
<p>Output 4</p> <p>4.1 Conduct survey to identify other plant species of Mount Mulanje and their potential uses and commercial value in year 2.</p> <p>4.2 Seed collected from est. 10 additional over-exploited species in years 1 and 2, stored at FRIM and distributed to at least ten botanic gardens.</p> <p>4.3 FRIM develop propagation protocols, communities test protocols and publish protocols for all species by end of year 3.</p> <p>4.4 Develop sustainable small enterprises pilot studies for at least 3 other over-exploited plant species with commercial potential.</p>			

Annex 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
<p>Impact:</p> <p>The Mulanje cedar is a sustainably managed commercial product, generating income for local households and the Malawian economy, and no longer threatened in the wild.</p>		<p>Distillation equipment for sustainable essential oil industries is now installed and functional at MMCT offices. Mulanje Cedar hedges have grown and harvested producing over 110ml of essential oils. These developments will act as a platform for further income opportunities from Mulanje Cedar in the future. Restoration trials are also ongoing that can suggest new methods for planting Mulanje Cedar trees more successfully. Within restoration planting carried out by WeForest, in parallel to this project, other species were included in their strategy showing an impact of the project activities on increasing biodiversity impacts of planting efforts on Mount Mulanje. 98 community members (68 women) have continued to gain incomes from the propagation work they have undertaken. Over 60 other community members received incomes from their involvement in planting activities. These activities can contribute to a reduction of threat to Mulanje Cedar trees in the wild in the future.</p>
<p>Outcome Communities living around Mount Mulanje receive short-term benefits from sustainable utilisation of Mulanje Cedar and opportunities are identified for sustainable commercial use of other over-exploited plant species of Mount Mulanje</p>	<p>0.1 Restoration protocols developed for Mulanje Cedar on Mount Mulanje improve survival rates by 30% compared to project 23-026 baseline, resulting in continued demand for seedlings for restoration.</p> <p>0.2 Documented example of the conservation-commerce model for Mulanje Cedar developed by end of year 3.</p> <p>0.3 Optimal extraction techniques identified for Mulanje Cedar essence by end of year 1 and essential oil produced and sold by communities, resulting in benefits for 150 local community members (60% women) and a market for Mulanje Cedar seedlings for essence extraction by end of year 3.</p> <p>0.4 Over-exploited plant species of Mount Mulanje are investigated for potential sustainable use by end of year 3.</p>	<p>0.1</p> <p>New restoration trials were finalised, including incorporating microbial inoculant investigation, and established in January 2022, following COVID-19 impacted delays. Initial data was collected from the new plots and from the plots established in 2019 in March 2022. A second-year data was also collected from the new plots in March 2023. Funding has been secured to collect data in 2024.</p> <p>0.2</p> <p>Essence extraction equipment is installed in new housing at MMCT with training on how to use it delivered in November 2021</p> <p>0.3</p> <p>Hedge harvesting investigations are underway and 110ml of essential oils has been produced. Investigations need to continue beyond the project. Economic benefits from essential oil sales have not been provided in the project, however those involved have received non-economic benefits through training in hedge planting and management, business skills and marketing. Two markets – local soap and international options in South Africa – are also being investigated and developed.</p> <p>0.4</p> <p>The ethnobotany survey has been completed and the report submitted with a recommendation of 13 species for future natural product development. Further project proposals were submitted for the Global Ecosystem Based Adaptation Fund and Darwin Initiative, with a Darwin Initiative project starting in June 2022 looking at miombo woodland opportunities with the establishment resource assessments</p>

Project summary	Measurable Indicators	Progress and Achievements
		using FairWild methodology, community co-operatives and a local social enterprise to support sustainable use options of target plant and fungi.
<p>Output 1. Improved restoration protocols developed for Mulanje Cedar on Mount Mulanje, resulting in continued demand for seedlings for restoration</p>	<p>1.1 Ten nurseries, established and certified in project 23-026, continue to produce a minimum aggregate total of 400,000 Mulanje Cedar seedlings in years 1, 2 and 3 (seedling production figures have not increased compared to project 23-026 due to limited seed availability) for restoration, commercial sales (timber and essence) and community cedar hedge plantations (output 3), benefiting 150 community nursery workers.</p> <p>1.2 FRIM and restoration experts from BGCI's network design and implement planting trials at 8 sites on Mount Mulanje by end of year 1, benefiting 80 additional community members employed to transport and plant seedlings on Mount Mulanje.</p> <p>1.3 Improved planting protocols for Mulanje Cedar developed by FRIM and restoration experts in BGCI's network by end of year 3.</p> <p>1.4 Mulanje Cedar seedling establishment and survival rates increased throughout life of the project (target 30% improvement against baseline by end of project 23-026).</p>	<p>1.1 Nursery propagation and sales figures are in section 3.1 in table 1 and section 4.2 in table 4.</p> <p>1.2 Meeting with ERA experts, MMCT, FRIM and WeForest finalised the new planting design for restoration trials as evidenced in section 3.1 and Annex 6. 5 initial sites were established to monitor sites planted pre 2019 (one was lost to fire) and new plots at 4 new sites were planted in January 2022. Over 500 community members benefited from restoration work carried out by WeForest in the project time, within which the restoration trials were established.</p> <p>1.3 & 1.4 Data have been collected from the plots established in 2019 and plots established in January 2022 with evidence provided in section 3.1 indicators 1.3 and 1.4. This will be used to improve the restoration protocols and understand the difference in survival rates under different circumstances.</p>

Project summary	Measurable Indicators	Progress and Achievements
Activity 1.1 Ten nurseries, established and certified in project 23-026, produce a minimum aggregate total of 400,000 Mulanje Cedar seedlings in years 1-3, benefiting 150 nursery workers.		493,873 seedlings were propagated in 8 nurseries (2 nurseries ceased functioning after the previous project 23-026). The 98 community members of the nurseries have received £34,383 from 2019-2023 for the sale of 254,482 seedlings for restoration, planting in hedges and to private enterprises.
Activity 1.2.a. Design and implement planting trials at 8 sites on Mount Mulanje by end of year 1, benefiting people employed to transport and plant seedlings.		4 online meetings (and numerous one-on-one calls) were held with the ERA group throughout the project to finalise the design for new plot establishment in January 2022. 9 sites in total were established – 5 in areas that were planted before the project (1 was destroyed by fire) and 4 in new sites planted in 2022.
Activity 1.2.b. FRIM and restoration experts from BGCI's network monitor planting trials in years 1, 2 and 3.		New restoration trials were established in January 2022. Data were collected for the third time for the 2019 plots and the first time for the 2022 plots in March 2022
Activity 1.3. FRIM and restoration experts from BGCI's network publish improved restoration protocols for Mulanje Cedar by end of year 3.		Data has been collected to be analysed for this assessment. Further data collection for another year or 2 will improve this (some funding secured).
Activity 1.4. Publish a review of survival rate improvements (target 30% improvement from Darwin project 23-026 baseline) by end of year 3.		Survival rates of plots established in 2019 ranged from 0 to 84% whilst plots set up in 2022 have survival rates from 51% to 65%. This was not published within the project timeframe due to insufficient monitoring time, however, EDGE Fellowship funding is to support data collection in 2024 and this will be used to publish an article on what has been found.
Output 2. Conservation-commerce model developed and documented for Mulanje Cedar	<p>2.1 Expert consultants appointed and project steering committee established by end of year 1, to guide and monitor project progress and development of conservation-commerce model.</p> <p>2.2 Feasibility study commissioned to improve understanding of Mulanje Cedar potential uses and markets, including identification of local and international commercial partners and quantifying potential income from essence manufacture, complete by end of year 1.</p> <p>2.3 Workshop held in year 1 involving the Union for Ethical BioTrade and TRAFFIC to determine Nagoya Protocol implications and requirements regarding access and benefit sharing in preparation for international trade of</p>	<p>2.1</p> <p>Over 10 consultants have been employed in the project with expertise in business and marketing; restoration ecology; distillation of essential oils; essential oils research; resource use assessment; and seed collection. NDAs have always been agreed and signed by these participants evidenced in example NDA text in Annex 8</p> <p>The steering committee met 6 times as evidenced in Annex 5.</p> <p>2.2</p> <p>The feasibility study was published in November 2019. Evidence is provided in section 3.1 and Annexes 9 and 10</p> <p>2.3</p> <p>The Nagoya Protocol workshop was undertaken in January 2020. A workshop report is evidenced in section 3.1 and Annex 11.</p> <p>Some potential international purchasers in South Africa were engaged in 2022/2023.</p> <p>2.4</p>

Project summary	Measurable Indicators	Progress and Achievements
	<p>certified essence product and assess whether wild harvesting might be appropriate in future. Potential international purchasers engaged in years 2 and 3.</p> <p>2.4 Public outreach campaign in years 2 and 3 to grow demand for purchase of Mulanje Cedar seedlings (for timber and essence extraction) and essential oil.</p> <p>2.5 MMCT and FRIM monitor nursery certification scheme and Cedar Growers and Planters Association (CGPA) established in project 23-036, which becomes fully inclusive of planters for essence extraction by end of year 3.</p> <p>2.6 Training delivered in business and marketing skills and Nagoya compliance to Mulanje Cedar essence producers in year 2.</p> <p>2.7 Model conservation-commerce project for Mulanje Cedar documented and published by end of year 3.</p>	<p>The public awareness campaign, including a Knowledge, Attitudes and Perceptions survey, was started in 2022 and completed in 2023, as outlined in section 3.1. This followed the plan outlined in Annex 12.</p> <p>2.5</p> <p>From 2 nurseries being certified in 2019, all 8 nurseries were certified in December 2021, as evidenced in sections 3.1 indicator and Annex 14</p> <p>2.6</p> <p>Business and marketing training was delivered to 200 local community members as evidenced in section 3.1 indicator 2.6 and Annex 16</p> <p>2.7</p> <p>Distillation equipment use training has been delivered at MMCT by an expert from EDE, as evidenced in section 3.1 and 3.4. 185 hedges were established within 255 (156 women) community members land with training delivered on their management. Soap opportunities that incorporate oils for local markets have started to be developed by MMCT (no incomes generated yet) and connections with contacts in South Africa have been made to continue developments beyond the project evidenced in section 3.1 indicators 3.2 and 3.5. Delays to business opportunities have meant that a final conservation-commerce model has not been published, although various documentation of the progress so far has been made, as evidenced in section 3.1 indicator 2.7</p>
Activity 2.1.a. Write contracts for consultants by end of year 1.		Throughout the project more than 10 contracts were made for training activities, essential oils research, market and use assessment
Activity 2.1.b. Establish project steering committee to guide and monitor project progress and development of conservation-commerce model.		Project steering committee was established in July 2019 and met 6 times throughout the project
Activity 2.2. Commission study to improve understanding of Mulanje Cedar potential uses and markets, identify commercial partners and quantify potential income, complete by end of year 1.		Feasibility study was completed in year 1 – see Annex 9
Activity 2.3. Workshop involving UEFT and TRAFFIC, determining Nagoya Protocol implications and ABS requirements for international oil trade, assessing whether wild harvesting might be appropriate in future.		A workshop on the Nagoya protocol was organised in year 1 with a report produced following – see Annex 11

Project summary	Measurable Indicators	Progress and Achievements
Activity 2.4. Run a public outreach campaign in years 2 and 3 to grow demand for purchase of Mulanje Cedar seedlings for timber and essence extraction.		<p>Knowledge, Attitudes and Perceptions (KAP) survey of the general population around Mulanje, four community awareness meetings, five signposts, one radio advertisement, and one TV advertisement were completed - See Annex 13 for KAP report and adverts submitted with report to Darwin Initiative team as mpeg and mp4 files</p> <p>Five demonstrations of the distillation equipment were held with 210 community members from around Mount Mulanje to see the equipment in action.</p>
Activity 2.5. MMCT and FRIM monitor nursery certification scheme and CGPA (established in project 23-036) which becomes fully inclusive of planters for essence extraction by year 3.		All eight nurseries were certified following certification assessments by FRIM in December 2021
Activity 2.6. Provide training in Nagoya compliance to Mulanje Cedar essence producers in year 2.		This was due to be delivered by the Malawian EAD, but this was incomplete
Activity 2.7. Model conservation-commerce project for Mulanje Cedar documented and published by end of year 3.		The business opportunities from essential oils have not been realised in the project timeframe, so this activity was incomplete
<p>Output 3. Manufacture of products from sustainably sourced Mulanje Cedar essence generates income for additional local households in the short-term and results in a larger market for cedar seedlings.</p>	<p>3.1 Optimal sustainable extraction techniques for Mulanje Cedar essence are identified in year 1.</p> <p>3.2 Samples sent to potential national and international purchasers by end of year 1, with continued engagement in years 2 and 3.</p> <p>3.3 150 people (60% women) from ten communities around Mount Mulanje are identified with help from Traditional Authorities, and ten trial cedar hedge plantations are planted at sites around the base of Mount Mulanje for essential oil extraction by end of year 1 and ten community cedar essence extraction enterprises fully equipped at start of year 2.</p> <p>3.4 150 people (60% women) from ten communities around Mount Mulanje are trained in planting and management techniques for cedar hedge plantations by end of year 1, sustainable harvesting</p>	<p>3.1</p> <p>Essential oils research was carried out by a Malawian researcher from Chancellor College at Mzuzu University (see Annex 7). Harvest regime tests to be undertaken at the start of an extended fourth year to understand if cutting hedge trees, a metre above the ground or side branches leads to better survival rates.</p> <p>3.2</p> <p>Samples have not yet been sent to potential purchasers, however Kate Chanthunya at MMCT has produced a soap using Mulanje Cedar essential oils to develop local businesses in collaboration with a local co-operative and has connected with businesses in South Africa to send samples to, following CITES permitting procedures. Engagements will continue beyond the project.</p> <p>3.3</p> <p>Community members for hedge planting were identified with support of Traditional Authorities and local leaders, with voluntary participation necessary. Around 100 of the 185 planted hedges (55%) have been raised successfully by the community members looking after them and were harvested for initial oil production in the distillation equipment installed at MMCT offices. Evidence is in sections 3.1 and 3.2.</p> <p>3.4</p>

Project summary	Measurable Indicators	Progress and Achievements
	<p>techniques, processing, business skills and marketing.</p> <p>3.5 150 people selling essential oil and earning at least USD250/year from sale of Mulanje Cedar essential oil by end of year 3.</p>	<p>255 (156 women) community members have been trained to plant and manage the hedges, as evidenced in section 3.1 indicator 3.3, and have been supported by MMCT to deal with any issues that arise in management along the way.</p> <p>200 community members were trained in (with over 60% women representation) in business skills and marketing as evidenced by section 3.1 indicator 3.4 and Annex 16</p> <p>3.5</p> <p>Incomes have still not been produced from any essential oils development following the delays to delivery, set up and training on the distillation equipment from South Africa. These milestones have now been achieved to continue developments in the extended fourth year of the project.</p>
Activity 3.1. Identify optimal sustainable extraction techniques for Mulanje Cedar essence by end of year 1.		Appropriate hedge harvesting methods and oil production needs of any industry remains to be confirmed. This will be further investigated by MMCT
Activity 3.2.a. Send samples to potential national and international purchasers by end of year 1.		Samples have so far not been sent to potential purchasers. MMCT are looking at transporting some oils to South Africa for further analysis with potential purchasers. This will require CITES permits
Activity 3.2.b. Continue to engage potential purchasers to expand markets in years 2 and 3		Engagement has started in the extended year and will continue beyond the project by MMCT
Activity 3.3.a. Work with Traditional Authorities in year 1 to identify 150 people (60% women) from ten communities around Mount Mulanje to form essence extraction enterprises.		Trainees were identified to be involved in essential oil enterprises in year 1
Activity 3.3.b. Communities plant ten trial cedar hedge plantations using established seedlings at sites around the base of Mount Mulanje by end of year 1.		185 hedges were planted on 255 (156 women) community members' land
Activity 3.3.c. Equip communities with essence extraction equipment at start of year 2.		Distillation equipment sourced from South Africa was delivered in March 2021 with training provided by the supplier in November 2021. Further consumable supplies have also been provisioned in 2022/2023
Activity 3.4.a. Train 150 people (60% women) in planting and management techniques for cedar hedge plantations by end of year 1.		255 (156 women) community members were trained in planting and management techniques for hedges
Activity 3.4.b. Train 150 people (60% women) in sustainable harvesting techniques and processing, business skills and marketing by end of year 2.		In 2020 and 2021, 200 community members were trained in (with over 60% women representation) in business skills and marketing
Activity 3.5.a. Essential oil sold to commercial buyers for product manufacturing in years 2 and 3.		No essential oils have been able to be sold in the project

Project summary	Measurable Indicators	Progress and Achievements
Activity 3.5.b. Carry out socio-economic study in years 1, 2 and 3 to monitor income obtained by essence extraction enterprises.		A baseline socio-economic survey was completed in year 1 as evidenced by Annex 17 and a second survey completed in year 3 as evidenced by Annex 18
<p>Output 4. Conservation measures in place for other over-exploited plant species on Mount Mulanje and conservation-commerce model replicated for five important plant species on Mount Mulanje.</p>	<p>4.1 Survey conducted to identify other plant species of Mount Mulanje and their potential uses and commercial value in year 1.</p> <p>4.2 Seed collected from all over-exploited rare and threatened plant species on Mount Mulanje (estimated 10 additional species) in years 1 and 2, stored at FRIM and distributed to at least ten botanic gardens for ex situ conservation.</p> <p>4.3 Propagation protocols developed by FRIM, tested by community nurseries and published for all collected species by end of year 3.</p> <p>4.4 Pilot studies for at least 3 other over-exploited plant species with commercial potential on Mount Mulanje, diversifying income streams by end of year 3 and helping ensure the conservation of those species. Candidate enterprises include propagation of <i>Kniphofia mulanjeana</i> and <i>Encephalartos gratus</i> (Vulnerable) for sale as ornamental plants (matched funding dependent).</p>	<p>4.1</p> <p>The ethnobotany study has been completed and a report submitted to the project partners. This identifies 12 other native plant species with natural product development potential. The report is evidence in Annex 19. Further research was also undertaken by a Master student, Samantha Hasek, from University of Kent investigating important fuelwood species as evidenced by the report in Annex 27.</p> <p>4.2</p> <p>14 extra species have been collected by FRIM with propagation investigations undertaken, as evidenced in section 3.1 and Annex 20. Seed collection training with 16 community members (8 women) was also delivered by FRIM in January 2022 so that they can target collection and propagation of useful species to them in the future – this is evidenced in the training report in Annex 22</p> <p>4.3</p> <p>The results from propagation trials at FRIM laboratory and nursery are available for use in new propagation protocols for 9 Mount Mulanje native plant species. This is evidenced in Annex 21. Protocols have not been finalised.</p> <p>4.4</p> <p>Resource assessment training was delivered by BIZ from Zimbabwe to 12 staff members from 3 local institutes, as evidenced by section 3.1 figure 4 and Annex 23</p> <p>Proposals were submitted to IUCN Global Ecosystem Based Adaptation and the Darwin Initiative with a new Darwin Initiative funded project starting in June 2022 (29-014)</p>
Activity 4.1. Conduct survey to identify other plant species of Mount Mulanje and their potential uses and commercial value in year 2.		Ethnobotanical study completed and report submitted to the project team
Activity 4.2. Seed collected from est. 10 additional over-exploited species in years 1 and 2, stored at FRIM and distributed to at least ten botanic gardens.		10 species were collected for propagation trials in FRIM laboratories and nursery in Zomba, with germination results produced to improve future propagation efforts for those species. Communities and MMCT staff received training and have been supported to grow other species for use in restoration trials.
Activity 4.3. FRIM develop propagation protocols, communities test protocols and publish protocols for all species by end of year 3.		Protocol investigations were established but results not finalised for protocols.

Project summary	Measurable Indicators	Progress and Achievements
Activity 4.4. Develop sustainable small enterprises pilot studies for at least 3 other over-exploited plant species with commercial potential.		Proposals for new projects submitted and one Darwin Initiative project accepted started in June 2022

Annex 3 Standard Indicators

Table 1 Project Standard Indicators

Indicator number	Darwin Initiative Standard Indicator	Name of Indicator after adjusting wording to align with DI Standard Indicators	Units	Disaggregation	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to BCF-Reports@niras.com putting the project number in the Subject line.	X
Is your report more than 10MB? If so, please discuss with BCF-Reports@niras.com about the best way to deliver the report, putting the project number in the Subject line.	
If you are submitting photos for publicity purposes, do these meet the outlined requirements (see section 10)?	X
Have you included means of verification? You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	X
Do you have hard copies of material you need to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	X
If you are submitting photos for publicity purposes, do these meet the outlined requirements (see section 10)?	X
Have you involved your partners in preparation of the report and named the main contributors	X
Have you completed the Project Expenditure table fully?	X
Do not include claim forms or other communications with this report.	