Darwin Initiative Main: Annual 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)

Submission Deadline: 30th April 2023

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Darwin Initiative Project Information

Project reference	27-014
Project title	Coffee natural capital for environmental and livelihood sustainability in Uganda
Country/ies	Uganda
Lead Partner	Royal Botanic Gardens, Kew
Project partner(s)	National Agriculture Research Organization (NARO), Kampala Makerere University, Kampala Kyagalanyi Coffee Ltd. (KCL), Kampala (ED&F Man/Volcafe Uganda) Clifton Coffee, Bristol
Darwin Initiative grant value	£200,050
Start/end dates of project	1 Oct 2020 to 30 Sep 2023
Reporting period (e.g. Apr 2022 – Mar 2023) and number (e.g. Annual Report 1, 2, 3)	1 April 2022 to 31 March 2023
Project Leader name	Aaron Davis
Project website/blog/social media	Coffee natural capital for environmental and livelihood sustainability in Uganda | Kew
Report author(s) and date	Aaron Davis Project Board 29 April 2023.

1. Project summary

Uganda's natural forests and coffee agroforestry systems and are critical to the sustainability of Uganda's coffee sector (which provides income for an estimated 8 million people), and also play a key role in landscape-level ecosystem service provision, and biodiversity conservation.

Since the 1980s there have been serious issues for coffee production in Uganda, related to disease (coffee wilt disease), pests (coffee twig/stem borers), and changing climate (increased temperatures, and rainfall seasonality shifts). The conversion of coffee agroforestry systems to other crops would lead to a decline in ecosystem services (e.g. pollinator services, climate amelioration, water cycling) a loss of biodiversity and a reduction in income diversity. In lowland Uganda (at 1000–1200 m elevation), coffee production is mostly situated above arable land, where it provides critical water cycling and soil stabilization services. Farmers require fair and sustainable incomes to maintain coffee production (agroforestry).

Uganda is unique amongst the world's coffee growing countries: being a major producer and home to three (of the four; Davis et al., 2019)) highest priority coffee crop wild relatives (*C.*

canephora, *C. liberica* and *C. eugenioides*). Presently the use of this natural capital is understudied, and grossly undervalued in terms of providing sustainability solutions for the Ugandan coffee sector.

A detailed assessment of wild coffee species diversity (distribution, population size/density, environmental range, extinction threat) in Uganda has never been undertaken. The last survey was undertaken over 80 years ago. Liberica and eugenioides coffee show potential as crop species; the development of the three main indigenous coffee species could offer substantial benefits for climate resilience, pest and disease resistance and productivity, and thus livelihood security and improvement under a changing climate. It is our assumption that excelsa coffee (*Coffea liberica* var. *dewevrei*) offers considerable hope as a climate resilient crop species for Uganda.

To ensure the sustainability and viability of these coffee crop resources, Uganda's forests require effective conservation. The overarching theme of the project is to clearly demonstrate the substantial, intrinsic value of coffee natural capital via direct commercial application and future-proofing potential, all the way through the value chain: in particular, we aim to demonstrate the income potential and sustainability benefits for farmers. We assume that doing so will serve to strengthen conservation policy and action for Ugandan humid forests, as it has done in Ethiopia.

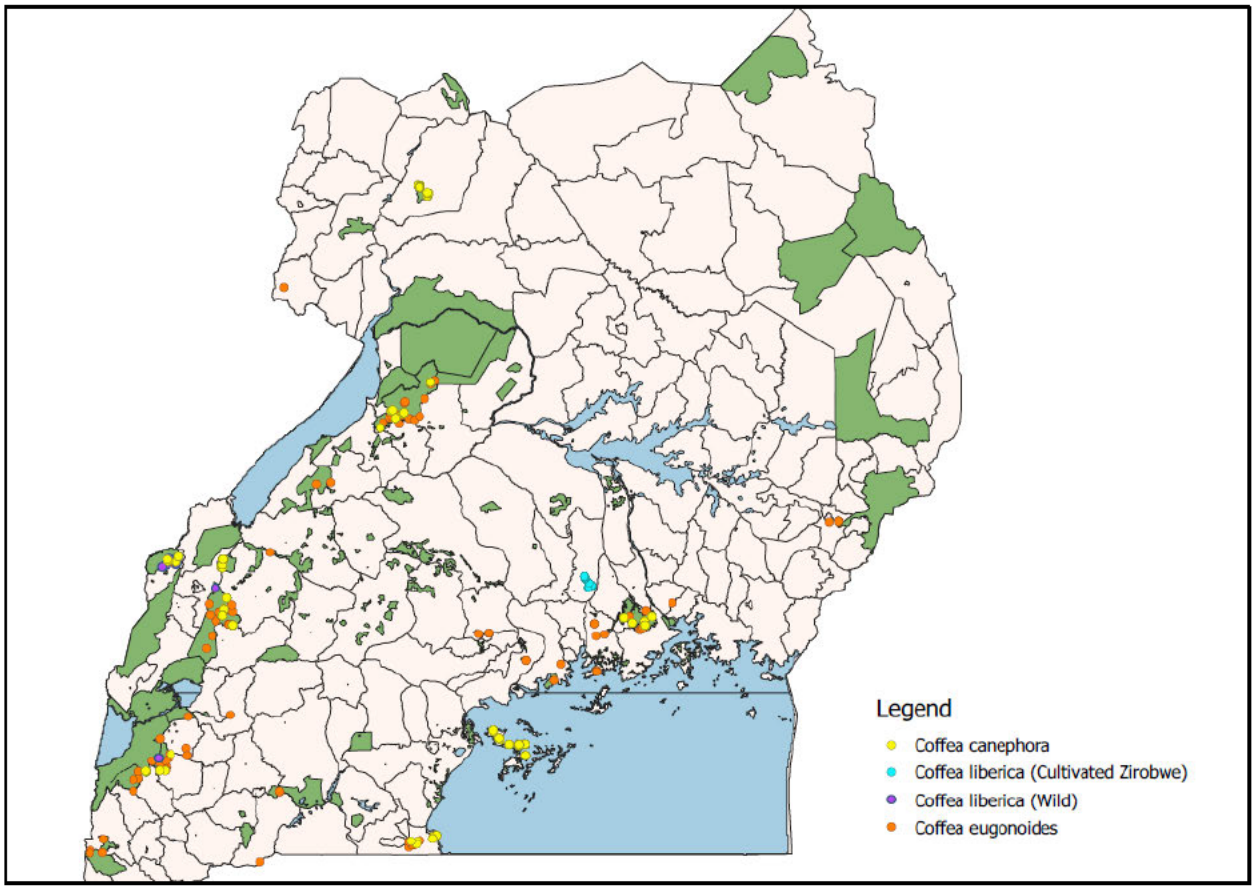

Fig. 1 Uganda's wild coffee species and cultivated Liberica coffee (based on Darwin project database), and overall project study area. Areas in green are protected areas. Map produced by Catherine Kiwuka in 2022 (NARO).

2. Project stakeholders/ partners

The project was devised and developed by all partners of the project team. Project scoping and proposal building began in 2016. Demand stemmed from the host country, with the following objectives. (1) To enumerate and catalogue the current diversity and conservation status of the wild coffee crop resources (natural capital in Uganda). (2) To demonstrate the value of Uganda's wild coffee resources (natural capital) for coffee production sustainably, and to use this to drive conservation-positive decision making. (3) To build a sustainable market for indigenous Liberica-excelsa coffee for the community in Luwero (Zirobwe), with a view to

improving livelihoods. (4) To understand the climate resiliency and agronomic potential of Liberica (excelsa) and *C. eugenioides*.

The project partnership has continued to be extremely effective during 2022/23. NARO and Makerere continue to work very closely. The Project Leader (Aaron Davis) is in constant (sometimes daily) communication with all project partners, via e-mail, WhatsApp, and on-line meetings. Unfortunately, project partner Josh Clarke left Clifton Coffee in late 2022, and we are in the process of revaluating this project partner relationship. Consequently, the Project Leader now has a closer working relationship with Kyagalanyi Coffee Ltd. (KCL), primarily with Geert Jan Heusinkveld); Ted Maberly (Trader at KCL) has been taking an increasingly active role in the project (quality, purchasing and logistics). All three Uganda partners remain motivated and enthusiastic about the project, and particularly around the emerging potential of Liberica-excelsa coffee.

3. Project progress

The following narrative provides progress on Year 2 and Year 3 activities (1 April 2022 to 31 March 2023), as the project start date was 1 Oct 2020. Note: Year 1: 1 Oct 20 to 31 Sep 21. Year 2: 1 Oct 22 to 31 Sep 2022. Year 3: 1 Oct 22 to 31 Sep 23. **AR3** = annual report period for this review period (1 April 2022 to 31 March 2023); **AR2** = previous report period (1 April 2021 to 31 March 2022). **Please see Annex 4 for evidence of main progress.**

3.1 Progress in carrying out project Activities

Activities for **Output 1. Coffee diversity/forest survey.** All activities were either completed or are on schedule. **Activities 1.1 and 1.2.** Completed under AR2. **Activity 1.3a and 1.3b.** Completed under AR3: the publication of a critical survey of Uganda's coffee natural capital (wild species diversity) with conservation assessments was published in February 2023: Davis, A.P., Kiwuka, C., Aisyah, F., Mulumba, J., Kalema, J. (2023). A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development. Frontiers in Plant Science 13: DOI=10.3389/fpls. 2022. 1057317. This was preceded by another project research paper (additional to the project log frame indicator; an enhancement for Output 1) Davis, A.P., Kiwuka, C., Aisyah, F., Walubiri, J.M., Kalema, J. (2022). The re-emergence of Liberica coffee as a major crop plant. Nature Plants 8: 1322–1328.

Activities for **Output 2. Development of Liberica coffee production**. All activities are on schedule, or completed. **Activity 2.1.** Final drying beds for the four remaining farms were installed in September 2022, to complete this activity. Tarpaulins were provided by KCL, as an addition to the project; tarpaulins prevent re-wetting of dried coffee (which causes a reduction in coffee quality). **Activity 2.2.** The field agent (Job Mweru Walubiri, from KCL, continued to provide training and support for farms in Zirobwe, focusing on the 10 main farms producing coffee for export. Collection of participatory farm data (location and size of farm/and production area, proportion of farm devoted to Liberica-excelsa production, gender and GPS location data) has been ongoing through 2022/23. **Activity 2.3.** Approximately 1.1 metric tonnes (mt) of clean coffee was purchased in April 2022. A total of 160 kg was shipped to Clifton Coffee in the UK (September 2022). **Activity 2.4**. In April 2022 KCL paid c. 10,000 UGX ($2.60 per kg/$1.18 per lb) at the farmgate (for the 1.1mt). That represents a 39% increase in unit price for farmers, over previous prices (i.e. for robusta at 7,200 UGX). In March 2023, KCL purchased 1.4 mt farmers were paid 4,500 UGX per kg of dried cherry (at an approximate cherry to clean coffee conversion of 2:1, this equates to c. 9,000 UGX per kg [$2.40 per kg/$1 per lb]) clean coffee), compared to the baseline price of 7,600 UGX per kg (i.e. for robusta), representing an 18% increase in unit price for farmers for this part of the harvest. This clearly shows the potential for improved farm prices, based on cup profile (what the coffee tastes like) and quality. The price is currently set at 4,500/9,000 UGX because KCL need to understand buyer demand and wholesale price, and pre-shipment costs (hulling, sorting, storage, transport). The final purchase for the 2023 excelsa harvest will come in April, and is likely to be closer to 5,000 UGX. **Activity 2.5a.** The scheduled coffee quality evaluation was completed (as per log frame) under AR2. However, in AR3 ten additional samples were evaluated (June, October 20022; March 2023). Overall, these assessments indicate a drastic improvement in coffee quality since the initial assessment and show that further improvements can be made in quality (and hence farm price). There were some issues with quality, due to insufficient drying, storage of coffee at a high moisture content, and

re-wetting of beans (probably due to rainfall). In summary, the cup quality of Ugandan Liberica (excelsa) continues to exceed expectations, placing it closer to Arabica coffee when correctly processed. **Activity 2.5b.** The final assessment of chemistry, including quantification of major coffee compounds was completed under AR3 (July 2022). Comparatively low quantities of major chlorogenic acids (and caffeine) with and other key compounds, compared to Arabica and robusta coffee, correspond with the mild (e.g. low bitterness) drinking experience of excelsa coffee. **Activity 2.6** Completed under AR2.

Activities for **Output 3 Biodiversity value and ecosystem service provision. Activity 3.1. and 3.2.** Climate/meteorological and soil moisture data collected and analysed in AR3; data collection for 3.1 will continue until the end of the project. A short report has been drafted, and is be finalized. **Activity 3.3.** Pest surveys on farms completed and extended to natural forests. First draft of summary report completed under AR3 (Oct 2022). **Activity 3.4.** All plots planted (AR2), plot management and data collection continued through AR3 and are ongoing. The climate recording equipment picked up the major drought period of 2002 (May to August), which caused a nationwide reduction in robusta exports; excelsa coffee showed improved drought resilience compared to robusta coffee. Despite the drought, the three plots are in excellent condition and the pants are growing well. **Activity 3.5.** Almost all fieldwork activities were completed as per the draft report (see Annex 4); the final transect work is to come in the remaining two quarters of the project.

Activities for **Output 4 Eugenioides coffee trials. Activity 4.1.** The Kawanda (low elevation) plot was planted in April/May 2022, and the plants are now growing well. The second plot in Bugusege (higher elevation), will not be planted in 2023 due to difficulties with propagation (cuttings) of eugeniodies (see AR2, and Annex 4, for details). Kawanda is a NARO research stations. **Activity 4.2.** observation of eugnioides has been ongoing since planting, and the plants are growing nicely [Annex 4].

Activities for **Output 5 Production of Wild Coffee Resources Strategy for Uganda document. Activity 5.1.** A one-day National Stakeholder Meeting was held in Kampala, at Makerere University, on 12 January 2023, and was a success. Sixteen key stakeholders attended the meeting, including the National Forestry Authority (NFA), National Coffee Resources Research Insitute (NaCORRI), National Agricultural Research Organisation Secretariat, Makerere University, Slow Food Uganda, Kyagalanyi Coffee Ltd. (KCL) and Royal Botanic Gardens-Kew. The awareness sessions were realised through three presentations from the project board (J. Kalema, C. Kiwuka and A. Davis; PowerPoint presentations sent to attendees and other stakeholders), recapitulating the project's objectives, progress to date, and aspirations post project; various presentations from key attendees were made on the importance of Ugandan coffee genetic resources; protected area management, and challenges for forest conservation. The meeting included serval rounds of discussion, and Q&A. There was general agreement that: (1) wild forests hold key resources for the sustainability of the Uganda coffee sector; (2) demonstrating the value of coffee natural capital (wild genetic resources) is a powerful argument for forest conservation, given the importance of coffee exports to the nation's economy; (3) that publicity and lobbying is required to ensure key measures are heard, understood and actioned; and (4) that Zoka forest is under particular threat and should be a priority for focused conservation effort. The meeting raised stakeholder awareness of the value of Uganda's coffee natural capital to the sustainability of the coffee sector and the livelihoods of millions of people who directly or indirectly depend on the coffee sector. **Activity 5.2.** Draft text for the strategy report completed under AR3. **Activity 5.3.** Maps (and other GIS outputs) and some of the main infographics produced for the strategy report; artwork (coffee illustrations) 75% complete. **Activity 5.4.** All materials for the strategy report scheduled for delivery to printers in Quarter 2 (July 2023). **Activity 5.5.** Shipping (or other form of delivery) is scheduled for end of Quarter 2 (August/September 2023).

3.2 Progress towards project Outputs

***Evidence and Output indicators are provided in 3.1.**

Output 1. A critical survey of Uganda's coffee natural capital (wild species diversity, distribution, and conservation threat). Baseline: No survey available.

This output is now complete and has been summarized in the comprehensive research paper: Davis, A.P., Kiwuka, C., Aisyah, F., Mulumba, J., Kalema, J. (2023). A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development. *Frontiers in Plant Science* **13:** DOI=10.3389/fpls. 2022. 1057317. A summary of the main outcomes are: Based on ground point data from various sources, survey of natural forests, and literature reviews we summarise taxonomy, geographical distribution, ecology, conservation, and basic climate characteristics, for each species. Using literature review and farm survey we also provide information on the prior and exiting uses of Uganda's wild coffee resources for coffee production. Three of the indigenous species (excluding *C. neoleroyi*) represent useful genetic resources for coffee crop development (e.g. via breeding, or selection), including: adaptation to a changing climate, pest and disease resistance, improved agronomic performance, and market differentiation. Indigenous *C. canephora* has already been pivotal in the establishment and sustainability of the robusta coffee sector in Uganda and worldwide, and has further potential for the development of this crop species. *Coffea liberica* var. *dewevrei* (excelsa coffee) is emerging as a commercially viable coffee crop plant in its own right, and may offer substantial potential for lowland coffee farmers, i.e. in robusta coffee growing areas. It may also provide useful stock material for the grafting of robusta and Arabica coffee, and possibly other species. Conservation assessments indicate that *C. liberica* var. *dewevrei* and *C. neoleroyi* are at risk of extinction at the country-level (Uganda). Adequate protection of Uganda's humid forests, and thus its coffee natural capital, is identified as a conservation priority for Uganda and the coffee sector in general.

Output 2. Development of Liberica coffee production (and establishment of producer-purchaser relationship at Luwero. Demonstration of Liberica as an important third coffee crop species for Uganda). Baseline: Liberica (excelsa) production is dispersed across the Luwero [Zirobwe] District, with the production of this species being sold into the robusta market, at low prices; there are no Liberica-excelsa specific exports from Uganda; Liberica-excelsa coffee produced in Luwero [Zirobwe] is of low quality.

Job Mweru Walubiri, the field agent from Kyagalanyi Coffee Ltd. (KCL) has achieved remarkable results again this year, in terms of outreach, training and building value-chain relationships with farmers in Luwero (200 farms), and overseeing drying bed installation, under the management of KCL. The focus has been on 20 farms, and particularly those 10 producing the bulk of coffee for export. The Sustainability (under Geert Jan Heusinkveld) and Trade (under Ted Maberly) departments at KCL have made further substantial progress with purchasing and export logistics, including the purchase of several metric tonnes of excelsa kiboko (dried coffee fruits) for the 2022/23 season (AR3 and until the end April 2023). The rest of the project partner team have been supporting value chain activities in Zirobwe, with on-farm quality assessment and sensory evaluation (in the UK). Excelsa coffee from Zirobwe is now entering the value chain as Liberica-excelsa, rather than as commodity grade robusta. This is a major achievement. Metrics on farmgate coffee prices, production/export volumes are provided elsewhere in this report. All of this work is key is to developing proof of concept and scalability for Liberica-excelsa in Uganda.

The provision of drying beds and associated training has led to a quantum improvement in coffee quality, from barely commercial in 2021 (based on the first round of quality assessments) to high quality coffee in 2022 and particularly in 2023 (second round of quality assessments). There are still some issues with quality consistency, as identified in our sensory and quality assessments, but these are being addressed on a farm-by-farm basis.

It should be reiterated (as stated in the original proposal) that a growing number of farmers in Luwero [Zirobwe] now prefer growing Liberica-excelsa over robusta (parenthetically, it is too hot to grow Arabica coffee in lowland Uganda) due to: ease of cultivation (fast growing, early yielding, high yielding; pest and disease resistance; tolerance of drought conditions (see Annex 4). This farmer feedback corresponds with by evidence from activities and indicators from Outputs 1–3, such as the meteorological work (Activities 3.1, 3.2), and pest and disease survey (Activity 3.3). The development of indigenous Liberica (excelsa) as a stand-alone, high value (e.g. on a par with particular grades of Arabica coffee) provides excellent proof-of-concept for the value of wild coffee natural capital, (and the forests in which they occur), which is the consistent with the Outcome of the project (see Section 3.3). The two AR3 research publications (see above), report on the above-mentioned summary in some considerable detail, and provide a clear demonstration of the potential for Liberica-excelsa coffee.

Overall, Output 2 has largely been achieved already; we await purchasing/exportation data to see if all activity targets have been met, however, achieving the targets is not as important as demonstrating proof-of-concept and scalability.

Output 3 Demonstrate biodiversity value and ecosystem service provision, and climate resiliency potential for Liberica coffee production. Baseline: no data or studies available to demonstrate the biodiversity value, ecosystem service provision, and climate resiliency potential of Liberica (excelsa) coffee production in Uganda.

Biodiversity. The field surveys (Activity 3.5) have demonstrated that the biodiversity (plant diversity) value of natural (coffee) forest is much higher than agroforestry and non-agroforestry systems. The application of malaise trapping to look at a subsection of insect diversity was unsuccessful (due to difficulties in implementing malaise traps on farms). Work is ongoing to measure tree diversity and abundance for Liberica farms vs. other production systems in the study area.

Ecosystem services. Agrometeorological survey experiments (Activity 3.1, 3.2) have demonstrated that Liberica agroforestry systems have a measurable and significant influence on air temperature, relative humidity, and (via calculation from the aforementioned variables) vapour pressure deficit (the evaporative demand within each production system (i.e. coffee forest and non-agroforestry systems). Increased soil moisture was recorded in four agroforestry plots, but there was no consistent difference between agroforestry and non-agroforestry, or over the three soil depths measured. It is clear to us now that there are a large range of variables influencing soil moisture across the two main systems; in particular, those agroforestry plots recording less capture of soil moisture were influenced by soil moisture uptake by trees (some soil loggers had been surrounded by tree roots, and consequently the soil was drier that that outside the root zone.

Climate resiliency. The Agrometeorological equipment (for Activity 3.1, 3.2, 3.4) recorded the major drought period of 2002 (May to August), which caused a nationwide reduction in robusta exports; Liberica-excelsa coffee showed improved drought resilience compared to robusta coffee during this period. The agrometeorological equipment very neatly measured key variables (air and soil moisture variables), which have been exceptionally useful for understanding tolerances in Uganda's lowland coffee-producing area, and the two species of interest (robusta and Liberica-excelsa. These data are consistent with observations from the field trials (Activity 3.4), and field trial climate recording equipment, when drought periods corresponded to plant stress (especially for robusta, e.g. visible by severe wilting), although none of the plants are yet fully established and had to be irrigated in cases when the plantings were new). These observations tally with those from farmers at Zirobwe, who report stress for both robusta and Liberica-excelsa, but far less so in the latter species. The pest and disease survey (Activity 3.3), clearly shows that robusta has a higher incidence of pest and disease (Annex 4), particularly during drier times of the year. Pest and diseases are a key indicator of environmental stress, particularly drought, and are often the major cause of morbidity and mortality losses during weather perturbations and climatic change (drier and warmer conditions). Output 3 is likely to be achieved during the lifetime of the project.

Output 4. Provide data for the suitability of *C. eugenioides* as a high-value niche crop for forest-based communities. Baseline: Zero information or experience on the cultivation of eugenioides coffee in Uganda (and little globally).

We have already learnt a considerable amount about this species so far; the field trial data will enable us to better understand the suitability of this minor crop species, as the first trial plot matures. Difficulties with vegetative propagation have been a major learning outcome. Output 4 is likely to be achieved during the lifetime of the project, even though we were only able to establish and single trial under the AR3 reporting period. This Outcome represents an important starting point in the commercial development of this species. The field trials will continue as part of project legacy. Efforts are also underway to systematically develop an efficient propagation protocol for eugenioides.

Output 5. Production of *Wild Coffee Resources Strategy for Uganda* document. Baseline: assessment of coffee natural capital for Uganda, and its value, use, and extinction threats, lacking.

Publication of *A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development*, a draft text, other materials from Outputs 2 to 4, and the generation of artwork and explanatory figures provides the resources for the *Wild Coffee Resources Strategy*. Perspectives, ideas, and other input from the stakeholder meeting held in Kampala in January 2023 (Activity 5.1) will be incorporated into the strategy document. Output 5 is on course and likely to be achieved during the lifetime of the project.

3.3 Progress towards the project Outcome

Outcome: a resilient and sustainable coffee sector supported by the use of coffee natural capital, demonstrating the value of native forests for their long-term conservation.

At this point, two and half years into the project, we believe that our original indicators are working well and are appropriate for the intended outcome. If the project continues on its current course we will provide: "A greatly Improved knowledge base for Uganda's coffee natural capital (Measurable Indicator (MI) **0.1**); "Evidence of production and procurement of Liberica coffee at Luwero [Zirobwe], as an example of the viability of scaling up commercial production for this indigenous coffee species" (**MI 0.2**); "Data on biodiversity, ecosystem service and climate resiliency data, for Liberica coffee farming, compared to robusta coffee and non-shade farming systems (**MI 0.3**); "**…**agronomy data via field trials for the high-value indigenous species *C. eugenioides*, with a view to commercial production (**MI 0.4**). "Assembly of project outcomes into a public document that provides key information on Uganda's coffee natural capital, for: (i) the conservation of its four indigenous coffee species; (ii) the biodiversity and ecosystem service benefits of coffee and indigenous coffee production; (iii) the development of these resources for the sustainable development of the country's coffee sector (including improved incomes for coffee farmers); and (iv) demonstration of the value of preserving Uganda's humid forests (i.e. indigenous coffee species used as a flagship and rationale for forest conservation). (v) Indigenous variants of *C. liberica* (excelsa) and *C. eugenioides* brought into cultivation (in project farms and research stations (NARO)) as part of increasing *ex situ* conservation capacity" (**MI 0.5**).

We believe that our indicators are appropriate for measuring the Outcome of the project. We see no reason why the Outcome will not be achieved by the end of the project (30 September 2023).

The potential of Liberica-excelsa as a third key coffee crop species for Uganda, aptly demonstrates the value of Uganda's coffee natural capital, via activities for Outputs 2 and 3, via two key publications (Output 1) and considerable media coverage (mainstream TV, high-quality videos, radio, blogs, national and international newspapers, and web articles). It should be reiterated that Liberica-excelsa is a wild plant, occurring in two of Uganda's forest protected areas. In our second research article we provided clear evidence for the value (past and future) for two other indigenous species (robusta and eugenioides), both exemplifying the value of indigenous natural capital and their forest habitats. Liberica-excelsa alone could safeguard the livelihoods of 100s of thousands of lowland coffee farmers, in the likely eventuality that robusta coffee will not be remain a viable option under a changing climate.

3.4 Monitoring of assumptions

Outcome assumptions

Assumption 0.2. The market requires Liberica Coffee (evidence to support this comes from producer and purchaser interest/demand)**.**
Comments: No change. Market and consumer interest in high-quality Liberica-excelsa is evident, with demand considerable but supply low to non-existent. Current prices support this assumption, e.g. https://houseofkendal.com/collections/our-liberica-collection-specially-selected-and-roasted.
Demand for Ugandan Liberica-excelsa is difficult to determine at the current time; wholesale buyers are interested in buying from the 2023 harvest, but purchasing documentation will not be available until later in 2023.

Assumption 0.3. Liberica coffee offers greater climate resiliency potential over robusta coffee (feedback from farmers and pilot field data supports this assumption, with further study urgently required).

Comments: Data collection to test this assumption (via Activities 3.1, 3.2 and 3.4) continued through 2022/23: observations so far support Assumption 0.3. Feedback from farmers during the drought of 2022, and national data on the impact of drought on robusta coffee production (e.g. production down by 14–26% in 2022) correspond with climate data gathered, thus proving support for Assumption 0.3. No assumption change is required.

Assumption 0.4 Consumer purchase prices places *C. eugenioides* in the (very) high value category, but expectations need to be managed to encompass possibility of a broader price structure across the value chain. Farmers remain interested in growing non-standard crop species (see notes on Output 4 assumption)
Comments: No change. High demand continues. Tests for agronomic and commercial viability are ongoing.

Assumption 0.5 Key stakeholders will require a tangible demonstration of conservation benefits, the viability of mainstreaming conservation activities, commercial application, and livelihood benefits.
Comments: This assumption still stands and was a key discussion topic of the national stakeholder meeting held in January 2023, in terms of supporting and enhancing conservation efforts for Ugandan forests. Two key project publications (see above), one in December 2022 and the other February 2023, and associated media coverage, were aimed at demonstrating this assumption. The export of indigenous Liberica-excelsa coffee in 2022 and 2023 provides a tangible demonstration of the value of indigenous coffee natural capital. No assumption change is required.

Output assumptions

Assumption 1.1 & 1.3 Timelines assume that the COVID-19 situation in Uganda doesn't significantly worsen, and that fieldwork can occur in Yr1 (if this assumption fails to hold true, more intensive fieldwork in Yr2 would compensate).
Comments: There were delays due to CV-19 in Yr 1 and early Yr 2, which required (agreed) reallocations of Yr 1 and Yr 2 budget, especially to cover fieldwork (i.e. by Ugandan partners, rather than Kew). 2022/23 (mid to late Yr 2 and Yr 3) was not directly impacted by CV-19, although extra effort was required to make up for lost time. No assumption change required.

Assumption 1.2 Owing to the worsening COVID-19 situation in Uganda, and the UK, the training course in Uganda may be suspended (now proposed for Yr 2).
Comments: The course was successfully undertaken in March 2022 (AR2).

Assumption 2.3 There are risks involved in ensuring shipping quantities. We have set an aspirational but realistic estimate for our shipping volumes. We have a dedicated agent working with farmers at Luwero, and a Ugandan-based coffee export company (KCL) working as a partner on the project, which should ensure that targets are met.
Comments: This assumption still stands: coffee production, purchasing and trade is a risk-laden activity. Based on experiences (and CV-19 setbacks from Yr 2/3 (2022). KCL were proactive in their planning (and training), and as a result the 2023 harvest season got off to a strong start, with the first round of purchasing completed in early March (2023).

Assumption 3.3 to 3.5 Field work activities run to schedule without interference (Gathering field data from plots and transects can be challenging due to circumstances beyond the knowledge or control of the researcher). We are mitigating these risks by undertaking the field work in areas known to us, that are close to Kampala (and Makerere University), and for which we have dedicated personnel and sufficient resources. Project partners in Uganda have long-standing experience in this type of work).
Comments This assumption still stands. For 2023/23 fieldwork targets have been met without issue.

Assumption 5.1 Stakeholders are willing and able to attend meetings (risk of non-attendance mitigated by the early announcement of dates and by keepings meeting short (1/2 day)).
Comments: This assumption still stands. Thanks to project partners in Uganda the meeting in January 2023 was well attended by key national stakeholders. The meeting was held for one full day.

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

Project Impact Statement: Sustainability of the Ugandan coffee sector for environmental (biodiversity, ecosystem services, climate resilience, conservation of forest and genetic resources) and livelihood benefit (increased household income, reduced risk, social improvement).

Biodiversity. Our project is designed to have a positive impact on biodiversity conservation, by placing a direct commercial, environmental and social (poverty alleviation) value on the humid forests of Uganda, which are home to flagship species including wild coffee species. Similar concepts have worked well in other countries, including those based on coffee production, particularly in Ethiopia. At this stage, we have no direct evidence for positive effects on biodiversity conservation, although we have clearly stated the case for the importance of biodiversity conservation as part of a strategy for the sustainability of the Ugandan coffee sector in the open access project publication *A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development*.

Poverty reduction. We have demonstrated the potential for improving prices (and thus household income) for farmers in Luwero (Zirobwe), by differentiating Liberica excelsa coffee from robusta coffee, and improving coffee quality. Before intervention Liberica excelsa coffee was being sold as lower value, commercial grade robusta, which farmer's sell at 3,600–3,800 UGX per KG (dried coffee fruit (kiboko)). For the first purchase round of (March 2023) farmers received 4,500 UGX/KG, which represents a minimum 18% increase in farm-gate price. A second purchase round will be made in April 2023, at a price of c. 5,000 UGX/KG. Sensory evaluation (Activity 2.5) confirms that the quality of Zirobwe excelsa can approach Arabica coffee, which generally commands a (unit purchase) price double that of commercial grade robusta coffee.

4. Project support to the Conventions, Treaties or Agreements

In January 2023 we held a successful project national stakeholder meeting in Kampala (Activity 5.1). with a view to supporting the Convention on Biological Diversity (CBD) and specifically: Art 10(e) "Encourage cooperation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources."; Art 11 "...adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity." Representatives of the meeting included the private sector (Kyagalanyi Coffee Ltd.; Slow Foods), Uganda's National Forest Association (NFA), National Agricultural Research Organization (NARO), National Agricultural Coffee Research Institute (NACORi), the Ugandan Coffee Development Authority (UCDA), and Makerere University. The Ugandan Wildlife Authority (UWA) were not able to make the meeting but are part of the stakeholder group.
Regarding CBD Art 13(a) "Promote and encourage understanding of the importance of biodiversity, as well as its propagation through media,…" we have made considerable efforts to fulfil Art 13(a) via various media work (news articles, TV, blogs, social media (see Annex 4), outreach (three MSc course lectures (two in the UK and one in Switzerland), and public lectures (UK and international).

5. Project support to poverty reduction

Our main mechanism to support poverty alleviation is to scale up two minor crop species, Liberica-excelsa and eugenioides coffee, the former as a higher value commodity crop and the latter as a very high value speciality coffee. The project area covers coffee farming communities in 'lowland' (1,000–1,300 m asl) Uganda, where robusta coffee is grown by farmers, as opposed to 'highland' coffee farmers (1,400 m asl and above) who grow the higher value Arabica coffee (which commands a one to twofold (and up to, or more than, threefold) higher purchase and commodity price). Throughout the project (and especially for the AR3 period) we have demonstrated that Liberica-excelsa coffee can achieve higher farm-gate unit prices over robusta (18–38 %; see elsewhere in this report), due to the intrinsic differences of the coffee. Moreover, climate resiliency, especially drought tolerance, improved pest/disease resistance, and high yields (as demonstrated via project activities in Outputs 2 and 3), serve to increase farm profitability. Improving farm profitability increases household income. In some cases, increases in coffee price and profitability can lift farming families above formally established poverty lines (Schuit et al., 2021).

In 2022 Uganda experienced a drought across large areas of its robusta growing region. In the project area robusta was badly affected by low rainfall, and pests associated with drought conditions, resulting in crop failure/low yields and low income. Liberica-excelsa was only partially affected by these conditions, aptly demonstrating the short- to long-term potential of this coffee

to safeguard against widespread poverty/loss of income. Without Liberica-excelsa there would be no future for these farmers as coffee growers; a transition away from coffee would be devastating for many Ugandan farmers. In the AR3 reporting period, several farmers stated that Liberica-excelsa (known locally as Kisansa) is the future for them as coffee growers; several other farmers have thanked our NARO partners for their guidance and use of this species.

Despite being an African species, with its centre of diversity in Uganda, eugenioides coffee is currently being grown as a high value crop (purchase price $80 per kg) in Colombia. Despite low yields, this crop species might provide Ugandan smallholders with a high value crop option, and thus support increases in household income. The project work being undertaken for eugenioides coffee will not have any short-term benefits, but importantly the work has started and is ongoing. In the long-term, eugenioides has been identified as a useful breeding resource for the production of improved coffee cultivars/hybrids, as discussed in our key project publication *A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development* (Output 1).

6. Gender equality and social inclusion

Famer training support at Luwero-Zirobwe (Activities 2.2 & 2.3) include all members of the community, male and female. The collection of gender disaggregation metrics was not covered in the original indicators. To resolve this, and address feedback from the AR2 report, we have added an additional farm survey, which includes the collection of gender data. As of April 2023, the data on gender is still being collected. Our GIS training course (AR2) was offered as an equal number of places for each gender, but we only manged to achieve 20% female participation. For our main stakeholder meeting (Activity 5.1) it was difficult to achieve gender balance (21% female participation), as the gender of national stakeholders is beyond our control.

Please quantify the proportion of women on the Project Board[1].	We have a project board of six. At project inception (until AR2) there was 50:50 representation. Owing to the replacement of Anneke Fermont by Geert Jan Heusinkveld, and the resignation of Josh Clarke (he moved to another company) it is now 60:40 (male: female).
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]~~.~~	As per criteria [2]: in AR3 we have a governance board of five. At project inception there (until AR2) there was 60:40 (female: male) representation. Owing to the replacement of Anneke Fermont, it is now 40:60.

7. Monitoring and evaluation

The outputs and activities were designed to achieve the project outcome. The evidence provided at this stage of the project demonstrates that the Outcome will be achieved, as stated above. The indicators of achievements (both qualitative and quantitative) are stated in the logical framework and change pathway (as given in the project application documents). These are monitored on a regular/continual basis by the Project Leader and reviewed by the M&E co-ordinator (Aisyah Faruk). We use a combination of an annotated and expanded Implementation

[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.

Timetable and a shared M&E document (overseen by Aisyah Faruk). Information is shared openly via cloud-based file sharing (Microsoft Teams), and e-mail transfer of project documentation, including project budgets. Ad hoc M&E checks occur on a regular basis. Project partners in Uganda have been proactive in project M&E. We have a warning light system (green, amber, red) for project activities, to address particular shortfalls, delays and missing evidence. There have been no changes to the M&E plan over the reporting period, except that key project milestones are recorded at RBG Kew as part of its KPI process.

8. Lessons learnt

Output 1. The smart indicators for this output worked extremely well: we were able to complete the output ahead of time and publish two research papers rather than one (Indicator 1.3a), despite some setbacks and readjustments due to CV-19.

Output 2. This output is on-course for completion: the methods and indicators were well placed and relevant. Our private sector partners (KCL and Clifton Coffee) set realistic targets for exports, and the export target of 5,000 kg of clean coffee is still possible (Indicator 2.5). However, it has been challenging to transition farmers from the production of low value (low quality) 'commercial' grade robusta, to higher value (higher quality) speciality/fine Liberica excelsa. We are now aware that it takes around three harvest seasons years (rather than two) to make this transition, for the export volumes we are working with, and would allow for this if redesigning the project. That said, there has been a quantum leap in the quality of Liberica-excelsa over two harvest seasons, through project intervention, and numerous lessons learnt concerning production logistics. Importantly, we now have the proof-of-concept required for scalability (including increases in household income), and the long-term potential of indigenous coffee natural capital. Any project concept dealing with export of goods, should undertake a value chain assessment before designing their project, and have complete buy-in along the entire value chain. Private sector involvement is essential.

Output 3. At this stage of the project, we realise that the ecosystem provision component was too ambitious, and that biodiversity, climate resiliency, and ecosystem service provision should have been treated separately. Various lessons were learnt concerning the technology used for the agrometeorological work (such as battery life, water ingress issues, and datalogger security); which have now been taken in account for the remainder of the project and for project legacy (see below).

Output 4. There were challenges with the propagation of eugenioides coffee, as this species proved difficult to propagate by cuttings. As this plant has scarcely been brought into cultivation, we should have made the propagation trials an activity.

Output 5. Publishing two peer-reviewed papers, in high quality journals (primary product), prior to the production of the Wild Coffee Resources Strategy for Uganda report, was a successful strategy: the peer-reviewed papers provide considerable resources and content to work with for the report (secondary/derived product). This is a much more efficient pathway than producing the primary and secondary products simultaneously, or the other way round. Having the main contents and outcomes of strategy report evaluated by peer-review will result in a higher quality strategy document (Activity 5.5).

9. Actions taken in response to previous reviews (if applicable)

Darwin responded (via email) that "the few issues raised by the reviewer in Section 2 can be answered through the next appropriate report, as indicated in the review". Project partners have been working towards this over the reporting period.

Specific points from the AR2 report, and actions taken.

1. Consider revising Output indicators so that these measure the change expected rather than simply the completion of activities. Include gender metrics, where appropriate.
Discussion on this point with the project partner board in Uganda concluded that between the Indicators and Methods of verification, the change expected was either implicit or explicit. There is also the change pathway document (as given in the project application documents). However, we are willing to draft a separate document, or updated the log frame. We will discuss this with

Darwin before or after the submission of the AR3. We are endeavouring to collect additional gender metrics (see section 3.1).

2. Include an Outcome-level Indicator which will provide a measure of poverty alleviation. We have been discussing this point with the export and import project partners (KCL and Clifton Coffee Ltd.). Indicator 2.4 states "Distribution of farmer payments (premium of 15–30% per unit price [$/lb]), above commodity (global) or national coffee prices, for participating farms. Yrs 2 & 3." Whilst we have been able to demonstrate these metrics for projected export volumes (Indicator 2.3), translating (or scaling) a measure of poverty alleviation within our Outcome ("A resilient and sustainable coffee sector supported by the use of coffee natural capital, demonstrating the value of native forests for their long-term conservation") would be difficult, as it depends on a broad range of factors that are beyond our control. We have demonstrated that the coffee natural capital of Uganda has been key to the sustainability of the coffee sector, and that it will be increasingly important over the coming decades, as explained in our main project paper (Output 1; Indicator 1.3) and report narrative. If indigenous excelsa coffee becomes the replacement or supplemental species for robusta coffee in lowland Uganda, under climate change, the outcome for poverty alleviation would be substantial (e.g. millions $US/year in national income). Quantifying this across a time-scale, at this point in time, would be extremely difficult. We will seek advice on this from Darwin.

3. AR2 mentions the use of 'non-project funds' for certain activities (e.g. 2.6). Where do these come from? These funds were provided via private benefaction (Amar-Frances Foster-Jenkins Trust).

4. The project website details 'pre-breeding research for the development of a climate resilient neo-Arabica (*C. canephora* x *C. eugenioides*) for Uganda' as a *main activity* of the project – and a covering letter with the Stage 2 application refers to 'arabica-like hybrids between *C. canephora* x *C. eugenioides, and C. liberica* x *C. eugenioides* which have demonstrated (in Madagascar) high productivity over a range of different environments (including those not seen in their progenitor species), and resistance to CLR. This is not mentioned in AR2 (nor is it listed as a project activity in the logframe). Please provide more detail (and results).**

All five project Outcomes are linked to pre-breeding research, with refence to the hybrids mentioned. The use of pre-breeding research on the website and the Stage 2 application was simply a means of explaining the work in a slightly different way. In the main project paper, *A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development* (Outcome 1; Activity 1.3), we carefully detail and discuss interspecies hybrids (*C. canephora* x *C. eugenioides, and C. liberica* x *C. eugenioides*), and other matters of pre-breeding research, with direct reference to Uganda coffee natural capital.

10. Risk Management

Output 1. Activity complete. No remaining risks.

Output 2. From farm to cup, coffee production is risk laden. Most of the risk comes at the early stages of production, especially at the farm-level, but also up until the point that it is exported. Ensuring coffee quality, and hence the unit price received by farmers, is especial risky. Poor quality coffee means low prices for farmers. This is not a new risk to the project, but one that has become increasingly more apparent over the reporting period. In order to reduce this risk, we have dedicated more effort (to ensure quality, through increasing farm training for the core group (of 10) farmers involved in the project (i.e. those receiving raised beds; Indicators 2.1,2.2), and an increase in the number of samples/sensory evaluations (Indicator 10.5). A considerable part of this additional work has been taken up by project partners Kyagalanyi Coffee Ltd. (KCL). In addition, coffee hulling (removal of dried pulp to produce clean coffee) is being undertaken off-site at a local hulling station, as the current project volumes are unsuitable for the processing capacity set up at KCL. This eliminates the risk of contamination from other types of coffee, which is a concern when dealing with a large volume (e.g. 20 mt/hour) processing facility (i.e. KCL).

Failure to ensure quality means lower prices for farmers, which whilst being a risk for project delivery (Output 2) is of negligible risk for farmers, as the project and private sector partners bear the risk. For the farmers, training and provision of processing equipment, ensures that project intervention can only be positive. Moreover, the project has demonstrated that there is substantial potential for increasing income from the farmer's Liberica-excelsa coffee, primarily because we have shown that the intrinsic quality of the coffee can deliver a substantial price differential.

Output 3. Minor risks only. One of the climate recording loggers (air temp and humidity) was stolen, and three (soil sensor) loggers were water damaged. Mitigation: visible loggers provided with improved security; soil logger capsules improved to prevent ingress of water.

Output 4. No new risks identified.

Output 5. No risks were identified.

11. Other comments on progress not covered elsewhere

Refinements. Kyagalanyi Coffee Ltd. (KCL) have taken on the responsibility for financing the purchasing of Liberica-excelsa coffee from Zirobwe, rather than Clifton Coffee. This has increased KCLs participation in the project.

Enhancements. Our additional project output paper (Davis, A.P., Kiwuka, C., Aisyah, F., Walubiri, J.M., Kalema, J. (2022). The re-emergence of Liberica coffee as a major crop plant. Nature Plants 8: 1322–1328) and the main peer-reviewed research output (Davis, A.P., Kiwuka, C., Aisyah, F., Mulumba, J., Kalema, J. (2023). A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development. Frontiers in Plant Science 13: DOI=10.3389/fpls. 2022. 1057317) has served to fuel additional interest in Liberica-excelsa in Uganda and worldwide, particularly as it includes key agronomy data and related benefits for coffee farmers. The information for both papers was collected during the project and represents a significant enhancement. See also 12. Sustainability and Legacy.

Plant diversity (biodiversity) data were collected for four humid-forest protected areas, as well as threats (see Annex 4), and these added to the main project publication for AR3.

We are endeavouring to collect additional gender metrics (see above).

Exit strategy. In our original exit strategy, we stated that we would seek either private or public sector funding to develop Liberica-excelsa and eugenioides, and other key areas of the existing project. We have now received substantial funding as part of a large project on neo-domestication, from private benefactors. The new project, which will run for 3–5 years, will continue to build (directly) on the Outcomes and Outputs of our Darwin Project, with four of the five original project partners (Kew, NARO, Makerere University, and KCL).

Project personnel changes. Josh Clarke resigned from Clifton Coffee Ltd., to take up a position at another coffee company. Josh's replacement, and the nature of the relationship with Clifton is pending.

12. Sustainability and legacy

Legacy/sustainability. Considerable interest remains across the project partnership and engagement has increased across stakeholders in Uganda, at national and local levels. Outside Uganda, we have engaged with the coffee community at large, particularly concerning the development and purchase availability of Liberica-excelsa coffee, and eugenioides coffee. We have also been advising and sharing lessons learnt with other projects developing Liberica coffee, in Africa (Sierra Leone, Guinea, South Sudan) and Asia (India, Malaysia, and Brunei).

Discussions are underway with stakeholders on how to secure effective protection for Zoka forest reserve. Zoka contains some of the most valuable crop wild relatives for Uganda (e.g. rice and coffee), and yet is probably the most threatened protected area in Uganda.

The follow-on project (see Section 11 (above) aims to build further capacity and impact, ensure Darwin project legacy, and to take sustainable benefits to scale (e.g. coffee sector sustainability, farmer income and livelihood improvement, within the framework of mainstreaming biodiversity conservation).

Open Access plan. All published outputs are either open access or freely available. We are open to engagement with any organization, although almost all activities come under the jurisdiction of Ugandan authorities, and in particular transfer or use of genetic resources.

Exit strategy. Our exit strategy is still valid (see 10, above). A sustained legacy is part of the exit strategy (see above).

13. Darwin Initiative identity

Project presentations undertaken for AR3, which includes UK (e.g. government ministers, DEFRA) and Ugandan governments, students (MSc students), the private sector (e.g. the beverage sector, risk and insurance companies), coffee industry symposia, either carry the Darwin logo or the work is identified as a Darwin Initiative project. In all media work we endeavour to inform journalists that the work was a supported by the Darwin Initiative, but many journalists do not include these details in their articles. However, we have had success on this front (see Annex 4). Via direct engagement, the UK government has been informed of the project and its outcomes, during visits to RBG Kew. So far, not formal recognition has been made, but our experience with other DI projects is that this comes later, post-project. In Uganda, various government and quasi-government departments are aware of our Darwin Project (Annex 4).

In mid-December 2022 the Nature Publishing Group decided to host a press release of the first project paper. Given the timing, i.e. close to Christmas, Kew did not have the availability to do their own press release but provided support for the press release. The press release generated considerable media interest, with a fair number of online articles, including leading national and international news outlets (including the BBC), blogs, radio interviews and social media. The *Nature Plants* paper has received almost 10,000 views on the NP journal website; it can be accessed free of charge via ReadCube https://rdcu.be/c1GZf. The second main paper (published Feb 2023) was not covered by a press release but has driven well above average media interest. The number of reads for the *Frontiers* paper (main project research output) is not yet know, as there is a technical problem with the Frontiers website; the reads have been fixed at 542 since the paper has been published; reads are estimated to be in the thousands. For both papers, the DI is clearly identified as the funder. Notifications were sent to Darwin/BCF for social media purposes (Twitter). Media metrics are provided in Annex 4, although these have shot up since 1 April 2023.

14. Safeguarding

Has your Safeguarding Policy been updated in the past 12 months?		~~Yes~~/No
Have any concerns been investigated in the past 12 months		Yes/No
Does your project have a Safeguarding focal point?	~~Yes~~/No [*If yes, please provide their name and email]*	
Has the focal point attended any formal training in the last 12 months?	~~Yes~~/No [*If yes, please provide date and details of training*]	
What proportion (and number) of project staff have received formal training on Safeguarding?		Past: % [and number] 20% Planned: % [and number] not known
Has there been any lessons learnt or challenges on Safeguarding in the past 12 months? Please ensure no sensitive data is included within responses. We have nothing to report.		
Does the project have any developments or activities planned around Safeguarding in the coming 12 months? If so please specify.		

Nothing planned. RBG Kew has strict guidelines and policies for safeguarding, and we receive training in safeguarding procedures and protocols. The project partners have their own safeguarding policies and procedures. We have no safeguarding concerns at the present time.

15. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2022 – 31 March 2023)

Project spend (indicative) since last Annual Report	2022/23 Grant (£)	2022/23 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Monitoring & Evaluation (M&E)				
Others (see below)				
TOTAL			**1.78%**	

Percentage variance for 2022/23 is based on **£62,254.75** budget and **£61,141.74** actual.

Table 2: Project mobilising of matched funding during the reporting period (1 April 2022 – 31 March 2023)

	Matched funding secured to date	Total matched funding expected by end of project
Matched funding leveraged by the partners to deliver the project.	[redacted]	
Total additional finance mobilised by new activities building on evidence, best practices and project (£)		

16. OPTIONAL: Outstanding achievements or progress of your project so far (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: Report of progress and achievements against Logical Framework for Financial Year 2022-2023

Project summary	SMART Indicators [and Activities]	Progress and Achievements April 2022 - March 2023 Meana of verification (see Annex 4 for evidence)	Actions required/planned for next period
Impact Sustainability of the Ugandan coffee sector for environmental (biodiversity, ecosystem services, climate resilience, conservation of forest and genetic resources) and livelihood benefit (increased household income, reduced risk, social improvement)		Data collection and activities on schedule, for achievement of impact	
Outcome A resilient and sustainable coffee sector supported by the use of coffee natural capital, demonstrating the value of native forests for their long-term conservation	**0.1** A greatly Improved knowledge base for Uganda's coffee natural capital, (*C. liberica*, *C. canephora*, *C. eugenioides* and *C. neoleroyi*), including conservation status (regional IUCN Red List assessments), biotic (phenology, morphological variation) and abiotic data (e.g. habitats, climate envelopes). By Yr 3. **0.2** Evidence of production and procurement of Liberica coffee at Luwero, as an example of the viability of scaling up commercial production for this indigenous coffee species. By Yr 3. **0.3** Data provided on biodiversity, ecosystem service and climate resiliency data, for Liberica coffee farming, compared to robusta coffee and non-shade farming systems. By Yr 3. **0.4** Production of agronomy data via field trials for the high-value indigenous species *C. eugenioides*, with a view to commercial production. By Yr 3. **0.5** Assembly of project outcomes into a public document that provides key	**0.1.** Data and analyses gathered for project and published in two research papers: Davis, A.P., Kiwuka, C., Aisyah, F., Walubiri, J.M., Kalema, J. (2022). The re-emergence of Liberica coffee as a major crop plant. Nature Plants 8: 1322–1328. Davis, A.P., Kiwuka, C., Aisyah, F., Mulumba, J., Kalema, J. (2023). A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development. Frontiers in Plant Science 13: DOI=10.3389/fpls. 2022. 1057317.	**0.1.** Completed AR3. No further action required. **0.2.** Collect and archive procurement data. **0.3.** Finalize biodiversity reports by adding final data. Continue to record and archive climate data; and finalize project reports. **0.4.** Continue planting of *C. eugenioides*; record field data and add to reports. **0.5.** Complete public-facing document (project summary report): The Indigenous

	information on Uganda's coffee natural capital, for: (i) the conservation of its four indigenous coffee species; (ii) the biodiversity and ecosystem service benefits of coffee and indigenous coffee production; (iii) the development of these resources for the sustainable development of the country's coffee sector (including improved incomes for coffee farmers); and (iv) demonstration of the value of preserving Uganda's humid forests (i.e. indigenous coffee species used as a flagship and rationale for forest conservation). (v) Indigenous variants of *C. liberica* and *C. eugenioides* brought into cultivation (in project farms and research stations (NARO) as part of increasing *ex situ* conservation capacity. By end Yr 3.	**0.2.** Second round of procurement being undertaken at time of writing report (see below). **0.3.** First version of report written, ecosystem service and climate resiliency data gathering systems in place and collecting data; report drafted (see below) **0.4.** *Coffea eugenioides* field trials underway (see below). 0.5 Assembly and archiving of data has been completed; narrative text in draft form; drafting of public report underway (see below).	Coffee Resources of Uganda; finalize production of report (with printers) and disseminate via hard-copy and web-available pdf.
Output 1. A critical survey of Uganda's coffee natural capital (wild species diversity, distribution, and conservation threat).		Evidence provided below, in sections 3.1 and 3.2 of report and Annex 4.	
1.1. The completion of 1 multi-field database (Access), containing all field survey data and herbarium data. By end Yr 3.		Completed under AR3 (November 2022).	Completed. No further action required.
1.2. Delivery of 1 two-day training course on GIS data collection and QGIS, including basic species distribution modelling (SDM) and production of IUCN Red List metrics (GeoCat). By end Yr 2.		Completed under AR3 (March 2022).	Completed. No further action required.
1.3a. Production of 1 critical survey of Uganda's coffee natural capital (wild species diversity). By mid Yr 3.		Completed under AR3 (February 2022). See Outcomes, above	Completed. No further action required.
1.3b. Production of regional IUCN Red List conservation assessments for Uganda's coffee species. By mid Yr 3.		Completed under AR3 (February 2022). See Outcomes, above	Submission to IUCN pending.

Output 2. Development of Liberica coffee production and establishment of producer-purchaser relationship at Luwero. Demonstration of Liberica as an important third coffee crop species for Uganda.		Evidence provided below, in sections 3.1 and 3.2 of report and Annex 4.	
2.1. Provision of coffee drying bed equipment (wooden posts; wire mesh, nails, plastic sheet), and associated equipment (tools), for 10 farms. 10 drying bed units per farm (100 units in total). By end Yr 2.		Completed under AR3 (September 2022); plus provision of tarpaulins.	Completed. No further action required.
2.2. Provide training in coffee harvesting, processing, value chain management and basic agronomy (300 community members: with equal gender participation, for 5 farms). End Yr 2. Repeated in Year 3 (i.e. 600 community members and 10 farms in total over project duration). By end of Yr 3.		Completed under AR3; ongoing until end of project (Sep 2023).	Continue support until end Sep 2023, with a focus on those providing coffee for export.
2.3. Ensure pre-shipment processing (milling, sorting and grading), evaluation, and export to UK, for 5,000 kg (2,500 kg per year) of clean, quality coffee. Yrs 2 & 3.		c. 1,100 kg of clean coffee was purchased in April 2022 (AR3), and 160 kg clean coffee exported to UK in July 2022. c. 1,500 kg purchased (for export) under AR3 (March 2023); further purchasing to come in April 2023.	Finalize coffee purchases from farms, report on total volume purchased and price, and arrange export (Kyagalanyi Coffee Ltd.).
2.4. Distribution of farmer payments (premium of 15–30% per unit price [$/lb]), above commodity (global) or national coffee prices, for participating farms. Yrs 2 & 3.		In AR3 period (April 2022). Farmers were paid 5,000 UGX per kg of dried cherry (= c. 10,000 UGX [$2.60]) clean coffee), compared to base (robusta) price of 7,200 UGX. A 39 % increase in unit price for farmers. In March 2023 (AR3) farmers were paid 4,500 UGX per kg of dried cherry (= c. 9,000 UGX [$2.40]) clean coffee), compared to base (robusta) price of 7,600 UGX. An 18% increase in unit price for farmers.	Provide evidence of coffee payments for 2023); export c. 3,000 kg of coffee (Kyagalanyi Coffee Ltd.).

2.5a. Sensory evaluation for 10 Liberica coffee samples. Yrs 1, 2 & 3.	Seven samples were evaluated in the AR3 period (June, October 2022; March 2023).	Collate reports and write summary for project completion.
2.5b. Caffeine and basic chemical analysis for 10 Liberica coffee samples. End of Yr 2.	Completed in AR2 review period.	Archive reports and write summary for project completion.
2.6. Provide nursery set-up and training to establish 1 Liberica seedling nursery for Luwero. Sale of 400 seedlings over course of project [e.g. 5 farms supplied with replacement stock; and 5 new farms with founding stock, per year]. By mid-year 3.	Completed in AR2 review period.	Completed. No further action required.
Output 3. Demonstration of biodiversity value, ecosystem service provision, and climate resiliency potential for Liberica coffee production.		
3.1. Install agrometeorological survey equipment (soil moisture, ambient air temp., humidity) for six farms/sites (Liberica cultivation vs. non-forest crops) using the latest logger and probe technology. Provide short report.	Climate recoding equipment was installed in period of AR2.	Collect remaining data and finalize report.
3.2. Extend agrometeorological survey equipment to measure soil moisture at a range of soil depths, and measure soil water potential at four (of the six) farm sites (Liberica cultivation vs. other crops) and over a depth gradient. Provide short report.	Climate recoding equipment was installed in period of AR1 & AR2.	Collect remaining data and finalize report.
3.3. Undertake pest and diseases survey at the six farm sites by regular measurement of pets and diseases incidence and severity (Liberica vs. robusta coffee), and supplement using farmer survey. Provide short report.	Completed under AR2 report period.	Completed. No further action required.
3.4. Construct a drought-induced field trial for Liberica (vs. robusta) coffee in Kampala (and one other location), using plots of 100 plants each) and record physical growth and stress metrics (at early stage development). Provide short report.	Planting of three trials completed under AR2 report period.	Collect final data and complete report.
3.5. Undertake malaise trapping survey of invertebrates, with a focus on predator species; and botanical transects for six farm sites (Liberica cultivation vs. other crops). Provide short report.	Mostly under AR2 and AR3 report period.	Complete remaining botanical transect work in first two quarters of 2023 . Add last section of work to report.
Output 4. Output 4. Provide data for the suitability of C. eugenioides as a high-value niche crop for forest-based communities.		
4.1. Set up two trial plots for *C. eugenioides* coffee, one in Kampala (1500 m asl) and another either at second NARO research station at higher elevation (1700–2000 m asl), or another suitable site. Each plot to contain 50 plants.	Plot 1 planted in AR3 period (April/May 2022)	Continue propagation of stock for Plot 2, for planting post project.

Activity 4.2. Record physical growth and stress metrics (at early stage development) and pest and disease incidence.	Data recording ongoing.	Continue data recording.
Output 5. Production of Wild Coffee Resources Strategy for Uganda.		
5.1. Set up and hold three half day meetings (one per year) with project members and key stakeholder (e.g. government, NGOs and private-sector stakeholders), at a neutral locality (hotel or conference room) to discuss project rationale and direction (Year 1), progress (Year 2) and outputs and advocacy (Year 3). Feedback from meetings used as part of M&E for adaptive management processes.	Main stakeholder/project (one-day) meeting held in Kampala in AR3 period (12 January 2023).	Finalize and distribute minutes (discussion and outcomes) of meeting to participants. Organize final, end of project meeting in the last quarter of project for project board.
5.2. Assemble project data and outcomes from Output 1–4 and write draft strategy (summary report) text. Send to partners/co-authors for review and comment. Yr 3	Draft text for summary report completed.	Finalize text.
5.3. Produce maps and other GIS outputs, graphs and infographics. Send to partners/co-authors for review and comment. Yr 3.	Maps (and other GIS outputs) and infographics produced; artwork (coffee illustrations 75% complete).	Finalize all graphics (1 June 2023)
5.4. Send all materials (draft strategy) to publishers (GoAgency, UK) for design and production. Co-authors to review pdf, comment and provide revisions and edits; send marked up draft back to publishers. Publishers to update, provide version for sign off, and then print hardcopies and provide low and high resolution pdfs. Yr 3.		To commence at the start of Quarter 2 (2023). Finalize report and send to printers.
5.5. Organize and undertake shipping to Uganda, and then delivery to stakeholders in Uganda. Upload pdf to ResearchGate and Kew website, and hopefully partner institute websites. Yr 3.		Disseminate hardcopies by hand; and on-line (PDF), Qtr 3.

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: Sustainability of the Ugandan coffee sector for environmental (biodiversity, ecosystem services, climate resilience, conservation of forest and genetic resources) and livelihood benefit (increased household income, reduced risk, social improvement)			
Outcome: A resilient and sustainable coffee sector supported by the use of coffee natural capital, demonstrating the value of native forests for their long-term conservation.	**0.1** A greatly Improved knowledge base for Uganda's coffee natural capital, (*C. liberica*, *C. canephora*, *C. eugenioides* and *C. neoleroyi*), including conservation status (regional IUCN Red List assessments), biotic (phenology, morphological variation) and abiotic data (e.g. habitats, climate envelopes). By Yr 3. **0.2** Evidence of production and procurement of Liberica coffee at Luwero, as an example of the viability of scaling up commercial production for this indigenous coffee species. By Yr 3. **0.3** Data provided on biodiversity, ecosystem service and climate resiliency data, for Liberica coffee farming, compared to robusta coffee and non-shade farming systems. By Yr 3. **0.4** Production of agronomy data via field trials for the high-value indigenous species *C. eugenioides*, with a view to commercial production. By Yr 3. **0.5** Assembly of project outcomes into a public document that provides key information on Uganda's coffee natural capital, for: (i) the conservation of its four indigenous coffee species; (ii) the biodiversity and ecosystem service benefits of coffee and indigenous coffee production; (iii) the development of these resources for the sustainable development of the country's coffee sector (including improved incomes for coffee farmers); and (iv) demonstration of the value of preserving Uganda's humid forests (i.e. indigenous coffee	**0.1** Publication of 1 open access research paper and 4 regional IUCN Red List assessments, authored by the project team. **0.2** Accounts/records/orders: for project equipment expenditure and sales/purchases of Liberica coffee from Luwero. **0.3** Availability of: 2 years of climate data (including soil-water) from 6 sites; biodiversity data from 6 sites; and 2-year field trial (2 plots) data, for Liberica coffee. **0.4** Availability of at least 1 year's agronomy field trial data (2 field trial plots) for *C. eugenioides.* **0.5** Publication of *Wild Coffee Resources Development Strategy;* dissemination to key stakeholder and free availability via open access. **0.5 i – iv** These elements included in the strategy document. **0.5 iv** Meetings to demonstrate, via coffee natural capital, the value of preserving Uganda's humid forests, with key organizations: the National Environment Management Authority; the Uganda National Commission for United Nations Educational, Scientific and Cultural Organisation (UNESCO); and the Man and Biosphere (MAB) Programme Committee. To include lessons learned and benefits encountered from coffee biosphere designation in Ethiopia (see 5.1, below) **0.5 iv** Accession information for farms and research stations.	**0.2** The market requires Liberica Coffee (evidence to support this comes from producer and purchaser interest/demand)**.** **0.3**. Liberica coffee offers greater climate resiliency potential over robusta coffee (feedback from farmers and pilot field data supports this assumption, with further study urgently required). **0.4** Consumer purchase prices place *C. eugenioides* in the (very) high value category, but expectations need to be managed to encompass possibility of a broader price structure across the value chain. Farmers remain interested in growing non-standard crop species (see notes on Output 4 assumption) **0.5** Key stakeholders will require tangible demonstration of conservation benefits, viability of conservation mainstreaming activities, commercial application, and livelihood benefits.

	species used as a flagship and rationale for forest conservation). (v) Indigenous variants of *C. liberica* and *C. eugenioides* brought into cultivation (in project farms and research stations (NARO) as part of increasing *ex situ* conservation capacity. By end Yr 3.		
Outputs: **1**. A critical survey of Uganda's coffee natural capital (wild species diversity, distribution, and conservation threat).	**1.1** The completion of 1 multi-field database (Access), containing all field survey data and herbarium data. By end Yr 3. **1.2** Delivery of 1 two-day training course on GIS data collection and QGIS, including basic species distribution modelling (SDM) and production of IUCN Red List metrics (GeoCat). By end Yr 2. **1.3a** Production of 1 critical survey of Uganda's coffee natural capital (wild species diversity). By mid Yr 3. **1.3b** Production of regional IUCN Red List conservation assessments for Uganda's coffee species. By mid Yr 3.	**1.1** Receipt of database by NARO and Makerere, with e-mail or letter confirming receipt and correct functioning. **1.2** Register of attendance for training courses (with equal gender allocation for 16-20 students/researchers). **1.3a** Publication of an open access research paper: *Wild coffee species diversity of Uganda, and its value for coffee sector sustainability* (Receipts for travel to UK for James Kalema. **1.3b.** Submission of 4 regional conservation assessment to IUCN Red List portal.	**1.1 & 1.3** Timelines assume that the COVID-19 situation in Uganda doesn't significantly worsen, and that fieldwork can occur in Yr1 (if this assumption fails to hold true, more intensive fieldwork in Yr2 would compensate). **1.2** Owing to the worsening COVID-19 situation in Uganda, and the UK, the training course in Uganda may be suspended (now proposed for Yr 2).
2. Development of Liberica coffee production and establishment of producer-purchaser relationship at Luwero. Demonstration of Liberica as an important third coffee crop species for Uganda.	**2.1** Provision of coffee drying bed equipment (wooden posts; wire mesh, nails, plastic sheet), and associated equipment (tools), for 10 farms. 10 drying bed units per farm (100 units in total). By end Yr 2. **2.2** Provide training in coffee harvesting, processing, value chain management and basic agronomy (300 community members: with equal gender participation, for 5 farms). End Yr 2. Repeated in Year 3 (i.e. 600 community members and 10 farms in total over project duration). By end of Yr 3. **2.3** Ensure pre-shipment processing (milling, sorting and grading), evaluation, and export to UK, for 5,000 kg (2,500 kg per year) of clean, quality coffee. Yrs 2 & 3.	**2.1** Bills of sale for drying bed and associated equipment, and signed document of receipt from farmers. **2.2** Attendance data for training courses (with gender disaggregation recorded). 600 community members in total. **2.3** Copies of procurement and export documents, for coffee sales/export. **2.4** Export documentation (or similar) to indicate premiums paid to cooperatives /farms. **2.5a** Cupping (taste and aroma) and defects report for 10 samples, from KCL & Clifton Coffee. **2.5b** Chemistry report on 10 samples, from RBG Kew. **2.6a** Bills of sale/receipt for potting bags and other materials. **2.6b** Records for sales (number and price) of seedlings.	**2.1** & **2.2**. These are low risk activities for the project as they are routinely carried out by Kyagalanyi Coffee Ltd. (KCL) to train robusta coffee farmers **2.3** There are a number of risks involved in ensuring shipping quantities. We have set a realistic estimate for our shipping volumes. We will have a dedicated agent working with farmers at Luwero, and a Ugandan-based coffee export company working on the project, which should ensure that targets are met. **2.4** Farmers will receive a fair price for Liberica coffee (Farmers and exporters are aware of coffee price volatility and the risks that this brings. Setting a premium will help to offset some of the risk for farmers; the broad premium range (%) should incentivise production targets (and quality). Ideally, Liberica

	2.4 Distribution of farmer payments (premium of 15–30% per unit price [$/lb]), above commodity (global) or national coffee prices, for participating farms. Yrs 2 & 3. **2.5** Sensory evaluation for 10 Liberica coffee samples, to include caffeine and basic chemical analysis. Yrs 1, 2 & 3 (sensory), and end of Yr 2 (chemical). **2.6** Provide nursery set-up and training to establish 1 Liberica seedling nursery for Luwero. Sale of 400 seedlings over course of project [e.g. 5 farms supplied with replacement stock; and 5 new farms with founding stock, per year]. By mid Yr 3.		coffee from Luwero would be decoupled from the commodity market and farmers would receive a non-market (e.g. speciality coffee) price, but we cannot guarantee this outcome over the course of the project.)
3. Demonstration of biodiversity value, ecosystem service provision, and climate resiliency potential for Liberica coffee production.	**3.1** Provide agrometeorological survey (Liberica cultivation vs. non-forest crops) for 6 sites. Completed by early Yr 3. **3.2**. Provide soil water survey, (Liberica cultivation vs. other crops) and over a depth gradient, for 4 (of the 6) sites/farm locations. Completed by early Yr 3. **3.3** Provide pest and diseases survey (Liberica vs. robusta coffee), over 6 sites/locations. Completed by early Yr 3. **3.4** Undertake drought-induced field trials, via 2 plots [100 plants for each plot], for Liberica vs. robusta coffee. Completed by early Yr 3. **3.5** Provide data on biodiversity differences between coffee and non-coffee producing farming areas, 6 sites in total. Completed by early Yr 3.	**3.1 & 3.2** Production of climate and soil water data database, plus graphs and analyses, with results summarized in a brief summary report (c. 10 pages). **3.3** Production of 1 pest & disease survey, plus wider household survey across Luwero region, available as a short report (5 pages). **3.4** Production of field trial data within 1 report (5 pages). Photographs of plots. Receipts for plot expenses (materials and labour). Receipts for travel to UK for Catherine Kiwuka (Yr 2 or 3) **3.5** Production of biodiversity survey report (5 pages). Photographs of plots. Receipts for transect expenses (materials and labour).	**3.1 & 3.2** Climate data collection equipment is not damaged or interfered with (gathering in situ climate data is a vital but rarely undertaken activity, due to certain risks and difficulties. In particular, climate data (loggers and sensors) may be stolen, interfered with (e.g. by children), or damaged by animals. We are mitigating these risks by using buried and cryptic sensors, which we have developed and tested by us over the last 8 years. The only in situ climate data for coffee In Uganda is from (old) books and non-accessible reports. The climate data gathered for the project will be gathered using project equipment, and robust on-line resources. We will not be relying on third parties for data, which is risk laden.) **3.3 to 3.5** Field work activities run to schedule without interference (Gathering field data from plots and transects can be challenging due to circumstances beyond the knowledge or control of the researcher. We are mitigating these risks by undertaking the field work in areas

			known to us, that are close to Kampala (and Makerere University), and for which we have dedicated personnel and sufficient resources. Project partners in Uganda have long-standing experience of this type of work.)
4. Provide data for the suitability of *C. eugenioides* as a high-value niche crop for forest-based communities.	**4.1** Set up of 2 trial plots [with 50 plants per plot] for *C. eugenioides* at 2 locations/elevations. By mid-Yr 2. **4.2** Provide base-line agronomic data for *C. eugenioides* coffee from the 2 field trials. Completed by mid Yr 3.	**4.1** Photographs of plots. Receipts for plot expenses (materials and labour). **4.2** Production of field trial data and report (c. 5 pages).	Farmers remain interested in growing non-standard crop species (For this project, we have farmers that have expressed interest in pursuing forest/niche coffee production, and the cultivation of *C. eugenioides*. Anecdotal information suggests that forest communities have tried to develop forest coffee.)
5. Production of Wild Coffee Resources Strategy for Uganda document	**5.1** Meetings held (1 per year) with public and private sector strategy steering committee. End Yrs 1–3. **5.2** Project data assembly and synthesis of outcomes from Outputs 1–4. Completed by mid Yr 3. **5.3** Production of c. 5 maps/ infographics and other GIS resources**.** By end Yr 3. **5.4** Production of 1 professionally produced publication: Wild Coffee Resources Strategy, with conservation status reports for four coffee species (*C. liberica*, *C. canephora*, *C. eugenioides*, *C. neoleroyi*) and their habitats (forests). Completed by mid Yr 3. **5.5** Dissemination of 200 hardcopies in Uganda (50 in UK and elsewhere) and placement of freely available pdf on the Internet (via Kew and partner websites; and Research Gate). Yr 3.	**5.1** Attendance lists, and accounts/receipts of expenses/costs, for 3 meetings; 3 sets of minutes distributed to attendees and interested parties. **5.2 & 5.3** Hardcopy of draft text and other materials for Wild Coffee Resources Strategy available, and sent to co-authors (e-mails to acknowledge receipt). **5.4** Invoice and final payment documents for production (design, printing and delivery) of Strategy (250 copies; c. 30 pages, with one page summary of key points)**.** **5.5.** Delivery receipt form for 200 hardcopies (signed by receiving institutes and organizations in Uganda). Pdf available on Research Gate and Kew website: on-line location provided; downloads metrics recorded.	**5.1** Stakeholders are willing and able to attend meetings (Risk of non-attendance mitigated by early announcement of dates and by keepings meeting short (1/2 day)). **5.5** Timely shipping and delivery of hard-copy (Risk of delays mitigated by planning export/income logistics early, and having a back-up plan).
Activities (each activity is numbered according to the output that it will contribute towards, for examples 1.1, 1.2 and 1.3 are contributing to Output 1) **Output 1**			

1.1 Gather and collate field survey data for all the coffee-holding forests of Uganda, with the collection of vouchers (and living material, where required), and ground observations (geo-location, habitat, vegetation, soil type, local extinction threats), for the species *C. liberica*, *C. canephora*, *C. eugenioides* and *C. neoleroyi* and their wild hybrids. Survey work will be based on a pre-survey review of herbarium collections at key herbaria.

1.2 Organize and run a two day course on GIS (QGIS), basic species distribution modelling (SDM), and conservation metric producing programmes (GeoCAT), at a dedicated venue for 16 to 20 Ugandan researchers/students.

1.3 Collate and analyse data from Activity 1.1, write paper and produce figures (maps and graphs) in collaboration with project partners. Send research paper to high impact journal for open access publication. Produce regional IUCN Red List conservation assessments for Uganda's coffee species, and submit them to IUCN via their portal.

Output 2

2.1 Purchase, deliver and install drying beds and associated equipment, for 10 farms.

2.2 Train 600 community members (over 10 farms), in two sets (300 farmers, 5 farms), with equal gender involvement, for coffee harvesting, processing, value chain management and basic agronomy; revisit farms to consolidate and monitor uptake and success of training.

2.3 Undertake the logistics and management required to ensure pre-shipment processing (milling, sorting and grading), evaluation (grading), and export to UK, for 5,000 kg of clean, quality coffee, over the lifetime of the project (with a focus on Yrs 2 and 3).

2.4 Revisit farms post-export to pay 15-30% quality premium, or pay premium as part of the Freight on Board (FOB) price; payments made directly to community members supplying quality coffee (on a per unit basis, i.e. per lb or kg produced).

2.5a Undertake quality evaluation using industry standard procedures (sensory characteristics (taste and aroma) and number and type of defects for 10 Liberica coffee samples from Luwero.

2.5b Undertake laboratory survey of caffeine content and basic coffee chemistry for 10 samples of Liberica coffee; these to be compared with sensory evaluation (2.5a).

2.6 Establish and maintain (within project lifetime) a Liberica coffee nursery at Luwero. Record number of seedling produced and sold, and all costs and income.

Output 3

3.1 Install agrometeorological survey equipment (soil moisture, ambient air temp., humidity) for six farms/sites (Liberica cultivation vs. non-forest crops) using the latest logger and probe technology. Provide short report.

3.2. Extend agrometeorological survey equipment to measure soil moisture at a range of soil depths, and measure soil water potential at four (of the six) farm sites (Liberica cultivation vs. other crops) and over a depth gradient. Provide short report.

3.3 Undertake pest and diseases survey at the six farm sites by regular measurement of pets and diseases incidence and severity (Liberica vs. robusta coffee), and supplement using farmer survey. Provide short report.

3.4 Construct a drought-induced field trial for Liberica (vs. robusta) coffee in Kampala (and on other location), using plots of 100 plants each) and record physical growth and stress metrics (at early stage development). Provide short report.

3.5 Undertake malaise trapping survey of invertebrates, with a focus on predator species; and botanical transects for six farm sites (Liberica cultivation vs. other crops). Provide short report.

Output 4

4.1 Set up two trial plots for *C. eugenioides* coffee, one in Kampala (1500 m asl) and another either at second NARO research station at higher elevation (1700–2000 m asl), or another suitable site. Each plot to contain 50 plants.

4.2 Record physical growth and stress metrics (at early stage development) and pest and disease incidence.

Output 5

5.1 Set up and hold three half day meetings (one per year) with project members and key stakeholder (e.g. government, NGOs and private-sector stakeholders), at a neutral locality (hotel or conference room) to discuss project rationale and direction (Year 1), progress (Year 2) and outputs and advocacy (Year 3). Feedback from meetings used as part of M&E for adaptive management processes.

5.2 Assemble project data and outcomes from Output 1–4 and write draft strategy text. Send to partners/co-authors for review and comment.

5.3 Produce maps and other GIS outputs, graphs and infographics. Send to partners/co-authors for review and comment.

5.4. Send all materials (draft strategy) to publishers (GoAgency, UK) for design and production. Co-authors to review pdf, comment and provide revisions and edits; send marked up draft back to publishers. Publishers to update, provide version for sign off, and then print hardcopies and provide low and high resolution pdfs.

5.5. Organize and undertake shipping to Uganda, and then delivery to stakeholders in Uganda. Upload pdf to ResearchGate and Kew website, and hopefully partner institute websites.

Annex 3: Standard Indicators

Table 1 Project Standard Indicators

DI Indicator number	Name of indicator using original wording	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
DI-A03	All indicators	Number of local/national organisations with improved capability and capacity as a result of project.	University Government organizations	Number of organisations	3	3	3	3	3
DI-A04	Activity 1.2. Organize and run a two day course on GIS (QGIS), basic species distribution modelling (SDM), and conservation metric producing programmes (GeoCAT), for 16 to 20 Ugandan researchers/students.	Number of people reporting that they are applying new capabilities (skills and knowledge) 6 (or more) months after training.	People	80% male; 20% female; Age 25-60. Public sector, within government departments; mostly genetic resources and biodiversity agents.		12	12	12	12
DI-A06	Activity 2.1. Provision of coffee drying bed equipment and associated equipment for 10 farms.	Number of people with improved access to **services** or infrastructure for improved well-being.	People	Families, i.e. equal gender assumed; Ages: 0-80; local community		50		50	50
DI-A07	Activity 5.1. Meetings held (1 per year) with public and private sector strategy steering committee.	Number of government institutions/departments with enhanced awareness and understanding of biodiversity and associated poverty issues5 .	Government institutions	Govt. and quasi-government. Organisations NARO NACORI UWA NFA UCDA Topics: Sustainable development; biodiversity, conservation.			5	5	5

DI Indicator number	Name of indicator using original wording	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
DI-B08	Activity 2.3. Ensure pre-shipment processing (milling, sorting and grading), evaluation, and export to UK, for 5,000 kg (2,500 kg per year) of clean, quality coffee. Yrs 2 & 3.	Volume of internationally traded products complying with sustainability standards .	5,000 KG (5MT) clean coffee	*Coffea liberica* var. *dewevrei* (excelsa coffee) Standard used; Volcafe Verified and Volcafe Excellence (recognised by the Global Coffee Platform (GCP) as Coffee SR Code equivalent, 2nd party assurance) https://www.volcafe.com/news/volcafe-launches-enhanced-responsible-sourcing-programme		c. 1.2 MT purchased	c. 1.2 MT purchased	2.4 MT	4.4 MT
DI-C02	Activity 1.3b. Production of regional IUCN Red List conservation assessments for Uganda's coffee species.	Number of new conservation or species stock assessments published .	Number	Coffea canephora, C. eugenioides, C. liberica, and C. neoleroyi. Flora; regional, IUCN Red List.			4	4	4
DI-C06	Activity 1.3a. Production of 1 critical survey of Uganda's coffee natural capital (wild species diversity). **2 publications were published**.	Number of downloads of new peer reviewed publications.	Number	Downloads per year			>10,000	>10,000	12,000

DI Indicator number	Name of indicator using original wording	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
DI-C12	Activity 1.3a. Production of 1 critical survey of Uganda's coffee natural capital (wild species diversity).	Social Media presence.	Number (metrics to be defined)	'By Social Media platforms'			5 months. Twitter 142, upper bound > 4 million; Facebook 2; Redditors 2, blogs 4; Mendeley 6. engagement)	As Year 3.	As Year 3. Total cannot be planned.
DI-C15	Activity 1.3a. Production of 1 critical survey of Uganda's coffee natural capital (wild species diversity).	Number of Media related activities.	Number	Internet/Print/Radio/Television, and sub-national/national/international			39 Internet; 3 print (UK); 2 national/international radio; national television (Channel 4)	As Year 3.	As Year 3. Total cannot be planned.
DI-C18	E.g. Articles published by members of the project team	E.g. Number of unique papers published in peer reviewed journals	Number	None			2	2	2

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author(s)	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)
The re-emergence of Liberica coffee as a major crop plant	Journal *Nature Plants*	Davis, A.P., Kiwuka, C., Aisyah, F., Walubiri, J.M., Kalema, J. (2022). Nature Plants 8: 1322–1328.	Male Authorship: 3 male: 2 female.	UK Authorship: 3 Ugandan: 2 UK.	Springer Nature Group	https://rdcu.be/c1GZf
A review of the indigenous coffee resources of Uganda and their potential for coffee sector sustainability and development.	Journal *Frontiers in Plant Science* Special issue: *Genetic resources: a hope for tomorrow.*	Davis, A.P., Kiwuka, C., Aisyah, F., Mulumba, J., Kalema, J. (2023). 13: DOI=10.3389/fpls. 2022. 1057317	Male & female* (60:40) Authorship: 60:40 male: female.	Uganda & UK, 2 Ugandan: 1 UK* Authorship: 3 Ugandan: 2UK. * Frontiers in Plant Science permits multiple lead authors	Frontiers Group	https://www.frontiersin.org/articles/10.3389/fpls.2022.1057317/full

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?	Yes
Is the report less than 10MB? If so, please email to BCF-Reports@niras.com putting the project number in the Subject line.	Yes
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.	No
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.	Yes
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.	No
If you are submitting photos for publicity purposes, do these meet the outlined requirements (see section 16)?	n.a.
Have you involved your partners in preparation of the report and named the main contributors	Yes
Have you completed the Project Expenditure table fully?	Yes
Do not include claim forms or other communications with this report.	