

## Darwin Initiative Main Project Annual Report

**Important note:** To be completed with reference to the Reporting Guidance Notes for Project Leaders:

*it is expected that this report will be no more than 10 pages in length, excluding annexes*

**Submission Deadline: 30 April**

### Darwin Project Information

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| Project Reference   | 22-005  |
| Project Title   | Conserving Madagascar's yams through cultivation for livelihoods and food security  |
| Host Country/ies  | Madagascar  |
| Contract Holder Institution   | RBG, Kew  |
| Partner institutions  | Kew Madagascar Conservation Centre (KMCC), Feedback Madagascar Ny Tanintsika (FBNT), Silo National des Graines Forestières (Madagascar, SNGF).  |
| Darwin Grant Value  | £291, 782   |
| Funder (DFID/Defra)   | DFID  |
| Start/end dates of project  | 1/4/15-31/3/18  |
| Reporting period (e.g., Apr 2015 – Mar 2016) and number (e.g., Annual Report 1, 2, 3) | Annual Report 1   |
| Project Leader name   | Dr. Paul Wilkin   |
| Project website/blog/Twitter  | Twitter: <a href="#">@TeamKMCC</a> . Blogs: <a href="https://teamkmcc.wordpress.com/category/darwin-initiative-yams/">https://teamkmcc.wordpress.com/category/darwin-initiative-yams/</a> . Website URL: <a href="http://www.teamkmcc.org/yams">www.teamkmcc.org/yams</a> |
| Report author(s) and date   | Dr. Paul Wilkin, with input from Dr. Mamy Tiana Rajaonah, Tiana Randriamboavonjy and Stuart Cable 30/4/16   |

### 1. Project Rationale

The project set out to combine conservation of threatened wild *Dioscorea* (yam) species in Madagascar with maintaining a sustainable food supply for low income families. Cultivated yams are key starch sources for at least 100M people worldwide, with the highest levels of production in West Africa, but are also important in other parts of equatorial Africa, Ethiopia and northern South America. Madagascar is probably the largest user of wild yams as a source of food worldwide. Madagascar is ranked at 207/213 by the World Bank for GNI per capita, and famine occurs regularly there. Food production is predicted to decrease with climate change.

Research undertaken by Kew and its collaborators over the last two decades has shown that there are over 40 species of wild yam in Madagascar, almost all of which have edible tubers and at least 5 are highly sought after as food sources, especially during the "hungry gap" when rice supplies are exhausted. The most recent data show that at least 18 of those species are threatened or near

threatened due to narrow distributions, habitat loss and rates of extraction. Wild yams occur in all climate zones, their diversity providing resilience against environmental change. Winged yam *Dioscorea alata*, a cultigen originally from Asia, is grown on a small scale in gardens in Madagascar. Other research involving Kew has shown that when cultivated at larger scale it improves food security, aids livelihoods and reduces pressure on wild species.

The project set out to conserve wild yams in three ways: seed banking, living germplasm collections at national and regional scale and initiating community cultivation. The latter planned to promote increased scale of growing winged yam by each project community to increase food production and dietary diversity and at the same time bringing the local wild yam species into cultivation. Wild species are preferred to winged yam in many parts of Madagascar. The areas of project activity were the Antsiranana province in the North, home to a group of endemic wild species of which all are threatened (see map below). Populations of wild yams in the selected regions were to be surveyed, and the data gathered combined with existing biodiversity and simultaneously captured conservation and biocultural data to help develop a national strategy for Madagascar for wild yams to complement that already in place for cultivated varieties

The proposed end points of the project include increasing awareness of yam and access to relevant information, providing stakeholders with access to genetic material of wild yam and improving livelihoods and food security. This would promote greater forest conservation, through demonstrating the natural capital of sustainably managed populations. In the longer term, it opens up the possibility of developing a novel crop for Madagascar from its own national genetic resources.

A Map of Madagascar showing the principal zones of project activity in Antsiranana Province (A) and the Ambositra-Vondrozo Corridor (COFAV) in Fianarantsoa Province.



## 2. Project Partnerships

### **Kew Madagascar Conservation Centre (KMCC)**

The lead organisation (RBG Kew) forms an axis with KMCC that is key to delivery of this project. KMCC employs the majority of the personnel that manage and undertake activities for the project, in

particular Dr. Mamy Tiana Rajanoah who leads the project in Madagascar and is assigned 100% to it. KMCC has very strong links to the full range of biodiversity conservation and development organisations and government bodies across Madagascar and is fully involved in all aspects of project activity. There is at least weekly contact between the Kew team and Dr. Rajaonah and Ms. Randriamboavonjy via skype and email for planning and decision making. The infrastructure, finance and management structure of KMCC are vital to supporting the yams project and to achieving its objectives.

The RBG Kew/KMCC relationship overall has become closer since the project proposal was written in 2014, with greater integration now than was the case in 2014. The yams project has been part of developing that closer relationship. The most significant achievements in Y1 have been launching the project and taking it to the point described below and the setting up of a new office in a region of Madagascar in which it had no previous track record of activity. The Ambanja Office in the North was set up principally for project logistic reasons; travelling from Antananarivo to Ambanja by road takes 1.5 days and to Antsiranana 2 days minimum. It enables us to reach effectively rural communities across Northern Madagascar via often challenging roads, especially in the rainy season. Two project staff have been hired there with complimentary community/business and botanical skillsets to jointly be responsible scientific and socioeconomic project aspects. There is no single NGO working in Antsiranana (unlike the COFAV) so we have generated our own regional infrastructure which we are continuing to build via links to government agencies and NGOs (see below). This has, however, taken time and needed input by several staff from KMCC from the yams project team and beyond.

Communications remain the main controllable obstacle to project productivity, including both cultural and linguistic elements (we are effectively a trilingual project) but we are continuing to increase seeking feedback to clarify that communication has been effective to overcome this. The need for the Ambanja office by the project is balanced against greater complexity of the communication chain.

The strength of the demand for a wild yams project in Madagascar coordinated through KMCC is evidenced by the strong turnout by Malagasy government agency staff and Malagasy NGOs at the Oct 15 workshop and by the scale of interest from community members in the project and in participating in it.

#### **Feedback Madagascar Ny Tanintsika (FBNT)**

FBNT is a key delivery partner in the COFAV, especially given its excellent network of agents there and detailed understanding of social and development issues there through its own project and a range of collaborators. Sam Cameron and her teams have regular links to the KMCC yams project team, especially Dr. Rajaonah and Ms. Randriamboavonjy and with lower frequency to Stuart Cable. A meeting with FBNT was held alongside the October 2015 workshop (see below). The success of this relationship is evidenced by the delivery of ca 2/3 of the socioeconomic survey data from the COFAV and the existing success of cultivating winged yams in the COFAV. RBG Kew and FBNT have collaborated successfully on several projects to the benefit of the host country.

#### **Parc Botanique et Zoologique de Tsimbazaza (PBZT).**

National living collection development with PBZT is about to get under way.

#### **Silo National des Graines Forestières (SNGF)**

The role of SNGF has evolved to be storage and monitoring of *Dioscorea* seed collected by project personnel based at KMCC. We now envisage that we will collect all the seed needed to reach project targets through project personnel undertaking plot survey work and via communities. The scale of collecting required has been discovered to be insufficient to justify SNGF making dedicated trips but they will be involved in seed processing and possibly the training of communities in seed collecting in addition to storage and monitoring

Additional in-country partners that have been involved in the project and supported delivery during Y1:

*Missouri Botanical Garden (MBG).*

Collaborating on *D. orangeana* cultivation/conservation monitoring and regional living collection development at Ramena near Antsiranana, the community principally responsible for extraction of *D. orangeana* to sell in the city.

*Service d'Appui à la Gestion de l'Environnement (SAGE)*. NGO in Antsiranana with whom we are working with communities in the Montagne de Français South of Antsiranana; they have a particular interest in socio-economic development of the communities there and facilitate biodiversity work in the area.

*University of Antananarivo, Département de Biologie et Ecologie Végétale (DBEV)*

National living collection development and exchange of knowledge

Ministère de l'Environnement, de l'Écologie, de la Marine et des Forêts (MEEMF)

Main government department linking to project with whom national strategy for wild yams will be developed. Principal interaction this year via October 2015 workshop. We are also collaborating with MEEMF at a regional scale via its subsidiary Direction Regionale des Eaux et Forêts (DREEF). This is particularly through development of a conservation collection of cultivated and wild yams in Ambanja with the local DREEF office. Other DREEF regional personnel are also engaged in the project and participated in the October 2015 workshop.

### **3. Project Progress**

#### **3.1 Progress in carrying out project activities**

Sources of evidence are listed in Sections 3.2/3.3 under Outputs, Outcome and their indicators.

##### ***Output 1 activities***

###### **Activity 1.1** Baseline surveys of populations of priority species

Surveys commenced in Q4 (March 2016), especially in Antsiranana Province where diversity is high and knowledge of populations at a lower level than elsewhere. The proformas used in the field with community members are presented in Annex 11-16. Project team members have spent 145 person days in the field during 15-16 undertaking survey and inventory activities, identifying sites for seed collection and collecting seeds.

###### **Activity 1.2** Inventory of new areas to enhance distribution data.

Inventory commenced in Q3 (October 2016), especially in Antsiranana where diversity is high and knowledge of its distribution at a lower level. It has already lead to the discovery of two (possibly three) new species that are edible and of limited distribution that will be published during 2016 and data that will enhance conservation status assessments. Specimens and material for DNA extraction have been collected.

###### **Activity 1.3** IUCN Red List assessments and ecological profiling.

31 IUCN red list assessments are in final review on SIS. The remaining species will be assessed once these are published/as they are described (species new to science). All will be repeated at the end of the project.

###### **Activity 1.4** Workshops to develop a national strategy and conservation action plans.

A workshop with 26 participants was held in early October with Government (9 individuals from 4 national/ regional bodies, including Environment and Agriculture Ministries) and NGO stakeholders at which the need for a wild yam strategy to complement that for cultivated yam was introduced and agreed. The workshop participants received a summary of the project (Annex 7) and a report on the workshop is presented as Annex 6. Group work covered three topics, refining conservation status assessments, cultivating yams to conserve them and socio-economic surveys.

##### ***Output 2 activities***

###### **Activity 2.1** Building and populating a project website and blog.

Blogs and tweets have been generated as indicated below. The project website is under construction and a test version will be soft-released during Q1 2016. It will then be developed incrementally during the remainder of the project.

## **Activity 2.2** Communication: radio, social media, leaflets and yam festivals etc.

The project communication strategy has been developed. We have relied on blogs and tweets in Y1 for project communication. In Y2 and 3 (as per the GANTT chart, which envisaged a Y2 start for this activity) we will engage with conventional media; plans are in place for Dr. Mamy Tiana Rajaonah to present on Ambanja local TV & radio and develop yam festivals, whilst continuing with social media activity.

## **Activity 2.3** Preparation of journal articles.

Two articles are in preparation describing new species. One will be submitted in May 2016, a second later in the year. They are in addition to the scheduled Y3 article preparation based on data acquired during the project.

## **Output 3 activities**

### Activity 3.1 Socio-economic surveys of consumption of yams and availability in markets

480 households have completed socio-economic survey; approx. 3600 individuals

### Activity 3.2 Training for community technicians in cultivation and ennoblement

948 people trained, 396 in the COFAV, 552 in Antsiranana. Of those, 119 (30%) were female and 277 (70%) male in the COFAV and 248 (45%) female and 304 (55%) male in Antsiranana. 74 person days have been spent on training by the project team in Y1.

### Activity 3.3 Development of a manual and other materials

The basic manual in Malagasy used in training household members and community (communauté de base or COBA) technicians in methods of growing wild and cultivated yams is presented in Annex 5. It will be developed during the remainder of the project into a richer resource via community engagement and using project-generated information to be presented to COBA members during Y3.

### Activity 3.4 Monitoring of food consumption in households

This activity is being undertaken in combination with the socio-economic surveys (3.1) and thus the number of participating households to date is the same.

## **Output 4 activities**

### Activity 4.1 Baseline surveys and monitoring of harvesting of priority species

Surveys commenced March 2016 following development of a survey protocol (Annex 4). In Antsiranana we have focussed on the most threatened species. In the closest to extinction (about to be submitted for publication, provisional status CR) one of its three known populations cannot be located. A second (which may be a subpopulation of the third) is only accessible when river levels are low. In the third 15 adult plants and over 100 extraction holes were counted. Fortunately the COBA has recently joined the project and we can bring it into cultivation.

### Activity 4.2 Research into the most effective ennoblement protocols and management of wild species for sustainable food production.

This is taking place via the cultivation of 13 wild yam species (and 2 subspecies) under cultivation by COBAs of which 5 are threatened, 1 NT. Their performance in cultivation is being monitored by the communities, in particular the trained technicians and the project team. The subject was workshopped at the annual workshop with government and NGO stakeholders in Antananarivo in October 2015.

### Activity 4.3 Development of a monitoring methodology for communities.

The plot survey methodology (Annex 4) has been developed by the project team in consultation with communities and will be used by them as far as is possible in addition to forming the basis of the in-country project team's population survey work.

### Activity 4.4 Development of conservation management plans for each species and agreement with communities and NGOs managing protected areas.

This activity is scheduled for Y3 although underpinning work has already been undertaken at the October 2015 government and NGO stakeholder workshop.

## **Output 5 activities**

Activity 5.1 Identification of sites for collection of seeds from yam populations, informed by the baseline surveys.

This activity started in Q3 when plants came into growth at the start of the rainy season not Q1 as per the GANTT chart.

Activity 5.2 Seed collection trips in combination with baseline surveys.

Started in Q4. 23 additional accessions of 9 species including including 6 species with demonstrated or provisional threatened status already collected despite seed maturity appearing to be late this year. Seed collection will continue into Y2 Q1.

Activity 5.3 Germination tests carried out on all yam species in Madagascar by SNGF and at Kew's Millennium Seed Bank (routine for all MSB collections).

14 species of *Dioscorea* from Madagascar are present on SID, 9 of which have germination test results. Further testing will take place in Y2 using Y1 collections as scheduled in the GANTT chart.

Activity 5.4 Establishment of living gene banks

Work on the national collection at University of Antananarivo DBEV is under way. Work is about to be initiated at PBZT. Regional collections have been started in collaboration with MEEMF/DREEF at Ambanja, and MBG at Ramena. A regional collection at Ranamafana for the COFAV is under discussion with the site owner and FBNT. 37 COBA plots are currently being used to cultivate 13 species.

## **3.2 Progress towards project outputs**

### **Output 1. A national strategy for wild yam species conservation**

In Y1 we have undertaken activities that underpin this output for the project which is scheduled for delivery in Y3 as described under each indicator below.

**Indicator 1:** IUCN Red List Assessments. From a baseline of two species of wild Malagasy yams on the IUCN red list, there are now 31 species with IUCN conservation status assessments in final review on SIS. Eighteen are threatened or near threatened, as evidenced by the IUCN website and SIS web submission system for assessments. The remaining species will be assessed once the initial 31 are published/as they are described (species new to science).

**Indicator 2:** Ecological profiles. The baseline here is that minimal descriptive data was available via a small number of hard copy taxonomic publications that are largely out of date. During Y1 we have commenced data capture via literature survey and begun plot-based population surveys to yield ecological data. Project team members have spent 145 person days in the field during 15-16 undertaking survey and inventory activities, identifying sites for seed collection and collecting seeds as evidenced by their per diem requests.

**Indicator 3:** National strategy for wild yams. At the start of the project there was a national strategy for cultivated yams in Madagascar but no strategy for wild yams. In order to make progress towards the Y3 goal of completing the strategy and presenting it to all relevant bodies we introduced the project to relevant government organisations (9 individuals from 4 national/ regional bodies, including MEEMF, DREEF and the Agriculture Ministry) and additional NGOs at Oct. 2015 workshop. The need for wild yam strategy introduced and agreed. Participation and the outcome are shown by the workshop report, summary and sign-in sheets (Annexes 6-9). Prof. Vololoniaina Jeannoda was a key player in the workshop and will be at Kew in May 2016 to discuss further collaboration with the project across a range of activities.

### **Output 2: Improved knowledge and awareness of the importance of yams**

Work towards this output has progressed in a manner close to that envisaged in the project GANTT chart and thus we envisage achieving the outcome in Y3.

**Indicator 1:** Website online by end of year 1. The project website is under construction and a test version will be soft-released during Q1 2016. It will then be developed incrementally during the remainder of the project. As soon as it has been released it will be viewable at the URL above.

**Indicator 2:** Communication strategy. 5 blog posts and 36 tweets (37784 impressions) have been produced by KMCC in Y1; they can be seen via the URLs listed above. Most of the 36 have been retweeted by DI. There are at least as many tweets again by individual project members. The DI Agroforestry project documentary aired on TVM featured yams work in the COFAV extensively. A DVD is being sent from Madagascar by TVM. In Y2 we will add conventional to social media to our portfolio. Plans are in place for Mamy Tiana Rajaonah to present on Ambanja local TV & radio in the first half of the year. We also plan to raise awareness of the project in Madagascar by bringing NGOs and similar organisations on board to allow the project's methodology to percolate over the landscape of the project study areas and beyond.

**Indicator 3:** 3 scientific papers submitted/published. We are on the verge of submitting one MS describing a critically threatened new species from sacred forest adjacent to a project COBA to a peer-reviewed journal. Another one is planned for later in 2016. Other MSS are also in development that will be clearly indicated to be products of DI funding. The draft MS/submitted pdf can be supplied on request

### ***Output 3: Cultivation of native species and cultivars by 60 communities***

Cultivation of winged yam is one of the strong selling points of the project in Madagascar. We have made progress against the indicators for this output and are looking critically at whether any need change, especially Indicator 1.

We are well over half way towards our target number of COBAs although behind on the number of households that represents. We will revisit our assumption that average COBA size is 50 households (currently it appears that 25 households is a better approximation) and this may result in a change being necessary to this output. We will also investigate whether households are not incorporated within the COBA in some communities but could be brought on board via (for example) donation of planting materials as an incentive to join to increase number of households per COBA.

**Indicator 1:** At least 50 households (=3000 total) in 60 communities engaged in yam cultivation. From a baseline of zero participation we have 37 COBAs with 925 households currently engaged in the project according to our project reporting document. 2 further COBAs with 122 households are ready to start socioeconomic surveys and planting. Following a short review of progress and an assessment of species and areas that are not covered by the project we will increase engagement to the level in the indicator during Y2. These figures have been taken from project reporting documents.

**Indicator 2:** 10% increase in household incomes. Baseline data being established COBA by COBA. To date 480 households have completed socioeconomic surveys according to our project reporting document. This equates to approximately 3600 individuals. A repeat survey for each COBA in Y3 will yield comparative data. Given the vigour of winged yam and our experience in the COFAV we still expect that surplus tubers will be available for cultivation by additional households or adjacent communities by Y3.

**Indicator 3:** Community technicians trained in year 1. From a baseline of very limited knowledge of yam cultivation by few people, and zero knowledge of cultivating wild species for conservation, 948 people been trained during project workshops with COBA members according to our project reporting document. The gender breakdown is given elsewhere in this report. 74 person days have been deployed to training in cultivation techniques in Y1 based on per diem requests. A basic manual in Malagasy used in training household/COBA members has been developed and will be made more information-rich as the project accumulates information. It will be disseminated to communities in Y3.

### ***Output 4: Conservation management of the 20 most threatened species***

Work towards this output has progressed in a manner close to that envisaged in the project GANTT chart and thus we envisage achieving the outcome in Y3.

**Indicator 1:** Conservation management plans for all 20 species with NGOs & communities. In order to develop conservation management plans by Y3 plot-based surveying and monitoring of harvesting started in March 2016. The topic has also been workshopped – see Activity 1.4

**Indicator 2:** Community monitoring methodology. This has been integrated into plot-based surveying – see Activity 4.1 and the protocol in Annex 4. Improvements to the methodology or necessary accommodations to COBA culture, knowledge or activities will be made prior to integration into the conservation management plans in Y3

**Indicator 3:** No decline in main populations. Underpinning work includes the initial set of conservation assessments (see output 1 Indicator 1) and plot-based surveying with a view to delivery in Y3

**Output 5:** *Ex-situ conservation of all wild species and non-native cultivars*

Y1 progress has been strong, especially in Indicator 1 where we now have seed banked of almost half the species of *Dioscorea* in Madagascar, with multiple populations of most, after only a few weeks of collection via the project.

**Indicator 1:** Collections of seed from up to 10 populations from throughout the ranges of all native species collected and stored *ex-situ* by year 3. The baseline here was 40 accessions of seed at MSB/SNGF representing 13 species, 6 unidentified. Our project reporting document indicates that 24 additional accessions of 9 species including 6 species with demonstrated or provisional threatened status have been collected since seed collection started in March 2016 as seeds of most species approached maturity. A total of 1-8 populations per species (19 overall) is now held in the MSB including 3 of favoured edible species *D. orangeana* (EN) and one of an undescribed edible species (provisionally CR). Project team members have spent 145 person days in the field during 15-16 undertaking survey and inventory activities, identifying sites for seed collection and collecting seeds according to per diem payment data.

**Indicator 2:** Germination protocols for all native species published by year 3. 14 species of *Dioscorea* from Madagascar are present on the RBG, Kew Seed Information Database (SID; <http://data.kew.org/sid/>), 9 of which have germination test results. Further testing will take place in Y2 using Y1 collections.

**Indicator 3:** Plants of all wild species and cultivars grown in living collections in Madagascar including 4 botanic gardens and/or regional community ‘gene-banks’. Work on a national collection at the University of Antananarivo DBEV is under way. Work on another at PBZT is about to be initiated. Regional collections have been started in collaboration with MEEMF/DREEF at Ambanja, and MBG at Ramena. The former currently consists of winged yam cultivars but will soon add wild *D. sambiranensis* (*Angona*). The latter specialises in *D. orangeana* but we will seek to add other Antsiranana species with our partners. A regional collection for COFAV wild yam species at Ranomafana is under discussion. 37 COBA plots are currently cultivating 13 species and we expect this figure to rise rapidly in 2016-17.

### 3.3 Progress towards the project Outcome

In Y1 we have made significant progress towards the project outcome which is Enhanced livelihoods and improved food security by project communities through cultivation, sustainable harvesting and conservation. Native yam species, particularly threatened species, cultivars and biocultural information conserved and accessible in Madagascar. We remain confident that it is achievable by Y3 and that the indicators represent appropriate measures of the outcome.

**Indicator 1:** Seeds conserved *ex-situ*, banked through the MSBP. See output 5 Indicator 1

**Indicator 2:** Living plants of all twelve endangered yam species/cultivars growing in at least 4 collections by year 3. Thirteen wild yam species (and two 2 subspecies of one) are under cultivation by COBAs of which five are threatened and one near threatened, as shown by the project reporting document. Regional and national collections are in development.

**Indicator 3:** Information on native species and cultivars. The information landscape at the start of the project was fragmented across several hard copy published articles and taxonomic treatments. Preparatory information capture and organisation is ongoing and the website is in final development (URL above). A test version will be soft-released during Q1 2016. It will then be enhanced incrementally during the remainder of the project.

**Indicator 4:** 60 communities (c.3,000 households) benefiting from yam cultivation via average 10% increase in nutritional intake. From a baseline of zero COBA involvement 37 COBAs and 925 households currently engaged in the project. 2 further COBAs with 122 households are ready to start socioeconomic surveys and planting. See Output 3 Indicator 1.

**Indicator 5:** Unsustainable wild yam exploitation reduced by 50% in the project areas by year 3. Y1 has involved starting underpinning research towards this Outcome Indicator for the project which is scheduled for delivery in Y3. See Activity 4.1 above.

**Indicator 6(7):** Two populations from each wild yam species located and assessed for harvesting impacts. See Activity 4.1 above.

### 3.4 Monitoring of assumptions

#### A. Outcome assumptions

Assumption 1: Within the time-frame of the project, weather and/or climate does not have adverse effects on yam cultivation and/or wild populations.

Comments: Seed collection period a few weeks late in 15-16 but otherwise no adverse effects

Assumption 2: Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value

Comments: The outcome is certainly met in the COFAV. The readiness of COBAs to join the project and conversations with household members suggest that it holds in Antsiranana.

Assumption 3: There are wild species in each region that can be cultivated successfully or that will respond to ennoblement.

Comments: Initial transplant survivorship and stem growth of species such as *D. sambiranensis* suggests that they can grow when cultivated but we will only know whether this assumption is correct towards the end of the project when we have yield data

Assumption 4 All 40 native species can be located and have some viable populations which can be conserved.

Comments: It is likely that a few species will remain elusive countrywide but we have had success with rediscovering species that have not been seen in many decades. In the zones of activity all species will be located.

#### B. Output assumptions

Assumption 1: Within the time-frame of the project, weather and/or climate does not have adverse effects on yam cultivation and/or wild populations.

Comments: Seed collection period a few weeks late in 15-16 but otherwise no adverse effects

Assumption 2: Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value).

Comments: The outcome is certainly met in the COFAV. The readiness of COBAs to join the project and conversations with household members suggest that it holds in Antsiranana.

Assumption 3 There are wild species in each region that can be cultivated successfully or harvested sustainably or that will respond to ennoblement.

Comments: We have managed to bring 13 wild species into cultivation for one growing season and survivorship has been demonstrated, albeit with losses. Growth rates and thus potential yield are clearly significantly lower than in *D. alata*. We will continue to investigate factors influencing success of wild species in cultivation.

Assumption 4: All 40 native species can be located and have some viable populations which can be conserved.

Comments: It is likely that a few species will remain elusive countrywide but we have had success with rediscovering species that have not been seen in many decades. In the zones of activity all species will be located.

Assumption 5: Pests do not have significant adverse effects on cultivation.

Comments: Some anthracnose (fungal pathogen) has been seen on cultivated *D. alata* in COBAs near Ambanja, although not at levels liable to reduce yield. Unfortunately, seed yams are in short supply in northern Madagascar and we are not in a position to select disease free planting material but have to take what is available.

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

The principal high level impact of promoting yam cultivation in Madagascar has been the clear demonstration via their popularity with communities that they represent a way to introduce conservation and sustainability projects to communities all over Madagascar. Yam cultivation is a quick and cheap way of getting community involvement without complex equipment or high levels of investment.

The winged yams planted in Y1 in 37 COBAs will help in early Y2 to provide food security in those communities and contributing to biodiversity conservation in their environs. The other impact goals will become apparent in Y2 and 3.

## **4. Contribution to SDGs**

In the proposal we indicated links to MDG 1 (end extreme hunger) and 7 (reducing the rate of biodiversity loss/recognising the value of forests for the poorest people). In the new era of the SDGs we believe that our principal contribution is towards two SDGs that jointly encompass the principal goals of project for Madagascar and specifically the project priority areas. They are SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture and SDG 15 Use terrestrial ecosystems sustainably/halt biodiversity loss

We are helping to achieve SDG 2 through promoting cultivation of winged yams in the 37 (and increasing) COBAs with which we are working. We anticipate that in Y2 and 3 wild yams from cultivation such as *D. sambiranensis* will also contribute to SDG2 and to the more sustainable use of community-adjacent forests in terms of yam exploitation. Our nascent COBA-based, regional and national collections combined with the seed accessions we have made are already helping to halt biodiversity loss given that we have several threatened taxa in the two types of collection.

By the end of Y3 we believe that the project will also link to SDG 1: end poverty SDG 3: Ensure healthy lives SDG 13 Combat climate change.

## **5. Project support to the Conventions, Treaties or Agreements)**

We are contributing in the project as a whole support to Conventions, Treaties and Agreements as outlined in the proposal.

ITPGRFA:

It will help Madagascar to meet its obligations under articles 5, 6, 7, 9 and 16 of the treaty, especially **6.2e** "promoting... the expanded use of local and locally adapted crops, varieties and underutilized species". Yams fall precisely into this area. We are encouraging their use and conservation to be an area

of interest for farmers. The planned national strategy for wild (and cultivated yams) will help to bring government policy in line with the ITPGRFA treaty as regards its yams. We also hope that one or more wild species will show potential as novel local and locally adapted crops.

GSPC Targets 1, 2, 4, 5, 6, 7, 8, 9, 12, 13 and 14 of the CBD, particularly 5 and 7 (*in-situ* conservation, via community cultivation), 6 and 12 (sustainable management of forests and their resources in the form of wild yams) and 9 (crop and CWR genetic diversity conservation).

The project will help Madagascar work towards Aichi Strategic Goals A, B, C, D and E of the CBD, particularly D (enhance the benefits from biodiversity and ecosystem services).

## **6. Project support to poverty alleviation**

The winged yams planted in Y1 in 37 COBAs will soon help to provide food security, enhanced nutrition and poverty reduction (though reducing the need to buy rice or other foods) in those communities and contributing to biodiversity conservation in their environs.

Harvest of wild yams in the 37 COBAs in which we are currently working will take place in Q1 2016 and we will be quantifying yields at that point in the project. Y3 will be the point at which we will have the clearest picture of how the project has supported poverty alleviation.

## **7. Project support to Gender equity issues**

Traditionally, yam cultivation is principally the domain of men in Madagascar, and yam sale, sometimes following preparation, that of women.

In Y1, our main contribution to gender equity has been to change was been through training 30% female COBA members in the COFAV and 45% in Antsiranana in cultivation methods for wild and cultivated yams. This is a first step towards encouraging women to be more involved in yam cultivation. Of the 138 households surveyed in Ambanja, 5 were headed by women (ca. 3.5%) and we are working to engage female-lead households within COBAs to take up yam cultivation as a source of nutrition and income. The project team in Antananarivo and Ambanja report strong interest in the project among women in the COBAs of the North of Madagascar during visits and workshops.

Overall we are increasing the number of all households cultivating or sustainably managing yams, including those with a majority of women or headed by women.

## **8. Monitoring and evaluation**

Monitoring and evaluation has been undertaken via the capture of evidence as cited in Sections 3.2/3.3. We are currently investigating the possibility of engaging a Malagasy NGO and/or Prof. Vololoniaina Jeannoda as M & E consultant(s). We will proceed should it improve project M & E and be cost-effective.

## **9. Lessons learnt**

There is a continuing need to manage with care internal communications, especially with the Ambanja Office of KMCC and other partners where communication can be from Kew via KMCC to those bodies. This is made more pressing by the trilingual nature of project: Malagasy, French and English all being used to conduct project business

It is important to factor in the complexity of Malagasy society and communities. However, we need to challenge partners in Madagascar and their aims and expectations at times in order to progress effectively towards goals.

There is a clear need in all parts of Madagascar for projects like this one that promote sufficient and improved diets and increased income whilst simultaneously conserving biodiversity. The need for daily use of natural capital in a short-term, probably unsustainable manner is striking.

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

N/A

## 11. Other comments on progress not covered elsewhere

Further information on the October 2015 workshop was given in the October 2015 half year report and workshops (and in Annexes 6 and 7).

The start date of 1 April 2015 has caused some problems for the project, specifically:

- 1) limited time after the February 2015 notification of success to start recruitment and project organisation
- 2) The start point not linking well to natural cycle of yam growth and harvesting driven by the November to April rainy season in most of Madagascar and especially those areas where yam diversity is highest. Fieldwork related to wild yams in particular activity is only possible during that period. A September start date would have been more appropriate for this project with regard to identification of species occurring near communities to allow development of community agreements to conserve those specific species and the sourcing and planting of seed yams. The the early stages of Y1 were dominated by background activities such as the recruitment of Dr. Mamy Tiana Rajaonah and the setup of the KMCC Ambanja Office necessitated by the lack of a single established NGO covering the whole of Antsiranana province. KMCC staff invested considerable time in the recruitment of Feno Rakotoarison Geodain Huckël Meva/and a Housekeeper and Guardian for the property. This resulted in delays in other project aspects of Y1 such as development and agreement of plot survey protocol aand locating and starting negotiations with communities to join the project,

Activities in the Near Future:

- A MS describing a critically endangered edible new species MS will be submitted imminently and IUCN cons assessment published for it on the IUCN red list website
- Two more new species will be published later in 2016 with conservation assessments
- We have recently discovered a likely additional edible new species on the Montagne des Francais.
- Socioeconomic survey work and yam cultivation will start Irodo and Ivovona in Antsiranana Province.
- We are exploring the potential for research on comparative nutritional properties of wild yams in Madagascar in collaboration with the University of Antananarivo DBEV and will report on outcome of investigation to DI with a view to incorporating it into the project. Data on nutritional profiles will be very helpful in prioritising cultivation effort and potential use as crop.
- A second workshop with government agencies and NGOs will take place in Autumn 2016 which will cover topics including:
  - Review of progress to date
  - Extension of community involvement to all households in the area, including those that may not be engaged in the COBA
  - Conservation management plan development review
  - Strategy development regarding how to scale up to other regions of Madagascar

## 12. Sustainability and legacy

We are already working with other organisations who will carry forward the work of the project beyond its end. For example, MBG will continue to conserve and sustainably use *D. orangeana*, as will conservation organisations such as Madagascar national parks in the protected areas they manage.

As noted above yams have been shown to represent a straightforward route to community engagement with conservation and sustainability in Madagascar.

In addition to these observations, the exit strategy described in the application remains valid.

### 13. Darwin Identity

The October 2015 workshop, internal Kew, KMCC and FBNT presentations, the household survey, yam workshop training manual, tweets and blogs all featured the Darwin Logo as did the documentary made with TVM. The Darwin Initiative was orally presented as funding body wherever possible.

### 14. Project Expenditure

**Table 1 Project expenditure during the reporting period (1 April 2015 – 31 March 2016)**

| Project spend (indicative) since last annual report | 2015/16 Grant (£) | 2015/16 Total Darwin Costs (£) | Variance % | Comments (please explain significant variances)  |
|---|-------------------|--------------------------------|------------|--|
| Staff costs (see below)                             |                   |                                | 9%         | Seed collection done by KMCC staff rather than SNGF.<br>PBZT work not fully completed in 2015-16.                                    |
| Consultancy costs                                   | 0                 | 0                              | -          |  |
| Overhead Costs                                      |                   |                                | 16%        | Overheads are reduced due to reduced staffing cost from partners (allowable overhead limited to 40%).                                |
| Travel and subsistence                              |                   |                                | (111%)     | Additional travel required by KMCC – new vehicle purchase (not included within the project budget) was delayed so hire car required. |
| Operating Costs                                     |                   |                                | 9%         | Underspend due to favourable exchange rate   |
| Capital items (see below)                           |                   |                                | (80%)      | Additional GPS purchased for communities due to change in project methodology  |
| Others (see below)                                  |                   |                                | 10%        | Within 10% but underspend due to exchange rate   |
| <b>TOTAL</b>  |                   |                                |            |  |

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## Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2015-2016

| Project summary   | Measurable Indicators   | Progress and Achievements April 2015 - March 2016   | Actions required/planned for next period  |
|---|---|---|---|
| <p><b>Impact</b></p> <p>Food security, livelihoods, forest protection, biodiversity conservation and resilience of communities to climate change is improved in Madagascar</p>  |   | <p>(Report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity e.g. steps towards sustainable use or equitable sharing of costs or benefits)</p>  |   |
| <p><b>Outcome</b> Enhanced livelihoods and improved food security by project communities through cultivation, sustainable harvesting and conservation. Native yam species, particularly threatened species, cultivars and biocultural information conserved and accessible in Madagascar.</p> | <p>Indicator 1: Seeds conserved <i>ex-situ</i>, banked through the MSBP, with at least 10 collections for each species/cultivar, and available to communities, projects and researchers in Madagascar through SNGF by year 3.</p> <p>Indicator 2: Living plants of all twelve endangered yam species/cultivars growing in at least 4 collections by year 3</p> <p>Indicator 3: Information on native species and cultivars</p> <p>Indicator 4: 60 communities (c.3,000 households) benefiting from yam cultivation via average 10% increase in nutritional intake</p> <p>Indicator 5: Unsustainable wild yam exploitation reduced by 50% in the</p> | <p>24 additional accessions of 9 species including 6 species with demonstrated or provisional threatened status collected. Current total 1-8 populations per species (19 in all) now in MSB including 3 of favoured edible species <i>D. orangeana</i> (EN) and one of an undescribed species (provisionally CR).</p> <p>13 wild yam species (&amp; 2 ssp) under cultivation by COBAs of which 5 are threatened, 1 NT. Regional/national collections in development.</p> <p>Website in development. Preparatory information capture and organisation ongoing.</p> <p>37 COBAs, 925 households currently engaged. 2 further COBAs with 122 households ready to start socioeconomic surveys and planting.</p> <p>Underpinning activities have progressed as described above</p> | <p>Will continue to build seed material conserved in Y2 Q1 and 3 towards target.</p> <p>Will continue to build COBA, regional and national collections during Y2.</p> <p>Website will be developed incrementally during the remainder of the project.</p> <p>Will build towards Y3 target of 60 COBAs and 3000 households during 2016 dry season (Q1, 2).</p> <p>Y3 target.</p> |

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|  | <p>project areas by year 3 and management agreements in place for threatened and valued edible species in all 60 communities</p> <p>Indicator 6(7): Two populations from each wild yam species located and assessed for harvesting impacts (through counting extraction holes) by end of year 1, creating a baseline for future community monitoring</p> | <p>Completed for 7 populations in Antsiranana</p>   | <p>Population surveys continuing in Y2Q1 linked to seed collection and will recommence in Y2Q3.</p> |
| <p><b>Output 1.</b> A national strategy for wild yam species conservation</p>  | <p>Indicator 1: IUCN Red List Assessments published for all species by end of year 2</p> <p>Indicator 2: Ecological profiles published for all species by end of year 2</p> <p>Indicator 3: National strategy for wild yams completed and presented to relevant authorities and NGOs by end of year 3.</p>   | <p>31 species IUCN assessments in final review on SIS; 18 threatened/NT.</p> <p>Data capture commenced via literature survey and plot-based population surveys. GIS-based research will take place in Y2 and 3 with a view to draft ecological profiles going online at the end of Y2.</p> <p>Project introduced to relevant government organisations (9 individuals from 4 national/ regional bodies) and NGOs at Oct. 2015 workshop. Need for wild yam strategy agreed.</p> |   |
| <p>Activity 1.1 Baseline surveys of populations of priority species, including: area, individuals/density, forest size and conservation status</p> |  |   |   |
| <p>Activity 1.2 Inventory of new areas to enhance distribution data</p>  |  |   |   |
| <p>Activity 1.3 IUCN Red List assessments and ecological profiling</p>   |  |   |   |
| <p>Activity 1.4 Workshops with stakeholders to develop a national strategy and conservation action plans for priority species.</p>                 |  |   |   |
| <p><b>Output 2.</b> Improved knowledge and awareness of the importance of yams</p>   | <p>Indicator 1: Website online by end of year 1 and updated with ecological profiles, conservation strategy and project materials as they become available.</p>  | <p>The project website is under construction and a test version will be soft-released during Q1 2016. It will then be developed incrementally during the remainder of the project. Blogs and tweets have been generated as indicated under I2</p> <p>Communication strategy devised. 5 blog posts and 36 tweets (37784</p>  |   |

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|   | <p>Indicator 2: Communication strategy devised in year 1, with regular national and regional newspaper articles and radio interviews and more frequent updates through Twitter and the KMCC blog. Annual regional yam festivals by year 3.</p> <p>Indicator 3: 3 scientific papers submitted/published in peer-reviewed open access journals, with at least one of these <i>Madagascar Conservation and Development</i> or <i>Malagasy Nature</i>.</p> | <p>impressions) in Y1. The DI Agroforestry project documentary on TVM featured yams work in the COFAV. Plans are in place for Mamy Tiana Rajaonah to present on Ambanja local TV &amp; radio.</p> <p>One MS on verge of submission to peer-reviewed journal, one planned for later in 2016</p>   |
| Activity 2.1. Building and populating a project website and blog.   |  | See Indicator 1 and 2 above  |
| Activity 2.2. Implementation of a project communication strategy, including radio, newspapers, social media, leaflets and yam festivals |  | See Indicator 2 above  |
| Activity 2.3 Preparation of journal articles  |  | See Indicator 3 above.   |
| <b>Output 3.</b> Cultivation of native species and cultivars by 60 communities  | <p>Indicator 1: At least 50 households in 60 communities engaged in yam cultivation by end of year 3.</p> <p>Indicator 2: 10% increase in household incomes, with surplus tubers also available for cultivation by additional households or adjacent communities by year 3.</p> <p>Indicator 3: Community technicians trained in year 1 and provided with a basic yam cultivation manual. Updated and improved manual available by end of year 3.</p>  | <p>37 COBAs, 925 households currently engaged. 2 further COBAs with 122 households ready to start socioeconomic surveys and planting</p> <p>Baseline data being established COBA by COBA. 480 households have completed socioeconomic survey; approx. 3600 individuals</p> <p>948 people trained via project workshops with COBA members, of which 119 (30%) were female and 277 (70%) male in the COFAV and 248 (45%) female and 304 (55%) male in Antsiranana.</p> |
| Activity 3.1 Socio-economic surveys of community and household consumption of yams and the availability of wild yams in local markets.  |  | See Indicator 2 above; the socioeconomic survey is covering all of these topics  |
| Activity 3.2 Training for community technicians in cultivation and ennoblement techniques.  |  | See Indicator 2 above.   |

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| <p>Activity 3.3 Development of a manual and other materials, tested by communities, to facilitate farmer to farmer dissemination.</p>               | <p>A basic manual in Malagasy has been developed for use in training household members and COBA technicians in methods of growing wild and cultivated yams is presented in Annex 5. It will be developed during the remainder of the project into a richer resource via community engagement and using project-generated information to be presented to COBA members during Y3.</p>   |
| <p>Activity 3.4 Repeated surveys of food consumption in households in the project areas to assess changes throughout the life of the project.</p>   | <p>See Indicator 2 above.</p>   |
| <p><b>Output 4.</b> Conservation management of the 20 most threatened species</p>   | <p>Indicator 1: Conservation management plans for all 20 species developed in partnership with NGOs and communities and agreed by year 3.</p> <p>Indicator 2: Community monitoring methodology developed and implemented and integrated into the conservation management plans by end of year 3.</p> <p>Indicator 3: No decline in main populations apparent by year 3.</p> <p>Plot-based surveying and monitoring of harvesting started March 2016. Data capture from published sources also under way.</p> <p>Communities also using plot survey protocol as far as possible via consultation with COBAs in addition to forming the basis of the in-country project team's population survey work.</p> <p>IUCN Assessments in final review on SIS and ongoing plot-based surveying will underpin progress towards this indicator.</p> |
| <p>Activity 4.1 Baseline surveys and monitoring of the harvesting of priority species and populations from forests</p>                              | <p>Plot-based surveying and monitoring of harvesting started March 2016</p>   |
| <p>Activity 4.2 Research into the most effective ennoblement protocols and management of wild species for sustainable food production.</p>          |   |
| <p>Activity 4.3 Participatory development of a monitoring methodology for communities.</p>  |   |
| <p>Activity 4.4 Development of conservation management plans for each species and agreement with communities and NGOs managing protected areas.</p> |   |
| <p><b>Output 5.</b> Ex-situ conservation of all wild species and non-native cultivars</p>   | <p>Indicator 1: Collections of seed from up to 10 populations from throughout the ranges of all native species collected and stored <i>ex-situ</i> by year 3.</p> <p>Indicator 2: Germination protocols for</p> <p>24 additional accessions of 9 species including 6 species with demonstrated or provisional threatened status. Total 1-8 populations per species (19) now in MSB including 3 of favoured edible species <i>D. orangeana</i> (EN) and one of an undescribed species (provisionally CR).</p> <p>14 species of Dioscorea from Madagascar are present on SID, 9 of which have</p>   |

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|   | <p>all native species published by year 3.</p> <p>Indicator 3: Plants of all wild species and non-native cultivars grown in living collections in Madagascar; including 4 botanic gardens and/or regional community 'gene-banks' that will be established through the project by year 3.</p> | <p>germination test results. Further testing will take place in Y2 using Y1 collections.</p> <p>Work on national collection at DBEV under way. PBZT: work to be initiated in near future. Regional collections started in collaboration with MEEMF/DREEF at Ambanja, and MBG at Ramena. Ranamafana regional collection for COFAV under discussion. 37 COBA plots cultivating 13 species.</p> |
| Activity 5.1 Identification of sites for collection of seeds from yam populations, informed by the baseline surveys.  |  | Activity started in Q3 when plants came into growth at the start of the rainy season not Q1 as per the GANTT chart. Progress in seed collecting as per Outcome Indicator 1 above.  |
| Activity 5.2 Seed collection trips in combination with baseline surveys.  |  | Started in Q4 not Q3 due to late maturation of seed, will continue into Y2 Q1. Progress in seed collecting as per Outcome Indicator 1 above.   |
| Activity 5.3 Germination tests carried out on all yam species in Madagascar by SNGF and at Kew's Millennium Seed Bank (routine for all MSB collections).                      |  | See Indicator 2 above.   |
| Activity 5.4 Distribution of germination protocols, seeds and tubers to botanic gardens and communities engaged to preserve living collections of wild species and cultivars. |  | See Indicator 3 above. Germination protocols and planting materials will be distributed during the remainder of the project.   |

## 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  |
|--|--|---|--|
| <p><b>Impact:</b> Food security, livelihoods, forest protection, biodiversity conservation and resilience of communities to climate change is improved in Madagascar.</p> <p>Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.</p> |  |   |  |
| <p><b>Outcome:</b> Enhanced livelihoods and improved food security by project communities through cultivation, sustainable harvesting and conservation. Native yam species, particularly threatened species, cultivars and biocultural information conserved and accessible in Madagascar.</p>   | <ol style="list-style-type: none"> <li>1. Seeds conserved <i>ex-situ</i>, banked through the MSBP, with at least 10 collections for each species/cultivar, and available to communities, projects and researchers in Madagascar through SNGF by year 3.</li> <li>2. Living plants of all twelve endangered yam species/cultivars growing in at least 4 collections by year 3</li> <li>3. Information on native species and cultivars (taxonomy, distribution, conservation, cultivation, sustainable utilisation and ethno-botanical) available online and through appropriate media (manuals, videos <i>etc.</i>) by year 3.</li> <li>4. 60 communities (c.3,000 households) benefiting from yam cultivation, with an improvement in food security shown by an average 10% increase in nutritional intake across all involved households (as shown by consumption survey) by year 3.</li> <li>5. Unsustainable wild yam exploitation reduced by 50% in the project areas by year 3 and management agreements in place for threatened and valued edible species in all 60 communities.</li> <li>6 (7). Two populations from each wild yam species located and assessed for harvesting impacts (through counting</li> </ol> | <ol style="list-style-type: none"> <li>1. MSBP databases and website.</li> <li>2. Project reports and website.</li> <li>3. Project website.</li> <li>4. Community association reports, photographs, socio-economic surveys and project website.</li> <li>5. Project website and peer-reviewed scientific publications.</li> </ol> | <ol style="list-style-type: none"> <li>1. Within the time-frame of the project, weather and/or climate does not have adverse affects on yam cultivation and/or wild populations.</li> <li>2. Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value of wild yams).</li> <li>3. There are wild species in each region that can be cultivated successfully or that will respond to ennoblement.</li> <li>4. All 40 native species can be located and have some viable populations which can be conserved.</li> </ol> |

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|   | extraction holes) by end of year 1, creating a baseline for future community monitoring.  |  |  |
| <p><b>Outputs:</b></p> <p><b>1. A national strategy</b> for wild yam species conservation, including baseline data on the conservation status of all species, ecological profiles and climate change predictions. Supported by workshops with national authorities and conservation and development NGOs managing the protected areas system.</p> | <p>1a. IUCN Red List Assessments published for all species by end of year 2.</p> <p>1b. Ecological profiles published for all species by end of year 2.</p> <p>1c. National strategy for wild yams completed and presented to relevant authorities and NGOs by end of year 3.</p>   | <p>1a. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website/Journal papers</p> <p>1b. 3-monthly project reports/Journal papers</p> <p>1c. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website</p> | All 40 native species can be located and have some viable populations which can be conserved.  |
| <p><b>2. Improved knowledge and awareness</b> of the importance of yams through appropriate media nationally and locally. Including a website with compiled data on the taxonomy, distribution, conservation, cultivation, sustainable utilisation and ethno-botany.</p>  | <p>2a. Website online by end of year 1 and updated with ecological profiles, conservation strategy and project materials as they become available.</p> <p>2b. Communication strategy devised in year 1, with regular national and regional newspaper articles and radio interviews and more frequent updates through Twitter and the KMCC blog. Annual regional yam festivals by year 3.</p> <p>2c. 3 scientific papers submitted/published in peer-reviewed open access journals, with at least one of these <i>Madagascar Conservation and Development</i> or <i>Malagasy Nature</i>.</p> | <p>2a. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website</p> <p>2b. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website</p> <p>2c. 3-monthly project reports/Journal papers</p>                | <p>Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value).</p> <p>Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value).</p>                      |
| <p><b>3. Cultivation of native species and cultivars</b> by 60 communities, with increasing output by year 3 that is economically sustainable and linked to the conservation of threatened species (in Output 4).</p>   | <p>3a. At least 50 households in 60 communities engaged in yam cultivation by end of year 3.</p> <p>3b. 10% increase in household incomes, with surplus tubers also available for cultivation by additional households or adjacent communities by year 3.</p> <p>3c. Community technicians trained in year 1 and provided with a basic yam</p>  | <p>3a. Agreements with collaborating NGOs and communities/3-monthly project reports</p> <p>3b. Agreements with collaborating NGOs and communities/3-monthly project reports</p> <p>3c. Agreements with collaborating NGOs and communities/3-monthly project reports</p>  | <p>Within the time-frame of the project, weather and/or climate does not have adverse affects on yam cultivation and/or wild populations.</p> <p>Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value).</p> <p>There are wild species in each region</p> |

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|   | cultivation manual. Updated and improved manual available by end of year 3.   |  | that can be cultivated successfully or harvested sustainably or that will respond to ennoblement.<br>Pests do not have significantly adverse affects on cultivation.  |
| <b>4. Conservation management</b> of the 20 species that are most threatened (including all IUCN rated CR and EN species) and most highly valued as wild food, in partnership with local communities.   | 4a. Conservation management plans for all 20 species developed in partnership with NGOs and communities and agreed by year 3.<br>4b. Community monitoring methodology developed and implemented and integrated into the conservation management plans by end of year 3.<br>4c. No decline in main populations apparent by year 3.   | 4a. Agreements with collaborating NGOs and communities/3-monthly project reports/ Blog posts, videos and photographs, links to media activity available through the project website<br>4b. Agreements with collaborating NGOs and communities/3-monthly project reports<br>4c. 3-monthly project reports | Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value).<br>Within the time-frame of the project, weather and/or climate does not have adverse affects on yam cultivation and/or wild populations.<br>All 40 native species can be located and have some viable populations which can be conserved. |
| <b>5. Ex-situ conservation</b> of all wild species and non-native cultivars through seed banking (Kew's Millennium Seed Bank and SNGF) and at least 4 living collections (community gene banks and/or botanic gardens).   | 5a. Collections of seed from up to 10 populations from throughout the ranges of all native species collected and stored <i>ex-situ</i> by year 3.<br>5b. Germination protocols for all native species published by year 3.<br>5c. Plants of all wild species and non-native cultivars grown in living collections in Madagascar; including 4 botanic gardens and/or regional community 'gene-banks' that will be established through the project by year 3. | 5a. 3-monthly project reports<br>5b. 3-monthly project reports/ Blog posts, videos and photographs, links to media activity available through the project website/Journal papers<br>5c. Agreements with collaborating NGOs and communities   | All 40 native species can be located and have some viable populations which can be conserved.<br>Pests do not have significantly adverse affects on cultivation.  |
| <b>Activities</b> (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)  |   |  |   |
| 1.1 Baseline surveys of populations of priority species, including: area, individuals/density, forest size and conservation status.<br>1.2 Inventory of new areas and collection of herbarium specimens and leaf samples for DNA analysis to refine the conservation assessments of priority species.<br>1.3 IUCN Red List assessments and ecological profiling.<br>1.4 Workshops with stakeholders to develop a national strategy and conservation action plans for priority species.<br>2.1 Building and populating a project website and blog.<br>2.2 Implementation of a project communication strategy, including radio, newspapers, social media, leaflets and yam festivals.<br>2.3 Preparation of journal articles. |   |  |   |

- 3.1 Socio-economic surveys of community and household consumption of yams and the availability of wild yams in local markets.
- 3.2 Training for community technicians in cultivation and ennoblement techniques.
- 3.3 Development of a manual and other materials, tested by communities, to facilitate farmer to farmer dissemination.
- 3.4 Repeated surveys of food consumption in households in the project areas to assess changes throughout the life of the project.
- 4.1 Baseline surveys and monitoring of the harvesting of priority species and populations from forests.
- 4.2 Research into the most effective ennoblement protocols and management of wild species for sustainable food production.
- 4.3 Participatory development of a monitoring methodology for communities.
- 4.4 Development of conservation management plans for each species and agreement with communities and NGOs managing protected areas.
- 5.1 Identification of sites for collection of seeds from yam populations, informed by the baseline surveys.
- 5.2 Seed collection trips in combination with baseline surveys.
- 5.3 Germination tests carried out on all yam species in Madagascar by SNGF and at Kew's Millennium Seed Bank (routine for all MSB collections).
- 5.4 Distribution of germination protocols, seeds and tubers to botanic gardens and communities engaged to preserve living collections of wild species and cultivars.

## 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 |
|-------------------|---|--------------------------------|-------------------------------------|---|--------------|--------------|---------------|----------------------------------|
| Established codes |   |                                |                                     |   |              |              |               |                                  |
| 1A/1B             | PhD submitted/obtained                                    |                                |                                     | 0                                       |              |              |               |                                  |
| 2                 | MSc obtained  |                                |                                     | 0                                       |              |              |               |                                  |
| 3                 | Other qualifications obtained                             |                                |                                     | 0                                       |              |              |               |                                  |
| 4A-D              | Undergraduate/postgraduate training                       |                                |                                     | 0                                       |              |              |               |                                  |
| 5                 | Other training 1 year plus                                |                                |                                     | 0                                       |              |              |               |                                  |
| 6A                | Other training than 1-5 number of people                  |                                |                                     | 948                                     |              |              |               |                                  |
| 6B                | Other training than 1-5 number of training weeks          |                                |                                     | 271                                     |              |              |               |                                  |
| 7                 | No. of training materials produced                        |                                |                                     | 1                                       |              |              |               |                                  |
| 9                 | No. of species/habitat action plans produced              |                                |                                     | 0                                       |              |              |               |                                  |
| 10                | No. of individual field guides/manuals produced           |                                |                                     | 0                                       |              |              |               |                                  |
| 11A/B             | No. of papers published/submitted                         |                                |                                     | 0/0                                     |              |              |               |                                  |
| 12A/B             | No. of databases for Madagascar established/enhanced      |                                |                                     | 1/0                                     |              |              |               |                                  |
| 13A/B             | No. of species reference collections established/enhanced |                                |                                     | 38/0                                    |              |              |               |                                  |
| 14A/B             | No. of conferences/seminars/workshops organised/attended  |                                |                                     | 1/8                                     |              |              |               |                                  |
| 20                | Estimated value of physical assets to Madagascar          |                                |                                     | £10,969                                 |              |              |               |                                  |
| 21                | No. of permanent facilities established and continued     |                                |                                     | 1 – KMCC Ambanja office                 |              |              |               |                                  |
| 22                | No. of permanent field plots established and continued    |                                |                                     | 7/180                                   |              |              |               |                                  |
| 23                | Value of resources from other sources raised              |                                |                                     | £0 raised, Contributions in kind £8,820 |              |              |               |                                  |

|  |  |  |  |                                     |  |  |  |  |
|--|--|--|--|-------------------------------------|--|--|--|--|
|  |  |  |  | Kew overhead, £10,000 MSBP UK costs |  |  |  |  |
|--|--|--|--|-------------------------------------|--|--|--|--|

**Table 2 Publications**

| <b>Title</b>      | <b>Type</b><br>(e.g. journals, manual, CDs) | <b>Detail</b><br>(authors, year) | <b>Gender of Lead Author</b> | <b>Nationality of Lead Author</b> | <b>Publishers</b><br>(name, city) | <b>Available from</b><br>(e.g. weblink or publisher if not available online) |
|-------------------|---|----------------------------------|------------------------------|-----------------------------------|-----------------------------------|--|
| <b>None in Y1</b> |   |                                  |                              |                                   |                                   |  |
|                   |   |                                  |                              |                                   |                                   |  |
|                   |   |                                  |                              |                                   |                                   |  |