

CWR conservation in the SADC region

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Plant Genetic Resources: Our challenges, our food, our future

2 June 2016, University of Birmingham



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CONTENTS

- Introduction to project
- Capacity building in the SADC region
- National Strategic Action Plans for CWR conservation and sustainable use in Mauritius, South Africa and Zambia
- CWR diversity analysis for the SADC region
- Key outputs

SADC CROP WILD RELATIVES PROJECT

- In situ Conservation and Use of Crop Wild Relatives in three ACP countries of SADC Region
- 2014-2016
- Led by Bioversity International
- Co-funded by the European Union and implemented through the ACP-EU Co-operation Programme in Science and Technology (S&T II) by the ACP Group of States. Grant agreement no. FED/2013/330-210.

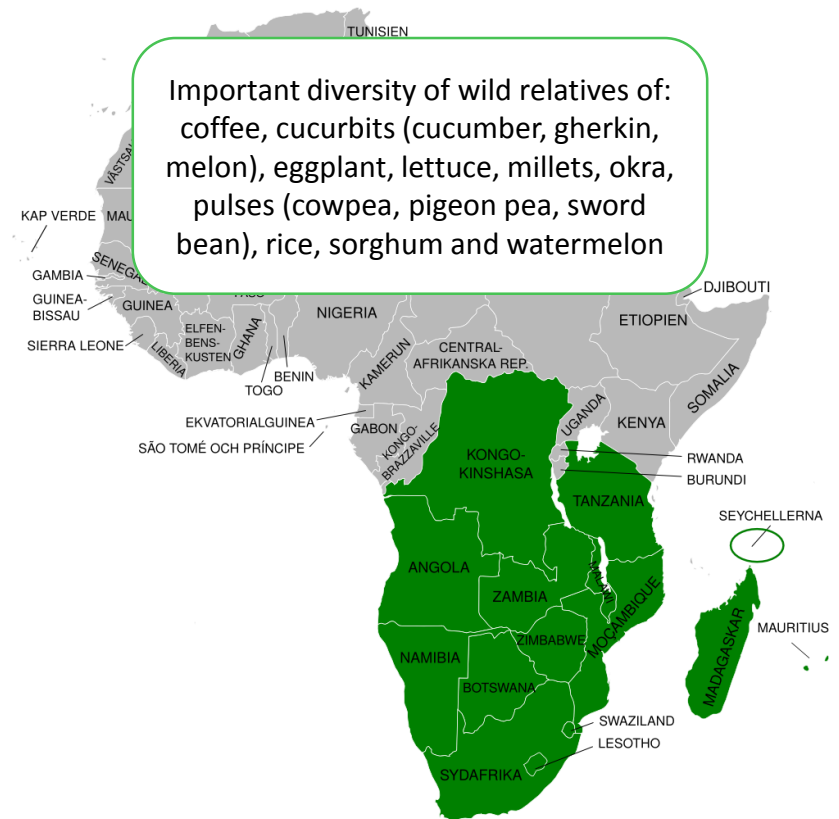


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SADC CROP WILD RELATIVES PROJECT

- CWR are an important source of trait diversity for crop improvement
- Food and economic security
- Their importance is not well recognised
- Threatened in the wild
- In situ and ex situ conservation inadequate
- Partnership between environment and agriculture sectors



SADC CROP WILD RELATIVES PROJECT

Overall objective

- Enhance the link **between conservation and use of CWR** in three ACP countries within the SADC region, as a means of underpinning regional food security and mitigating the predicted adverse impact of climate change

Specific objectives

- **Enhance the scientific capacities** within the partner countries to conserve CWR and identify useful potential traits for use to adapt to climate change.
- **Develop exemplar National Strategic Action Plans** for the conservation and use of CWR in the face of the challenges of climate change across the SADC region

CAPACITY BUILDING IN THE SADC REGION

CAPACITY BUILDING

To assess and improve capacities on *in situ* conservation and use of CWR in the SADC region

Capacity of SADC member states in *in situ* conservation and use of crop wild relatives in breeding programmes: Baseline report

Pier Rudeliger, Imke Thormann, Natalie Feldman, Godfrey Mula, Yasmira Zuberally-Fakim, Joana Magos Brehm

March 2015

Training needs assessment

Training workshops

Skype and face-to-face meetings

EUROPEAN UNION

SADC WILD RELATIVES

TEMPLATE FOR THE PREPARATION OF A NATIONAL STRATEGIC ACTION PLAN FOR THE CONSERVATION AND SUSTAINABLE USE OF CROP WILD RELATIVES

Ehsan Dulloo, Joana Magos Brehm, Shelagh Kell, Imke Thormann and Nigel Maxted

Templates

ERACTIVE TOOLKIT FOR CWR WILD RELATIVE CONSERVATION

THE TOOLKIT CROP WILD RELATIVES NATIONAL STRATEGIC ACTION PLANS CAPTION ACHIEVEMENTS

Download Toolkit

Online toolkit

CAPACITY BUILDING TRAINING NEEDS ASSESSMENT

Assess training
needs on CWR in
situ conservation
and utilization

Surveys in Mauritius, South Africa and Zambia

Survey in the SADC region

Key findings:

- Expertise on CWR is limited
- Lack of capacity in taxonomy, ecogeographic survey, seed handling, climate change modelling, data management and analysis
- CWR data quantity and quality are poor and accessing data within the SADC region is difficult
- Lack of policies on CWR

CAPACITY BUILDING TRAINING WORKSHOPS

Provide training on CWR
in situ conservation and
utilization

Regional training workshop on in situ conservation of CWR – Mauritius, November 2014

26 participants from 14 SADC countries

- Creating CWR checklists and inventories
- Prioritization of CWR for conservation
- Conservation status assessment of priority CWR
- Plans for implementation of conservation priorities
- Relevant policy for the conservation of CWR



Regional training workshop on predictive characterization and pre-breeding – South Africa, April 2015

23 participants from 9 SADC countries

- Application of ecogeography to PGR
- Predictive characterization of selected CWR for a specific traits
- CAPFITOGEN tools
- Definition and application of pre-breeding
- Genebank operations critical to pre-breeding programmes
- Principles for parental selection and the generation and management of variation
- Outline of actions that promote the use of CWR diversity for inclusion into NSAP for the conservation and use of CWR

CAPACITY BUILDING TEMPLATES

Support CWR
conservation planning and
development of NSAP



TEMPLATE FOR THE PREPARATION OF A NATIONAL STRATEGIC ACTION PLAN FOR THE CONSERVATION AND SUSTAINABLE USE OF CROP WILD RELATIVES

Ehsan Dulloo, Joana Magos Brehm, Shelagh Kell, Imke Thormann and
Nigel Maxted

Bioversity International
and
University of Birmingham



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TEMPLATE FOR THE TECHNICAL BACKGROUND DOCUMENT OF A NATIONAL STRATEGIC ACTION PLAN FOR THE CONSERVATION AND SUSTAINABLE USE OF CROP WILD RELATIVES

Joana Magos Brehm, Shelagh Kell, Imke Thormann, Nigel Maxted and
Ehsan Dulloo

University of Birmingham
and
Bioversity International



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CAPACITY BUILDING INTERACTIVE TOOLKIT FOR CWR CONSERVATION

Support CWR
conservation
planning

INTERACTIVE TOOLKIT FOR
CROP WILD RELATIVE CONSERVATION

HOME THE TOOLKIT CROP WILD RELATIVES NATIONAL STRATEGIC ACTION PLANS CITATION ACKNOWLEDGEMENTS

Home / The Toolkit Share: [f](#) [t](#) [e](#) [p](#)

The Toolkit

- NATIONAL CWR CONSERVATION PLANNING
- GENERATION OF A CWR CHECKLIST
- PRIORITIZING THE CWR CHECKLIST
- COMPILATION OF THE CWR INVENTORY
- GENETIC DATA ANALYSIS OF PRIORITY CWR
- DIVERSITY DATA ANALYSES OF PRIORITY CWR
- NOVEL THREAT ASSESSMENT OF PRIORITY CWR
- GAP ANALYSIS OF PRIORITY CWR
- CLIMATE CHANGE ANALYSIS
- ESTABLISHMENT OF IN SITU CONSERVATION GOALS
- IMPLEMENTATION OF IN SITU CONSERVATION PRIORITIES
- ESTABLISHMENT AND IMPLEMENTATION OF EX SITU CONSERVATION
- MONITORING CWR DIVERSITY

NATIONAL CWR CONSERVATION PLANNING

Involves the planning for systematic *in situ* and *ex situ* conservation of CWR diversity at national level. It results in the systematic representation of the nation's CWR diversity in an *in situ* network of genetic reserves (within existing protected areas or by establishing novel conservation areas) with back-up *ex situ* collections of genetically representative population samples in national gene banks (i.e. seeds, tissue, DNA, living plants). The conservation recommendations that result from this national CWR conservation planning process can and should be used to feed the National Strategic Action Plan for the conservation and utilization of CWR.

[+ READ MORE](#)

CAPACITY BUILDING

INTERACTIVE TOOLKIT FOR CWR CONSERVATION

Resource Book for the Preparation of
National Plans for Conservation of
Crop Wild Relatives and Landraces



Nigel Maxted, Joana Magos Brehm and Shelagh Kell
University of Birmingham
United Kingdom

Feedback

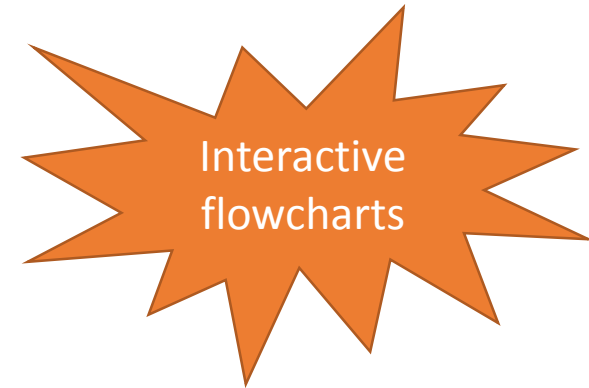
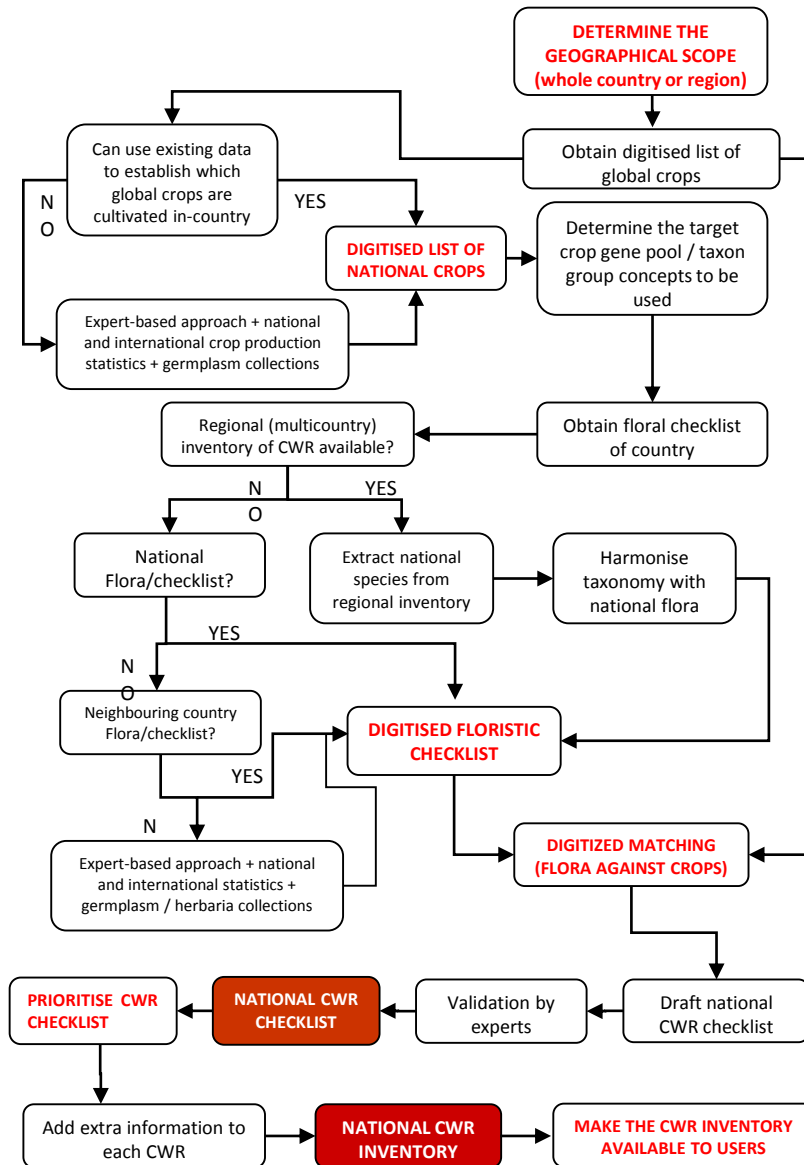
Examples



http://www.fao.org/fileadmin/templates/agphome/documents/PGR/PubPGR/ResourceBook/TEXT_ALL_2511.pdf

CAPACITY BUILDING

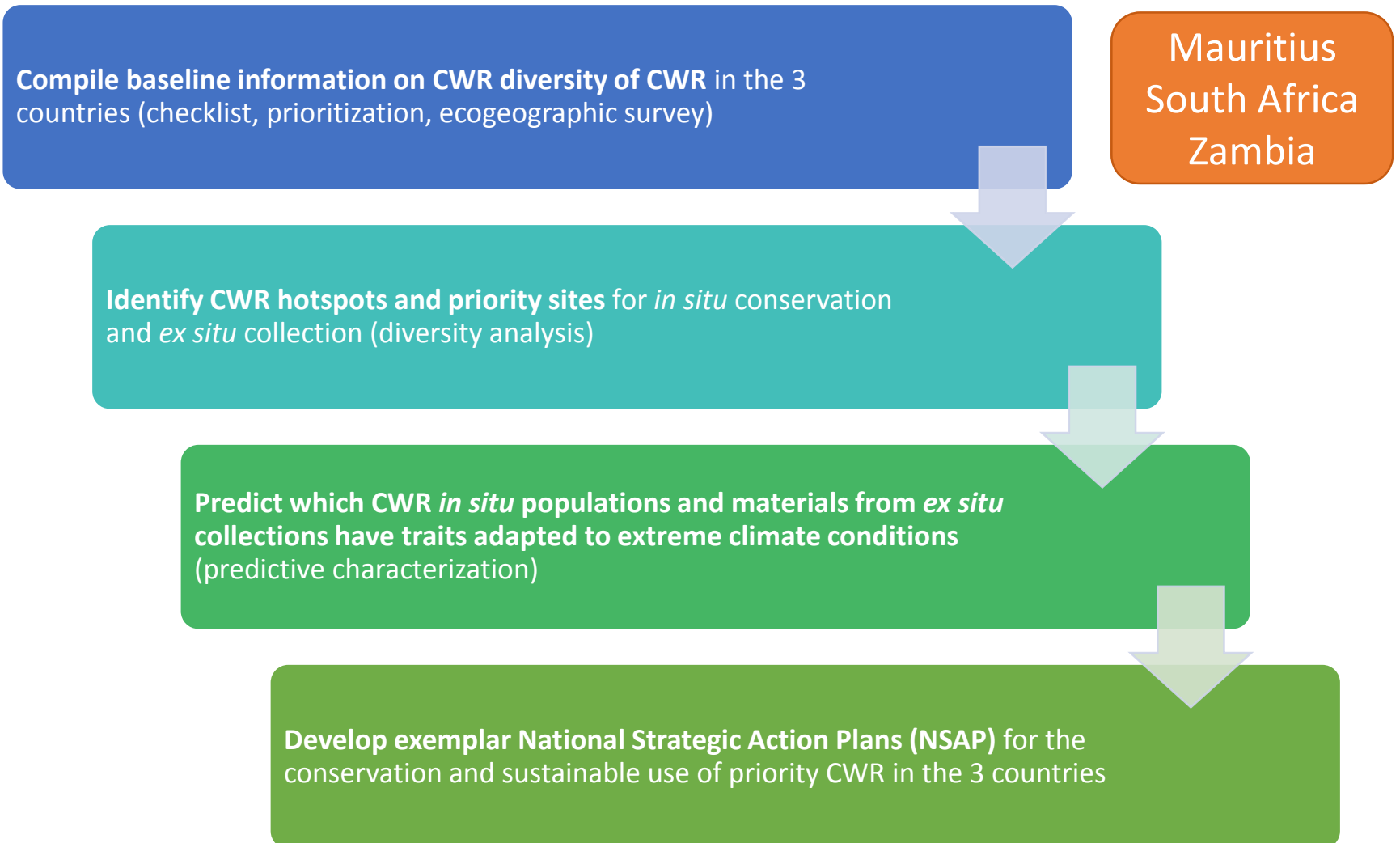
INTERACTIVE TOOLKIT FOR CWR CONSERVATION – innovation



NATIONAL STRATEGIC ACTION PLANS FOR CWR CONSERVATION AND SUSTAINABLE USE

MAURITIUS, SOUTH AFRICA AND ZAMBIA

NATIONAL STRATEGIC ACTION PLANS FOR CWR CONSERVATION AND SUSTAINABLE USE



CWR CONSERVATION PLANNING

CWR CHECKLIST

CWR CHECKLIST RESULTS

MAURITIUS

Global crops, endemic taxa with cultivated species.

Human food, forestry, medicinal, ornamental crops + wild harvested plants.

Only native.

527 taxa (Mauritius) (75% of flora)

142 taxa (Rodrigues) (96.2% of flora)

SOUTH AFRICA

Global crops, minor crops potentially important for South Africa and regionally.

Human food (incl. beverages), fodder crops.

1609 taxa

ZAMBIA

Global approach (global crops).

National approach (national crops) – 59 crops' prioritization.

Cereal, food legumes, vegetable, root and tuber, oil, fibre, pasture and forage and green manure national (native and introduced) crops.

Only native.

3671 and 464 taxa

CWR CONSERVATION PLANNING

PRIORITIZATION CRITERIA

MAURITIUS

Economic value (10 year average production value at national, regional, global levels)

Utilization potential for crop improvement

Relative distribution

Occurrence status

IUCN Red List categories

SOUTH AFRICA

Economic value (10 year average production value in SADC)

Socio-economic value (average annual contribution to dietary energy per capita per day for Africa + globally important crops for food security)

Utilization potential for crop improvement

Relative distribution

Occurrence status

IUCN Red List + national categories

ZAMBIA

Crop use category

Utilization potential for crop improvement

Relative distribution

IUCN Red List categories

CWR CONSERVATION PLANNING PRIORITIZATION

PRIORITIZATION METHOD

PRIORITY CWR

PRIORITY CWR RELATED CROPS

MAURITIUS

CWR related to food crops prioritized.

Scoring and sum of scores used to further prioritize CWR related to food crops.

Top 10 in each Mauritius and Rodrigues.

13 in Mauritius
9 in Rodrigues

MAURITIUS: coffee (*Coffea*), olive (*Olea*), fig (*Ficus*), Indian olive (*Elaeocarpus*), fonio (*Digitaria*), palm, (*Dictyosperma*, *Acantophoenix*)

RODRIGUES: *Aloe*, *Asparagus*, fig (*Ficus*), fonio (*Digitaria*), olive (*Olea*), sweet potato (*Ipomoea*)

SOUTH AFRICA

Scoring and sum of scores.

Score ≥ 11 (out of 26)
+ all GP1-GP3 taxa that didn't score ≥ 11

292 taxa

Cucumber/gherkin and melon (*Cucumis*), eggplant (*Solanum*), millets (*Digitaria*, *Echinochloa*, *Eleusine*, *Panicum*, *Paspalum*, *Setaria*), rooibos tea (*Aspalathus*), sweet potato (*Ipomoea*), yam (*Dioscorea*), etc

ZAMBIA

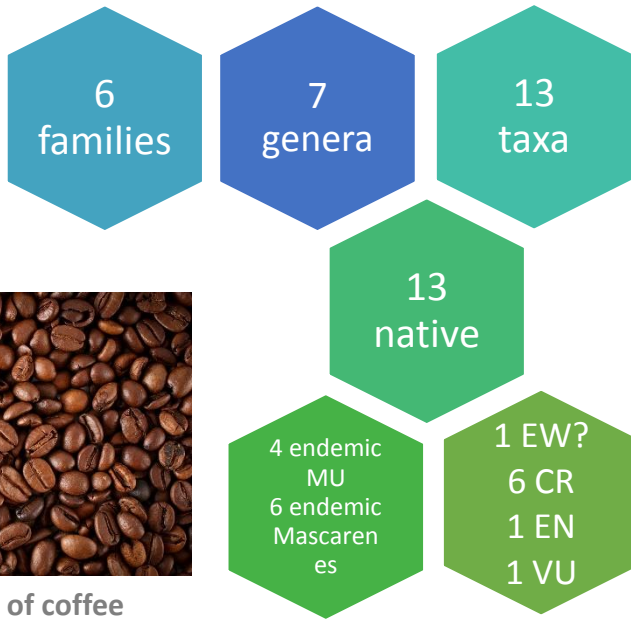
Scoring and sum of scores.

CWR grouped according to range of scores (high, medium, low)

32 taxa

Cowpea (*Vigna*), cucumber/melon (*Cucumis*), eggplant (*Solanum*), millets (*Eleusine*, *Pennisetum*), rice (*Oryza*), *Sorghum*, sweet potato (*Ipomoea*), yam (*Dioscorea*)

PRIORITY CWR MAURITIUS



3 CWR of coffee

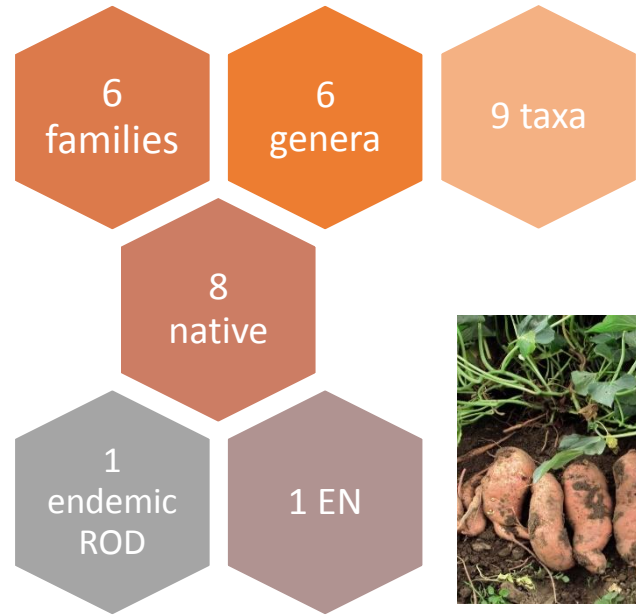


2 CWR of Indian olive



2 CWR of fig

RODRIGUES



2 CWR of sweet potato



2 CWR of fonio

PRIORITY CWR SOUTH AFRICA



49 CWR of sweet potato

15
families

33
genera

292
taxa



32 CWR of millets

253
native

93
endemi
c to ZA

25 CR
26 EN
16 VU



41 CWR of rooibos tea



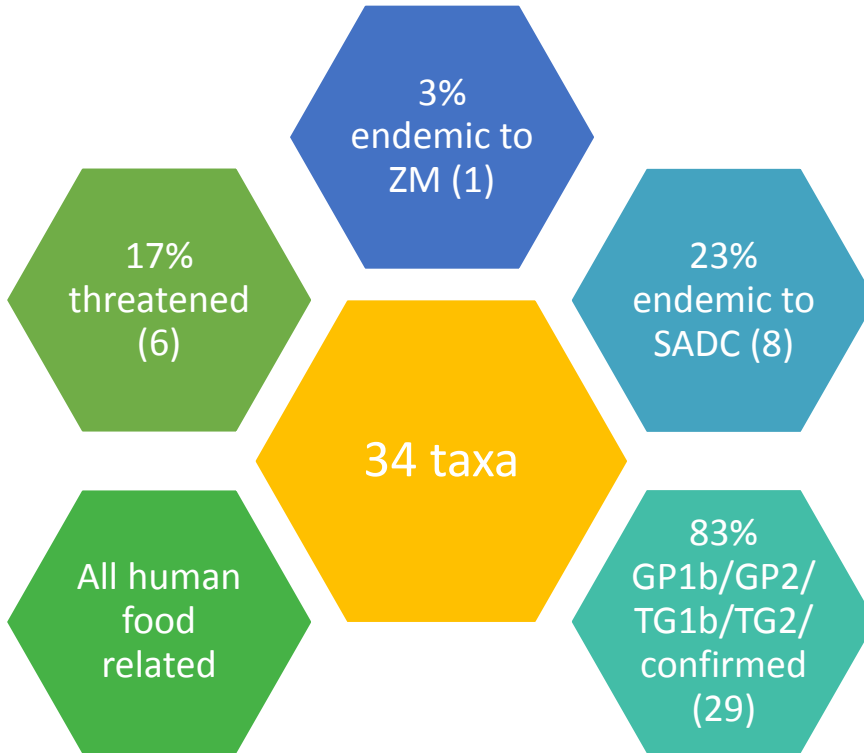
48 CWR of eggplant

PRIORITY CWR

ZAMBIA



9 CWR of cowpea



5 CWR of yam



5 CWR of rice



7 CWR of cucumber/melon

CWR CONSERVATION PLANNING

OCCURRENCE
DATA

DIVERSITY
ANALYSIS

MAURITIUS

7 sources
MU: 118 populations (12
priority CWR)
ROD: 84 populations (10
priority CWR)

Species distribution
Richness
Complementarity
analysis
% o populations
within PAs

SOUTH AFRICA

3 sources
Ongoing

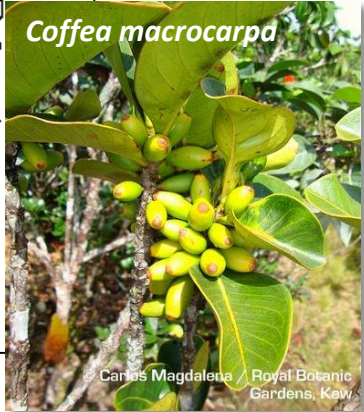
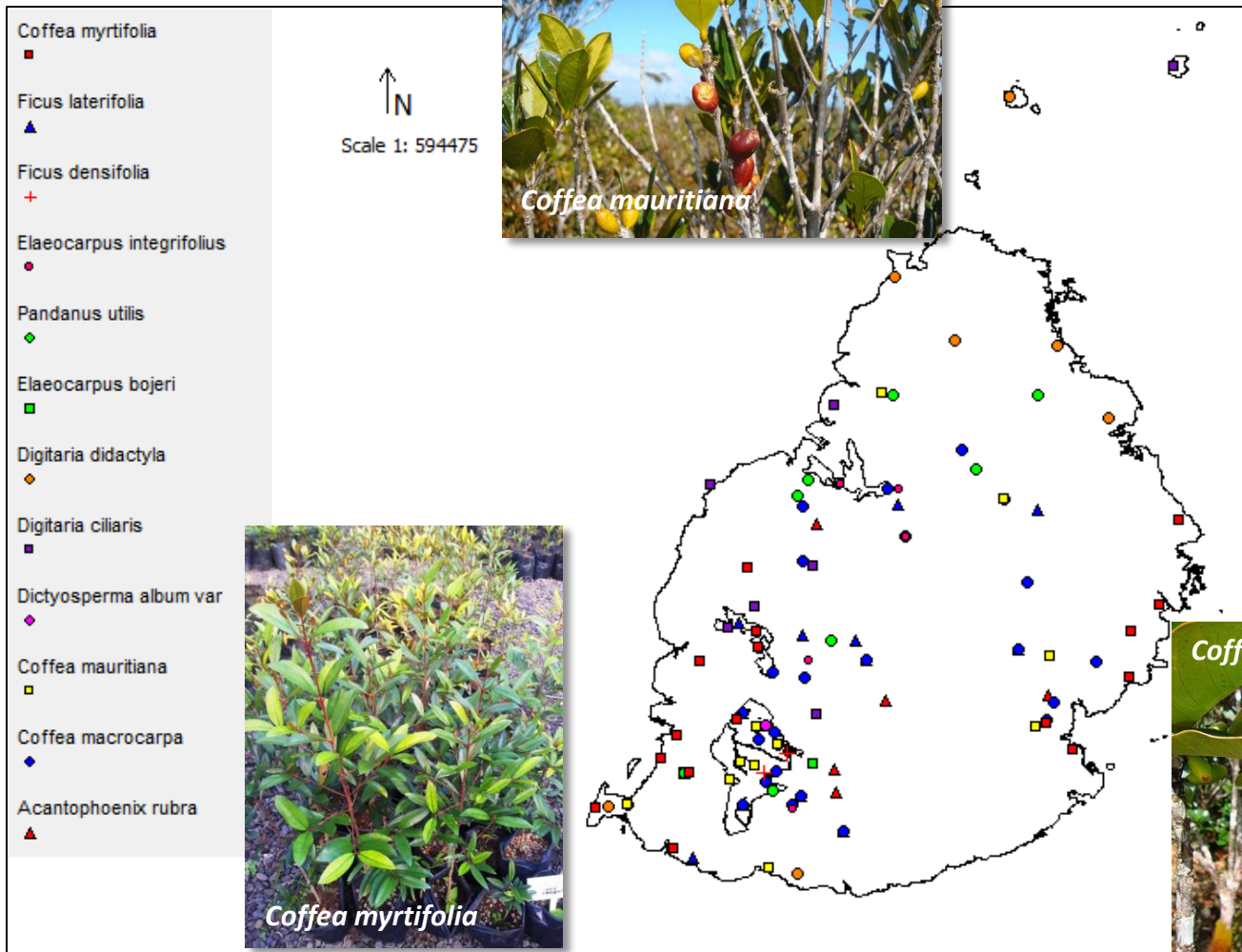
Systematic conservation
planning
In situ gap analysis
Identification of genetic
reserves that conserves
both both species and
ecogeographic diversity
and takes into
consideration climate
change
Ex situ gap analysis

ZAMBIA

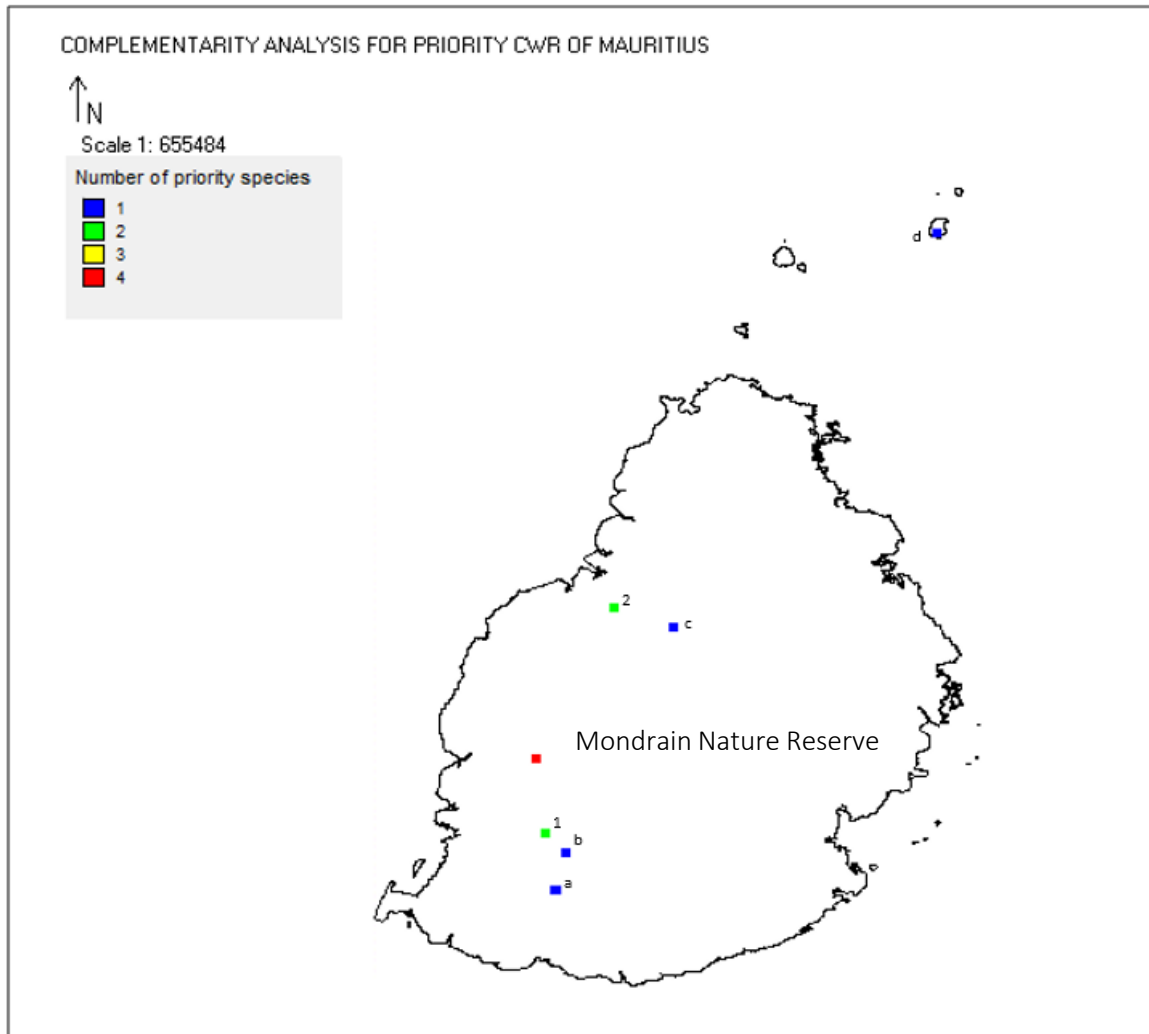
??? Sources
590 populations (21
priority CWR)

Species distribution
Richness
Complementarity
analysis
In situ gap analysis
Ex situ gap analysis

CWR DIVERSITY ANALYSIS MAURITIUS



CWR DIVERSITY ANALYSIS MAURITIUS

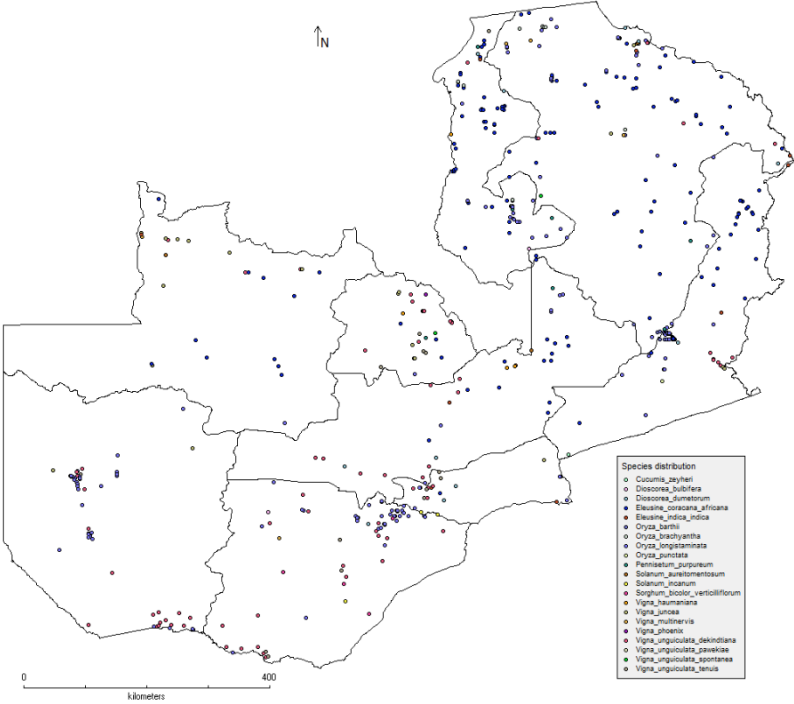


- 12 priority CWR occur within existing PAs – genetic reserves
- Need to identify additional site for 1 priority CWR (outside PAs)

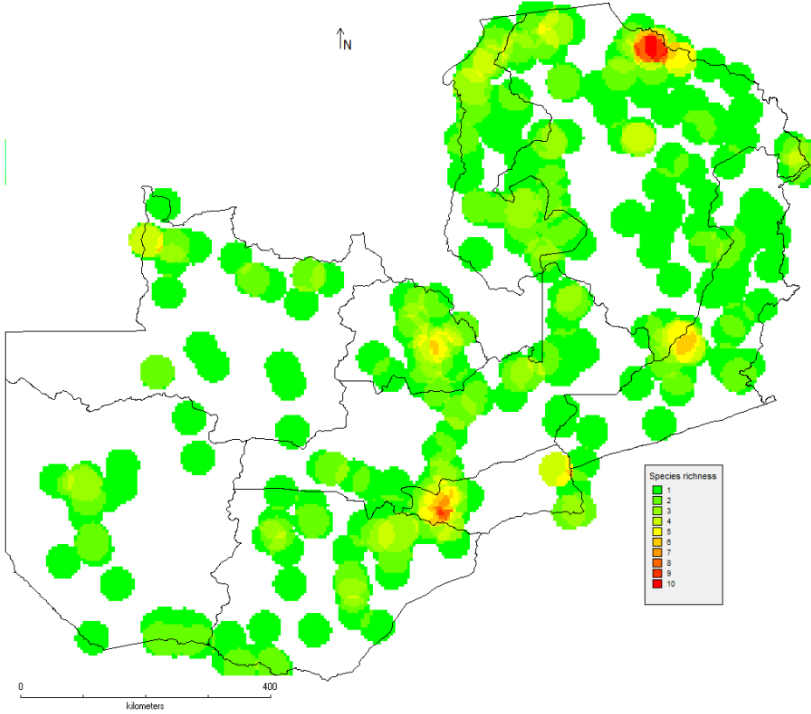
CWR DIVERSITY ANALYSIS

ZAMBIA

Taxa distribution



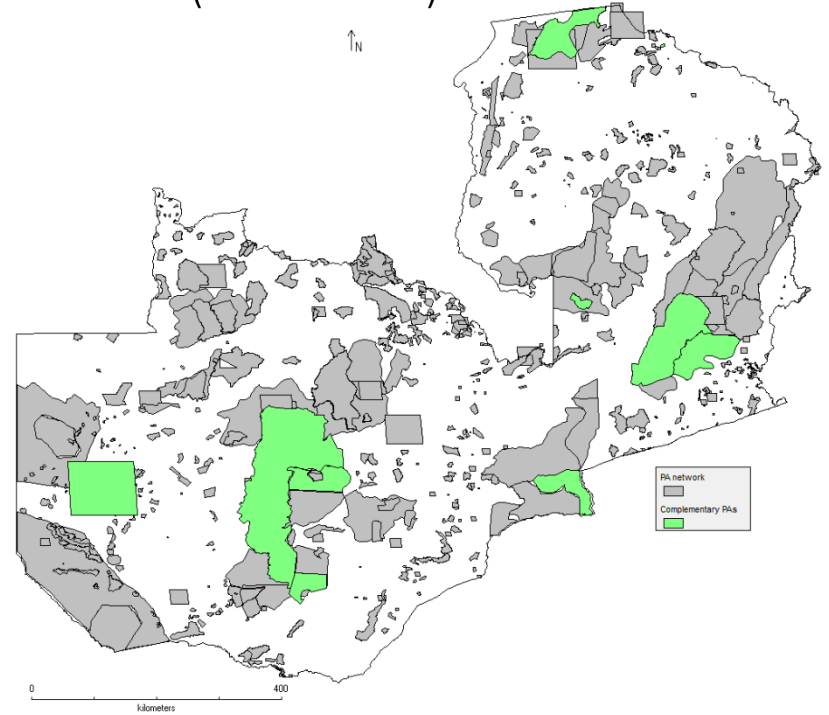
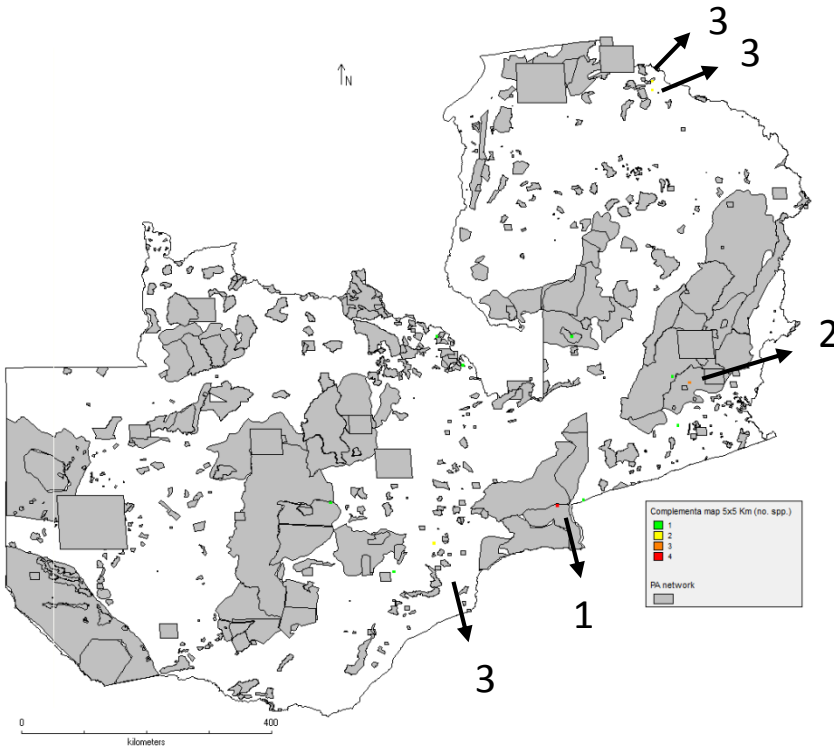
Observed taxa richness



CWR DIVERSITY ANALYSIS ZAMBIA

- 13 5x5 Km grids - 21 CWR

- 10 PAs - 18 CWR
- Need to identify additional sites for 3 priority CWR (outside PAs)



PREDICTIVE CHARACTERIZATION

MAURITIUS



COFFEE

- Drought tolerance
- Low caffeine content
- Resistance to pests and diseases

SOUTH AFRICA



COWPEA

- ???

ZAMBIA



RICE

- Flood tolerance
- Drought tolerance

CAPFITOGEN TOOLS (<http://www.capfitogen.net>)

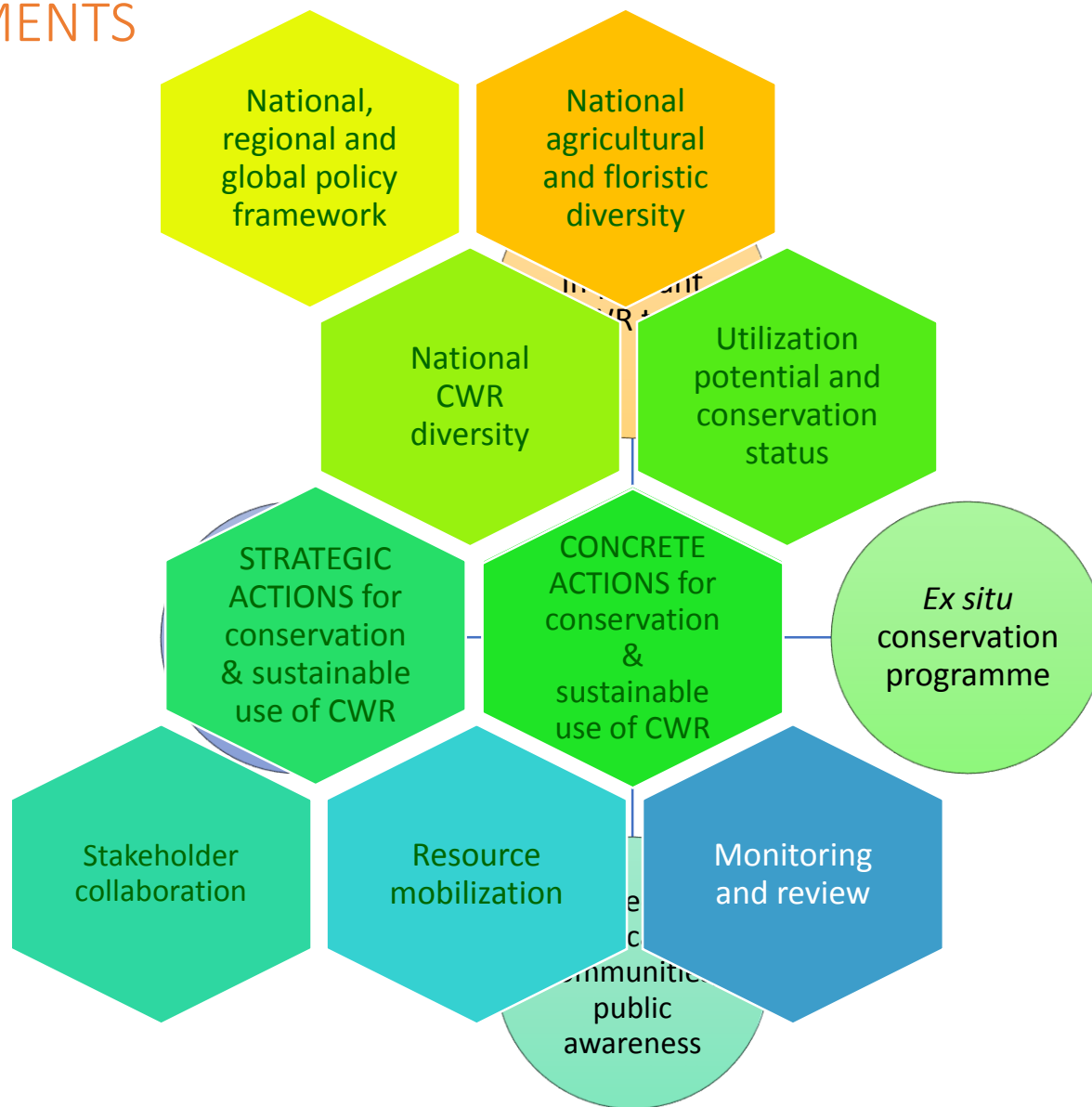
Select populations of target CWR with target traits – pre-breeding

NATIONAL STRATEGIC ACTION PLANS FOR CWR CONSERVATION AND SUSTAINABLE USE

- Raise awareness of the value of national CWR diversity for food and economic security, particularly for adapting crops to the impacts of climate change
- Define the specific actions and resources required to effectively conserve and sustainably utilize national CWR diversity
- Provide a framework and roadmap for long-term conservation and sustainable use of CWR
- Contribute to regional and global efforts in CWR conservation and sustainable use

NATIONAL STRATEGIC ACTION PLANS FOR CWR CONSERVATION AND SUSTAINABLE USE

ELEMENTS



NATIONAL STRATEGIC ACTION PLANS FOR CWR CONSERVATION AND SUSTAINABLE USE IMPLEMENTATION

Strategic actions

- Policy interventions to enable concrete actions
- Provide the enabling conditions and necessary incentives to achieve NSAP objectives

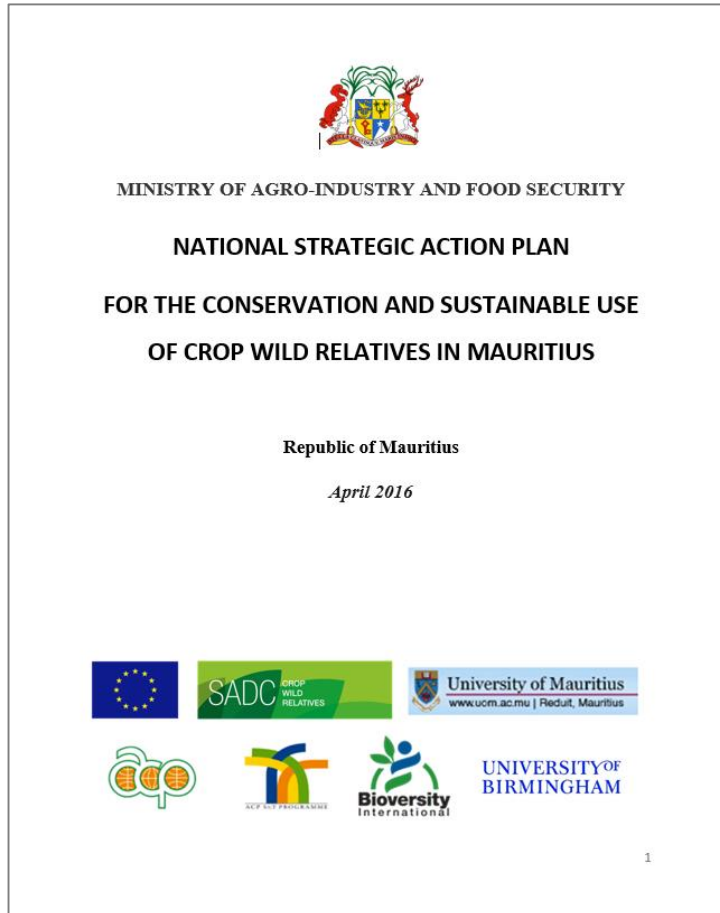


NATIONAL STRATEGIC ACTION PLANS FOR CWR CONSERVATION AND SUSTAINABLE USE IMPLEMENTATION

Enabling environment

- Review existing policy
- Integrate CWR conservation into existing national, regional and global conservation and sustainable use initiatives
- Define lead agencies and stakeholder responsibilities
- Identify capacity building needs
- Develop communication strategy
- Sustainability: endorsement, financial support, stakeholder commitment

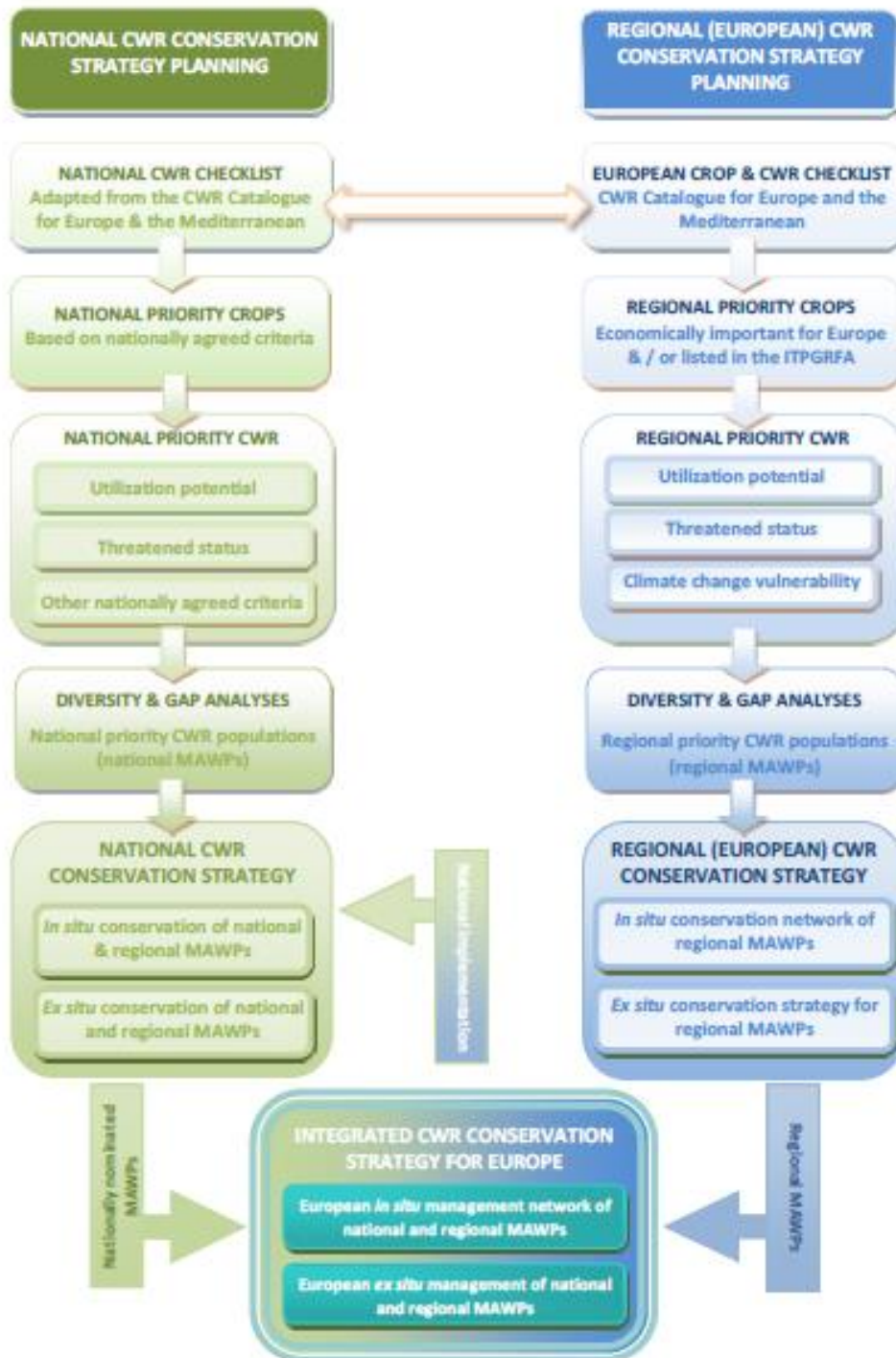
NATIONAL STRATEGIC ACTION PLANS FOR CWR CONSERVATION AND SUSTAINABLE USE MAURITIUS



- Involvement of the Deputy Permanent Secretary from the beginning
- National stakeholders' workshops in Mauritius and Rodrigues
- NSAP to be adopted by the Ministry of Agroindustry
- Extension of existing network of PAs (based on CWR conservation planning)

CWR DIVERSITY ANALYSIS

SADC REGION



TWO CORE LEVELS OF CONSERVATION PLANNING

Maxted *et al.* 2015

[http://www.ecpgr.cgiar.org/fileadmin/templates/ecpgr.org/upload/WG_UPLOADS_PHASE_IX/WILD_SPECIES/Concept for in situ conservation of CWR in Europe.pdf](http://www.ecpgr.cgiar.org/fileadmin/templates/ecpgr.org/upload/WG_UPLOADS_PHASE_IX/WILD_SPECIES/Concept_for_in_situ_conservation_of_CWR_in_Europe.pdf)

CWR DIVERSITY ANALYSIS IN THE SADC REGION

Develop of food and beverage CWR checklist for the SADC region



Prioritize of CWR for conservation action



Identify hotspots and priority sites for *in situ* conservation and *ex situ* collection (diversity analysis)



Develop SADC CWR conservation strategy planning and integration of NSAP from 3 countries

CWR DIVERSITY ANALYSIS IN THE SADC REGION

DEVELOPMENT OF CWR PARTIAL CHECKLIST - DATA SOURCES

- Harlan and de Wet Inventory [cwrdiversity.org – Vincent *et al.* 2013]
- GRIN Taxonomy for Plants [www.ars-grin.gov/cgi-bin/npgs/html/index.pl – USDA Agricultural Research Service]
- SPGRC species lists, including taxa in the base collection
- FAOSTAT [<http://faostat3.fao.org/home/E>]
- Various other online resources



CWR DIVERSITY ANALYSIS IN THE SADC REGION

DEVELOPMENT OF CWR PARTIAL CHECKLIST - DATA SOURCES

- The SADC region contains a wealth of CWR diversity with > 1900 spp.
- Food and beverage crops with native CWR diversity in the region include **rice, millet, eggplant, cucurbits (cucumber, gherkin, melon), sorghum, sugarcane, sweet potato, pulses (eg, cowpea, pigeon pea, sword bean), sesame seed, coffee, lettuce, watermelon, okra and asparagus**
- Many other crops of socio-economic importance have wild relatives in the region, including several **minor food crops and species related to non-food crops** (e.g. herbs, spices, environmental, industrial, ornamental, medicinal, forestry)



CWR DIVERSITY ANALYSIS IN THE SADC REGION

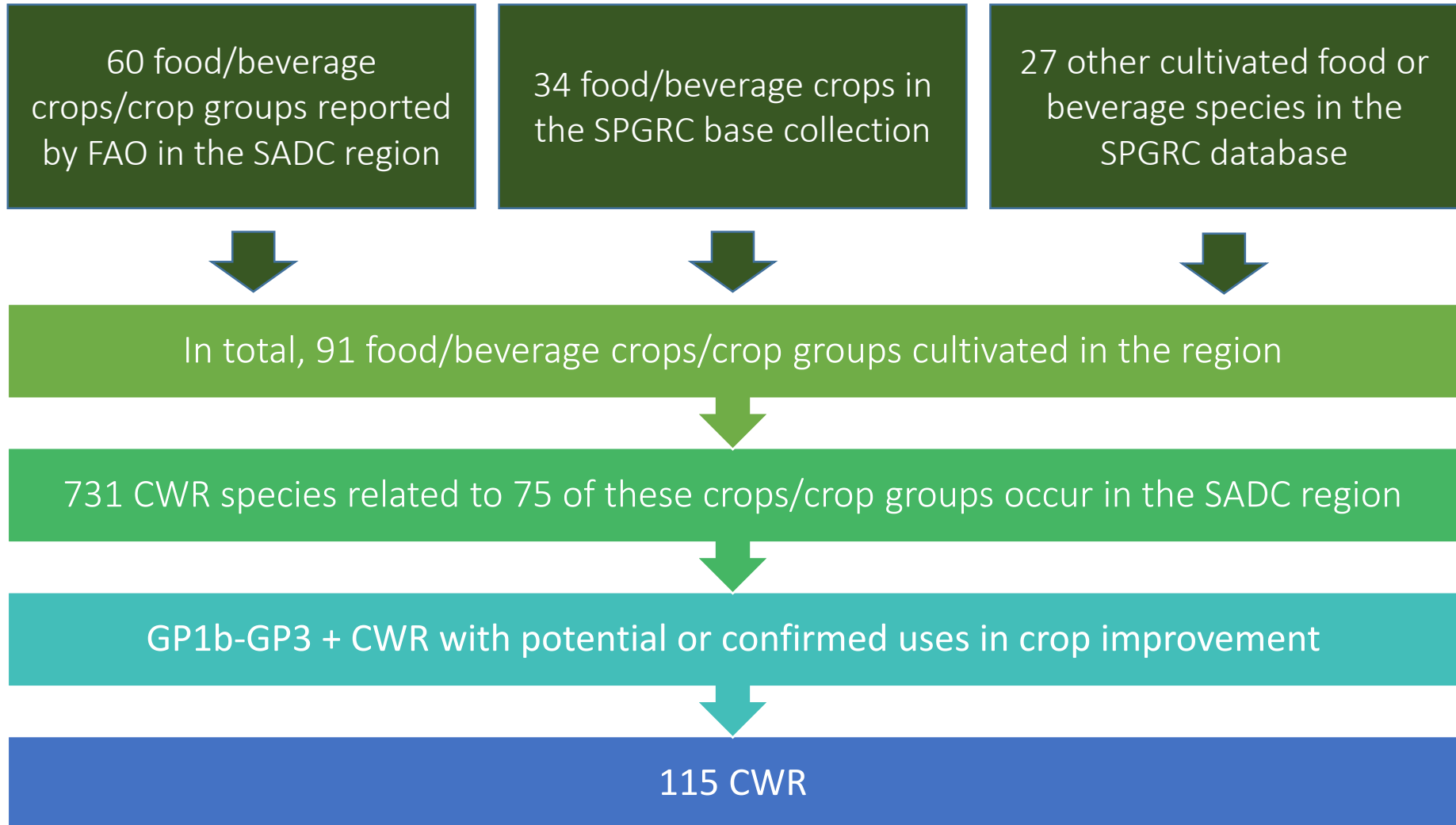
PRIORITIZATION OF CWR FOR REGIONAL CONSERVATION ACTION



- More than 1900 CWR species occur in the region
- Which species are the highest priorities for conservation action?
 - Species related to crops important for food and economic security
 - Species with greatest potential for utilization in crop improvement programmes

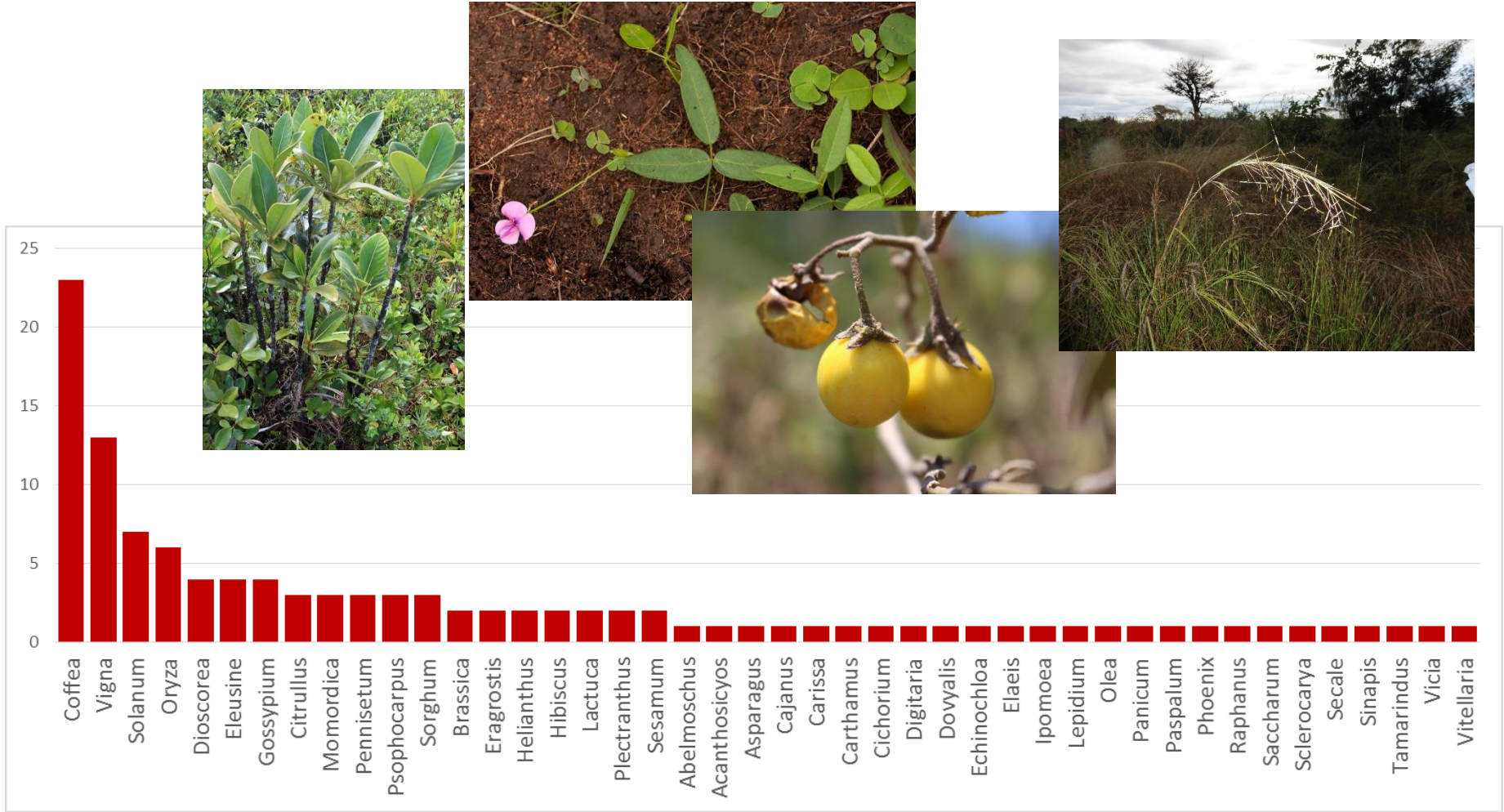
CWR DIVERSITY ANALYSIS IN THE SADC REGION

PRIORITIZATION OF CWR FOR REGIONAL CONSERVATION ACTION



CWR DIVERSITY ANALYSIS IN THE SADC REGION

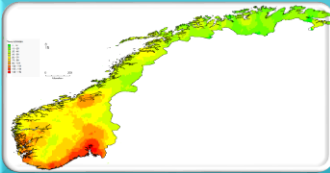
PRIORITY CWR FOR REGIONAL CONSERVATION ACTION



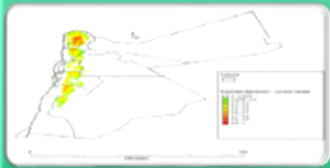
CWR DIVERSITY ANALYSIS IN THE SADC REGION



Diversity analysis (complementarity, ecogeographic, combination of both)



In situ and *ex situ* gap analyses



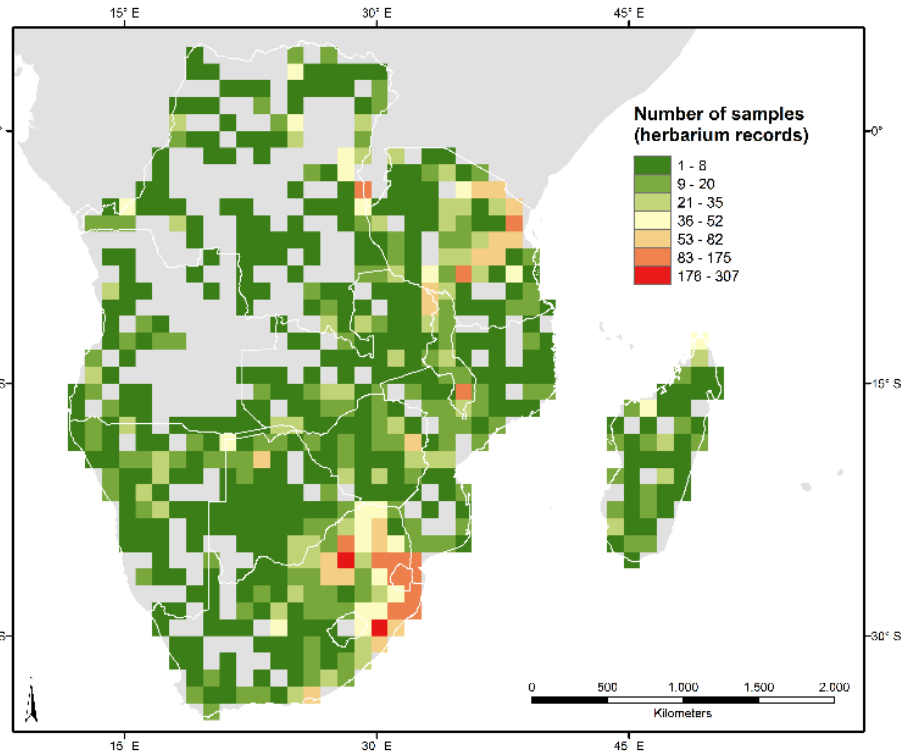
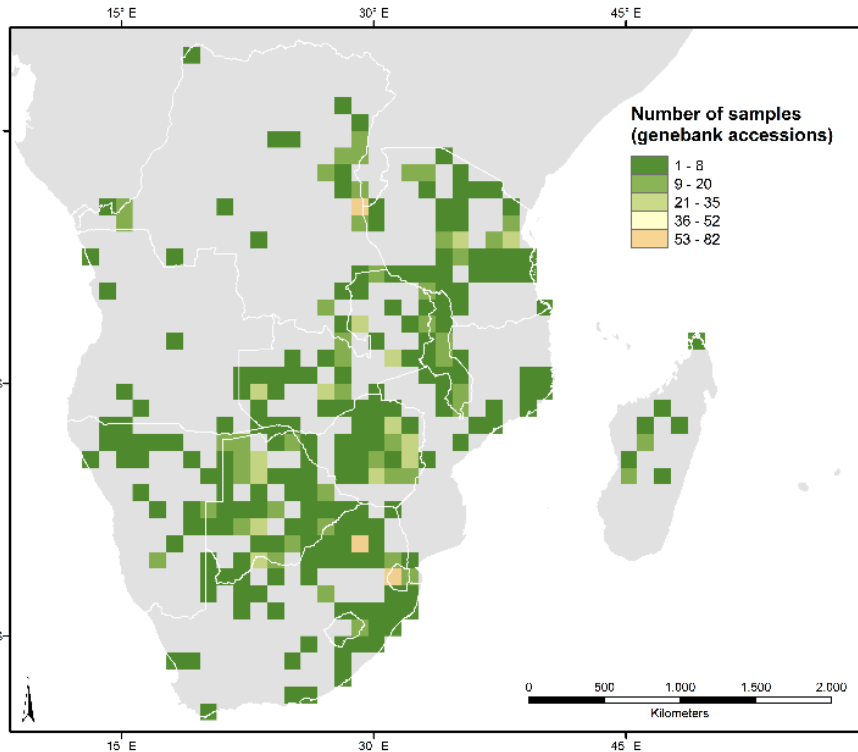
Climate change analysis



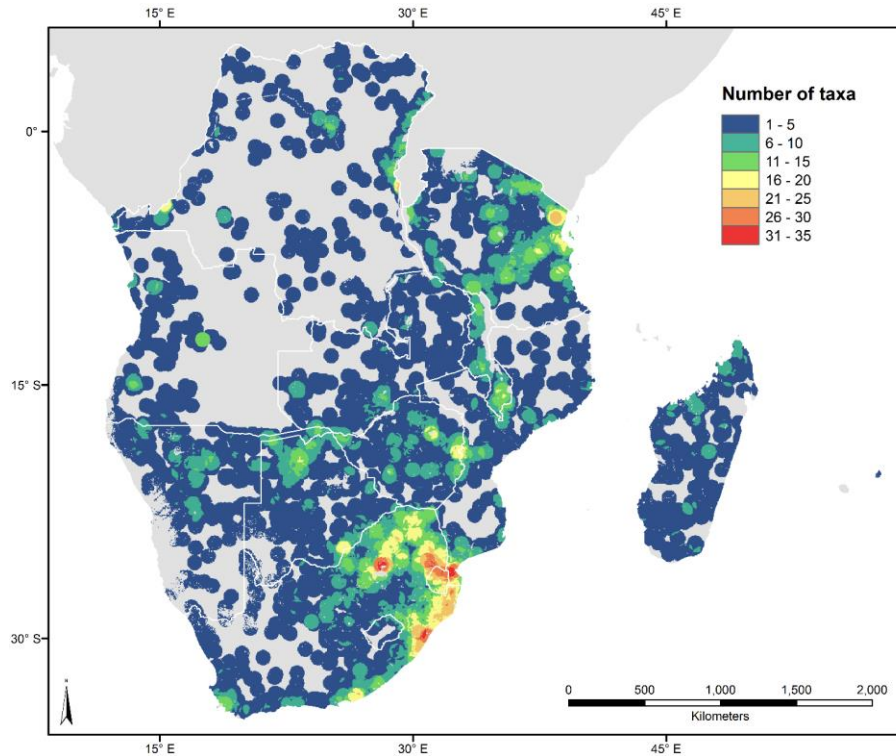
Conservation recommendations

CWR DIVERSITY ANALYSIS IN THE SADC REGION

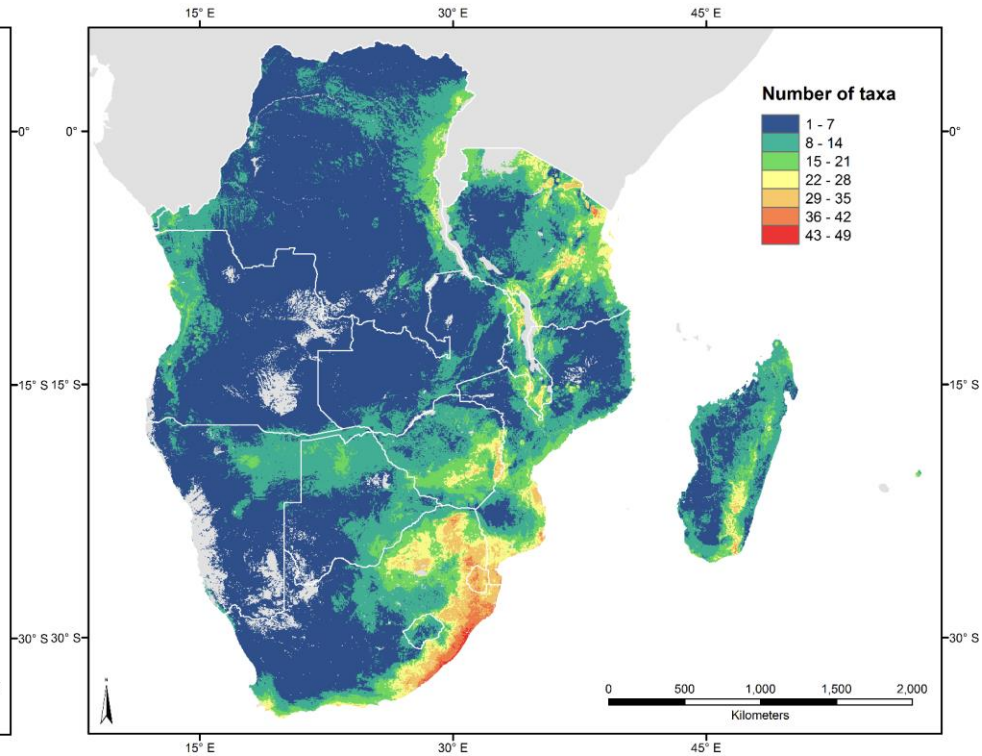
Total of 13076 georeferenced and good quality records (GEOQUAL tool, CAPFITOGEN)



CWR DIVERSITY ANALYSIS IN THE SADC REGION



Observed taxon richness [circular buffer of 50 km (CA50) around each occurrence point for all priority CWR]



Predicted taxon richness [estimated by potential distribution models (for 77 taxa) combined with CA50 (for 36 taxa)]

TO FINALIZE...

KEY OUTPUTS

- Capacity of over 50 participants from SADC Member States in *in situ* conservation and use of CWR has been strengthened.
- Templates (checklis and inventory, occurrence data collation, NSAP and technical background document) will be published.
- An interactive toolkit for conservation of CWR will be made available online.
- CWR checklists and inventories in each of the three partner countries have been developed.
- Hotspots of priority CWR sites have been identified in each country and in the SADC region for active in situ conservation and ex situ collections, based on diversity analyses.
- National Strategic Actions plans (NSAP) for CWR conservation and use in Mauritius, South Africa and Zambia will be developed and implemented.
- The foundations of a SADC Strategic Action Plan for the conservation of priority CWR will be established.

CWR conservation in the SADC region

Thank you!

Plant Genetic Resources: Our challenges, our food, our future

2 June 2016, University of Birmingham



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