



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: 30th April 2017

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 institution(s) | Kew Madagascar Conservation Centre (KMCC), Feedback Madagascar Ny Tanintsika (FBNT), Silo National des Graines Forestières (Madagascar, SNGF). |
| Darwin grant value | £291, 782 |
| Start/end dates of project | 1/4/15-31/3/18 |
| Reporting period (e.g., Apr 2016 – Mar 2017) and number (e.g., Annual Report 1, 2, 3) | Annual Report 2 |
| Project Leader name | Dr. Paul Wilkin |
| Project website/blog/Twitter | Twitter: @TeamKMCC . Blogs: https://teamkmcc.wordpress.com/category/darwin-initiative-yams/ . Website URL: www.teamkmcc.org/yams |
| Report author(s) and date | Dr. Paul Wilkin and Dr. Mamy Tiana Rajaonah, (MR) with input from Tiana Randriamboavonjy (TR), Feno Rakotoarison (FR), Geodain Meva Huckel (GH) and Stuart Cable (SC) [March 27-April 28 2017] |

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; B) in Fianarantsoa Province. C and D are the Menabe and Bongolava regions respectively; see section 11).



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 Rajaonah (MR) 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 MR and TR 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. KMCC has set up an Ambanja office as described in the Y1 report, which is now staffed by a botanist (FR), a technical officer (GH) and Miraille Razafindravelo a technician responsible for yam project databasing for all work in the Antsiranana region, seed germination testing and occasionally also undertaking fieldwork with the rest of the team. MR maintains regular contact with the Ambanja team by phone, email or skype, and reports on their activities to the RBG, Kew team. To aid communications and facilitate project activities the Ambanja office has been equipped with wifi, a backup generator, mobile phone each for FR and GH, 2 motorbikes and a further camera and laptop. We are continuing to build links to government agencies and NGOs in Antsiranana, especially FOFIFA (The National Centre for Applied Agricultural/Rural Development Research under both the Agriculture Ministry and the Ministry of Higher Education and Scientific Research). IT provision in the Antananarivo office has also been upgraded to enhance and improve email and skype communication.

Communications remain the main controllable obstacle to project productivity, but we have continued to increase seeking of feedback to clarify that communication has been effective during Y2. Both the RBG, Kew and KMCC project teams have become increasingly well-adapted to trilingual working, as confirmed through discussion of communication effectiveness during the PIs visit to co-author this report.

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 (especially the Ministry of the Environment, Water, Sea and MEEMF) and Malagasy NGOs at the November 8 workshop and by the scale of interest from community members in the project and in participating in it. We have also made progress with FOFIFA on a national basis and are aiming to get them on board with the national strategy for yams (see below).

Feedback Madagascar Ny Tanintsika (FBNT)

FBNT is a key delivery partner in the COFAV, especially given its 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 monthly meetings with the KMCC yams project team, especially MR and with lower frequency to SC at Kew.

Parc Botanique et Zoologique de Tsimbazaza (PBZT).

The principal role of PBZT in the project has been national living collection development via a nursery for tuber propagation plus substantial a plot in the PBZT site in central Antananarivo. PBZT also provides help with research authorisation and specimen/seed collection and export to Kew and the MSB. The national living collection at PBZT to date contains 122 individuals accessions comprising 21 species, of which 10 are threatened.

Silo National des Graines Forestières (SNGF)

The role of SNGF is storage and monitoring of *Dioscorea* seed collected by project personnel based at KMCC. We have discovered that we can 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 not proved sufficient to justify SNGF making dedicated trips but they are undertaking seed processing, storage and monitoring of the *Dioscorea* seeds collected by KMCC and communities they work with.

Additional in-country partners that have been involved in the project and supported delivery during Y2:

University of Antananarivo, Departement de Biologie et Ecologie Vegetale (DBEV)

The roles in the project of DBEV are national living collection development, exchange of knowledge and national strategy development. Pr. Vololonianina Jeannoda (VJ) has played a key role in drafting the strategy alongside MR. The national living collection at DBEV to date contains 83 individual accessions comprising 21 species, of which 10 are threatened. It duplicates the collection at PBZT but offers a different aspect and cultivation conditions.

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

MEEMF is the main government department linking to project with whom national strategy for wild yams will be developed. Principal interaction this year via November 2016 workshop. We are also collaborating with MEEMF at a regional scale via its subsidiary Direction Regionale des Eaux et Forêts (DREEF) Help with research authorisation.

Other DREEF regional personnel are also engaged in the project and participated in the November 2016 workshop.

FOFIFA

We are working on a new collaboration with FOFIFA to jointly implement germplasm collections in Ambanja (N) and Kianjavato (COFAV) and aim to bring them on board with national strategy development.

Tao Tsara

This NGO works in the Mikea area of SW Madagascar and are on the process of adopting the project's methodology for yam cultivation (wild species and *D. alata*) and population surveying. A representative participated in the November 2016 workshop and is involved in the national strategy production. We believe there to be 6 wild species in the Mikea forest, including the highly sought after *D. maciba* and *D. alatipes* which has an IUCN assessment of vulnerable. The transfer of our methods to a new biome (dry deciduous forest) and region helps to give the project a national profile and applicability.

Missouri Botanical Garden (MBG).

We are collaborating on *D. orangeana* cultivation/conservation monitoring and germplasm collection development at Ramena near Antsiranana, the community principally responsible for extraction of *D. orangeana* to sell in the city. Their collection contains all described northern wild species plus *D. alata*. We do not yet know if Cyclone Enawo (March 7 2017) caused damage to the collection.

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.

3. Project progress

3.1 Progress in carrying out project Activities

Sources of evidence where not stated below are listed in Sections 3.2/3.3 under Outputs, Outcome and their indicators, but most are listed here and not repeated subsequently or in Annex 1. See also Annexes 4-13.

Output 1 activities

Activity 1.1 Baseline surveys of populations of priority species

Surveys were undertaken in March and April 2016 for 16 sites in Antsiranana with three locations per site. In the COFAV there are relatively few forested areas remaining, so four communities undertook population surveys, again with three locations per community (see Annex 4). Surveys in Year 2/3 have started in March and will be reported on when complete. Overall the principal project actors (MTR, TR, FR, GH) have spent 248 person days in the field undertaking survey and inventory activities, identifying sites for seed collection and collecting seeds. A similar level of field activity has been achieved by COFAV community agents and technicians.

Activity 1.2 Inventory of new areas to enhance distribution data.

In addition to the community survey work described above, field inventory work has taken place in three main areas:

1) Beanka in June 2016 and January 2017. Beanka is in central-western Madagascar North of Menabe, area C in the map in section 1. It is outside our main project areas but home to recently discovered populations of a highly desirable edible species *D. bako* (IUCN conservation status EN). The Antananarivo KMCC team recovered population data for *D. bako* for 2 populations plus learnt of one that was described by communities but could not be reached. The first population was extensive, with hundreds of plants in 1 population, but the second had just four adult plants. Locations of the populations and photographs of *D. bako* are available on Zavamaniry Gasy (see e.g. <http://www.inaturalist.org/observations/5037161> alongside other species occurrence data captured during the trip.

2) Analalava in January 2017. *D. analalavensis* (not yet assessed, but likely CR) was rediscovered in January by the Ambanja KMCC team with just 3 populations and ca 40 adult plants near Analalava (ca 140 SW of Ambanja). It was previously known only from type specimen collected ca 100 years ago and is eaten in the area where it occurs. See e.g. <http://www.inaturalist.org/observations/5106875>. Other inventory data from the Analalava area is also present on Zavamaniry Gasy.

3) Sahafary Forest ca 40 km S of Antsiranana city. Three new populations of the recently described *D. irodensis* have been found in Sahafary forest near Saharenana and at Ivovona. Its conservation status will be positively impacted. See e.g. <http://www.inaturalist.org/observations/5936546>.

KMCC team members have gathered wild yam occurrence data Madagascar-wide on Zavamaniry Gasy, but especially in Antsiranana province (see homepage interactive map). We now have 201 wild yam records in total and are aiming to exceed 1000 records by the end of Y3 to inform reassessments of conservation status.

Activity 1.3 IUCN Red List assessments and ecological profiling.

The initial 31 IUCN red list assessments described in the Y1 report are now revised, accepted for publication on IUCNredlist.org and will be published by IUCN in June. The remaining yam species from Madagascar will be assessed once the 31 are published/as they are described (species new to science) when we will be given access to the working set by IUCN. All will be repeated in the final months of the project. MR was trained in red list assessment at Kew in August 2016 to undertake this task.

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

A workshop with 32 participants was held in early November with Government (6 individuals from MEEMF/DREEF) and 8 NGO stakeholders from 5 organisations, plus 3 participants from MBG, including MBG in Antsiranana (see Annex 5). We were not able to secure Agriculture ministry participation this year due to communication problems at FOFIFA but we are in dialogue with them independently. At the workshop key players made presentations and the developing National strategy for wild yams in Madagascar was workshopped. This was undertaken via group work to pull together the vision and aims for wild yams of each of the participants. Four groups looked at problems of yam (e.g. overexploitation, habitat loss) in the context of the objectives for the strategy, the research needed and activities to be undertaken to develop it.

Following the Y2 workshop the first draft of the national strategy is close to completion in April 2017 despite illness to key Personnel (MR and VJ). It will be circulated to key stakeholders for review early in

Y3 and fully workshopped in the Autumn 2017 workshop prior to being signed and adopted by the relevant ministries at a meeting to close the project in spring 2018.

Output 2 activities

Activity 2.1 Building and populating a project website and blog.

We have delivered 12 blogs and a total of 152 tweets with 105, 617 impressions by the project leaders at KMCC in Antananarivo and Ambanja alone in Y2. (see <https://twitter.com/TeamKMCC>, <https://twitter.com/Rfenonir>, <https://twitter.com/hgeodain>, <https://twitter.com/RajaonahMamy>. For comparison, we disseminated 5 blogs and 36 tweets with 37, 784 impressions in Y1).

A basic project website is now online at the URL listed in project information on page 1.

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

A radio programme on the project aims and activities was broadcast and repeated once on the Antsiranana local radio station in December 2016.

3 radio programmes (each repeated once) were broadcast on the Ambanja local radio station in August 2016. We plan to develop further radio programmes during May 2017 prior to that year's harvest festivals in both Ambanja and Antsiranana. Ambanja radio programmes resulted in a considerable level of interest evidenced by numbers of people visiting the Ambanja KMCC office. A transcript of one in ion Annex 6

The price of a broadcast on Ambanja local TV proved to be too high to be cost-effective. In addition there are frequent power cuts there, and TV ownership levels are low and decreasing. Thus we decided to restrict media communication activity to radio.

Blogs and tweets presented as described above

A project video featuring one of the communities near Ambanja was made in January and posted on https://www.youtube.com/watch?v=oPl_mHDq0w in March.

TVM, a Madagascar cable channel, broadcast a programme in September 2016 on wild yams and yam cultivation in the COFAV and Itremo in association with material on the Darwin Initiative Madagascar Agroforestry project (20-020). We have a DVD copy.

At least 1 meeting with each community has taken place prior to project adoption to discuss and promote project activities and benefits.

Two yam harvest festivals were held in the in COFAV in August, with more than 700 people participating and being engaged with wild yams conservation and cultivation.

T-shirts have been printed and distributed to key players at MREEF and MNP plus 100 for FBM, SAGE, MGB, Taotsara and local agents (total 187). The front states "Project for yam conservation in Madagascar" with an attractive yam harvesting image and the back the slogan "yam used sustainably, enough food and forests conserved long term". The DI and KMCC logos are printed on the sleeves. See Annex 7.

Activity 2.3 Preparation of journal articles.

One article describing a threatened new species was published in April 2017 (*D. irodensis*); see <https://link.springer.com/article/10.1007/s12225-017-9677-6>, NB open access. The article on the second species referred to in the Y1 report has been delayed. Three other MSS on yam diversity and conservation are also in preparation. 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

674 households (HHs) have now completed the baseline socio-economic survey; 379 in COFAV and 295 in Antsiranana, ca 3370 individuals. 480 of those HHs completed the survey in Y1. Exemplar income

data in Annex 8. Analysis of the data obtained in Y2 shows annual income, calorific and protein intake as follows:

| Income Ar | Mean/HH | Min/HH | Max/HH |
|--------------|----------|----------|-------------------|
| Antsiranana | 265, 780 | 0 | 1.7M (-7.1M) |
| COFAV | 297, 060 | 0 | 1.4M |
| Energy Kcals | Mean/HH | Min/HH | Max/HH |
| Antsiranana | 101, 950 | 331 | 511, 500(-3.53M) |
| COFAV | 659, 170 | 197, 450 | 5, 720, 250 |
| Protein g | Mean/HH | Min/HH | Max/HH |
| Antsiranana | 2, 830 | 42 | 12, 090(-45, 370) |
| COFAV | 11, 930 | 966 | 102, 680 |

To place this in context, mean annual HH income in Antsiranana and the COFAV is ca £65-75.

We will start to develop and promote simple yam markets in Antsiranana and the COFAV during the 2017 harvest festivals in late May/June

Activity 3.2 Training for community technicians in cultivation and ennoblement

Total numbers of people trained in cultivation and wild population surveying (some still need training in harvesting) were COFAV 1053 616 male, 437 female (41.5%); Antsiranana 1387, 763 male 624 female (45%) The total number trained is now 2440 with 948 in Y1 so 1492 people were trained in Y2. The KMCC team spent 82 person days training in Y2, as opposed to 74 in Y1, and the % of females trained was 43.3% as opposed to 37.5%. The baseline at the start of the project was close to zero knowledge of yam cultivation in Antsiranana; yams were grown on a very small scale. There was limited pre-existing knowledge of yam cultivation and use in the COFAV. Formal evaluation of training via completion of questionnaires is very hard to do in a rural Madagascar context due to literacy issues and has not been attempted. However, discussions with trainees by trainers indicate that training has been successfully received and success rates in winged yam cultivation (see Activity 4.2) are a further indicator of training efficacy. Training is demonstrated in https://www.youtube.com/watch?v=oPI_mHDq0w min 1:36-2:32 and in Annex 9.

Project team members and local technicians/agents have informed us that individuals have adopted the training given in both the communities where it was undertaken and surrounding ones, but we have no means of quantifying this.

Activity 3.3 Development of a manual and other materials

The basic manual in Malagasy covered in the Y1 report and used in training HH members and community (communauté de base or COBA) technicians in methods of growing wild and cultivated yams (see Y1 report) is still being used as a training tool but has not been further developed in Y2. It will be developed during Y3 using project-generated information (e.g. species information specific to a given COBA) to be presented to COBA members at the end of the project.

Activity 3.4 Monitoring of food consumption in HHs

This activity is being undertaken in combination with the socio-economic surveys; see activity 3.1 above.

Output 4 activities

Activity 4.1 Baseline surveys and monitoring of harvesting of priority species

See description of Activities 1.1 and 1.2.

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

We are cultivating with 60 communities a total of 21 species of wild yam, plus an additional endemic subspecies (*D. sambiranensis* ssp. *bardotiae*) and 2 varieties of *D. alata* (ovibe and ovy lava, with small quantities also of ovy lalina, ovy tanty and florido in the COFAV) Of the 21, 6 are threatened. We have 1 harvest's yield data (June 2016) for *D. alata* and wild species. In Antsiranana, total yield was 6, 818 kg of *D. alata* and 35 kg of wild yams. In the COFAV 23, 598 kg of *D. alata* and 57 kg of wild yams were produced (see Annex 10). We attribute the very low yields of wild yams in 2016 to late sourcing and planting of forest-collected seed yams during the rainy season (December 2015-February 2016), as opposed to October in both areas. This was due to the time taken to recruit project staff (as described in the Y1 report). The Ambanja team that is responsible for work in Antsiranana Province was not fully complemented until December 2015 and COBA agents not recruited until January 2016. We expect that wild yam yields will be significantly greater in June 2017 and allow a meaningful starting dataset to understand wild yam performance in cultivation to be developed. Despite late planting of *D. alata* in Y1 due to the issues above and difficulty in sourcing sufficient *D. alata* seed yams at the outset of the project it still yielded well. The rains of 2015-16 were rather light in the COFAV and Antsiranana. Minisett divisions of a large tuber of *D. alata* can tolerate dry periods, but wild yams are especially vulnerable to dry weather after transplanting. There has been substantially more rain during the 2016-17 rainy season such that we may encounter yield issues due to flooding (but the rains started late).

Activity 4.3 Development of a monitoring methodology for communities.

The plot survey methodology (developed in Y1 and supplied and an annex to the Y1 report) has been used as described above under Activity 1.1. Development was achieved ahead of schedule at the end of Y1.

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

Development of conservation action plans is scheduled for Y3

In Y2 we have signed agreements (see example in Annex 11) with 29 COBAs/communities in Antsiranana covering between 2 and 6 wild species per community. Similarly, we have signed agreements with 13 COBAs in the COFAV covering between 2 and 4 wild species. We have also signed agreements with FBNT regarding the COFAV communities and in Antsiranana KMCC-Ambanja and the local authorities have an agreement regarding all 29 communities there.

Output 5 activities

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

Sites for seed collection were identified during early 2016 and collected in March-June of that year. Further sites have been identified in early 2017 and seed collection from them is currently under way.

Activity 5.2 Seed collection trips in combination with baseline surveys.

Since the start of the project in 2015 we have added to the pre-existing MSB/SNGF collections of Malagasy *Dioscorea* 54 additional accessions representing 17 species, plus 5 accessions that are unidentified. 8 of the 17 species are threatened. In Y1 we reported 23 additional accessions of 9 species including including 6 species with demonstrated or provisional threatened status (see Annex 12).

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).

The SID database (<http://data.kew.org/sid/>) indicates that 13 Malagasy yam species now have germination tests. Thus 4 new tests have been done in Y2 (9 in Y1). Further germination tests are in the pipeline for Y3 for the remaining Malagasy species; 54 additional accessions are already available for

this work and collecting will take place for this year until June 2017. Additionally in Y2 we have tested germination of seed tubers in Ambanja.

Activity 5.4 Establishment of living gene banks

Germplasm collections (see Annex 13).

1. DBEV University

The national living collection at DBEV to date contains 83 individual accessions comprising 21 species, of which 10 are provisionally or demonstrated to be threatened

2. PBZT

The national living collection at PBZT to date contains 122 individuals accessions comprising 21 species, of which 10 provisionally or demonstrated to be threatened.

3. Ramena/Ankoriky (with MBG). Northern species including *D. orangeana* are cultivated at Ankoriky but we have no further data on the collection. We do not yet know if Cyclone Enawo (March 7 2017) caused damage to the collection.

4. Ambanja MEEMF/DREEF. This germplasm collection has not been progressed further due to a decision on their part.

3.2 Progress towards project Outputs

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

In Y2 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. The initial 31 IUCN red list assessments described in the Y1 report have been reviewed by two IUCN specialist groups, revised accepted for publication on IUCNredlist.org and will be published by IUCN in June. The remaining yam species from Madagascar will be assessed once the 31 are published/as they are described (species new to science) when we will be given access to the working set by IUCN. We are limited by IUCN's processes and ways of working with this indicator. Pre-project there were no published IUCN assessments.

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 at the outset of the project. In Y2 we have undertaken species occurrence data capture as described under Activity 1.2 in order to achieve for as many species as possible a minimum of 10 records per species and to supplement the available herbarium specimen database. Basic Maxent modelling will then be used in Y3 to deliver ecological profiles via the project website. Pre-project there were no ecological profiles.

Indicator 3: National strategy for wild yams. This indicator has been fully addressed during Y2; it was not scheduled for work in Y1 so the baseline at the start of the year was no progress towards a strategy. The first draft of the national strategy is close to completion in April 2017 having been drafted by MR and VJ. It will be circulated to key stakeholders for review early in Y3 and fully workshopped in the Autumn 2017 workshop. Pre-project there was a strategy for cultivated yams to which the wild yam national strategy will be connected.

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

Work towards this output has continued to progress 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. A basic project website is now online at the URL listed in project information on page 1. Baseline was no website.

Indicator 2: Communication strategy. Project communication has been via radio, TV, blogs, tweets, website and T-shirts as described under Activity 2.1 and 2.2. We have also communicated extensively with the communities with which we work on a direct basis. The drafted national strategy will also be a key communication tool. Clearly baseline activity was zero; we have elevated our levels of activity in Y2

(see Activity 2.1/2.2). Two yam harvest festivals were held in the in COFAV in August, with more than 700 people participating and being engaged with wild yams conservation and cultivation.

Indicator 3: 3 scientific papers submitted/published. One article describing a threatened new species was published in April 2017 (*D. irodensis*, <https://link.springer.com/article/10.1007/s12225-017-9677-6>). The article on the second species referred to in the Y1 report has been delayed. Three other MSS on yam diversity and conservation are also in preparation. They are in addition to the scheduled Y3 article preparation based on data acquired during the project. We anticipate that two more minimum will be submitted by March 2018. Baseline zero publications.

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

Cultivation of winged yam alongside wild species is one of the strong selling points of the project in Madagascar. Progress is as described below but we anticipate achieving the output in broad terms at least in Y3. Progress in Indicator 3 has been particularly strong, leading to adoption of project methods by non-project communities.

Indicator 1: At least 50 HHs (=3000 total) in 60 communities engaged in yam cultivation.

As reported in the Y1.5 report, the number of HHs with whom the project is working has risen from 37 communities and 925 HHs in the Y1 Annual report to 60 communities and 3000 HHs, with 1500 in Antsiranana and 1500 in the COFAV. As described in the funding application and Y1 report, cultivation of *D. alata* or winged yam has been particularly successful in the COFAV through FBNT's intervention. However, the original plan of FBNT to meet the indicator 1 target was to supply 600 HHs with seed yams in Y1 and bring it up to 1500 in Y2 via each of the 600 HHs bringing 2 more HHs into the project in 2016-17 and supplying them with seed tubers. In Y2 it has proved problematic to get the initial 600 HHs to recruit further ones – they did not all want to pass seed tubers to further HH without financial gain. Additionally in Y1 all available COFAV forest-dwelling communities were recruited (there are relatively few), but they were unable to supply enough wild species seed tubers to the village based communities for full cultivation by all planned communities, some are only cultivating *D. alata*. There is also some resistance to growing wild yams in COFAV village communities. The total number of HHs currently in the project in the COFAV is 1053 growing *D. alata* and wild yams; other HHs are currently growing *D. alata* alone. We are engaged with 3000 HHs but in some not to the degree that we would wish.

As described under Activity 3.1, 674 HHs have now completed the baseline socio-economic survey; 379 in COFAV and 295 in Antsiranana, ca 3370 individuals. 480 of those HHs completed the survey in Y1. While the time-consuming nature of gathering the data via the questionnaire included in the Y1 report had led to the number of HHs completing it being reduced, we are confident that sufficient data will be captured to evaluate the success of the project in changing income and nutrition indicators. We will complete baseline socioeconomic surveys for 350 further HHs that joined the project in 2016 across both Antsiranana and the COFAV so we anticipate ca 1000 HH in total, ca 5000 individuals. This will be completed by June 2017 so that the second socio-economic survey work can be collected between September 2017 and June 2018

Indicator 2: 10% increase in HH incomes. Baseline data is presented in summary form in Activity 3.1. The second survey will take place in Y3.

Indicator 3: Community technicians trained. Total numbers of people trained in cultivation and wild population surveying (some still need training in harvesting) were COFAV 1053 616 male, 437 female (41.5%); Antsiranana 1387, 763 male 624 female (45%). An example of community training by FR can be seen in https://www.youtube.com/watch?v=oPl_mHDq0w min 1:36-2:32. The total number trained is now 2440 with 948 in Y1 so 1492 people were trained in Y2. The baseline at the start of the project was close to zero knowledge of yam cultivation in Antsiranana; yams were grown on a very small scale. There was limited pre-existing knowledge of yam cultivation and use in the COFAV. Formal evaluation of training via completion of questionnaires is very hard to do in a rural Madagascar context due to literacy issues and has not been attempted. However, discussions with trainees by trainers indicate that training has been successfully received and success rates in winged yam cultivation (see Activity 4.2) are a further indicator of training efficacy.

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. Finalised conservation management plans are scheduled for Y3. Progress towards this Indicator during Y2 has been via signature of 42 agreements with communities regarding conservation of multiple wild species per community as described under Activity 4.4. The baseline at project startup was zero, and there was no progress on this in Y1 until the end of the reporting year.

Indicator 2: Community monitoring methodology. Progress as described under activity 1.1

Indicator 3: No decline in main populations. This will be assessed at the close of the project via repeating the initial IUCN assessments based on data captured under Activities 1.2 and 1.3. Progress in Y2 has been in the acceptance for publication of the 31 original assessments in June 2017 and training of MR in red list assessment at Kew in August 2016 to carry out the final assessment.

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

Y2 progress has been strong, especially in Indicator 1 where we now have multiple populations of most species. We envisage achieving Output 5.

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 pre-project baseline here was 40 accessions of seed at MSB/SNGF representing 13 species, 6 unidentified. In April 2016 (seed collecting season March-June) we had collected additional accessions of 9 species including 6 species with demonstrated or provisional threatened status were collected with 1-8 populations per species in total. By the end of Y2 we have 54 additional collections making the total 23 species, representing 2 new species in Y2 (see Annex 12). We have 1-11 collections per species so, for example, *D. sambiranensis ssp sambiranensis* (VU) and *D. antaly* (LC) are already collected to target. Other species are now approaching the 10 population target e.g. *D. soso* (7), *D. bemarivensis* (6), *D. maciba* (5) *D. bemandry* (provisionally threatened, 5), *D. buckleyana* (EN, 4) and *D. orangeana* (EN, 4). We anticipate that all accessions will be on SID at the end of Y3. Seed collecting in field is just restarting at the point of data compilation (late March). Evidence take the form of the project seed collecting spreadsheet.

Indicator 2: Germination protocols for all native species published by year 3. The SID database (<http://data.kew.org/sid/>) indicates that 13/14 Malagasy yam species now have germination tests. Thus 4 new tests have been done in Y2 (9 in Y1). Further germination tests are in the pipeline for Y3 for the remaining Malagasy species; 54 additional accessions are already available for this work and collecting will take place for this year until June 2017.

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'. 21 species are in cultivation in our principal germplasm collections in Antananarivo as described under Activity 5.4. We also have 21 species of wild yam under community cultivation, plus an additional endemic subspecies (*D. sambiranensis ssp. bardotiae*) and 2 varieties of *D. alata* (ovibe and ovy lava, with small quantities also of ovy lalaina, ovy tanty and florido in the COFAV); see Activity 4.2. The baseline for cultivation of wild yam species was of course zero. Work on both collections in Antananarivo started towards the end of Y1 so all significant progress has been made in Y2.

3.3 Progress towards the project Outcome

In Y2 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, which includes baseline information and a reference to supporting evidence.

Indicator 2: Living plants of all twelve endangered yam species/cultivars growing in at least 4 collections by year 3. We currently have living plant material of 8 threatened species in cultivation in Antananarivo and via communities, including all 6 that occur within the two project activity areas. We have plans to increase the numbers from other areas in Y3 (see section 11). In Y1 we had 5 threatened species in cultivation.

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. The website has recently been released. It will then be enhanced incrementally during Y3. The basic manual in Malagasy used in training HH members and community (communauté de base or COBA) technicians in methods of growing wild and cultivated yams compiled in Y1 also presents relevant information. It will be further developed during Y3 using project-generated information (e.g. species information specific to a given COBA) to be presented to COBA members at the end of the project.

Indicator 4: 60 communities (ca 3,000 HHs) benefiting from yam cultivation via average 10% increase in nutritional intake. As reported in the Y1.5 report, the number of HHs with whom the project is working has risen from 37 communities and 925 HHs in the Y1 Annual report to 60 communities and 3000 HHs, with 1500 in Antsiranana and 1500 in the COFAV. Notwithstanding problems with seed yam transfer in the COFAV described under Output 3 Indicator 1 above, we are engaged with 3000 HHs via project information and cultivation methods. Project team members and local technicians/agents have informed us that individuals have adopted the training given in both the communities where it was undertaken and surrounding ones outwith the project.

Indicator 5: Unsustainable wild yam exploitation reduced by 50% in the project areas by year 3. Y2 has involved further underpinning research towards this Outcome Indicator for the project which is scheduled for delivery in Y3. See Activities 1.1-1.3 above. Signature of 42 agreements with communities regarding conservation of multiple wild species per community has also taken place as described under Activity 4.4

Indicator 6(7): Two populations from each wild yam species located and assessed for harvesting impacts. See Activities 1.2 and 1.3 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 affects on yam cultivation and/or wild populations.

Comments: Cyclone Enawo (March 7 2017) caused disruption in fieldwork due to flooding in N Madagascar. Overall more rain fell than in 2015-16.

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 assumption has been met in both the COFAV and Antsiranana. Yam cultivation underpinned by free seed yams has proved popular and motivated the collection of wild yam seed tubers from forest.

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

Comments: Transplant survivorship has been of an acceptable levels as indicated by yield data (see Activity 4.2) and numbers of species in cultivation (see Activities 4.2 and 5.4). We will evaluate the success of wild yams in cultivation at the end of the project when we have data from multiple seasons.

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

Comments: It remains 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, and indeed new taxa (see Activity 1.2). In the zones of project activity all species have been located except *D. tsaratananensis*.

B. Output assumptions

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

Comments: Cyclone Enawo (March 7 2017) caused disruption in fieldwork due to flooding in N Madagascar. Overall more rain fell than in 2015-16.

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 assumption has been met in both the COFAV and Antsiranana. Yam cultivation underpinned by free seed yams has proved popular and motivated the collection of wild yam seed tubers from forest.

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

Comments: Transplant survivorship has been of an acceptable levels as indicated by yield data (see Activity 4.2) and numbers of species in cultivation (see Activities 4.2 and 5.4). We will evaluate the success of wild yams in cultivation at the end of the project when we have data from multiple seasons.

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 have been located except *D. tsaratananensis*.

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

Comments: Some anthracnose (fungal pathogen) has been seen on cultivated *D. alata* in COBAs and in germplasm collections 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. Wild yams appear to be much less susceptible.

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

Yam cultivation is a quick and cheap way of getting community involvement without complex equipment or high levels of investment in Madagascar. This was shown in Y2 via yam yields: in Antsiranana, total yield was 6, 818 kg of *D. alata* and just 15 kg of wild yams. In the COFAV 23, 598 kg of *D. alata* and 57 kg of wild yams were produced. These harvests should increase food intake and nutritional status in project communities. The second socioeconomic survey at the end of Y3 will clarify this alongside income status. Biodiversity impacts are primarily the seeds banked (now 23 species in total) and the 21 species in duplicated cultivation on germplasm collections. These are significant mid-project conservation successes. Evidence is provided under the relevant Activities and Indicators.

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

In the project 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 60 communities in which we are working. This has led to the yields quantified under Section 3.5, with wild yams from under cultivation such as *D. sambiranensis* will also make a small contribution to SDG2 and to the more sustainable use of community-adjacent forests in terms of yam exploitation. Yam cultivation is likely to be already positively impacting natural vegetation through reduction of extraction. Community and national germplasm collections combined with the seeds banked 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 and 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 project proposal.

ITPGRFA:

The project is helping 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 drafted national strategy for wild (and cultivated) yams will help to bring government policy in line with the ITPGRFA treaty as regards 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) through exploitation of native yam species in a sustainable manner.

6. Project support to poverty alleviation

Poverty alleviation is being most directly addressed by yam production benefitting project communities by reducing the need to buy rice or other foods: in Antsiranana, total yield was 6, 818 kg of *D. alata* and just 15 kg of wild yams. In the COFAV 23, 598 kg of *D. alata* and 57 kg of wild yams were produced. The end of 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 equality issues

Traditionally, yam cultivation is principally the domain of men in Madagascar, and yam sale, sometimes following preparation, that of women. We have contributed to changing gender roles in yam cultivation and use by training in cultivation and wild population surveying and harvesting 616 males and 437 females (41.5%) in the COFAV and 763 males and 624 females (45%) in Antsiranana. We note that the % of females trained rose to 43.3% in Y2 from 37.5% in Y1. Indirectly, we aim to encourage women to be more involved in yam cultivation. As stated in the Y1 report, we are working to engage female-lead HHs within COBAs to take up yam cultivation as a source of nutrition and income. The project team in Antananarivo and Ambanja continue to 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 HHs 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. It has not proved possible or cost-effective to engage engaging a Malagasy NGO and/or VJ as M & E consultant(s). Other roles in the project (e.g. national strategy production in the case of VJ) has proved more important and we foresaw failure to meet project outputs should we divert resources to M & E.

9. Lessons learnt

We aim not to repeat the FBNT experience with tubers not being passed on from 1st 600 HHs in the COFAV communities as described under Output 3 Indicator 1. We will aim to acquire additional seed yams for planting in October 2017 to fill the gap and are considering a new project with a strong social science component to address the problem uncovered.

Planting time is critical. We attribute the very low yields of wild yams in 2016 to late sourcing and planting of forest-collected seed yams during the rainy season (December 2015-February 2016). We should see increased wild yam yields in Y3 through.

Communication issues have largely been surmounted despite the longer communication chain to the Ambanja office. This has been for the reasons stated above in Section 2 but also greater confidence and project ownership by the KMCC-based project leader.

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

We have attempted to be clearer in this report about baselines, Y1 progress as opposed to Y2, and progress against indicators.

11. Other comments on progress not covered elsewhere

We have recently received news that we have secured matched funding from the April Trust to undertake livelihoods-based research on wild yams in Bongolava and Menabe (see Map in section 1) using the same methods as this project. The £91, 503 raised will allow us to conserve additional species via cultivation and seed banking, including in particular *D. maciba* and *D. bako*, major edible species. The latter is threatened (EN). Working in extra regions and a different biome will also increase the scope of the project to be fully national within Madagascar, and enhance the national strategy.

We are starting to plan how to run the existing project in the COFAV and Antsiranana through to June 2018 on existing funding plus some efficiencies deriving from the matched funding. We will need to do so in order to gather data on the 2017-18 yam harvest and finalise socioeconomic survey data collection and analysis.

We have initiated research on the nutritional work properties of seven yam species from Antsiranana with Mme Razanamparany of DBEV via a MSc student. Initial results suggest higher than expected protein levels, and that the most favoured may not be the most nutritious. We plan to repeat the research in Y3 using tubers grown under standard conditions in our germplasm collections. Clearly further work in this area is needed to underpin the long term use of Madagascar's yams.

Yam cultivation is also being used in KMCC project work at Itremo in central-western Madagascar and by the NGO Tao Tsara in Mikea. The former was funded by FBM (Fund of Madagascar Biodiversity) from 2013 to 2016 to improve the local community's food as a compensatory activity for the restriction access to natural resources following protected area creation in Itremo. The activity was implemented in 10 villages situated in Itremo and surrounding areas

As result of KMCC training and some use of the relatively new winged yam cultivar Florido in 2016 alongside older varieties, yams production from the targeted farmers was about 2 tons which has been eaten or been planted and for the next season. KMCC & FAPBM will support yam cultivation in 2017 with a budget of 2 million ariary for about 80 households.. The work in Mikea is described further in

Section 2. We see this as further evidence that the scope of the project is becoming fully national within Madagascar and interest in the use of wild and cultivated yams to develop sustainable livelihoods has considerable potential for further growth.

12. Sustainability and legacy

We are working with other organisations who will carry forward the work of the project beyond its end. For example, Tao Tsara and the community association in Bongolava. 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 November 2016 workshop, internal Kew, KMCC and FBNT presentations, the HH survey, yam workshop training manual, tweets and blogs all featured the Darwin Logo as did the documentary made with TVM. The UK government origin of the funding was raised at the workshop and in conversations with Malagasy partners. The DI was acknowledged in all radio broadcasts and in https://www.youtube.com/watch?v=_oPl_mHDq0w. The Darwin Initiative was orally presented as funding body wherever possible. The T-shirts described above under Activity 2.2 has the DI logo on its sleeve. Our blogs and tweets have frequently been retweeted by DI.

14. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2016 – 31 March 2017)

| Project spend (indicative) since last annual report | 2016/17 Grant (£) | 2016/17 Total Darwin Costs (£) | Variance % | Comments (please explain significant variances) |
|---|-------------------|--------------------------------|------------|--|
| Staff costs (see below) | | | 1 | |
| Consultancy costs | 0 | 0 | | |
| Overhead Costs | | | -15 | Reduced via not replacing Tim Harris and not funding PBZT or SNGF via staffing – see Section 2. Not submitted as change request. |
| Travel and subsistence | | | 4 | |
| Operating Costs | | | 26 | Extra field activity by KMCC has been needed to reach communities and locate populations of threatened species; has been driven managerially by RBG, Kew team. Price of fuel has increased. Not submitted as change request. |
| Capital items (see below) | 0 | 0 | | |

| | | | | |
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| Others (see below) (vehicle maintenance) | | | 4 | |
| TOTAL | | | | |

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2016-2017

| Project summary | Measurable Indicators | Progress and Achievements April 2016 - March 2017 | Actions required/planned for next period |
|---|--|---|--|
| <p>Impact</p> <p>Food security, livelihoods, forest protection, biodiversity conservation and resilience of communities to climate change is improved in Madagascar</p> | | | |
| <p>Outcome 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 HHs) benefiting from yam cultivation via average 10% increase in nutritional intake</p> | <p>By the end of Y2 we have 90 collections covering species, representing 2 new species in Y2 and 26 accessions. We have 1-11 collections per species.</p> <p>We currently have living plant material of 8 threatened species in cultivation in Antananarivo and via communities, including all 6 that occur within the two project activity areas.</p> <p>The website has recently been released. It will then be enhanced incrementally during Y3. The basic manual in Malagasy used in training also presents relevant information.</p> <p>The number of HHs with whom the project is working has risen from 37 communities and 925 HHs in the Y1 Annual report to 60 communities and 3000 HHs, with 1500 in Antsiranana</p> | <p>We anticipate that all accessions will be on SID at the end of Y3. Seed collecting in field is just restarting at the point of data compilation (late March).</p> <p>We have plans to increase the numbers from other areas in Y3 via recently obtained matched funding.</p> <p>Manual will be further developed during Y3 using project-generated information (e.g. species information specific to a given COBA) to be presented to COBA members at the end of the project.</p> |

| | | | |
|--|---|---|--|
| | <p>Indicator 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</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>and 1500 in the COFAV.</p> <p>Underpinning research, see Activities 1.1-1.3 above. Signature of 42 agreements with communities regarding conservation of multiple wild species per community</p> | <p>Completion of activities relating to this indicator in Y3</p> |
| <p>Output 1. 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>The initial 31 IUCN red list assessments described in the Y1 report have been reviewed by two IUCN specialist groups, revised accepted for publication on IUCNredlist.org and will be published by IUCN in June. The remaining yam species from Madagascar will be assessed once the 31 are published/as they are described (species new to science).</p> <p>We have undertaken species occurrence data capture as described in Activity 1.2 in order to achieve for as many species as possible a minimum of 10 records per species and to supplement the available herbarium specimen database.</p> <p>The first draft of the national strategy is close to completion in April 2017 having been drafted by MR and VJ. It will be circulated to key stakeholders for review early in Y3 and fully workshopped in the Autumn 2017 workshop.</p> | |
| <p>Activity 1.1 Baseline surveys of populations of priority species, including: area, individuals/density, forest size and conservation status</p> | | <p>Surveys were undertaken in March and April 2016 for 16 sites in Antsiranana with three locations per site. In the COFAV four communities undertook population surveys, again with three locations per community. Surveys in Year 2/3 have started in March.</p> | |
| <p>Activity 1.2 Inventory of new areas to enhance distribution data</p> | | <p>Inventory work in 3 areas. We now have 201 wild yam records in total and are aiming to exceed 1000 records by the end of Y3 to inform reassessments of conservation status.</p> | |
| <p>Activity 1.3 IUCN Red List assessments and ecological profiling</p> | | <p>The initial 31 IUCN red list assessments described in the Y1 report are now revised, accepted for publication on IUCNredlist.org and will be published by</p> | |

| | | |
|---|--|--|
| | | IUCN in June. |
| Activity 1.4 Workshops with stakeholders to develop a national strategy and conservation action plans for priority species. | | A workshop with 32 participants was held in early November with Government (6 individuals from MEEMF/DREEF) and 8 NGO stakeholders from 5 organisations, plus 3 participants from MBG, including MBG in Antsiranana. First draft of the national strategy is close to completion in April 2017. It will be circulated to key stakeholders for review early in Y3 |
| Output 2. Improved knowledge and awareness of the importance of yams | <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>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>A basic project website is now online; will be augmented during Y3.</p> <p>Project communication has been via radio, TV, blogs, tweets, website and T-shirts. Elevated levels of all communications over Y1. Two yam harvest festivals were held in the in COFAV in August, with more than 700 people participating and being engaged with wild yams conservation and cultivation.</p> <p>One article describing a threatened new species published in April 2017 (<i>D. irodensis</i>). The article on the second species referred to in the Y1 report has been delayed. Three other MSS on yam diversity and conservation are in preparation in addition to the scheduled Y3 article preparation based on data acquired during the project.</p> |
| Activity 2.1. Building and populating a project website and blog. | | 12 blogs and a total of 152 tweets with 105, 617 impressions by the project leaders at KMCC in Antananarivo and Ambanja alone in Y2. |
| Activity 2.2. Implementation of a project communication strategy, including radio, newspapers, social media, leaflets and yam festivals | | 4 repeated radio programmes in Ambanja and Antsiranana, video and TV broadcast. Two yam harvest festivals held in the in COFAV in August, over 700 people participating and engaged with wild yam conservation and cultivation. |
| Activity 2.3 Preparation of journal articles | | One article describing a threatened new species published in April 2017 (<i>D. irodensis</i>). Three other MSS on yam diversity and conservation are in preparation in addition to the scheduled Y3 article. |
| Output 3. Cultivation of native species and cultivars by 60 communities | <p>Indicator 1: At least 50 HHs in 60 communities engaged in yam cultivation by end of year 3.</p> <p>Indicator 2: 10% increase in HH incomes, with surplus tubers also</p> | <p>Working with 60 communities and 3000 households, with 1500 in Antsiranana and 1500 in the COFAV albeit degree of engagement variable.</p> <p>Baseline annual income in Antsiranana mean 265, 780 Ar, range 0-1.7M. COFAV mean 297, 060, range 0-1.4M.</p> |

| | | |
|---|---|---|
| | <p>available for cultivation by additional HHs 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>COFAV 1053 616 male, 437 female (41.5%); Antsiranana 1387, 763 male 624 female (45%). The total number trained is now 2440 with 948 in Y1 so 1492 people were trained in Y2.</p> |
| Activity 3.1 Socio-economic surveys of community and HH consumption of yams and the availability of wild yams in local markets. | | Baseline survey Antsiranana: mean annual income 265, 780 Ar, Calories 101, 950 Kcal, protein 2, 830g. COFAV 297, 060, 659, 170, 11, 930 respectively. |
| Activity 3.2 Training for community technicians in cultivation and ennoblement techniques. | | COFAV 1053 616 male, 437 female (41.5%); Antsiranana 1387, 763 male 624 female (45%). The total number trained is now 2440 with 948 in Y1 so 1492 people were trained in Y2. |
| Activity 3.3 Development of a manual and other materials, tested by communities, to facilitate farmer to farmer dissemination. | | Basic manual in Malagasy used in training. Will be developed during Y3 using project-generated information (e.g. species information specific to a given COBA) to be presented to COBA members at the end of the project. |
| Activity 3.4 Repeated surveys of food consumption in HHs in the project areas to assess changes throughout the life of the project. | | Baseline survey Antsiranana: mean annual Calories 101, 950 Kcal, protein 2, 830g. COFAV 659, 170, 11, 930 respectively. |
| Output 4. Conservation management of the 20 most threatened species | <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>Signature of 42 agreements with communities regarding conservation of multiple wild species per community.</p> <p>Surveys were undertaken in March and April 2016 for 16 sites in Antsiranana with three locations per site. In the COFAV four communities undertook population surveys, again with three locations per community. Surveys in Year 2/3 have started in March.</p> <p>Assessed at the close of the project via repeating the initial IUCN assessments based on data captured under Activities 1.2 and 1.3. Progress in Y2 has been in the acceptance for publication of the 31 original assessments in June 2017.</p> |
| Activity 4.1 Baseline surveys and monitoring of the harvesting of priority species and populations from forests | | Surveys were undertaken in March and April 2016 for 16 sites in Antsiranana with three locations per site. In the COFAV four communities undertook population surveys, again with three locations per community. Surveys in Year |

| | | |
|--|---|--|
| | | 2/3 have started in March. Inventory at Beanka, Analalava and Sahafary. 201 Zavamaniry Gasy records. |
| Activity 4.2 Research into the most effective ennoblement protocols and management of wild species for sustainable food production. | | Cultivating a total of 21 species of wild yam, plus an additional endemic subspecies (<i>D. sambiranensis</i> ssp. <i>bardotiae</i>) and 5 varieties of <i>D. alata</i> . Of the 21, 6 are threatened. June 2016 harvest data: Antsiranana, total yield 6, 818 kg of <i>D. alata</i> , 15 kg of wild yams. COFAV 23, 598 kg of <i>D. alata</i> , 57 kg of wild yams. |
| Activity 4.3 Participatory development of a monitoring methodology for communities. | | Surveys were undertaken in March and April 2016 for 16 sites in Antsiranana with three locations per site. In the COFAV four communities undertook population surveys, again with three locations per community. Surveys in Year 2/3 have started in March. |
| Activity 4.4 Development of conservation management plans for each species and agreement with communities and NGOs managing protected areas. | | Signature of 42 agreements with communities regarding conservation of multiple wild species per community. |
| Output 5. Ex-situ conservation of all wild species and non-native cultivars | <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 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>By the end of Y2 we have 90 collections covering 23 species, representing 2 new species in Y2 and 26 accessions. We have 1-11 collections per species.</p> <p>The SID database (http://data.kew.org/sid/) indicates that 13/14 Malagasy yam species now have germination tests. 4 new tests done in Y2 (9 in Y1).</p> <p>21 species are in cultivation in our principal germplasm collections in Antananarivo. 21 species of wild yam, plus an additional endemic subspecies (<i>D. sambiranensis</i> ssp. <i>bardotiae</i>) in community cultivation and 5 varieties of <i>D. alata</i>. Of the 21, 6 are threatened.</p> |
| Activity 5.1 Identification of sites for collection of seeds from yam populations, informed by the baseline surveys. | | Sites for seed collection were identified during early 2016 and collected in March-June of that year. Further sites have been identified in early 2017 and seed collection from them is currently under way |
| Activity 5.2 Seed collection trips in combination with baseline surveys. | | By the end of Y2 we have 90 collections covering 23 species, representing 2 new species in Y2 and 26 accessions. We have 1-11 collections per species. |
| 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). | | 4 new tests have been done in Y2 |
| Activity 5.4 Distribution of germination protocols, seeds and tubers to botanic gardens and communities engaged to preserve living collections of wild species | | DBEV: 83 individual accessions comprising 21 species, of which 10 are provisionally or demonstrated to be threatened. PBZT 122 individual accessions comprising 21 species, of which 10 provisionally or demonstrated to be |

and cultivars.

threatened. Smaller collections at Ramena/Ankoriky and Ambanja.

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>Impact: 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>Outcome: 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"> 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. 2. Living plants of all twelve endangered yam species/cultivars growing in at least 4 collections by year 3 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. 4. 60 communities (c.3,000 HHs) benefiting from yam cultivation, with an improvement in food security shown by an average 10% increase in nutritional intake across all involved HHs (as shown by consumption survey) by year 3. 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. 6 (7). Two populations from each wild yam species located and assessed for harvesting impacts (through counting | <ol style="list-style-type: none"> 1. MSBP databases and website. 2. Project reports and website. 3. Project website. 4. Community association reports, photographs, socio-economic surveys and project website. 5. Project website and peer-reviewed scientific publications. | <ol style="list-style-type: none"> 1. Within the time-frame of the project, weather and/or climate does not have adverse affects on yam cultivation and/or wild populations. 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). 3. There are wild species in each region that can be cultivated successfully or that will respond to ennoblement. 4. All 40 native species can be located and have some viable populations which can be conserved. |

| | | | |
|---|---|--|--|
| | extraction holes) by end of year 1, creating a baseline for future community monitoring. | | |
| <p>Outputs:</p> <p>1. A national strategy 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>2. Improved knowledge and awareness 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>3. Cultivation of native species and cultivars 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 HHs in 60 communities engaged in yam cultivation by end of year 3.</p> <p>3b. 10% increase in HH incomes, with surplus tubers also available for cultivation by additional HHs 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> |

| | | | |
|---|---|--|---|
| | 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. Pests do not have significantly adverse affects on cultivation. |
| 4. Conservation management 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. 4b. Community monitoring methodology developed and implemented and integrated into the conservation management plans by end of year 3. 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 4b. Agreements with collaborating NGOs and communities/3-monthly project reports 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). Within the time-frame of the project, weather and/or climate does not have adverse affects on yam cultivation and/or wild populations. All 40 native species can be located and have some viable populations which can be conserved. |
| 5. Ex-situ conservation 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. 5b. Germination protocols for all native species published by year 3. 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 5b. 3-monthly project reports/ Blog posts, videos and photographs, links to media activity available through the project website/Journal papers 5c. Agreements with collaborating NGOs and communities | All 40 native species can be located and have some viable populations which can be conserved. Pests do not have significantly adverse affects on cultivation. |
| Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1) | | | |
| 1.1 Baseline surveys of populations of priority species, including: area, individuals/density, forest size and conservation status. 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. 1.3 IUCN Red List assessments and ecological profiling. 1.4 Workshops with stakeholders to develop a national strategy and conservation action plans for priority species. 2.1 Building and populating a project website and blog. 2.2 Implementation of a project communication strategy, including radio, newspapers, social media, leaflets and yam festivals. 2.3 Preparation of journal articles. | | | |

- 3.1 Socio-economic surveys of community and HH 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 HHs 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 (0 unless included)

| 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 | 0 | | 0 | |
| 2 | MSc obtained | | | 0 | 1 | | 1 | |
| 3 | Other qualifications obtained | | | 0 | 0 | | 0 | |
| 4A-D | Undergraduate/postgraduate training | | | 0 | 0 | | 0 | |
| 5 | Other training 1 year plus | | | 0 | 0 | | 0 | |
| 6A | Other training than 1-5 number of people | | | 948 | 1492 | | 2440 | |
| 6B | Other training than 1-5 number of training weeks | | | 271 | 0 | | 271 | |
| 7 | No. of training materials produced | | | 1 | 0 | | 1 | |
| 9 | No. of species/habitat action plans produced | | | 0 | 0 | | 0 | |
| 10 | No. of individual field guides/manuals produced | | | 0 | 0 | | 0 | |
| 11A/B | No. of papers published/submitted | | | 0/0 | 1/1 | | 1 | |
| 12A/B | No. of databases for Madagascar established/enhanced | | | 1/0 | 0/0 | | 1 | |
| 13A/B | No. of species reference collections established/enhanced | | | 38/0 | 2/2 | | 40/2 | |
| 14A/B | No. of conferences/seminars/workshops organised/attended | | | 1/8 | 1/0 | | 2/8 | |
| 20 | Estimated value of physical assets to Madagascar | | | £10,969 | £0 | | £10,969 | |
| 21 | No. of permanent facilities established and continued | | | 1 – KMCC Ambanja office | 0 | | 1 | |
| 22 | No. of permanent field plots established and continued | | | 7/180 | 20/180 | | 27/180 | |
| 23 | Value of resources from other sources raised | | | £0 raised, Contributi | £91,503 | | | |

| | | | | | | | | |
|--|--|--|--|--|---------|--|--|--|
| | | | | ons in kind £8,820 Kew overhead, £10,000 MSBP UK costs | raised. | | | |
|--|--|--|--|--|---------|--|--|--|

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) |
|---|---|---|------------------------------|-----------------------------------|-----------------------------------|---|
| A new species of critically endangered edible yam endemic to northern Madagascar, <i>Dioscorea irodensis</i> (Dioscoreaceae) and its conservation | Journal; | Paul Wilkin, James A. Kennerley, Mamy Tiana Rajaonah, Geodain Meva Huckël, Feno Rakotoarison, Tianjanahary Randriamboavonjy, Stuart Cable | M | UK | Springer | https://link.springer.com/article/10.1007/s12225-017-9677-6 |
| | | | | | | |
| | | | | | | |

Annex 4 Onwards – supplementary material (optional but encouraged as evidence of project achievement)

Annex 4: An e-copy of a fieldwork order and part of a participatory survey sheet (See Activity 1.1)

a) Fieldwork order



Antananarivo, le 16 Janvier 2017

ORDRE DE MISSION

N° **OM/KMCC/2017**

Je soussignée Dr Ralimanana Hélène, Team Manager au Kew Madagascar Conservation Centre (KMCC), autorise par la présente que:

- 1.) *Dr Rakotonasolo Franck, KMCC Inventory Team Leader*
- 2.) *Mr Onjalalaina Guy Eric, KMCC Botanist*
- 3.) *Mr Rabarijaona Romer, KMCC Botanist*
- 4.) *Dr Rajaonah Mamy Tiana, KMCC Livelihoods Team Leader*
- 5.) *Mr Rabehevitra David, KMCC Species Conservation Team Leader*
- 6.) *Mme Rajaovelona Landy, KMCC Orchid Conservation Officer*
- 7.) *Mr Rajaonarison Roger, KMCC Driver*
- 8.) *Mr Andrianantenaina Tatamo, KMCC Driver*
- 9.) *Mme Jacqueline Razanatsoa, PBZT Technician*

sont autorisés à faire une mission de terrain à Beanka près de Maintirano, Région de Melaky pendant 10 jours à partir de 17 au 26 Janvier 2017.

Ils vont faire **des collectes générales des plantes (y compris les spécimens d'herbier, des graines et des ADN) et en particulier des graines et des tubercules des ignames sauvages pour le compte du Projet Darwin Yam et de KMCC.** Cet ordre de mission leur est délivré pour servir et valoir ce que de droit.

Le Team Manager

Vu au passage

Date, signature et cachet

Vu au passage

Date, signature et cachet

FIELDTRIP REGION(S) AND LOCALITIES (Beanka in MELAKY region)

1. Fieldtrip date and duration: 17th to 26th May 2016 (15 days)

2. Fieldtrip leader: RAJAONAH Mamy Tiana
3. Participants and institution: 07 people
 - *Dr Rakotonasolo Franck, KMCC Inventory Team Leader*
 - *Mr Onjalalaina Guy Eric, KMCC Botanist*
 - *Mr Rabarijaona Romer, KMCC Botanist*
 - *Dr Rajaonah Mamy Tiana, KMCC Livelihoods Team Leader*
 - *Mr Rabehevitra David, KMCC Botanist*
 - *Mme Rajaovelona Landy, KMCC Orchid Conservation Officer*
 - *Mr Rajaonarison Roger, KMCC Driver*
 - *Mr Andrianantenaina Tatamo, KMCC Driver*
 - *Mme Jacqueline Razanatsoa, PBZT Technician*
4. Budget requested: **8,319,300** MGA from DARWIN yam project (50%) and KMCC project (50%)
5. Objects: - General collecting including: specimens, DNA and seeds
- Collecting seeds and tuber-seeds of wild yams
6. Expected results:
 - Availability of specimen, seeds and genetic material of the flora on these regions
 - Yams tuber-seeds collected for the living collection in PBZT and University
 - Seeds collected for SNGF and MSB
7. Risks assumption (re. safety)

a) Part of a participatory survey sheet

-Daty :21/05/2016

Anaran'ny ovy ala: Ovivotsy (*Dioscorea serifflorea*)
; *D. kimiae*
Vala laharana faha: 02

-Anaran'ny tanàna: Antanifotsy
-VOI: FITAMITO
-Anaran'ny ati-ala misy ny vala: Ankaramainty
-Halaviran'ny vala miala ny tanàna: 400m
-Halaviran'ny vala miala ny moran'ala akaiky indrindra: 100m

-Tsidry mianjady amin'ny ovy ala: tsy misy
-Tsidry mitatao amin'ny ala misy ovy ala: fakana hazo hanaovana trano, kitay, fakana tantely dia.

VALA FANADIHADIANA OVIALA DIA

VOI FITAMITO2

-GPS:
-Haavon'ny toerana: 1060m

S 22°03' 238 " E 47°10' 149"
S 22°03' 251 " E 47°10'140 "
S 22°03' 244" E 47°10' 149"
S 22°03' 253" E 47°10'149"

VALA

-Fitadiky ny toerana amin'ny masoandro: Avaratra -miatsinanana
- Fisolampin'ny toerana: Misolampy 30°
- Karazan'ny ala: Ala mikitr oka
-Haavon'ny yhazo lava anaty ala: 30 m
-Fisokatry ny ala rahajerena avy aty ambany (mitraka): 65 %
-Hamaodana: manda manda (30 %)
- Karazan'ny tany: tsabofo
-Taharan'ny tany: volanala
- Lokan'ny tany: mairity ny ambony, mena ny ambany
- Fitadiky ny laharan'ny hefitra anaty vala: Andrefana miatsinanana
-Karazana hazo betsaka indrindra anaty vala: Mahanoro, rotra fotsy

| Laharan'ny hefitra | Karazana oviala | Lavaka oviala vaovao | Lavaka oviala taloha | Oviala lahy | Oviala vavy | Tanora | Zanany avy amin'ny voany | Fitambaran'ny Isan'ny fotorany | Misy felany sa Misy voany | Laharan'ny Herbier |
|--------------------|------------------|----------------------|----------------------|-------------|-------------|--------|--------------------------|--------------------------------|---------------------------|--------------------|
| 1 | Ovivotsy | | | | | 0 | 1 | | | |
| 2 | Ovivotsy | | | | | 0 | 0 | | | |
| 3 | Ovivotsy | | | | | 2 | 1 | | | |
| 4 | Ovivotsy, kimiae | | | | | 8 | 4 | | | |
| 5 | Ovivotsy, kimiae | | | | | 4 | 8 | | | |
| 6 | 0 | | | | | 0 | 0 | | | |
| 7 | kimiae | | | | | 3 | 0 | | | |
| 8 | kimiae | | | | | 4 | 0 | | | |
| 9 | Ovivotsy | | | | | 3 | 4 | | | |
| 10 | Ovivotsy | | | | | 6 | 2 | | | |
| 11 | Ovivotsy | | | | | 0 | 0 | | | |

Annex 5. Workshop report and Fiche de Presence

[MTR/TR email]

a) Workshop report (P1 of 9).

RAPPORT DE L'ATELIER SUR LA MISE EN PLACE DE LA STRATEGIE NATIONALE POUR LA CONSERVATION DES IGNAME DE MADAGASCAR

La Résidence Ankerana, Antananarivo

08 Novembre 2015

A Madagascar, Les ignames sauvages font partie de la nourriture des communautés rurales surtout pendant période de soudure. Au total, ces espèces sont au nombre de 40 sont toutes endémiques et comestibles à 95%. Menacées par la perte d'habitat et la collecte illicite et abusive des tubercules. Les espèces d'ignames sauvages vont disparaître dans la nature car les mesures pour la collecte rationnelle ne semblent pas appliquées.

En collaboration avec les communautés locales, RBG Kew a mené le projet de conservation des ignames Malagasy dont l'objectif principal est d'améliorer la sécurité alimentaire des COBAs vulnérables en adoptant avec elles la technique de plantation des ignames sauvages. Grâce au financement de Darwin Initiative, ce projet mené par Dr Paul Wilkin entame actuellement sa deuxième année en mettant en exergue la participation active des communautés locales au nombre de soixantaine et des dizaine d'ONGs partenaires.



Partenaires du projet, NT/FBM et ONG
Taotsara, en participation active
pendant l'atelier



Intervention du DREEF Haute Matsiatra
à la séance questions-réponses

Comme activité principale du projet, l'élaboration d'une stratégie nationale de la conservation des ignames sauvages de Madagascar en fait partie. Plusieurs entités participent activement à l'atelier du 8 Novembre mené par MEEMF et des échanges se sont faits efficacement après toutes présentations successives dont le programme est présenté ci-dessous.

| Heure | Intervention | Responsable |
|--------------|--|---|
| MATIN | | |
| 9h | Accueil des participants | KMCC |
| 9h20 | Mot de bienvenu et ouverture de l'atelier | MEEMF |
| 9h30 | Programme de l'atelier et KMCC | Dr Hélène Ralimanana (Team Manager – KMCC) |
| 9h45 | Etat des lieux du projet Darwin ignames | Dr Paul Wilkin (Head of Natural Capital and Plant Health – RBG Kew) |
| 10h00 | Approches et techniques de culture des ignames | Dr Rajaonah Mamy Tiana (Livelihoods Team Leader – KMCC) |

b) Fiche de presence



Fiche de présence

Activité: Ateliers de la mise en place de la Stratégie nationale de conservation des
 Date: 8 NOVEMBRE 2016
 Lieu: Le club Jeanie Antsirana

| Nom et prénom | Institution/titre | Contact | Signature |
|----------------------------|---------------------------------|-----------------|-------------|
| RAHINA NANA Hélène | RB&K MW | 22423 68 | [Signature] |
| RAKOTOMANGA Rolo EAZ | - 11 - | - 11 - | [Signature] |
| RAKOTOMAMONJY Fahiny | Coll. DSAP/NEEF | 034 94 62 80 | [Signature] |
| RAZAFINDRALAHAJA Talina | PBZT | 0337639715 | [Signature] |
| RAHASANIRINA Vonina | ONG TADISA | +34 9741736 | [Signature] |
| RAZAFIMAMONJY Nontra | ONG TADISA | 034 1095362 | [Signature] |
| Randrianarison Esthèle | FBM/Ny Tanantsika | 034 1755389 | [Signature] |
| CAMERON Samantha | FBM/Ny Tanantsika | 034 1094074 | [Signature] |
| RAHAISONA Eugene | FBM/Ny Tanantsika | 033 145163 | [Signature] |
| Jenny RAZAFISALAMA | MISSOURI BOTANICAL GARDEN - MEG | 0331163930 | [Signature] |
| RANIRISON PATRICK | DSAP/AR Amparan'Antsirana | 0320543145 | [Signature] |
| TAEOLONE | CRMS DSAP/NEEF | 0340562095 | [Signature] |
| CABLE Stuart | RBG Kew | s.cable@kew.org | [Signature] |
| RAVOSOA Marie Philippine | DREEF, HM | 034 05 62148 | [Signature] |
| JEANNOA Volodionaine | NEEV/UA v. Tana | 032 02 414 88 | [Signature] |
| RAJONARISON Julien | ONG L'Homme et l'Environnement | 0349546565 | [Signature] |
| * RAKOTOVAOMITA Haumisa | Chf. Proj. Forat DSAP | 0340562122 | [Signature] |
| RAHAJARIVONY Andriantsoa | collab. DSAP | 034 05 62170 | [Signature] |
| Andriamparany Jessica | Projet SALANA | 034 99 019 63 | [Signature] |
| RAKOTONDRAZISIMBA Mbola | Association Jahatra | 033 2163655 | [Signature] |
| GEODAIN Huckiel Meva | KMCC AMBANJA | 032 51.213.59 | [Signature] |
| RAKOTOARISON Fononirina | KMCC Ambanja | 034 79 156 12 | [Signature] |
| RANCO TONASOLO Franck | KMCC | 034 03 119 56 | [Signature] |
| RABARIVONA Pomea | KMCC | 032 9383305 | [Signature] |
| RAHANITRINIANTHA Volatiana | DSAP/DSAP/SEB | 0347254025 | [Signature] |
| RAUDRIATERAVONJY Tam | KMCC | 92423 68 | [Signature] |
| RAJANAH Mamy Tiana | KMCC | 0340409552 | [Signature] |
| RAVAVELONA Randy Rita | KMCC | 0331887860 | [Signature] |
| MBOLATAHIANA Rodouane | KMCC | 0325172254 | [Signature] |
| RABARIVOZA Lina | KMCC | 0331276385 | [Signature] |

"Ovala voakajy...sakafo ampy sy ala maharitra"

Radio emission in Ambanja

Inona ny vaovao hoentinareo avy ao amin'ny KMCC izay miandraikitra ny tetik'asa fambolena oviaala?

Miarahaba

Presentation participants

Izahay dia avy ao amin'ny Royal botanic gardens na RBG izay manana ny foibe any Kew Londres ary manana birao maharitra eto Madagasikara antsoina hoe Kew Madagascar Conservation Centre na KMCC ka ny foiben'izy io dia ao Antananarivo.

Ny KMCC dia misehatra amin'ny resaka tontolo iainana sy ny zava-boary indrindra ny zava-maniry.

ka asa ataonay ao anatin'izany dia mamantatra ireo karazan-javamaniry misy eto madagasikara ary miaro azy ireo sy ny toerana ivelomany (dia ny ala izany). Araka izany dia manao fikarohana na recherche izahay, manao ny fanangonana sy fitahirizana azy ireo amin'ny toerana azo antoka (ohatra ao anatin'izany ny fanangonana sy fitahirizana ny voany na graines)

Toerana maro no iasan'ny KMCC ary anisan'izany ny faritra DIANA.

Amin'izao fotoana izao ary dia mitondra tetik'asa aty amin'ny faritra avaratra izahay. Izy io dia tetik'asa fiarovana oviaala ka amin'ny alalan'ny fambolena azy an-tanàna no hoentinay manatanteraka izany.

Ahoana ny mahakasika io tetik'asa io aty avaratra?

- Ny tetik'asa fiarovana sy fambolena oviaaladia dia tetik'asa izay vatsiana'ny **Darwin Initiative** (any Londres) vola
- 3 taona eo aloha no faharetany ary efa nanomboka tami'nny taona 2015.
- Ny mpiara-miasa aminay ao anatin'ny tetik'asa dia:
 - o Ny vondron'olona ifotony monina sy mivelona amin'ny tanàna manodidina ny ala arovana na tsia ka misy misy oviaaladia maniry

- Missouri botanical garden na MBG Diego (mitantanana ny ala ao Oronjia et Diego sy MBG Ambanja (mitantana ny ala ao Galoko-Kalabinono)
 - Ny Service d'appui à la gestion de l'environnement na SAGE eto Diego
 - Ny Silo national des graines forestières na SNGF-Antananarivo
 - Ny Parc botanique et zoologique de Tsimbazaza-Antananarivo
 - Ny l'homme et l'environnement ao Ambanja
 - Ny minisiteran'ny rano sy ny ala na DREEF Diego sy Ambanja ary Ambilobe
 - Ny Tanintsika
- Toerana maro no hanatanterahana azy: anisan'izany ny any amin'ny faritra Fianaratsoa sy aty ami'ny faritra Diana (aty amin'ny faritra DIANA: District Diego misy toerana 7, Ambilobe Misy 5 ary Ambanja misy 2) ary mbola eo am-panitarana izany tetik'asa izany amin'ny toerana hafa izahay amin'izao

Annex 7. Project T-Shirt



Annex 9. Images of training activity: theory and practice (setting up a nursery). Note female participation



Annex 10. Exemplar yam production data from the COFAV for 2016, plus photographs of community plots and a list of species cultivated with communities

Miarinarivo (COFAV)

| | ANKOTS BR | AMBHPNN | ANTNF TS | AMBZTN | TSIPPK | ANDRN ZR | AMBH TS | total |
|----------------|----------------------|----------------|---------------------|---------------|---------------|---------------------|--------------------|-------------------|
| Ovibe | 1171 | 1827.5 | 3231 | 2605 | 1623 | 1772 | 3914.5 | 161 44 |
| Florida | 58 | 48 | 107 | 57.5 | 60.4 | 60 | 164 | 554. 9 |

| | | | | | | | | |
|------------------|----|------|-----|-------|-----|------|-----|--------------|
| Ovy tanty | 24 | | | 33.5 | | 16.5 | | 74 |
| Ovy lalaina | 28 | | 236 | 222.5 | | | | 486.5 |
| D. seriflora | | 10.7 | 7.9 | | 5.1 | 3.8 | 6.5 | 34 |
| D. heteropoda | | | 1.8 | 4 | | | | 5.8 |
| D. bosseri | | | | 3.5 | | | | 3.5 |
| D. arcuatinervis | | | | | 3.8 | 3.4 | 2.5 | 9.7 |
| D. kimiae | | | | | | 3.2 | | 3.2 |

Ambohimahamasina (COFAV)

| | AMPSPTS | ANDASY | ANTNTR | AMBLB | MANA HY | TSANG MS | <i>total</i> |
|--------------|---------|--------|--------|-------|------------|-------------|---------------|
| Ovibe | 187 | 772 | 562.5 | 751.6 | 354 | 740 | 3367.1 |
| Florida | 77 | 40 | 37 | 56 | 115.75 | 100 | 425.75 |
| Ovy lalaina | | 6.5 | | | | | 6.5 |
| Ovy tanty | | 31.5 | | | | | 31.5 |
| D. seriflora | | | | | 1 | | 1 |

Vinanitelo (COFAV)

| | AMPGN RY | FOROMBO LOY | AKAY | ANDRENDRAV OLA | <i>total</i> |
|---------|-------------|----------------|------|-------------------|--------------|
| Ovibe | 350 | 987 | 639 | 442 | 2418 |
| Florida | 6.5 | 37 | 41.3 | 5 | 89.8 |

COFAV *D. alata* community plot



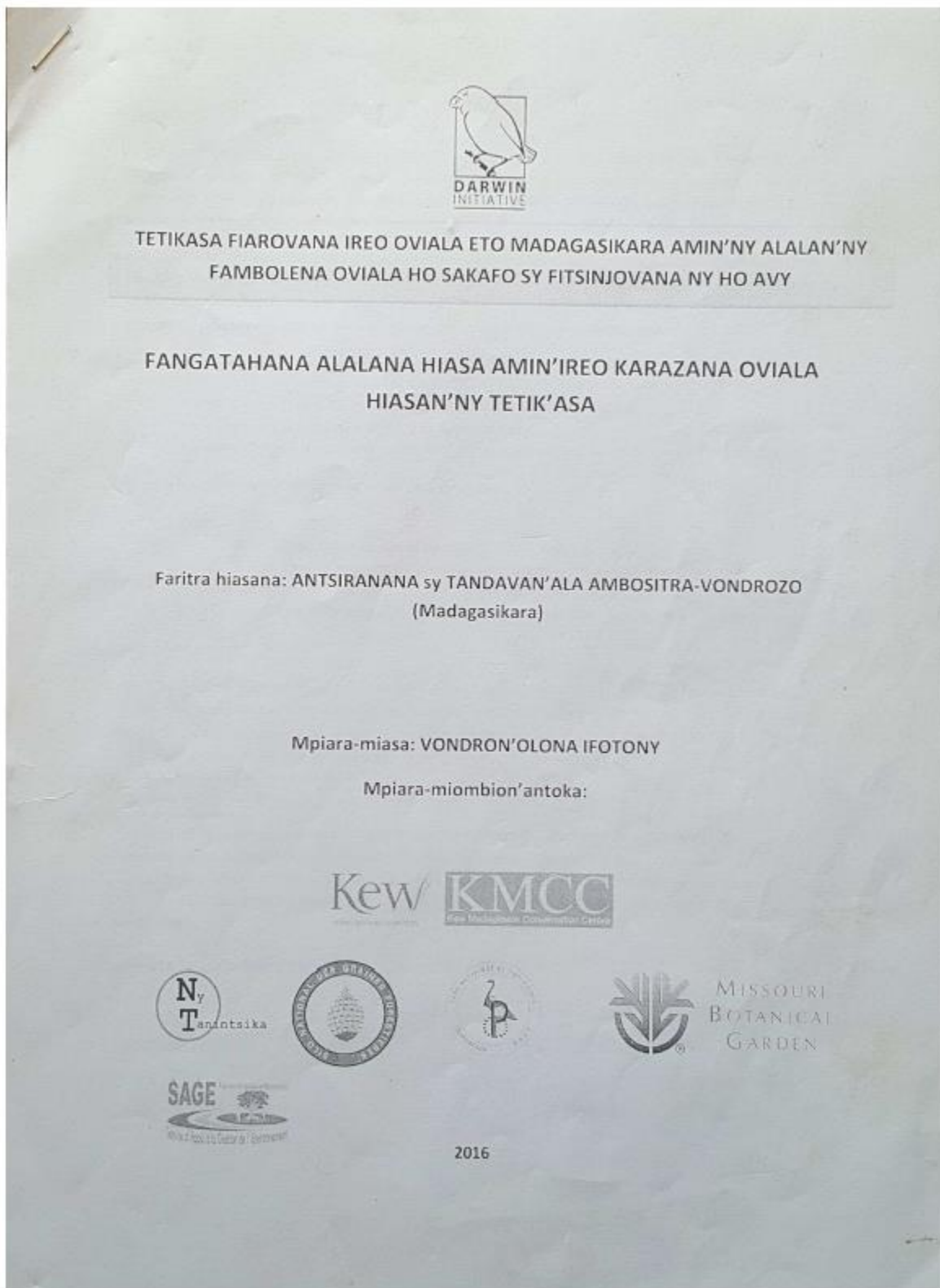
Community plot near Ambanja with *D. sambiranensis* and *D. alata* (background)



List of Species cultivated with communities (P1 of many)

| N o | Comm unity | Region | Housholds (nb) | | | | Indicator 5 (sustainable management) | | | | | |
|--------|------------------|-----------------|-------------------|--------|--------|---|--------------------------------------|---|---------|---------------|-------------|---------------|
| | | | Y 1 | Y 2 | Y 3 | TO TA L | Year 1 | | Year 2 | | Year 3 | |
| | | | | | | | Species | agree ment | Species | agree ment | Spe cies | agree ment |
| 1 | Ankorika hely | DIANA /Diego | 2 4 | 7 | 31 | D. alata (Majola) | not | D. alata (Majola) | yes | | | |
| | | | | | | D. orangeana (Ovy jia/Ovy/Ovy fotsy) | not | D. orangeana (Ovy jia/Ovy/Ovy fotsy) | yes | | | |
| 2 | Ramena | DIANA /Diego | 1 1 | 2 9 | 40 | D. alata (Majola) | not | D. alata (Majola) | yes | | | |
| | | | | | | D. orangeana (Ovy jia/Ovy/Ovy fotsy) | not | D. orangeana (Ovy jia/Ovy/Ovy fotsy) | yes | | | |
| 3 | Andavak oera | DIANA /Diego | 2 4 | 8 | 32 | D. alata (Majola) | not | D. alata (Majola) | yes | | | |
| | | | | | | D. sambiranensi s var. | not | D. sambiranensi s var. | yes | | | |

| | | | | | | | | | | | |
|---|-----------------|--------------|--------|--------|----|--|-----|--|-----|--|--|
| | | | | | | sambiranensis (Maherivahy) | | sambiranensis (Maheryvahy) | | | |
| | | | | | | D. sambiranensis var. bardotiae (Taravy) | not | D. sambiranensis var. bardotiae (Taravy) | yes | | |
| | | | | | | D. sp3 (Ovy lasoie) | not | D. maciba (Ovy lasoie) | yes | | |
| | | | | | | D. buckleyana (Ovy malandy) | not | D. buckleyana (Ovy malandy) | yes | | |
| | | | | | | D. alata (Majola) | not | D. alata (Majola) | yes | | |
| | | | | | | D. sansibarensis (Haragnarana /Kabouma/ sary majola) | not | D. sansibarensis (Haragnarana /Kabouma/ sary majola) | yes | | |
| | | | | | 58 | D. sp1 (ovy mena) | not | D. sambiranensis var bardotiae (ovy mena) | yes | | |
| | | | | | | D. sambiranensis var. sambiranensis (Maherivahy) | not | D. sambiranensis var. sambiranensis (Maheryvahy) | yes | | |
| 4 | Andrano manitra | DIANA /Diego | 2 6 | 3 2 | | | | | | | |



Fampidirana

Ny tetikasa fiarovana ny oviala eto Madagasikara amin'ny alalan'ny fambolena azy ho fihinana sy ho fitsinjovana ny maitso ahitra dia tetikasa tanterahina mandritra ny telo taona izay manomboka ny taona 2015. Darwin Initiative-UK no mamatsy vola ny tetik'asa izay hiasa anatin'ny toerana roa: faritra Atsinanan'ny Nosy (eo anivon'ny Tandavan'ala Ambositra-Vondrozo) sy ny faritra Avaratr'i Madagasikara.

Ireo VONDRON'OLONA IFOTONY (VOI) voafidy no hahazo tombotsoa anatin'ny tetik'asa. Hanao ny fambolena ireo karazana oviala misy any an-toerana izy ireo, na oviala dia io na oviala efa famboly. Hisy noho izany ny TOERANA HAMPIRANTIANA ny fambolena oviala isaky ny vondron'olona tsirairay. Kendrena hanaraka io teknika famboly io ny tokatran'io liana ary hanaparitaka izany no tanjon'ny tetikasa.

Tanjon'ny tetikasa amin'ny fambolena hatao:

- Hiarovana ny oviala anaty ala amin'ny fitrandrahana mihoampampana,
- Hananana sakafo ampy rehefa tonga ny maintso ahitra
- Hananana materialy hahafana manao fikarobana ara-jenetika amin'ny fotoana mahamety azy,

Endrika fiarovana sy hitehirizana ny oviala (dia, famboly):

Fambolena:

- o Manakaiky tanàna ao anivon'ny VOI;
- o Anatin'ny saha iarahana amin'ireo mpiara-miasa anatin'ny tetik'asa (Antananarivo, Ambanja, Antsiranana);

Endrika fitehirizana hafa: anatin'ny banky fitehirizam-boa (MSBP - Kew sy SNGF - Antananarivo)

Ireo oviala misy :

Madagasikara dia manana oviala maro: andaniny, ireo oviala dia miisa 40 karazana izay fihinana avokoa ary marefo satria efa ho lany taranaka ny sasany amin'izy ireo; ankilany, ireo oviala famboly miisa 3 karazana eo ho eo ka fihinana ny ankamaroany. Miparitaka eran'i Madagasikara ireo oviala ireo ary mazana dia hita anatin'ny faritra arovana indrindra fa ireo oviala dia :

- *Brymeria (mahery vady)*
- *Brymeria (tarany)*
- *Anahana*

Ho fanatrarana ny tanjona iombonana anatin'ity tetikasa ity dia maro ireo asa hatao miaraka amin'ny vondron'olona ifotony isa-tanàna. Ireo VOI ireo no manana andraikitra voalohany amin'ny fikajiana, sy fiarovana ary fampitomboana ny oviala ho sakafo. Noho izany, ny tetik'asa dia vonona hiaraka hiasa amin'ny VOI ka mangataka amin'izy ireo tolo-tanàna mavitrika, sy fanomezan-dalana mba hiasana amin'ireo karazana fanatrarana.

Natao teto..... *Andrianomantso*..... ny *22/07/2016*.....

Solitenan'ny KMCC

[Signature]

RAKOTOARISON Fenoniriana

Solitenan'ny VOI



Razafina Romuald

Saoso

Hosongo

Raisa

Annex 12. Seed collecting during project (from 17 March 2016)

| MSB ser. | Species | Collector | Number | Date | See ds | Lat (dec deg) | Long (dec deg) |
|----------|-----------------------------------|--------------------------|---------|------------|--------|---------------|----------------|
| 1 | <i>D. sp (irodoensis)</i> | Fenoniriana Rakotoarison | FEN 016 | 17/03/2016 | | 12.6517 2 | 49.5273 1 |
| 2 | <i>D. pteropoda (sahafary)</i> | Fenoniriana Rakotoarison | FEN 028 | 18/03/2016 | | 12.5726 4 | 49.4398 9 |
| 3 | <i>D. pteropoda (la carrière)</i> | Fenoniriana Rakotoarison | FEN 034 | 19/03/2016 | | 13.1982 | 49.0816 |

| | | | | | | | |
|----|---|--------------------------|---------|------------|-------|------------|------------|
| | | | | 2016 | | 5 | 9 |
| 4 | D. buckleyana (ambilomago dra) | Fenoniriana Rakotoarison | FEN 033 | 24/04/2016 | 30 0 | 13.0291 4 | 49.1434 7 |
| 5 | D. sansibarensis (amdranomaitra) | Fenoniriana Rakotoarison | FEN 045 | 10/04/2016 | 10 00 | 12.4046 9 | 49.3380 3 |
| 6 | D. maciba (Maevatanana) | Mamy Tiana Rajaonah | MT 517 | 20/04/2016 | 80 0 | 16.5530 9 | 46.5347 2 |
| 7 | D. bemarivensis (Boriziny) | Mamy Tiana Rajaonah | MT 518 | 21/04/2016 | 11 00 | 15.2744 6 | 47.3555 5 |
| 8 | D. maciba (Boriziny) | Mamy Tiana Rajaonah | MT 519 | 21/04/2016 | 80 0 | 15.2736 8 | 47.3608 3 |
| 9 | D. maciba (Boriziny) | Mamy Tiana Rajaonah | MT 520 | 21/04/2016 | 40 0 | 15.2736 8 | 47.3608 3 |
| 10 | D. pteropoda (la carrière) | Mamy Tiana Rajaonah | MT 521 | 22/04/2016 | 50 0 | 13.1144 3 | 49.0438 8 |
| 11 | D. sp (faringdoniana) (la carrière) | Mamy Tiana Rajaonah | MT 524 | 22/04/2016 | 80 0 | 13.1154 | 49.0453 7 |
| 12 | D. orangeana (Ankorikihely) | Mamy Tiana Rajaonah | MT 526 | 23/04/2016 | 70 0 | 12.1439 9 | 49.2113 1 |
| 13 | D. orangeana (Ankorikihely) | Mamy Tiana Rajaonah | MT 527 | 23/04/2016 | 80 0 | 12.1438 7 | 49.2114 4 |
| 14 | D. bemarivensis (Ivovona) | Mamy Tiana Rajaonah | MT 528 | 23/04/2016 | 70 0 | 12.1824 6 | 49.2349 2 |
| 15 | D. orangeana (Ivovona) | Mamy Tiana Rajaonah | MT 529 | 23/04/2016 | 90 0 | 12.1826 | 49.2349 |
| 16 | D. sambiranensis var. bardotiae (Andavakoera) | Mamy Tiana Rajaonah | MT 530 | 23/04/2016 | 35 0 | 12.2039 4 | 49.2134 7 |
| 17 | D. sambiranensis var. bardotiae (Andavakoera) | Mamy Tiana Rajaonah | MT 531 | 23/04/2016 | 60 0 | 12.2034 9 | 49.2135 6 |
| 18 | D. sansibarensis (Mahagaga) | Mamy Tiana Rajaonah | MT 532 | 23/04/2016 | 11 00 | 12.2441 | 49.202 |
| 19 | D. antaly (Ambalanjanakomby) | Mamy Tiana Rajaonah | MT 534 | 23/04/2016 | 90 0 | 16.7053 89 | 47.0756 67 |
| 20 | D. antaly (Ikalamilotra) | Mamy Tiana Rajaonah | MT 535 | 23/04/2016 | 10 00 | 16.4219 4 | 47.0432 4 |
| 21 | D. decaryana (Analabe) | Fetra Randriatsara | FRO 001 | 28/04/2016 | 80 0 | 16.5224 8 | 46.5801 3 |
| 22 | D. sambiranensis | Fenoniriana Rakotoarison | FEN 050 | 11/05/2016 | | 13.5669 44 | 48.7701 39 |
| 22 | D. | Fenoniriana Rakotoarison | FEN | 13/05/ | | 13.6168 | 48.8023 |

| | | | | | | | |
|---|-------------------------|--------------------------|------------|----------------|----------|---------------|---------------|
| 3 | sambiranen sis D. | | 051 | 2016 | | 61 | 61 |
| 2 | sambiranen | Fenoniriana Rakotoarison | FEN 053 | 15/05/ 2016 | | 13.6522 78 | 48.7381 94 |
| 4 | sis D. | | | | | | |
| 2 | sambiranen | Fenoniriana Rakotoarison | FEN 056 | 19/05/ 2016 | | 13.4587 78 | 48.7652 5 |
| 5 | sis D. | | | | | | |
| 2 | sambiranen | Fenoniriana Rakotoarison | FEN 057 | 20/05/ 2016 | | 13.4779 44 | 48.7561 39 |
| 6 | sis | | | | | | |
| 2 | D. antaly | Fenoniriana Rakotoarison | FEN 058 | 20/05/ 2016 | | 13.4787 78 | 48.7579 17 |
| 7 | D. | | | | | | |
| 2 | sambiranen | Fenoniriana Rakotoarison | FEN 059 | 25/05/ 2016 | | 13.8355 83 | 48.4450 56 |
| 8 | sis | | | | | | |
| 2 | D. antaly | Mamy Tiana Rajaonah | MTR 537 | 10/06/ 2016 | 13 00 | 17.9885 3 | 44.6303 3 |
| 9 | | | | | | | |
| 3 | D. sp | Mamy Tiana Rajaonah | MTR 539 | 10/06/ 2016 | 10 00 | 18.0632 2 | 44.5295 8 |
| 0 | | | | | | | |
| 3 | D. bemandry | Mamy Tiana Rajaonah | MTR 540 | 10/06/ 2016 | 12 00 | 18.0632 2 | 44.5295 8 |
| 1 | | | | | | | |
| 3 | D. quartiniana | Mamy Tiana Rajaonah | MTR 541 | 10/06/ 2016 | 10 00 | 18.0632 2 | 44.5295 8 |
| 2 | | | | | | | |
| 3 | D. bemandry | Mamy Tiana Rajaonah | MTR 542 | 11/06/ 2016 | 10 00 | 18.0186 7 | 44.4636 7 |
| 3 | | | | | | | |
| 3 | D. bemandry | Mamy Tiana Rajaonah | MTR 543 | 11/06/ 2016 | 10 00 | 18.0028 3 | 44.462 |
| 4 | | | | | | | |
| 3 | D. sp | Mamy Tiana Rajaonah | MTR 544 | 11/06/ 2016 | 10 00 | 18.0324 4 | 44.4856 4 |
| 5 | | | | | | | |
| 3 | D. bemandry | Mamy Tiana Rajaonah | MTR 548 | 16/06/ 2016 | 10 00 | 19.9905 | 44.6105 |
| 6 | | | | | | | |
| 3 | D. maciba | Mamy Tiana Rajaonah | MTR 551 | 16/06/ 2016 | 10 00 | 19.9907 5 | 44.6101 9 |
| 7 | | | | | | | |
| 3 | D. ovinala | Mamy Tiana Rajaonah | MTR 553 | 16/06/ 2016 | 10 00 | 19.9905 | 44.6105 |
| 8 | | | | | | | |
| 3 | D. fandra | Mamy Tiana Rajaonah | MTR 559 | 17/06/ 2016 | 11 00 | 20.143 | 44.4263 9 |
| 9 | | | | | | | |
| 4 | D. antaly | Mamy Tiana Rajaonah | MTR 561 | 18/06/ 2016 | 12 00 | 20.4079 4 | 44.7766 9 |
| 0 | | | | | | | |
| 4 | D. antaly | Mamy Tiana Rajaonah | MTR 562 | 19/06/ 2016 | 13 00 | 19.7968 31 | 45.5320 6 |
| 1 | | | | | | | |
| 4 | D. buckleyana | Fenoniriana Rakotoarison | FEN 70 | 05/06/ 2016 | 10 00 | 12.3517 5 | 49.3209 7 |
| 2 | | | | | | | |
| 4 | D. sp | Fenoniriana Rakotoarison | FEN 72 | 05/06/ 2016 | 10 00 | 12.3530 6 | 49.3196 1 |
| 3 | | | | | | | |
| 4 | D. buckleyana | Fenoniriana Rakotoarison | FEN 75 | 05/06/ 2016 | 10 00 | 12.3518 9 | 49.3196 7 |
| 4 | | | | | | | |
| 4 | D. sambiranen sis | Fenoniriana Rakotoarison | FEN 76 | 07/06/ 2016 | 10 00 | 12.3946 9 | 49.3444 2 |
| 5 | | | | | | | |
| 4 | D. orangeana | Fenoniriana Rakotoarison | FEN 77 | 07/06/ 2016 | 10 00 | 12.2791 1 | 49.3846 7 |
| 6 | | | | | | | |
| 4 | D. buckleyana | Fenoniriana Rakotoarison | FEN 78 | 07/06/ 2016 | 10 00 | 12.3380 6 | 49.3724 2 |
| 7 | | | | | | | |

| | | | | | | | |
|---|-------------------------|---|--------|------------|-------|----------------|---------------|
| 4 | <i>D. sambiranensis</i> | Fenoniriana Rakotoarison | FEN 79 | 08/06/2016 | 10 00 | 12.3380 6 | 49.3289 2 |
| 4 | <i>D. sp</i> | Fenoniriana Rakotoarison | FEN 80 | 08/06/2016 | 10 00 | 12.3709 4 | 49.3321 7 |
| 5 | <i>D. sp</i> | Fenoniriana Rakotoarison | FEN 81 | 11/06/2016 | 10 00 | 12.4146 4 | 49.3623 1 |
| 5 | <i>D. sambiranensis</i> | Fenoniriana Rakotoarison | FEN 82 | 11/06/2016 | 10 00 | 12.4146 1 | 49.3616 9 |
| 5 | <i>D. sambiranensis</i> | Fenoniriana Rakotoarison | FEN 83 | 12/06/2016 | 10 00 | 12.3463 3 | 49.3586 4 |
| 5 | <i>D. bemarivensis</i> | Onjalalaina, G.E.; Rabehevitra, D.; Rabarijaona, N.R. | FBM 15 | 05/08/2016 | 10 00 | 15.4122 439 | 47.2907 |
| 5 | <i>D. seriflora</i> | VOI Miarinarivo (Razafimamonjy Modeste) | FBM 1 | 15/01/2017 | 10 00 | 22.1448 61 | 47.1273 33 |

Annex 13. Photographs of the PBZT and DBEV collections under construction (Nov. 16) and in growth (March 17), and the nursery at PBZT

a) PBZT; main collection in bed shaped like Madagascarto demonstrate distribution. Pots keep plants under control.





b) DBEV: Offers different conditions and collection duplication.





c) Nursery at PBZT



Checklist for submission

| | Check |
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