Department for Environment Food & Rural Affairs

DARWIN INITIATIVE

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Darwin Initiative Main Project Annual Report

To be completed with reference to the "Writing a Darwin Report" guidance: (http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms). It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)

Submission Deadline: 30th April 2018

Darwin Project Information

Project reference	23-034
Project title	Edible wild orchid trade: sustaining livelihoods and biodiversity in Zambia
Host country/ies	Zambia
Contract holder institution	RBG Kew
Partner institution(s)	Homegarden Landscape Consultants Ltd. (Zambia), Copperbelt University (Zambia), Sanga Research & Development (Zambia), Uppsala University (Sweden), Cape Institute of Micropropagation (South Africa), Orchid Seeds Stores of Scientific Use (UK).
Darwin grant value	£220,313
Start/end dates of project	1st June 2016 to 31st May 2019.
Reporting period (e.g., Apr 2017 – Mar 2018) and number (e.g., Annual Report 1, 2, 3)	April 2017 – March 2018 Annual Report No. 2
Project Leader name	Dr Ruth E. Bone
Project website/blog/Twitter	https://www.facebook.com/chikandaorchidconservation/
Report author(s) and date	Dr. Ruth E. Bone (PL), with contributions from Mr. Nicholas Wightman (Project Manager) and Project Partners Prof. Royd Vinya; Mr Paul Mumba, Mr Geophat Mpatwa, Dr. Sarina Veldman; Dr. Serene Hargreaves; Mr Jonathan Kendon.

1. Project rationale

Increased demand for orchid cake (Chikanda) in Zambia currently depends on exploitation of wild orchids (ca. 85-140 species in ≥4 genera) threatening species with extinction or extirpation. Harvesting levels are unsustainable and undertaken by low income rural community members (mostly women and girls in Zambia and neighbouring countries) who increasingly travel great distances to access the resource, jeopardising their personal safety. We seek to stem biodiversity loss and support vulnerable rural livelihoods that depend on this scarce resource by establishing a) cultivation methods in-country, with enhanced facilities and expertise b) community based management plans in rural areas to encourage sustainable harvest, and c) alternative sustainable income streams to support rural livelihoods in orchid harvest areas. These problems have been identified by ecologists, biologists and social science and conservation practitioners in Zambia (including partners on this project). The majority of project activities

are focused in North Western Province, Zambia, with some workshops, meetings and market research taking place in other towns and cities.

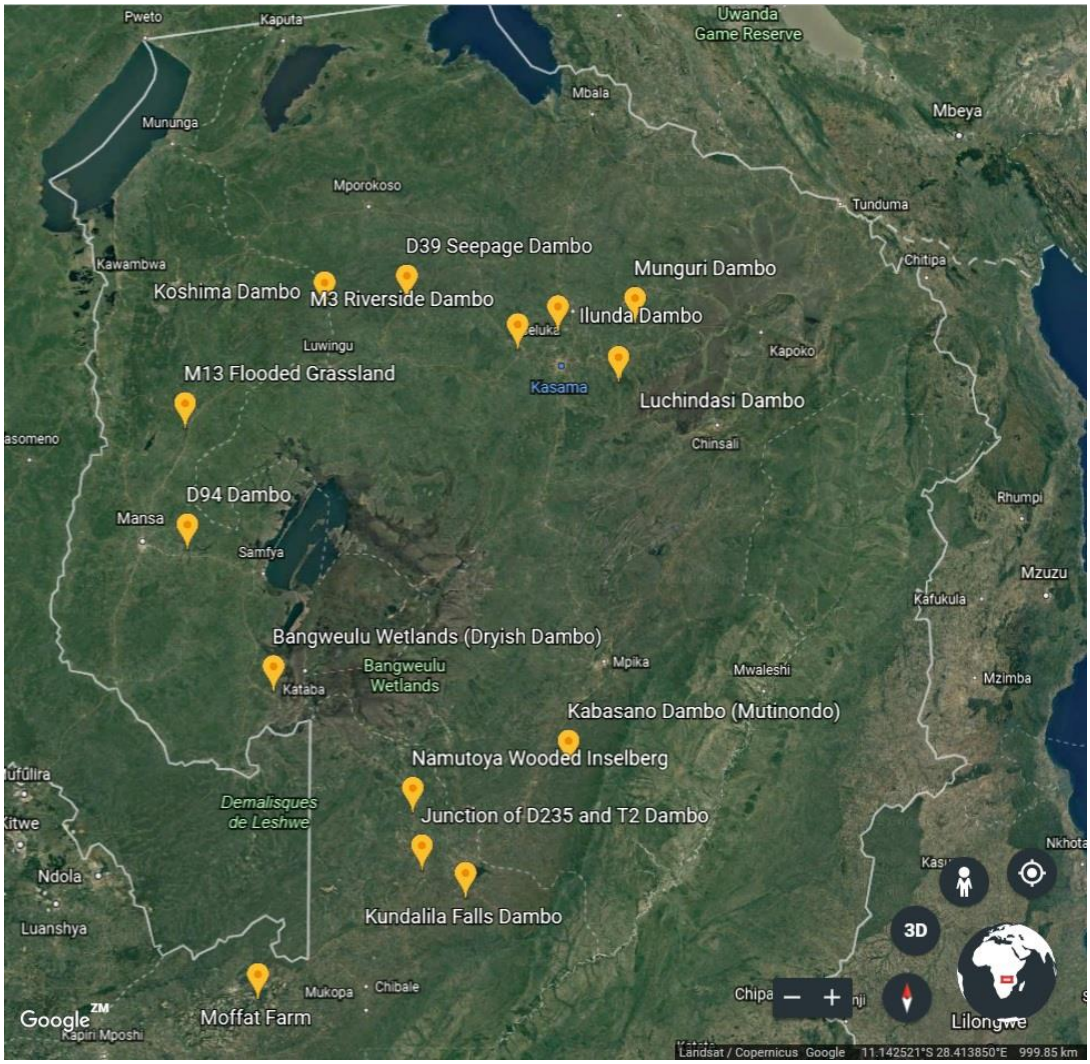

Fig 1. Google map illustrating localities of specimen and seed collection sites visited during fieldwork in February 2018, led by Project Manager Nicholas Wightman.

Fig 2. Project locations in Zambia: Mwinilunga District is the focus for livelihoods surveys and development of community based natural resource management plans led by Copperbelt University (Kitwe).

2. Project partnerships

The Royal Botanic Gardens Kew (UK) is the lead organisation, with several partner organisations in the project host country Zambia (Homegarden Landscape Consultants; Copperbelt University (CBU) School of Natural Resources; Sanga Research and Development), in addition to partners in South Africa (Cape Institute of Micropropagation) and Sweden (Uppsala University).

Homegarden Landscape Consultants (Project Management) – RBG Kew *partnership*

The project is over-seen by the Project Leader (PL) Ruth Bone at the lead institution (RBG Kew), with day to day management by the in-country Project Manager (PM) Nicholas Wightman (Homegarden Landscape Consultants Ltd., Zambia). Regular communications are maintained between the PL and PM via email and weekly/ fortnightly video-conferencing meetings.

Over the past year the PL (10% time commitment) has focused on project administration (partner agreements, partner and PM payments, drafting annual report), communications existing and new partners, forging new collaborations to sustain the project's legacy, and promotion to raise awareness of issues the project seeks to address.

Working in parallel with the PL, the PM Nicholas Wightman (50% time commitment) has had administration responsibilities (organising Workshop 3, permit applications for fieldwork, seed and voucher specimen shipments, drafting half yearly reports and writing the bi-annual newsletters) and project deliverables (interactive key using Lucid software; orchid seed storage and shipments; organising and leading fieldwork).

Successes include:

- The PM's abstract was accepted for presentation by the major African botanical congress (AETFAT), delivered in Nairobi, Kenya in May 2017 (Annex 4.1).
- The PM organised a two week field trip in collaboration with Dr. Benny Bytebier (a specialist in African terrestrial orchid taxonomy and co-chair of the IUCN Orchid Specialist Group Afro-Madagascar Orchid sub-group] and Francisco Llarena (a Peace Corps Zambia volunteer with interests in ecology and conservation).
- The PM organised all permits and logistics of travel in Zambia, and led the field team, ensuring additional orchid seed and herbarium voucher specimens were collected. Please refer to Appendix 4.2 for the trip report.
- Hand pollinations of orchids in PM's nursery – to yield more seeds- and cultivation from traded tubers to support efforts to document trade.
- Work with the PL on development of the interactive key for Chikanda orchid species.

Examples from the PL:

- Interviews with journalist Stephanie Pain leads to project featuring in the 6th May 2017 issue of *New Scientist* article "Eaten to Extinction" Annex 4.3.
- PL invited speaker as a member of the IUCN delegation, to present at a side event organised by orchid trade sub-group of the IUCN Orchid Specialist Group at the Plants Committee (PC23) meeting in Geneva (presentation ref. *Selling like Hot Cakes*, Annex 4.4)

- During fieldwork in 2017 to the team were part of the bid for Zambia to host AETFAT for the first time in the Congress's history. Thanks to the bid organisers and film co. the PL and PM were able to secure unused footage to promote this project. 15 min short film – focused on one collection trip (final edit pending May 2018).
- Invited panellist, LUSH Summit honey panel: honey alternative livelihoods, biodiversity conservation. Foreign links with LUSH as potential honey buyer to support rural community livelihoods seeking alternatives to Chikanda harvest/ trade.
- Meeting with Gaia Education Foundation, LUSH UK, Agents of Change Foundation Zambia, WWF Zambia and Zycala Project leader (Gaia-WWF Zambia), Edinburgh 16th April 2018 to discuss synergies (alternative livelihoods and Chikanda); and meeting with Agents of Change Zambia to plan Yr 3 project plan (youth awareness campaign and communications strategy).

Copperbelt University – RBG Kew partnership

Origins of relationship and demand from host country:

The 2015 Darwin Initiative grant proposal was developed by the PL with input from project partners. These included Prof. Royd Vinya (Dean of the School of Natural Resources at Copperbelt University) who acknowledged a demand among his lab and nursery staff for development of specialist orchid conservation biotechnology skills and expertise (seed collection methods, post-harvest handling, storage, sowing, isolation and culture of fungal symbionts) to complement existing *in vitro* expertise, facilities and specialist equipment, and to enhance experimental methods of orchid cultivation with techniques training provided by the project specialists.

The Copperbelt University (CBU) work programmes are led by Prof. Vinya, and are focused on:

- Cultivation of Chikanda orchids in Zambia (from seed using in vitro methods in the CBU lab; onward cultivation in the CBU nursery; development of household/ village nurseries).
- Community engagement (surveys to estimate household income and school absenteeism; documentation of Chikanda harvest trends (past and present), use and contribution to income in rural areas; participatory development of the orchid conservation action plan.

The lead organisation (Kew) does not have a role in the community engagement work and it is an area outside the expertise of the PL. In this partnership Kew is involved in CBU's work on orchid biotechnology methods. This work has primarily been delivered by Mr Jonathan Kendon for Kew (in vitro biology technician) who visited the team in Year and continues to support the team by correspondence and with procurement of additional lab equipment (please refer to Activities 1.7 and 3.5 for examples of complementary efforts being made by Kew and CBU to cultivate Zambia's terrestrial orchids).

The CBU team are currently dependent on the PM to supply seeds for cultivation trials. It would be advantageous for the CBU staff to develop seed collection strategies to ensure additional supplies of Chikanda orchid seeds, and seeds from additional locations to improve the genetic and species diversity of seed supplies.

Uppsala University – RBG Kew partnership

The majority of project work under this partnership was completed in Year 1. Additional lab work was undertaken by the Uppsala University MSc student in Year 2, due to delays caused by difficulties with DNA amplification of Chikanda tubers and cake samples; and to incorporate DNA sequences from the new project Reference collections, that became available early in Year 2. Co-operation among partners enabled added value to the MSc work.

Within RBG Kew, partnerships

Collaborations within Kew supported the continued extinction risk (IUCN Red List) work, thanks to the Head of Conservation Science's endorsement of two internship positions within the Plant Assessment Unit, in direct support of the Darwin project (geo-referencing ca. 600 herbarium specimens and completed assessments for 16 species, submitted to IUCN).

Dr Kazutomo Yokoya's post-doctoral research has been completed in the field and lab and Mr Jonathan Kendon continues to maintain the orchid mycorrhizal fungi in culture for symbiotic orchid culture. Jonathan has also continued to liaise with Mr Paul Mumba (in vitro biology technician at CBU) and has supplied additional lab equipment in Year 2 based on identified needs.

Honorary Research Associate Mr Philip Seaton (project manager of former Darwin project Orchid Seeds Stores for Scientific Use) delivered the third and final specialist skills workshop, with logistics support from the PM.

3. Project progress

3.1 Progress in carrying out project Activities

Output 1 Mitigation, Activities:

1.1 Year 1 Activity (completed and not reported here).

1.2 Local supplementary sustainable income streams identified (Year 1 Activity, but on-going):

Prior to project inception and during Year1, the PL met with ethical cosmetics company LUSH Ltd UK to scope collaboration (18th December 2015 and 11th July 2016) for development of an international market for honey products that may provide an alternative or supplementary income to communities dependent on the Chikanda edible wild orchid trade. Plans for development of honey markets were discussed (email and telephone) with Mr. Bob Malachi (Kasamba Honey Co. Ltd., Zambia) and Mr David Wainwright (Wainwright Honey and Tropical Forest Products, UK) who have worked together on honey production (using traditional Zambian bark hive methods) and supply to UK markets for many years (a partnership first developed during David's time living and working in Zambia as a VSO in the late 1970s). Sadly Bob Malachi passed away in August 2016.

In Project Year 2 the PL has continued to develop the collaboration with LUSH:

- Highlighting role of honey as an alternative livelihood for biodiversity conservation, as an invited member of the "honey panel" at the LUSH Summit 14-15th February 2018 in London
- Convened meeting on April 16th at UN House Edinburgh hosted by Gaia Education Foundation to develop a collaboration with the Zambian Youth for Conservation, Agriculture and Livelihood Action (ZYCALA) project, led by Gaia Education Foundation and WWF Zambia. In attendance: Gaia Education Foundation CEO May East (host), Agents of Change Foundation Zambia Executive Director, Brighton Kaoma, ethical honey buyer LUSH Ltd., Raquel Rubim, PL Ruth Bone, WWF Zambia Governance and Partnerships Manager, Mwape Sichilongo (via Skype), ZYCALA Project Manager Paddy Atkinson (via Skype).

Next steps: Following the recent Edinburgh meeting, the meeting participants agreed to seek evidence for Chikanda harvest and trade in the ZYCALA project areas. The PL has sought permission to share the DI project MSc thesis for this purpose, while WWF Zambia has immediately commenced survey work (April 2018). Export/ import permits for honey products from the ZYCALA Project communities will have to be secured for shipment to Europe and quality testing, before supply chains can be established and access to UK and international markets.

Fig. 3 Recent meeting in Edinburgh, exploring potential for alignment of the Zambian Youth for Conservation, Agriculture and Livelihood Action (ZYCALA) project aims with identification and development of alternative livelihoods (primarily honey products) for project community members with Chikanda-dependent livelihoods.

Photographed, left to right: Raquel Rubim, Ethical Honey Buyer, LUSH Ltd., PL Ruth Bone, youth leader (Agents of Change Foundation Zambia) Brighton Kaoma. Photo: May East.

1.3 Years 1 (completed) & 3 Activities.

1.4 Local-level enterprises and institutional structures established to support production and trade of cultivated orchids (Year 1 Activity but on-going):

In Yr 1 CBU staff Drs Gillian Kabwe and Jane Kwenye visited local women's groups in the project target areas to establish focus groups and develop institutional structures that will support production and trade of cultivated edible orchids. This was followed up in project Year 2 (December 2017) when Drs Kabwe and Kwenye undertook group formation activities (18th to 21st December 2017) in the project area (Mwinilunga, North-Western Province) in order to:

- Support development of well-structured groups in the communities
- Facilitate selection of group leaders
- Facilitate selection of group representatives who will visit the CBU lab and nursery facilities

Of the three project communities, only members of one community (Nyaminkada) were available to participate. Drs Kabwe and Kwenye report that "Most community members of Munwa and Kamau had moved to their farming sites and were unavailable." This work is also hampered by the slow progress of the Chikanda orchid cultivation work underway by the CBU and RBG Kew teams, meaning that cultivated orchids are not yet available for distribution to household nurseries. Please refer to Activities 1.7 and 3.5 below.

1.5 Training needs for local communities for orchid management, storage of tubers, and cultivation assessed (Year 1 Activity, delayed):

This activity has become integrated into 1.6 (below).

1.6 Participatory orchid management plan (including handling and storage of harvested tubers) formulated and implemented (Year 1 Activity, delayed):

In preparation for the draft participatory orchid conservation plan, in late August 2017 Prof Royd Vinya and nursery technician Mr Geophat Mpatwa (CBU) undertook work with communities in Mwinilunga to facilitate formulation of orchid conservation plans in three pilot villages. Through a series of visioning exercises, engaging community members that included natural resource user groups (such as charcoal producers, beekeepers, mushroom collectors in addition to Chikanda orchid collectors) the communities identified an agreed "vision" for self-determined orchid conservation.

For each of the three village communities, the workshops enable documentation of: Key challenges in Chikanda orchid harvesting, processing and marketing; A summary of past and present Chikanda

harvesting practices including governance (past and present) and proposed local regulations for future orchid harvesting.

This work has been delayed by a number of factors, including changes in community location to seasonal farming sites, mean that they were unavailable to attend continued engagement activities (cf. Annex 4.5 page 1). In a recent update Prof Royd Vinya (RV) leading these activities has explained that the process of formulating the plans will only be completed (scheduled this quarter) once the communities have completed farming activities. RV plans to convene a validation meeting to finalize the plan.

1.7 Cultivated orchid stock distributed to participating households (Year 2 Activity, delayed):

Suitable quantities of cultivated orchid stock are not yet available for distribution to participating households. Challenges include low quantities of orchid seed found during field surveys by the PM in Year 1; delays with securing permissions from the Zambian authorities to export seeds to Kew; once permissions were secured, delays with dispatch of seed batches by the PM (due to circumstances beyond our control, explained in confidential correspondence with the DI office), and low seed viability rates of the initial batches of seeds received by the project lab (cf. lab reports from *in vitro* biology technicians Mr Jonathan Kendon, Kew, and Mr Paul Mumba, CBU, Annex 4.6 and 4.7). Seed collection wok completed in Year 2 has been more successful, but seeds have only recently been sent to the CBU lab (Zambia) for germination and the shipment to the RBG Kew lab (UK) is dependent on permissions being secured from the Zambian authorities (application submitted mid-March 2018, approximately one month after fieldwork and still pending 6 weeks later).

A summary of activities, including challenges experienced, are described by Senior lab technician at CBU Mr Paul Mumba in the accompanying report (Annex 4.6). Successes and challenges include:

- CBU nursery and lab staff are currently using seeds collected around the time of the cultivation workshops held in 2017, and are dependent on new collections made by the PM.
- Mr Mumba reports that experimental work (during and following the Workshops in 2017) with non-Chikanda orchid *Liparis nervosa* was successful (631 plantlets established, now separated into 91 cultures)
- However putative Chikanda species *Disa erubescens* has taken almost a year to germinate and no transfer to the greenhouse have yet been possible. This is much slower than anticipated.

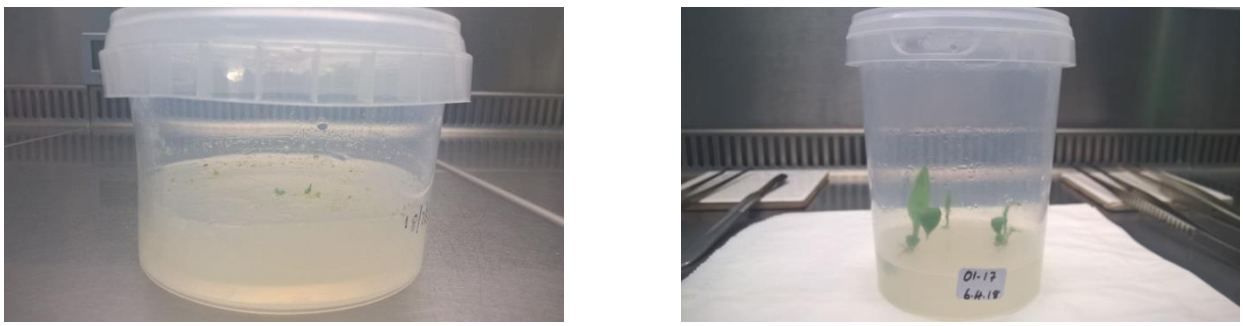

Fig. 4 Left: The first seeds to germinate (in August 2017) at the CBU labs, following the orchid biotechnology workshops in March and April 2017 (Photo: Nicholas Wightman). Right: Development of the same seedlings eight months later (April 2018) and one year after sowing (Photo: Felix Chileshe).

1.8 Year 3 Activity (not reported).

<u>Output 2 Capacity, Activities:</u>

2.1 CBU lab equipped for orchid culture; 3xCBU technical staff trained in asymbiotic orchid seed germination and culture methods (Year 1 Activity, however the second workshop took place in April 2017 at the beginning of Year2):

- Most of the project activities were completed in Year 1 (including procurement and installation of additional equipment required for orchid conservation biotechnology by CBU and Kew staff; and delivery and participation in specialist orchid culture methods).
- In Year 2 Jon Kendon (Kew) purchased additional lab items identified by the CBU team (e.g. water still). Please see the lab report provided by CBU Senior In Vitro Biology lab technician Mr Paul Mumba (Annex 4.6).
- Mr Philip Seaton (Orchid Seed Stores for Scientific Use) delivered a workshop on mature seed collection methods, viability testing (including the Tetrazolium test), seed drying and storage methods, and cultivation using asymbiotic techniques. Please refer to point 2.3 below for further details.

2.2 Year 1 Activity (completed) but please see Annex 4.8 for copies of attendance certificates

2.3 3 x CBU technical staff (≥9 other conservation practitioners) trained orchid seed banking and viability testing, and orchid seed bank established at CBU (Workshop 3):

- The Mature orchid seed workshop led by Philip Seaton (Orchid Seed Stores for Scientific Use) teaching participants from government, academia and conservation institutions on techniques of seed harvest, storage and viability testing as well as the start of a Chikanda seed bank at CBU.
- There were fewer participants than expected in this workshop (ten including 3 CBU staff). Of these, only two female colleagues were selected by their organisations to participate. Please refer to the Newsletter (Issue 2 p. 5) for a report by PM Nicholas Wightman on this workshop (Annex 4.9), and the certificates of attendance (Annex 4.10).

Workshop participant name	Professional affiliation	Gender
Geophat Mpatwa	CBU, School of Natural Resources	M
Felix Chileshe	CBU, School of Natural Resources	M
Paul Mumba	CBU, School of Natural Resources	M
Davie Simposya	Zambia Forestry Dept. (Ministry of Lands, Natural Resources and Enviro. Protection)	M
Florence Nyirenda	Curator, Herbarium, University of Zambia Lusaka	F
Francis Mvula	Zambia Forestry Dept. (Ministry of Lands, Natural Resources and Enviro. Protection)	M
Francisco Llarena	US Peace Corps (Zambia) Volunteer, who is assiting the DI Project Manager with seed collection and documentation of orchid trade and phenology in rural locations of Zambia	M
Mpande Sichamba	Zambia Forestry Dept. (Ministry of Lands, Natural Resources and Enviro. Protection)	M
Mokawne Kaluwe	Herbarium Curator, Zambia Forestry Dept. (Ministry of Lands, Natural Resources and Enviro. Protection)	F
Nicholas Wightman	Project Manager (DI project)	M

Table 1. Participant list for the workshop on mature orchid seed collection, viability testing, storage and germination methods, held at CBU (April 2017) and led Mr Philip Seaton (Orchid Seed Stores for Scientific Use, and Honorary Research Associate RBG Kew). This was the third and final specialist workshop delivered as part of the project. Participants were selected based on access to in vitro biology facilities to undertake orchid biotechnology work following the training, and demand for training in orchid seed collection methods.

Fig. 5 Florence Nyirenda extracting seed from one of the collected dry infructescences as Mokwani Kaluwe looks on.

2.4 Year 1 Activity (completed). Please refer to point 3.3 (below) for a description of how this Year 1 Activity (workshop delivering IUCN Red List and rapid conservation assessment methods) was developed throughout Year 2, following an identified need for improved access to species distribution data to expedite this process.

2.5 Reference Collection & Tissue Bank (orchid specimens) established for DNA extraction and identification of traded species using molecular markers (Year 1 Activity, repeated in Year 2 using unspent funds carried forward from Year 1 following a Change Request):

This work was led by the PL in Year 1 (Jan-Feb 2017) and the PM in Year 2 (Feb 2018). The Reference collection comprising herbarium specimens, supplemented by spirit collections of flowers and silica-dried material for DNA extraction. Herbarium and spirit collections held in three herbaria, Forestry Service Zambia, RBG Kew (K) UK and the Bews Herbarium South Africa.

Associated silica-dried material (tissue bank) of these specimens was used by the Uppsala University team for DNA extraction and sequencing of three molecular barcoding regions (*ITS* from nuclear genome and *rbcL* and *matK*, cf. Annex 4.11 for example FASTA file). These sequences were then used by project MSc student Mr Seoljong Kim to improve identification success using algorithms to find the most probable match to DNA sequences from traded Chikanda tuber and Chikanda cake samples generated during his MSc research. Surplus samples of extracted DNA will be returned to RBG Kew and incorporated into the Kew DNA Bank for long-term storage at -80C.

We are very grateful to terrestrial African orchid specialist Dr. Benny Bytebier (Curator of the University of Kwa-Zulu Natal, South Africa, Bews Herbarium) who in 2017 reviewed all specimens collected in Project Year 1 and verified or added species identifications to the Reference collection. Dr Bytebier then joined the PM's field team in Year 2. Dr Bytebier's on-going research on terrestrial African orchids was

supported by the project through our provision of transport costs (vehicle hire and fuel), support with the research permit process and logistics organised by the PM. In return the project has benefited from Dr Bytebier's expert knowledge of terrestrial African orchid genera, including those used for Chikanda. The Reference collections were identified during fieldwork but await detailed study and confirmed identification following export to South Africa (pending permission from Zambian authorities, facilitated by the PM and Prof. Vinya).

Expert identification is critical to the Reference collection, ensuring that all associated project work is accurately reporting results based on specimens available in national repositories, with taxonomic identification verified by experts. The PM has already used Dr. Bytebier's identifications from Year 1 Reference collections to update lab reports and records compiled by Dr. Yokoya on orchid fungal symbionts in culture at RBG Kew, and seed collections made to date. He has also reviewed Mr Kim's MSc thesis and provided updates to Uppsala University colleagues in advance of publication.

2.6 Multi-access illustrated orchid identification key created using Lucid software and made available for download in Google Play Store (Year 2 Activity – underway but not yet complete).

Following a procurement process at RBG Kew by the PL, the project laptop with installed software were delivered to the PM in April 2017 (later than scheduled). The PM's work on this Activity was then delayed by events of last year during which his project laptop and the Lucid software were temporarily unavailable to him (please refer to confidential correspondence with the DI office). However the PM has since familiarized himself with the software and has developed the key, using floras and his knowledge of Chikanda orchids cf. Annex 4.12 for example screenshots). The PM and PL will be working together in early May 2018 when the PM is scheduled to visit RBG Kew (funded by the Bentham-Moxon Trust) to discuss and further develop the key, and aim to make a first draft available online by end of Year 2.

To complement the key, the PM has started work on an illustrated guide to Chikanda orchids (cf. Annex 4.13 for a draft) and, in early 2017, initiated an online Orchids of Zambia project in iNaturalist as a means of providing free access to images of specimens in the field (that are also represented by botanical specimens in herbaria) http://inaturalist.ca/projects/orchids-of-zambia

To build on the PM's iNaturalist project, the PL and iNaturalist co-founder Dr. Scott Loarie (California Academy of Sciences) submitted a grant application to the JRS Biodiversity Fund in 2017, to hold a citizen science workshop at the Mutinondo Wilderness Reserve, led by iNaturalist and South African and Zambian ecologists, botanists and entomologists (Prof. Steve Johnson and Dr. Timo van der Niet, and Dr. Donald Chungu from CBU), with participation of school-aged girls from Zambian NGO Baksahana and Peace Corps Zambia volunteers. It was hoped that this workshop would inspire a new network of rural citizen science "observers" (Peace Corps volunteers and youth groups) and "identifiers" (South African and Zambian scientists, in addition to global users of the iNaturalist platform). Unfortunately this grant application was unsuccessful, however the co-authors will continue to identify funding sources to undertake this work in future (ideally in advance of the AETFAT 2020 congress).

2.7 Symbiotic seedlings (5,000) of ten of the rarest Chikanda orchid species cultured at RBG Kew, for in-country ex situ conservation and species recovery plans (Year 2 and Year 3 Activities):

Fieldwork in 2017 resulted in 61 collections of orchid roots or protocorms that were used for isolation of endophytic fungi (cf. Annex 4.14). Seed collection by the PM in 2017 resulted in fewer seed collections than anticipated (seeds from 9 species). Seeds did not arrive in the *in vitro* lab at RBG Kew until September 2017 due to:

- Delays with the permit process for export to RBG Kew were experienced.
- Delays further hampered due to unforeseen circumstances (confidential, but shared with the Darwin Initiative and DEFRA in separate communications in 2017).

Seeds were sown by Mr Jonathan Kendon (JK; RBG Kew) on two different asymbiotic media at RBG Kew as part of initial seed viability tests, followed by pairwise tests, pairing orchid species with different fungal isolates (isolates based on work in 2016-17 by project post-doc Dr. Kazutomo Yokoya). Low germination rates have been eported so far (≤ 5 % indicating), thought to be related to low viability of the seed collections (determined by whether seeds were harvested at optimal times, dried effectively and stored in optimal conditions). Please see report by JK, Annex 4.7.

2.8 Symbiotic seedlings repatriated to Zambia CBU *ex situ* conservation facility (Year 2 and Year Activity):

The project does not yet have seedlings at a suitable stage in development or in sufficient quantities to deliver the planned pilot project of shipping plants to the CBU lab and nursery (originally scheduled for Q 3 of Year 2).

Output 3 Knowledge, Activities:

3.1 Participatory orchid management plan (Activity 1.6) agreed for rural, community-managed resources, incorporating local traditional knowledge (Year 1 Activity – underway with delays):
Activities described under point 1.6 (above).

3.2 Year 1 Activity (completed Year 1, attendance certificates copies currently available).

3.3 Fungal symbionts of "top 10" orchids sampled from the field, isolated, identified and cultured, with full voucher specimens (Year 1 and Year 2 Activity, complete):

Following the IUCN Red List workshop in October 2016, Red List activities were initially hampered due to a lack of available species distribution data. This was in part over-come through the PL and Workshop leader Dr. Serene Hargreaves securing two Kew Conservation Science summer intern placements at the Plant Assessment Unit, RBG Kew, in 2017 (Ms. Louise Henry and Ms. Amy Barker). Louise and Amy's primary work was geo-referencing historic botanical specimens from Zambia held in the Kew Herbarium to improve availability of distribution data. A total of 600 specimens were geo-referenced enabling extinction risk assessments of 16 species of putative Chikanda orchids Amy, Louise and Serene following IUCN Red List criteria. Of the 16 species assessed, 15 were determined as Data Deficient.

Assessment challenges included: Increasing rate of collection being based on anecdotal evidence rather than quantified measures of population decline and lack of documentation of Chikanda species being used in the trade. Both factors mean that Red List threat categories cannot currently be applied, despite a high likelihood of the study species being a risk due to unsustainable Chikanda harvesting practices. In all 15 Data Deficient assessments, the assessors suggest that the species is very likely to be Endangered or Critically Endangered.

Species name	Country distribution	Proposed IUCN Red List Category
Disa celata	South-central Africa in Angola, Malawi, Tanzania and Zambia	Data Deficient
Disa dichroa	South-central Africa in the Democratic Republic of Congo (DRC), Zambia and Tanzania	Data Deficient
Disa katangensis	South-central Africa in Zambia, the Democratic Republic of Congo (DRC) and eastern Angola	Data Deficient

Disa nyikensis	South-central Africa and occurs in Zambia, Malawi, and Tanzania	Data Deficient
Disa roeperocharoides	South-central Africa in the Democratic Republic of Congo (DRC) and Zambia	Data Deficient
Disa satyriopsis	South-central Africa in Tanzania, Malawi, Zambia and Burundi	Data Deficient
Disa ukingensis	South-central Africa in Zambia, Malawi, and Tanzania	Data Deficient
Disa verdickii	South-central Africa in Zambia, the Democratic Republic of Congo (DRC) and western Angola	Data Deficient
Satyrium anomalum	South-central Africa in Malawi, Zambia, Zimbabwe, Tanzania and Mozambique	Data Deficient
Satyrium compactum	South-central Africa in Zambia and Zimbabwe	Data Deficient
Satyrium elongatum	South-central Africa in Zambia, Tanzania and Zimbabwe	Data Deficient
Satyrium microcorys	South-central Africa in Tanzania, Malawi, Zambia, Zimbabwe and Mozambique	Data Deficient
Satyrium monadenum	Southern and eastern Africa in Tanzania, Malawi and Zambia	Data Deficient
Satyrium princeae	Southern and east Africa in Tanzania, Malawi and Zambia	Data Deficient
Satyrium shirense	South-central Africa in Malawi, Tanzania, Zambia and Mozambique	Data Deficient
Satyrium trinerve	South, central, east and west Africa and Madagascar	Least Concern

Table 2. Proposed IUCN Red List status (following expert reviewed and pending approval by IUCN for publication in the Red List) for 16 species of suspected Chikanda species that occur in Zambia in habitat types targeted for Chikanda harvest. For all Data Deficient taxa recorded, the Assessors state that "Research into the rates of loss of this species is also highly recommended and further research is likely to provide evidence that this species should be classified as Endangered or Critically Endangered."

Please see Appendix 4.15 draft IUCN Red List assessments.

Fig. 6 Top, mother and daughter harvest and clean tubers of *Satyrium trinerve*, near Kasama, Northern Province in 2017.
Left: *Satyrium trinerve* in flower in Muchinga Province, Zambia (specimen number RB445) in 2017. Photos: Ruth Bone (PL).

Fig. 7 Dr. Kazutomo Yokoya (RBG Kew project post-doctoral researcher) in 2017 collecting roots and tubers of *Satyrium trinerve* in flower in Muchinga Province, Zambia (specimen number RB445) for isolation, culture and identification of orchid mychorrhizal fungi for symbiotic culture of seeds in vitro.
Due to its wide geographic distribution (extending as far as Madagascar) this species has been assessed as Least Concern despite being a targeted species for the Chikanda trade in Zambian and neighbouring countries.
Photo: Ruth Bone (PL).

Because it was not possible to develop the "top-10" list of most threatened orchids (using Red List methods) in advance of the fieldwork in Jan-Feb 2017, instead putative orchid mycorrhizal fungi (OMF) were collected during extensive fieldwork across a broad geographical range, and almost 30 orchid species were sampled for fungal symbionts by the project post-doctoral research Dr Kazutomo Yokoya (KY). In summary:

- 1,722 fungal cultures were isolated from roots of 28 orchid species (36 collections).
- 840 isolates were sequenced (using the ITS marker), of which 336 were identified (from 20 orchid species represented by 23 collections).
- Based on the closest matches available from an online repository (GenBank) these were identified as *Rhizoctonia*-like fungi (*Ceratobasidium*, *Tulasnella*, *Sebacina*, *Piriformospora* as closest matches in GenBank) or other fungi previously described as orchid mycorrhiza.
- Voucher (botanical) specimens were collected in all cases for all mature plants sampled (this was not possible for the few immature plants/ seedlings included in the survey).
- Fungal cultures have been used by in vitro biology lab technician Mr Jonathan Kendon (RBG Kew) to trial orchid seed germination using symbiotic culture techniques. (Please see the lab report Annex 4.14). These cultures are being maintained for use once the Year 2 seed shipment arrives (shipment pending permissions from Zambian authorities; please see permissions letters Annex 4.16).

3.4 Follow-up seed collection completed for target taxa and seeds dispatched to RBG Kew for symbiotic culture (Year 1 and Year 2 Activity; Year 1 completed, Year 2 seed collection completed, dispatch pending permissions approval for shipment):

Fieldwork conducted in Year 1 (January-February 2017) was focused on Northwestern, Copperbelt, Muchinga and Northern Provinces of Zambia in a survey that encompassed 34 species of orchid. Far fewer orchids were found than expected, with evidence of harvesting in many areas (e.g. visible holes across dambo grasslands at Shiwa Ngandu) and few seed collections made later in the season (cf. Table 4).

The follow-up fieldwork in Year 2 (led by the PM in February 2018) was instead focused on Northern and Luapule Provinces, with minor stops in Central and Muchinga provinces. The main aims were to make geo-referenced seed collections, with associated voucher specimens. In addition the PM arranged a meeting with HRH the Paramount Chief of the Bemba, Chitimukulu Sosala, to introduce the project and its aims and seek his counsel. The field team included a US Peace Corps volunteer and Dr Benny Bytebier, specialist in African terrestrial orchids at the Bews Herbarium (South Africa) who has provided expert identification of the orchid specimens collected in 2017 and 2018.

Seed collection work in Year 2 (February 2018) was much more successful, with over 30 seed collections made, including six seeds collected by the PM from hand-pollinations that he conducted on specimens that he cultivated from purchased tubers (in order to increase knowledge of taxa in the trade by growing specimens to flowering stage in an experimental home nursery). Seed collections were made from all four genera considered to be the most commonly traded for Chikanda (*Brachycorythis, Disa, Habenaria*, and *Satyrium* (cf. Table 3 and Annex 4.17 for the full list of seed collections made).

However the PM is again experiencing significant delays (6 weeks and on-going) in the permissions process, despite the full support of Prof. Royd Vinya who has made significant efforts to support the PM with this work (cf. Annex 4.16). Despite the PM carefully storing the seeds in conditions recommended by Mr Philip Seaton (Workshop leader early Year 2), these delays may mean that seed viability has deteriorated by the time it reaches the RBG Kew *in vitro* lab.

Taxon (preliminary ID, awaiting ID/ verification)	Number of collections per taxon
Brachycorythis sp.	3
Brachycorythis sp. aff. buchananii	1
Brachcorythis aff. pubescens	2
Disa sp.	1
Disa aperta	2 (hand pollinated - cultivation from trade tubers)
Disa engleriana	1
Disa equestris	1
Disa erubescens ssp. carsonii	1
Disa sp. aff. hircicornis	1
Disa hircicornis	1
Disa welwitschii sp. aff. welwitschii	8
Habenaria sp.	2
Habenaria holubii	4 (hand pollinated - cultivation from trade tubers)

Habenaria sp. aff. macroplectron	1
Habenaria macroplectron	1
Satyrium sp.	2
Satyrium buchananii	1
Satyrium sp. af. kitimboense	1
Satyrium trinerve	1

Table 3. Seed collections made during fieldwork organised and led by the PM in February 2018 and following hand pollinations of cultivated tubers purchased at the Soweto market (Lusaka).

Fig. 8 Left: Orchid tubers from Soweto Market, Lusaka, illustrating a range of tuber morphologies of species in the trade. Centre: Tubers sprouting at an experimental nursery established by the PM. Right: *Disa* aff. *aperta* flowering from tubers purchased in the market place, enabling identification to scientific name (increasing knowledge of traded species) and hand pollinations to increase seed availability for cultivation. Photos: Nicholas Wightman.

Please refer to the field report Appendix 4.2 by the PM

3.5 Orchid seed viability testing undertaken during orchid seed collection phases (Year 1 and Year 2 Activity; Year 1 Activity completed Year 2 following delayed shipment; Year 2 Activity pending export permissions and shipment):

The first seed batch was received at Kew in September 2017. In Vitro Biology lab technician Jonathan Kendon reports that, during initial inspection under dissection microscope, the seeds mostly appeared to have embryos. The seed batches were relatively clean and devoid of flower or capsule fragments, although a few foreign bodies were observed, and this meant that surface sterilisation time had to be increased. Viability of seed collections made in 2017 has so far been reported as low. Appendix 4.7.

Coll No.	Genus	species
CBU007	*Disa*	sp
CBU010	*Disa*	sp
CBU11	Unknown	species
NCW10	*Habenaria*	*zambesina*
NCW11	*Habenaria*	sp
NCW12	*Disa*	*roeperocharoides*
NCW20	*Disa*	sp
NCW4	*Satyrium*	*buchananii*
NCW9	*Disa*	*hircicornis*

Table 4 Accessions of seeds received at RBG Kew, September 2017. *Satyrium buchananii* has been identified through molecular bar-coding work (MSc thesis) to be among those species in the trade.

Fig. 8 *Disa roeperocharoides*, a conspicuous orchid in the dambos (seasonally inundated grasslands) of Zambia. Photo: Lari Merrett.

3.6 Open access paper submitted for publication, and conference/ symposium presentation delivered (End of project activity, but work underway).

A paper summarising the MSc research findings of Uppsala University student Seol-jong Kim on molecular bar-coding of Chikanda orchids is in preparation (target paper Frontiers in Plant Science, and due for submission in early May 2018). Academic supervisor Dr. Sarina Veldman has submitted an abstract (Annex 4.18) to the International Society of Ethnobiology Congress (schedule for August 2018 in Belém, Brazil).

3.7 Year 1 Activity (not reported but please see Appendix 4.19 MSc thesis).

3.8 Year 1 Activity (Completed Year 1 Activity, please see Appendix 4.19 MSc thesis submitted in Year 2).

3.9 MSc thesis and paper(s) prepared (Year 1 Activity, extended and completed end of Year 2):

MSc student Seol-Jong Kim (Uppsala University) submitted his thesis "**Mapping Harvesting and Trade in Zambian Edible Orchids**" in March 2018. Delays with this work (originally scheduled for submission by the end of Year 1) included difficulties experienced with DNA extraction and amplification from Chikanda products (lower success rates than experienced in previous studies by Seol-Jong's academic supervisor Dr. Veldman, based on edible orchids from Tanzania). In addition Seol-Jong and his supervisor wished to utilise the Darwin project Reference collection of Zambian terrestrial orchids (specimens collected during fieldwork led by the PL in early 2017, with field-based identifications verified or corrected by African terrestrial orchid specialist Dr. Benny Bytebier (Bews Herbarium, South Africa). DNA extractions and sequencing of silica-dried samples associated with herbarium and spirit collections enabled these collections to be included in screening for likely matches to Chikanda orchid derivative samples DNA sequenced by Seol-Jong Kim, improving accuracy of species ID using molecular bar-coding methods.

DNA sequences were obtained from 130 individual samples (at least one DNA marker each) from 28 of the 46 collections. The collections mostly comprised tubers, but samples of Chikanda cake was also sampled, four sachets of desiccated ground tubers of mixed species, and one collection of dry sliced tubers with mixed species.

In addition to molecular work the MSc thesis includes an analysis of interviews conducted with 82 Chikanda traders (9 harvesters, 45 middlemen and 29 vendors). Despite reported dwindling quantities of Chikanda tubers (e.g. reported by community members interviewed in Mwinilunga by the CBU team) some dealers working in the neighbouring Province (Copperbelt) have reported selling more than 200 kg sack of fresh Chikanda tubers per day with a profit of 2000 Zambian Kwacha (£146 GBP) per bag, with an estimated 40 sacks of fresh Chikanda tubers are sold per month.

Fig. 9 Chikanda cake traded in a Zambian market. Photo: Seol-jong Kim


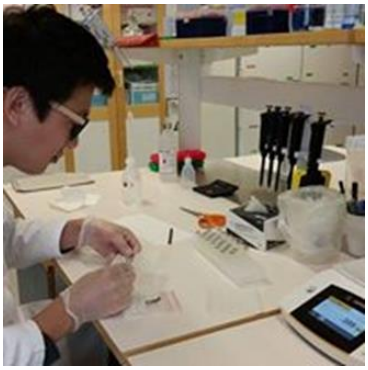

Fig. 10 Left: Prof Royd Vinya, Dean of the School of Natural Resources (CBU) with MSc student Mr Seol-jong Kim. Photo: CBU staff. Right: Seol-jong in the molecular lab in Sweden.

4.1 Communication and environmental awareness strategy developed and implemented in rural communities through participatory meetings (required for all Output 1 activities). Year 1 Activity -

In Year 1 the CBU team made every effort to engage the local communities increase awareness of the project aims during site visits following the baseline household income surveys. The local traditional chief (His Royal Highness Chief Kanyama) was made aware of the project aims and how it will benefit his subjects, and the project was well received by the traditional authority.

The CBU team's work in (for development of the participatory orchid management plan) has included awareness raising of the issues, with community members in three villages identifying past and present Chikanda harvest practices, economic pressures caused by traders from outside the communities, and an identified interest in cultivation of Chikanda orchids. However there has been no formalization of the strategy and a demand for support with communications has been expressed by members of one of the project communities (Kasan'ga, Mwinilunga District) who were "of the opinion that, it is imperative for the project to generate sensitization posters on orchid conservation. These posters must be pinned in strategic points in the participating community areas. Among these sites should include notice boards in local schools, churches, and Health Centres" (quoted from the Minutes of the participatory orchid management plan meeting held from 30th of August to 1st September 2017, Annex 4.20, Kasan'ga Minutes). The PL and PM will be supporting with development of posters if required. In addition please refer to Section 4.8 on development of a youth awareness strategy that will be delivered in Year 3.

4.2 Biodiversity Convention national focal points aware of project through correspondence and meetings with project leader and partners. (Year 1 Activity, completed).

Please see Annex 4.16 as an example of continued correspondence with the Nagoya Focal Point, and the project Newsletters that are circulated to over 50 addressees including Mr Alan Dauchi, the Nagoya Protocol focal point for Zambia and the CBD. Please also see a copy of the presentation (Annex 4.21) given, on request, on February 2017 to the Department for National Parks and Wildlife, that is the CITES authority for Zambia.

4.3 & 4.4 Year 3 Activity (postponed from Year 1 following Change Request in Year 1).

4.5 Bi-annual project newsletter circulated (all project years):

The PM writes and designs the bi-annual newsletter, that is edited by the PL and circulated (approximately at 6 month intervals) by email to the project mailing list of over 50 recipients. In addition to project team members and workshop participants, recipients include private landowners,

youth leaders, botanists and ecologists, the Nagoya Focal Point, CITES scientific authorities and the British High Commission. In addition notification of the newsletter's release is posted to social media accounts (the project Facebook page and the PL's personal Twitter account). Please Annex 4.9, 4.22 and 4.23 for newsletter editions made available in the past year.

4.6 First results of wildlife "forensics" study (DNA bar-coding) communicated in a report/ article written, directed at CITES officer and legislators (Year 1 Activity, delayed while awaiting MSc thesis completion):

This work has been delayed following a one year delay with completion of the MSc thesis (please refer to point 3.9, above, for an explanation of causes of these delays. A paper is in preparation for submission to a peer-reviewed journal. Following publication the team will prepare an article for circulation among CITES legislators.

4.7 End of Project activity, not reported here.

4.8 Public awareness programme completed: "Patchwork Meadow" programme integrated into existing UK-Zambia cultural-educational exchange programme, culminating in a public exhibition (Year 2 Activity, delays experienced):

The PL has not been able to advance the partnership required to develop and deliver the public awareness programme suggested in the original grant application. Reasons include staff changes at Plantlife International (departure of Dr. Seona Anderson European Projects Coordinator) who have IP for the Patchwork Meadow concept, and who had endorsed development of this concept as part of the UK-Zambia cultural exchange programme) and the Zambia partner school (retirement of the Head Teacher Mrs. Freda Mvula from Helen Kaunda School). In addition the PL has not been able to secure a meeting with the UK Partner School (Kingsmead) to progress project development due to time commitments of the teachers, who are currently unable to take on additional work.

In project Year 2 the PL has instead developed a collaboration with Mr Brighton Kaoma, a young Zambian youth leader who has an established track record of delivering environmental youth campaigns (e.g. UNICEF, WWF Zambia) and Executive Director of Agents of Change Foundation Zambia. Mr Kaoma often uses radio interview (by youth volunteers) and broadcasting as medium to deliver awareness strategies at relatively low cost but large scales. Kew Foundation colleagues have secured additional funds (from the Ferguson Trust) to support delivery of this public awareness programme that will be delivered by Mr Kaoma through Agents of Change Foundation in Year 3.

4.9 Field trip to orchid habitats with workshop on plant ID (using interactive key tool); visits by local school groups to CBU orchid conservation facility, to learn lab methods (with advice from the Rwandan Orchid Schools' Project). (Year 2 and Year 3 Activity).

Due to the delays described above with development of public awareness programme, this activity has not been achieved. We anticipate that the youth awareness programme led by Mr Kaoma (Agents of Change Foundation Zambia) will have far greater reach than the original "Patchwork Meadow" project and will also primarily benefit young Zambians, current and future consumers of Chikanda cake.

3.2 Progress towards project Outputs

1. **Mitigation:** Sustainable resource management practiced, securing livelihoods for women in poor rural communities.

MI 1.1 Number of households practising destructive harvest methods reduced (from baseline measured in Yr 1) by 60% by Yr 2, and gaining access to supplementary cultivated Chikanda plants for household nurseries by Yr 2.

Baseline: As recorded in November 2016, across the study area (nine villages in Mwinilunga District, NW Province), the bulk of the population were engaged in subsistence agriculture involving maize and cassava cultivation. Orchid harvesting is seasonal occurring mainly from April to about July.
Information was gathered from Focus Discussion Groups and interviewees were selected for in-depth interview based on being known orchid collector households.

Females constitute about 73% of the collectors. Orchid collectors rarely complete primary education. More than 60% of the collectors interviewed had not completed primary school education and more than 60% of the orchid collectors fall in the youth group (20-40 years) category. 4% of time was allocated to this activity as part of the main livelihood strategy of the informants (largely due to seasonality), but contributing 20% of household income.

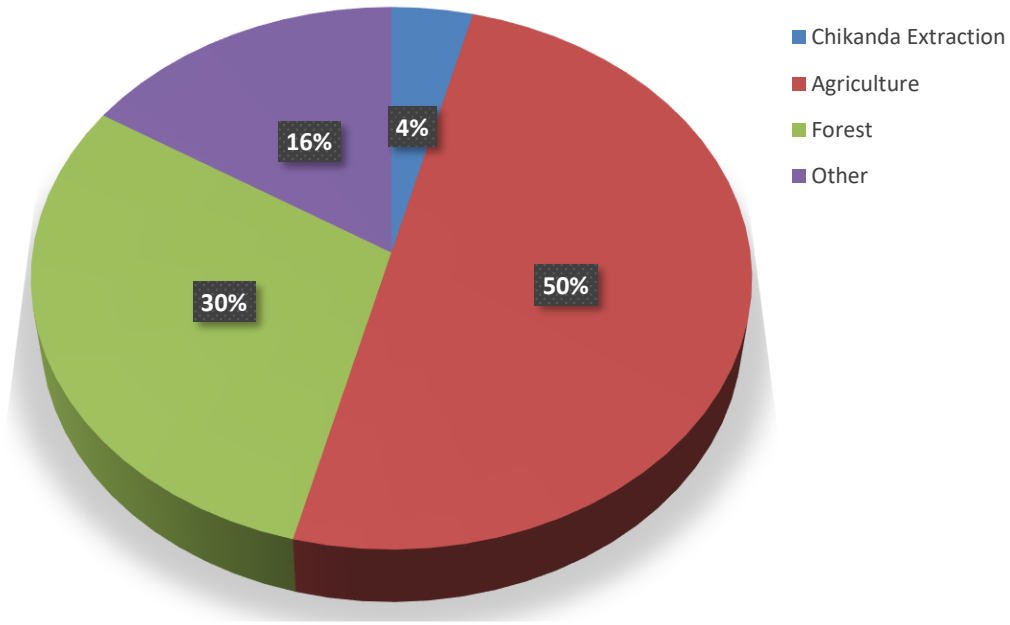

Fig. 11 Main livelihood strategies in the project area (Mwinilunga District), as reported by the CBU team in the Year 1 Baseline Study Report, submitted by Prof. Vinya (included in Annex 4 of the Year 1 Annual Report).

Change recorded to date: The participatory orchid management plan has been drafted but not finalised by the community groups. Group formation activities (led by Drs Kabwe and Kwenye) took place in Mwinlunga District in March 2017 (Year 1) that included formal visits to local government and traditional authorities, and workshops with ca. 85 community members in two villages (Nyminkanda and Munwa). In Year 2 a CBU team comprising Prof. Vinya and Mr Geophat Mpatwa (CBU technician) led community engagement activities to develop the orchid conservation plans in Nyminkanda and Munwa and an additional pilot village (23rd August to 1st September 2017). This was followed by work designed to formalize group formation in these communities, by Dr. Kabwe and Kwenye (18th to 21st December 2017). However Drs Kabwe and Kwenye reported that community members for two of the three pilot villages had moved to seasonal farming sites and were therefore unavailable (meetings held in Nyminkanda only).

Prof. Vinya estimates that the participatory orchid management plan will be finalised in the second quarter of 2018 (i.e. first quarter of Project Year 3). June 2018 has been suggested by community

members in Kasan'ga (one of the pilot villages) as a deadline for finalising the plan (Minuted Annex 4.20).

Evidence for change: At this stage we cannot currently provide evidence for change, but the CBU team have identified willingness to implement change through traditional community hierarchies (as evidenced in the CBU team reports and Minutes from meetings with communities in three villages; cf. Annex 4.20). The three pilot communities have participated fully in meetings led by CBU to develop the orchid conservation management plans. However they have expressed frustration that awareness ("sensitization") work on the issues of sustainable harvesting practice have been hampered due to long gaps between meetings with CBU staff, and suggested that CBU should devote staff to provide a permanent presence in the villages. However the communities acknowledged that this was not possible due to staff time commitments and budget constraints (cf. Meeting Minutes, Annex 4.20).

The delayed development of the orchid management plan has been further compounded by absences of community members in two of the three pilot villages in a follow up meeting due to seasonal farming practices at alternative faming sites (Annex 4.5). The slow progress of orchid seed collection and germination (low viability of some batches, and viable seeds taking one year to germinate) has affected community engagement, as there is not yet a readily available supply of plants for household nurseries. However community members reported willingness to persevere with increasing awareness around dwindling orchid resources, and development of the orchid management plan cf. Meeting Minutes, Annex 4.20 Doc X).

Please refer to the community meeting Minutes and CBU staff reports as Means of Verification for this indicator (Annex 4.5, 4.20, 4.24).

MI 1.2 a) Household income increased (from baseline measured in Yr 1) by 30% in Yr 3 through adoption of supplementary sustainable income streams (cultivated Chikanda and other sources). 1.2 b) School absenteeism reduced (from baseline measured in Yr 1) by 40% in Yr 3 due to increased household income, and reduced pressure on school-age children to participate in Chikanda harvest.

Baseline: Baseline data on household income was gathered by the CBU team from nine villages in one District (Mwinilunga) of Northwestern Province, Zambia, in Year 1. The project area selected in Year 1 has 800 households with a total population of 4,363 people (2,208 female). Comparison to other sources of income indicated that agriculture is the main source (average annual income GBP 83.33) supplemented by Chikanda harvest (GBP 41.67 p.a.) which accounts for less than 20% of household income among those surveyed. The total annual average domestic incomes from all sources in the baseline stands at ZMW 1,500.00 (GBP125.00). Therefore, project activities aimed at raising this figure to ZMW 1,950.00 (GBP162.50) per annum.

Change recorded to date: No changes in household income have been recorded (Surveys were planned as Year 1 and end of project Activities).

Evidence for change:

Output indicators: Household income is no longer a suitable indicator within the funded project timeframe. Instead, baseline surveys documenting awareness of the dwindling resource, reasons for its scarcity, and practice of sustainable (traditional) harvesting practices should have been used as the measurable indicators for this Output.

MI 1.3 Orchid tuber waste reduced at entry to supply chain (due to reduced harvest of juvenile material) from baseline in Yr 1, by 30% in Yr 3.

This work, led by Zambian NGO Sanga R&D, was scheduled for Year 1 but was postpone to Year 3 at the request of Sanga, and with approval from the Darwin Initiative following a Change Request submitted by the PL. Sanga R&D intend to use previous survey work as the baseline for comparison.

2. Capacity: Both local level community capacity AND conservation practitioner capacity increased to: Manage wild orchid populations; enhance delivery of CBD (GSPC Objectives); and facilitate implementation of CITES legislation for plants.

MI 2.1 1,000 asymbiotic seedlings cultivated for supplementary plantings or household nurseries, by end Yr 1, rising to 5,000 by end Yr 2.

Baseline: No orchids grown from seed in the CBU labs or household nurseries.
Change recorded to date: 631 plantlets of *Liparis* have been established, that were sown during the greenpod orchid cultivation workshop in March 2017 with Mrs. Hildegard Crous. Very recently (in the last few weeks) Mr Mumba has reported germination of putative Chikanda orchid species (*Disa erubescens*), which has taken almost one year to germinate.
Evidence for change: Please refer to section 1.7 (under Activities) and the lab report provided by Mr Paul Mumba (CBU).
Output indicators: Please refer to section 1.7 (under Activities) and the lab report provided by Mr Paul Mumba (CBU).

MI 2.2 By end Yr 2, 40% of the participating community households are cultivating orchid germplasm supplied by the CBU laboratory.

Please refer to MI 2.1 above. This work has not been achievable due to small quantities of seed collected in Year 1, and low viability of those seeds. It is hoped that the far more successful seed collection season in February 2018 will lead to increased productivity in the CBU and Kew labs in Year 3. For the Kew based work (using symbiotic culture techniques), the seeds are currently awaiting permission from the authorities for shipment, which could adversely affect viability.

MI 2.3 By end Yr 1, specialist plant conservation skills base increased to ≥12 individuals (3xCBU staff and ≥ nine other conservation practitioners) [IUCN Red List, orchid conservation biotechnology methods and augmented with seed banking].

Baseline: At project inception there was a reported absence of specialist plant conservationist with applied skills of relevance to implementation of the Global Strategy for Plant Conservation (cited in BSAP and CBD reports).
Change recorded to date: Due to the need for specialist lab equipment, fewer participants attended the orchid conservation biotechnology methods and seed banking workshop in Year 2 (10 participants including the CBU core team of 3 technicians).
Evidence for change: Attendance certificates, attendance lists and workshop reports. Cf. Section 1.7

MI 2.4 Increased resources for classical and molecular identification of traded taxa, from 0 specimens to ≥ 150, by end Yr 2 (two field collection seasons).

Baseline: Historic specimens (≤1970s) available in national and other international herbaria, with an absence of detailed distribution data (hampering conservation assessment); an identified need for additional reference materials and samples suitable for DNA extraction to enable improved matching of traded tubers and Chikanda cake, via molecular barcoding methods, to high quality scientific material.

Change recorded to date: 125 specimens collected during two field trips (in Year 1 and Year 2). Specimens collected in Year 1 were identified (in Year 2) by expert African terrestrial orchid taxonomist Dr Benny Bytebier, who then joined project fieldwork in Year 2. Samples collected in year have already been DNA sequenced, and the sequences included in comparison work by MSc student Seol-Jong Kim.

Evidence for change: Excel file of samples (Annex 4.25); example Fast file of DNA sequence data (Annex 4.11) and MSc thesis (Annex 4.19).

MI 2.5 Increased accessibility to orchid identification tools by end Yr 2, to support implementation of CITES for plants [target for ≥20 species of the most commonly traded Chikanda orchid species, and ≥5 species from the "Top-10" rarity list].

Baseline: Traditional taxonomic treatments and Flora of Zambia website.
Change recorded to date: The PM has not yet completed the online interactive key (in Lucid software) and will continue with the work in Year 3. Please refer to section 2.6 (under Activities) for further details.
Evidence for change: Please refer to the screenshots of Lucid key in draft (Annex 4.12)

MI 2.6 First symbiotic seedlings (5,000) of Zambia's 10 rarest Chikanda orchid species made available for in-country ex situ conservation and species recovery plans by end Yr 3. [A foundation towards future work by CBU staff to begin symbiotic seed culture in-house].

Please see section 2.1 under Activities.

3. Knowledge: Understanding of orchid identity, rarity, cultivation and traditional utilization practices incorporated into Chikanda orchid conservation plan.

MI 3.1 Traditional, local utilization practices of the 20 most commonly harvested Chikanda orchid species documented by end Yr 1. *[Please refer to Ethics Statement included in application].*

Reported in year 1 by the CBU team.

MI 3.2 a) Preliminary, rapid Red List assessments completed for the three target Chikanda genera (100 species) by end Yr 1. 3.1 b) A "top-10" of the most endangered species identified for in-depth research and ex situ conservation, by end Yr 1.

Baseline: Assessments available on the Red List for Zambian species with broad distributions that occur in South Africa. Absence of contemporary species distribution data (majority of specimens date to ≤1970s before Chikanda trade increased to current levels).
Change recorded to date: IUCN Red List assessments have been completed for 16 species from Zambia, reviewed and submitted to IUCN for publication online. In addition to extinction risk, the assessments describe species distribution, taxonomy, and identify gaps in current knowledge to draw attention to work required.
Evidence for change: Please see Annex 4.15 for the Red List assessments submitted to IUCN, that are due to be published online, and Table 2 above.

MI 3.3 In-depth study of seed germination requirements completed for high risk species (from "top-10" list), enabling in-country ex situ conservation and species recovery (contributing to GSPC Targets 3 and 8), by end Yr 2. Includes collection of 250 root samples

This work has been delayed. Please see Sections 1.7 and 2.1 under Activities.

MI 3.4 First seed storage information and viability testing data available for Chikanda orchids of Zambia (completed for 30 species), by end Yr 3.

Baseline: No information available, to our knowledge.
Change recorded to date: Tests completed on 9 seed batches received in September 2017 (Table 4 above).
Evidence for change: Please refer to section 2.1 and the report by Mr Jonathan Kendon, documenting the seed germination testing completed so far (Annex 4.7).

MI 3.5 Molecular data gathered for ≥200 samples of traded wild orchid tubers and derivatives, collected (by MSc student) from markets in ≥2 urban centres in Zambia for identification at Uppsala University, Sweden, by end Yr 1.

Baseline: No material available for study from Zambia.

Change recorded to date: 130 samples gathered from > 2 urban markets and included in molecular barcoding work led by MSc student Mr Seol-jong Kim, under academic supervision of Dr. Sarina Veldman (Uppsala University).

Evidence for change: Please see section 3.9 under Activities in this report. MSc thesis (4.19) and conference abstract (Annex 4.18).

4 Awareness: Communication and environmental awareness strategy developed and implemented

MI 4.1 a) All participating local communities (traditional leadership, headmen, households, government agencies) are aware of the project purpose. 4.1 b) Environmental awareness strategy leading to 60% of the commodity groups aware of the negative environmental implications of their orchid harvesting methods by 2nd Quarter of Yr 2.

Baseline: No documentation of awareness of Chikanda trade in the project area (Mwinilunga District).
Change recorded to date: The survey method has meant that it is difficult to quantify community awareness. Interviews were focused on households known to participate in Chikanda harvest and/ or trade.
Evidence for change: Community meeting minutes and workshop reports.

MI 4.2 Increased awareness of traded Chikanda waste management options among traders in 3 urban markets by mid- Yr 2.

This Year 1 work was postponed to Year 3 following a change request.

MI 4.3 a) Strong communication channels established with CITES (Zambian Wildlife Authority) and CBD (Director of Environment) focal points by mid- Yr 1; 4.3 b) >20 senior conservation practitioners aware of project activities and early outputs by end Y1; 4.3 c) >40 conservation practitioners aware of project activities by project end (in addition to workshop participants).

Baseline: At project inception correspondence by email had been used to alert the CBD, CITES and Nagoya focal points to the project aims.
Change recorded to date: Communications related to permit requests for export of seeds and/ or botanical specimens, led by the PM and with support from Prof. Vinya. Inclusion of over 20 conservation practitioners from Forestry Service, academia, NGOs, and independent botanists and ecologist in three workshops (two in Year 1 and one workshop in Year 2). Ca. 50 conservation practitioners aware of the project activities via bi-annual circulation of the newsletter (Annex 4.9, 4.22 and 4.23).
Evidence for change: Newsletters, attendance lists of workshops and certificates (Annex 4.8, and 4.10).

MI 4.4 Public awareness increased (of vulnerable rural livelihoods, plant conservation and DI project) with minimum of 60 school children (+ families) participating in an education/ outreach exhibition in a major urban area, by end Yr 2.

Please see Activity 4.8 for a description of the delays with this Measurable Indicator.

3.3 Progress towards the project Outcome

Outcome: Sustainable orchid harvest, cultivation and conservation adopted in poor Zambian communities, providing improved livelihoods and security for women, and enhanced local and national governance of wetland genetic/species diversity.

MI 0.1 Women from ≥600 participating households in 2 Districts engaged in CBNRM scheme, reporting 30% increase in household income from sustainable natural-resource products, and 40% reduction in school absenteeism by end Yr 3.

At baseline there was no CBNRM scheme and no households engaged. Following initial household survey work in Year 1, this has changed through continued community engagement activities (group formation and community consultations) in Years 1 and 2. In late August 2017 149 meeting participants (41 in Nyamikanda, 54 in Munwa and 54 in Kasan'ga) attended meetings and contributed to development of the draft orchid management plan towards building consensus on sustainable harvest practices that could be adopted by each village community.

However, as described in under Activities 1.7 and 3.5, this work has been hampered by the slow progress of cultivation efforts in the Kew and CBU labs due to poor seed harvest in 2017/ Year 1, delays in the permissions process, low seed viability (of the Year 1 batch), long germination times (up to one year) and slow growth rates (Fig. 4). Despite these setbacks, community members have expressed interest in visiting the CBU lab and nursery to see orchids in cultivation and requested a visit by June 2018 (cf. Minutes of the meeting with the Nyamikanda community).

Meeting minutes and reports on project activities submitted by the CBU team are evidence of interest in adopting Community Based Natural Resource Management methods, and also describe an interest in support for direct access to urban markets, to improve the trade price for harvest tubers (rather than via intermediaries).

The planned work led by Sanga R&D in Year 3 (postponed from Year 1) may focus on working with the same communities (plans currently in draft). If so there is potential for additional project support for greater understanding of market forces in Mwinilunga District. However it is imperative that we identify alternative sustainable income streams in lieu of orchid cultivation in household nurseries being available in the medium term. It is hoped that developing links with the ZYCALA project may lead to increased access to national or international markets for honey products. However this cannot be immediately realised (the ZYCALA project is in its early stages of development, and honey requires permission for export and testing for foreign markets).

MI 0.2 a) ≥40% of participating CBNRM households gaining access to cultivated orchid stock and techniques training for household nurseries by end Yr 3. 0.2 b) Resources and skills increased for ≥12 conservation practitioners, cascading to ≥40 by end Yr 3 enabling ex situ conservation and cultivation of orchids (implementation of GSPC).

As described above, delays with establishment of orchids in cultivation mean that this measurable indicator cannot currently be achieved. The PM is experimenting with cultivation of tubers in a household nursery (on his small holding) and is consulting our project partner the Cape Institute of Micropropagation on scope for vegetative propagation methods (as has been described for *Disa*). Please refer to Section 3.4 (Assumptions) below.

Resources and skills have been increased for >12 conservation practitioners, as described above (Measurable indicator 4.3).
While the IUCN Red List workshop was a success, the feasibility for participants to develop into an autonomous working group has been hampered by the lack of contemporary species distribution data. Dr Serene Hargreaves, Amy Barker and Louise Henry (two summer interns in the Kew Plant Assessment Unit) expedited this process by geo-referencing historic specimens, and completed 16 full IUCN Red List assessments (Table 2). The PM has received recent expressions of interest from group members to work collectively on Red List assessments in Year 3.

MI 0.3 For 20 of the most commonly traded Chikanda orchid species, and 10 of the rarest: understanding of identity, traditional use and cultivation requirements documented by end Yr 3.

Documented use of Chikanda species has increased in Year 2, following community-based interviews by the CBU team and interviews with market traders by the MSc student. The main challenge of understanding identity is the alignment of different classification systems, that differ among user groups (e.g. harvesters are familiar with flowers and foliage in addition to tuber characteristics, while traders' classification systems are usually based on tuber morphology and storage traits). In addition several names may be in use across languages and geographic regions. And finally the scientific names are applied for communication among the project team members and wider scientific community. The MSc project has made a significant contribution to understand which species are traded (based on molecular barcoding methods). In addition, the PM has, for the past year, experimented with cultivation of tubers in the trade, developing flowering specimens for identification, an approach that leaves no ambiguity as to whether that species is traded. Cultivation methods from tubers is being documented by the PM, alongside the seed germination work underway in the Kew and CBU labs.

MI 0.4 Communication and environmental awareness strategy implemented providing increased awareness of environmental implications of orchid harvesting: Among ≥600 rural households in participating communities; ≥40 conservation practitioners; ≥60 urban school children (and their families).

Please see Activities 4.1 and 4.8 for a description of the delays with this Measurable Indicator.

Regarding urban school children and their families, the PL is collaborating with Zambian youth leader Mr Brighton Kaoma (Executive Director of Agents of Change Foundation Zambia) who will deliver a public awareness programme using radio broadcasting (additional external funding secured).

3.4 Monitoring of assumptions

Assumption 1: No breakdown in communication or change of priorities between UK lead and collaborating institutes**.**

The in-country PM continues to be proactive in his efforts to promote regular communications among partners, particularly those also based in Zambia. Combined with delays experienced with seed and specimen shipments, and consequently delays with seed germination and decreased seed viability, competing priorities (other work commitments as none of the project staff are dedicated full time to this project) of the project members have led to delays or postponement of some activities.

Assumption 2: Edible orchids can be successfully cultivated and tubers obtained for harvest.

Both the CBU and Kew lab teams have had success with seed germination despite the very small numbers, and low viability of seed collected in Project Year 1. However the progress is very slow (please refer to Activities 1.7 and 3.5 for details). Based on the experimental work in his household nursery, the PM is hoping to find evidence of some taxa bearing stolons with potential for bulking of plants more rapidly, using vegetative propagation methods. Please refer to Annex 4.26 for images and notes, that have been shared with our colleague at the Cape Institute of Micropropagation, Hildegard Crous, seeking advice.

Assumption 3: Identifying communities/ individuals willing to participate, and gaining free, prior and informed consent from Chikanda harvester and trader communities/ individuals for all initiatives and activities.

This has proved to be a low risk, thanks to the CBU team's long-established experience of working with rural communities in the region. However the communities identify an emerging risk of successful engagement being eroded due to the slow pace of community-based activities and the orchid cultivation work. The PL and PM can support through delivery of posters (as requested by one

community). Work to improve direct links with urban markets may be realised in Year 3 by Sanga R&D (who will focus on market research). Annex 4.20 Doc for Meeting Minutes.

Assumption 4: Local communities willing to adopt new methods.

The Year 2 report from the CBU team (Annex 4.24) and the Meeting Minutes (Annex 4.20) indicate willingness to discuss past harvest methods (that are perceived by communities as having been more sustainable) and current practices, and have also expressed interest in visiting the CBU nursery and lab to see plants in cultivation, in addition to receiving plants for household nursery cultivation.

MSc student Seol-jong Kim states in his thesis that "*Most of the interviewees indicated that they would not mind changing their business when Chikanda plants are not available anymore and that they would be willing to grow the orchids if they can be cultivated."* (Annex 4.19).

Assumption 5: Infrastructure and need identified, enabling specialist methods/ skills from training workshops to be applied by participants.

Attendance of specialist training workshops was prioritised for 3 core staff at CBU. Additional places at workshops were assigned competitively, based on the capacity (existing resources, skills and institutional remit) available that enable the prospective participants to make immediate use of the methods/ skills and who have potential to cascade to their teams.

Assumption 6: Users can access the internet (to access online tools).
Not yet tested.

Assumption 7: Fungal symbionts can be found and host orchid species identified (see mitigation for IA 3.2). Seeds of the target taxa are gathered and delivered to RBG Kew for culture.
Fungal symbionts were successfully collected during fieldwork in Year 1, exported to Kew for isolation, culture and identification using molecular barcoding methods. Year 1 work led by Mr Paul Mumba (CBU) and Mr Jonathan Kendon (Kew) also involved fungal isolation and culture methods at CBU. The extensive work of Dr Kazutomo Yokoya in Years 1 and 2 mean that cultures are available for symbiotic orchid seed cultivation- pending greater quantities and higher quality seed lots being available (symbiotically raised plants due for export to Zambia during lifetime of project).

Assumption 8: Electricity "load shedding" causing disruption to power supply in Zambia and reduces computing and internet access.

Red List activities in Year 2 were undertaken by Kew interns due to lack of available species distribution data. Red List activities in year 3 will test this assumption.

Assumption 9: Fungal symbionts can be found and host orchid species identified.
Work completed, write up and publication pending.

Assumption 10: MSc student can be recruited and gain access to the markets.
Work complete.

Assumption 11: Communities will want to engage.
Please see Assumptions 3 and 4.

Assumption 12: Focal points will want to engage.
The focal point for the Nagoya Protocol has been very communicative and supportive, although we are experiencing significant delays with processing of permit applications for export of specimens and seeds.

Assumption 13: Schools will want to participate.

Schools have not wished to participate to date, due to staff changes (Zambia school) and time pressures (UK school). The PL is collaborating with a Zambian youth leader who is developing an alternative, Zambia led, initiative for delivery in Year 3.

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

It is hoped that long-term commitment to self-determined sustainable orchid harvesting levels can be achieved, however we recognise that this is unlikely without improved access to markets for harvesters (where harvesters can command higher prices for selectively harvested tubers), exposure to the cultivation work underway by project teams (community members have expressed interest in cultivation methods, and an interest in visiting the CBU nursery and labs will be addressed by the CBU team by June 2018, Minuted, Annex 4.20), and support for development of alternative lucrative and sustainable income streams, to supplement potential lost income during establishment of the conservation plans (allowing orchid stock recovery) and *in lieu* of plants being available for cultivation in household nurseries (due to slow progress of propagation and establishment work; despite enhancement of in-country conservation biotechnology).

Increased awareness and support from traditional and government authorities for adoption of sustainable harvesting practices (supported by access to urban markets and alternative livelihoods) is also an identified need. Meetings and correspondence between project partners in the first quarter of Year 3, will seek to address this issue and develop a strategy for improved engagement.

The youth-led environmental awareness strategy drafted by Agents of Change Foundation Zambia (Exec. Director Brighton Kaoma) will be a vital asset to wider community participation in achievement of the long-term project impact.

4. Contribution to the Global Goals for Sustainable Development (SDGs)

The long-term outcomes of our project contribute towards achievement of numerous SDGs, including 1. No Poverty; 2. Zero Hunger; 3. Good Health and Well Being; 8. Decent work and economic growth and 11. Sustainable Cities and Communities.

The targets under SDG Goal 12 (sustainable consumption and production patterns) are of particular relevance to the work already undertaken by the CBU team, during which rural communities have associated changes to harvesting practice with dwindling wild orchids. SDG 12 aims include, by 2030: “achieve the sustainable management and efficient use of natural resources” and “halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.” Rotting of the tubers during transportation from remote harvesting areas was a critical issue for the middlemen interviewed by the MSc student, who reportedly prefer store the tubers sliced and dried (Annex 4.19, p. 20 MSc thesis). The Year 3 work (postponed from Year 1) led by Sanga R&D proposes to document storage methods and waste in supply chains, direct access to the market by harvesters, and the role of middlemen in competition for the resource.

Targets under SDG Goal 15 (life on land) include, by 2020, “ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.” The project focuses on dambo (seasonally inundated grassland) habitats that include marginal wetlands, and it is hoped that long-term commitment to self-determined sustainable orchid harvesting levels can be achieved (however please refer to point 3.5 for a summary of challenges). SDG 15 Targets also include “enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities.” Rural communities involved in the project have identified that direct access to urban

markets (where they can command higher prices by working directly with customers) could incentivize adoption of the conservation management plan. The plan also has potential for communities to have improved control of natural resources in their areas, reducing levels of trade across Zambia's borders.

In the 2017-18 financial year, the continued work towards SDG 17 "Partnerships for the goals." Partnerships (e.g. the Kew and CBU in vitro biology labs) developed during the proposal writing and Year 1 of work have been enhanced through collaborative work and shared training opportunities. In Year 2 work on the development of the Reference collection has been enhanced thanks to the efforts of Dr Benny Bytebier (Bews Herbarium, South Africa) who has provided expert identifications (Year 1) and joined the PM-led field team in Year 2. The collaboration between iNaturalist, Zambian NGO Bakashana, Zambian and South African entomologists and the Zambia Peace Corps (developed for a JRS Biodiversity Fund bid in early 2017) must be revived for additional fundraising efforts to improve rural education opportunities for girls and young women (through Bakashana), generation of new observation records to facilitate conservation assessment and improve access to identification tools, and mutually beneficial collaborations between Zambian and South African universities. New partnerships (e.g. LUSH Ltd., Gaia Education Foundation, Agents of Change Foundation Zambia) are emerging as we enter Year 3.

5. Project support to the Conventions, Treaties or Agreements

The project is primarily focused on wildlife trade, legislated by CITES. Work undertaken by the CBU team in Years 1 and 2 includes documenting the trade and its contribution to household incomes in rural areas, in close proximity to Zambia's national borders with Angola and DRC, community awareness of past and present harvesting levels (that community members acknowledge have changed, causing dwindling supplies and competition for resources). The MSc thesis combined market surveys (interviews with harvesters, traders and cake producers) with molecular methods to try to identify orchids in the trade (DNA sequencing of traded tubers and cake samples).

Of particular note: During MSc student Seol-Jong Kim's interviews he documented cross-border trade at Kasumbalesa Market in Chililabombwe (Copperbelt Province, Zambia, bordering DRC, reporting that *"Many Congolese vendors were trading numerous Chikanda tubers and ready-made cakes… they buy fresh or dried tubers at the market and bring it back to the DRC at their home for preparing the chikanda cakes. The vendors come back to Kasumbalesa market again to sell the cakes because the border market is huge with many potential customers. The price of Chikanda tubers in the DRC is just same as in Zambia, but Zambians consume more Chikanda, the interviewees reported. People were using Zambian and Congolese currency altogether at the market."*

"Most interviewees indicated that the Chikanda plants are getting scarce… Regulatory legislation was not a big issue for most of the respondents even though it is not allowed to harvest in the National Parks according to Zambian national legislation and transportation of any orchid species between countries requires a CITES permit."

The Reference collection developed in years 1 and 2 is supporting this work, but improving accuracy of the barcoding work (comparison to expertly identified high quality voucher materials, supported by Dr Benny Bytebier). The IUCN Red Listing work completed to date has highlighted the urgent need for quantification of threats to populations of terrestrial orchids in Zambia and the region, with 15 of 16 species assessed for extinction risk being reported as Data Deficient but with high likelihood of being Endangered or Critically Endangered at the time of assessment. Geo-reference images (e.g. the PM's iNaturalist project) and additional botanical survey work is required to fill these knowledge gaps.

This project has influenced international awareness of the trade in Chikanda orchids since inception. Aware of the PL's work on Chikanda during development of the current grant application, Chair of the IUCN SSC Orchid Specialist Group Dr. Mike Fay included Chikanda in an information document for the

22nd Meeting of the Plants Committee (19th-23rd October 2015): "Undocumented trade in species of Orchidaceae: examples from Asia, the eastern Mediterranean region and Africa" (p. 3-4): https://cites.org/sites/default/files/eng/com/pc/22/Inf/E-PC22-Inf-06.pdf

In 2016 the PL has became a member of IUCN Orchid Specialist Group Global Trade Programme, and was invited to join the IUCN delegation to the 23rd meeting of the Plant Committee in Geneva, in July 2017. She presented an illustrated talk outlining the project's aims at the side event organised by the sub-group (chaired by Dr. Jacob Phelps) to an audience of several national CITES scientific authorities, including the USA. Please see Annex 4.4 for a copy of this presentation and p. 7-8 of the non-compliance with CITES concerning orchids information document for the 69th Meeting of the CITES Standing Committee (27th November-1st December, 2017), with reference made to the current Darwin project: https://cites.org/sites/default/files/eng/com/sc/69/inf/E-SC69-Inf-39.pdf

The project team communicates regularly with CITES, CBD and Nagoya Protocol authorities. In terms of CITES enforcement, the PL is concerned regarding the cultural significance of Chikanda, and implications for enforcement of CITES legislation (un-regulated trade across international borders). In the spirit of Article 8j of the CBD (and its implementing Aichi Biodiversity Target) she aims to address this in consultation with traditional authorities, including potentially HRH the Paramount Chief of the Bemba, Chitimukulu Sosala, and new project collaborators including youth leader Mr Brighton Kaoma (Agents of Change Foundation Zambia).

6. Project support to poverty alleviation

There is little evidence to sate that the project is working to alleviate poverty within the project timeframe. However we are optimistic that the project impact can ultimately achieved, with continued development of the project partnerships (existing and planned for Year 3).

Who are the expected beneficiaries of this work? The expected beneficiaries are rural communities, primarily women and girls involved in the trade 9although survey work conducted in year 2 has revealed that men and boys are also significantly involved in the trade).

Notable achievements this year include proactive participation in community meetings convened by the CBU team (late August-September 2017) that supported continued documentation of harvesting practice and stated interest and willingness to develop and adopt community-based orchid conservation plans. However this work is challenged due to the remote locations of the villages involved in this work, that means infrequent visits from the CBU teams. In addition the communities have expressed interest (cf. Annex 4.20 Minutes) in a permanent presence by the CBU team members to support awareness and action plan development and implementation, but this has not been possible due to budget constraints (it would require employment of additional staff members).

7. Project support to gender equality issues

We have struggled to address gender inequality, for example the majority of participants on both orchid biotechnology workshops held in Zambia were male, reflecting gender inequality in science-based careers globally (Please refer to Table 1). Of the three specialist skills workshops, two were led by females and one male. The Kew team is an equal split of male (Jonathan Kendon and Kazutomo Yokoya) and female (Serene Hargreaves and Ruth Bone), with additional work completed in Year 2 by project interns Amy Barker and Louise Henry.
The CBU project team is male dominated (Prof Royd Vinya, Paul Mumba, Geophat Mpatwa and Felix Chileshe), however Prof, Vinya has included colleagues Drs Gillian Kabwe and Jane Kwenye as leaders of group formation activities. Most community-based activities have reported gender of meeting participants and interviewees (Please see Annex 4 meeting minutes).
The Uppsala University team is led by a female academic (Sarina Veldman) with a male MSc student recruited to undertake the project.

8. Monitoring and evaluation

In the grant application, monitoring and evaluation of achievements were built into the structure of the project, with Prof Royd Vinya monitoring project implementation of CBU led activities, and the PL and PM meeting regularly (weekly/ fortnightly via Skype) to discuss progress of work that he directly manages (e.g. support for the MSc student's fieldwork in Year 1, delivery of the three specialist skills workshops in Years 1 and 2, organisation and leadership of seed and reference collection fieldwork in Year 2, correspondence with authorities and permit applications, production of the project newsletter, development of online identification tools and an illustrated manual of Chikanda orchid). In addition to feedback to the PL on the PM's initiatives to develop experimental propagation (hand pollinations and cultivation from tubers) in his household nursery.

Measures of indicators of achievements are mostly dependent on written reports and meeting minutes submitted by project members, or delivery of tangible final products (e.g. newsletters, the MSc thesis).

In some cases it is proving difficult to demonstrate the Outputs and Activities of the project are contributing directly to the Outcome. This is partly due to the complexity of this project, and the PL's acknowledged lack of experience in sustainable development and sociological methods, and also due to infrequent communications between project partners who are working in remote areas with restricted access to phone and internet networks, and the PL/ PM. In hindsight, the PL acknowledges that inclusion of an M&E specialist would have been advisable.

9. Lessons learnt

The project is overly ambitious and complex given the three year duration, and time-lag caused by formalisation of partnerships during Year 1 (rather than a project based on an established consortium of partners), the unforeseen absence of the PM during part of Year 1 (please consult the DI office for information), and the remote locations of many of the community-based project activities. The key issue of the seasonality of orchids, and the scarcity of flowering specimens and seeds in Year 1, was not fully appreciated during project development and grant writing. Having corresponded with policy focal points during project development, and having the support of Prof. Vinya for all permit applications, we had also not anticipated delays with permissions to export specimens, including seeds that risk viability losses during these delays.

As acknowledged above (Section 8) the PL would like to include an M&E specialist in future projects of this nature, especially given the diversity of topics and methods.

The success of CBU's community-based work on development of the orchid conservation management plan has been hampered by gaps between community meetings, further complicated by the seasonal nature of farming in rural areas, that mean community members are often absent for long periods. For future projects working in such remote areas we acknowledge the opinions of the community members, for example in Kasan'ga, who felt that a continuous presence by the CBU team was required. This would require additional budgeting for recruitment of additional CBU staff, or alternatively development of opportunities for nominated Kasan'ga community members to be recruited to the CBU team seasonally, and to act as community liaisons between the rural communities and urban, university based CBU teams.

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

By email from LTSI (Darwin Projects), the few issues raised by the reviewer in Section 2 can be answered through the next appropriate report, as indicated in the review.

The PL is grateful to the reviewer for suggested improvements on project development methods, primarily development of a communications protocol and a mechanism to ensure structured and effective communications. Due to the PL's distance (UK) from many of the project activities (Zambia) and remote locations of the community-based work (NW Province Zambia) and frequent fieldwork

activities of the project partner leading the community-based work in the region, the PL and CBU project lead communicate infrequently and mostly by email, with essential calls made by the PM. 10% of PL's working time is allocated to the Darwin Project, which has not proved to be sufficient meaning most PL work is undertaken outside regular working hours. The suggestion of a risk assessment approach during project development is also gratefully received, and will be applied in future project development, and would have almost certainly identified mitigation strategies in advance.

In response to the Reviewer's third comment, the PL suggests that sustainability of the edible wild orchid trade requires a combination of technical solutions (ideally vegetative methods of propagation that can be used to supplement wild harvest), social solutions (that have been self-determined by the communities that CBU are working with) and market solutions (identified by the communities as including direct access to urban markets where they may command a higher price; but potentially also including development of new / emerging markets for sustainably sourced Zambian produce such as Community Markets for Conservation Action (COMACO) or accreditation through FairWild).

It is acknowledged by the project team that we are unlikely to achieve all aspects of the Outcome within the project funding period. It is acknowledged that community-based work needs to progress with pace in the first quarter of Year 3 to finalize the orchid conservation management plan, and respond to requests for visits to the CBU orchid lab and nursery and for support with access to urban markets (for the latter it is hoped that Sanga R&D, joining the project in Year 3, can facilitate this). It is also hoped that increased awareness can be realised in both rural and urban communities in Year 3, with positive impact on local and national governance of wetland genetic or species diversity. It is acknowledged that positive impacts on livelihoods may not be achievable within the project timeframe, but we are optimistic for a positive and long-lasting legacy of the project as we enter our third year.

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11. Other comments on progress not covered elsewhere

12. Sustainability and legacy

The project is hopes to deliver a strong legacy for increased botanical research and plant conservation biotechnology.

It is hoped that the Red Listing efforts of two Kew summer interns will encourage further Red Listing effort, led by Zambian Red List assessors who participated in the Year 1 workshop. Accessible, online resources such as the iNaturalist "Orchids of Zambia" and interactive key tools will facilitate Red Listing by providing increased access to contemporary species distribution data. The collaboration between the CBU and Kew *in vitro* biology labs is supporting on-going development of unique conservation biotechnology expertise and germplasm conservation in both labs with protocols and collections development underway in support of Zambian orchid conservation.

The PM was part of a successful bid for Zambia to host a major taxonomy conference (AETFAT) for the first time, and will host the conference in Livingstone in 2020.

The PM expressed interest in attending Kew's two week Tropical Plant Identification course in 2018, and the PL and PM's co-authored funding applications secured £2.2k of additional (the Bentham-Moxon Trust, Kew) for travel, subsistence and course fees and a place for the PM on the Tropical Plant ID course at Kew in May 2018. The Bentham-Moxon Trust grant funding also supports the PM to:

- Develop a schedule of side meetings with key Kew colleagues with research interests in the Zambian flora
- Africa programme coordinator for the Millennium Seed Bank (who will deliver seed conservation techniques training with Zambian foresters in June 2018- potentially with the PM's involvement, delivering orchid/ micro-seed training materials).
- Research leaders in Kew's Africa regional programmes who currently lead programmes of relevance to the Project Manager's future career development in Zambia (Tropical Important

Plant Areas phase II (TIPAS phase I is integrated into a Kew-led Global Challenges Research Fund proposal: Under-utilised plants of tropical Africa hub).

- Work with the PL on development of the interactive key for Chikanda orchid species.

The PL leads activities related to policy implementation and, with MSC supervisor Dr Sarina Veldman and Agents of Change Foundation Zambia (ACFZ) Exec Director Mr Brighton Kaoma, has discussed potential to participate in the forthcoming Illegal Wildlife Trade conference in London, and raise awareness of the trade and environmental and societal impacts including the cultural significance of Chikanda, particularly within Bemba communities (please refer to Section 5).

Planned Year 3 activities with potential for a lasting legacy include the adoption of the conservation action plan (although see sections 3.5 and 6), market survey work led by Sanga R&D and anticipated recommendations for improved storage methods (that can reduce waste in supply chains and improve profits). And finally the youth-led environmental awareness strategy (to be implemented by ACFZ; supported with external funds) to develop the legacy of the Darwin project and achieve its long-term impact.

13. Darwin identity

Examples of inclusion of the Darwin Initiative logo include: Conference presentations (cf. Annex 4.1 and 4.4 AETFAT and PC23 Geneva); a film by Tobias Tembo (Easthood Productions, Zambia) commissioned by the PL and PM to promote the project (using footage generated as part of the bid to host AETFAT 2020 in Zambia for the first time in the congress's history). The bi-annual project newsletters (cf. Annex 4.9, 4.22 and 4.23).

Whenever possible, the PL, PM and project partners make clear that Darwin Initiative is UK Government funded, during communications and presentations.

The project has a distinct identity, and is referred to as the "Darwin project" in informal communications. The Darwin Initiative is primarily known among conservation and development NGOs in Zambia, and organisations working with the British High Commission.

The personal Twitter account of the PL is regularly used to promote the project, and cite @Darwin-Defra to link back to the Darwin Initiative. The project Facebook page acknowledges the Darwin Initiative as the primary funder of this project.

14. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2017 – 31 March 2018)

Project spend (indicative) since last annual report	2017/18 Grant (£)	2017/18 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)			3.8%	
Consultancy costs				
Overhead Costs			9%	
Travel and subsistence			34.6%	Please see notes belov
Operating Costs			-6%	
Capital items (see below)			100%	Please see notes belov
Monitoring & Evaluation (M&E)				
Others (see below)			52.1%	Please see notes belov

TOTAL			**£13,871**	**17.1%**

Travel and subsistence Variance: Unspent Year 1 travel and subsistence costs budgeted were brought forward (following a Change Request) to support a second field trip (in February 2018) for collection of additional Reference materials and seeds. In addition the PL did not visit Zambia in Year 2 and (with permission from the DI office, by correspondence) contributed these costs to support fieldwork led by the PM in Year 2.

Costs were lower than expected for two main reasons: The field team economized on accommodation by staying with friends and supporters of the project, leading to cost savings during travel. Fieldwork was shorter in duration than expected (10 days in 2018 vs. 3 weeks in 2017), due to there being a much more favourable flowering season in 2018, with far greater quantities of specimens collected (within conservation thresholds established in the team) and seeds for the experimental orchid cultivation work. The shorter duration of the fieldwork also enabled Dr. Benny Bytebier to travel from South Africa to join the PM. Dr Bytebier provided expertise in terrestrial African orchid identification and naming during the fieldwork (and has identified all specimens in the Reference collections of 2017 and intends to work on the 2018 collections and feedback to the PM and PL).

Capital equipment variance: This represents a £175 underspend on the computer purchased for the Project Manager.

Other costs variance: Due to the challenges of orchid seed collection in Project Year 1, the project has not required the anticipated quantities of consumables required for symbiotic culture in Year 2. The most recent fieldwork (February 2018) included extensive seed collection effort, however symbiotic orchid culture in the in vitro biology lab will not be at the scale anticipated at project inception.

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2017-2018

Project summary	Measurable Indicators	Progress and Achievements April 2017 - March 2018	Actions required/planned for next period
Impact Vulnerable rural livelihoods enhanced, and threatened wildlife resources protected, by community-governed resource management practices, supported by in-country conservation biotechnology expertise and demand for sustainable products from environmentally aware populations.		It is hoped that long-term commitment to self-determined sustainable orchid harvesting levels can be achieved, however we recognise that this is unlikely without improved access to markets for harvesters (where harvesters can command higher prices for selectively harvested tubers), exposure to the cultivation work underway by project teams and support for development of alternative lucrative and sustainable income streams, to supplement potential lost income during establishment of the conservation plans (allowing orchid stock recovery) and *in lieu* of plants being available for cultivation in household nurseries (due to slow progress of propagation and establishment work; despite enhancement of in-country conservation biotechnology). The youth-led environmental awareness strategy (drafted for implantation in Yr 3) will be a vital asset to wider community participation in achievement of the long-term project impact.	[redacted]

Outcome Sustainable orchid harvest, cultivation and conservation adopted in poor Zambian communities, providing improved livelihoods and security for women, and enhanced local and national governance of wetland genetic/species diversity.	0.1 Women from ≥600 participating households in 2 Districts engaged in CBNRM scheme, reporting 30% increase in household income from sustainable natural-resource products, and 40% reduction in school absenteeism by end Yr 3. 0.2 a) ≥40% of participating CBNRM households gaining access to cultivated orchid stock and techniques training for household nurseries by end Yr 3. 0.2 b) Resources and skills increased for ≥12 conservation practitioners, cascading to ≥40 by end Yr 3 enabling ex situ conservation and cultivation of orchids (implementation of GSPC). 0.3 For 20 of the most commonly traded Chikanda orchid species, and 10 of the rarest: understanding of identity, traditional use and cultivation requirements documented by end Yr 3. 0.4 Communication and environmental awareness strategy implemented providing increased awareness of environmental implications of orchid harvesting: Among ≥600 rural households in participating communities; ≥40 conservation	0.1 At baseline there was no CBNRM scheme and no households engaged An orchid conservation plan has been drafted by three communities facilitated by the CBU teams. 0.2 The PM has established a household nursery, to experiment with vegetative propagation of orchids (multiple-tubers, fertiliser regimes), and hand-pollinations to supplement low seed quantities collected in Year 1. These activities are intended to complement those underway in the Kew and CBU labs, with slow progress on raising orchids from seed. 0.3 Cultivation has proved challenging but success have been reported in the labs (germination) and see 0.2 for additional exp. Work. The MSc work has contributed to knowledge of species in the trade, complemented by the PM's work cultivating traded orchids and creating flowering specimens for ID, and the community interviews led by CBU. 0.4 Not yet adequately formalised among rural communities.	0.1 Respond to requests made by the communities include support with direct access to urban markets, tangible means of increasing awareness (e.g. posters in key locations), visits to the CBU lab to see orchids in cultivation (in lieu of them being available for distribution). 0.2 and 0.3 PM to document his household nursery work, and use the document to align scientific names with naming systems in use in Zambia. 0.4 Year 3 activities planned to address a range of communities (primarily urban).

	practitioners; ≥60 urban school children (and their families).		
Output 1. **1**. **Mitigation:** Sustainable resource management practiced, securing livelihoods for women in poor rural communities.	1.1 Number of households practising destructive harvest methods reduced (from baseline measured in Yr 1) by 60% by Yr 2, and gaining access to supplementary cultivated Chikanda plants for household nurseries by Yr 2. 1.2 a) Household income increased (from baseline measured in Yr 1) by 30% in Yr 3 through adoption of supplementary sustainable income streams (cultivated Chikanda and other sources). 1.2 b) School absenteeism reduced (from baseline measured in Yr 1) by 40% in Yr 3 due to increased household income, and reduced pressure on school-age children to participate in Chikanda harvest. 1.3 Orchid tuber waste reduced at entry to supply chain (due to reduced harvest of juvenile material) from baseline in Yr 1, by 30% in Yr 3.	1.1 The participatory orchid management plan has been drafted but not finalised by the community groups. Group formation activities (led by Drs Kabwe and Kwenye) took place in Mwinlunga District in March 2017 (Year 1) that included formal visits to local government and traditional authorities, and workshops with ca. 85 community members in two villages (Nyminkanda and Munwa). In Year 2 a CBU team comprising Prof. Vinya and Mr Geophat Mpatwa (CBU technician) led community engagement activities to develop the orchid conservation plans in Nyminkanda and Munwa and an additional pilot village (23rd August to 1st September 2017). This was followed by work designed to formalize group formation in these communities, by Dr. Kabwe and Kwenye (18th to 21st December 2017). However Drs Kabwe and Kwenye reported that community members for two of the three pilot villages had moved to seasonal farming sites and were therefore unavailable (meetings held in Nyminkanda only). 1.3 Work postponed to Year 3 following change request.	
Activity 1.1 Baseline study completed on current wild resource management of Chikanda orchid tubers (harvesting practice, handling and storage).		Completed Year 1	
Activity 1.2 Local supplementary sustainable income streams identified [in partnership with RBG Kew staff].		It is hoped that a collaboration with the ZYCALA Project (Gaia Education Foundation and WWF Zambia) can link honey production (training opportunities, access to markets) to communities involved in Chikanda harvest. This work is dependent on honey samples being exported for testing (pending permits being secured as of April 16th 2018).	

Activity 1.3 Baseline & repeat studies of household income and school attendance (Yrs 1 and 3).		Completed Year 1
Activity 1.4 Local-level enterprises and institutional structures established (to support production and trade of cultivated orchids).		In December 2017 Drs Kabwe and Kwenye undertook group formation activities in the project area (Mwinilunga, North-Western Province) in order to: Support development of well-structured groups in the communities ; Facilitate selection of group leaders; Facilitate selection of group representatives who will visit the CBU lab and nursery facilities. Drs Kabwe and Kwenye report that "Most community members of Munwa and Kamau had moved to their farming sites and were unavailable." This work is also hampered by the slow progress of the Chikanda orchid cultivation work underway by the CBU and RBG Kew teams, meaning that cultivated orchids are not yet available for distribution to household nurseries.
Activity 1.5 Training needs for local communities for orchid management, storage of tubers, and cultivation assessed.		Integrated into Activity 1.6
Activity 1.6 Participatory orchid management plan (including handling and storage of harvested tubers) formulated and implemented.		This work has been delayed by a number of factors, including changes in community location to seasonal farming sites, meaning that they were unavailable to attend continued engagement activites. In a recent update Prof Royd Vinya (RV) leading these activities has explained that the process of formulating the plans will only be completed (scheduled this quarter) once the communities have completed farming activities. The draft plan is due for finalisation by June 2018.
Activity 1.7 Cultivated orchid stock distributed to participating households.		While there have been successes with germination in both Kew and CBU labs, progress has been slow and cultivated orchids are not yet available for distribution. A summary of activities, including challenges experienced, are described by Senior lab technician at CBU Mr Paul Mumba in the accompanying lab reports.
Activity 1.8 Survey of changes in harvesting practice of Chikanda orchid tubers.		Year 3 Activity
Output 2. **2. Capacity:** Both local level community capacity AND conservation practitioner capacity increased to: Manage wild orchid populations;	2.1 1,000 asymbiotic seedlings cultivated for supplementary plantings or household nurseries, by end Yr 1, rising to 5,000 by end Yr 2.	2.1 631 plantlets of *Liparis* have been established, that were sown during the greenpod orchid cultivation workshop in March 2017 with Mrs. Hildegard Crous. Very recently (in the last few weeks) Mr Mumba has reported germination of putative Chikanda orchid species (*Disa erubescens*), which has taken almost one year to germinate.

enhance delivery of CBD (GSPC Objectives); and facilitate implementation of CITES legislation for plants.	2.2 By end Yr 2, 40% of the participating community households are cultivating orchid germplasm supplied by the CBU laboratory. 2.3 By end Yr 1, specialist plant conservation skills base increased to ≥12 individuals (3xCBU staff and ≥ nine other conservation practitioners) [IUCN Red List, orchid conservation biotechnology methods and augmented with seed banking]. 2.4 Increased resources for classical and molecular identification of traded taxa, from 0 specimens to ≥ 150, by end Yr 2 (two field collection seasons). 2.5 Increased accessibility to orchid identification tools by end Yr 2, to support implementation of CITES for plants [target for ≥20 species of the most commonly traded Chikanda orchid species, and ≥5 species from the "Top-10" rarity list]. 2.6 First symbiotic seedlings (5,000) of Zambia's 10 rarest Chikanda orchid species made available for in-country ex situ conservation and species recovery plans by end Yr 3. [A foundation towards future work by CBU staff to begin symbiotic seed culture in-house].	2.2 Dependent on 2.1 2.3 Workshop 3 delivered and attended by 10 participants including the CBU core team of 3 technicians. 2.4 125 specimens collected during two field trips (in Year 1 and Year 2). Specimens collected in Year 1 were identified (in Year 2) by expert African terrestrial orchid taxonomist Dr Benny Bytebier, who then joined project fieldwork in Year 2. Samples collected in year have already been DNA sequenced, and the sequences included in comparison work by MSc student Seol-Jong Kim. 2.5 The PM has not yet completed the online interactive key (in Lucid software) and will continue with the work in Year 3. 2.Please refer to 2.1
Activity 2.1 CBU lab equipped for orchid culture; 3xCBU technical staff trained in asymbiotic orchid seed germination and culture methods.		Mr Philip Seaton (Orchid Seed Stores for Scientific Use) delivered a workshop on mature seed collection methods, viability testing (including the Tetrazolium

		test), seed drying and storage methods, and cultivation using asymbiotic techniques. Please refer to point 2.3 below for further details.
Activity 2.2 3xCBU technical staff (≥9 other conservation practitioners) trained in greenpod orchid seed harvest and sowing, and general orchid cultivation (Workshop 2) for dissemination to rural communities (in Activity 1.5).		Year 1 Activity.
Activity 2.3 3xCBU technical staff (≥9 other conservation practitioners) trained orchid seed banking and viability testing, and orchid seed bank established at CBU (Workshop 3).		The Mature orchid seed workshop led by Philip Seaton (Orchid Seed Stores for Scientific Use) teaching participants from government, academia and conservation institutions on techniques of seed harvest, storage and viability testing as well as the start of a Chikanda seed bank at CBU. There were fewer participants than expected in this workshop (ten including 3 CBU staff). Of these, only two female colleagues were selected by their organisations to participate.
Activity 2.4 3xCBU technical staff (≥9 other conservation practitioners) trained in IUCN Red List and rapid conservation assessment methods (Workshop 1; see 3.1).		Year 1 Activity
Activity 2.5 Reference Collection & Tissue Bank (orchid specimens) established for DNA extraction and identification of traded species using molecular markers.		The Reference collection established in Year 1 was further developed during fieldwork led by the PM in Year 2.
Activity 2.6 Multi-access illustrated orchid identification key created using Lucid software and made available for download in Google Play Store		Drafted by PM but not yet available online.
Activity 2.7 Symbiotic seedlings (5,000) of ten of the rarest Chikanda orchid species cultured at RBG Kew, for in-country ex situ conservation and species recovery plans.		Fieldwork in 2017 resulted in 61 collections of orchid roots or protocorms that were used for isolation of endophytic fungi. Seed collection by the PM in 2017 resulted in fewer seed collections than anticipated (seeds from 9 species), with low viability.
Activity 2.8 Symbiotic seedlings repatriated to Zambia (CBU ex situ conservation facility).		
Output 3. **3. Knowledge:** Understanding of orchid identity, rarity, cultivation and	3.1 Traditional, local utilization practices of the 20 most commonly harvested Chikanda orchid species	3.1 Year 1 Activity reported by CBU team.

traditional utilization practices incorporated into Chikanda orchid conservation plan.	documented by end Yr 1. *[Please refer to Ethics Statement].* 3.3 In-depth study of seed germination requirements completed for high risk species (from "top-10" list), enabling in-country ex situ conservation and species recovery (contributing to GSPC Targets 3 and 8), by end Yr 2. Includes collection of 250 root samples 3.5 Molecular data gathered for ≥200 samples of traded wild orchid tubers and derivatives, collected (by MSc student) from markets in ≥2 urban centres in Zambia for identification at Uppsala University, Sweden, by end Yr 1.	3.2 IUCN Red List assessments have been completed for 16 species from Zambia, reviewed and submitted to IUCN for publication online. In addition to extinction risk, the assessments describe species distribution, taxonomy, and identify gaps in current knowledge to draw attention to work required. 3.3 Work delayed please refer to Activities 1.7 and 2.1 in the main text. 3.4 Tests completed on 9 seed batches received in September 2017 (Table4 main text). 3.5 130 samples gathered from > 2 urban markets and included in molecular barcoding work led by MSc student Mr Seol-jong Kim, under academic supervision of Dr. Sarina Veldman (Uppsala University).
Activity 3.1 Participatory orchid management plan (Activity 1.6) agreed for rural, community-managed resources, incorporating local traditional knowledge.		Year 1 Activity
Activity 3.2 Workshop 1: Participatory IUCN Red List and rapid assessment workshop completed. (See Activity 2.4).		Year 1 Activity. The workshop identified a need for greater access to species distribution data (including herbarium specimens and geo-referenced photos of live plants). In response, the PL and workshop leader secured places for new Kew interns who, in 2017, georeferenced ca. 600 specimens and completed 16 full Red List assessments.
Activity 3.3 Fungal symbionts of "10-ten" orchids sampled from the field, isolated, identified and cultured (with full voucher specimens).		Due to incompatible timeframes of Red List activities vs. fieldwork to collect fungal symbionts (in Year 1), fungal symbionts were instead sampled during fieldwork based on opportunistic survey across a broad geographical area, to try to sample a range of putative fungal symbionts for culture. The lab work is complete (1722 fungal cultures isolated from roots of 28 orchid species; 840 isolated were DNA barcoded (ITS) and 336 identified (from 20 orchid species).
Activity 3.4 Follow-up seed collection completed for target taxa and seeds dispatched to RBG Kew for symbiotic culture.		Over 30 seed collections made (Feb 2018), including six from hand-pollinations of plants cultivated from traded tubers in the PM's household nursery. Seeds have been sent ot the CBU lab, and the PM is awaiting permissions (> 6 weeks) for export to Kew.

Activity 3.5 Orchid seed viability testing undertaken during orchid seed collection phases.		Of the 9 collections received at Kew in Year 1, there is reported low viability (tested by germination).
Activity 3.6 Open access paper submitted for publication, and conference/ symposium presentation delivered		
Activity 3.7 Chikanda orchid tubers and processed Chikanda cake sampled from urban markets for identification using molecular barcodes.		Year 1 Activity
Activity 3.8 Four molecular markers sequenced for ≥200 samples of traded wild orchid tubers and derivatives.		Year 1 Activity; with extension into Year 2, enabling comparison (DNA bacode markers) to the project reference collections identified and made available to date.
Activity 3.9 MSc thesis and paper(s) prepared.		MSc thesis completed Year 2, paper in prep.
Output 4. **4. Awareness:** Communication and environmental awareness strategy developed and implemented.	4.1 a) All participating local communities (traditional leadership, headmen, households, government agencies) are aware of the project purpose. 4.1 b) Environmental awareness strategy leading to 60% of the commodity groups aware of the negative environmental implications of their orchid harvesting methods by 2nd Quarter of Yr 2. 4.3 a) Strong communication channels established with CITES (Zambian Wildlife Authority) and CBD (Director of Environment) focal points by mid- Yr 1; 4.3 b) >20 senior conservation practitioners aware of project activities and early outputs by end Y1; 4.3 c) >40 conservation practitioners aware of project activities by project end (in addition to workshop participants).	4.1 The survey method has meant that it is difficult to quantify community awareness. Interviews were focused on households known to participate in Chikanda harvest and/ or trade. 4.2 This Year 1 work was postponed to Year 3 following a change request. 4.3 Communications related to permit requests for export of seeds and/ or botanical specimens, led by the PM and with support from Prof. Vinya. Inclusion of over 20 conservation practitioners from Forestry Service, academia, NGOs, and independent botanists and ecologist in three workshops (two in Year 1 and one workshop in Year 2). > 40 conservation practitioners aware of the project activities via bi-annual circulation of the newsletter. 4.4 Please see Activity 4.8 for a description of the delays with this Measurable Indicator.

Activity 4.1 Communication and environmental awareness strategy developed and implemented in rural communities through participatory meetings (required for all Output 1 activities).	No formal strategy yet developed among community groups, although community members have requested support with production of posters in key places around villages.
Activity 4.2. Biodiversity Convention national focal points aware of project through correspondence and meetings with project leader and partners	Continued correspondence. However mostly during permit applications for research and export of specimens. The project newsletter is circulated among ca. 50 addressees, including focal point contacts.
Activity 4.3 Market survey and supply chain analysis completed in 3 urban areas: Lusaka (Soweto market), Ndola (Masala) and Kitwe (Sokoine).	Year 3 Activity (postponed from Year 1 following Change Request in Year 1).
Activity 4.4 Pamphlets produced and made available to traders/ market associations with recommendations on improved Chikanda handling and storage.	Year 3 Activity (postponed from Year 1 following Change Request in Year 1).
Activity 4.5 Bi-annual project newsletter circulated.	Circulated among ca. 50 addressees, including focal point contacts.
Activity 4.6. First results of wildlife "forensics" study (DNA bar-coding) communicated in a report/ article written, directed at CITES officer and legislators	This work has been delayed following a one year delay with completion of the MSc thesis. A paper is in preparation for submission to a peer-reviewed journal. Following publication the team will prepare an article for circulation among CITES legislators.
Activity 4.7 Report delivered to CBD and NBSAP focal point (Contact Officer) detailing facilities, resources, and skills available for implementation of GSPC Objectives, in preparation for 6th CBD Report and updated 1999 NSBAP.	End of project activity.
Activity 4.8 Public awareness programme completed: "Patchwork Meadow" programme integrated into existing UK-Zambia cultural-educational exchange programme, culminating in a public exhibition.	It has not been possible to develop the Patchwork Meadow initiative, but an alternative public awareness programme has been developed by Agents of Change Foundation, Zambia for delivery in Year 3.
Activity 4.9 Field trip to orchid habitats with workshop on plant ID (using interactive key tool); visits by local school groups to CBU orchid conservation facility, to learn lab methods (with advice from the Rwandan Orchid Schools' Project).	This activity is related to the programme in 4.8 and has not been achieved. We anticipate that the youth awareness programme led by Mr Kaoma (Agents of Change Foundation Zambia) will have far greater reach than the original "Patchwork Meadow" project and will also primarily benefit young Zambians, current and future consumers of Chikanda cake.

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

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: (Max 30 words) Vulnerable rural livelihoods enhanced, and threatened wildlife resources protected, by community-governed resource management practices, supported by in-country conservation biotechnology expertise and demand for sustainable products from environmentally aware populations.			
Outcome: (Max 30 words) Sustainable orchid harvest, cultivation and conservation adopted in poor Zambian communities, providing improved livelihoods and security for women, and enhanced local and national governance of wetland genetic/species diversity.	0.1 Women from ≥600 participating households in 2 Districts engaged in CBNRM scheme, reporting 30% increase in household income from sustainable natural-resource products, and 40% reduction in school absenteeism by end Yr 3. 0.2 a) ≥40% of participating CBNRM households gaining access to cultivated orchid stock and techniques training for household nurseries by end Yr 3. 0.2 b) Resources and skills increased for ≥12 conservation practitioners, cascading to ≥40 by end Yr 3 enabling ex situ conservation and cultivation of orchids (implementation of GSPC). 0.3 For 20 of the most commonly traded Chikanda orchid species, and 10 of the rarest: understanding of identity, traditional use and cultivation requirements documented by end Yr 3.	0.1 Orchid conservation action plan (incorporating traditional utilization, agreed sustainable harvest measures and identified supplementary income streams); community surveys to record average income at project start (Yr 1) and close (Yr 3); local school attendance registers (comparison between Yrs 1 and 3). 0.2 Community surveys (Yrs 1 and 3) and project reports; workshop attendance application forms and certificates; photo essay of CBU lab facility development; collections database of CBU seedlings/ plants. 0.3 Orchid conservation plan; community surveys and meeting minutes; scientific papers and presentations; collections databases.	No breakdown in communication or change of priorities between UK lead and collaborating institutes. *Mitigation for this IA*: Strong foundation for all project partnerships from outset with regular communication (email/ Skype/ meetings). Strong individual and institutional commitment to project aims from main partners. Edible orchids can be successfully cultivated and tubers obtained for harvest. *Mitigation for this IA:* We have access to a wide range of expertise at Kew and from a specialist growers and conservationists, using a range of methods. The genus *Disa* will be our first priority due to ease of seed germination and some taxa growing from stolons (that rapidly give rise to new tubers).

	0.4 Communication and environmental awareness strategy implemented providing increased awareness of environmental implications of orchid harvesting: Among ≥600 rural households in participating communities; ≥40 conservation practitioners; ≥60 urban school children (and their families).	0.4 Community surveys and interviews; qualitative data from interviews and social media entries; bi-annual newsletter and Darwin reports; correspondence with focal points; updated of plant conservation capacity (skills and resources) reported to Contact Officer for CBD and NBSAP, for incorporation in national reports.	[Please refer to cover letter, and supporting documents from Hildegard Crous for "Proof of Concept"].
Outputs: **1**. **Mitigation:** Sustainable resource management practiced, securing livelihoods for women in poor rural communities.	1.1 Number of households practising destructive harvest methods reduced (from baseline measured in Yr 1) by 60% by Yr 2, and gaining access to supplementary cultivated Chikanda plants for household nurseries by Yr 2. 1.2 a) Household income increased (from baseline measured in Yr 1) by 30% in Yr 3 through adoption of supplementary sustainable income streams (cultivated Chikanda and other sources). 1.2 b) School absenteeism reduced (from baseline measured in Yr 1) by 40% in Yr 3 due to increased household income, and reduced pressure on school-age children to participate in Chikanda harvest.	1.1 a) Community surveys and participatory meetings* (comparison between Yrs 1 and 3). 1.1 b) Minutes of Commodity groups and village conservation clubs* 1.1 c) Illustrated manual describing best practice, following consultation with harvesters/ the community.* 1.2 a) Community surveys* to record household income (comparison between Yrs 1 and 3); recorded interviews* for qualitative data; newspaper article or newsletter entry. 1.2 b) School attendance registers, and community surveys* (comparison between Yrs 1 and 3).	Identifying communities/ individuals willing to participate, and gaining free, prior and informed consent from Chikanda harvester and trader communities/ individuals for all initiatives and activities. *Mitigation for this IA*: Project partners (Dr. Royd Vinya's team and Sanga R&D) have considerable experience in participatory community based natural resource management in Zambia, in both rural settings, and urban market places. This includes (in rural settings) sensitivity to traditional community hierarchies and language skills.

	1.3 Orchid tuber waste reduced at entry to supply chain (due to reduced harvest of juvenile material) from baseline in Yr 1, by 30% in Yr 3.	1.3 Qualitative data (interviews*) reporting positive/ negative trends. *<u>For all Outputs: all meeting attendance records, survey data and interview participation aggregated by gender, and data gathered and shared in line with our Ethics Statement.</u>*	
2. Capacity: Both local level community capacity AND conservation practitioner capacity increased to: Manage wild orchid populations; enhance delivery of CBD (GSPC Objectives); and facilitate implementation of CITES legislation for plants.	2.1 1,000 asymbiotic seedlings cultivated for supplementary plantings or household nurseries, by end Yr 1, rising to 5,000 by end Yr 2. 2.2 By end Yr 2, 40% of the participating community households are cultivating orchid germplasm supplied by the CBU laboratory. 2.3 By end Yr 1, specialist plant conservation skills base increased to ≥12 individuals (3xCBU staff and ≥ nine other conservation practitioners) [IUCN Red List, orchid conservation biotechnology methods and augmented with seed banking]. 2.4 Increased resources for classical and molecular identification of traded taxa, from 0 specimens to ≥ 150, by end Yr 2 (two field collection seasons).	2.1 CBU collections database (available online); laboratory reports; blog posts and photographs to project website. 2.2 Training workshop reports, local level community meeting minutes, work plans, and quarterly reports. 2.3 Attendance certificates, attendance lists and workshop reports. 2.4 Collections data retrievable via free, online* data repositories; project reports; scientific publications and/ or conference proceedings. [When sufficient material is available, collections will be duplicated at RBG Kew and University of Uppsala]. **Detailed specimen locality data will be obscured to protect rare species from exploitation. Ethnobotanical & traditional knowledge data will be*	Local communities willing to adopt new methods. *Mitigation for this IA:* There is an identified need from communities seeking to gain control over the resource in household nurseries. The communities will be involved from the outset, and will inform the conservation plan to ensure that traditional use is respected alongside new cultivation methods. The real potential for increased income (both from sustainable management and cultivation, and additional income streams) are strong incentives for participation and willingness to adopt methods. Infrastructure and need identified, enabling specialist methods/ skills from training workshops to be applied by participants.

	2.5 Increased accessibility to orchid identification tools by end Yr 2, to support implementation of CITES for plants [target for ≥20 species of the most commonly traded Chikanda orchid species, and ≥5 species from the "Top-10" rarity list]. 2.6 First symbiotic seedlings (5,000) of Zambia's 10 rarest Chikanda orchid species made available for in-country ex situ conservation and species recovery plans by end Yr 3. [A foundation towards future work by CBU staff to begin symbiotic seed culture in-house].	*safeguarded in line with our Ethics Statement.* 2.5 Interactive key made available online and number of views/ downloads tracked by Google analytics. Informal interviews with users of key reported (annual DI report). 2.6 RBG Kew and CBU collections databases (available online); blog posts and photographs to project website; Darwin Project report.	*Mitigation for this IA:* Attendance of specialist training workshops is prioritised for 3 core staff at CBU who have been assigned to the project (CBU that has pledged institutional commitment to the project). Additional places at workshops will be assigned competitively, based on the capacity (existing resources, skills and institutional remit) available that enable the prospective participants to make immediate use of the methods/ skills and who have potential to cascade to their teams. Users can access the internet. *Mitigation of this IA:* Mobile internet connections are widely used in Zambia (via portable USB "dongles", e.g. MTN Fastlink). The interactive key can also be downloaded for use offline. The illustrations from the key, and described spot ID characters, can be re-purposed for hard-copy pamphlets/ posters. Fungal symbionts can be found and host orchid species identified (see mitigation for IA 3.2). Seeds of the target taxa are gathered and delivered to RBG Kew for culture.

			Mitigation for this IA: At least one in-country project partner will participate in fieldwork for collection of target taxa fungal symbionts, ensuring follow-up seed collection is accurate and timely.
3. **Knowledge:** Understanding of orchid identity, rarity, cultivation and traditional utilization practices incorporated into Chikanda orchid conservation plan.	3.1 Traditional, local utilization practices of the 20 most commonly harvested Chikanda orchid species documented by end Yr 1. *[Please refer to Ethics Statement].* 3.2 a) Preliminary, rapid Red List assessments completed for the three target Chikanda genera (100 species) by end Yr 1. 3.1 b) A "top-10" of the most endangered species identified for in-depth research and ex situ conservation, by end Yr 1. 3.3 In-depth study of seed germination requirements completed for high risk species (from "top-10" list), enabling in-country ex situ conservation and species recovery (contributing to GSPC Targets 3 and 8), by end Yr 2. Includes collection of 250 root samples 3.4 First seed storage information and viability testing data available for Chikanda orchids of Zambia (completed for 30 species), by end Yr 3.	3.1 Survey reports. Orchid conservation plan (incorporating local utilization practices). 3.2 List of "Top-10" most at risk orchid species included in Darwin Project Report, press releases, the project website and a short popular press article. 3.3 a) Species-specific seed germination protocols delivered to project partners towards development of Conservation Action Plans for the "Top-10" species most at risk. 3.3 b) Field records and associated herbarium vouchers, for number of root samples gathered. Laboratory records (reports/ database) for accessions of fungal isolates, cryopreserved specimens and symbiotic orchid seedlings cultured in vitro. 3.3 c) Results presented in an academic paper submitted for peer review and open access publication, and at least one scientific conference.	Electricity "load shedding" causing disruption to power supply in Zambia and reduces computing and internet access. *Mitigation for this IA:* Conservation assessments will be completed during a rapid participatory workshop, reducing dependence on long-term use of online resources. Fungal symbionts can be found and host orchid species identified. *Mitigation for this IA:* The team member leading this work programme has considerable relevant experience, most recently working on the successful Madagascar Orchid Conservation Project (RBG Kew) in challenging field conditions. Herbarium vouchers and material for DNA extraction will be gathered to enable classical and molecular ID of host orchids. MSc student can be recruited and gain access to the markets. *Mitigation for this IA:* The MSc supervisors have recruited several past students and completed a complementary study (using similar

	3.5 Molecular data gathered for ≥200 samples of traded wild orchid tubers and derivatives, collected (by MSc student) from markets in ≥2 urban centres in Zambia for identification at Uppsala University, Sweden, by end Yr 1.	3.4 CBU collections database (available online). 3.5 MSc thesis, scientific paper and article in Traffic Bulletin (for Traffic, the wildlife trade monitoring network).	methods) in Tanzania. The MSc student will be supported by in-country collaborators for the market surveys, who bring participatory meeting and local language skills.
4. Awareness: Communication and environmental awareness strategy developed and implemented.	4.1 a) All participating local communities (traditional leadership, headmen, households, government agencies) are aware of the project purpose. 4.1 b) Environmental awareness strategy leading to 60% of the commodity groups aware of the negative environmental implications of their orchid harvesting methods by 2nd Quarter of Yr 2. 4.2 Increased awareness of traded Chikanda waste management options among traders in 3 urban markets by mid- Yr 2. 4.3 a) Strong communication channels established with CITES (Zambian Wildlife Authority) and CBD (Director of Environment) focal points by mid- Yr 1; 4.3 b) >20 senior conservation practitioners aware of project activities and early outputs by end Y1; 4.3 c) >40 conservation practitioners aware of project activities by project end (in addition to workshop participants).	4.1 Copperbelt University project quarterly reports (sensitization workshop report); Communication and environmental awareness strategy document. 4.2 Market survey results and value chain analyses report; recorded interviews for qualitative data; newspaper article or newsletter entry; pamphlets from Sanga R&D advising on best practice for Chikanda (available among traders and marketing associations). 4.3 a) Correspondence. 4,3 b) Meetings recorded in DI report(s). 4.3 c) Wildlife "forensics" article made available. 4.2 d) Outcomes regularly communicated throughout project cycle, Yrs 1-3, via bi-	Communities will want to engage (Please see box 2 for mitigation). Focal points will want to engage. *Mitigation for this IA:* The PI and other project partners (CBU) have worked with the focal points in the past and have made them aware of proposed project. In addition, we have contacted the FCO who are involved in lobbying on environmental issues in Zambia. Schools will want to participate. *Mitigation for this IA*: One high school (Helen Kaunde School, Kitwe) has already been approached by the PI (in 2013) and the idea was warmly received. In addition this is one of two schools in Kitwe that participate in a UK-Zambia cultural exchange programme (>15 exchanges completed). The PI has secured advisory support from the Rwandan Orchid Schools Project (led by Writhlington Orchid School, UK and Kitabi College for Conservation and

	4.4 Public awareness increased (of vulnerable rural livelihoods, plant conservation and DI project) with minimum of 60 school children (+ families) participating in an education/ outreach exhibition in a major urban area, by end Yr 2.	annual project newsletter. 4.3 e) Final report delivered to CBD and NBSAP focal point (Contact Officer). 4.4 Press releases and radio broadcasts; social media posts (e.g. Kingsmead-Zambia Link Facebook Page); promotional materials featuring project from Plantlife International; entry in bi-annual project newsletter.	Environmental Management, Rwanda), and Plantlife International.

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

1.6 Baseline study completed on current wild resource management of Chikanda orchid tubers (harvesting practice, handling and storage).
1.7 Local supplementary sustainable income streams identified.
1.3 Baseline & repeat studies of household income and school attendance (Yrs 1 and 3).
1.4 Local-level enterprises and institutional structures established (to support production and trade of cultivated orchids).
1.5 Training needs for local communities for orchid management, storage of tubers, and cultivation assessed.
1.6 Participatory orchid management plan (including handling and storage of harvested tubers) formulated and implemented.
1.7 Cultivated orchid stock distributed to participating households.
1.8 Survey of changes in harvesting practice of Chikanda orchid tubers.

2.1 CBU lab equipped for orchid culture; 3xCBU technical staff trained in asymbiotic orchid seed germination and culture methods.
2.2 3xCBU technical staff (≥9 other conservation practitioners) trained in greenpod orchid seed harvest and sowing, and general orchid cultivation (Workshop 2) for dissemination to rural communities (in Activity 1.5).
2.3 3xCBU technical staff (≥9 other conservation practitioners) trained orchid seed banking and viability testing, and orchid seed bank established at CBU (Workshop 3).
2.4 3xCBU technical staff (≥9 other conservation practitioners) trained in IUCN Red List and rapid conservation assessment methods (Workshop 1; see 3.1).
2.5 Reference Collection & Tissue Bank (orchid specimens) established for DNA extraction and identification of traded species using molecular markers.
2.6 Multi-access illustrated orchid identification key created using Lucid software and made available for download in Google Play Store.

2.7 Symbiotic seedlings (5,000) of ten of the rarest Chikanda orchid species cultured at RBG Kew, for in-country ex situ conservation and species recovery plans.
2.8 Symbiotic seedlings repatriated to Zambia (CBU ex situ conservation facility).

3.1 Participatory orchid management plan (Activity 1.6) agreed for rural, community-managed resources, incorporating local traditional knowledge.
3.2 Workshop 1: Participatory IUCN Red List and rapid assessment workshop completed.
3.3 Fungal symbionts of "10-ten" orchids sampled from the field, isolated, identified and cultured, with full voucher specimens.
3.4 Follow-up seed collection completed for target taxa and seeds dispatched to RBG Kew for symbiotic culture.
3.5 Orchid seed viability testing undertaken during orchid seed collection phases.
3.6 Open access paper submitted for publication, and conference/ symposium presentation delivered.
3.7 Chikanda orchid tubers and processed Chikanda cake sampled from urban markets for identification using molecular barcodes.
3.8 Four molecular markers sequenced for ≥200 samples of traded wild orchid tubers and derivatives.
3.9 MSc thesis and paper(s) prepared.

4.1 Communication and environmental awareness strategy developed and implemented in rural communities through participatory meetings (required for all Output 1 activities).
4.2 Biodiversity Convention national focal points aware of project through correspondence and meetings with project leader and partners.
4.3 Market survey and supply chain analysis completed in 3 urban areas: Lusaka (Soweto market), Ndola (Masala) and Kitwe (Sokoine).
4.4 Pamphlets produced and made available to traders/ market associations with recommendations on improved Chikanda handling and storage.
4.5 Bi-annual project newsletter circulated.
4.6 First results of wildlife "forensics" study (DNA bar-coding) communicated in a report/ article written, directed at CITES officer and legislators.
4.7 Report delivered to CBD and NBSAP focal point (Contact Officer) detailing facilities, resources, and skills available for implementation of GSPC Objectives, in preparation for 6th CBD Report and updated 1999 NSBAP.
4.8 Public awareness programme completed: "Patchwork Meadow" programme integrated into existing UK-Zambia cultural-educational exchange programme, culminating in a public exhibition.
4.9 Field trip to orchid habitats with workshop on plant ID (using interactive key tool); visits by local school groups to CBU orchid conservation facility, to learn lab methods (with advice from the Rwandan Orchid Schools' Project).

Annex 3: Standard Measures

Table 1 Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
2	1 MSc student	M	S Korea	1	1		1	1
3[1]	IUCN Red List Assessor training workshop (Oct. 3-7, 2016) [IUCN accredited course qualifying as Red List Assessor]	4 female 8 male	7 Zambian; 1 South African; 2 British; 2 American (all Zambian residents)	12			12	≥ 12
4c	1	As above	As above	1	1		1	1
4d[2]	34 weeks	As above	As above	34	34		68	34
6A[3]	Greenpod orchid seed micropropagtion training workshop (Mar. 20-24, 2017)	1 female, 5 male	Zambian	6			6	≥ 12
6A[3]	Dry orchid pod seed workshop (April 2017)	2 female, 8 male	7 Zambian, 1 American (Zambian resident)		10		10	≥ 12
6A[3]	Orchid/fungal isolation/culture training workshop (Sept. 9-22, 2016)	3 male	Zambian	3			3	3
9	Conservation management plan, based on consultation with communities in 3 villages						0	1
10	1 field guide, 1 interactive key				1st drafts available		0	2
11A							0	1
11B							0	1
12A	1 Fungal symbionts in culture at Kew;							2

[1] Please note that this training was erroneously coded as 4A in the Year 1 annual report
[2] Please note that this was erroneously coded for undergraduate studies in the Year 1 annual report
[3] Please that this training was erroneously coded as 4B in the Year 1 annual report

	1 Orchid Reference Collection							
13A	1 Botanical Reference Collection data (in two parts)			0.5			0	1
13B	1 Geo-referenced dataset developed for IUCN Red Listing						0	1
14A	Seminar at Dept. National Parks & Wildlife (Feb. 3, 2017)	4 female 7 male	Zambian	11				0
14B	3[4]				3			
20	£1,911			£1,911[5]	£982[6]		£2,893	£1,000[7]
23	Bentham-Moxon Trust and Ferguson Trust Grant contributions[8]				£7,7109		£7,7109	

[4] Poster presented by Hildegard Crous on behalf of H. Crous, N. Wightman, F. Chileshe, P. Mumba, G. Mpatwa, M. Kaluwe, M. Sichamba, R.E. Bone, R. Vinya at the European Orchid Congress (Paris) March 2018 [*Challenges and Success achieved in the Chikanda conservation project*]; Illustrated talk presented by Ruth Bone (PL) at an IUCN SSC Global Orchid Programme side event at the Plants Committee 23 meeting (CITES), in Geneva, July 2017; Illustrated talk presented by Nicholas Wightman (PM) at an AETFAT Congress in Nairobi, in May 2017.

[5] £825 laptop for PM, excluding interactive key software costs; £1086 lab equipment to CBU

[6] Water distiller purchased for CBU lab (excluding freight from South Africa)

[7] Latop only, the physical assets in the lab were not budgeted for (small lab items only, budgeted under operating costs) but identified as needed during Year 1

[8] Supporting additional activities outside scope of original grant application budget (additional funds to support community engagement activities in NW Province led by CBU; support for dissemination including film by Easthood Productions, conference attendance and additional training opportunities for the PM, youth-led awareness strategy development and delivery in Year 3).

Fig. 11 Some of the scientific equipment purchased for the project for the project host country in vitro biology lab (CBU, School of Natural Resources).

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)
Chikanda Orchid Conservation Initiative Newsletter *	Newsletters	Nicholas Wightman (PM), Issue 1 (2016), Issue 2 (2017) Issue 3 (2018)	M	Zambian	Self-published	https://www.facebook.com/chikandaorchidconservation/
Eaten to extinction *	Popular press article	Stephanie Pain (2017)	F	British	New Scientist	Full article available from PL on request (summary available online)

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	Y
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	N
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	Y
Do you have hard copies of material you want 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.	N
Have you involved your partners in preparation of the report and named the main contributors	Y
Have you completed the Project Expenditure table fully?	Y
Do not include claim forms or other communications with this report.	