



Darwin Initiative: Final Report

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

Darwin Project Information

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
Project leader’s 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, Dr. Mamy Tiana Rajaonah, (MR) and Stuart Cable (SC) with input from Feno Rakotoarison (FR), Sam Cameron (FBNT) and KMCC/FBNT team members.

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 combined with existing biodiversity records and simultaneously captured conservation and biocultural data to help develop a national strategy for the wild yams of Madagascar to complement that already in place for cultivated varieties

The proposed end points of the project included 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 indirectly promote greater forest conservation, through demonstrating the natural capital of sustainably managed populations. In the longer term, it opened 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, including both Antsiranana District in the northern part of the circle and Ambanja District further south) and the Ambositra-Vondrozo Corridor (COFAV; B) in Fianarantsoa Province. C and D are the Menabe and Bongolava regions respectively; see Section 5).



2 Project Partnerships

Kew Madagascar Conservation Centre (KMCC)

The lead organisation (RBG Kew) formed an axis with KMCC that was key to the delivery of this project. KMCC employed the majority of the personnel that manage and undertake activities for the project, in particular Dr Mamy Tiana Rajaonah (MR) who lead the project in Madagascar and was 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 was fully involved in all aspects of project activity. There was at least weekly contact between the Kew team and MR via skype and email for planning and decision making. The infrastructure, finance and management structure of KMCC were 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 set up an Ambanja office as described in the Y1 report, which was staffed by a botanist (FR), a technical officer (Geodain Meva Huckel) 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 maintained regular contact with the Ambanja team by phone, email or skype, and reported on their activities to the RBG, Kew team. To aid communications and facilitate project activities the Ambanja office was equipped with wifi, a backup generator, mobile phone each for FR and GH, 2 motorbikes and a further camera and laptop. We built links to government agencies and NGOs in Antsiranana, especially FOFIFA (The National Centre for Applied Agricultural/Rural Development Research under both the Agriculture Ministry, MINAGRI, and the Ministry of Higher Education and Scientific Research). IT provision in the Antananarivo office was also been upgraded to enhance and improve email and skype communication.

Communications were the main controllable obstacle to project productivity, but we continued to increase mutual understanding and seeking feedback to clarify that communication has been effective during its duration. Both the RBG, Kew and KMCC project teams became increasingly well-adapted to trilingual working, as confirmed through discussion of communication effectiveness during the Pls visit to co-author this report.

The strength of the demand for a wild yams conservation and cultivation project in Madagascar was evidenced by the strong turnout by Malagasy government agency staff (especially MEEF, the Ministry of Environment, Ecology and Forests) and Malagasy NGOs at project workshops from the outset and by the scale of interest from community members in the project and in participating in it. We made progress engaging with FOFIFA on a national basis and have both them and MINAGRI on board with the National Strategy for yams (see below and logframe Output 1 Indicator 3).

Feedback Madagascar - Ny Tanintsika (FBNT)

FBNT was the 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 and PW at Kew. FBNT and KMCC are key partners in the DI Post Project Award (PPA) EIDPO049 Sustainable yam markets for conservation and food security in Madagascar.

Parc Botanique et Zoologique de Tsimbazaza (PBZT)

The principal role of PBZT in the project was national living collection development via a nursery for tuber propagation plus substantial a plot in the PBZT site in central Antananarivo. PBZT also provided help with research authorisation and specimen/seed collection and export to Kew and the MSB. The national living collection at PBZT has 199 individual accessions comprising 25 species, of which 12 are provisionally or actually demonstrated to be threatened.

Silo National des Graines Forestières (SNGF)

The intended role of SNGF in the project was modified to storage and monitoring of *Dioscorea* seed collected by project personnel based at KMCC, as opposed to active collection. We discovered that we could collect all the seed needed to reach project targets through KMCC/FBNT project personnel undertaking plot survey work and via communities. The scale of collecting required did not prove sufficient to justify SNGF making dedicated trips. Thus they undertook seed processing, storage and monitoring of the *Dioscorea* seeds collected by KMCC/FBNT and communities they work with.

Additional in-country partners that became stakeholders in the project and supported its delivery or have employed its methods or plan to do so:

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

The roles in the project of DBEV were national living collection development, exchange of knowledge and National Strategy development. Prof. Vololoniana Jeannoda (VJ) has played a key role in drafting the strategy alongside MR. The national living collection at DBEV comprises 103 individual accessions of 21 species, of which 10 are provisionally or actually demonstrated to be threatened. It duplicates the collection at PBZT for conservation security, but offers a different aspect and cultivation conditions. Propagation employed the nursery at PBZT. The horticultural worker employed on the project manages both collections. DBEV are key partners in the DI PPA EIDPO049 Sustainable yam markets for conservation and food security in Madagascar.

Ministère de l'Environnement, de l'Écologie et des Forêts (MEEF)

MEEF is the main government department linked to the project with whom the National Strategy for wild yams has been developed and will lead on it becoming a decree. The principal interaction mode has been via project workshops such as that on June 12 2018. We also collaborated with MEEF at a regional scale via its subsidiary

Direction Regionale des Eaux et Forêts (DREF) who helped with research authorisation. DREF regional personnel were directly engaged in the project and participated in the workshops.

FOFIFA

We worked to bring FOFIFA on board with National Strategy development with their sponsor MINAGRI. Joint implementation of germplasm collections in Ambanja (N) and Kianjavato (COFAV) unfortunately proved impossible during the main project.

Tao Tsara

This NGO works in the Mikea area of SW Madagascar and adopted the project's methodology for yam cultivation (wild species and *D. alata*) and population surveying. Representatives participated in the later project workshops and thus was 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 (VU). The transfer of our methods to a new biome (dry deciduous forest) and region helped to give the project a national profile and applicability

Missouri Botanical Garden (MBG).

We collaborated 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 living collection (see Activity 5.4) contains all described northern wild species plus *D. alata* through interaction with the project.

Service d'Appui à la Gestion de l'Environnement (SAGE).

NGO in Antsiranana with whom we worked with communities around 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 Achievements

3.1 Outputs

Output 1: A National Strategy for wild yam species conservation

The baseline for this output was a National Strategy for cultivated yams in Madagascar (principally *D. alata*) which did not include the wild yams that are frequently favoured as starch sources in the northern and western parts of the country (links to all sources of evidence including Annexes 7A-J are provided in the logframe below). We have succeeded in developing a final draft strategy that was presented and validated by NGOs and other partners in the project and the Ministries of Environment and Agriculture during the final workshop (12 June) 2018. It will be signed as soon as possible by the Ministries that will lead delivery of the strategy; senior civil servants were not at the workshop due to a change of government on 11 June. The clear roadmap towards this and its subsequent declaration as a Decree by the Government are listed in the logframe under Indicator 3: National Strategy for wild yams completed and presented to relevant authorities and NGOs by end of year 3. We have generated IUCN assessments for most species and both reviewed existing biodiversity information and generated it *de novo* as suggested by the other indicators. The principal problems were bureaucratic delay and political changes within the country, such as the absence of senior civil servants at the June 12 2018 workshop due to a change of government on 11 June. . A significant strength of the strategy is that it was co-authored by the project manager in Madagascar (MTR) and an external expert, Prof. Vololoniaina Jeannoda (VJ). The breadth of her knowledge from yam diversity to conservation (she chairs the Madagascar Plant Specialist Group of IUCN) and Malagasy policy, law and government made her uniquely qualified to deliver an effective strategy in collaboration with the project. Conservation assessments were not completed for all species due to IUCN's working practices around assigning working sets of species. We intend to learn from the fact that the cultivated yam strategy has become a historical document gathering dust on shelves by engaging further with MEEF, MINAGRI and FOFIFA in the PPA and monitoring activity and uptake of the incipient wild yam National Strategy via the committee for its implementation (see logframe indicator 3).

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

The baseline for output 2 was a scattered information landscape, with much of it out of date (e.g. the Flore de Madagascar treatment dating from 1950. As reported in the logframe under the output indicators, we have sought to make maximum use of multiple communication channels, from TV to T-shirts. 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 concentrate media communication activity in

Madagascar on radio. We also maximised use of the website as indicated in the logframe under Indicator 1. One scientific article was published, with four other manuscripts in relatively advanced development based on discoveries of further edible new species during the project and an unforeseen rate. Thus we have broadly achieved the successes envisaged under Output 2.

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

We met our objective of working with 60 communities late in Y1 of the project and were very close to the targeted number of households (see logframe). Baseline figures for all indicators were of course zero. We also substantially increased mean income across the project, despite a negative result in one project area where poor rainfall in the early 2016-17 rainy season impacted that year's harvest (see logframe Output 3 Indicator 2) Mean figures for livelihoods indicators are provided below. The numbers of HHs participating in the socioeconomic survey were 297 in Ambanja District, 220 in Antsiranana District in Y1 and Y3 with, 321 in Y1 and 189 in Y3 in the COFAV.

	Mean annual calorific intake (Kcal/person)			Mean annual protein intake (g/person)			Mean HH annual income (Ariary)		
	Y1	Y3	% change	Y1	Y3	% change	Y1	Y3	% change
Ambanja	432,000	553,000	+28	7,994	9,900	+24	580,000	693,000	+20
Antsiranana	400,000	311,000	-22	8,023	6,700	-16	354,000	208,000	-41
COFAV	656,000	623,000	-5	11,600	17,820	+54	459,000	712,000	+55

In the socioeconomic survey respondents were asked to report on their annual intake of all classes of food (e.g. yams, rice, zebu, chicken....) for the HH. Mean calorific and protein values for each class of food obtained from the published literature were then used to estimate intake under each class (e.g. United Nations. 1975. Poverty, unemployment and development policy: a case study of selected issues with references to Kerala. New York, United Nations. 235 p; Payne, P.R. 1969. Effect of quantity and quality of protein on the protein values of diets, Voeding, (30): 182-191; <http://www.fao.org/rice2004/fr/f-sheet/fiche3.pdf>; <http://www.fao.org/docrep/t0567f/T0567F0n.gif>; <http://www.fao.org/quinoa-2013/what-is-quinoa/nutritional-value/fr/>). These figures were then combined to estimate total household intake per annum, from which Y1 and Y3 means could be derived and their % change. In a similar manner respondents to the survey were asked to list all income sources available to them from sale of goods or products (virtually all agricultural or wild-harvested natural assets) and the market value of each. This allowed total household annual income to be calculated in Y1 and Y3, and thus mean values and their % change.

Training of community technicians was a particular success of the project, with 3,209 people trained (COFAV 1,053 of which male 58.5%, female 41.5%; Antsiranana Province (Ambanja & Antsiranana Districts) 2,156 people, male 47%, female 53%) in yam propagation, cultivation, harvesting and wild population surveying. This helped to deliver production figures as provided below.

Production (kg)	COFAV: Wild spp.	COFAV: <i>D. alata</i>	Antsiranana: Wild spp	Antsiranana: <i>D. alata</i>
Y1 (2016)	57	23,598	35	6,878
Y2 (2017)	0*	114,936	4,127	41,859
Y3 (2018)	259	123,020	6,702	77,064

Training also underpinned the conservation achieved under output 4. The principal issues with cultivation were convincing people that it was possible to cultivate wild yams. This was overcome by training expertise and providing access to demonstration plots in nearby communities. It was also surmounted to the extent that some HH now have over 1000 individual plants of "wild" *D. sambiranensis* in cultivation. The socioeconomic survey work was problematic principally due to the scale of the survey and analysis necessary and in the COFAV changes in community attitudes to the project. This was overcome by the hard work and flexibility of the in-country teams.

Output 4: Conservation management of the 20 most threatened species

60 agreements have been signed with communities regarding conservation of multiple wild species per community. Wild yam management plans have been discussed with and accepted by the 30 communities in COFAV: 4 are already signed, available and in use, 24 remain in draft. Three populations of each locally available wild yam species have been monitored by each of 29 communities in the North and for COFAV in 4 areas across the 30 communities there. The latter has been integrated into conservation management plans in the COFAV. See logframe. Community cultivation (see Output 5) has been the easier approach to deliver conservation for yams in Madagascar with locally clearer and more profitable results and hence greater uptake by communities. Based on numbers of individual adult plants and extraction holes in exemplar monitored forests in Antsiranana Province, the rate of extraction has not increased across 6 species (one with two subspecies). Increases in adult plant numbers were recorded in 2018 over 2016 and 2017. Thus overall Output 4 has been realised. Baseline agreements, plans and data were of course zero.

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

The project has had strong conservation outcomes in all three indicators listed in the logframe. Baselines were minimal conservation in all cases, with existing germplasm collections virtually non-existent. All seed collections listed are additional to baseline. Baseline germination testing was 14 accessions. The successes against indicators include over half of the species of yams of Madagascar being conserved as seed, with all the five main edible wild species that are of commercial importance represented by multiple accessions, and *D. sambiranensis* by 40. A general seed germination protocol that works for native species has been developed. We also have extensive living germplasm collections in place that cover all the species in areas where we have worked under DI and matched funding. They are duplicated to avoid loss. An effective propagation method has been developed via activity 3.2 and 3.3. To fill the remaining gaps in living collections would require country-wide working, which was not planned or possible under this project.

3.2 Outcome

The intended outcome was enhancement of livelihoods and food security via wild and domesticated yam cultivation, sustainable harvesting and conservation coupled with information generation and mobilisation. The indicators provided in the logframe show broad success in achieving the outcome. Seed conservation has delivered 23 species, including all the threatened wild species of Antsiranana Province and the COFAV, and with 10-40 accessions of the main economically important wild species of northern Madagascar. Living germplasm collections, principally in Antananarivo, were similarly successful, containing 12 threatened species. Information has been enhanced by the project website, e-communications, open access publication and National Strategy. We have worked with 60 communities and just under 3000 communities. Those communities showed HH calorific intake increased by 28% in Ambanja District from Y1 to Y3, while reducing by 22% in Antsiranana District and 5% in the COFAV. Thus overall calorific intake across the project has been flat, albeit that it increased substantially where rainfall is higher and more reliable (see logframe). In contrast to calories, protein intake increased by 24% in Ambanja District and 54% in the COFAV, with a decrease of 16% in Antsiranana District stemming from poor early season rains in 2016-17. Hence protein intake has increased across the project as a whole by ca 60%. Populations were monitored in Antsiranana Province, showing no increase in rate of extraction; agreements about cultivation of local species are in place in all 60 communities and *in situ* management plans have been put in place in some. We believe that this indicator was not feasible for achievement in 3 years given the requirement for multiple multi-stakeholder consultations (see logframe). Unfortunately this only became fully apparent in Y3, but we have maintained dialogue on sustainable management with all communities throughout the project.

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

Project communities have benefitted in terms of livelihoods and food security as indicated by the livelihoods indicators (with favourable cultivation conditions); see Output 3 above and logframe for evidence. Protein intake and income increases in the COFAV and across the board food security and income indicator improvements in Ambanja District were particularly notable. Species conservation has been enhanced for endemic wild yams (Output 5). Understanding of the value of wild yams and their provisioning ecosystem service has been enhanced from communities (Output 2) to national level by National Strategy (Output 1) development. This has, we believe, increased awareness of forest and biodiversity conservation in project communities and beyond. Candidate wild species to provide a climate-resilient novel crop from Madagascar's national genetic resources have been identified, in particular *D. sambiranensis*.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Contribution to 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 has been 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 have helped 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 and livelihoods indicator improvements provided in the logframe, with wild yams under cultivation such as *D. sambiranensis* which are contributing to SDG2 and to the more sustainable use of community-adjacent forests in terms of yam exploitation. Yam cultivation appears to be already positively impacting natural vegetation through preventing increase of the rate of extraction (logframe Activity 4.4). Community and national germplasm collections combined with the seeds banked we have made are already helping to halt biodiversity loss given that we have multiple threatened taxa in the two types of collection. The HH income figures in the logframe indicate a contribution to SDG 1: End poverty. Work underpinned by the main project in the PPA will also help in achieving SDG 3: Ensure healthy lives.

4.2 Project support to the Conventions or Treaties (CBD, CITES, Nagoya Protocol, ITPGRFA)

The project has helped Madagascar to meet its obligations under articles 5, 6, 7, 9 and 16 of the ITPGRFA, especially 6.2e “promoting... the expanded use of local and locally adapted crops, varieties and underutilized species”. Yams fall precisely into this area. We have encouraged and incentivised their use (via free seed tubers of *D. alata*) and conservation to farmers. The National Strategy for wild (and cultivated) yams will help to bring government policy in line with the ITPGRFA treaty as regards yams. We also believe that one or more wild species (especially *D. sambiranensis*) will show potential as novel local and locally adapted crops and plan a future project with FOFIFA undertaking field trials of the principal 5 species.

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) have been most relevant to this project.

4.3 Project support to poverty alleviation

In the project communities HH calorific intake increased by 28% in Ambanja District from Y1 to Y3, while reducing by 22% in Antsiranana District and 5% in the COFAV. Thus overall calorific intake across the project has been flat, albeit that it increased substantially where rainfall is higher and more reliable; we believe that poor rainfall in the early 2016-17 rainy season (November 2016-January 2017) reduced yields of yams and other crops for the 2017 harvest that underpinned Y3 livelihood indicators. In contrast to calories, protein intake increased by 24% in Ambanja District and 54% in the COFAV, with a decrease of 16% in Antsiranana District stemming from poor early season rains in 2016-17. Hence mean protein intake has increased across the project as a whole by ca 60%. HH income has increased by 20% in Ambanja District and 55% in the COFAV (see Outcome Indicator 4). There was a decrease of 41% in Antsiranana District which we believe is a product of rainfall deficits especially in Y1 and Y2. Overall project income increase was therefore ca 25%. We were not able to capture finer resolution socioeconomic data to investigate the impact on less resilient elements of communities.

4.4 Gender equality

Yam cultivation has 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 the benefits that accrue from it via the 3,209 people trained in yam propagation, cultivation, harvesting and wild population surveying, with over 50% female in Antsiranana Province (2156 people, male 47%, female 53%). In the COFAV 1,053 people were trained, male 58.5%, female 41.5%. We note that the % of females trained rose to 47.3% by Y3, versus 43.3% in Y2 and 37.5% in Y1. The project team have sought to encourage women to be more involved in yam cultivation via working to engage female-lead HHs within communities to take up yam cultivation as a source of nutrition and income. We do not have figures, but we are aware that a small but significant number of HH in both COFAV and Antsiranana Province communities are female lead. The project team in Antananarivo and Ambanja reported strong and growing interest in the project among women in the COBAs of northern of Madagascar during visits and workshops.

4.5 Programme indicators

- **Did the project lead to greater representation of local poor people in management structures of biodiversity?**

The development of wild yam management plans gave community members direct access to local DREF staff as regards yam conservation in forests used by those communities. Madagascar fully embraced the Durban Accord and management of protected areas is a collaboration between NGOs, such as FBNT and KMCC, and local communities. We have worked with community management associations at COFAV and in Antsiranana Province, so the farmers growing yams through the project are directly engaged in the management of biodiversity. With communities not associated with protected areas, we have promoted a clear link between sustainable management of yams and conservation of biodiversity. Yams are a significant NTFP and help to reinforce the need to conserve forest. Under the PPA we will set up community business platforms that will help to enhance representation of cultivators of both wild and domesticated yams.

- **Were any management plans for biodiversity developed?**

As described in the logframe, we developed the National Strategy for wild yams, community management plans and agreements between the project and communities regarding conservation of multiple wild species per community.

- **Were these formally accepted?**

The National Strategy has been agreed and is on track to become law through government decree. 60 species conservation agreements were signed with communities. Community management plans have been signed in part but require multiple meetings between community members and DREF officials which is complex to facilitate.

- **Were they participatory in nature or were they ‘top-down’? How well represented are the local poor including women, in any proposed management structures?**

All three were participatory in nature. The National Strategy was extensively workshopped and communities were consulted and involved in some workshops. Agreements with communities were secured through dialogue. The project team have sought to encourage women to be more involved in yam cultivation via working to engage female-lead HHs within communities to take up yam cultivation as a source of nutrition and income, although challenging traditional roles in COBAs was beyond the scope of the project.

- **Were there any positive gains in household (HH) income as a result of this project?**

Yes, see below.

- **How many HHs saw an increase in their HH income?**

An estimated 2,118 or 72% of HH across the project increased their income from Y1 to Y3 based on the sampled households (see Output 3.3 above) that undertook the socioeconomic survey.

- **How much did their HH income increase (e.g. x% above baseline, x% above national average)? How was this measured?**

HH income indicators changed as follows, with Y1 being the baseline. For methods of measurement see Output 3 above

	Mean HH annual income (Ariary)		
	Y1	Y3	% change
Ambanja	580,000	693,000	+20
Antsiranana	354,000	208,000	-41
COFAV	459,000	712,000	+55

Mean annual income per HH across the project as a whole therefore increased from a baseline of 464, 300 Ar (\pm £110) to 537, 600 Ar (\pm £135).

4.6 Transfer of knowledge

The primary vehicle for knowledge transfer to policy makers has been the National Strategy; it is a complete review of the state of knowledge on the yams of Madagascar (including project-derived information) is extensively described elsewhere in this report. This document could also be used by practitioners, although the yam cultivation manuals were more appropriate products for them. Two MSc from the University of Antananarivo were obtained on the natural product chemistry of wild and cultivated yams and its role in nutrition. Both graduates were Malagasy, and one was female.

4.7 Capacity building

Dr Mamy Tiana Rajaonah (σ) is now a member of the Madagascar Specialist Group of IUCN. Other project staff have gained experience on management and community-based and biodiversity research that will enable them to succeed in obtaining subsequent roles elsewhere.

5 Sustainability and Legacy

As described elsewhere in this report, the National Strategy will endure through becoming government legislation and thus guide national policy. We also seek to keep it as vibrant and dynamic document via an implementation committee to monitor its use and addition of annexes via DI PPA activities and outputs, especially in the area of nutrition. For conservation outputs security of sustainability is of course variable (hence the decision to use multiple conservation modes). Seed banking in the UK and Madagascar is the most secure. Cultivation is less certain to have long term legacy, although we hope that MINAGRI/MEEF will pick up the germplasm collections following the PPA. The PPA itself aims to provide a sound economic basis for sustainability of cultivation of wild and cultivated yams for project communities and beyond. That will support longer term income and nutritional benefit and reduction in (e.g.) calorific, protein and carotenoid shortages in the Malagasy diet. Additional funding from the April Trust as described in the budget and Annex 3 both extends the project and its methods to additional areas of Madagascar and until 2020 in those areas. It is already succeeding in conserving additional species (e.g. *D. bako*, EN, *D. maciba*, the principal edible species found on markets in much of western Madagascar) via community plots and seed banking and in capturing baseline socioeconomic data. Main project staff in Ambanja and Antananarivo will be retained under PPA funding.

6 Lessons learned

In this project we applied lessons learnt from previous projects, including the key role of the logframe as a managerial tool. We benefitted from a having a dedicated local KMCC manager and support team that included an accountant. During the project the KMCC office in Antananarivo had its IT systems upgraded to enable weekly skype meetings. Over its duration we have seen greater confidence and project ownership by the KMCC-based project manager in dealing with other partners. We held 3-monthly meetings in Madagascar with principal partners, 4 workshops over the project lifetime, and used a reporting tool derived from the logframe to record progress against outputs. Yams proved culturally appropriate and the supply of seed tubers of cultivated yams stimulated buy-in by de-risking the change for farmers, as did the significant growth in production. An exchange trip between different project regions was a major success in terms of learning by farmers, and the harvest festivals promoted the project very effectively. On the negative side office setup and equipment supply to Ambanja was not rapid enough to enable early startup, and it was difficult at times to connect the annual cultivation cycle with the DI UK financial year, especially at the start and end of the project. The final harvest fell beyond the end of the reporting period necessitating an extension, and the Y1 harvest was poor due to late planting, especially for wild yams. The infrastructure of Madagascar made transport of people and equipment hard even in a Land Rover. We also underestimated the scale and complexity of socioeconomic survey work at the outset. The principal lessons would be to make sure that planting could take place on time in Y1, and to make even greater use of video, radio and the internet for project communications. In a longer term and larger project we would have wanted to do more work on agroecology and especially maintaining soil fertility and microbiome diversity maintenance. In the PPA we will be able to make initial steps towards added value and marketing of yams to help fund conservation, but we still seek to de-risk innovation at each step.

6.1 Monitoring and evaluation

The logframe remained unaltered through the lifetime of the project. It was the principal management tool used to assess project progress towards goals with colleagues from FBNT and KMCC, and thus a vital element in internal M & E via weekly skype meetings with MTR and quarterly meetings with other principal collaborators.

External M & E from a country-specific source was effected principally by collaboration with VJ on the National Strategy. This provided her the opportunity to assess and review the project's outputs and methods. All were integral and important parts of the resulting strategy. VJ and other project stakeholders were also able to assess the project and its progress via Workshop presentations ranging from experts and NGOs to farmers; methods, approaches and findings were questioned and critiqued with a view to modification or improvement.

6.2 Actions taken in response to annual report reviews

AR1R: We have attempted in subsequent reports to be clearer in this report about baselines, in-year progress in the Y2 report and final report where appropriate, and progress against indicators

AR2R. 1) Evaluation of training using visual approaches. We do not have the expertise within the UK or in country teams of the project to undertake this. We believe that the increased production of wild and cultivated yams is evidence of the effectiveness of training by those teams in the COFAV and Antsiranana Province. 2) End of project evidence. We have striven to provide robust evidence in this final report as far as is possible. 3) Output 1 Indicators 1 and 2 slightly behind. We have completed ecological profiles via information on Zavamaniry Gasy and the release of SDMs via the project website. IUCN assessments have been published during the project as far as IUCN's processes permit. We still intend to deliver published assessments of the species in the other working set and for new species as they are published. *D. irodensis* is now in review, for example. 4) Check outcome level baselines. Baselines have been indicated for all outcome level indicators in the final report logframe. 5) Manual not further developed. We have continued to use the basic manual used to train communities. At national scale, the National Strategy is rich in information. At community scale, the continued discovery of new edible species (6 are currently being described) and continued learning with farmers in each cultivation period during the project has meant that information acquisition for a more developed manual is incomplete.

The Y1 and Y2 reviews were sent immediately via email to partners in Madagascar and the feedback discussed in the subsequent skype call or 3 monthly meeting, leading to refocussing of project activity on the areas of concern raised.

7 Darwin identity

The funding of the project by DI was integral to its public presentation through its lifetime. It was presented in a range of fora including Geneva 6GBGC, a UCL Departmental awayday, the Linnean Society's *Courtyard Lates*, the Kew Science Festival, the acknowledgements of the scientific publication, yam harvest festivals in Madagascar and even directly to the President of Madagascar, when he and some of his ministers and the then DEFRA Minister Therese Coffey visited Kew in September 2017 (<https://www.kew.org/blogs/kew-science/madagascar%E2%80%99s-wildlife-%E2%80%93-a-president%E2%80%99s-vision>). The project 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 all workshop and in discussions with Malagasy partners and government ministries.. The DI was acknowledged in all radio broadcasts and in https://www.youtube.com/watch?v=_oPI_mHDq0w. The Darwin Initiative was orally presented as the funding body wherever possible. The project T-shirts (see logframe) have the DI logo on its sleeve. Fullest understanding of the DI will be among academic, government and NGO collaborators but all participating communities will have a level of comprehension about the backing and funding of the project by DI. Our blogs and tweets have frequently been retweeted by DI and have high numbers of views/impressions.

8 Finance and administration

8.1 Project expenditure

Project spend (indicative) since last annual report	2017/18 Grant (£)	2017/18 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)			-6	Tim Harris left RBG, Kew and was not replaced on project
Consultancy costs				
Overhead Costs			-57	KMCC overhead costs not charged; Tim Harris as above

Travel and subsistence			333	Underestimated in original budget; high inflation
Operating Costs			117	Underestimated in original budget; high inflation
Capital items (see below)				
Others (see below)			4	Underestimated in budget; fuel price increases
TOTAL				

Staff employed (Name and position)	Cost (£)
Paul Wilkin	
Stuart Cable	
Partner - KMCC	
Partner – Feedback Madagascar	
TOTAL	

Capital items – description	Capital items – cost (£)
TOTAL	0

Other items – description	Other items – cost (£)
Vehicle costs (repairs, fuel etc.)	
TOTAL	

8.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
April Trust 2017-18	
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
April Trust 2018-20 (subject to annual review; grant made July 2018)	
Darwin Initiative Post Project Award	
TOTAL	

8.3 Value for Money

Mean annual income per HH across the project increased from a baseline of 464,300 Ar (\pm £110) to 537,600 Ar (\pm £135). Thus over 2941 HH and the three years of the project we estimate that income was increases for ca 20,000

people by 215,575 300 Ar or ca £54,000. Virtually all would be earning less than \$2/day, the widely accepted international definition of poverty. Food security was improved for the majority of project communities, reducing outlays on food. In addition to the additional income and nutritional benefit the project conserved highly important natural assets for the benefit of Madagascar and humankind. Their value is harder to quantify, but crop wild relative taxa such as Malagasy wild yams were globally valued at \$42 Bn in 2013, with a projected future value of \$120 Bn (<https://www.cwrdiversity.org/how-much-are-cwr-worth/>). Thus the project represents good value for money on both short and long term timescales.

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Note: Insert your full logframe. If your logframe was changed since your Stage 2 application and was approved by a Change Request the newest approved version should be inserted here, otherwise insert the Stage 2 logframe.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Food security, livelihoods, forest protection, biodiversity conservation and resilience of communities to climate change is improved in Madagascar			
<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 	<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. 	<ol style="list-style-type: none"> 1. Within the time-frame of the project, weather and/or climate does not have adverse effects 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.

	harvesting impacts (through counting extraction holes) by end of year 1, creating a baseline for future community monitoring.	5. Project website and peer-reviewed scientific publications.	
Outputs: 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.	1a. IUCN Red List Assessments published for all species by end of year 2. 1b. Ecological profiles published for all species by end of year 2. 1c. National strategy for wild yams completed and presented to relevant authorities and NGOs by end of year 3.	1a. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website/Journal papers 1b. 3-monthly project reports/Journal papers 1c. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website	All 40 native species can be located and have some viable populations which can be conserved.
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 ethnobotany.	2a. Website online by end of year 1 and updated with ecological profiles, conservation strategy and project materials as they become available. 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. 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> .	2a. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website 2b. 3-monthly project reports/Blog posts, videos and photographs, links to media activity available through the project website 2c. 3-monthly project reports/Journal papers	Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value). Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value).
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).	3a. At least 50 HHs in 60 communities engaged in yam cultivation by end of year 3. 3b. 10% increase in HH incomes, with surplus tubers also available for cultivation by additional HHs or adjacent communities by year 3. 3c. Community technicians trained in year 1 and provided with a basic yam	3a. Agreements with collaborating NGOs and communities/3-monthly project reports 3b. Agreements with collaborating NGOs and communities/3-monthly project reports	Within the time-frame of the project, weather and/or climate does not have adverse effects on yam cultivation and/or wild populations. Most communities will prefer cultivation of yams to harvesting wild yams (that convenience and productivity will be valued over the taste and cultural value).

	cultivation manual. Updated and improved manual available by end of year 3.	3c. Agreements with collaborating NGOs and communities/3-monthly project reports	There are wild species in each region that can be cultivated successfully or harvested sustainably or that will respond to ennoblement. Pests do not have significant adverse effects 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 effects 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 effects 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 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
<p>Impact:</p> <p>Food security, livelihoods, forest protection, biodiversity conservation and resilience of communities to climate change is improved in Madagascar</p>		<p>Project communities have benefitted in terms of livelihoods and food security as indicated by the livelihoods indicators (with favourable cultivation conditions); see Output 3 below. Species conservation has been enhanced for endemic <i>Dioscorea</i> (Output 5). Understanding of the value of wild yams and their provisioning ecosystem service has been enhanced from communities (Output 2) to national level by the incipient national strategy (Output 1). Candidate wild species to provide a climate-resilient novel crop from Madagascar's national genetic resources have been identified, in particular <i>D. sambiranensis</i>.</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</p>	<p>We have made 177 seed collections covering 23 species during the project in addition to the 35 accessions covering 13 species at the MSB/SNGF at project start; five species have more than 10 accessions (<i>D. sambiranensis</i> 40, of which 21 were <i>D. sambiranensis</i> subsp. <i>bardotiae</i> and 10 <i>D. sambiranensis</i> subsp. <i>sambiranensis</i>; <i>D. buckleyana</i> 29; <i>D. maciba</i> 24; <i>D. orangeana</i> 20; <i>D. 10</i>; <i>D. seriflora</i> 10). Two collections represent additional new (undescribed) species. They are available through the MSB and SNGF, with some collections at different stages within the accessioning process. An inventory of collections of <i>Dioscorea</i> seeds from Madagascar via the project is available via Brahm's online http://brahmsonline.kew.org/msbp/Account/Login?returnUrl=%2Fmsbp%2FExplore.</p> <p>We have living plant material of 12 threatened (both published on IUCNredlist.org and preliminary assessments) species in cultivation in 2 germplasm collections in Antananarivo and in communities. 25 species are in ex-situ conservation, in the living collections (community plots, regional plots, UA and PBZT) and 12 threatened yam species are included in these collections. <i>D. sambiranensis</i> appears the best preadapted to cultivation among wild species. See Annex 7A. Baseline was unsystematically collected, minimal material under cultivation with poor accession information by small independent projects.</p> <p>Species content available on project website www.teamkmcc.org/yams for five principal edible species that are sold in specific seasons on markets (as opposed to being consumed locally). Zavamaniry Gasy (ZG) (https://www.inaturalist.org/projects/zavamaniry-gasy-plants-of-madagascar) has 344 records of wild yam containing images and locations with phenology, habitat and growth form information for 24 species. The National Strategy is also information-rich. Baseline was minimal and scattered content.</p> <p>We have worked with 60 communities and 2,941 Households through the project, 1,500 in the COFAV and 1,441 in Antsiranana Province. In the latter (see table below and Annex 7B), HH calorific intake increased by 28% in Ambanja District from Y1 (baseline) to Y3, while reducing by 22% in Antsiranana District and 5% in the COFAV.</p>

	<p>yam cultivation via average 10% increase in nutritional intake</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</p>	<p>Thus overall calorific intake across the project has been flat, albeit that it increased substantially where rainfall is higher and more reliable; we believe that poor rainfall in the early 2016-17 rainy season (November 2016-January 2017) reduced yields of yams and other crops for the 2017 harvest that underpinned Y3 livelihood indicators (see most recent blog; https://teamkmcc.wordpress.com/2018/08/01/reduced-yam-production-in-northern-madagascar-in-2016-17/#more-1718). In contrast to calories, protein intake increased from the baseline in Y1 by 24% in Ambanja District and 54% in the COFAV, with a decrease of 16% in Antsiranana District stemming from poor early season rains in 2016-17. Hence mean protein intake has increased across the project as a whole by ca 60%.</p> <table border="1" data-bbox="887 459 2116 869"> <thead> <tr> <th rowspan="2"></th> <th colspan="3">Mean annual calorific intake (Kcal/person)</th> <th colspan="3">Mean annual protein intake (g/person)</th> <th colspan="3">Mean HH annual income (Ariary)</th> </tr> <tr> <th>Y1</th> <th>Y3</th> <th>% change</th> <th>Y1</th> <th>Y3</th> <th>% change</th> <th>Y1</th> <th>Y3</th> <th>% change</th> </tr> </thead> <tbody> <tr> <td>Ambanja</td> <td>432,000</td> <td>553,000</td> <td>+28</td> <td>7,994</td> <td>9,900</td> <td>+24</td> <td>580,000</td> <td>693,000</td> <td>+20</td> </tr> <tr> <td>Antsiranana</td> <td>400,000</td> <td>311,000</td> <td>-22</td> <td>8,023</td> <td>6,700</td> <td>-16</td> <td>354,000</td> <td>208,000</td> <td>-41</td> </tr> <tr> <td>COFAV</td> <td>656,000</td> <td>623,000</td> <td>-5</td> <td>11,600</td> <td>17,820</td> <td>+54</td> <td>459,000</td> <td>712,000</td> <td>+55</td> </tr> </tbody> </table> <p>60 agreements between the project and communities have been signed with communities regarding conservation of multiple wild species per community. Wild yam management plans have been discussed with community members during training and accepted by the 30 communities in COFAV: 4 are already signed, available and in use, 24 remain in draft because multiple meetings involving DREF officers and the community are required to finalise them. See Annex 7C.</p> <p>Three populations of each locally available wild yam species have been monitored by 29 communities in Antsiranana Province and the COFAV in 4 areas across the 30 communities. Based on numbers of individual adult plants and extraction holes in monitored forests, the rate of extraction has not increased; across 6 species (one with two subspecies) increases in adult plant numbers were recorded in 2018 over 2016 and 2017. See Annex 7D.</p>		Mean annual calorific intake (Kcal/person)			Mean annual protein intake (g/person)			Mean HH annual income (Ariary)			Y1	Y3	% change	Y1	Y3	% change	Y1	Y3	% change	Ambanja	432,000	553,000	+28	7,994	9,900	+24	580,000	693,000	+20	Antsiranana	400,000	311,000	-22	8,023	6,700	-16	354,000	208,000	-41	COFAV	656,000	623,000	-5	11,600	17,820	+54	459,000	712,000	+55
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	year 1, creating a baseline for future community monitoring	
Output 1. A national strategy for wild yam species conservation	<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>29 IUCN red list assessments of wild yams species have published on http://www.iucnredlist.org/, one with two subspecies. The remaining described species are in a working set to which we have only had access in 2018. New species are being assessed as they are described; an assessment for <i>D. irodensis</i> is currently under review.</p> <p>Maps showing species distribution models (SDMs) of 38 currently published species (introduced or cultivated species and those with very limited spatial data excluded due to methodological issues) on project website www.teamkmcc.org/yams. See also ZG for basic ecological data on 24 species.</p> <p>The final draft of the National Strategy was presented and validated by NGOs and other partners in the project and the Ministries of Environment and Agriculture during the workshop on 12 June 2018 (see Annex 7E). It will be signed as soon as possible by the Ministries that will lead delivery of the strategy; senior civil servants were not at the workshop due to a change of government in 11 June. Subsequent steps are as follows: 1) KMCC meet with the DSAP (Protected Area Director in MEEF) and a letter is generated that attests that the National Strategy is already validated technically and in the signature process; 2) committee for the implementation of the National Strategy formed 3) The document will be presented and checked by the DSAP, with minutes of the National Strategy validation workshop (June 12 2018), a preface to the document and the list of the participants; 4) Government Decree of the National Strategy.</p> <p>A parallel process of steps 1-3 is also taking place via MINAGRI leading to the Government Decree.</p>
Activity 1.1 Baseline surveys of populations of priority species, including: area, individuals/density, forest size and conservation status		Surveys were undertaken in each year (Y1, Y2, Y3) for 16 sites in Antsiranana with three locations per site and in the COFAV four communities undertook population surveys, again with three locations per community. See Outcome Indicator 6 above. Project staff undertook 214 days in the field in Y3, following 145 in Y1 and 248 in Y2, undertaking survey and inventory activities, identifying sites for seed collection and collecting seeds. A similar level of field activity has been achieved by community agents and technicians.
Activity 1.2. Inventory of new areas to enhance distribution data		Inventory work in 3 new areas in 2017-18 (Beanka, Analalava, Sahafary). We have generated 382 new wild yam location records, of which 344 are on Zavamaniry Gasy https://www.inaturalist.org/projects/zavamaniry-gasy-plants-of-madagascar . We have also undertaken inventory work in Bongolava and Menabe under matched funding from the April Trust (see budget above and standard measure #23).
Activity 1.3 IUCN Red List assessments and ecological profiling		29 IUCN red list assessments of wild yams species have published on http://www.iucnredlist.org/ , one with two subspecies. SDMs on project website and ZG basic ecological information as per output 1 indicator 2.

<p>Activity 1.4 Workshops with stakeholders to develop a National Strategy and conservation action plans for priority species</p>	<p>Workshops in Y2 and 3 (supported by other meetings) were organized to draft the National Strategy. The final draft was presented on 12th June 2018 and validated by stakeholders and Ministries. 36 participants attended the workshop intended to deliver strategy validation with Government (7 individuals from MEEF/DREEF) and 7 NGO stakeholders from 5 organisations, plus 4 participants from MBG, including MBG in Antsiranana (see Annex 7F). The document will be signed by MINAGRI, FOFIFA and MEEF in the near future as soon as KMCC has implemented a steering group to deliver the National Strategy; see Output 1 Indicator 3. The general election in November/December may delay the process.</p>
<p>Output 2. Improved knowledge and awareness of the importance of yams</p>	<p>Indicator 1: Website online by end of year 1 and updated with ecological profiles, conservation strategy and project materials as they become available</p> <p>Indicator 2: Communication strategy with regular national and regional newspaper articles, radio interviews, Twitter, the KMCC blogs and Annual regional yam festivals</p> <p>Indicator 3: 3 scientific papers submitted/published in peer-reviewed open access journals, with at least one of these Madagascar Conservation and Development or Malagasy Nature</p> <p>See project website www.teamkmcc.org/yams and reported relevant content above.</p> <p>303 Radio broadcasts (including repeats) (see Annex 13) were made in Antsiranana Province and 1 TV broadcast in Ambanja. A TV programme filmed in the COFAV covered yam cultivation technique information; it was broadcast on national and regional TV 2 times per week for one month. A project video featuring one of the communities near Ambanja was made in January 2017 and posted on https://www.youtube.com/watch?v=oPl_mHDq0w. 229 Tweets and 20 blogs were published. 8 annual regional yam festivals were organized. 195 T-shirts were made and distributed to profile the project (Annex 7G).</p> <p>One article describing a threatened new species was published in April 2017 (<i>D. irodensis</i>), see https://link.springer.com/article/10.1007/s12225-017-9677-6. Other MSS on yam novel/rediscovered diversity and conservation are in preparation (two new species found on sandstone, two species from sites in the North, one from the west, two in the centre) and will be completed by April 2019 at the latest.</p>
<p>Activity 2.1. Building and populating a project website and blog.</p>	<p>20 blogs and a total of 229 tweets were published via the websites listed above alongside other relevant content.</p>
<p>Activity 2.2. Implementation of a project communication strategy, including radio, newspapers, social media, leaflets and yam festivals</p>	<p>Project communication has taken place via radio, TV, blogs, tweets, website, T-shirts and Annual regional yam festivals. 303 radio broadcasts were made (3 in the north with one local station and 300 in COFAV on 5 stations) and 1 TV broadcast in Ambanja. A TV programme 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. 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. 229 Tweets with 329,730 impressions and 20 blogs were</p>

		published. 8 yam harvest festivals were organized, 2 in the north with 700 participants and 6 in the COFAV with 2700 participants. 195 T-shirts were made and distributed to raise awareness of yam conservation, the project and DI.																				
Activity 2.3 Preparation of journal articles		One article describing a threatened new species published in April 2017 (<i>D. irodensis</i>). Other MSS on yam novel/rediscovered diversity and conservation are in preparation.																				
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 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>We have worked with 60 communities and 2941 households (HH) through the project.</p> <p>HH income has increased by 20% in Ambanja District and 55% in the COFAV (see Outcome Indicator 4). There was a decrease of 41% in Antsiranana District which we believe is a product of rainfall deficits especially in Y1 and Y2. Overall project income increase was therefore ca 25%.</p> <p>3,209 people trained (in the COFAV 1,053 people trained, ♂ 58.5%, ♀41.5%; Antsiranana Province 2,156 people, ♂ 47%, ♀ 53%) in yam propagation, cultivation, harvesting and wild population surveying (see Annex 7H). A basic yam cultivation manual was used during community training and left for future reference. Yam production was as follows; 2018 harvest figures estimated from sampled harvesting in June 2018 (see Annex 7J).</p> <table border="1"> <thead> <tr> <th>Production (kg)</th> <th>COFAV: Wild spp.</th> <th>COFAV: <i>D. alata</i></th> <th>Antsiranana: Wild spp</th> <th>Antsiranana: <i>D. alata</i></th> </tr> </thead> <tbody> <tr> <td><i>Y1 (2016)</i></td> <td><i>57</i></td> <td><i>23,598</i></td> <td><i>35</i></td> <td><i>6,878</i></td> </tr> <tr> <td><i>Y2 (2017)</i></td> <td><i>0*</i></td> <td><i>114,936</i></td> <td><i>4,127</i></td> <td><i>41,859</i></td> </tr> <tr> <td><i>Y3 (2018)</i></td> <td><i>259</i></td> <td><i>123,020</i></td> <td><i>6,702</i></td> <td><i>77,064</i></td> </tr> </tbody> </table> <p>* Communities requested not to harvest wild yams to provide larger yield in Y3.</p>	Production (kg)	COFAV: Wild spp.	COFAV: <i>D. alata</i>	Antsiranana: Wild spp	Antsiranana: <i>D. alata</i>	<i>Y1 (2016)</i>	<i>57</i>	<i>23,598</i>	<i>35</i>	<i>6,878</i>	<i>Y2 (2017)</i>	<i>0*</i>	<i>114,936</i>	<i>4,127</i>	<i>41,859</i>	<i>Y3 (2018)</i>	<i>259</i>	<i>123,020</i>	<i>6,702</i>	<i>77,064</i>
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Activity 3.1 Socio-economic surveys of community and HH consumption of yams and the availability of wild yams in local markets.		Y1 and Y3 socio-economic surveys used to deliver the results for household income and individual calorific and protein intake above under Outcome Indicator 4.																				

<p>Activity 3.2 Training for community technicians in cultivation and ennoblement techniques.</p>	<p>3,209 people trained (COFAV 1,053, ♂ 58.5%, ♀ 41.5%; Antsiranana Province 2,156, ♂ 47%, ♀ 53%) in yam propagation, cultivation, harvesting and wild population surveying. A basic yam cultivation manual was used during community training and left for future reference.</p>
<p>Activity 3.3 Development of a manual and other materials, tested by communities, to facilitate farmer to farmer dissemination.</p>	<p>A basic yam cultivation manual was used with each community during training and left for future reference.</p>
<p>Activity 3.4 Repeated surveys of food consumption in HHs in the project areas to assess changes throughout the life of the project</p>	<p>HH calorific intake has increased by 28% in Ambanja District, while reducing by 22% in Antsiranana District where rainfall levels were low in the early part of the 2016-17 rainy season, and 5% in the COFAV. Thus overall calorific intake has been flat, albeit increasing substantially with reliable rainfall. In contrast, protein intake has increased by 24% in Ambanja District and 54% in the COFAV, with a 2016-17 rainy season-related decrease of 16% in Antsiranana District and hence it has increased across the project as a whole. See Outcome Indicator 4.</p>
<p>Output 4. Conservation management of the 20 most threatened species</p>	<p>Indicator 1: Conservation management plans for all 20 species developed in partnership with NGOs and communities and agreed by year 3.</p> <p>Indicator 2: Community monitoring methodology developed and implemented and integrated into the conservation management plans by end of year 3.</p> <p>Indicator 3: No decline in main populations apparent by year 3.</p> <p>60 agreements have been signed with communities regarding conservation of multiple wild species per community. Wild yam management plans have been discussed with and accepted by the 30 communities in COFAV: 4 are already signed, available and in use, 24 remain in draft. See Output 1 Indicator 1 above.</p> <p>Three populations of each locally available wild yam species have been monitored by each of 29 communities in the North and for COFAV in 4 areas across the 30 communities there. The latter has been integrated into conservation management plans in the COFAV. See Outcome Indicator 6.</p> <p>Based on numbers of individual adult plants and extraction holes in exemplar monitored forests in Antsiranana Province, the rate of extraction has not increased across 6 species (one with two subspecies). Increases in adult plant numbers were recorded in 2018 over 2016 and 2017.</p>
<p>Activity 4.1 Baseline surveys and monitoring of the harvesting of priority species and populations from forests</p>	<p>Three populations of each locally available wild yam species have been monitored by 29 communities in the North and for COFAV in 4 areas across the 30 communities. Inventory at Beanka, Analalava and Sahafary was undertaken in 2017 for <i>Dioscorea bako</i>, <i>D. analalavensis</i> and <i>D. irodensis</i> respectively. Zavamaniry Gasy added 344 wild yam localities in Madagascar.</p>

<p>Activity 4.2 Research into the most effective ennoblement protocols and management of wild species for sustainable food production.</p>	<p>We are currently cultivating a total of 21 species of wild yam (in COBA cultivation), plus an additional endemic subspecies (<i>D. sambiranensis</i> ssp. <i>bardotiae</i>) and 5 varieties of <i>D. alata</i>. In Antsiranana and Ambanja Districts many households have currently more than 1000 individuals of <i>D. sambiranensis</i>, which appears at this stage to be the most amenable wild species to cultivation. However, we have to date employed a single method of cultivation for wild species; others may respond better to methodological modifications.</p> <p>Yields in Y1, 2 and 3 are given under Output 3 Indicator 3. 1,976 kg of the 6,702 of wild yams cultivated in Antsiranana Province were of <i>D. sambiranensis</i>.</p>
<p>Activity 4.3 Participatory development of a monitoring methodology for communities.</p>	<p>Wild yam management plans have been discussed with during training and accepted by the 30 communities in COFAV: 4 are already signed, available and in use, 24 remain in draft.</p>
<p>Activity 4.4 Development of conservation management plans for each species and agreement with communities and NGOs managing protected areas</p>	<p>Wild yam management plans have been discussed with during training and accepted by the 30 communities in COFAV: 4 are already signed, available and in use, 24 remain in draft. Based on numbers of individual adult plants and extraction holes in monitored forests in Antsiranana Province, the rate of extraction has not increased; across 6 species (one with two subspecies). Increases in adult plant numbers were recorded in 2018 over 2016 and 2017. In the same 6 species. We have not been able to capture data on wild yams populations in the COFAV.</p>
<p>Output 5. Ex-situ conservation of all wild species and non-native cultivars</p>	<p>Indicator 1: Collections of seed from up to 10 populations from throughout the ranges of all native species collected and stored <i>ex-situ</i> by year 3.</p> <p>Indicator 2: Germination protocols for 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;</p> <p>We have made 177 seed collections covering 23 species during the project in addition to the 35 accessions covering 13 species at the MSB/SNGF at project start; five species have more than 10 accessions (<i>D. sambiranensis</i> 40, of which 21 were <i>D. sambiranensis</i> subsp. <i>bardotiae</i> and 10 <i>D. sambiranensis</i> subsp. <i>sambiranensis</i>; <i>D. buckleyana</i> 29; <i>D. maciba</i> 24; <i>D. orangeana</i> 20; <i>D.</i> 10; <i>D. seriflora</i> 10). Two collections represent additional new (undescribed) species. They are available through the MSB and SNGF, with some collections at stages within the accessioning process.</p> <p>The RBG, Kew MSB has carried out 39 germination tests on 17 collections representing 10 species that covered both the phylogenetic and ecological diversity of <i>Dioscorea</i> in Madagascar: <i>D. antaly</i>, <i>D. bemarivensis</i>, <i>D. fandra</i>, <i>D. heteropoda</i>, <i>D. homboka</i>, <i>D. maciba</i>, <i>D. pteropoda</i>, <i>D. sansibarensis</i>, <i>D. soso</i> and <i>D. trichantha</i>. They used samples of 10 or 20 seeds depending on accession sizes with a light:dark ratio of 8:16 hours and a 1% agar solution for all, and no other special treatments except temperature. They achieved the following consistent results at the temperatures 20°C = 69% pass, 25°C = 73% pass, 30°C = 73% pass. A pass is 50% germination or greater. Test data is available via http://data.kew.org/sid/. This e-resource also shows that the results obtained from <i>Dioscorea</i> in Madagascar are consistent with those from elsewhere.</p> <p>25 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>) are in community cultivation with 5 varieties of <i>D. alata</i>. Of the 25, 12 have been actually (iucnredlist.org) or provisionally demonstrated to be threatened.</p>

	including 4 botanic gardens and/or regional community 'gene-banks' that will be established through the project by year 3	
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, 2017 and 2018 with seed collected from them in March-June of each year leading to the collections reported under Output 5 Indicator 1
Activity 5.2 Seed collection trips in combination with baseline surveys.		Seed collecting work took place in conjunction with both baseline surveys of species and visits to communities during the period above to maximise efficiency.
Activity 5.3 Germination tests carried out on all yam species in Madagascar by SNGF and at Kew's Millennium Seed Bank (routine for all MSB collections).		See indicator 2 above.
Activity 5.4 Distribution of germination protocols, seeds and tubers to botanic gardens and communities engaged to preserve living collections of wild species and cultivars.		The collection at DBEV comprises 103 individual accessions of 21 species, of which 10 are provisionally or actually demonstrated to be threatened. PBZT has 199 individual accessions comprising 25 species, of which 12 are provisionally or actually demonstrated to be threatened. Smaller collections are sited at Ramena/Ankoriky (MBG collaboration) with 40 individuals (i.e 4 individuals per species) and covering 9 wild yams species and one cultivated yam species (<i>D. alata</i>). In collaboration with DREEF Ambanja we had 112 individuals of <i>D. alata</i> and 20 individuals of <i>D. sambiranensis</i> , but this was abandoned due to a problem in establishing a long term working relationship. Instead we sought a collaboration with FOFIFA (Agriculture Ministry Research Institute) locally in Ambanja but they were unable to deliver an <i>ex situ</i> conservation plot. In Y3 we focussed instead on cultivation at the KMCC Ambanja office with 3 individual plants of each of <i>D. alata</i> , <i>D. seriflora</i> , <i>D. buckleyana</i> , <i>D. sambiranensis</i> var. <i>sambiranensis</i> , <i>D. maciba</i> , <i>D. irodensis</i> , <i>D. sansibarensis</i> and <i>D. pteropoda</i> . Community cultivation as reported above was supported in each case by provision of <i>D. alata</i> seed tubers at the outset.

Annex 3 Standard Measures

Code	Description	Total	Nationality	Gender	Title or Focus	Language	Comments
Training Measures							
1a	Number of people to submit PhD thesis	0					

1b	Number of PhD qualifications obtained	0					
2	Number of Masters qualifications obtained	2	Malagasy	1 x ♂, 1 x ♀	Natural Product Chemistry/Dioscorea in N Madagascar/Nutrition	French	
3	Number of other qualifications obtained	0					
4a	Number of undergraduate students receiving training	0					
4b	Number of training weeks provided to undergraduate students	0					
4c	Number of postgraduate students receiving training (not 1-3 above)	0					
4d	Number of training weeks for postgraduate students	0					
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification (e.g., not categories 1-4 above)	0					
6a	Number of people receiving other forms of short-term education/training (e.g., not categories 1-5 above)	3,209 people trained	Malagasy	COFAV 1,053, ♂ 58.5%, ♀ 41.5%; Antsiranana Province 2,156, ♂ 47%, ♀ 53%)	Yam propagation, cultivation, harvesting and wild population surveying		

6b	Number of training weeks not leading to formal qualification	0					
7	Number of types of training materials produced for use by host country(s) (describe training materials)	1			Yam propagation, cultivation, harvesting and wild population surveying		Basic yam cultivation manual used with each community during training and left for future reference.
Research Measures		Total	Nationality	Gender	Title	Language	Comments/ Weblink if available
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (ies)	1			National Strategy		Fully participatory, covering 43 species and others awaiting description
10	Number of formal documents produced to assist work related to species identification, classification and recording.	5					www.teamkmcc.org/yams
11a	Number of papers published or accepted for publication in peer reviewed journals	1					https://link.springer.com/article/10.1007/s12225-017-9677-6
11b	Number of papers published or accepted for publication elsewhere	0					
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	3					Specimen database, seed collection database (KMCC, PBZT and SNGF and Zavamaniry Gasy project available through GBIF and at https://www.inaturalist.org/projects/zavamaniry-gasy-plants-of-madagascar
12b	Number of computer-based databases enhanced	0					

	(containing species/genetic information) and handed over to host country						
13a	Number of species reference collections established and handed over to host country(s)	40					Species distribution data; ZG data.
13b	Number of species reference collections enhanced and handed over to host country(s)	0					

Dissemination Measures		Total	Nationality	Gender	Theme	Language	Comments
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	4					Project workshops in Madagascar
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	12					UK and international

Physical Measures		Total	Comments
20	Estimated value (£s) of physical assets handed over to host country(s)	£14,624	Project equipment purchased for KMCC and FBNT
21	Number of permanent educational, training, research facilities or organisation established	3	KMCC Offices in Ambanja (via DI funding) and Morondava/Borziny (April Trust Funding)
22	Number of permanent field plots established	95	Cultivation plots and wild yam population monitoring zones.

Financial Measures		Total	Nationality	Gender	Theme	Language	Comments
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23	Value of additional resources raised from other sources (e.g., in addition to Darwin funding) for project work	£96,078 + £205,361					April Trust Funding for work using same methods in Menabe/Bongolava 2017-2020. DI Post project award EIDPO049.
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Annex 4 Aichi Targets

	Aichi Target	Tick if applicable to your project
1	People are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	X
2	Biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	X
3	Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	
4	Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	
5	The rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	
6	All fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	
7	Areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	X
8	Pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	
9	Invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	
10	The multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	
11	At least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	
12	The extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	X
13	The genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	X

14	Ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	
15	Ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	
16	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	
17	Each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	
18	The traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	
19	Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	
20	The mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	

Annex 5 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. web link, contact address etc)
Journal Article	A new species of critically endangered edible yam endemic to Northern Madagascar, <i>Dioscorea irodensis</i> (Dioscoreaceae) and its conservation. Wilkin, P., Kennerley, J.A., Rajaonah, M.T., Huckël, G.M., Rakotoarison, F., Randriamboavonjy, T. & Cable, S. 2017	British	British	Male	RBG, Kew, London	https://link.springer.com/article/10.1007/s12225-017-9677-6

Annex 6 Darwin Contacts

To assist us with future evaluation work and feedback on your report, please provide details for the main project contacts below. Please add new sections to the table if you are able to provide contact information for more people than there are sections below.

Ref No	22-005
Project Title	Conserving Madagascar's yams through cultivation for livelihoods and food security
Project Leader Details	
Name	Paul Wilkin
Role within Darwin Project	PI
Address	
Phone	
Fax/Skype	
Email	
Partner 1	
Name	Mamy Tiana Rajaonah
Organisation	KMCC
Role within Darwin Project	Project Manager
Address	
Fax/Skype	
Email	
Partner 2	
Name	Sam Cameron
Organisation	FBNT
Role within Darwin Project	Programme Coordinator
Address	
Fax/Skype	
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