Conserving Madagascar's yams through cultivation for livelihoods and food security

KMCC
Kew Madagascar Conservation Centre

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MISSOURI BOTANICAL GARDEN

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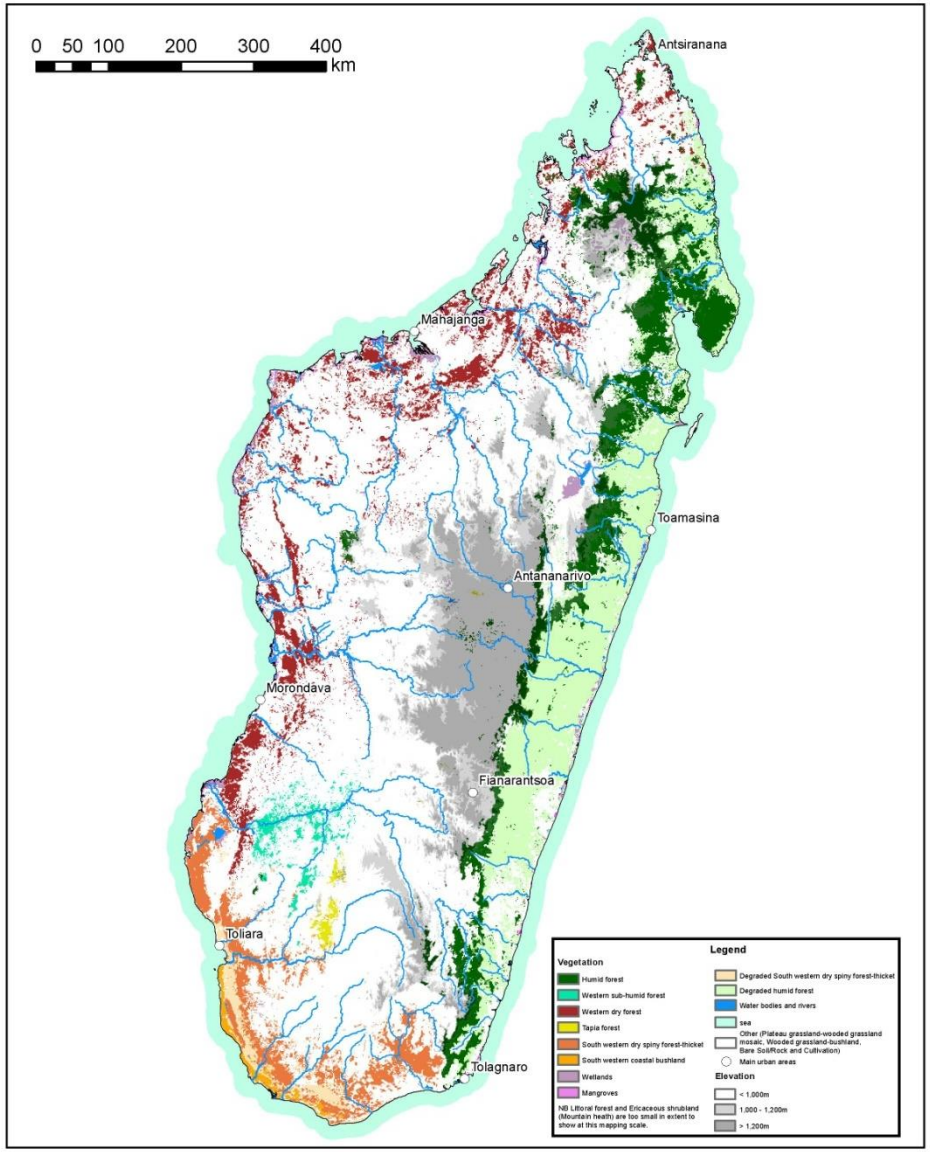
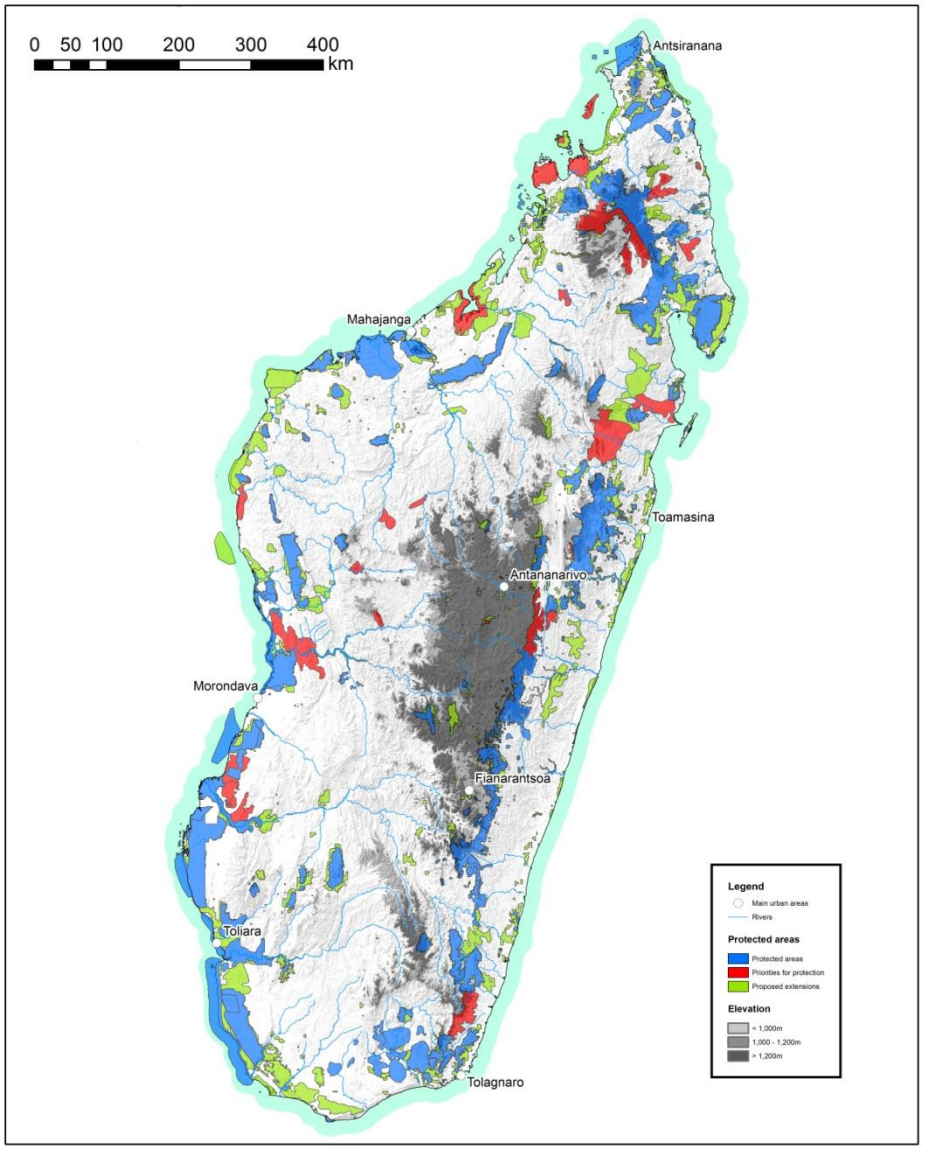
The April Trust

Challenge for conservation & livelihoods

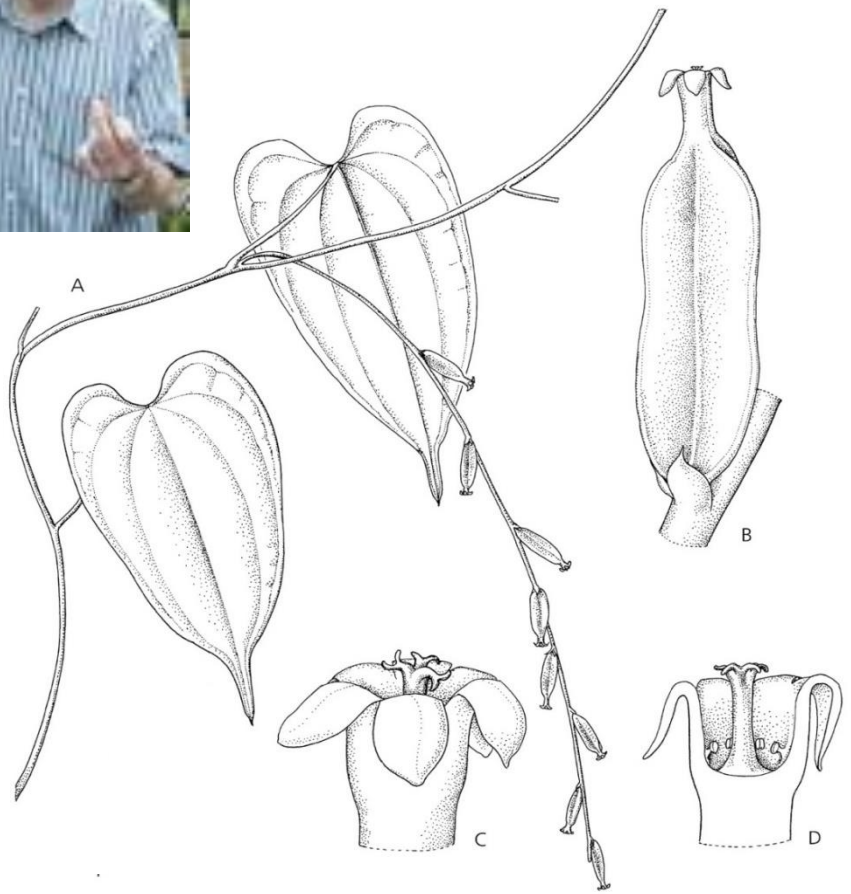
- Madagascar poorest country not in armed conflict
- 25m people (80% depend on subsistence agric.)
- slash and burn agriculture (upland rice, cassava)
- 22m m^3 wood per year (cooking, construction)
- 50% of children are malnourished
- high plant species richness (14,000 species)
- >90% of plant species are endemic
- many species have narrow distributions
- many species poorly known
- forest cover decline from 28% 1950s to 16% now
- 20% of original forest cover is left???
- highest soil erosion in the world (200-400 t/ha/yr)

Vegetation and SAPM 2012





Yam taxonomy – Dr Paul Wilkin, RBG Kew



***Dioscorea kimiae*, from Fianarantsoa (described in 2008)**

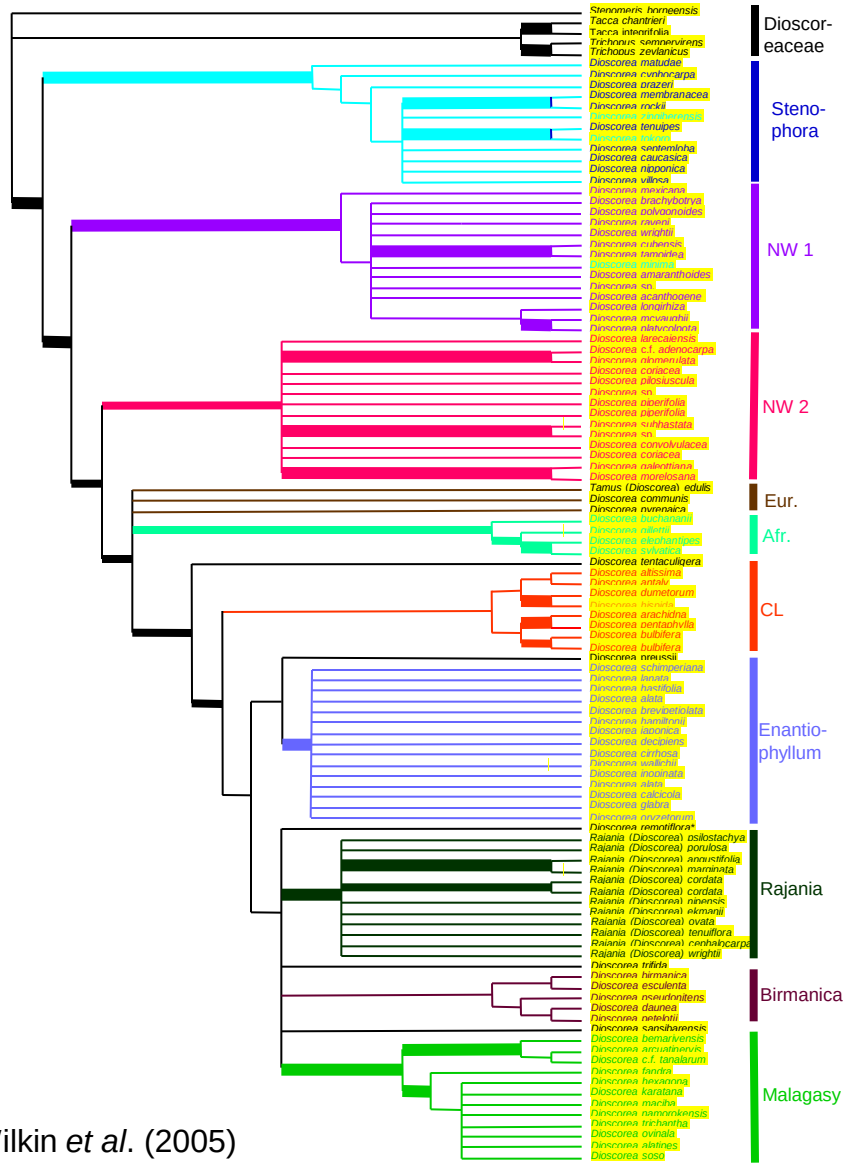
Cultivated yams in Madagascar

- ***Dioscorea alata***
- Winged yam, Ovibe
- Introduced from S/SE Asia
- Cultivated in kitchen gardens
- Previous project in COFAV
- Improved cultivation
- To improve livelihoods
- Alternative to wild species
- National Strategy
- Also *Dioscorea esculenta*

Dioscorea alata **in the COFAV Protected Area**

Alternatives to shifting cultivation

Yam classification (Syst. Bot. 2005)



Wilkin *et al*. (2005)

Globally:

650 species in 9 main clades

Madagascan clade distinctive: EDIBLE

Madagascar & Comorian Archipelago wild yam diversity

- **45** species (6 awaiting description)
- 2 cultivated & introduced
- 4 non-endemic
- 2 Comorian Archipelago endemics
- **37** currently described endemic species of yam in Madagascar

D. mayottensis tuber. Photo F. Barthelat

D. proteiformis tuber. Photo V. Jeannoda

D. madecassa ♀

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A new species of critically endangered edible yam endemic to northern Madagascar, *Dioscorea irodensis* (Dioscoreaceae) and its conservation

Paul Wilkin[1], James A. Kennerley[2], Mamy Tiana Rajaonah[3], Geodain Meva Hudël[4], Feno Rakotoarison[4], Tianjanahary Randriambo avonjy[3] & Stuart Cable[1]

Summary. Morphological character data are used to show that a distinct morphotype of *Dioscorea* L. from the Irodo valley (East of Sadjoavato) in Antsiranana Province of Madagascar is an undescribed species, differing in its leaf arrangement, pubescence form and male inflorescence structure from all other taxa. It is described as *Dioscorea irodensis* Wilkin, Rajaonah & Randriamb., illustrated and a distribution map and ecological information provided. It is known from three sites, but is likely to have been eradicated from one of them. The population that has been studied in the field contains a very low number of adult plants. Tubers have been extracted for use as food at a level that appears to be unsustainable. Thus its provisional IUCN conservation status assessment is that it is critically endangered (CR). Its vernacular name in Irodo is *Bemandry*.

Famintinana. Ny toetra sy ny bikan'ny oviala dia azo ampiasaina hanehoana fa miavaka ny oviala iray, izay hita tao anatin'ny lohasahan'Irodo (Atsinanan'i Sadjoavato, faritanin'Antsiranana) ao Avaratr'i Madagasikara, ary tsy mbola voasoritra ny momhamomba azy. Mampihavaka azy amin'ny hafa ireto toetra manaraka ireto: ny fipetraky ny ravina, ny fisian'ny volo, sy ny firafitry ny tahom-bony lahy eo aminy. Nosoritana ho *Dioscorea irodensis* Wilkin, Rajaonah & Randriamb. izy ity, nampiratiana an-tsary ny momba azy, namoahana saritany ny toerana misy azy, ary nomena ireo tavotao ara-ekolojika mikasika azy. Vondrona oviala miisa telo fara-faha-betsany no fantatra fa misy azy, ary efa ho fongana ny iray amin'ireo. Ny vokatry ny fanadihadiana izay natao tamin'ny vondrona oviala misy no nahitana fa vitsy ny fototra oviala lehibe afaka mamoa, ary maro ireo nohadiana ho sakafo, izay mamaritra sahady fa tsy hateza io karazana io. Noho izany, ny sata fiarovana vonjimaika IUCN dia manombana fa zavamaniry tena tandindomin-doza (CR) io karazana oviala io. *Bemandry* no fianso io karazana oviala io any Irodo.

Key Words. conservation, critically endangered, distribution, edible, *ex situ*, *in situ*, Madagascar, morphology, new species, yam.

D. soso s.l. ♀ & ♂. Photos D. Rabehevitra

D. irodensis tuber. Photo F. Rakotoarison

D. bemarivensis ♀

Madagascar wild yam use

Digging for *D. maciba* tubers in dry littoral forest in sandy soil

D. alata & *D. esculenta* cultivated as starch sources

All 37 endemics eaten or edible; several preferred to *D. alata*

Variation in degrees of use:

- Staples, especially during the hungry gap e.g. *D. maciba*, *D. seriflora, D. bako, D. orangeana. D. sambiranensis*
- Occasional snacks e.g. *D. bemarivensis*
- Famine foods e.g. *D. antaly, D. arcuatinervis*
- Water sources/edible raw e.g. *D. fandra, D. soso*

Regional variation:

- Central – limited
- S, SW and E – more widespread
- W and N – highest levels

Finding *D. seriflora* tubers in the COFAV region

Madagascar wild yam conservation

IUCN Red List Assessments for 29 *Dioscorea* species in Madagascar & the Comorian Archipelago. Published 07/12/2017

Threat category	Number of taxa	%
CR	2	6.9
EN	6	20.7
VU	3	10.3
NT	6	20.7
LC	11	37.9
DD	1	3.4
Total	29	100

38% Threatened

59% Threatened or NT

D. decaryana ♀ CR

D. comorensis ♀ EN.
Photo N. Crestey

D. bako EN

D. orangeana EN.

D. acuminata ♀ & ♂ EN

Aims of DI Project in 2015

- Improved livelihoods in ca 60 communities (*c*.3,000 households, >22,000 people) in terms of both dietary intake and household income
- Conservation of all wild species ex situ and threated/key edible species in situ
- Improved knowledge and awareness of yam diversity and its uses in Madagascar
- A national strategy for wild yam species conservation
- Progress towards understanding of whether wild yam species could be developed into crops through ennoblement

Project preliminary outcomes 2018

1. Livelihoods

Project has worked with 60 Communities & 2941 households over 3 years in the COFAV and Antsiranana province

All households supplied with *D. alata* seed yams & most obtained wild yams locally

COFAV:

- 1053 growing wild yams & *D. alata*
- 447 *D. alata* only

Antsiranana Province

- 1441 growing wild yams & *D. alata*

Project preliminary outcomes 2018

1. Livelihoods

	Mean HH member annual calorific intake (Kcal)			Mean HH member annual protein intake (g)			Mean HH annual income (Ariary)		
	Y1	Y3	% change	Y1	Y3	% change	Y1	Y3	% change
Ambanja	432,000	553,000	**+28**	7,990	9,990	**+24**	445,000	693,000	**+56**
Antsiranana	376,000	282,000	**-25**	7,350	5,740	**-22**	386,000	208,000	**-47**
COFAV	656,000	623,000	**-5**	11,600	17,820	**+54**	330,000	1,350,000	**+310**

Project preliminary outcomes 2018

2. Conservation

1. Communities
- 14 species & 2 subsp. (7 threatened, 1 NT) in 60 COBA plots alongside *D. alata*
- Population monitoring methodology for wild edible yams deployed in all 60 COBAs

2. Germplasm collections
- PBZT & DBEV: Over 200 accessions, 23 spp, 12 of which are threatened
- DREF Antsiranana: 3150 plants of 10 spp & *D. alata*
- Antsiranana – MBG. 40 plants, 10 species from Antsiranana province, inc. *D. orangeana*

3. Seed banking (SNGF, RBG Kew MSB):
- 20 species.166 accessions collected, up to 15 populations per species, 8 threatened

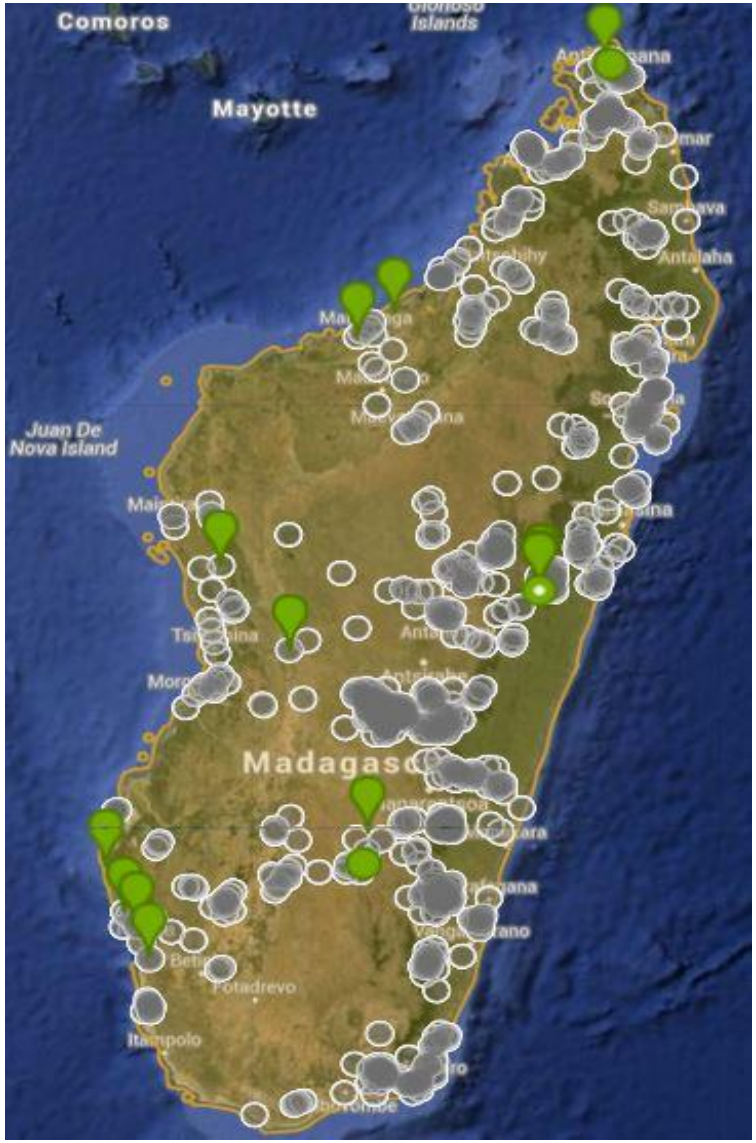
4. Zavamaniry Gasy:
- 311 images/data points, 23 species.

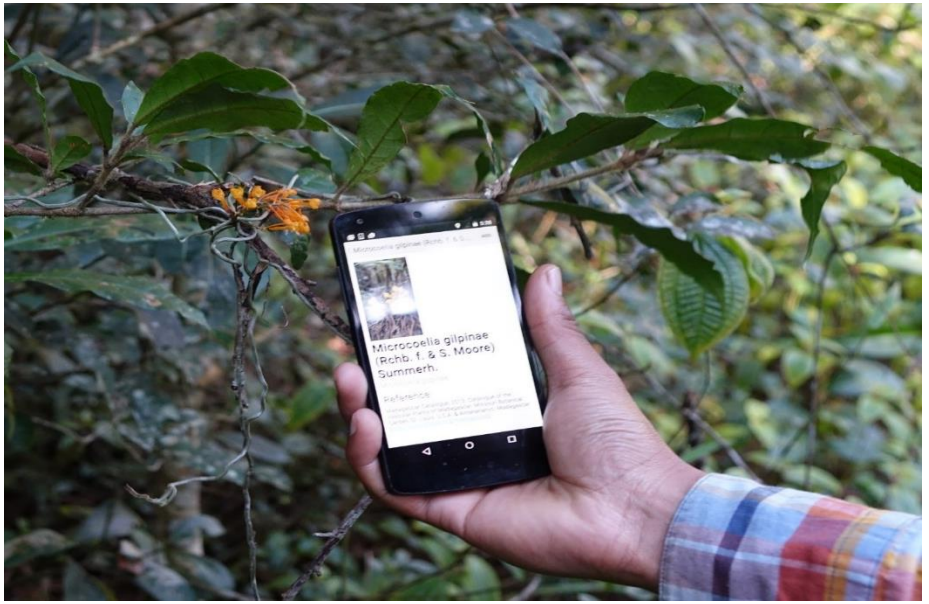
5. Conservation assessments published on iucnredlist.org
- 29

D. orangeana: principal target species for conservation with MBG

Project preliminary outcomes 2018

2. Conservation





Project preliminary outcomes 2018

3. Improved knowledge and awareness of yams

a) Training in yam propagation, cultivation, harvesting and wild population surveying

- COFAV 1053 people trained in all 4 areas
- ♂ 58.5%, ♀ 41.5%
- Antsiranana 2156 people trained
- ♀ 47%, ♂ 53%.
- 1387 in all 4 areas

Total: **3209 people trained**

Basic cultivation and diversity manual provided for each community as training resources

Project preliminary outcomes 2018

3. Improved knowledge and awareness of yams

b) Yam Harvest Festivals
August/September 2017

4 festivals in COFAV (1/commune), <2000 people participating

2 festivals in Antsiranana (Ambanja and Diego), ca 700 people participating.

Both a significant increase on 2016

Project preliminary outcomes 2018

3. Improved knowledge and awareness of yams

c) Research

- 1 new species published 2017
- 3 more in preparation
- 3 more awaiting description
- Revision of 4 species in prep
- Nutritional profiles with LABASAN via MSc projects
- Wild yam performance in cultivation explored
- Measurable wild yam yields

***D. irodensis* tuber. Photo F. Rakotoarison**

Project preliminary outcomes 2018

4. National Strategy for Wild Yams

- Workshops in October 2015, Nov 2016 and Nov 2017
- Validation by Gov't principal aim of workshop in June 2018

National Strategy for wild yams: critical for the future of yam use in Madagascar

Project preliminary outcomes 2018

5. Can wild yams be cultivated as crops?

- 2017 COBA cultivation yields:
  - Antsiranana: Wild 4,127 kg (7 sp), *D. alata* 41,856 kg
  - COFAV Wild 0* kg, *D. alata* 114,936 kg
- 2018 better rains than 2017 so expecting higher yields
- Cultivated wild yam tubers observed to be larger than forest-harvested wild yams
- *D. sambiranensis* (Angona) particularly preadapted to cultivation

Project preliminary outcomes 2018

4. National Strategy for Wild Yams

- *Dioscorea orangea* – IUCN CR to EN
- Now in cultivation by local communities

April Trust Project

Yam Cultivation for Conservation in Bongolava and Menabe

- Funding 2017-2020
- Same methods as DI, smaller numbers of communities
- Menabe for *D. bako*
  - EN – habitat loss, over-exploitation
  - 5 x price increase in 10 years!
- Bongolava for *D. maciba & D. soso*
  - LC but locally heavily exploited (esp. *Malita*) and habitat loss
- Progress:
  - 35 communities, 1410 HH, each with a community yam plot
  - 1706 people trained
  - Y1 socioeconomic surveys completed
  - First seeds collected including 2 accessions of *D. bako*

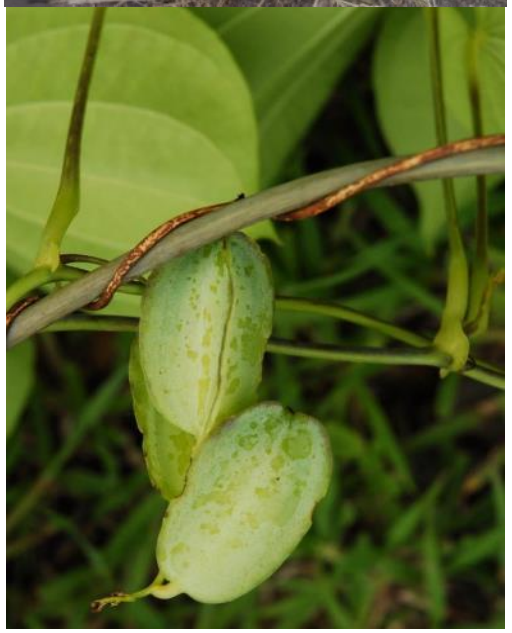
D. bako . Photos M.T. Rajaonah

*D. maciba (*Malita) for sale at Borziny

Successes and failures

- Learnt from previous projects (logframe critical)
- Dedicated local KMCC manager and team
- KMCC accountant
- Upgraded IT to enable weekly skype meetings
- 3-monthly meetings in Madagascar with partners
- Reporting tool recording progress against outputs
- Appropriate partners at local and national levels
- **Yams culturally significant & quick production**
- **Exchange trips and festivals big success**
- Equipment not in place quick enough in Ambanja
- Logistics difficult even for a Land Rover
- Underestimated the socio-economic surveys
- Final harvest not within project timeframe (Darwin have agreed to a reporting extension)
- **More emphasis on sustainable production**
- **More emphasis on communication (video, radio)**
- **More emphasis on added value and marketing**
- **More emphasis on de-risking innovation**

***D.alata* in COFAV.**
Photo Randriamboavonjy



***D. buckleyana* ♀**

Darwin Initiative Post-Project Award

Sustainable yam markets for conservation and food security in Madagascar

Aims:

- Sustainable yam platforms with clear business models and value-chains from small scale producers to viable markets
- Improved knowledge of nutritional value and extended period of consumption and marketing.
- Conservation and cultivation of native species and cultivars to build on Main Project successes.
- Strategy, communication and planning.

Duration: 2 years from July 2018

Team: Lead organisations

Workshop: potentially Autumn 2018

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Ny Tanintsika

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UNIVERSITY of GREENWICH | Natural Resources Institute

Royal Botanic Gardens Kew

Acknowledgements and thanks

***Dioscorea soso* tuber (photo David Rabehevitra)**

The April Trust