Department for Environment Food & Rural Affairs

DARWIN INITIATIVE

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Darwin Initiative Main: Final Report

To be completed with reference to the "Project Reporting Information Note": (https://www.darwininitiative.org.uk/resources/information-notes/).

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

Submission Deadline: no later than 3 months after agreed end date.

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Darwin Initiative Project Information

Project reference	DARNV005
Project title	Understanding Ugandan native plant species' role in innovative sustainable landscapes
Country(ies)	Uganda
Lead Organisation	Botanic Gardens Conservation International
Project partner(s)	Tooro Botanical Gardens (TBG), GrassRoots Ltd (GRU), Makerere University, National Agriculture Research Organisation (NARO) - Entebbe Botanical Garden (EBG)
Darwin Initiative grant value	£199,995
Start/end dates of project	1st April 2022 to 31st March 2025
Project Leader name	Alex [redacted]
Project website/blog/social media	https://www.bgci.org/our-work/projects-and-case-studies/agroforestry-with-native-edible-plants-in-uganda/
Report author(s) and date	Alex [redacted] (BGCI), Godwin [redacted] (Makerere University), Rehema [redacted] (GRU), Jim [redacted] (GRU), Harriet [redacted] (TBG), Sebastian [redacted] (TBG), Alislam [redacted] (TBG) and Godfrey [redacted] (TBG)

1 Project Summary

Natural resource degradation in Uganda has increased over the past 30 years, causing biodiversity loss and food security challenges from reduced nutritional diversity and food yields caused by soil erosion and flooding. Agriculture is a driver of this, having expanded from 84,695 km2 (1990) to 105,317 km2 (2015) as the country's largest employment sector, often aiming for high-calorie production rather than nutrient diversity.

Population increases, market pressures, and policies contribute to degradation with land use systems converted to monoculture cash crops. A lack of awareness of the benefits of more diverse food systems to people's health and the environment also contributes to this.

These challenges are well-documented in scientific and development literature and were identified in a previous Darwin Initiative project (25-020), which established nurseries to propagate native species for Forest Landscape Restoration (FLR). This project builds upon this initiative by developing agroforestry practices that incorporate propagated native species, including food sources. The project aims to create the evidence needed to stimulate new markets for native plant products and reduce the risk of investment in them.

In IUCN and government FLR reports (Ministry of Water and Environment, 2016; 2018) agroforestry was a proposed restoration intervention in all the project areas (see figure 1). It is recommended to support the restoration of reserves, to improve agricultural land, like degraded bare hills for soil and water conservation. Exotic species are often recommended in the report though, including some which have invasive potential (e.g. *Senna siamea*) and this project offers native plant alternatives. Cost-benefit analysis in Karamoja and Northern Moist landscape (NOTE: not project areas) also suggest it is a financially viable option for investors.

We have investigated how native food plant species in diverse agroforestry systems have helped address plant conservation challenges in Uganda. A target list of useful species has been tested in agroforestry trials and analysed nutritionally, and new food products have been developed. The goal was to develop novel food products from native species that address nutritional gaps in Ugandan diets, improving their value and marketability. The inclusion of smallholder farmers at every stage of this development has ensured that they are the beneficiaries of developments and innovations. As demand increases, there will be increased farmer uptake of agroforestry compared to less diverse systems increasing national biodiversity and health impacts. The results are then being promoted to rural and urban communities.

The project took place in 5 districts of Uganda – Mpigi, Kagadi, Mbale, Kabarole and Wakiso – See map in figure 1.

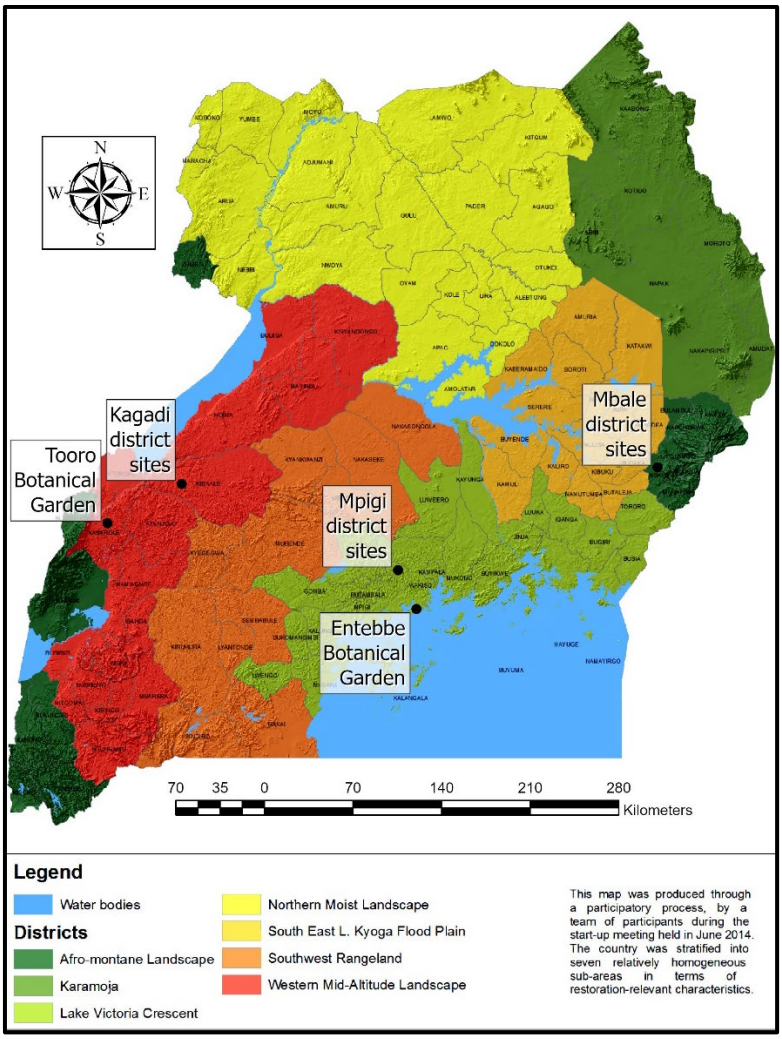

Figure 1: Uganda map and the 5 project sites of activities.

2 Project Partnerships

Steering committee meetings have been run 5 times during the project, with all partners present, following group terms of reference being produced in the first quarter of year 1 (see Annex 5.1 for example minutes and 5.2 for ToRs - indicator 3.1). At the meetings, partners presented

progress, discussed challenges, and made adaptation plans for the project. Outside of these, partners communicated and collaborated regularly using email and a project WhatsApp group.

Partners had clear lead roles withing the project: BGCI co-ordinated and supported administratively, leading the use of co-creation methods for education and awareness raising activities; TBG co-ordinated activities in Uganda, and led on community workshops, seed collection and agroforestry trial establishment and awareness raising (see section 3.1 Outputs 1,3 and 4); Makerere University led the collection of raw materials with community groups, nutrition analysis and development of new products (see section 3.1 Output 2); GRU investigated markets for opportunities for products from native plants (see section 3.1 Output 1); EBG supported agroforestry trials and engagement and awareness raising events at the gardens in Entebbe.

The partners also collaborated on some activities, for example, GRU and EBG staff took part in the early project community workshops (See Annex 5.3) and Makerere University took part in the open days in the final year, presenting the products that have been developed in the project (See Annex 5.4 and section 3.1 Output 4). TBG also supported EBG with the provision of plants needed for the agroforestry plots; and BGCI, TBG and GRU collaborated to develop target species information leaflets that were used to engage different stakeholders in markets to discuss their uses (see examples in Annex 5.5).

When various key project activities were completed (community workshops, comprehensive market surveys and analyses, raw materials nutritional analysis) by quarter 2 of year 2, BGCI brought partners together in a workshop to select species for product development (see section 3.1 Output 2), which led to the successful creation of 7 products by Makerere University.

TBG, Makerere University and EBG, jointly organised and implemented co-creation and training workshops and open days across the project. This collaborative effort significantly enhanced the overall effectiveness of the initiative, resulting in the successful engagement of a diverse range of stakeholders. These came from various sectors and backgrounds, and actively participated in and appreciated the project initiatives. These fostered a sense of community ownership and support for the project's goals.

The Ugandan National Forestry Resources Research Institute (NaFFORI), not a formal partner, also supported the project by advising on the agroforestry trial planting designs and monitoring standards. This followed their participation in steering committee meetings. Farmers were also engaged in the first year for the establishment of the trials on plots of their land signing Memorandum of Understanding (MOU) agreements with TBG (See section 3.1 Output 3 and Annex 5.6)

3 Project Achievements

Output 1: Current use and markets of 34 target indigenous food species understood

Five consultation workshops were organised and conducted in the project areas of Kagadi, Mbale, Lwamunda, Entebbe, and Fort Portal. These workshops gathered traditional knowledge about the 34 target plant species and involved farmers, producers and marketers in discussions about barriers to year-round access to nutrient-dense food (indicator 1.1 achieved). Three hundred people participated - 170 males and 130 females – including farmers, sub-county and district leaders, youth, school representatives, religious leaders, cultural institutions, political and business representatives. A wide range of information was collected on the target species (see annexes 5.3 and 5.7).

Throughout the project, GRU provided market analysis looking at plants sold in 35 urban and rural markets across the 5 project areas, from May 2022 to April 2024 (see annex 5.8 – indicator 1.3 achieved). The GRU team looked at produce in green markets and the herbal sector and in both some sellers and consumers knew the species, but it was often noted that they are being lost, not planted or being replaced by exotic species. Health and environmental benefits were noted by some interviewed, and the retention of cultural identity was considered important.

Among the green markets surveyed, some markets have better supplies for native plant produce, such as Nakasero market – in the Central Business District. There were also differences in

knowledge per region, age (40+ generally more aware) and gender (women being knowledgeable more often than men). They also noted that sellers often specialise to sell one thing, rather than a diversity of products from different species.

In the herbal sector, GRU noted interest in medicinal properties in native plants and it was felt there is more effort needed for capsules and other products. The markets are also currently supplied heavily by capsules from India and China - an opportunity for local supply as an alternative. GRU feel that to engage younger farmers and entrepreneurs, earning good incomes and having good seedling supplies would be important for successful market developments.

This work contributed to the selection of 13 species for further development of food products, as explained in the Output 2 section below (indicator 1.2 achieved).

Output 2: Nutritional profiles of 34 target native food species known showing levels of important micro- and macronutrients with at least 6 new food products produced from the 12 species selected as most beneficial

Thirty-one collectors were trained (19 women) by Makerere University to collect raw materials of the target species and deliver them to Makerere University for nutritional analysis (indicator 2.1 partially achieved). Cool boxes were purchased to transport raw food materials to keep them fresh for analysis.

In total seventeen of the thirty-four target species were collected with voucher specimens taken for identification purposes and nutrition analysis completed (see Annex 5.9 and 5.10 - indicator 2.2 partially achieved). It was not possible to collect and analyse materials from all species (for the reasons given in section 6). Collections continued throughout the project with Makerere University dealing with any issues that arose through regular communications with the collectors.

For the remaining species, a literature review was carried out by Godwin Anywar and Alex Hudson to compile published nutritional information (see Annex 5.11 - indicator 2.3 achieved), focusing on 4 nutrients that the management team decided are important in the Uganda context for good health and addressing health deficiencies:

1. Vitamin A: supports immune function, vision, growth and normal function of various organs, with Vitamin A deficiency at 8.3-9% in Uganda.
2. Iron: important for oxygen transport in blood systems, muscle metabolism and growth and development, with iron deficiency hitting 50% of pregnant women and 30% of maternal deaths linked to anaemia.
3. Calcium: important for bone and teeth health, with low availability in Ugandan food supply and consumption, and inadequate calcium intake for both children and women of reproductive age common.
4. Selenium: critical to thyroid hormone metabolism, DNA synthesis, reproduction, and protection from oxidative damage and infection; research shows it provides positive health benefits for HIV patients.

Despite these efforts, there was no nutrition information for 6 species (*Beilschmiediea ugandensis, Citropsis articulata, Morus mesozygia, Raphia farinifera, Vepris nobilis* and *Warburgia ugandensis*).

From the initial list of 34 native and known useful plant species, 13 species were selected at a selection scoring workshop in August 2023. Scoring was based on nutritional values, market assessment, perceptions and knowledge at rural community workshops, biological factors (e.g., speed of growth, time to harvestable produce) and horticultural factors (e.g., seed availability, propagation knowledge) (see scoring in Annex 5.12).

The highest scoring selected species were (indicators 1.2 and 2.4 achieved):

1. *Amaranthus thunbergii* - herb
2. *Annona senegalensis* - fruit (December to May)
3. *Cleome gynandra* - herb
4. *Corchorus olitorius* - herb

5. *Harungana madagascariensis* - fruit (unsure which months)
6. *Monodora myristica* – fruit (June to March)
7. *Phoenix reclinata* - fruit (February to July)
8. *Pseudospondias microcarpa* - fruit (May to September and December to March)
9. *Saba comorensis* - liana / fruit (September to December)
10. *Solanum nigrum* - herb
11. *Tamarindus indica* - fruit (January to March; July and August)
12. *Vangueria apiculata* - fruit (September to November)
13. *Vigna unguiculata* - fruit (unsure which months)

Following the selection, 7 new food products were developed by Makerere University, as outlined in table 1 (indicator 2.5 achieved) and their nutritional profiles with important nutrients, were compared to some other well-known fruits with international markets, as outlined in table 2 (indicator 2.6 achieved).

Table 1: New products developed by Makerere University from native economically useful plants

Species	**Product**	**Raw material input (kg)***	**Amount produced (Kg)**
Tamarindus indica	Ready to drink fruit juice	1kg (dry weight)	5 L of Juice
Phoenix reclinata	Ready to drink fruit juice	1 kg (fresh weight)	1 L of juice
Annona senegalensis	Ready to drink fruit juice	1 kg (fresh weight)	2 L of Juice
Solanum nigrum	Leaf powder	1 kg (fresh weight)	Approx. 100g of powder
Cleome gynandra	Leaf powder	1 kg (fresh weight)	Approx. 100g of powder
Amaranthus thunbergia	Leaf powder	1 kg (fresh weight)	Approx. 100g of powder
Corchorus olitorius	Leaf powder	1 kg (fresh weight)	Approx. 100g of powder

Table 2: Nutritional profiles of new products and some well-known fruits

Plant Name	**Vitamin A** (RAE* µg/100g)	**Iron** (mg/100g)	**Calcium** (mg/100g)	**Selenium** (µg/L)
Tamarindus indica Ready to drink fruit juice	120+0.02	0.2+0.9	34 - 94	1.30
Phoenix reclinanta Ready to drink fruit juice	2740.+0.06	7.60	4306.35	3.05
Annona senegalensis Ready to drink fruit juice	140+0.06	6.71	9887.1	3.48
Solanum nigrum leaf powder	2674	5.9	847	-
Cleome gynandra leaf powder	2603	2.6	189	1.000±0.66
Amaranthus thunbergia leaf powder	452	7.2	368	-

Corchorus olitorius leaf powder	434	6.3	207	-
Nutritional Profiles of some well-known plant species consumed in the study areas				
Banana (USDAb, 2019)	8	<0.4	5	<2.5
Papaya (Ali et al, 2011)	208.67–4,534.26 µg/g (β – carotene)	0.61–0.85	27.88–32.48	1.2 – 1.5 µg/100g
Guava (USDAa, 2019	374	0.26	18	0.62

*RAE/day = Retinol Activity Equivalents

Output 3 - Five agroforestry plots, with at least 6 of the target native food plant species, established to investigate the benefits to people and nature compared to less diverse alternatives, with baseline data collected

At steering committee meetings in year 1 (see section 2 and Annex 5.1 – indicator 3.1 achieved) it was decided to change the project to include an agroforestry plot in Entebbe Botanical Gardens to reach a wider urban community during the project and beyond its lifetime; a change request was submitted in December 2022 which was accepted.

Agroforestry trial planning meetings were held with smallholder farmers committees in each project area from 5th to 8th September 2023 attended by 27 farmers (10 women) (see Annex 5.13). These groups helped to make decisions about the designs of the trials to fit their local areas. TBG undertook a benchmarking and assessment process on degraded farmlands suggested for the trials to select the final plot sites. To ensure the project's agroforestry trial's establishment and continuation both during and after the project, MOUs were signed by TBG and the property owners (see example in Annex 5.6).

Five agroforestry designs were confirmed, tailored to the selected sites, with scientific input from the National Agricultural Research Organization (NARO) and the National Forestry Research Institute (NaFFORI) (indicator 3.2 achieved). These designs considered the provenance of the 34 target food species and the agroecological zones to which they would be most suited:

- Western mid-altitude landscapes for the Fort Portal and Kagadi agroforestry designs.
- Lake Victoria crescent for the Mpigi-Lwamunda and Entebbe EBG designs.
- Afromontane landscapes for the Mbale design.

Each design was intended for 1 hectare of land and integrated food crops that would not interfere with the growth demands of the tree species. Approximately 13-14 fruit tree species were targeted for each plot. A Randomised Complete Block Design was used for planting, with 3 tree individuals of each species in each plot. The agroforestry trials were divided into strata or uniform blocks, with seedlings randomly distributed within these blocks (see Annex 5.14 for designs).

A total of 183 tree seedlings, representing 23 different species, were planted across the five 1 ha plots (indicator 3.4 achieved). These were demarcated and mapped (See Annex 5.15). Six herbaceous target species (e.g. *Amaranthus thunbergii*, *Cleome gynandra*, *Corchorus olitorius*, *Vigna unguiculata*, *Aframomum angustifolium*, and *Solanum nigrum*) were integrated as crops between the trees, as well as standard cash crops, to provide short-term benefits to the farmers managing the sites (e.g., *Vigna radiata*, *Phaseolus vulgaris*, *Zea mays* and *Arachis hypogaea*).

Twenty-six smallholders (8 women) from the 5 project areas, and 4 botanic garden staff (2 women) were trained in the management of agroforestry plots (see Annex 5.16 - indicator 3.3 achieved). This covered practical skills for agroforestry plot establishment and management - including soil preparation, species selection, planting techniques, and sustainable management practices. Participants learned about the importance of biodiversity conservation and the role of agroforestry in environmental sustainability.

A monitoring framework to track the growth and survival of native tree species, as well as the productivity of intercropped crops, and operational plans defining management activities were created (see Annex 5.20 and 5.21). These plans extend beyond the project duration.

The production of crops was monitored, and the impact of their proximity to the newly planted trees assessed to understand the long-term effects of the trees on crop yields throughout the project period. Baseline data on productivity of 4 agroforestry plots (0.9 hectares in Kagadi, the rest 1 hectare) was collected across 2 growing seasons following the plot establishment (see table 3 and Annex 5.22 - indicator 3.5 mostly achieved). The harvested records are not a record of the complete productivity, since managers also took some harvest for home use, providing some non-monetary benefits to their households, which were not recorded.

Table 3: Total harvests and incomes seen in agroforestry and standard farms across 2 growing and harvesting seasons of the project

Site	Crop	Agroforestry harvest (kg)	Standard farm harvest (kg)	Agroforestry income (UGX)	Standard income (UGX)
Fort Portal	Maize	248	220	198,400	176,000
	Beans	160	125	560,000	437,500
	Potatoes	18	26	360,000	520,000
Mpigi district	Maize	142	145	113,600	116,000
	Beans	128	140	448,000	490,000
	Potatoes	33	32	480,000	640,000
Kagadi district	Maize	220	165	176,000	132,000
	Beans	145	126	507,500	441,000
	Groundnuts	135	195	675,000	815,000
Mbale district	Maize	200	122	160,000	97,600
	Beans	150	135	325,000	472,500
	Soya	155	155	620,000	620,000
Totals:		**1,734**	**1,586**		

In the 5 established plots, between 13-15 tree and shrub species were planted with 3 individuals each that are being managed and monitored with records of height and DBH as well as biodiversity information (see Annex 5.23 - indicator 3.6 partially achieved). From the trees and shrubs perspective, all plots were degraded with none present before the project, then following planting and allowing natural regeneration to occur, the diversity of all increased – using Simpsons Diversity Index scores, Mbale had the lowest score at the project end and Fort Portal the highest. In the project, dung beetles are being measured as a proxy for below ground diversity – all sites varied in data on species richness and abundance, but all were similar in increases from the initial baseline data of both metrics from pre-planting to the project conclusion (except for Mbale that increased diversity but had a slight decrease in number of individuals seen. Baseline bird diversity data was also collected for future monitoring with a total of 34 species being seen across all 5 agroforestry trial plots.

Output 4 - 200 farmers and 400 urban community members help design promotion options to reach wider audiences about the benefits of native food species and agroforestry via radio shows and botanic gardens

During the project, 435 farmers (171 women) from rural areas have been reached through community meetings, open days and agroforestry activities; whilst 314 urban community members (175 women) were reached through co-creation activities and open days (see table 4 and Annex 5.4 – indicator 4.2 achieved).

Table 4: Project activities and events that engaged rural and urban populations, with the times these occurred and the number of people and women.

Event	**Date**	**Number of people**	**Number of women**	**Audience**
Consultation workshops	Jul-Aug 2022 and Feb 2023	300	130	Rural
World cafe (TBG)	31st Aug 2023	30	12	Urban
Co-creation (TBG)*	1st Sept 2023	11	6	Urban
World cafe (EBG)	28th Sept 2023	30	11	Urban
Co-creation (EBG)*	3rd Oct 2023	9	3	Urban
Open day (TBG)	24th Feb 2024	250	150	Urban
Open day (Kagadi)	15th Jan 2024	34	7	Rural
Open day (Lwamunda)	17th Jan 2024	34	7	Rural
Agroforestry training participant farmers	Feb 2024	26	8	Rural
Agroforestry training participant garden staff	Feb 2024	4	2	Urban
Seed collectors	Supported throughout	10	0	Rural
Fruit collectors	Supported throughout	31	19	Rural
Online videos		157	Unsure	Online – see section 3.2
Total		**749 (+157)**	**346**	

*a subset of attendees of world cafes and so numbers not included in the total

The Interpretation and Co-creation training conducted from February 24th to 1st of March 2023, aimed to enhance the knowledge and skills of staff members from TBG and EBG in interpretation techniques (e.g., interpretation panels and leaflets), and participatory approaches to co-creation (indicator 4.1 achieved). This was led by Ane Zabaleta, BGCI, who trained 12 staff (2 women) from both institutes (see Annex 5.17 for BGCI project awareness and education activities report). Co-creation served as a platform for community involvement in decision-making, aimed at raising awareness regarding the significance of agroforestry practices and the utilization of native food plant species in this project.

Co-creation workshops with communities were undertaken by TBG and EBG from 31st of August to 3rd October 2023 in a two-step process (See Table 4). Firstly, a larger group (30 people) attended preliminary workshops to discuss visitor preferences, potential additions to the garden to increase project public awareness and the garden's conservation goals, and strategies to

increase community outreach. Smaller groups then met (under 10) to identify the key outputs needed from the project. The following targets were defined:

1. Install interpretation panels around TBG and EBG.
2. Video clip: promotion of agroforestry practices and the use of native food and plant species. Staff from TBG to explain the importance of agroforestry and show footage of the agroforestry site.
3. Exhibitions.
4. Start a tour company in the garden to highlight different locations and increase the awareness of the visitors in matters related to conservation.

At TBG, the apiary, agroforestry area, and nursery were prioritized as key locations for interpretation, highlighting their significance for TBG's conservation efforts (see figure 2 – indicator 4.4 achieved):

Figure 2: Interpretation panels at TBG: agroforestry (*left*), apiary (*middle*) and nursery (*right*)

At EBG, it was also decided to install a panel for the agroforestry site as well as an entrance panel and 1 with nature games for families and children (see figure 3 – indicator 4.4 achieved):

Figure 3: Interpretation panels at TBG: welcome sign (*left*), agroforestry (*middle*) and children's games (*right*)

Twenty radio programmes were aired on 4 Ugandan radio channels (see table 5 – indicator 4.3 mostly achieved). These were aired from April 2023 to March 2024. Two shorter radio jingles were also aired 4 times a day from October 2023 to March 2024 advertising the open days and the agroforestry component of the project, which have also been converted to videos to be shared via WhatsApp by the TBG team (see section 9)

Table 5: Radio channels used to promote the project message with the 20 radio programmes and 2 jingles created in the project

Radio station	Frequency	Approximate listenership	Coverage (e.g. district / national etc.)
KRC FM-radio	102MHz	600,000	Western region of Uganda
VOT FM- radio	101MHz	900,000	Western region of Uganda
Kagadi -broadcasting services FM- Radio	91.7MHz	998,000	Kagadi district
Pacis FM - radio	90.9MHz	300,000	Eastern and Norther regions of Uganda

3.1 Outcome

New innovative development opportunities using native food plant species are available with the baseline biodiversity information of their use in agroforestry systems collected ready for future impact monitoring

From this project, new innovative development opportunities using native food plant species have been created, based on data from farmers, markets and nutritional analysis (see section 3.1 Outputs 1-2). Agroforestry trial plots have also been established in 5 parts of the country, planting native plants that are suited to the local agro-ecological zones with monitoring protocols and baseline data created to be able to monitor the long-term impacts on productivity (of cash crops, and native plant species) and biological diversity (see section 3.1 Output 3).

Indicator 0.1 - By July 2023, the current use and markets for 34 native food plant species is understood following engagement with 100 smallholder farmers and 10 local markets in 5 districts with a top 12 for each of the 5 project districts identified - achieved: GRU staff visited 35 markets in the 5 project districts, whilst TBG ran 5 consultation community meetings to understand use and markets of the 34 target species, involving 300 people (see section 3.1 output 1 and Annex 5.8). Initial market visits helped to identify markets and stalls that sold target species to gather more at repeat visits, whilst also establishing relations with a selection of 11 mature female sellers. The market assessments and community workshops helped to decide the top 13 species (see list in section 3.1 Output 2) in August 2023, that were then targeted for product development.

Indicator 0.2 - 6 new food products created from native food plant species that provide valuable nutrition content and have value chain development potential by February 2024 - achieved: In total 7 products were developed – 3 fruit juices and 4 dried powdered products (see figure 4 and section 3.1 Output 2). For 100g equivalent of each: 3 have over the recommended daily intake for calcium (700mg); 3 are over the recommended daily intake of Vitamin A (700µg for men and 600µg for women); 2 are high in Iron and just short of recommended daily intake for men and women over 50 (8.7mg, although it is 14.8mg for women aged 19-49). None of the products had high selenium content, with the recommended daily intake being 75µg for men and 65µg for women (recommended intake from www.nhs.co.uk). A scientific publication is in draft to be published that will explain the local knowledge data collection, species selection and nutritional analysis results (see section 8 and Annex 5.18).

Figure 4: Fruit juices and dried powders being displayed at project open days in Kagadi and Mpigi districts

Indicator 0.3 – Baseline biodiversity indicators are established for agroforestry plot managers using 5 1ha agroforestry plots, 5 1ha farmland plots and 5 1ha degraded unmanaged plots by March 2024 - achieved: initial data on crop productivity in the first 2 growing seasons has been collected from agroforestry trial plots and nearby farms using standard local farming practices (see table 3 in section 3.2 Output 3). This suggests similar figures between the plots (some crops with greater productivity in agroforestry, some less so). Considering the small size of these trials and other impacting factors this suggests larger trials with more replicates of plots could demonstrate the lack of negative impacts of agroforestry systems.

A monitoring framework was created (see Annex 5.20) with baseline biodiversity indicators established and initial data recorded for plants, dung beetles (as a proxy for soil diversity) and birds (see section 3.1 Output 2 and Annex 5.23). The sites and indicators will need to be monitored to better understand the long-term impacts from agroforestry.

Indicator 0.4 - Nutrition and biodiversity benefits of producing and consuming native plant food species in diverse land use systems promoted to over 200 smallholder farmers and 400 - achieved: The biodiversity and nutrition benefits of native plants in agroforestry has been promoted to 435 rural farmers (171 women) and 314 urban community members (175 women) in the project at 13 events (see table 4 in section 3.1 Output 4 and Annex 5.17). Promotion materials were also created that will reach audiences beyond the project, namely through installed interpretation panels at TBG and EBG and 4,000 leaflets (1,000 in Runyoroo toro language – see figure 5 in section 8). The TBG team also created online informative videos associated with the interpretational panels, accessible through QR codes:

- https://www.youtube.com/watch?v=CpQTHEGHDU0
- https://www.youtube.com/watch?v=KfqxF1PZuzA
- https://www.youtube.com/watch?v=i8jMPdm3Hec

3.2 Monitoring of assumptions

Risks and assumptions were monitored in steering committee and management meetings during the project. One major assumption was that "The collectors are able to collect sufficient raw materials from the known sites in a year to be used by Makerere University for analysis" (see section 3.1 Output 2). The collection and nutrition analysis work continued throughout the project, and a literature review was carried out to compile available data for those that proved difficult to collect data for analysis. However, 6 species were not able to be properly assessed because there was a lack of materials from the field and nothing found in the literature.

The only other major assumption challenge was that "The partner organisations are able to deal with any issues community members have within their roles and support them to overcome them". Initially, access to farmer's land to establish the agroforestry trials was not forthcoming and required TBG to undertake more engagement activities to identify willing farmers and to get the agreements secured for this activity and continuation beyond the project, but they were able to negotiate this confidently (see section 3.1 output 3 and Annex 5.6).

Despite these 2 challenges, the goals of the project were still largely achieved, and in particular some opportunities for future developments have been produced that can be up-scaled beyond this project, so the pathway to change holds true.

3.3 Impact

Forest Landscape Restoration in Uganda includes a substantial amount of Agroforestry on degraded land using native food plant species to improve significantly rural and urban populations' health outcomes and local biodiversity.

To increase the use of agroforestry in Uganda, with native food plants, the project has established 5 agroforestry trial plots around Uganda, with target species that are relevant to the local agroecological conditions. Data has been collected to start to show the productivity of these systems against standard farming as well as the biodiversity differences. These have provided initial benefits from the crops grown to the 26 farmers (8 women), whose land was used in the trials. They received the initial short-term benefits from the herbaceous target species and cash crops (see section 3.1 Output 3) and will receive longer term benefits when the trees and shrubs reach maturity. These farmers are also local champions in their communities that can now spread this knowledge to other farmers in the local area.

Through the engagement with NaFFORI for support in the trial designs (see section 2) results are reaching government institutes and so have the potential to influence agroforestry policies in Uganda to incorporate native plant species. These initial results can be built on further after the project concludes, with continued data collection and data sharing with NaFFORI and other government institutes, including the sharing of nutritional research results.

Including the agroforestry farmers, the project reached at least 749 rural and urban community members (346 women - see section 3.1 Output 4) with the project messages promoting the benefits of agroforestry to people and nature, and the nutrition benefits of native species. A wider community was also reached through radio (over 2.5 million channel listenership – see table 5) and online videos (157 views by June 2024) and through the interpretation panels at the botanic gardens (ca. 39,000 visitors per year). The open days have showed great promise to promote messages and native plant products at botanic gardens and in the community, increasing knowledge and accessibility from rural to urban communities.

Further expansion of the awareness campaign and agroforestry trials to build evidence of productivity and biodiversity benefits, will continue this progress. Up scaling will reach more urban and rural community members, increasing demand to provide monetary benefits to rural populations and improved nutritional benefits to both groups. Further targeting of policy makers and conservation and development NGOs will also ensure they have the evidence to switch their strategies away using exotic species in land management.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Project support to the Conventions, Treaties or Agreements

Through new value chain investigations, this project contributes to Objective 4 of Uganda's National Biodiversity Strategy and Action Plan 2 (2015-2025) "To promote the sustainable use and equitable sharing of costs and benefits of biodiversity" - target 17 "appropriate incentives for biodiversity conservation and sustainable use are in place and applied". The proof of concept of native plant products can be expanded to provide financial incentives from urban markets to support rural communities to manage their farms more sustainably with better biodiversity outcomes. This can help Uganda to achieve the Kunming-Montreal Global Biodiversity Framework (GBF) Target 19 "Mobilize $200 Billion per Year for Biodiversity From all Sources, including $30 Billion Through International Finance" through the mobilisation of benefit sharing finances, and innovative finance schemes that could support markets in the future they develop.

IF this evidences is used to expand agroforestry with support of markets for native plants THEN Uganda will also start to achieve GBF targets 2 (Restore 30% of all Degraded Ecosystems), 10 (Enhance Biodiversity and Sustainability in Agriculture, Aquaculture, Fisheries, and Forestry),11 (Restore, Maintain and Enhance Nature's Contributions to People) and 13 (Increase the Sharing of Benefits From Genetic Resources, Digital Sequence Information and Traditional Knowledge).

4.2 Project support for multidimensional poverty reduction

The project beneficiaries included farmers from Mpigi, Kagadi and Mbale districts (435 with 171 women) and urban community members in Fort Portal and Entebbe (314 with 175 women) – see section 3.1 Output 4. A main benefit was increasing their involvement in project decisions; from knowledge gathering at workshops and market research to decide which species to target for development, to the co-creation of communications materials.

Educational benefits were also provided at open days (3 in total with 323 attendees, 191 women – see Annex 5.4), by information materials at 2 botanic gardens (interpretation panels and leaflets), and via a radio campaign (See section 3.1 Output 4). These will continue to increase awareness impacts of agroforestry, native plants and their benefits to health and the environment, beyond the project.

For a subset of 26 farmers (8 women), the project also provided agroforestry practices and land management training. These farmers then managed the trial plots in the project and were the direct beneficiaries of the crop produce growing between the planted tree and shrubs (see section 3.1 Output 3). They harvested roughly 1,734Kg of fruits and vegetables in the project for home

consumption or sale, which is comparable to the 1,585Kg produced in comparison farm plots, despite the potential competition with the planted trees and shrubs. These trials were small without replication in each area or the timeframe to robustly understand the interaction implications, but it offers a positive starting point and reason to implement bigger trials.

A notable achievement in the project was the development of 7 native plant products, as a proof of concept. These can provide health benefits indirectly to Ugandan urban and rural communities by supporting access to them in the future - it creates an incentive for smallholder farmers to diversify their crops and their own nutrition consumption whilst also improving the accessibility of diverse nutritional foods to urban consumers.

With more farmers switching to agroforestry, regulating and supporting ecosystem services will improve through reduced soil-water evaporation, stabilisation of soils and reduced depletion, with increased biodiversity across the landscape. Careful species selection of those that grow well together, support each other and provide multipurpose benefits (e.g., incorporating nitrogen fixers, like *Vigna unguiculata*) can help to reduce any negative impacts on provision services. Combining this will provide the Ugandan economy with improved potential for resilience, particularly under future climate impacted scenarios, and reduce reliance on food imports.

4.3 Gender Equality and Social Inclusion (GESI)

Please quantify the proportion of women on the Project Board[1].	38%
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].	40%

GESI Scale	Description	Put X where you think your project is on the scale
Not yet sensitive	The GESI context may have been considered but the project isn't quite meeting the requirements of a 'sensitive' approach	
Sensitive	The GESI context has been considered and project activities take this into account in their design and implementation. The project addresses basic needs and vulnerabilities of women and marginalised groups and the project will not contribute to or create further inequalities.	
Empowering	The project has all the characteristics of a 'sensitive' approach whilst also increasing equal access to assets, resources and capabilities for women and marginalised groups	X

[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.

[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.

Transformative	The project has all the characteristics of an 'empowering' approach whilst also addressing unequal power relationships and seeking institutional and societal change	

GESI was considered for the project design, with activities aiming for at least 50% female participation. Although 50% female participation wasn't achieved due to patriarchal social norms in Uganda, for all activities the partners ensured that there was good participation of women giving their opinions to feed into project decisions as well as benefiting from the project outputs.

The project has not sought to address unequal power relationships or directly sought institutional and societal change, but this would be important for considerations of any further developments of native plant value chains and promotion of agroforestry systems. Targeting and supporting women and marginalised groups will be important to stopping benefits being usurped by elite actors in Uganda, which is still largely male dominated.

During the project, it has become apparent that Ugandan youth have few job opportunities, despite making up a large segment of society (75.7% are under 30 in 2014 – UBOS, 2016; and median age is 16.3 versus UK 40.1 in 2023 - Worldometers.info, 2024) and are less aware of native plants and their benefits than older generations (see section 3.1 Output 1). As well as women, they will be an ideal, marginalised group to target to increase their knowledge and skills to be able to benefit from new value chains and agroforestry.

4.4 Transfer of knowledge

Results and information from the project has been shared, including the results of the project nutritional analysis, via open days, a radio campaign and leaflets (See section 3.1 Output 4). Inclusion of government officials from the NARO and NaFFORI, in the steering committee and meetings with TBG have ensured that the progress has been disseminated to policy makers. The next step for partners will be to increase engagement with policy makers and engage the wider CSO and NGO communities in Uganda that work on development and environmental conservation, including botanical institutes that are BGCI members (e.g., like Tukuuma, Save a seed for the future, Lukango Tree Conservancy and Nature Palace Botanical Gardens).

4.5 Capacity building

Capacity was built at 2 botanic gardens to use co-creation methods to engage different audiences to participatorily develop outputs (in this case awareness raising materials). Due to this project, as well as other projects jointly run by BGCI and TBG, staff from TBG have been more involved in restoration work in Uganda in a WWF project and as a restoration expert for the Uganda Ministry of Water and Environment and the World Conservation Society. TBG has gained notoriety in Uganda as a good plant science practitioner and leader.

At the rural community level, 31 people (19 women) were trained and supported by Makerere University to collect raw plant material for nutritional analysis, whilst 10 seed collectors (0 women) were supported and 26 smallholders (8 women) provided training in agroforestry land management by TBG.

5 Monitoring and evaluation

For general M&E a steering committee was established to guide the project. Terms of Reference for this group were agreed and it met 5 times in the project (see section 2). One in-person meeting in Uganda had to be postponed due to the Ebola outbreak from October 2022 to January 2023 (see section 13). In meetings, the team presented progress and challenges and discussed the risk register to make sure activities were on track. This enabled the team to identify challenges and address them.

The steering committee helped to confirm logframe changes in the project. The first, was done in December 2022, when it was decided that the agroforestry plots should be established at EBG as well as TBG to increase the impact with urban communities, due to the garden's proximity to the capital Kampala (see Annex 5.1).

Further logframe changes were requested in December 2023, following a request by the reviewer in the Year 1 Annual Report to revisit/reformulate project indicators. This was done, with some timelines adjusted according to the project progress. Some logframe errors were also corrected – for Output 2 testing and the adjusting the number of new food products to 6 from 12, in indicators 0.2 and 2.6, to keep coherence with the indicators 2.4 and 2.5. Finally, the indicator for leaflets was changed to do 3,000 in English and 1,000 in a single Uganda language, Luganda (see Annex 5.19).

TBG made sure that all actions were carried out according to the plan in its capacity as the lead in-country partner.

Within the project, analysis of 3 project activities – community meetings, market assessments and nutritional analysis – was instrumental to guide the decision on which of the 34 target species to focus on for product development. The management team came together to score the species based on important factors as part of an internal evaluation process in the project (see section 3.1 Output 2). No external evaluation was done in the 2 years.

6 Lessons learnt

General:

A bottom-up approach has worked well - engaging the beneficiaries in all the project activities to create a sense of ownership for the project. From the preliminary research (see section 3.1 Output 1) to co-creation of awareness messages (see section 3.1 Output 4), collaborative decisions were made on species and messaging selections, increasing the decisions' impact.

Bureaucratic delays were noted with government and research partners that need to be included in project designs – in this project this caused delays of release of funds and in procurement. Makerere University lead, Dr Godwin Anywar, was able to use social networks and good will to carry out work before funds were officially released to alleviate this issue.

The importance of agreements and contracts was highlighted in the project, whether MoUs with communities (see section 3.1 Output 3) or with student trainees, local service providers, or plant collectors to ensure they upheld the work assigned to them.

Collection of raw materials:

Insufficient quantities of some of the 34 target plant species was a challenge for a two-year project to carry out meaningful or complete nutritional analysis. Either analysis was not able to be done or recollection was needed to get enough to carry out all the tests. Various factors contributed to this:

1. Changed seasonal fruiting or ripening of some species.
2. Poor collection practices by collectors.
3. The rarity of some species and their range restrictions (e.g.*Citropsis articulata*).
4. Animal competition, such as with primates.

Initially unripe fruits of some species were collected, which were unsuitable for nutritional analysis. Continuous support was provided to community collectors to improve the timing of fruit collections and cool boxes were procured to reduce perishing in transport. Having these systems in place for post-harvest handling from the start would be recommended for similar projects.

Nutrition analysis and product development:

Analysis was made difficult by an overall increase in the cost of consumables and the breakdown of equipment that is difficult to fix in Uganda. Alternate options should be identified at the beginning of the project as well as possible experienced technicians should other equipment not

be available. This project was lucky in that we could use equipment in other labs at Makerere University to conduct the analysis. The reliance on students for analysis work caused difficulties since they did not continue studies for the full project duration, moving on to other modules in their studies. This increased the time needed for training new students, something which could have been reduced by having specific positions supported by project funds (e.g., project researcher or administrator).

When developing new products, stability was an initial challenge during the formulation stage, requiring iterative formulation testing to get good results for the juices. However, this led to the 7 potentially commercial products, and useful learning on processing that can be applied to other plants in the future.

Agroforestry

For the plots, during community workshops, concerns about the security of the agroforestry demonstration sites were raised, particularly regarding livestock grazing. In response site protection fencing was installed by altering budgets, but this is something that should be included in other similar projects from the planning stage. Engagement with participating stakeholders should be done regarding the type of fencing that is appropriate and acceptable at the site.

Market analysis

Botanical misidentification by the market assessment partner, GRU, was noticed in the first year of the project, with the team mistaking exotic species for wild species, including those from the same target taxonomic group, in part because of common name uses (e.g. Soursop - *Annona murcata* from Latin America -, instead of *Annona senegalensis*, native to Uganda). Earlier quality control by a range of local and international botanical experts is recommended for future work of this kind.

The provision of raw materials to take to markets to aid discussion would have been useful but was not possible (due to their seasonality and perishability), therefore information sheets were compiled for use instead to aid conversations, with images, local names, simple descriptions, phenology and locally known ethnobotanical information (see example in Annex 5.5). Doing this at the outset of the project would be recommended.

GRU also learnt that some larger private farmers were growing the exotic *Annona muricata* but were failing to market products beyond local fresh markets. This highlights the need to develop products for sale in the commercial markets including blending, storage and packing for success. If this is not done, then opportunities are likely to fail, especially if working with smaller scale farmers for which immediate benefits would be important if aiming for rapid income generation.

Further recommendations:

As a results if this project, plant species have been identified for use and new products developed, a recommendation is to engage commercial entities / entrepreneurs to consider larger-scale manufacture and marketing of the species and products. This could focus on the products that received very positive feedback during the sensory evaluation at open days and the feedback used to improve products, for example the *Annona senegalensis* juice received a complaint of acidity so was altered to reduce this. The project has shown that there is a need for the development of supporting systems to connects the suppliers/producers with consumers, this could be in the form of co-operatives, Saving and Credit Cooperative Societies (SACCOs), new bio-enterprises and/or processing businesses.

It was noted in all project engagements that the populations of the target native species are dwindling, and it is recommended that outreach and engage is undertaken with farmers, government and other stakeholders to domesticate and cultivate the selected species. This should be supported by establishing protected genetically diverse *ex situ* collections, in relevant agroecological zones considering the plant's requirements, including under future climate scenarios.

7 Actions taken in response to Annual Report reviews

The actions taken regarding the year 1 annual reviewer's 5 points are:

1. *Please provide some background information / context on the status of Uganda's FLR programme, which this project is said to be supporting. E.g. what part does agroforestry play in it?*
   This has been included in the project summary – see section 1.

2. *Revisit all project Indicators: currently they read (mostly) as timebound Activities – and provide little useful information on progress towards Outputs and Outcome. Consider rephrasing Output statements as deliverables.*
   This has been addressed – see section 5.

3. *Ensure that future progress reporting is focused on indicators – and addresses all metrics.*
   In section 3, the indicators and metrics from the logframe are always referenced within the text.

4. *Please provide better disaggregation and evidence of gender data.*
   Throughout the report, when reporting numbers of people involved in activities, disaggregation by gender has been included in this report.

5. *It would be useful/interesting if the presentation of the nutritional status of the tested species could be set alongside that of, say, bananas, papaya or guava.*
   This has been addressed – see table 2 in section 3.1 Output 2.

8 Sustainability and Legacy

The development of new food products from native plants is a major project achievement that will endure considering decisions were built on evidence of interest from stallholders, farmers, herbalists and potential customers (see section 3.1 Output 1). The research shows some Ugandans understand the species' importance for people's health and the environment, and that these species are disappearing. There was also interest in gaining access to plant materials, for consumption or sale, and for printed information to help to market them. This provides evidence for future success to be built upon and upscaled where possible.

All project staff are continuing their positions and work at TBG, GRU and EBG. The resources produced for the botanic gardens, such as the interpretation panels have been installed in the gardens and so will remain, providing valuable information to visitors beyond the project.

A draft manuscript titled "Understanding Ugandan native plant species' role in innovative sustainable landscapes" is in draft and to be submitted to an open access journal. Once published, the team will also aim to get the nutrition results onto a publicly available online database (e.g., the World Agroforestry Centre "Priority Food Tree and Crop Food Composition" database - https://apps.worldagroforestry.org/products/nutrition/index.php/home/).

Knowledge has also been shared openly with visitors to the 2 Botanic Garden partners and will continue to be shared as part of the function of botanic gardens to support education and awareness raising for plant conservation and sustainable use (see figures 2, 3 and 5).

There was no specific impact on policy in this project, but this would be a goal of upscaling the results in Uganda as a next step.

9 Darwin Initiative identity

At all project presentations (steering committee meetings, open days and training events), the Darwin Initiative and the UK Government is always promoted as the funding body supporting this project. This reached all levels of society from local community members up to government officials.

The Darwin Initiative support has also been recognised on important outputs produced in the project, from the packaging for the juices and powders, to the leaflets and interpretation panels at the botanic gardens (see figure 5 – indicator 4.4)

Figure 5: Juice bottles and leaflets with the Darwin Initiative and UK International Development logos

A project page on the BGCI website was also created (https://www.bgci.org/our-work/projects-and-case-studies/agroforestry-with-native-edible-plants-in-uganda/) that explains the Darwin Initiative funding support with the logos displayed. BGCI social media channels have promoted the project throughout the implementation, referencing the Darwin Initiative as the funder and linking to Biodiversity Challenge Fund and Darwin Initiative accounts (e.g., LinkedIn.com, 2024; X.com, 2024).

A project blog was also posted on the Darwin Initiative website in January 2024 (https://www.darwininitiative.org.uk/news/2024/01/04/native-plants-food-for-people-and-biodiversity/)

The Darwin Initiative was also referenced in radio programmes and jingles, which were converted into videos to be posted online for further sharing, for example via WhatsApp, here:

- Open days: https://www.youtube.com/watch?v=X2LNUBauRxU
- Agroforestry: https://youtu.be/HLS-qyNwNcc?si=1DCKwZI1T4_M9250

10 Risk Management

No major new risks were identified in the second year and no resulting major adaptations were needed in the project design.

11 Safeguarding

Has your Safeguarding Policy been updated in the past 12 months?	Yes
Have any concerns been investigated in the past 12 months	No
Does your project have a Safeguarding focal point?	Yes Ane [redacted]
Has the focal point attended any formal training in the last 12 months?	Yes 14th of December 2023 – delivered by the National Council for Voluntary Organisations titled "Designated Safeguarding Leads in Charities". This provided understanding of the safeguarding lead's role, statutory and multi-agency safeguarding mechanisms and the importance of effective policies and procedures to foster positive safeguarding culture. It also addressed how to receive and manage safeguarding concerns, including best practices for confidentiality and data protection, effective signposting and referral processes.
What proportion (and number) of project staff have received formal training on Safeguarding?	Past: 81% [13] Planned: 19% [3]

Has there been any lessons learnt or challenges on Safeguarding in the past 12 months? Please ensure no sensitive data is included within responses.

No lessons were learnt or challenges on safeguarding in the past 12 months

Please describe any community sensitisation that has taken place over the lifetime of the project; include topics covered and number of participants.

Have there been any concerns around Health, Safety and Security of your staff over the lifetime of the project? If yes, please outline how this was resolved.

No, there were none during the project.

12 Finance and administration

12.1 Project expenditure

Project spend (indicative) since last Annual Report	2023/24 Grant (£)	2023/24 Total actual Darwin Initiative Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistence				Costs for BGCI trave in second year were less due to good progress in awareness activities
Operating Costs				Nutrition analysis costs in year 1
Capital items (see below)				
Others (see below)				Community costs in year 1
TOTAL	199,995	190,013.5		

Staff employed (Name and position)	Cost (£)
Alex Hudson, project leader	[redacted]
Helen Miller, head of engagement and vocational training	
Ane Zabaleta, engagement and education manager	
Dominic Grantley-Smith, engagement and education manager (year 1)	
Annelies Andringa-Davis, engagement and education officer	
Godfrey Ruyonga, project lead	
Said Musa Mutegeki, project manager	
Harriet Kokugonza, public awareness officer	
Juliet Kobusinge, project bookeeper	
TBG Nyangoma Faith, project bookkeeper	
Rehema Walubembe, marketing logistics	
James Barnard, market survey lead	
Alex Sempira,	
Peter Jemba, market research team lead and team of 4	
Seed collectors	

TOTAL	**96,150**

Capital items – description	**Capital items – cost (£)**
TBG Officer printer	375
TOTAL	375
Other items – description	**Other items – cost (£)**
Transport and perdiem for plot monitoring Nursery bed consumables Publication costs	[redacted]
TOTAL	6,539

12.2 Additional funds or in-kind contributions secured

Matched funding leveraged by the partners to deliver the project	**Total (£)**
Terraformation support for seed collection and banking	[redacted]
Staff time – Godwin Anywar and other researchers from Makerere University	
Staff time – GrassRoots Ltd extra staff time	
VOT FM radio provided 3 in-kind radio programmes	
Staff time – Alex Hudson from BGCI extra staff time	
Travel costs – Entebbe Botanical Gardens	
Staff time – Joyce Adokorach from Entebne Botanical Gardens	
TOTAL	**26,412**

Total additional finance mobilised for new activities occurring outside of the project, building on evidence, best practices and the project	**Total (£)**
TOTAL	

12.3 Value for Money

The project met the value for money criteria as it brought together different partner institutes with differing strengths to frame the project – nutrition research (Makerere University), business development and market assessments (GRU), community engagement, awareness raising and co-creation (BGCI and TBG) and plant sciences, including agroforestry, ethnobotany and native plants (TBG and EBG – with NaFFORI support). This group allowed very quick progress to be made, achieving most of the project planned outputs despite being only 2 years. These included the major goals of new nutritional products made that can be marketed using the nutritional benefits ("New innovative development opportunities using native food plant species are available…") and ("…baseline biodiversity information of their use in agroforestry systems collected ready for future impact monitoring") with the agroforestry trials established early on data was collected that will show the benefit of these to farmers

This has created a proof of concept for native plant products and markets, and their suitability of growth on farms without impact other crops grown. This paves the way for further development to achieve improved land management in Uganda to reduce degradation and support farmers through benefits of nutritional food, potential monetary incomes and involvement in decisions and capacity building on new farming practices. Expanding this by developing efficient value chains and promoting native plant products will enable these practices to reach many more farmer and urban consumer beneficiaries in the long term.

For expanding messaging to grow markets, TBG have tested good strategies (open days and radio campaign) and have built strong relationships with media industry. This has even led to radio production team at Voice of Tooro (VOT FM), doing 3 radio shows for free in February and March, saving the equivalent of 6,400,000 UGX (roughly £1,300) – see Annex 5.24.

The proof of concept from this project will enable finance for these sorts of developments via other means, which is often difficult in the early stages. With new products and growing trees, the risks are high for private investors or farmers, until a proof of concept is completed to provide the evidence they need. Interest in the project results has been received and word of mouth about the project is being shared. Further evidence is required to reduce risks further, for which public funds are perfect.

Despite the Ebola outbreak providing a difficult moment in the project life cycle (see section 13) the team worked through it by avoiding travel through the impacted districts (between Fort Portal and Kampala) and halted collection activities to reduce the risk to community members involved. The project work still progressed, and agroforestry plots were established in the project life cycle, requiring travel from seed collection and propagation at nurseries, and several species have their nutritional profiles assessed (although not all, see section 3.1 Output 2).

For BGCI, overhead cost for this project have been at a reduced rate (10% and 7% per year) to allow more of the funding to be put towards project implementation. GRU provided a lot of extra staff time towards market investigations in year 2 as in-kind because the initial budget had most GRU staff costs down for year 1, but it was realised that further engagements were needed. Makerere University and EBG staff time was also in-kind throughout this project, with extra staff time provided by GrassRoots Ltd in the second year as in-kind support too.

BGCI has also taken on an extra finance staff, to ensure that partner financial reporting is accurate, timely and fully supported by appropriate documentation, and we are developing online training sessions with the partners to that effect.

13 Other comments on progress not covered elsewhere

From 20 September 2022 to 10 January 2023 (see https://www.ecdc.europa.eu/en/ebola-virus-disease-outbreak-uganda), there was an Ebola outbreak in Uganda that impacted Mubende district, with cases (more than 10) reaching the capital Kampala. In total over 55 people died from more than 140 infected. This meant that a planned visit to Uganda from the BGCI team and some internal travels had to be cancelled in that period. BGCI held meetings online to try to accommodate for this unforeseen impact on travel.

14 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).

File Type (Image / Video / Graphic)	File Name or File Location	Caption, country and credit	Online accounts to be tagged (leave blank if none)	Consent of subjects received (delete as necessary)
				Yes / No
				Yes / No
				Yes / No
				Yes / No
				Yes / No

Annex 1 Report of progress and achievements against logframe for the life of the project

Project summary	Progress and achievements
Impact FLR in Uganda includes a substantial amount of Agroforestry on degraded land using native food plant species to improve significantly rural and urban populations' health outcomes and local biodiversity.	Five agroforestry trial plots established with native plant species relevant to the local agroecological context and baseline productivity and biodiversity data collected, benefiting 27 farmers (10 women), who received training and short-term crop benefits (evidence provided: section 3.1 Output 3). This provides evidence for: farmers, government, CSOs and NGOs increasing take up. 710 rural and urban community members were directly reached with messages about agroforestry and nutrition benefits of native species (evidence provided: section 3.1 Output 4). Radio, online videos, and interpretation panels and open days at botanic gardens increased knowledge further (evidence provided: Annex 5.4). Further expansion of the awareness campaign and agroforestry trials will continue this progress reaching more urban and rural community members, increasing demand for native plant products. Targeting policy makers and conservation and development NGOs will also catalyse a switch from exotic species.
Outcome New innovative development opportunities using native food plant species are available with the baseline biodiversity information of their use in agroforestry systems collected ready for future impact monitoring	
Outcome indicator 0.1 By July 2023, the current use and markets for 34 native food plant species is understood following engagement with 100 smallholder farmers and 10 local markets in 5 districts with a top 12 for each of the 5 project districts identified.	Achieved: 34 markets in the 5 districts visited and 5 community consultation meetings with 300 people (130 women) to understand use and markets of the 34 target species (evidence provided: section 3.1 output 1 and Annexes 5.7 and 5.8). Information used to decide top 13 species to target for development in August 2023 (evidence provided: section 3.1 Output 2).
Outcome indicator 0.2, 6 new food products created from native food plant species that provide valuable nutrition content and have value chain development potential by February 2024	Achieved:7 products were developed, and nutritional values understood (evidence provided: figure 4 and section 3.1 Output 2). A scientific publication is in draft to be published shortly (evidence provided: section 8 and Annex 5.18).
Outcome indicator 0.3 Baseline biodiversity indicators are established for agroforestry plot managers using 5 1ha agroforestry plots, 5 1ha farmland plots and 5 1ha degraded unmanaged plots by March 2024	

Outcome indicator 0.4 Nutrition and biodiversity benefits of producing and consuming native plant food species in diverse land use systems promoted to over 200 smallholder farmers and 400 urban community members by the end	Achieved: Project messages promoted directly to 435 rural farmers (171 women) and 314 urban community members (175 women) (evidence provided: table 4 in section 3.1 Output 4 and Annex 5.17).
Output 1 Current use and markets of 34 target indigenous food species understood	
Output indicator 1.1 Knowledge gathered for 34 native plant species, through 4 consultation workshops held with local farmers, producers, and marketers by end of Year 1	Achieved: Knowledge gathered on plant use at 5 consultation workshops with 300 people (130 women) and data used to decide which species to take forward as development opportunities (evidence provided: section 3.1 Output 1 and Annexes 5.3 and 5.7).
Output indicator 1.2 Twelve species chosen for development of food products by October 2023.	Achieved: 13 species to target for development selected at workshop in August 2023 (evidence provided: section 3.1 Output 2).
Output indicator 1.3 Market research to identify current markets, national market gaps, food consumer opinions and decisions published by February 2024.	Achieved: 34 markets in the 5 districts and data used to decide which species to take forward as development opportunities (evidence provided: section 3.1 Output 1 and Annex 5.8).
Output 2. Nutritional profiles of 34 target native food species known showing levels of important micro- and macronutrients with at least 6 new food products produced from the 12 species selected as most beneficial	
Output indicator 2.1 Fifty community members (seed collectors) trained in collection of raw food materials to facilitate nutritional analysis by October 2022	Partially achieved: 31 collectors were trained (19 women) to collect raw plant materials for nutritional analysis (evidence provided: section 3.1 Output 2).
Output indicator 2.2 Collection of quality samples for analysis of relevant species to each of the 5 project areas by July 2023	Partially achieved: 17 of the 34 target species were collected with suitable samples for nutritional analysis, coming from the 5 project areas, where each species was found (evidence provided: section 3.1 Output 2 and Annex 5.18).
Output indicator 2.3 Thirty-four target species reviewed for nutrition profiles by August 2023	Achieved: All species reviewed, with no nutritional information available for 6 species (evidence provided: 3.1 Output 2).
Output indicator 2.4 Selection of at least 12 species for food product development by October 2023	Achieved: 13 species to target for development selected at workshop in August 2023 (evidence provided: section 3.1 Output 2).
Output indicator 2.5 At least 6 new food products developed using Makerere University's food technology methods, from the 12 species selected, that have improved shelf life by February 2024	Achieved: 7 products developed with improved shelflife (evidence provided: table 1 section 3.1 Output 2).
Output indicator 2.6 Nutritional profiles of 6 newly developed food products produced by March 2024	Achieved: Nutritional analysis of all 7 new products completed (evidence provided: table 2 section 3.1 Output 2).

Output 3. Five agroforestry plots, with at least 6 of the target native food plant species, established to investigate the benefits to people and nature compared to less diverse alternatives, with baseline data collected	
Output indicator 3.1 Steering committee established of project partners and relevant experts from the fields of Ugandan biodiversity, human wildlife conflict, agriculture, and forestry by July 2022	Achieved: Steering committee met 5 times during the project following group terms of reference (evidence provided: sections 2 and 5 and Annexes 5.1 and 5.2).
Output indicator 3.2 Agroforestry trial design developed with local smallholder farmer input, by October 2022	Achieved: Agroforestry trials designed in collaboration with community members and the Uganda National Forestry Research Institute (evidence provided: section 3.1 Output 3 and Annexes 5.14 and 4.16)
Output indicator 3.3 Train 25 smallholder agroforestry champion farmers (50% women) and botanic garden staff in establishment and management of agroforestry trials, by December 2023	Achieved: 26 smallholder farmers (8 women) and 4 botanic garden staff (2 women) were trained to establish and mange agroforestry plots (evidence provided: section 3.1 Output 3 and Annex 5.16).
Output indicator 3.4 Establishment of 5 agroforestry trials; 3 x 1ha on community land, 1 at TBG and 1 at EBG by November 2022	Achieved: 3 1ha plots were established in Kagadi, Mbale and Mpigi districts, and 2 at botanic garden partners (Tooro Botanical Gardens – TBG - and Entebbe Botanical Gardens - EBG) (evidence provided: section 3.1 Output 3 and Annex 5.15).
Output indicator 3.5 Baseline productivity of 5 x 1ha agroforestry and 5 x 1ha local smallholder farmer 5 collected for 2 growing seasons by January 2024	Achieved: Monitoring framework created and baseline productivity data has been collected (evidence provided: 3.2 Output 3 and Annexes 5.20 and 5.22)
Output indicator 3.6 Baseline data on biodiversity indicator species for comparison between 5 agroforestry, 5 local smallholder farmer and 5 degraded forest plots collected by March 2024	Achieved: Monitoring framework created and baseline productivity data has been collected (evidence provided: 3.2 Output 3 and Annexes 5.20 and 5.23)
Output 4. 200 farmers and 400 urban community members help design promotion options to reach wider audiences about the benefits of native food species and agroforestry via radio shows and botanic gardens	
Output indicator 4.1 Co-creation, education awareness and interpretation development training delivered to staff at TBG and EBG by April 2023	Achieved: Co-creation training delivered to 12 staff (2 women) from TBG and EBG by BGCI (evidence provided: section 3.1 Output 4 and Annex 5.17).
Output indicator 4.2 ≥600 individuals engaged through co-creation workshops and public outreach activities by the end of project	Achieved: 749 individuals directly reached through project activities, with more indirectly reached because of activities for indicator 4.4 (evidence provided: section 3.1 Output 4 and Annex 5.17)
Output indicator 4.3 Twenty-four promotional radio shows sharing project information in the 5 project areas by end of project	Partially achieved: 20 promotional radio shows and 2 short radio jingles were aired in Uganda in the project (evidence provided: section 3.1 Output 4

Output indicator 4.4 Agroforestry interpretation materials shared/distributed including 4000 leaflets/flyers in English, 2 magazine promotions and at least 1 information board at the agroforestry plots at TBG and EBG, by end of project	Achieved: 6 interpretation panels installed at TBG and EBG and 4,000 leaflets printed (evidence provided: sections 3.1 Ouput 4 figures 2 and 3 and section 9 figure 5). 3 open days were also held to promote results (evidence provided: Annexes 5.4 and 5.19)

Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	SMART Indicators	Means of verification	Important Assumptions
Impact: FLR in Uganda includes a substantial amount of Agroforestry on degraded land using native food plant species to improve significantly rural and urban populations' health outcomes and local biodiversity.			
Outcome: New innovative development opportunities using native food plant species are available with the baseline biodiversity information of their use in agroforestry systems collected ready for future impact monitoring	0.1 By July 2023, the current use and markets for 34 native food plant species is understood following engagement with 100 smallholder farmers and 10 local markets in 5 districts with a top 12 for each of the 5 project districts identified. 0.2 6 new food products created from native food plant species that provide valuable nutrition content and have value chain development potential by February 2024 0.3 Baseline biodiversity indicators are established for agroforestry plot managers using 5 1ha agroforestry plots, 5 1ha farmland plots and 5 1ha degraded unmanaged plots by March 2024 0.4 Nutrition and biodiversity benefits of producing and consuming native plant food species in diverse land use systems promoted to over 200 smallholder farmers and 400 urban community members by the end	0.1 Database records, workshop reports that highlight communities' use of species including disaggregation by gender, market research report including disaggregation by gender, species target lists 0.2 Scientific publications, information on the World Agroforestry Centre "Priority Food Tree and Crop Food Composition" database 0.3 Site biodiversity records, biodiversity baseline report 0.4 workshop attendees lists, radio recordings, promotional materials (e.g. signs and posters for use at TBG agroforestry plot)	From the target species some benefits can be shown (e.g. nutritional, seasonal production outside of main crops to provide year round food security, market use and potential) to select 12 for new product development Biodiversity indicators are selected that can be monitored easily by the plot managers with support from TBG
Output 1 Current use and markets of 34 target indigenous food species understood	1.1 Knowledge gathered for 34 native plant species, through 4 consultation workshops held with local farmers, producers, and marketers by end of Year 1	1.1 Workshop attendance disaggregated by gender from the 4 project districts; information on traditional methods of growing, eating, recipes and others recorded	Markets can be assessed multiple times in the year to include seasonal changes in availability of food plant resources, with research teams based in suitable locations to provide locality specific data

	1.2 Twelve species chosen for development of food products by October 2023. 1.3 Market research to identify current markets, national market gaps, food consumer opinions and decisions published by February 2024.	1.2. Data from 4 workshops analysed, report of consultation workshops with suggestions for product development 1.3 Market research report, species target list	
Output 2 Nutritional profiles of 34 target native food species known showing levels of important micro- and macronutrients with at least 6 new food products produced from the 12 species selected as most beneficial	2.1 Fifty community members (seed collectors) trained in collection of raw food materials to facilitate nutritional analysis by October 2022 2.2 Collection of quality samples for analysis of relevant species to each of the 5 project areas by July 2023 2.3 Thirty-four target species reviewed for nutrition profiles by August 2023 2.4 Selection of at least 12 species for food product development by October 2023 2.5 At least 6 new food products developed using Makerere University's food technology methods, from the 12 species selected, that have improved shelf life by February 2024 2.6 Nutritional profiles of 6 newly developed food products produced by March 2024	2.1 Training reports with trainee names and details, pre and post-training surveys to understand knowledge gained 2.2 Quality collections suitable for analysis provided to Makerere University for 13 to 28 species 2.3 Report on analysis of nutrition, scientific publication, community engagement reports and market research 2.4 Steering committee meeting minutes describing rationale and the decision made by the committee 2.5 New food products developed or identified in a list, low-cost methods of production documented 2.6 Report on analysis of nutrition, scientific publication, community engagement reports and market research	The collectors are able to collect sufficient raw materials from the known sites in a year to be used by Makerere University for analysis Community members engaged lose interest due to lack of support or miscommunications
Output 3 Five agroforestry plots, with at least 6 of the target native food plant species, established to investigate the benefits to people and nature compared to less diverse alternatives, with baseline data collected	3.1 Steering committee established of project partners and relevant experts from the fields of Ugandan biodiversity, human wildlife conflict, agriculture, and forestry by July 2022 3.2 Agroforestry trial design developed with local smallholder farmer input, by October 2022	3.1 Steering committee minutes outlining data and presentations given and decisions made on any changes required 3.2 Trial design report outlining how trials will be planted and monitored 3.3 Training attendees lists, training reports, payslips, plot data, socio-economic survey data	The partner organisations are able to deal with any issues community members have within their roles and support them to overcome them

	3.3 Train 25 smallholder agroforestry champion farmers (50% women) and botanic garden staff in establishment and management of agroforestry trials, by December 2023 3.4 Establishment of 5 agroforestry trials; 3 x 1ha on community land, 1 at TBG and 1 at EBG by November 2022 3.5 Baseline productivity of 5 x 1ha agroforestry and 5 x 1ha local smallholder farmer 5 collected for 2 growing seasons by January 2024 3.6 Baseline data on biodiversity indicator species for comparison between 5 agroforestry, 5 local smallholder farmer and 5 degraded forest plots collected by March 2024	3.4 Plot establishment report with photos and GPS data, baseline monitoring data 3.5 & 3.6 Plot monitor reports, impact analysis report, Socio-economic and biodiversity data from agroforestry trials, nursery transaction records	
Output 4 200 farmers and 400 urban community members help design promotion options to reach wider audiences about the benefits of native food species and agroforestry via radio shows and botanic gardens	4.1 Co-creation, education awareness and interpretation development training delivered to staff at TBG and EBG by April 2023 4.2 ≥600 individuals engaged through co-creation workshops and public outreach activities by the end of project 4.3 Twenty-four promotional radio shows sharing project information in the 5 project areas by end of project 4.4 Agroforestry interpretation materials shared/distributed including 4000 leaflets/flyers in English, 2 magazine promotions and at least 1 information board at the agroforestry plots at TBG and EBG, by end of project	4.1 Co-creation training report disaggregated by gender 4.2 Awareness raising strategy for engagement with urban populations, workshop reports disaggregated by gender, social media statistics, news articles 4.3 Radio programme recordings available online 4.4 Number of leaflets produced, number of signs produced, numbers of visitors to gardens for period that interpretation has been up and participation in open days	Urban and rural communities engage with the co-creation workshops to understand their diverse perspectives for promotion activities.
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) 1.1 Run 4 workshops in project areas to engage local communities to discuss food consumption, barriers to accessing nutritional food year-round, and to gather traditional knowledge on the target plant species 1.2 Select community members for inclusion in agroforestry activities from workshop attendees			

1.3 Analyse data and report on community perception
1.4 Market research to investigate market gaps for food products and nutrition content
1.5 Publish market research report
2.1 Complete training for food raw materials monitoring and collection
2.2 Trained community members collect food raw materials from target species for nutritional analysis
2.3 Carry out nutritional analysis on samples collected from all target species
2.4 Report on nutritional content of all target species produced
2.5 Agree 6 species to take forward for new food product development
2.6 Development of products from selected food species - including organoleptic testing
2.7 Carry out nutritional analysis carried out on newly developed food products
3.1 Establish steering committee and meet every 6 months
3.2 Decide agroforestry trial design and monitoring framework that incorporates target native food species, alongside other useful and beneficial species to the system (e.g. nitrogen fixers)
3.3 Seed collected and propagated in community nurseries. Plant 5 trial plots at TBG, EBG and public land (e.g. church groups) or willing community members' land. Complete training for community member site managers
3.4 Carry out baseline monitoring of plots
3.5 Monitor plots quarterly after establishment
4.1 Botanic Garden co-creation, education awareness and interpretation development training delivered at TBG to staff from TBG and EBG
4.2 Co-creation workshops held with community members, outreach events and social media used to share project information
4.3 Radio programmes created and delivered monthly to promote agroforestry and native food plant species, including using co-creation workshop knowledge towards the project end
4.4 Interpretation materials designed, printed and installed at TBG and EBG using knowledge from co-creation workshops and open days

Annex 3 Standard Indicators

Table 1 Project Standard Indicators

DI Indicator number	Name of indicator	Units	Disaggregation	Year 1 Total	Year 2 Total	Year 3 Total	Total achieved	Total planned
DI-A03	Number of organisations completed co-creation training	Number	NGO	1	0	-	1	-
DI-A03	Number of organisations completed co-creation training	Number	Public	1	0	-	1	-
DI-A05	Number of co-creation trainers trained by BGCI	Number	Men	10	0	-	10	-
DI-A05	Number of co-creation trainers trained by BGCI	Number	Women	2	0	-	2	-
DI-C08	Number of Media related activities	Number	Radio	0	22	-	22	
DI-C08	Number of Media related activities (videos online on TBG YoutTube chanel)	Number	Internet	0	3	-	3	
DI-C09	Number of records added to accessible databases (nutrition data uploaded to ICRAF database)	Number	Global	0	0	-	0	15
DI-D04	Number of people with improved education	Number	Men	12	209	-	221	
DI-D04	Number of people with improved education	Number	Women	19	195	-	214	

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
Different reporting templates have different questions, and it is important you use the correct one. Have you checked you have used the **correct template** (checking fund, type of report (i.e. Annual or Final), and year) and **deleted the blue guidance text** before submission?	X
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. All supporting material should be submitted in a way that can be accessed and downloaded as one complete package.	X
If you are submitting photos for publicity purposes, **do these meet the outlined requirements (see section 14)?**	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
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.	