



Project MGU – The Useful Plants Project
Review Workshop Report
22-24 July 2014

**Compiled by Tiziana Ulian, Alex Hudson,
Efisio Mattana & Paulina Hechenleitner**



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Royal Botanic Gardens, Kew
Richmond,
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Table of Contents

List of Acronyms and Abbreviations	v
<hr/>	
1 Plant conservation for the benefit of local communities: The MGU - Useful Plants Project	1
Annexes – General	11
<hr/>	
2 Project MGU – The Useful Plants Project, Botswana	19
Annexes - Botswana	36
<hr/>	
3 Project MGU – The Useful Plants Project, Kenya	51
Annexes - Kenya	68
<hr/>	
4 Project MGU – The Useful Plants Project, Mali	79
Annexes - Mali	93
<hr/>	
5 Project MGU – The Useful Plants Project, Mexico	105
Annexes - Mexico	123
<hr/>	
6 Project MGU – The Useful Plants Project, South Africa	133
Annexes – South Africa	147
<hr/>	
7 Summary of SWOT (Strengths Weaknesses Opportunities and Threats) analysis	155
<hr/>	
ANNEXES - Project MGU – The Useful Plants Project Review Workshop	
Programme	
Poster	
Presentations	
List of Participants	

List of Acronyms and Abbreviations

AFAAS	African Forum for Agricultural Advisory Services
BCA	Botswana College of Agriculture (Botswana)
BCA PRO	Botswana College of Agriculture Public Relations Office (Botswana)
BIDPA	Botswana Institute for Development Policy Analysis (Botswana)
BIOCHAR	Biological charcoal created from agricultural waste by pyrolysis for various uses including as a soil amendment
BRAHMS	Botanical Research and Herbarium Management System
CCARDESA	Center for Coordination of Agricultural Research and Development for Southern Africa
CNRA	<i>Conseil National de la Recherche Agricole</i>
DEA	Department of Environmental Affairs (Botswana)
DFRR	Department of Forestry and Range Resources (Botswana)
DMT	<i>Département de la Médecine Traditionnelle</i> (Mali)
DWAF	Department of Water Affairs (South Africa)
FCB	Forest Conservation Botswana (Botswana)
FES Iztacala	<i>Facultad de Estudios Superiores Iztacala</i> (Mexico)
GBK	National Genebank of Kenya (Kenya)
ha	hectare
IER	<i>L'Institut d'économie rurale</i> (Mali)
INR	<i>Institut National de Recherche en Santé Publique</i> (Mali)
KARI	Kenya Agricultural Research Institute (Kenya)
KEFRI	Kenya Forestry Research Institute (Kenya)
KFS	Kenya Forest Service (Kenya)
KzN	Kwazulu-Natal (South Africa)
LNBG	Lowveld National Botanical Garden (South Africa)
LTPA	Limpopo Tourism Parks Agency (South Africa)
MDG	Millennium Development Goals
MoESD	Ministry of Education and Skills Development (Botswana)
MoU	Memorandum of Understanding
MTPA	Mpumalanga Tourism & Parks Agency (South Africa)
MSB	Millennium Seed Bank
MSBP	Millennium Seed Bank Partnership
MSBP2	Millennium Seed Bank Project-second phase (2010-2020)
NFTRC	National Food Technology Research Centre (Botswana)
NGO	Non-Governmental Organisation
NMK	National Museums of Kenya (Kenya)
NPGC	National Plant Genetic Resources Center (Botswana)
NTSC	National Tree Seed Centre (Botswana)
ORD	Office of Research and Development (Botswana)
ORI	Okavango Research Institute (Botswana)
PGR	Plant Genetic Resource
PMG	Project Managements Group
PSG	Plant Specialist Group (South Africa)
PSLE	Primary School Leaving Examination

PTA	Parent Teachers Association
RBG Kew	Royal Botanic Gardens, Kew
SANBI	South African National Biodiversity Institute (South Africa)
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SEMARNAT	<i>Secretaría de Medio Ambiente Y Recursos Naturales</i> (Mexico)
SfLP	Seeds for Life Project
Sida	Swedish International Development Cooperation Agency
SLU	Swedish University of Agricultural Sciences
sp.	species
TK	Traditional Knowledge
UK	United Kingdom
UMA	<i>Unidad de Manejo Ambiental</i> (Mexico)
UNAM	<i>Universidad Nacional Autónoma de México</i> (Mexico)
UOB	University of Botswana (Botswana)
UBIPRO	<i>Unidad de Biotecnología y Prototipos</i> (Mexico)
UPP	Useful Plants Project
UPP1	Useful Plants Project-first phase (June 2007-Nov. 2010)
UPP2	Useful Plants Project-second phase (June 2011-May 2014)
UPS	Useful Plant Species
VPR&D	Veld Products Research and Development (Botswana)

1 **Plant conservation for the benefit of local communities: The MGU - Useful Plants Project**

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“Botanists of the 21st Century: roles, challenges and opportunities”)

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Abstract

The Millennium Seed Bank Partnership (MSBP) of the Royal Botanic Gardens, Kew, works with rural communities in Botswana, Kenya, Mali, Mexico and South Africa through the MGU - Useful Plants Project, with the aim of strengthening the capacity of local people to successfully conserve and use sustainably indigenous plants most important to them. To date, the project has acquired a reservoir of knowledge on over 1,480 plants that are important to human well being and has contributed to the long term conservation of almost half of these species by securing them in seed banks in the country of origin and duplicating them in the Millennium Seed Bank in the UK. Seeds and seedlings of over 170 species have been made available to the local communities for propagation and planting activities and a number of selected species were promoted as plant products to support revenue generation and for cultural services. Research is carried out to tackle knowledge gaps which limit plant conservation and people's livelihoods, with contributions from a wide range of experts, including botanists,

horticulturists, agronomists and foresters, and by working with nongovernmental organizations for the benefit of local communities. The MGU - Useful Plants Project is supporting local biodiversity conservation of useful plants selected and exploited by communities for their importance as sources of food, feed and for health on improving livelihoods. Training and education through the project are strengthening of the capacity of local people to face changing environmental challenges through the conservation and sustainable use of indigenous plant species. The success of this project stems from the participative approach involving local communities who select, prioritise and propagate important indigenous species, that is combined with the science support underpins by plant and seed research on these species. This could be a significant model for succeeding biodiversity conservation at local level, integrated with activities to improve human well being.

Keywords: Useful plants, Local communities, Research, Conservation, Livelihoods.

Résumé

Le Millennium Seed Bank Partnership (MSBP) du Royal Botanic Gardens, Kew, travaille avec les communautés rurales du Botswana, Kenya, Mali, Mexique et Afrique du Sud par le « MGU - Useful Plants Project », dans le but de renforcer la capacité des populations locales à conserver avec succès et utiliser durablement les plantes indigènes les plus importants pour eux. Le projet a acquis un réservoir de connaissances sur plus de 1480 plantes qui sont importantes pour le bien-être et a contribué à la conservation à long terme de plus de la moitié de ces espèces dans des banques de semences dans le pays d'origine et de les dupliquer dans la Millennium Seed Bank au Royaume-Uni. Semences et plants de près de la moitié de 170 espèces ont été mis à la disposition des collectivités locales pour la propagation et les activités de plantation et produits végétaux d'un certain nombre d'espèces sélectionnées ont été promus pour soutenir la génération de revenus, et les services culturels. La recherche est effectuée à combler les lacunes de connaissances qui limitent la conservation des plantes et des moyens de subsistance, avec les contributions d'un large éventail d'experts comme botanistes, horticulteurs, agronomes et forestiers, et en travaillant avec des organisations non gouvernementales au profit des communautés locales. Le « MGU - Useful Plants Project » soutient la conservation de la biodiversité locale des plantes utiles choisis et exploités par les communautés pour leur importance comme source de nourriture, alimentation et santé, en améliorer leurs moyens de subsistance. Formation et éducation par le projet ont été le renforcement de la capacité des

populations locales à faire face à l'évolution des problèmes environnementaux par la conservation et l'utilisation durable d'espèces végétales indigènes. Le succès de ce projet découle de l'approche participative avec les communautés locales qui select, priorise et propagent espèces indigènes importantes, combinée avec le soutien de la science par la recherche de plantes and graines de ces espèces. Ceci pourrait être un modèle important pour assurer la conservation de la biodiversité au niveau local, intégrée avec des activités pour améliorer le bien-être communautés locales.

Mots-clés: Plantes Utiles, Communautés locales, Recherche, Conservation, Subsistance.

Introduction

It is widely accepted that biodiversity loss and poverty are intricately linked problems such that conservation and poverty reduction should be tackled together (Adams et al., 2004). *In situ* conservation measures, such as the protection and restoration of natural habitats, are the best methods of preserving plant diversity (CBD 2002). However, *ex situ* conservation provides an alternative way to prevent immediate extinctions. One of the most effective ways to conserve plant diversity *ex situ* is storage in seed banks, which allows the preservation of large amounts of genetic material in a small space and with minimum risk of genetic damage (Iriando & Pérez 1999). These two conservation approaches should be viewed as complementary rather than alternative. However, there are economic drivers working against *in situ* conservation, with the costs for *ex situ* conservation being estimated as little as 1% of those needed for *in situ*, although *ex situ* conservation must address some technical challenges (Li & Pritchard 2009).

Underutilized species are those species whose potential to improve people's livelihoods is not being fully realized because of their limited competitiveness with crops in mainstream agriculture. However, they are of significant importance locally, being highly adapted to their environments and contributing significantly to diversification of agro-eco-systems. Underutilised species include not just food plants but also many other species used as sources of oil, fuel, fibre, fodder, beverages, stimulants, narcotics, ornamentals, aromatic compounds, and medicines (Padulosi et al., 2011). However, there is a poor representation of underutilised crops in *ex situ* gene banks' collections (Padulosi et al., 2002). The work of the Royal Botanic Gardens Kew, has been contributing to the conservation of important useful plants through the Millennium Seed Bank Partnership (Way et al., 2010), which has already banked seed from 14% of the world's plant species and is aiming to achieve 25% by 2020 (Griffiths et al., 2014).

“Pro-poor” conservation, detailed by Adams et al. (2004), can be used to address the dual goals of biodiversity conservation and poverty reduction (Davies et al., 2014). This is based on the empirical claim that financially poor, and socially and politically marginalized people, depend on living species in biodiverse ecosystems for their livelihoods from the ecosystems services provided, so that their livelihoods can be improved through appropriate conservation activities (Adams et al. 2004).

The MGU - Useful Plants Project (2007 – 2015) uses an applied scientific approach to improve plant conservation and people's livelihoods across local rural communities in Mexico, Botswana, Mali, Kenya and South Africa. The project has brought together staff from the Royal Botanic Gardens, Kew, and a wide range of national scientific institutions, including Kew’s Millennium Seed Bank (MSB) partners, to help local communities tackle the environmental challenges threatening their livelihoods through the conservation and sustainable use of indigenous plant species.

In this paper, the overall results achieved on the different activities of the MGU - Useful Plants Project are presented with a discussion of their contribution to human well being through the enhancement of food security and human health, the improvement of the community livelihoods, and the strengthening of the capacity of local people to face environmental changes.

Materials and Methods

In Mexico, the MGU - Useful Plants Project is led by the Facultad de Estudios Superiores Iztacala from the Universidad Nacional Autónoma de México (UNAM), and activities have been carried out in the communities of Guadalupe Victoria (Pueblo Nuevo), San Rafael and San José Tilapa (Coxcatlán Municipality), in the state of Puebla. In Botswana, the main institutional partner is the Botswana College of Agriculture (BCA) which has mainly focused its work in the communities of Tsetseng (Kweneng West) and Pilikwe (Tswapong region). The Institut d'Economie Rurale (IER) is working in Mali in collaboration with the Département Médecine Traditionnelle (DMT) from the Institut National de Recherche en Santé Publique (INRSP) and nine rural communities of Zégoua, Kougué, Ifola, Yanfolila, Tori, Katélé, Bla, Kokélé and Sesso, in southern Mali. In Kenya, three institutional partners, the National Museums of Kenya (NMK), the Kenya Forestry Research Institute (KEFRI) and the Kenya Agricultural Research Institute (KARI), are working with 15 community groups in Tharaka,

Siaya and Nyamira. In South Africa, SANBI's Lowveld National Botanical Garden is working with 11 community schools in the Mpumalanga province.

To document the ethnobotanical, biological and ecological information of useful plants in the study areas, a literature review (including herbarium specimens) was carried out, together with interviews and workshops in the local communities, with the aim of targeting and prioritizing the most useful plants for the well-being of local communities.

The international standards described for seed collecting, conservation and testing in the framework of the Millennium Seed Bank Partnership of the Royal Botanic Gardens, Kew, (Smith et al., 2003) were applied in order to guarantee long term *ex situ* conservation of the targeted species. In particular, joint field expeditions with national counterparts were carried out for seed collection and seed lots stored both in the national seed banks and duplicated at the Kew's Millennium Seed Bank (MSB) in the UK. Seed viability and germination tests were carried out to verify the quality of the seed lots and to carry out research on the germination requirements of the targeted species.

Plant propagation activities by seed were carried out in country by the institutional partners while seeds and seedlings were transferred to community nurseries following training and the enhancement of local facilities. Plant propagation by cutting was also carried out as a complementary conservation activity, in particular for those species with low seed yields and slow growth.

Joint research was carried out on selected species to support their conservation and sustainable use and by training and supervising technicians, undergraduate and postgraduate students in the framework of the project.

To support *in situ* conservation, community gardens have been established in all countries, while seeds and seedlings have been planted in demonstration woodlots (Kenya), restoration sites (South Africa and Mexico) and sacred forests (Mali).

For the most important indigenous plant species domestication, cultivation and conservation activities have been carried out, as well as marketing, including studies on packaging, presentation, and shelf-life and storage.

Data management and project monitoring has been aided by a dedicated project database elaborated using BRAHMS v. 7 (<http://herbaria.plants.ox.ac.uk/bol/>).

Results

The results obtained from this project have covered 1,480 plant species, which have been selected for their importance to local communities through ethnobotanical surveys, literature reviews and community workshops. 703 seed sample collections of 622 species have been quality tested, banked in country and duplicated at Kew's Millennium Seed Bank in the UK.

Ex situ conservation activities have been enhanced through the propagation of 371 plant species in country and 263 of these have been planted in over 40 local community and school gardens by involving more than 6,000 farmers and students after receiving technical training. In South Africa, the project promoted the cultivation and sustainable use of medicinal plants in schools in the Mpumalanga province and education activities have been enhanced through the establishment of a medicinal plants section at the Lowveld National Botanical Garden in Nelspruit and by collaborating with the Mpumalanga education department. Protocols to successfully propagate the most important medicinal plant species of the region, by seed and by cuttings, were developed for more than 100 species. These protocols report information on seeds (collecting, processing and seed dormancy loss requirements), germination conditions (soil mixture, light and temperature), containers and transplanting techniques.

In order to support the *in situ* conservation of species 67,862 seedlings of 263 species have been grown in communities gardens and 16 plant species have been planted and are monitored in demonstration woodlots, restoration plots and sacred forests. In Mali, based on communities' requirements, 5 ha of demonstration farmer-school arboreta were planted with 45 species important for medicine, food and craft wood, and four sacred forests were restored and reinforced by planting 12 species.

Research and education activities support the conservation and sustainable use of plants and 289 species have been studied for ethnobotany, ecology, physiology, seed biology and biochemistry and phytochemistry with over 27 students supervised. In Mexico, several research activities have been carried out and the results published in scientific papers and academic theses. For example, investigations were completed on the differences in hexanic extract composition of two populations of *Lippia graveolens* Kunth growing in contrasting ecological conditions (Hernández et al., 2009) and the effects of *ex situ* cultivation on the medicinal properties of this species (Moreno Rodriguez et al., 2014).

To support local livelihoods, 37 plant species were selected to generate income through their sustainable use and commercialisation by local communities. For example, in Botswana, communities are involved in the collection of the edible seeds of *Tylosema esculentum* (Burch.) (Morama bean) which are used for cultivation, consumption, sale and processing into numerous

marketable products. The Tsetseng community, through their community trust, have become leading innovators in marketable morama products (Mogotsi and Ulian, 2013). In Mali, women's groups have been trained in the processing and production of soaps and oil from two important species, *Carapa procera* DC. and *Khaya senegalensis* (Desv.) A.Juss.

Discussion

The MGU - Useful Plants Project has helped to confirm the potential of biodiversity conservation to contribute to human well being through the enhancement of food security and human health and the improvement of the community livelihoods, giving an example of a successful “pro-poor” conservation project.

The project, through its seed conservation activities, has improved the number of underutilised species stored in *ex situ* facilities for long term conservation (which are poorly represented in *ex situ* gene banks' collections; Padulosi et al., 2002) in the country of origin and in the UK, and has supported the use of seeds of native species for propagation and planting purposes in country. This is in accordance with the implementation of the Global Strategy for Plant Conservation and in particular with Objective II (Plant diversity is urgently and effectively conserved), Target 8: “At least 75% of threatened plant species in *ex situ* collections, preferably in the country of origin, and at least 20% available for recovery and restoration programmes” (CBD, 2010). In addition, these collections may be a source of genes for plant breeders interested in identifying potential sources of resistance to drought or other environmental stresses in species originating from areas affected by severe climatic and/or marginal growth conditions (Padulosi et al., 2002).

At the same time, the MGU - Useful Plants Project has helped strengthen the capacity of local people to conserve and use sustainably wild plant species which are important for their well being and better adapted to withstand environmental changes. In Mexico, local communities were trained, mainly through workshops, on propagation techniques and on the uses and potential commercialization of useful plants and plant products. In Botswana, communities' knowledge of conservation and utilization of indigenous plant resources was supplemented with technical training in the modern scientific methods for research, cultivation, value adding, processing, packaging and marketing of products. In Mali, project activities are mainly carried out by women's groups, improving their household conditions. In South Africa, schools are actively involved in the project and the school gardens are appreciated by the whole communities. In Kenya, the project promoted the conservation and sustainable use of

indigenous trees (e.g., *Markhamia lutea* (Benth.) K.Schum. and *Maesopsis eminii* Engl.) versus introduced species (e.g., *Eucalyptus* spp. and *Grevillea robusta* A.Cunn. ex R.Br.) to provide economic and environmental benefits to local communities. Through this project several of the Millennium Development Goals, (MDGs) (UN, 2014) have been addressed, by enhancing the conservation and sustainable use of species which have the potential to eradicate extreme poverty and hunger (1), combat diseases (6) and ensure environmental sustainability (7) and by working in partnership (8) with project partners and communities worldwide through a participatory approach and driven by local people's needs.

The success of this project stems from the participative approach involving local communities who select, prioritise and propagate important indigenous species, that is combined with the science support underpins by plant and seed research on these species. This could be a significant model for succeeding biodiversity conservation at local level, integrated with activities to improve human well being.

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Annexes - General

Annex 1: Project overall logframe

Logframe. Project MGU- the Useful Plants Project (UPP)			
Objectives	Indicators	Means of Verification	Assumptions
Overall Project Goal	Welfare of local communities improved and useful important plants safeguarded from extinction in Latin America and Africa		
	Capacity of local communities in Latin America and Africa to conserve and use sustainably useful plant species enhanced	Dissemination material, workshop documents and facilities in Latin America and Africa for plant conservation and sustainable use enhanced in local communities	
Project Purpose	Conservation and sustainable use of plants for human wellbeing		
	At least 550 seed collections of priority useful plant species made and held to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK	Seed collections registered in the seed banks in country and in Kew's Millennium Seed Bank in the UK	Access agreements and permits are available; all projects partners are committed and provide consistent support to the project; seed conservation is scientifically feasible for the target species
	220 priority useful plant species (137,000 plants) grown in 27 local communities	Propagation documents	Plant propagation is scientifically feasible for the target species;

		Priority useful plant species maintained by the local communities in community/home/school gardens	Community members are engaged and provide time and land for growing and maintaining priority useful plant species in the communities
	Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining.	Long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Tools and infrastructures that enable long term promotion of knowledge and use of plants. Income generation data from useful plant species or their plant products	Policy makers are supportive of the use of traditional knowledge and indigenous useful plants. Sustainable harvesting of useful plants; new partners engaged to support the socio-economic aspects of the project; market for useful plant species available
	Information about useful plant species shared more widely and project promoted at the local, national and international level	Dissemination material and publicity about project	Extra staff are made available in country and at RBG Kew to disseminate material and promote project
Project Outputs			
Output 1: Project planned, monitored and implemented effectively			
	Existing partnerships consolidated and at least 5 new relevant partnerships established and integrated into the project within 6 months (September 2011)	Correspondence and agreements with relevant partners	All agreements are available; all project partners are committed and provide consistent support to the project; funds are available in country without delay from start of project

	Project documents (logframe, budget, management structure and work plan) agreed and finalized per country with partners within 6 months (September 2011)	Correspondence and project documents for each country (logframe, budget, management structure and work plan)	Project successfully integrated into partners' institutional programmes; good communication is maintained with all project partners
	Country reports (mid and annual reports) submitted to RBG Kew and general report submitted to donor every six months	Country reports and general reports; RBG Kew management meeting minutes	
	Project reviewed by the 2nd year of the project	Project workshop and report	
Output 2: Species conserved <i>ex situ</i>			
	Cumulative target list with 1,320 useful species agreed within 6 months (September 2011)	Lists of targeted useful plant species with relevant information (use, distribution, conservation status) updated and incorporated into the 'Useful Plants Project' database	Extra staff are made available in country and at Kew to maintain and update lists of useful plant species and the 'Useful Plants Project' database
		Country Databases/Excel Spreadsheets and 'Useful Plants Project' database updated	
	At least 550 seed collections of priority useful plant populations made and held to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK by the 3rd year of the project	Seed collections registered in the seed banks in country and in Kew's Millennium Seed Bank in the UK	Access agreements and permits are available; all projects partners are committed and provide consistent support to the project; seed conservation is scientifically feasible for the target species
	Quality of 360 seed collections assessed through seed testing (viability, germination, storability) in Kew's MSB by the 3rd year of the project	Data on seed testing (viability, germination, storability)	Extra staff from RBG Kew are made available for seed testing

Output 3: Species propagated and conserved in the communities			
	211 priority useful species propagated with propagation protocols produced	Propagation protocols	Propagation is scientifically feasible for the targeted species; trials are successful
	12 additional communities (to the existing 12 communities) engaged and integrated into the project within 6 months (September 2011)	Workshop documents and agreements with communities	Community members are committed to the project and make available their time and land for project
	290 priority useful species (345,000 seedlings) planted and maintained in 27 local communities	Priority useful plant species maintained by the local communities in community/home/school gardens	Communities are committed to the project and provide time and land for targeted useful plants
	Capacity of local communities to propagate and conserve plants enhanced through training and the improvement of local facilities	Training material and enhanced facilities for plant propagation and conservation	Community members are receptive to training and interested in propagating and conserving useful plant species
	School programme enhanced through the involvement of 39 schools and 3,350 children in the communities	School material (e.g. species portraits, posters) and priority useful plant species maintained in school gardens	School teachers committed and actively involved in the project
<i>In situ</i> conservation	At least 156 priority useful plant species planted <i>in situ</i> (managed areas)	Priority useful plant species planted <i>in situ</i> (managed areas)	Propagation is scientifically feasible for the targeted species; trials are successful; relevant stakeholders are engaged and managed areas are made available for <i>in situ</i> conservation of priority useful plant species

	Research on at least 34 useful plant species to enhance their conservation and sustainable use in the local communities	Monitoring data and scientific material (reports/thesis/papers)	Research is feasible for priority useful plant species; students and extra staff are made available in country and at RBG Kew to research priority useful plant species
Output 4: Sustainable use and income generation from useful plants			
	Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining	Development of long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Development of tools and infrastructures that enable long term promotion of knowledge and use of plants	Policy makers are sympathetic and supportive of the use of traditional knowledge and indigenous useful plants
	Sustainable use and marketing (product, pricing, place) of at least 83 useful plants (seeds/seedlings/part of plants) or their plant products promoted for income generation in 12 communities	Entrepreneurs trained; income generation data from useful plant species or their plant products	Sustainable harvesting of useful plants; new partners engaged to support the socio-economic aspects of the project; market for useful plant species available

Output 5: Information disseminated & project promoted

	<p>Information derived from the first phase of Project MGU compiled, updated, organized and disseminated at the local, national and international level by the end of project</p>	<p>Volume 1 of book on Project MGU published at Kew and further material published in country in collaboration with RBG Kew (e.g. books/manuals; species leaflets, booklets, posters, press and scientific articles)</p>	<p>Extra staff are made available in country and at RBG Kew to disseminate material and promote project</p>
	<p>Project exposure enhanced through the generation of publicity material at the local, national and international level by the end of project</p>	<p>Development of a UPP- specific logo and generation of publicity material (e.g. press articles, project webpage, videos, radio interviews)</p>	

Annex 2: List of dissemination material

Conferences

Paris, France (22-25 September 2014) - International Conference “Botanists of the twenty-first century: Roles, challenges and opportunities”: Ulian, T., Hudson, A. and Mattana, E. Plant conservation for the benefit of local communities: the Useful Plants Project. [oral communication]

Vienna, Austria, May 2014 (2014) - EGU General Assembly: Ulian T., Sacande M., and Mattana E. Conservation and restoration of indigenous plants to improve community livelihoods: the Useful Plants Project. [oral communication]

Merida, Mexico (21-25 August 2011) - 4th World Conference on Ecological Restoration. Re-establishing the link between Nature and Culture: T. Ulian, M. Sacande and P. Smith. Seed collections helping local communities to conserve and cultivate useful native plants. [oral communication]

Santa Clara, Cuba. 13-29 September 2010 - III Simposio Internacional sobre Restauración Ecológica: Ulian, T., Smith, P., Way, M. - Kew's Millennium Seed Bank partnership -Use of seed collections to restore habitats and improve livelihoods worldwide. [oral communication]

Milano, Italy (25-28 August 2010) - 105° Congresso Società Botanica Italiana: Ulian, T., Way, M. And Smith, T.-Use of seed collections to restore habitats and improve livelihoods worldwide. [oral communication]

Scientific articles

CHRISTENSEN, C., RICO ARCE, L., SEAL, C., CHALLEN, G, MONRO, A., ULIAN, T., CUEVAS SÁNCHEZ, J., CASTILLO, Y., CERVANTES MAYA, H., ANDREASEN, C., PRITCHARD, H. and LAIDLAY, R. Threatened status of neglected and underutilised *Jatropha* sp. endemic to Mexico. *In preparation*.

ULIAN T., SACANDE M. and MATTANA E. May 2014. Conservation and restoration of indigenous plants to improve community livelihoods: the Useful Plants Project. EGU General Assembly, Geophysical Research Abstracts, Vienna, Austria.

Ulian T. 2014. Project MGU: The Useful Plants Project at the Millennium Seed Bank (MSB). Pp 118 in J. Salick, K. Konchar, M. Nesbitt (eds). *Curating Biocultural Collections: A Handbook* ed., Kew Publishing Richmond.

Popular articles

- ULIAN, T. and HUDSON A. 2014. Conservation and sustainable use of indigenous plants for the benefit of local communities. *Trees: journal of the International Tree Foundation*, 71:22-23. (On line publication: <http://internationaltreefoundation.org/wp-content/uploads/2014/09/trees-24pp-2014-low-res.pdf>)
- MAMATSHARAGA, A. HUDSON, A. and ULIAN, T. June 2014. The Useful Plant Project in South Africa. *Samara: The International Newsletter of the Partners of the Millennium Seed Bank Project*, 24: 5 (On line publication: www.kew.org/msbp/samara).
- MOGOTSI, K. and ULIAN, T. June 2013. Conserving indigenous food plants in Botswana – the case of the morama bean. *Samara: The International Newsletter of the Partners of the Millennium Seed Bank Project*, 26: 4 (On line publication: www.kew.org/msbp/samara).
- LIRA, R. and ULIAN, T. December 2011. Conserving useful plants with the local community in San Rafael Coxcatlán (Mexico). *Samara: The International Newsletter of the Partners of the Millennium Seed Bank Project*, 21: 13 (On line publication: www.kew.org/msbp/samara).
- WAY, M., ULIAN, T. and SACANDE, M. December 2010. Saving Useful Plants through the Millennium Seed Bank Partnership. (On line publication: <http://webarchive.nationalarchives.gov.uk/20140827110041/http://sd.defra.gov.uk/2010/12/saving-useful-plants-through-the-millennium-seed-bank-partnership/>)
- ULIAN, T and SACANDE, M. December 2010. The Useful Plants Project now bears fruits of success and sustainability. *Samara: The International Newsletter of the Partners of the Millennium Seed Bank Project*, 18-19: 7 (On line publication: www.kew.org/msbp/samara).
- ULIAN, T. December 2008. Project MGU – The Useful Plants Project. *Samara: The International Newsletter of the Partners of the Millennium Seed Bank Project*, 15: 1 (On line publication: www.kew.org/msbp/samara).

2

The MGU –Useful Plants Project, Botswana



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Abstract

Within Botswana, the project has established twenty four strategic partnerships with national and international institutions. The project has benefited from these organisations' experiences which included financial management and human resources. All activities were designed, planned and implemented through local *kgotla* meetings, focus groups and participation in different fora. The project has produced a list of 352 species which are useful to communities;

178 seed collections – 133 of which have been banked in country and 48 banked at the Millennium Seed Bank (MSB) in the UK; 90 seed collections have had germination tests completed; 107 species have been propagated at four sites; and 42 species have been researched. Four communities have participated directly in the project whilst training has extended to other communities through training programmes in plant conservation, utilization and value addition – in total 1,700 people attended 17 workshops. Six community gardens of useful plants have been established. Two community gardens at communities in Tsetseng and Pilikwe; two at primary schools in Tsetseng and Pilikwe villages; and one in Botswana College of Agriculture (BCA). The project has also worked with two other communities in New Xadi and Shaikarawe. Fifty-three species have been planted in the following gardens: 34 at Ithuseng Community Development Trust (Tsetseng), 13 at Moselewapula Community Trust (Pilikwe), 12 at Pilikwe Primary, 10 at Tsetseng Primary and 30 at BCA. The target of 50,000 seedlings planted was not reached because of adverse weather conditions in Botswana producing a lack of water across the country.

Keywords: Communities, conservation, kgotla, propagation, Pilikwe, Tsetseng, schools.

Introduction

Rationale

Botswana is a landlocked country which shares its borders with the Republic of South Africa, Zimbabwe, Namibia and Zambia. It covers an area of approximately 581,730km² of which 488,654 km² (84%) belong to the dry savanna or Kalahari Desert and 17,000 km² (3%) to the wetlands/the Okavango Delta (where the Okavango river drains inland from Angola). Sand dune habitats are found in the south and south-west of the country, whilst in the north most of the remainder vegetation is sparse grassland with *Colophospermum mopane* woodlands with *Acacia* species found across the country. The countries ecosystems are fragile and levels of land degradation, deforestation, overgrazing and bush encroachment are high.

Botswana receives a mean annual rainfall of around 650 mm in the extreme north and north east (Okavango and Chobe districts), with less than 250 mm in the south west/west (Kgalagadi district). Rainfall occurs during the summer period from September to April when temperatures rise up to 40°C; the temperature then drops as low as -4°C during the winter. The country has

2,300 – 3,000 plant species, which support 164 mammal species (including 2,5 million people), 157 reptiles, 50 birds and a large numbers of invertebrate species.

Among the main conservation challenges in Botswana are: i) the lack of policy on the domestication, cultivation and conservation of indigenous plant species, ii) the lack of knowledge and use of indigenous plant species for medicines and improved nutritional diets and iii) the lack of markets and marketing (packaging, viability, and storage/shelf-life) of wild collected species. Other important challenges are over-exploitation and unsustainable harvesting of wild plants and their fruits, elephant damage to vegetation (e.g. *Baikiaea plurijuga* and *Pterocarpus angolensis*), frequent forest fires and die-back of tree species (e.g. *Pterocarpus angolensis*).

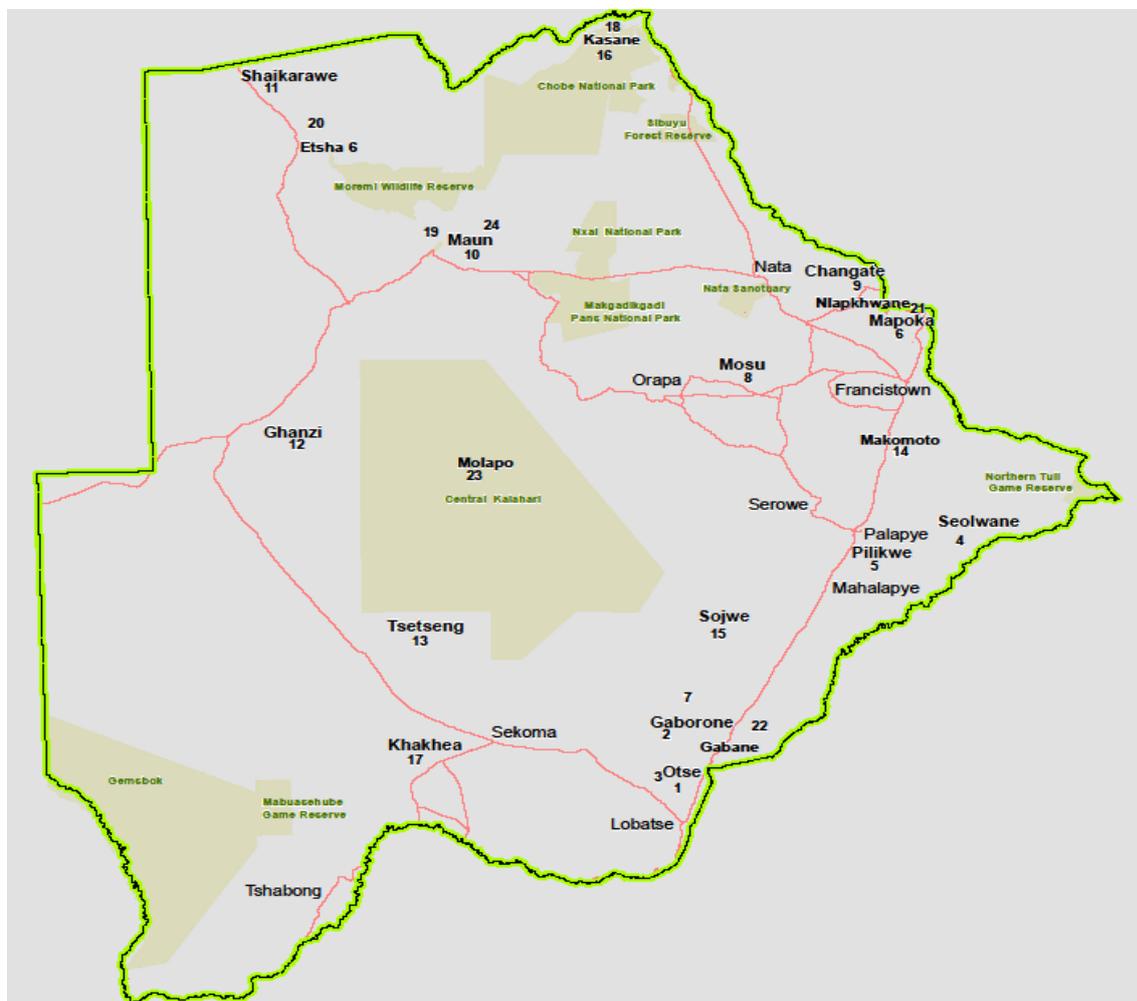


Fig. 1: Map showing UPP and Forest Conservation Botswana (FCB) project sites (Source: FCB)

Summary of results of Phase 1 (UPPI)

In Botswana, the UPP has worked in ecosystems where plant diversity is tightly bound to the livelihoods of the people (Smith, 2009). The activities during the phase 1 of the project included:

- Identification of plant species which are useful to local communities and that would benefit from value addition and product development. Activities included: a) the creation of a poultry feed from three plant products to rival commercial feed, b) the introduction of cold press oil extraction machines for communities to produce oils and c) sun drying of truffles to improve storage;
- Seed collection and *ex situ* conservation;
- Establishment and management of nurseries including plant propagation activities;
- Establishment of community gardens;
- Investigation of the phytochemistry and eco-physiology of selected plant species;
- Establishment of school programmes to improve teaching and learning of science, agriculture and environmental education in basic education.

The UPP team participated in 14 seed collection expeditions – six with the Millenium Seed Bank Partnership (MSBP), four with communities and four with schools. A total of 153 seed collections were made and 48 plant species were propagated using seeds and cuttings at BCA.

Project activities were undertaken in collaboration with two communities in Tsetseng (Kweneng West) and Pilikwe (Tswapong region) including a primary school of each community. Fifty-two species have been planted in newly established gardens: 33 at Ithuseng Community Development Trust (Tsetseng), 11 at Moselewapula Trust (Pilikwe), 12 at Pilikwe Primary, 10 at Tsetseng Primary and 30 at BCA.

Consultations on future partnerships and funding were made with government and non governmental organizations. Funds were awarded for two community projects, one on the cultivation of multipurpose trees using saline water in Tsetseng and the other on the cultivation and value addition of Botswana medicinal plants in Pilikwe. The project's sites hosted national environmental and biodiversity conservation activities and included work by local and international students.

The UPP provided training for communities on: i) garden establishment, planting and management and ii) leadership skills and proposal writing up. The technical partners were trained in: i) database management, ii) tropical plant identification and iii) seed collection and processing. Information was disseminated at community workshops with informative posters; through undergraduate and graduate thesis publications; through international media stories and blogs; and through participation in fairs and public activities such as the commemoration of Vision 2016 and the 2010 International Year of Biodiversity.

After a consultation period the communities prioritized 15 species to work on. These species are displayed in Table 1.

Table 1: Plant species identified, prioritized, and selected for cultivation and income generation by Tsetseng and Pilikwe Communities (UPP1)

Plant species	Uses	Products
<i>Adansonia digitata</i>	Food, fodder, medicine, cosmetics	Juice, wine, alcohol
<i>Cassia abbreviata</i>	Medicine, environmental services	Multipurpose in most conditions, firewood
<i>Citrullus lanatus</i>	Food, fiber, medicine, environmental services	Water, seed oil, pickles, juice, wine, alcohol, porridge
<i>Colophospermum mopane</i>	Firewood, animal feed, environmental services	Habitat for phane .
<i>Cucumis africanus</i>	Food, environmental services	Vegetable
<i>Elaeodendron transvaalense</i>	Medicine , environmental services	Multipurpose in most conditions, firewood, nutrient recycle
<i>Grewia retinervis</i>	Food, firewood, fire stick, steamer	Juice, wine, alcohol, porridge, shelter, traditional doors and beds
<i>Kalaharituber pfeilli</i>	Food, medicine, environmental services	Oil, flavonoids, reduces cholesterol boost immunity, high in antioxidants, nutrient recycle
<i>Myrothamnus flabellifolia</i>	Medicine, food, environmental services	Controls hypertension
<i>Sclerocarya birrea</i>	Food, medicine, environmental services	Oil, juice, wine, alcohol, vitamins, minerals, household utensils, agricultural tools, etc.
<i>Stomatostemma monteiroae</i>	Food, medicine, environmental services	Meat substitute (nama ya setlhare)
<i>Strychnos cocculoides</i>	Food, environmental services	Juice, yoghurt, firewood
<i>Tylosema esculentum</i>	Food, medicine, environmental services	Milk, yogurt, butter, snacks, protein-rich flours, provides soil cover and soil nutrients recycle
<i>Ximenia caffra</i>	Food, medicine, fuel, environmental services, animal feed	Seed oil, pickles, juice, wine, alcohol

Source: Pers. com. communities of Tsetseng (2008) and Pilikwe (2009).

Summary of results of Phase 2

The goal of the project was to improve the welfare of local communities and to safeguard important useful plants from extinction in Botswana. The purpose was the conservation and sustainable use of plants for human wellbeing improvement in Botswana.

To achieve the goals and objectives in UPP2, a total of ten strategic partnerships were formed with national and international government and non-governmental organizations. Thirty plant species have been banked (*ex situ*) at the MSB, germination tests have been conducted on 53 plant species using three germination protocols (sand, compost and 50% sand : 50% compost mixture) at BCA and 53 species have been planted and maintained in community gardens.

In addition to the two UPP1 communities, Shaikarawe (in Ngamiland) and other communities across the country prioritized another 15 plant species for domestication, cultivation and commercialization (Table 2). One of the project partners, Forest Conservation Botswana (FCB), co-funded the drilling and equipping of a borehole in Tsetseng for the supply of water for the gardens and the community.

Materials and Methods

Project Outputs/Indicators

Output 1: Project planned, monitored and implemented effectively

- Existing partnerships were consolidated through joint activities and at least five new relevant partnerships were formed. For example, a partnership with the University of Botswana (Department of Adult learning) was formed in order to conduct functional adult learning classes in Tsetseng and Kacgae communities. The activities included the consultation with community leaderships to select learners who were unable to read and write.
- Produce project documents which included: a log frame, budget, management structure and a work plan finalised in November 2011.
- Country reports, mid and annual reports were submitted to the Royal Botanic Gardens, Kew (RBG Kew) every six months.

- Funding from the project donor and other matched funds were received by BCA for all project activities.

Output 2: Species conserved *ex situ*

- Cumulative target list of at least 150 useful species was collated, selected and prioritised by the communities.
- 80 seed collections of priority useful plant species were targeted to be made and held at international standards in Botswana and duplicated at RBG Kew's MSB.
- Quality of 80 seed collections was to be assessed through seed testing (viability, germination and storability).

Output 3: Species propagated and conserved in the communities

- A target of 80 priority useful species (100,000 seedlings) propagated was set. Two additional communities/community groups (belonging to Tsetseng and Pilikwe) were engaged and integrated into the project through participatory consultation with community leaders. Community leaders used community *Kgotla* meetings to inform the communities about the proposed project. Workshops were conducted to explain the project objectives and activities to follow the *Kgotla* meetings. At the workshops the community members were encouraged to identify, select and prioritise plant species that are useful to them.
- A target of 80 priority useful species (50,000 seedlings) was set to be planted and maintained in four local communities/schools.
- The school programmes were enhanced through the involvement of four schools and 400 children from the communities.

Output 4: Support to *in situ* conservation and use

- A target of at least 25 priority useful plant species planted *in situ* (managed areas) was set.
- Research was carried out on at least 25 useful plant species to enhance their conservation and sustainable use in the local communities.

Output 5: Sustainable use and income generation from useful plants

- To ensure sustainability of UPP, the project developed strategic partnerships, mainstreamed its activities and empowered local communities to be self-sustaining. The partnerships allowed UPP activities to be scaled up by providing financial and technical support in the communities and at BCA.
- A target was set for the sustainable use and marketing (product, pricing, and place) of at least 30 useful plants (seeds/seedlings/plant parts) or their plant products promoted for income generation in four communities.

Output 6: Information disseminated & project promoted

- Information derived from the project was compiled, updated, organized and disseminated at the local, national and international level through workshops, participation in fairs and public activities, and through the production of posters, journals, press releases, etc.
- Project exposure was enhanced through the generation of publicity material at the local, national and international level.

Results/Achievements

Output 1: Project planned, monitored and implemented effectively

During UPP1 the project worked with the following fourteen partners:

- Ministry of Agriculture – National Plant Genetic Resources Center (NPGC);
- Ministry Environment Wildlife and Tourism – Department of Forestry and Range Resources (DFRR):
 - National Tree Seed Centre (NTSC)
 - Three District Forestry Offices
- Department of Environmental Affairs (DEA)
- Department of National Museum and Monuments (National Herbarium and Botanical Gardens)
- Veld Products Research and Development (VPR&D)
- National Food Technology Research Center (NFTRC)
- University of Botswana (Okavango Research Institute - ORI)
- Forest Conservation Botswana (FCB)

- Ministry of Education and Skills Development (MoESD)
- MoESD (Department of Primary Education)
- Vision 2016 Council (Botswana)

The project planned for five additional partners to UPP1; however, the team incorporated ten new partners, taking the total to 24 national and international partners in Botswana. The ten additional partners are:

- The University of Botswana (UOB):
 - Office of Research and Development (ORD) – supported the Morama bean project; and
 - Department of Adult Education – supporting the literacy project undertaken in Tsetseng and Kacgae communities.
- Botswana Institute for Policy Development Analysis (BIDPA) – supported the morama bean project and the development of a manuscript (book chapter) on emerging crops of Botswana.
- Ministry of Education and Skills Development (MoESD – Department of Out of School Education and Training) supported adult learning in the Kacgae community.
- Letloa Trust – participated in the MSBP-UPP seed collection expeditions and value addition of *Schinziophyton rautanenii* (mongongo) in Shakawe/Shaikarawe community.
- The Southern African Science Service Centre for Climate Change and Adaptive Land Use (SASSCAL) – provided funding for research on *Bauhinia petersiana*, *Citrullus lanatus*, *Schinziophyton rautanenii* and *Tylosema esculentum*. These species have been prioritised by communities.
- Swedish University of Agricultural Sciences (SLU) funded by Sida – established the morama bean project with the following partners: University of Namibia (Department of Biological Sciences); Cornell University (Market Matters Inc.); University of Botswana, ORD; Botswana Institute of Policy and Development Analysis (BIPDA) and NFTRC.
- Ministry of Trade and Industry (Department of Registrar of Companies and Intellectual Property) – supported the development of intellectual property policy encompassing new products and indigenous knowledge.

- Botswana Post Foundation – supported the introduction of Kacgae Primary School (Kalahari) into the project and carried out research and development activities with the community.
- The Ivory Foundation (funder) / Pronatura (Biochar experts) – supported activities in BCA, Tsetseng, Kacgae and New Xadi through Ghanzi Permaculture International.
- Ghanzi Permaculture International – supported training of communities in the Kgalagadi on useful plants.

Output 2: Species conserved *ex situ*

In UPP2 the project added 113 new species to the list of important species, above the target of 150 (see Table 3). The cumulative total in the list from UPP1 and UPP2 is 221 (see Table 3). In UPP2, a total of 154 seed collections of 84 species were made against the target of 80 species. Of the species collected, 65 have been banked in Botswana and 73 species have been banked at the MSB. Of the 154 seed collections, 53 have been assessed through seed testing and 41 species have been propagated (see Table 3). Combining UPP1 and UPP2, the project collected 307 seed accessions, and banked 153 and 211 seeds, in Botswana and at the MSB respectively (see Table 3).

Output 3: Species propagated and conserved in the communities

Due to lack of water supply around the country, seedlings were mainly raised at BCA and then transferred to community gardens for propagation and management. A total of 41 plant species (6,677 seedlings) have been propagated and 53 of these species (4,574 seedlings) have been planted and maintained in community gardens (see Table 3).

In UPP2, one new school (Kacgae Primary School) and two new communities (Shaikarawe and New Xadi) were integrated into the project. Through the engagement of Permaculture Ghanzi and together with the support from The Ivory Foundation/Pronatura partnership, the project will be working more with New Xadi community in the future.

Through a series of workshops the project team encouraged and supported the communities to share indigenous knowledge of plant propagation and processing. For example, the Shaikarawe community exchanged indigenous knowledge on cracking of *Schinziophyton rautanenii* (mongongo) seeds, extraction of the oil and vegetative propagation of the plant. Workshops

trained community members in seed collection, seed propagation, garden establishment, planting, nursery/garden management, leadership skills, book keeping, proposals writing up, food processing and standardization. Communities were also trained on data collection methods and have assisted the project to ensure accurate reporting. A total of 183 pupils have participated in training activities in UPP2.

Output 4: Support to *in situ* conservation and use

Experiments on *Tylosema esculentum* (Morama) growth rates of species of different provenances under different soil conditions have been completed in order to understand the regional variation. In addition to this, experiments on saline water treatments on plants of the same species have been carried out within community plots and at BCA nursery. Two papers have been published by students who have been involved in the project – one in the *Scientific Journal of Animal Science* and the other in the *African Crop Science Journal* (see Annex 7).

Output 5: Sustainable use and income generation from useful plants

In addition to the species prioritised in UPP1 by Tsetseng (Kweneng District) and Pilikwe (Central District) communities (see Table 1), Shaikarawe (North West District) and other communities were consulted. As a result another 15 plant species were prioritised for domestication, cultivation and commercialization (see Table 2).

Table 2: Plant species identified, prioritised, uses recorded and selected for cultivation and income generation by communities across the country

Scientific Name	Uses	Products
<i>Boscia albitrunca</i>	Food, fodder, timber, poles, agricultural equipment and utensils	Food, fodder, fuel, coffee substitute, porridge, drinks (alcoholic & nonalcoholic), household utensils
<i>Schinziophyton rautanenii</i>	Food, fire (matches), medicinal, building/roofing (bark)	Oil, milk, snack, soup, juice, wine, alcohol, dugout canoe
<i>Securidaca longipedunculata</i>	Medicinal, firewood, fodder	Curing liver, flue, cough
<i>Eriosema cordatum</i>	Medicinal	Roots
<i>Pterocarpus angolensis</i>	Medicinal, environmental services	Wood carvings, furniture, poles
<i>Ochna pulchra</i>	Food	Oil, snack, wood carvings
<i>Strychnos pungens</i>	Food, medicinal	Juice, yoghurt, firewood
<i>Strychnos cocculoides</i>	Food, medicinal (snake bites)	Juice, wine, alcohol
<i>Guibourtia coleosperma</i>	Food, medicinal	Lotion, oil, sprouts, dugout canoes, mortars, knife handles, spoons
<i>Grewia retinervis</i>	Food, firewood, fire stick, steamer	Juice, wine, alcohol, porridge, shelter, traditional doors and beds

<i>Dialium englerianum</i>	Food, medicinal, firewood	Fruit, vegetables (leaves), juice, wine, alcohol
<i>Grewia flava</i>	Food, medicinal, firewood, fodder	Alcoholic/non-alcoholic beverages, highly valued wood for bows making, knobkerries, springhare sticks and other tools, bark used for weaving
<i>Bauhinia petersiana</i>	Food, fodder, medicinal	Protein supplement, vegetable
<i>Harpagophytum procumbens</i>	Medicinal, environmental services	Arthritis, lack of appetite, joints, reduces cholesterol, etc.
<i>Opuntia spp.</i>	Food, fodder, fiber, medicinal	Pharmaceutical industry, weaving, clothing industry, paper making toothpicks, needles, pins and for numerous essential products

Source: Pers. com. communities of Ditshegwane (2011), Shaikarawe (2012), Tsonyane (2012), Lefhoko (2012), MEKGATSI Trust (11 villages, 2012), Maokane (2012) and Thankane (2012).

Output 6: Information disseminated & project promoted

Community shows and workshops have enhanced useful plants in communities in Botswana (see annex 7). Information was disseminated in Botswana and to other strategic partners at workshops, national dialogue events, press releases, television appearances, and meetings at project sites. The UPP team members attended national and international conferences to present articles on useful plants and these have been published in conference proceedings and journal articles (see annex 7).

Table 3: Results for the project per each indicator divided by phase (2007-2014)

Quantitative indicators	UPP 1	UPP 2	Total	Notes
New partnerships	14	10	24	
Cumulative target list with useful species	108	113	221	
Seed collections made	153 (121 species)	154 (84 species)	307 (172 species)	3 species not identified
Seed collections banked in country	68	85	153	Some collected seeds were immature and some spoilt
Seed collections banked at the MSB	57 (57 species)	123 (73 species)	211 (141 species)	
Seed collections tested	37	53	90	
Species propagated	48	41 (6,677 seedlings)	107 species	
Propagation protocols produced	0	4	82	Tested at 3 sites Pilikwe, BCA, Tsetseng and Kacgae

Communities/community groups involved in the project	2	2	4	Parents Teachers Association (PTA), literacy groups working with UPP at Kacgae
Species planted and maintained in local communities/schools	52 (447 seedlings)	53 (4,574 seedlings)	53 (5,021 seedlings)	
Local communities/schools involved in planting activities	2	1	3	
Community/school gardens/woodlots where planting activities have been carried out.	4	4	5	
Capacity of local communities enhanced through workshops, training events, nurseries	7 training workshops 500 people	10 training workshops 1,204 people	17 training workshops 1704 people	
School programme enhanced through the involvement of 3 schools	2	3	3	
Children involved in school programmes in the communities	130	183	313	
Research on species	13	29	42	
Species (seeds/seedlings/part of plants) promoted for income generation	5	10	15	

Discussion

The project has attracted both local and international partners to implement biodiversity and plant conservation for livelihoods improvement/income generation. Some of the activities include local and international student attachments, national tree planting, participation in Botswana government policy, launching of the 2010 International Year of Biodiversity and provision of information on indigenous plant resources for use in Botswana.

The reach of the project was expanded to 15 other communities through presentations at dialogue events organised by the Botswana Vision 2016 Council at several districts around the country – including Moshupa sub-district (Southern District), Bobirwa sub-district (Central District), Kgalagadi District, Ghanzi District and North-East District – and at the Commemoration of the Vision 2016 in Tsetseng (Kweneng District). At these events participants were informed about the benefits of conservation of useful plants for livelihood improvement and were asked to select and prioritise their most useful indigenous species.

Botswana Post Foundation introduced Kacgae Primary School in Ghanzi district into the project, which also allowed the introduction of the New Xadi community.

Through the partnership with the University of Botswana (Department of Adult learning) functional adult learning classes were held in Tsetseng and Kacgae communities. The Ministry of Education and Skills Development, MoESD (Department of Out of School Education and Training) supported adult learning of thirty 35 learners in Kacgae and 35 community members in Tsetseng including the village leadership.

Seed collection expeditions involved collaboration with MSB partners and communities throughout the country. The priority useful seeds are currently stored in Botswana and at the MSB. Research on seed germination, physiological development, provenance performance and value addition has been conducted at BCA. In Tsetseng and BCA, an experiment to determine the effect of saline water applications of tree species is being carried out including measurements of growth rates, percentage of seedling emergence and performance, and seedling growth. In all UPP gardens, plants have been monitored for growth and development of seedlings including stem diameter, number of branches, height, and flowering and fruiting periods. Maturity tests are being conducted on four SASSCAL – UPP species: *Bauhinia petersiana*, *Citrullus lanatus*, *Schinziophyton rautanenii* and *Tylosema esculentum*. An MSc thesis project entitled “Performance of Tswana hens fed three different protein sources (*Imbrasia belina* (westwood), *Tylosema esculentum* (Burchell) Schreiber and *Vigna subterranea* (L) Verdic in Botswana” has been successfully completed and published. The research findings are shared with project partners and collaborators and will continue to be shared within the communities to increase their importance.

The UPP schools participated in exchange visits, where they conducted plant identification, seed collection, seed cleaning and conservation using the ‘Great Plant Hunt’ toolbox. The pupils have supported the management of the school garden plots which have been used to enhance environmental education, together with science and agricultural programmes. These activities are referred to as adding value to education in Botswana. The improvement to science, environment and agricultural education is reflected in improved school results of pupils from Pilikwe, Tsetseng and Kacgae primary schools since the beginning of the project.

Tables 1 and 2 provide information on plant species which have been identified, prioritized and selected for cultivation and income generation by communities across the country. The indigenous uses and products have been recorded and new information has been confirmed through research activities and literature reviews. Annex 5 provides information on the communities consulted, the consultation dates and the list of priority useful plant species selected by each community.

The project team results have been communicated at events across Botswana, for example, at the Botswana Consumer Fair, the African Forum for Agricultural Advisory Services (AFAAS) conference and National Agriculture Shows. The Botswana College of Agriculture Public Relations Office (BCA PRO) has displayed indigenous plant products at the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) general assembly. The UPP team displayed posters at these fairs, shows and conferences. A book chapter including 25 priority useful plants to Botswana is being prepared and scientific papers have been presented in national and international conferences.

Conclusions

Over the last seven years (2007 – 2014), the UPP project has made an impact in the development of knowledge, skills, empowerment and conservation for the utilization (cultivation, value addition and income generation) of indigenous plant resources. Although policy of research and development of indigenous plant resources (emerging crops) is still lacking in Botswana, policy development institutions such as Vision 2016 Council and Botswana Institute for Development Policy Analysis (BIDPA) have been attracted to and adopted UPP activities into their strategies.

The Botswana and UK MSBP teams have worked together and reached successfully the targets in seed collection and seed banking. However, the targets related to seed/germination tests, seedling propagation and growth performance have not been reached due to extreme weather conditions, lack of water supply and water quality, and lack of staff commitment. *Ex situ* conservation activities are taking place at the BCA.

Two UPP1 communities (Tsetseng and Pilikwe) and the two UPP2 communities (Shaikarawe and New Xadi) have been involved in the project. The Primary School Leaving Examination

(PSLE) results (Grade 7), at Pilikwe, Tsetseng and Kacgae Primary Schools, have been improved due to participation in UPP school activities.

Communities already possess a wide knowledge on conservation and utilization of indigenous plant resources. The project team trained members of the marginal areas of Botswana in aspects of modern/scientific methods of research, cultivation, value addition, processing, packaging and marketing of products derived from indigenous plants in order to provide them with the opportunity to improve their livelihoods.

The development, packing and sharing of information has given additional value to the project at BCA (Botswana College of Agriculture) in Botswana and internationally. For example, the Swedish International Agency (Sida) funded the Morama project on *Increasing community awareness and utilization of indigenous grains to improve nutrition security and livelihoods in Botswana and Namibia*. The Forest Conservation Botswana (FCB) has funded projects in UPP communities and is currently engaging with The Ivory Foundation for funding and support in the use of soil improvement technologies (BIOCHAR) in the Kalahari area. Research activities on targeted plant species has been achieved at some level with publications listed in annex 7.

Recommendations

The continuation of UPP to ensure project sustainability in community livelihoods improvement and infrastructural development is recommended by the project team. The Ithuseng Community Development Trust (Tsetseng) has submitted a proposal to FCB for funding for value addition and establishment of ecotourism activities. Water de-salination is urgently required in the Tsetseng community for watering the gardens and providing water to the community which lives in the driest and poorest part of Botswana.

UPP has supported, and should continue to support, national and international institutions to help the government of Botswana to achieve poverty eradication efforts using indigenous plant resources. The project team plans to continue its involvement with Vision 2016 activities and MSBP2 and will continue to engage in conservation and sustainable development of indigenous plant resources.

Acknowledgement

The Useful Plants Project – Project MGU (UPP) has been implemented together with the Royal Botanic Gardens, Kew under the Millennium Seed Bank Partnership. Financial support has been received from a philanthropist based in Spain through Kew's UPP. We would also like to thank the communities of Tsetseng, Pilikwe, Shaikarawe, New Xadi, together with Tsetseng, Pilikwe and Kacgae primary schools for engaging in the project. Acknowledgement also goes to the government of Botswana through various ministries and departments, non-governmental organisations and international organisations for supporting UPP financially and in kind. Without the help of all the above, the UPP activities would not have been achieved.

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Annexes - Botswana

Annex 1: SWOT Analysis

	Strength	Weaknesses	Opportunities	Threats
Community participation	- Botswana communities are eager to work with UPP	- Some project community members are involved in other activities for their livelihoods	- VISION 2016 Council collaboration - Engagement with the Ministry of local government	- Size of the country makes engagement with some communities difficult - Lack of commitment by project staff
Human Resource	- Commitments of members from UPP1 - Support by BCA	- Non-commitment by new members - Lack of commitment from project officers	- Potential for human resource development and scientific information and research	- Lack of interest from new staff members - Several UPP team members are leaving BCA either taking retirement or resignation.
Financial Resource	- BCA support through staff salaries, offices, staff time, office equipment, experimental plots - Financial support from MGU/RBG Kew	- Botswana is no longer considered for support from most sources of funding as a middle-income country	- BCA partly financing fuel and transport - Traditional co-funder's such as MGU, FCB willing to continue supporting UPP. - New collaborators are potential funders	- Lack of definitive sustainable financial support by current funder as well as BCA
Biophysical	- High indigenous knowledge of the Botswana flora by communities	- Botswana is a semi-arid country with extreme temperatures and low rainfall	- There is variety of indigenous plants that have been documented and which could provide livelihoods benefits to local communities	- High temperatures in the summer - Low temperatures in winter - Poor sandy soils - Saline water - Droughts in most areas where we work
Infrastructure	- Currently housed under BCA facilities - Using BCA infrastructure including computers, internet, etc.	- Lack of facilities to store products of UPP activity e.g. seed collections, herbarium specimens, etc.	- UPP using BCA vehicles for field activities	- Size of the country makes transport difficult to remote communities - Engagement of UPP team members in BCA work
Project outputs				
Output 1: Project planned, monitored and implemented effectively	- UPP1 collaborations maintained and more funding received in UPP2	- Some collaborators are not very active	- Potential for financial support from some collaborators - Potential for human resource development - Potential for enhanced research and development	- The UPP team is not strong enough to support all collaborations - Future place in MSBP2 under the MEWT
Output 2: Species conserved <i>ex situ</i>	- Seed collection targets achieved - Seeds successfully banked in Botswana - BCA garden and greenhouse used with UPP owned net house for seedling propagation	- Not all of the seeds collected have been sent to the MSB for duplication - Lack of knowledge and skill on seed processing & management by project staff - BCA garden not fenced and is burgled thus the team is unable to keep proper data for	- Seed collection has been supported by MSBP1 partners: MoA and MEWT - Use of Plant Genetic Resources Centre (Seed Bank) maintained by the MoA - BCA gardens and greenhouse are easily accessible to provide support for the project	- Size of the country made it difficult to cover the targeted areas - Lack of seed banking facilities at BCA - Break down of facilities and equipment, and electricity rationing around Gaborone

	<ul style="list-style-type: none"> - Target species' seeds planted and seedlings propagated 	<ul style="list-style-type: none"> fruit production and other produce - Not all team members active 	<ul style="list-style-type: none"> - Closeness of the operations and facilities 	<ul style="list-style-type: none"> -Extreme variations in weather conditions & water
Output 3: Species propagated and conserved in the communities	<ul style="list-style-type: none"> - Community members have been involved in seed collection, planting and propagation in the gardens 	<ul style="list-style-type: none"> - Some community members have livelihoods activities and so participation is difficult 	<ul style="list-style-type: none"> - Support from UPP team needs to be maintained -Other sources of livelihoods could be initiated 	<ul style="list-style-type: none"> - Extreme variations in weather conditions - Water rationing - Lack of water in most parts of the country - Saline water from the borehole in Tsetseng
Output 5: Sustainable use and income generation from useful plants	<ul style="list-style-type: none"> - Communities prioritised plant products, uses, social importance and potential for commercialisation (indigenous knowledge) 	<ul style="list-style-type: none"> - Lack of Standardization of equipment, methods, tools and compliance on product development 	<ul style="list-style-type: none"> - Forest Policy in Botswana supports value adding to natural resources - The Ministry of Trade is engaged in Regional discussions on value adding and commercialisation of indigenous plant resources - The Vision 2016 Council is keen to further support commercialisation of indigenous plants and plant products ii. There are potential markets for emerging crops 	<ul style="list-style-type: none"> - Current agricultural programs do not include domestication, cultivation, value adding and commercialisation of indigenous plant resources
Output 6: Information disseminated & project promoted	<ul style="list-style-type: none"> - The project team has been involved with local, national and international stakeholders and institutions - Many workshops and seminars have been conducted - The project has hosted the Botswana President, Swedish Ministry of Rural Development and other government officials iv. Publications and press releases have been produced. 	<ul style="list-style-type: none"> See Output 1 - Inability to analyse all the data and to publish it. 	<ul style="list-style-type: none"> See Output 1 	<ul style="list-style-type: none"> See Output 1

Annex 2: Logframe of the project.

Logframe for Second Phase of Project MGU-the Useful Plants Project (UPP)			
Objectives	Indicators	Means of Verification	Assumptions
Overall Project Goal	Welfare of local communities improved and useful important plants safeguarded from extinction in Latin America and Africa		
	Capacity of local communities in Botswana to conserve and use sustainably useful plant species enhanced	Dissemination material, workshop documents and facilities in Botswana for plant conservation and sustainable use enhanced in local communities	
Project Purpose	Conservation and sustainable use of plants for human wellbeing		
	At least 80 seed collections of priority useful plant species made and held to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK	Seed collections registered in the seed banks in Botswana and in Kew's Millennium Seed Bank in the UK	Access agreements and permits available; all project partners committed and consistently supporting the project; seed conservation scientifically feasible for target species
	10 priority useful plant species (100,000 seedlings) grown in 4 local communities	Propagation documents	Plant propagation scientifically feasible for target species; Communities will set up community nurseries that will distribute/sell seedlings to individuals, schools, hospitals and other institutions in Botswana

		Priority useful plant species maintained by the local communities in community/home/school gardens	Community members engaged and providing time and land for growing and maintaining priority useful plant species
Conservation and sustainable use of at least 25 priority useful plant species supported <i>in situ</i>		Priority useful plant species planted <i>in situ</i>	Relevant stakeholders engaged and managed areas made available for <i>in situ</i> conservation
		Monitoring data and scientific material (reports/thesis/papers)	Research feasible for priority useful plant species; students and extra staff made available in-country and at Kew
Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining.		Long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Tools and infrastructures that enable long term promotion of knowledge and use of plants. Income generation data from useful plant species or their plant products	Policy-makers supportive of use of traditional knowledge and indigenous useful plants. Sustainable harvesting of useful plants; new partners engaged to support the socio-economic aspects of project; markets for useful plant species available
Information about useful plant species shared widely and project promoted at local, national and international levels		Dissemination material and publicity about project	Extra staff made available in-country and at Kew to disseminate material and promote project

Project Outputs			
Output 1: Project planned, monitored and implemented effectively			
	Existing partnerships consolidated and at least 1 new relevant partnership established and integrated into the project within 6 months (by November 2011)	Correspondence and agreements with relevant partners	All agreements available; all project partners committed and consistently supporting the project; funds available in-country without delay from start of project
	Team set up within six months (by November 2011)	Meetings and recruitment	Project partners committed and consistently supporting the project; funds available in-country without delay from start of project
	Project documents (logframe, budget, management structure and work plan) agreed and finalised with partners within 6 months (by November 2011)	Correspondence and project documents (logframe, budget, management structure and work plan)	Project successfully integrated into partners' institutional programmes; good communication maintained with all project partners
	Country reports (mid-year and annual) submitted to Kew and general report submitted to donor every six months	Country reports and general reports; Kew management meeting minutes	
	Project reviewed by the end of the 2nd year of the project (May 2013)	Project workshop and report	
Output 2: Species conserved <i>ex situ</i>			
	Target list of 150 useful species agreed in Botswana within 6 months (by November 2011)	List of targeted useful plant species with relevant information (use, distribution, conservation status) updated and incorporated into UPP database	Extra staff made available in-country and at Kew to maintain and update lists of useful plant species and the UPP database
		Country Databases/Excel Spreadsheets and UPP database updated	

	At least 80 seed collections of priority useful plant populations made and held to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK by the end of the 3rd year of the project (May 2014)	Seed collections registered in seed banks in-country and in Kew's Millennium Seed Bank in the UK	Access agreements and permits available; all projects partners committed and consistently supporting the project; seed conservation scientifically feasible for the target species
	Quality of 80 seed collections assessed through seed testing (viability, germination, storability) in Kew's MSB by the end of the 3rd year of the project (May 2014)	Data on seed testing (viability, germination, storability)	Extra staff from RBG Kew made available for seed testing
Output 3: Species propagated and conserved in the communities			
	10 priority useful species (1,000,000 seedlings) propagated	10 Propagation protocols	Propagation scientifically feasible for targeted species; trials successful
	2 additional communities (to the existing 2 communities) engaged and integrated into project within 6 months (November 2011)	Workshop documents and agreements with communities	Community members committed to project and making available time and land for project
	10 priority useful species (50,000 seedlings) planted and maintained in 4 local communities	Priority useful plant species maintained by local communities in community/home/school gardens	Communities are committed to the project and provide time and land for targeted useful plants
	Capacity of local communities to propagate and conserve plants enhanced through training and the improvement of local facilities	Training material and enhanced facilities for plant propagation and conservation	Community members are receptive to training and interested in propagating and conserving useful plant species

	School programme enhanced through involvement of 4 schools and 400 children	School material (e.g. species portraits, posters) and priority useful plant species maintained in school gardens	School teachers committed and actively involved in the project
Output 4: Support to <i>in situ</i> conservation and use			
	At least 25 priority useful plant species planted <i>in situ</i>	Priority useful plant species planted <i>in situ</i>	Propagation scientifically feasible for targeted species; trials successful; relevant stakeholders engaged and managed areas made available for <i>in situ</i> conservation
	Research on at least 25 useful plant species to enhance conservation and sustainable use in the local communities	Monitoring data and scientific material (reports/thesis/papers)	Research feasible for priority useful plant species; students and extra staff made available in-country and at Kew to research priority useful plant species
Output 5: Sustainable use and income generation from useful plants			
	Sustainability of UPP programmes in Botswana ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining	Development of long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Development of tools and infrastructures that enable long term promotion of knowledge and use of plants	Policy-makers sympathetic and supportive of use of traditional knowledge and indigenous useful plants
	Sustainable use and marketing (product, pricing, place) of at least 30 useful plants (seeds/seedlings/plant parts) or their products promoted for income generation in 4 communities	Entrepreneurs trained; income generation data from useful plant species or their products	Sustainable harvesting of useful plants; new partners engaged to support socio-economic aspects of project; market for useful plant species available. Resources for adding value and entrepreneurial activities available

Output 6: Information disseminated & project promoted			
	Information derived from the first phase of Project MGU compiled, updated, organised and disseminated at local, national and international levels by July 2012	Volume 1 of book on UPP1 published at Kew and further material published in-country in collaboration with Kew (e.g. books/manuals; species leaflets, booklets, posters, press and scientific articles, technical information sheets)	Extra staff made available in-country and at Kew to disseminate material and promote project
	Project exposure enhanced through publicity material at local, national and international levels by the end of project (May 2014)	Development of UPP logo and generation of publicity material (e.g. press articles, journal articles, project webpage, videos, radio interviews)	

Annex 3: List of communities/community groups and schools with activities carried out since 2007.

Community / Community group / School	Locality	Number of people involved	Activities carried out (e.g. workshops, seed collecting, propagation, planting, income generation activity)
Ithuseng Community Development Trust	Tsetseng Village (Kweneng District)	550	Workshops, seed collection, propagation, planting, income generation activity
Moselewapula Community Development Trust	Pilikwe Village (Central District)	18	Workshops, seed collection, propagation, planting, income generation activity
Shaikarawe Community	Shaikarawe (North West District)	220	Workshops, seed collection, propagation, planting, income generation activity
New Xadi Community	New Xadi (Ghanzi District)	125	Workshops, income generation activity
Pilikwe Primary School	Pilikwe Village (Central District)	210	Workshop, seed collection, planting
Tsetseng Primary School	Tsetseng Village (Kweneng District)	120	Seed collection, planting, workshop
Kacgae Primary School	Kacgae Village (Ghanzi District)	55	Planting, workshop

Annex 4: List of community/school gardens, woodlots, sacred forests and number of species and seedling planted since 2007, as applicable.

Community/school gardens, woodlots, sacred forests	Locality	Surface (hectares)	Number of species planted	Number of seedlings planted	Notes
Ithuseng Community Development Trust Garden (10 ha)	Tsetseng Village (Kweneng District)	10	17	3241	<i>Tylosema esculentum</i> seedlings (3,024)
Ithuseng Community Development Trust Garden	Tsetseng Village (Kweneng District)	0.36	33 (22)	110	Some species died due to cold
Moselewapula Community Development Trust Garden	Pilikwe Village (Central District)	0.25	13	47	The community propagate seedlings for sale
Pilikwe Primary School Garden	Pilikwe Village (Central District)	0.20	12	42	
Tsetseng Primary School Garden	Tsetseng Village (Kweneng District)	0.16	10	30	

Botswana College of Agriculture Garden	Gaborone(Sebele)	1.5	30	90	
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Annex 5: Sustainable use and income generation from useful plants.

Community	District	Year Consulted	Top 4- 10 prioritized plant species for domestication, cultivation and commercialization
Tsetseng	Kweneng	2008	<i>Tylosema esculentum, Citrullus lanatus, Ximenia caffra, Grewia retinervis, Kalaharituber pfeilli</i>
Pilikwe	Tswapong	2009	<i>Cassia abbreviata, Elaeodendron transvaalense, Stomatostemma monteiroae, Myrothamnus flabellifolia, Sclerocarya birrea, Strychnos cocculoides, Adansonia digitata</i>
Ditshegwane	Kweneng	2011	<i>Tylosema esculentum, Citrullus lanatus, Boscia albitrunca, Bauhinia petersiana</i>
Shaikarawe	Ngamiland	2012	<i>Schinziophyton rauteneni, Securidaca longipedunculata, Eriosema cordatum, Pterocarpus angolensis, Ochna pulchra, Strychnos pungens, Strychnos cocculoides, Guibourtia coleosperma, Grewia flavescens, Dialium englerianum</i>
Tsonyane	Southern	2012	<i>Tylosema esculentum, Grewia flava, Grewia retinervis, Kalaharituber pfeilli, Harpagophytum procumbens, Bauhinia petersiana, Boscia albitrunca</i>
Lefhoko	Southern	2012	<i>Tylosema esculentum, Grewia flava, Grewia retinervis, Boscia albitrunca, Kalaharituber pfeilli, Strychnos cocculoides</i>
Maokane	Southern	2012	<i>Tylosema esculentum, Grewia flava, Opuntia spp.</i>
Thankane	Southern	2012	<i>Tylosema esculentum, Grewia flava, , Harpagophytum procumbens, Boscia albitrunca</i>
MEKGATSI Trust of 11 villages	Southern	2012	<i>Tylosema esculentum, Grewia flava, Grewia retinervis, Kalaharituber pfeilli, Harpagophytum procumbens, Bauhinia petersiana, Boscia albitrunca</i>

Annex 6: List of people/organizations who have contributed to the project since 2007.

- Ministry of Agriculture, National Plant Genetic Resources Center (NPGC)
- Ministry Environment Wildlife and Tourism (Department of Forestry and Range Resources, DFRR, (National Tree Seed Centre (NTSC) & District Forestry Offices, 3), Department of Environmental Affairs, DEA, Department of National Museum and Monuments (National Herbarium and Botanical Gardens)
- Veld Products Research and Development (VPR&D)

- National Food Technology Research Center (NFTRC)
- University of Botswana: Okavango Research Institute, ORI, Office of Research and Development (ORD); Department of adult education
- Forest Conservation Botswana (FCB)
- Ministry of Education and Skills Development (MoESD): Department of Primary Education); Department of Out of School Education and Training.
- Vision 2016 Council (Botswana)
- Botswana Institute for Policy Development Analysis (BIDPA)
- Letloa Trust in Shakawe/Shaikarawe
- The Southern African Science Service Centre for Climate Change and Adaptive Land Use (SASSCAL)
- Swedish University of Agricultural Sciences (SLU)
- The Ivory Foundation / Pronatura: Two French partners
- Ghanzi Permaculture International
- Ministry of Trade and Industry (Department of Registrar of Companies and Intellectual Property)
- Botswana Post Office Foundation.
- Ministry of Local Government.
- Cornell University (Market matters), US
- Pavia University, Italy

Annex 7: List of dissemination material since 2007.

Scientific articles

- MANYEULA, F., TSOPITO, C., KAMAU, J., MOGOTSI, K.K, NSOSO, S.J. and MOREKI, J.C. 2013. Effect of *Imbrasia belina* (westwood), *Tylosema esculentum* (Burchell) Schreiber and *Vigna subterranea* (L) Verde as protein sources on growth and laying performance of Tswana hens raised under intensive production system. *Scientific Journal of Animal Science* 2(1).
- MOGOTSI, K.K. and NGWAKO, S. 2011. Towards afforestation and livelihoods improvement: MSB-UPP contribution in Botswana. Paper presented at MSB International Forestry Workshop. Afforestation in Africa: constraints and opportunities. 5–10th December 2011, Nairobi, Kenya, p17–24.

- MOGOTSI, K.K. 2012. Climate Smart Agriculture and Role of Emerging Crops in Africa: A case of Botswana. *Climate Change and Livelihoods in Africa*, DocLinks/Commonwealth Residential School. The University of Botswana. Gaborone, Botswana.
- MOGOTSI K. and ULIAN T. 2013. Conserving indigenous food plants in Botswana – the case of morama bean. *Samara* 24:4.
- MOGOTSI, K.K. 2014. Promoting Development of Indigenous Plants (Emerging Crops) in Botswana. In Seleka, T.B. (eds). *Towards 50 Years of Independence: The State of Agriculture in Botswana*. BIDPA (*in press*).
- MORAMA ENGAGED. 2012. *Morama Bean*.
<http://www.youtube.com/watch?v=6VXgcsmSyF0>
- NGWAKO, S. and MOGOTSI, K.K. 2010. Botswana Useful Plants Project (UPP). Presented at a UPP Workshop in Bamako, Mali, 20–24th May 2010.
- NGWAKO, S. and MOGOTSI, K.K. 2010. Morama bean (*Tylosema esculentum* (Burch.) A. Schreib). Presented at a Morama bean Seminar in Ghanzi, Botswana, 6–7 April 2010.
- TAKUNDWA, M., NEPOLO, E., MOGOTSI, K., KANDAWA-SCHULZ, M.A., CULLIS, A.C., KUNERT, K., JACKSON-MALETE, J.J., CHIWONA-KARLTUN, L. and CHIMWAMUROMBE, P.M. 2012. Development and use of microsatellite markers in marama bean. *African Crop Science Journal* 20(2): 95–105.

Poster presentations

- MOGOTSI, K.K., NGWAKO, S., MOGOTSI, A.T. and AMOSSO, C. 2011. Selected indigenous plant species targeted for domestication and commercialization in Botswana. *3rd Crop Science and Production Conference*. 11–13th April 2011, Gaborone, Botswana. p47.
- NGWAKO, S., MOGOTSI, K.K., MOJEREMANE, W., OBOPILE, M., MOGOTSI, A.T., BATISANI, N., TSHIRELETSO, K. and KGWATALALA, P. 2011. Successes and challenges in propagation and management of indigenous plant species in community gardens: a case of useful plants project. *3rd Crop Science and Production Conference*. 11–13th April 2011, Gaborone, Botswana. p47.

Other posters

- UPP activities and achievements
- 15 community prioritized plant species
- Product development (five species)
- Medicinal plants (five species)

Press articles

- ADAMS, T. and HALL, A. 2009. The No.1 Lady Seed Detective. The Observer Magazine. pp 31–37.
- SCRASE, R. 2009. From the Bush to the Garden. Peolwane (August 2009). Air Botswana In-flight Magazine. pp 26–30.
- SCRASE, R. 2009. Domesticating wild trees in Botswana. New Agriculturist: July.
- SCRASE, R. 2009. Lessons in Collaboration. Research Africa. pp 22–23.
- BOTSWANA PRESS AGENCY, BOPA. 2011. Rural electrification project to cover Tsetseng – Khama, Gaborone, Botswana.
- BCA, PRO. 2012. The Useful Plants Project Acquires a vehicle. Weekly Briefs, BCA, Botswana.
- MFILA, I. 2013. Poverty fight on: more than 15 communities empowered. Botswana Guardian, Gaborone, Botswana. p8.

MSc Thesis research

FREDDY, M. 2012. Performance of Tswana hens fed three different protein sources (*Imbrasia belina* (westwood), *Tylosema esculentum* (Burchell) Schreiber and *Vigna subterranea* (L) Verdic) in Botswana. MSc thesis. Botswana: University of Botswana.

Workshops attended

- Pilikwe village hosted 2009 national tree planting day on 24 October 2009.
- Tsetseng community hosted the 2009 National tree planting day for the Kweneng West in Tsetseng on 31 October 2009 (Three hundred and ninety (390) seedlings were planted in the garden and in the community).
- The community participated in the national annual review and commemoration of Botswana Vision 2016 in November 2009.

- Presentation of the MSBP/UPP at the National Biodiversity Agency annual meeting in February 2010.
- Presentation of the MSBP/UPP at the Community workshop on Climate Change Adaptation strategies organized by the Department of Meteorological Services in 2010.
- Tsetseng community hosted the 2010 International Year of Biodiversity on 22 May 2010.
- UPP presented a paper on the potential for commercialization of *Tylosema esculentum* at a community workshop organized by the University of Botswana 7 June 2010 in Ghanzi, Botswana.
- 1st workshop on sustainable production morama bean and UPP, Tsetseng, September 27–29, 2011.
- Mabutsane Sub District workshop, 23rd July 2012.
- 2nd workshop on sustainable production morama bean and UPP, Lethakeng, September 25–26, 2012.
- Kgalagadi District Smart Partnership Dialogue (Kang), 30th July–1st August 2013.
- UPP-Botswana team attended the Botswana Consumer Fair, the AFAAS conference and the National Agriculture Show, August 2013.
- Pilikwe workshop for Moselewapula trust on the 7–8th August 2013.
- Pilikwe Primary School workshop for teachers and students on the 8th August 2013.
- Presentation on Local Indigenous Plants and Trees to promote economic growth in North East District as part of the Vision 2016 Council Dialogues.
- UPP staff in collaboration with BCA PRO office displayed indigenous plants products at the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) general assembly on the 6–7 May 2014.

3

The MGU –Useful Plants Project, Kenya



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Abstract

Within Kenya, the first phase of the Useful Plants Project (UPP) focused its activities in the Tharaka district (eastern Kenya) with the aim of addressing the threats to medicinal plants in the region. The project made significant achievements through strategic partnerships with local communities and other stakeholders. A list of 779 useful plant species was developed, 224

species were prioritised for further activities and conservation interventions were completed for 65 prioritised species. A total of 252 seed accessions were collected and 149 accessions were duplicated at the Royal Botanic Gardens, Kew's (RBG Kew) Millennium Seed Bank (MSB) for *ex situ* conservation. A phytochemical analysis to improve the development of the species *Zanthoxylum gillettii* was completed and published during the Project's first phase (UPP1). Capacity building activities were carried out within the communities in order to produce plants for their own needs and also for income generation through the sale of plants. This was done through training workshops, by providing technical support and by procuring the materials needed to establish and run community nurseries, gardens and woodlots. The project activities were disseminated through various outlets including publications, workshops and through the mass media. In its second phase, the project was expanded to two new sites with new communities and the scope was widened to include other important indigenous plants with uses based on community knowledge and local habitats. About 100,000 seedlings of 39 species were propagated, procured and distributed to local people and schools to be planted and to promote their growth and uses into the wider community. Seed collection activities were intensified (124 collections of 120 species) and links to other stakeholders and market channels were identified. These activities improved the adoption, use and conservation of the selected plants. The demand for planting material of several species is on the increase as the barriers associated with propagation and marketing of their products have been reduced as a result of the project.

Introduction

Rationale

Background to the Useful Plants Project in Kenya

The Useful Plants Project (UPP) in Kenya began in June 2007 focussing on the drier area of eastern Kenya – Tharaka District. During its first phase, the project focused on enhancing the *ex situ* conservation of medicinal plants. The project was scaled up in 2012 to two other locations around the Lake Victoria Basin in western Kenya – Siaya and Nyamira districts. The communities in these areas depend directly or indirectly on plants for their everyday needs (such as food, medicine, fuel and building materials). Indigenous plants in these areas are faced with a range of threats including climate change, over-exploitation, drought, habitat loss and invasion of exotic species, particularly *Eucalyptus* spp. and *Grevillea robusta*. In implementing activities in Kenya, the UPP has built on the 'Seeds for Life Project' (SfLP) through its

partnership with the Millennium Seed Bank Project (MSBP). In Kenya, this partnership has taken a lead role in: i) the enhancement of *ex situ* and *in situ* conservation and the sustainable utilisation of indigenous plant genetic resources, and ii) in the enhancement of technical and scientific co-operation in order to support biodiversity conservation nationally and internationally including the improvement of exchange of information.

Problems associated with propagation of most local species have led to a lack of planting material and reduced planting. The three local communities involved in the project are faced with a different range of challenges such as poverty, lack of markets for their plant products and a poor understanding of plants and their products. The project attempted to assist communities to face these challenges by improving their livelihoods through the sustainable use of local plant resources. The lack of markets for plant products has remained a challenge and affected the local community's morale to propagate and plant the selected species. Some areas in the three project sites have undergone massive degradation, which has led to a decline in the availability of local plants' goods and services. To reverse these trends the project has undertaken intervention measures based on informed scientific investigations to improve their success.

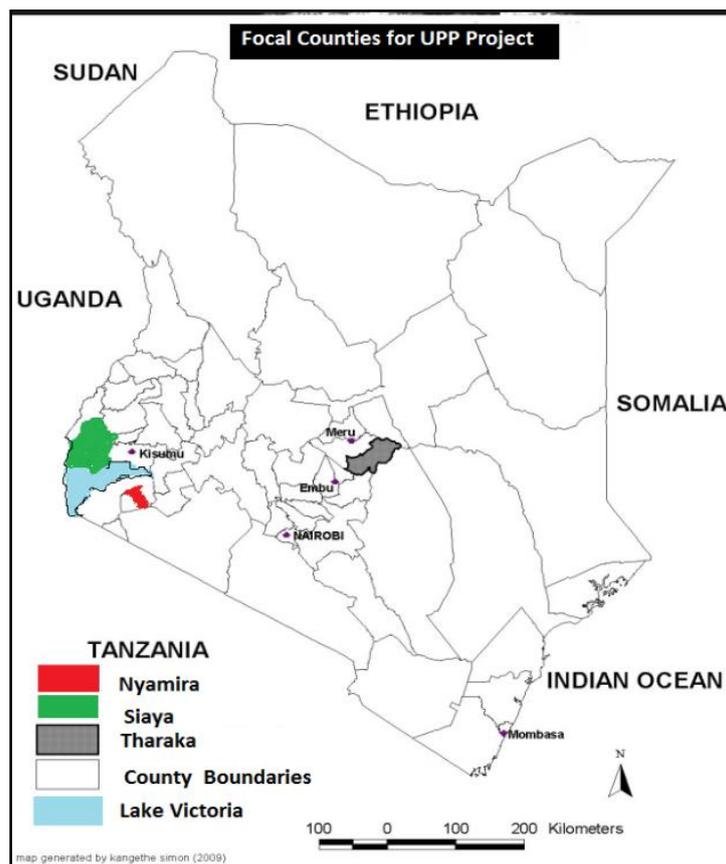


Fig. 1: Focal counties for UPP project.

Description of project sites

Tharaka County

The county was recently renamed Tharaka Nithi in order to cover the area extending from Mt. Kenya to Meru National Park. It is located in eastern Kenya and covers a total area of 2,638.8 km² with an average elevation of approximately 1,200 meters above sea level. The coldest month is July with temperatures falling to 11°C compared to the hottest period when temperatures reach up to 26°C. The total number of people living in the county is estimated to be 130,098. Most of the population resides in urban areas while only 6.6% lives in urban areas. The lower region, where the project has operated, is classified as semi-arid and considered to be the least populated in Kenya, with a density of approximately 138 people per km². The mean annual rainfall ranges from between 200 and 500 mm per year and can be unreliable. The ‘short rain’ season occurs from October to December and is more reliable than the ‘long rain’ season, which falls between April and June. Despite the low rainfall, agriculture is one of the main economic activities carried out by the population. Among the main crops are early maturing grains and legumes. There is a high potential to grow fruit trees, as for example high volumes of legumes are already being transported to external markets. The income generated by the sale of these products provides farmers with an important capital to invest. The area also produces very high quality honey which can be processed, branded and marketed locally and internationally to support the region’s economy. Frequent droughts together with the arid conditions are a key constraint to rain-fed crop agriculture and an important determinant of vegetation types. Tree planting requires species selection and interventions that target dryland technologies to improve seed and seedling production. The most common local tree and shrub species are *Acacia* spp. (various Acacias), *Adansonia digitata* (or Baobab tree) and *Melia volkensii*.

Nyamira County

The county is located in western Kenya in the former Nyanza province. It covers a total area of 899.3 km². The total population of the county is estimated to be 486,975 inhabitants, with 14% of the population residing in urban areas while the rest lives in the rural areas. Proximity of the Nyamira County to Lake Victoria helps determine the county’s rainfall and climate. The annual rainfall ranges from 600 to 2,300 mm. The rainfall pattern is bimodal whereby the ‘short rain’ season occurs between September and November, and the ‘long rain’ season between February and June. Annual mean temperatures range from 16°C to 17°C. Most rivers are

permanent which is very useful to the agricultural sector as farmers depend on their water for irrigation.

Agriculture is one of the major activities carried out by most of the residents of Nyamira county, with bananas and tea as the main crops. This is attributed to the high rainfall received all year round and the fertile soils that are less susceptible to soil erosion. These crops are grown both on a small and large scale. However, an increase in the population has led to a decline in land available for agricultural activities. Some of the residents of Nyamira also keep dairy cattle for milk and meat production. Other crops, which are mainly grown for subsistence, include maize, sorghum, beans, potatoes and vegetables. Any surplus is sold in the county's agricultural markets. The region is dominated by exotic trees and shrubs, mostly *Eucalyptus* spp. and the local plant diversity is minimal in much of the region. The county's economy is driven by agriculture of cash crops and other crops that fetch high prices in the local and international markets. These earnings provide the residents with some income to meet their financial needs.

Siaya County

The project is situated in West Ugenya of the Siaya county which has a population of about 31,000 inhabitants in an area of 98 km². The project area is characterised by crop production with patches of shrubs and low tree cover. The area is generally considered a wood deficit zone, in which demand for wood is higher than what the region can provide. Rainfall is unevenly distributed and has become more unreliable during the last decade. West Ugenya is 142 km from Kisumu city, which is the third largest city in Kenya. The increasing population in the area and the reduction of land fertility has led to increased human encroachment on natural ecosystems through homestead and farm expansion onto natural bush lands. Poor farming methods and unplanned land management techniques are a threat to food security and the local flora. These activities have extensively reduced the tree cover leading to soil erosion in most of the landscape.

Much of the land is dedicated to the cultivation of exotic food plants with the remaining areas of land consisting mainly of remnant bushland vegetation of indigenous species such as *Albizia coriaria*, *Carissa edulis*, *Ficus capreifolia*, *Grewia bicolor*, *Rhus natalensis* (synonym of *Searsia natalensis*), *Teclea nobilis* (synonym of *Vepris nobilis*) and *Vitex doniana*. In contrast, two and three decades ago indigenous food plants and other plants sourced from the wild

formed part of the local diets. Within the project area, a 60 ha government owned woodland had been the traditional firewood gathering area for a long time. The woodland was also a valuable source of indigenous fruits and medicinal plants, which provided both dietary and medicinal supplements to the local community. The continuous degradation of this woodland has significantly contributed to a loss of biodiversity and soil erosion evidenced by the high siltation of the nearby river Nzoia that flows along the southern boundary of the project area.

West Ugenya is only 10 – 12 km away from the traditional flood basin of river Nzoia, where the river enters Lake Victoria and act as an important catchment area. Restoration of trees and plant vegetation cover along the riverine systems using rehabilitation and on-farm tree planting activities is pertinent. In addition, the use of native species in such programmes has been emphasized.

The local community recognises primary schools as champions of conservation by involving students and teachers. One of the major constraints to afforestation efforts is the appropriate seed and seedling species supply. Some community members have started developing private nurseries comprising mostly exotic species as dictated by markets and plant demand. This follows the strong belief that indigenous trees take too long to mature. Some traditional beliefs also shun the planting of specific trees, for example *Milicia excelsa*. However, the continued over reliance on exotic species could lead to serious environmental damage and biodiversity degradation. Training on seed collection, handling, plant propagation and nursery management has been designed to encourage plantation activities using native species. By promoting the use of native species, the project aims to recover forest biodiversity and enhance ecosystem services such as improved water catchments, and to provide an income for the communities through the provision of forest products (such as charcoal, fruits and timber). The integration of commercial fruit trees and the introduction of fast growing species of special interest such as *Melia volkensii* and bamboo, from regions of similar climatic conditions, could boost tree planting activities.

Summary of results of phase 1 (UPPI)

During the first phase of the project, the focus was the utility value of key medicinal plants and woody species that are used for wood, fuel or carving in the district of Tharaka. It was found that documentation of medicinal plant species in Kenya needed improving by adding and consolidating new information. The project ensured that seed-lots of several Kenyan plant

species were secured and tested for viability prior to long-term *ex situ* storage. Academic studies to screen for active ingredients and test different tissue culture techniques were developed. Data and protocols necessary for the commercial exploitation of selected Kenyan medicinal plants were also compiled. Many stakeholders, including organisations and professionals, met to prioritize species for conservation. The project collaborated with local communities to propagate plants which could be used to raise incomes for community households. Sale of seedlings to schools, government departments, hospitals and local communities has contributed to increased households incomes, and at the same time increased the different counties' tree cover. The project also significantly contributed towards the fulfilment of national and international obligations, for example i) to the Millennium Development Goals 1, 3, 7 and 8; ii) the Global Strategy for Plant Conservation (up to 2010) and iii) to Kenya's vision 2030.

Goal, Purpose and Outputs of Project (UPP2)

Goal of Project

To improve the welfare of local communities and to safeguard important useful plants from extinction in three selected communities in Kenya. The second phase of the UPP project focuses on improving the capacity of local communities in Kenya to conserve their most valuable plants and use them sustainably. The project also seeks to scale up and strengthen its gains made during the first phase of UPP with focus on the specific areas and outputs described below.

Purpose

To conserve and use plants sustainably for human well-being.

Output 1. Project planned, monitored and implemented effectively

Sustainability of UPP programmes in Kenya will be guaranteed through strategic partnerships, the mainstreaming of activities and by enabling users to be self-sustaining. Activities will be scaled up to other sites. The project strategy in the second phase is to incorporate additional partners and to re-arrange the management structure and implementation.

Output 2. Species conserved ex situ

The target list of useful plant species compiled during the first phase of UPP is to be enhanced with species from the Nyanza province (Nyamira and Siaya). Species in each community and project site will also be added to the compilation.

Output 3. Species propagated and conserved in the communities

The second phase of the project will address the aspirations of all community groups during the implementation of activities. The project will use the goals of stakeholders (institutions, communities and school groups) to tailor planning to enhance technology transfer which improves sustainable production and use of useful plants. There is good anecdotal evidence that large scale tree planting and riverine catchment restoration in Kenya is a long way from complete, which will cause future problems because of species invasiveness and a lack of resilience to the system.

Output 4. Sustainable use and income generation from useful plants

UPP2 will seek to help communities in the establishment of sustainable use and marketing strategies of at least six plant based enterprises (seeds / seedlings / part of plants) and two livelihood options (fish ponds, bee hives, dyes and basketry) to be promoted for income generation in the three project sites. This component of the project will be covered by UPP-CITI in Tharaka and by UPP-MGU in both Nyamira and Siaya.

Output 5. Information disseminated and project promoted

The project will facilitate the production of project publicity material by project teams and the RBG Kew team for dissemination. Furthermore, project exposure will be enhanced through the generation of publicity material at the local, national and international level by the end of the project, including updating the project website, producing species leaflets and posters, and publishing at least one scientific article in collaboration with RBG Kew.

Materials and Methods

UPP-MGU continued to address its focus on improving the capacity of local communities to conserve their most valuable plants. The project scaled up and strengthened gains made during the first phase with a focus on the following specific outputs:

Project Outputs/Indicators

Output 1: Project planned, monitored and implemented effectively

Activities were prioritised by increasing its local institutional partnerships to three institutions in line with the SfLP local partnerships. This was decided by the SfLP Project Managements Group (PMG) composed of lead managers of the collaborating institutions. The project secretariat was consequently relocated from the National Museum of Kenya (NMK) to Kenya Forestry Research Institute (KEFRI). The main roles of these institutions were as follows:

Kenya Forestry Research Institute (KEFRI)

KEFRI has a national mandate to collect, test and distribute tree seeds. The institute undertakes the identification, registration and establishment of tree seed sources. In order to support this, the institute implements relevant training and offers advisory services in the tree seed sector relating to seed studies and quality tests of indigenous forest tree species. The institution's goal is to support effective production and use of tree seeds. The institute is endowed with fully trained and experienced scientists, technologists, seeds analysts and seed collectors.

The key project role of KEFRI, acting through its National Tree Seed Centre was:

1. To collect and conserve all trees and shrub species from project sites.
2. To cooperate with partners staff on capacity building of key technologies and innovations related to forestry and Plant Genetic Resource (PGR) conservation for the purpose of information dissemination in Kenya and the United Kingdom;
3. To jointly synthesize, develop, produce and distribute extension material and knowledge as mutually identified by all stakeholders;
4. To act as a Lead Agency in the management and implementation of the project and to host the secretariat with office space and associated logistical support;
5. To screen seed collections for their storability through seed studies;
6. To support the Kenya Agricultural Research Institute's (KARI) seed testing for tree and shrub species;
7. To work with KARI and NMK to develop a common data management system;
8. To develop and implement a seed procurement and distribution system to promote seedling production by various stakeholders and partners.

Kenya Agricultural Research Institute (KARI)

KARI's National Genebank of Kenya (GBK) maintains a base collection of wild and cultivated plant species. It also coordinates germplasm collection, rejuvenation, multiplication and characterization. The institute has a wealth of highly trained and experienced specialists comprising scientists, technologists, database managers and seed collectors. The key project responsibilities of KARI were:

1. To support the collection and conservation of target plant species;
2. To complete germination tests of collections held at GBK;
3. To manage collections information (seed bank database management);
4. To share expertise and information with partners on the collection and processing of plant species;
5. To work with KEFRI, NMK and RBG Kew to develop a common data management system which may include the establishment of an online data resource either through the MSBP Data Warehouse and/or an online GBK seed list;
6. To utilize its expertise to generate propagation protocols for plant species that exhibit poor germination rates.

National Museums of Kenya (NMK)

The key project roles of NMK reflect its botanical expertise residing in the Botany Department. These include scientists, technologists, database managers and taxonomists. These experts are linked to the wealth of collections preserved at the herbarium and *ex situ* sections. The NMK project responsibilities were:

1. To build on existing skills in the collection and propagation of plants such as orchids, which possess microscopic seeds;
2. To utilise and share with partners its expertise in investigating seed maturity, acquisition of desiccation tolerance and post-harvest technology in order to improve seed quality in wild species collections not targeted by KARI and KEFRI;
3. To support plant identification, provision of voucher specimens and general collection of herbarium material in seed collection expeditions;
4. To work with KARI and KEFRI to develop a common data management system;
5. To ensure access to gazetted areas under its jurisdiction, for the purpose of seed and voucher specimen collections.

By June 2014 indications were that two county governments and one NGO were interested to join the partnerships at a local level in the new sites. As a result of working as partners (through the project secretariat and the lead institution) all project documents were agreed at participatory meetings with consensus reached before approval and implementation. As a management requirement, and as good practice, country reports (mid and annual reports) have been submitted to RBG Kew to enable them to compile and submit a general report to the donor every six months. The project was subject to external review by the end of the second year.

At the national level, the project has been managed through a project coordinator and a project officer who reported to the international coordinator and the PMG. The main role of the project officer has been to facilitate the implementation of activities by procuring services and equipment; arranging meetings; and compiling work plans, budgets and reports. The roles of the project coordinator and the technical team leader were addressed to provide greater clarity of purpose. At the institutional level, a technical manager oversaw the implementation of all project activities which included the preparation of work plans and budgets; the identification of appropriate staff for project activities; and the compilation of relevant reports.

The process of identifying local communities at each project site was undertaken through links with relevant government agencies, such as the Kenya Forest Service, local administration and NGOs. Through this collaboration, communities have been mobilized for all training, workshops and general project implementation strategies. Each project site has a unique plant species composition and there is a diversity of cultures and languages. Priority identification and listing of species has been undertaken at stakeholder workshops and specialised user group meetings, for example with traditional herbalists and/or village elders. The use of relevant literature and existing plant markets also provided valuable information.

Output 2: Species conserved *ex situ*

Seed collection was extended to the new sites in Nyanza with a total target of 600 seed collections comprising 300 species from all the three sites (Tharaka, Nyamira and Siaya). It was planned to bank and duplicate these collections at RBG Kew's MSB by the end of the third year. Research was to be carried out on 150 seed collections in order to assess their quality using seed testing techniques (germination and storage potential) at KARI and at Kew's MSB.

Output 3: Species propagated and conserved in the communities

Communities were encouraged to focus on indigenous plant species when producing seedlings both in communal and individual nurseries following policies developed by all stakeholders and which support PGR conservation. Training and nursery support was provided by institutional teams and the communities were involved in planting experimental woodlots on selected private farms and schools.

Output 4: Sustainable use and income generation from useful plants

Communities were linked with markets for various plant products. Some of these were with various user groups, such as the Traditional Healers Associations and tree planting initiatives in Kenya. The communities in Tharaka were supported with the sustainable use and marketing (product, pricing, place) of seeds of *Melia volkensii*.

Output 5: Information disseminated & project promoted

Information derived from the first phase of the project was compiled, updated, organized and disseminated at the local, national and international level. Project exposure was enhanced through the generation of publicity material at the local, national and international level and at conferences and open days. Media coverage was also used as part of the strategy.

Results/Achievements

Output 1: Project planned, monitored and implemented effectively

In addition to NMK two new partners (KARI and KEFRI) were included in the project through their involvement in the development of workshops and meetings (with a broad consensus achieved on the role of each partner in the project). In playing these roles, the partners ensured they comply with the provisions of the relevant institutional guidelines and mandates, national laws and regulations, as well as conventions and treaties to which Kenya is a party. These partners were collectively involved in scaling up and implementing the activities completed during the first phase of the project. The re-location of the project secretariat to KEFRI and activity expansion to additional project sites increased the intensity of project activities in regard to resource allocation requirements and the strategic technical approach required.

Output 2: Species conserved *ex situ*

A prioritised list of targeted useful plant species was derived for each project site with relevant information (use, distribution, conservation status) which was incorporated into the 'Useful Plants Project' database. This list was shared with all project partners databases. A cumulative target list of 468 useful species was identified to inform seed collection activities. A total of 401 seed collections of priority useful plant populations were made and 123 of these accessions were duplicated at RBG Kew's MSB. In addition, all the seed collections were assessed for viability, germination and storability. Not all the species identified for collection were collected because of the challenges related to the species reproductive biology and different fructification periods.

Output 3: Species propagated and conserved in the communities

Across all sites, a total of 16 priority useful species were propagated with five propagation protocols developed. In addition, two new communities/locations were engaged and integrated into the project. The project's links to schools resulted in 20 priority useful species (100,000 seedlings) being planted and maintained in gardens and woodlots at 11 local schools. The capacity of local communities to propagate and conserve plants was enhanced following six training programmes, four workshops, the establishment of 10 nurseries and the improvement of other local facilities in all the three project sites. The school programmes were also enhanced through the involvement of seven schools and over 200 children in training activities. The project paid school fees and procured uniforms in support of 40 selected vulnerable children. No planting was undertaken in any protected area (due to institutional and legal issues and protocols) but this will be achieved before the end of the project. Research on seven useful plant species to enhance their conservation and sustainable use in the local communities has been initiated. One of these is *Garcinia b Buchananii*.

Output 4: Sustainable use and income generation from useful plants

During UPP1, significant achievements were made in the production and marketing of local plant products such as baskets and seedlings. Opportunities were created by linking the communities to other user groups. In UPP2 this was extended to the two new sites by linking these communities to the seedling markets. The Siaya group nursery sold 25,000 seedlings of assorted species worth Ksh 250,000 (\$ 3,000). In addition, some community members sold locally collected seeds of *Markhamia lutea* to KEFRI through the public private partnership policy of the institute. More products are in development following demonstrations of other

species' uses to communities. Among these products are fruits of *Garcinia buchananii* and *Dovyalis macrocalyx* and several other plants with proven medicinal and food value (e.g. Moringa).

Output 5: Information disseminated & project promoted

Information derived from the first phase of the project has been compiled and disseminated at the local, national and international level. One poster and two brochures were developed. The project activities were also presented in one scientific conference and an open day in 2009. Two media articles have been published, one in a national newspaper and another in a British Airways magazine in September 2009. In addition, an article on *Adenium obesum* was included on the RBG Kew website. Other four dissemination activities were completed during two school open days and two general farmers' field days in Siaya and Nyamira.

Table 1: Results for the project per each indicator divided by phase (2007-2014)

Quantitative indicators	UPP 1	UPP 2	Total	Constraints
New partnerships	2	0	2	
Cumulative target list with useful species	319	468	468	
Seed collections made	252 (251 species)	149 (134 species)	401 (371 species)	
Seed collections banked in country	221 (220 species)	124 (120 species)	354 (331 species)	
Seed collections banked at the MSB	123 (118 species)	0 (0)	123 (118 species)	
Seed collections tested		120 (124)		
Species propagated	37 (10,000 seedlings)	39 species (82,505 seedlings)	46 species (92,505 seedlings)	
Propagation protocols produced	68	5	73	
Communities/community groups involved in the project	1	2	3	
Species planted and maintained in local communities/schools	5 species (450 seedlings)	13 species (6,552 seedlings)	16 species (7,002 seedlings)	
Local communities/schools involved in planting activities		11		
Community/school gardens/woodlots where planting activities have been carried out	8	19	27	

Capacity of local communities enhanced through workshops, training events, nurseries	101 people trained	20	121	
School programme enhanced through the involvement of schools		9		
Research on species	4	4	7	
Species (seeds/seedlings/part of plants) promoted for income generation	0	11	11	

Discussion

During the first phase of the project significant achievements were made in the drier project region in eastern Kenya. The communities were introduced to a technical approach to plant and propagate difficult species through active participation in the project's implementation. Through the training programmes, members of the participating communities acquired technical skills which enabled them to produce seedlings and to initiate tree planting activities on their own farms. Woodlots were planted through the efforts of some groups which triggered a tree planting culture within the area. The project has directly contributed to the constitutional requirement to achieve 10% tree cover at the farm and National levels. Through the exposure and participation in this project, several community members have had the opportunity to initiate enterprises associated with plant products and to improve their incomes. This ensured the cultivation of many local species which enhances their conservation on farms and which provides many environmental services and increases biodiversity. Many people in the area have realised the hidden benefits of trees and their potential to change their lives.

The project also supported partners to achieve institutional, national and international mandates and obligations. The scientific results and the protocols developed under this project have provided valuable knowledge to the fields of plant science and environmental conservation. The results provide opportunities to expand activities to other areas as part of a global campaign to conserve the world's flora. The major strength of this project is that it focussed on the communities whilst facilitating shared experiences across regions and communities, and between professionals from many countries.

The extension of the project into a third phase will enable the fulfilment of some issues raised by communities that are currently not addressed.

Conclusions and Recommendations

Through planting large areas with woodlots in all the project sites, the project has positively contributed to the increase of Kenya's forest cover. Despite tree planting not being a priority activity at all project sites, the project directly instilled a planting culture following training which informed communities of the benefits accrued from the tree products. It is important to note that, through the involvement of other stakeholders, the project and the partner institution's profiles have been enhanced at the international level. Kenya has increased its seed collection capacity and at the same time, the partner institution's ability to adhere to their national obligations has been enhanced following the provision of equipment and transport. The implementation model and management approach of partnerships, with regular site monitoring, contributed to its impacts by giving the communities the opportunity to participate in discussions with the management teams at the national and international levels. In the future, it is recommended that the project focuses more on the following areas:

- To establish a specialised monitoring system for the woodlots and planted areas. One method would be to digitise efforts and to maintain quarterly reports on their performance.
- To expand training to include other plants and propagation techniques such as grafting of fruit trees like mangoes or other indigenous fruits.
- To develop business models for each community to address various market options for their plants and products.
- To explore export markets for some local products.
- To promote exchange visits as learning opportunities between communities and technical managers.

Acknowledgement

We would like to acknowledge all the partners especially the communities. All the technical managers who undertook their responsibilities with zeal and sincerity to ensure the achievement of the goals of the project. Special recognition goes to the local administration

that provided guidance, security and mobilization of members of the communities, the Kenya Forest Service and all other stakeholders. Special thanks also to the managers of the partner institutions, KEFRI, KARI and NMK for their guidance and support. Lastly special recognition goes to Ms. Tiziana Ulian and her colleagues at RBG Kew for their technical, logistic and moral support, guidance and for offering us the opportunity to participate in this project. We cannot forget to give our very special thanks to the financial support of “MGU”, who in her own philanthropic nature made a difference to the lives of those communities who were part of this project.

Annexes - Kenya

Annex 1: Logframe of the project.

Logframe for Second Phase of Project MGU-the Useful Plants Project (UPP)			
Objectives	Indicators	Means of verification	Assumptions
Overall Project Goal	Welfare of local communities improved and useful important plants safeguarded from extinction in Latin America and Africa		
	Capacity of local communities in Latin America and Africa to conserve and sustainably use useful plant species enhanced	Dissemination material; workshop documents; facilities for plant conservation and sustainable use enhanced in local communities in Latin /America and Africa	
Project Purpose	Conservation and sustainable use of plants for human wellbeing		
	At least 300 seed collections of priority useful plant species made and held to international standards in seed banks in-country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK	Seed collection registers and/or catalogues maintained in partner seed banks.	Access agreements and permits are available; all Project partners are committed and provide consistent support to the Project; seed conservation is scientifically feasible for the target species
	120 useful plant species (60,000 plants) prioritised and grown in 3 local Project sites (Tharaka, Siaya and Nyamira)	Propagation protocols, minutes of prioritisation process/meetings, Project reports, species register, partner institute biannual/annual reports, nursery records	Plant propagation is scientifically feasible for the target species; favourable climatic conditions prevail

		Priority useful plant species maintained by local communities in members' and school gardens	Community members are engaged and agree to provide time and land for growing and maintaining priority useful plant species
		List of community gardens	
	At least 30 priority useful plant species conserved and sustainably used <i>in situ</i> (managed areas) (at least 10 per site)	Project technical reports; Biannual and annual reports	Relevant stakeholders engaged and managed areas made available for <i>in situ</i> conservation
		Monitoring data and scientific material (reports/thesis/papers)	Research is feasible for priority useful plant species; students and extra staff are made available among partners
	Sustainability of UPP programme in country ensured through strategic partnerships, mainstreaming activities and enabling users to be self-reliant	Partner institutional work plans/Project partnership agreement signed; Project annual reports; Project reports on enterprises; Publicity materials; Database	National and international policy framework remains supportive of the use of traditional knowledge and indigenous useful plant.
	Information on useful plant species generated and shared in accordance with existing national policy framework	Dissemination material; Enrichment of databases and publicity about Project	Institutionally-affiliated staff are available
Project Outputs			
Output 1: Project planned, monitored and implemented effectively			
	Existing partnerships consolidated and at least 3 new relevant partnerships established and integrated by May 2012.	Minutes of Project meetings; Correspondence and agreements with relevant partners; Finalised Project documents (logframe, budget, management/staff structure and work plan)	All agreements are available; all Project partners are committed and provide consistent support to the Project; Funds are disbursed in a timely fashion at all levels

	Project documents (logframe, budget, management structure and work plan) agreed and finalised with partners by May 2012	Finalised Project documents (logframe, budget, management/staff structure and work plan)	Project successfully integrated into partners' institutional programmes; Good communication maintained with all Project partners
	Country biannual reports submitted to RBG Kew every six months (by end of May and November each year)	Country reports; Minutes of in-country technical and management group meetings	Stakeholders agree on Project structure
	Project reviewed by the 2nd year (2004) of the Project at the international level	Attendance and presentation to International Project review workshop and country report	Representatives from Kenya attends Project Review Workshop and prepare Report
Output 2: Species conserved <i>ex situ</i>			
	Target list of 300 useful species with relevant information developed in-country within 1 year by the end of the first year	Lists of targeted useful plant species with relevant information (use, distribution, conservation status) derived and incorporated into the 'Useful Plants Project' database	Staffs are made available among partner institutions
		EA, KARI and KEFRI Genebank institutionalise Project databases	Staff and facilities available in-country
	At least 600 seed collections comprising 300 species collected from three local Project sites (Tharaka, Siaya and Nyamira) and effectively conserved and duplicated at Kew's MSB by third year of the Project	Seed collections registered in the National Genebank of Kenya and in Kew's Millennium Seed Bank in the UK; Herbarium specimens of the corresponding seed collections deposited at EA Herbarium and duplicates in Kew's Herbarium	Seed conservation is scientifically feasible for the target species; favourable climate and political stability for supporting the Project prevails
	Quality of 150 seed collections assessed through seed testing (germination and storage potential) in-country and at Kew's MSB by the end of the Project	Data on seed testing (germination and storability)	Necessary facilities and technology exchange regimes are made available for seed testing

Output 3: Species propagated and conserved in the communities			
	60 priority useful species (120,000 seedlings per site) propagated by the third year of the Project	Propagation protocols; Species lists; Partner progress reports; Letters of agreement between partners and communities	Propagation is scientifically feasible for the targeted species; Trials are successful
	At least 6 additional community groups engaged and integrated into the Project by June 2012	Workshop documents and agreements with communities; Correspondence; Field reports	Community members and Project partners are committed to the Project
	60 priority useful species (120,000 seedlings per site) planted and maintained in at least 6 local community groups by the 3rd year of the Project	Records of the species propagated by community groups	Communities provide needed support including time and land for targeted useful plants
	12 experimental woodlots established and monitored at each of the Project sites (4 at each site) initiated by year 1, including 1 research woodlot per site being replicated on-farm (3 research woodlots)	Biannual and annual Project reports; Minutes of meetings with communities; Written methodology for experimental design of research woodlots; Results disseminated (establishing woodlots)	Appropriate weather conditions prevail to allow plant survival; Community members and partners are committed to managing woodlots
	Capacity of 120 local community members to propagate and conserve plants enhanced through training and the improvement of local facilities	Training reports and certificates	Community members are receptive to training and interested in propagating and conserving useful plant species
	School programme enhanced through involvement of 15 schools (5 per Project site) totalling 3000 children in communities	Training reports; Posters and brochures; Attendance lists	Teachers and students committed to undertake the national school greening programme

Output 4: Support to <i>in situ</i> conservation and use			
	At least 40 priority useful plant species (2000 per species) planted (80,000 seedlings) <i>in situ</i> (managed areas) in 3 Project sites by end of Project.	Records of Kenya Forest Service (KFS) registered nurseries; Records of KEFRI registered seed sources; Biannual and annual Project reports	Propagation is scientifically feasible for the targeted species; Relevant stakeholders are engaged and managed areas are made available for <i>in situ</i> conservation of priority useful plant species
Output 5: Sustainable use and income generation from useful plants			
	At least 6 plant-based enterprises and 2 livelihood options (seeds / seedlings / part of plants) promoted for income generation (e.g. bee hives, dyes and basketry) in 3 project sites by end of project	Dissemination material elaborating the value and use of indigenous useful plants (Output 6); Tools and infrastructure enabling long-term promotion of knowledge and use of indigenous plant species	Policy makers supportive of the use of traditional knowledge and indigenous useful plants
			Sustainable harvesting of useful plants or their products is feasible; value addition options and markets for useful plant species available
Output 6: Information disseminated & project promoted			
	Information derived from the first phase of Project MGU updated and disseminated to all project partners (how many? to include indicators here)	Volume 1 of book on Project MGU published at RBG Kew in collaboration with country team and further material published in country in collaboration with RBG Kew, including x species leaflets, x posters, x press and scientific articles	Extra staff are made available in-country and at RBG Kew to disseminate material and promote project

	<p>Awareness of project enhanced through the generation of publicity material at the local, national and international levels by the end of project (to include indicators here)</p>	<p>UPP-specific logo; publicity material such as press articles, project webpage, videos, radio interviews; Local/regional and global workshop attendance lists; Subscriptions to relevant societies</p>	<p>The project teams will have good working relations and frequent communications; Adequate funding available to support participation in workshops; Timely funding for production of dissemination material</p>
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Annex 2: List of priority species.

Genus	Species
<i>Acacia</i>	<i>gerrardii</i>
<i>Ageratum</i>	<i>conyzoides</i>
<i>Albizia</i>	<i>gummifera</i>
<i>Bersama</i>	<i>abyssinica</i>
<i>Bidens</i>	<i>pilosa</i>
<i>Conyza</i>	<i>bonariensis</i>
<i>Crassocephalum</i>	<i>montuosum</i>
<i>Crassocephalum</i>	<i>rubens</i>
<i>Croton</i>	<i>megalocarpus</i>
<i>Croton</i>	<i>macrostachyus</i>
<i>Ehretia</i>	<i>cymosa</i>
<i>Emilia</i>	<i>discifolia</i>
<i>Gomphocarpus</i>	<i>spp.</i>
<i>Gutenbergia</i>	<i>cordifolia</i>
<i>Hoslundia</i>	<i>opposita</i>
<i>Laggera</i>	<i>brevipes</i>
<i>Leonotis</i>	<i>nepetifolia</i>
<i>Maesa</i>	<i>lanceolata</i>
<i>Markhamia</i>	<i>lutea</i>
<i>Ocimum</i>	<i>gratissimum</i>
<i>Ocimum</i>	<i>lamiifolium</i>
<i>Ocimum</i>	<i>suave</i>
<i>Olea</i>	<i>africana</i>
<i>Plectranthus</i>	<i>barbatus</i>
<i>Portulaca</i>	<i>oleracea</i>
<i>Prunus</i>	<i>africana</i>
<i>Ricinus</i>	<i>communis</i>
<i>Rubia</i>	<i>cordifolia</i>
<i>Rumex</i>	<i>usambarensis</i>
<i>Senna</i>	<i>didymobotrya</i>

<i>Sesbania</i>	<i>sesban</i>
<i>Sida</i>	<i>acuta</i>
<i>Sida</i>	<i>tenuicarpa</i>
<i>Spathodea</i>	<i>campanulata</i>
<i>Spilanthes</i>	<i>mauritiana</i>
<i>Tragia</i>	<i>brevipes</i>
<i>Triumfetta</i>	<i>rhomboidea</i>
<i>Urena</i>	<i>lobata</i>
<i>Verbascum</i>	<i>brevipedicellatum</i>
<i>Verbena</i>	<i>bonariensis</i>
<i>Vernonia</i>	<i>auriculifera</i>
<i>Vernonia</i>	<i>biafrae</i>
<i>Vernonia</i>	<i>galamensis</i>
<i>Vernonia</i>	<i>hymenolepis</i>
<i>Vernonia</i>	<i>sp.</i>
<i>Vernonia</i>	<i>sp. (muteoitimo)</i>
<i>Vernonia</i>	<i>sp. (Umororia)</i>
<i>Vernonia</i>	<i>sp. (omonyarikana)</i>
<i>Vitex</i>	<i>keniensis</i>

Annex 3: List of ToTs and farmers trained during the 2nd biannual.

NAME	ORGANISATION/GROUP	MOBILE NOs
Dr. Desterio Nyamongo	KARI-Genebank	0725-234249
George McOoko	KFS	0722-880803
Daniel Omwansa	Chief Officer Environment & Energy	0722-571651
Rael Nyatenge	KFS	0717-605203
Mark Okari	Utubora Self-Help Group	0701-684088
Beatrice Nyakayo	Utubora Self Help group	0700-326508
Justus Nyariki	Chikwoyo Self Help group	0713-147274
Nixon Ombato	Chikwoyo Self Help Group	0702-768440
Julius Amenyua	Mazingira Bora Mashinani	0729-921033
Karen Momanyi	Mazingira Bora Mashinani	0718-141734
David Orina	Bundo Primary	0724-715789
James Gecheo	Bundo Primary	0735-343317
Charles Anari	Bundo Farmer	0722-715147
Elezabeth Mosomi	Mazangira Bora Mashinani	0723-580505

Jimmy Moindi	BDO	0714-127141
Linus Nyaribari	BDO	0719-325248
Yuvenalis Maangi	Mazangira Bora Mashinani	0729-667756
Evans Mosei	Omwobo Tree Nursery	0716-040032
Gladys Mogaka	Omwobo Tree Nursery	0728-828318
John Sitawa	KARI Headquarters	0722-981332
Charles Ndiege	KARI- Genebank	0722-262029
Shadrack Sanganyi	KARI-Genebank	0734-291817
Isiah Nayika	Department of Information	0710-213439
Edwin Mongare	Media Group	0725-223341
Fabian Khamusali	KARI Headquarters	0722-751205
Dennis Kirwa	Milele FM	0725-233082
Naftal Makori	Standard Group Ltd	0721-845398
Henry Nyarora	Nation Media Group	0710-711699
Samuel Mogire	KEFRI	0720-905003

TOT & FARMERS

NAME	ORGANISATION/ GROUP	MOBILE NO.
Dr. Desterio Nyamongo	KARI-Genebank	0725-234249
John Sitawa	KARI Headquarters	0722-981332
Charles Ndiege	KARI- Genebank	0722-262029
Fabian Khamusali	KARI Headquarters	0722-751205
Shadrack Sanganyi	KARI-Genebank	0734-291817
Samuel Mogire	KEFRI	0720-905003
Nixon Ombati	Chikwoyo Self Help Group	0702-768440
Beatrice Nyakayo	Utubora Self Help group	0700-326508
Jimmy Moindi	BDO	0714-127141
Karen momanyi	Mazingira Bora Mashinani	0718-141734
Justus Nyariki	Chikwoyo Self Help group	0713-147274
David Orina	Bundo Primary	0724-715789
James Gecheo	Bundo Primary	0735-343317
Charles Anari	Bundo Farmer	0722-715147
Elezabeth Mosomi	Mazangira Bora Mashinani	0723-580505
Julius Amenya	Mazingira Bora Mashinani	0729-921033
Jimmy Moindi	BDO	0714-127141
Linus Nyaribari	BDO	0719-325248
Paskeys Oyaro Ntabo	Chikwoyo Self Help Group	0714-337137
Ben Onsongo	KMF Workers	0726-742123
Josiah Nyangoya	Bonyakonias H. Group	0701525707
Nixon Morishwa	Mwanacha Self Help	0714326720
Isaac Nyangemi	Bonyakoni USH Group	0714736696
Josephine Moturi	Bonyakomoni Unity Self Help Group	0715717248
Rachel K Sigira	Bonyakoni USH Group	0719582922

Ronald M Maina	Bonyakoni USH Group	0717837578
Barnabas O Mounde	Mwanacha SH Group	0700762047
Hesbone Nyamongo	Bonyakoni USH Group	0729783932
Kennedy m Nyamweya	Nyabigena RSHG	0714441939
Meshack Kiboma	Nyabigena RSHG	0715699295
Meroka J Lawrence	Nyamomenta Group	0729238058
Ronald Ogero	Nyamomenta Group	0700727874
Kef N Kibogo	Nyamomenta Group	0717088610
Osoro Maruko	Mwanacha SH Group	0729784170
Calister Osoro	Mwanacha SH Group	0714673960
Margret Mongare	Mwanacha SH Group	0711244555
Rael Nyatenge	KFS	0717-605203
Jeremiah Ntabo	Chikwoyo	0714337137
Paskis Oyaro	Chikwoyo	0714337137
Caren Momanyi		0718141737
James Gecheo	Bundo DOK	0735343317
Mark Okari	Utubora SHG	0701684088
Nicholas Nyangau	Mazingira Bora Mashinani	0723715612
Evans Moseti	Omwobo	0716040032
Shaddrack	Omwobo	0716767894
Gladys K Mogaka	Omwobo	0728828318
Susan Kemunto	Omwobo	0707788806
Ruth Ndubi	Mwanacha	0718439303
Mary Nyabato	Omwobo	0752760300
Margret Korabo	Omwobo	071240735
Mary Nyasimi	Rianyating Nyabigena SHG	0714546325
Salome Obanyi	Rianyating Nyabigena SHG	Xxx
Josephine Keroti	Bonyakoni Unit SHG	0734329906
Vane K Omwenga	Bonyakoni Unit SHG	0717556657
Roseline Anunda	Bonyakoni Unit SHG	0714022313
Hamisi Junior	Bonyakoni Unit SHG	0719810707
Walter R Kimori	Sangaamo SHG	0710949095
Eliud Areba	Sangaamo SHG	0728786243
Isaac Ndubi	Sangaamo SHG	0728534676
Daniel O Kimori	Nyamonuri SHG	0720418349
Samuel Nyagwoka	Mwanacha SHG	0754538448
Nyaburi Maruko	Mwanacha SHG	0712391480
Elija Mwencha	Nyamomenta Youth Group	0727295248
George Nyaisimi	Nyamomenta Youth Group	0721403214
Daniel Mongare	Omwobo	0718171055

Annex 4: List of dissemination material since 2007.

Scientific articles

GAYA, C.H., KAWAKA, J.F., MUCHUGI, A. and NGERANWA. J.J. 2013. Variation of alkaloids in the Kenyan *Zanthoxylum gillettii* (De Wild Waterman). *African Journal of Plant Science*, 7(9): 438-444.

Species booklets

Booklet of 10 species: 'Selected Useful Plants of Tharaka - Kenya, A guide to Seed Collection, Propagation and Use' published and dispatched to relevant stakeholders in Kenya.

Posters

HUDSON A., ULIAN, T., MATTANA E., GAYA C.H., MUTHOKA P., BELL S., KRUMINS A., and ALLAN S. 2014. – 'The Wild Beauty of Tharaka school poster'

MSc Thesis Research

GAYA, C.H. 2011. Evaluation of the variation of active ingredients in *Zanthoxylum gillettii* across different geographical regions in Kenya.

4

The MGU –Useful Plants Project, Mali



Authors: Abdoul K. Sanogo¹, Sidi Sanogo¹ and Rokia Sanogo².

Affiliation, address and email

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Abstract

The Useful Plants Project (UPP) in Mali focused its activities in Sikasso and Mopti regions aiming for the sustainable management of plants and the conservation of plant biodiversity. Reforestation and product harvesting was conducted in partnership with local communities in both phases of the project (UPP1 and UPP2). Ethnobotanical surveys carried out with plant harvesters and end users identified 300 plants species which are useful to the local communities. Seeds of targeted species were collected, conserved at seed banks in Mali and

the UK (Millennium Seed Bank, MSB) and propagated in the communities. In total, 9.5 ha of arboretums of useful plants were planted with nine associations. At the same time four sacred forests were restored and enriched with plant species of specific socio-cultural importance. Monitoring of these planted species has proven good survival rates and interesting height and stem base diameter growth rates. The project has enriched l'Institut d'économie rurale's (IER) herbarium with 3,000 plant voucher specimens. Extracts from plant parts (bark, roots, leaves, etc.) of ten medicinal plants which are frequently used by therapists were analysed to determine their phytochemical compounds. Analyses revealed the presence of important chemical groups (like flavonoids, coumarins and saponins) which are used in the treatment of malaria and fever, two of the most frequent pathogens in rural areas in Mali. Laboratory efficiency tests of these compounds were completed and positive effects were proven against some tropical diseases which therapists use these local plants to treat.

Introduction

Rationale

Mali is a sahelian country located in West Africa covering an area of about 1,242,000 km² (see figure 1). Ecosystems and natural habitats in the country are unique and very diverse. Due to the repeated drought conditions over the previous 30 years, isohyets (rainfall patterns) have shifted south by around 200 km (PNAE, 1995). This decline in rainfall caused a change in the natural forest stands from Guinean clear forests to Sahelian steppes of the north of the country dominated by spiny tree species. Like the other sahelian countries, the natural resources of Mali are under heavy climatic and human pressures (e.g. rainfall decrease and irregularity, erosion, bush fires, wood cutting, over grazing, plant harvesting, etc.). These pressures are real threats for conserving plant species diversity. For instance, a study conducted in Sikasso's region (south of the country) revealed that some very useful tree species for rural populations are becoming increasingly scarce and/or are disappearing (GRASE, 1999). Mali's flora is rich of various tree species as evidenced in the vascular plant catalogue of Mali (Boudet and Lebrun 1986) which list 1,739 species. These species belong to 687 genera and 155 botanical families. According to the authors, eight species of Mali's flora are endemic (*Acridocarpus monodii*, *Brachystelma medusanthemum*, *Elatine fauquei*, *Gilletiodendron glandulosum*, *Hibiscus pseudohirtus*, *Maerua de-waillyi*, *Pandanus raynalii* and *Pteleopsis habeensis*). In order to preserve natural forest stands, Mali's government has progressively imposed restriction on 113

forest stands and fauna reserves of 992,241 ha which is considered as efficient *in situ* conservation policies for biological resources (MEA/DNEF, 2009). Regarding plant species protection, eleven woody species have been protected by forest law (ME/DNCN, 1999). These eleven tree species are: *Acacia albida* (synonym of *Faidherbia albida*), *Acacia senegal* (Gommier blanc), *Anogeissus leiocarpa* (Bouleau d'Afrique), *Azzeria africana* (Doussier d'Afrique), *Bombax costatum* (Kapokier rouge), *Borassus aethiopum* (Rônier), *Elaeis guineensis* (Palmier à huile), *Khaya senegalensis* (Caïlcédrat), *Parkia biglobosa* (Néré), *Pterocarpus erinaceus* (Vène) and *Vitellaria paradoxa* (Karité). Eighty percent of the population in Mali uses traditional medicine for primary health care and 95% of the population uses firewood to satisfy their energy needs. Hence, many exotic species have been planted in forests and villages' territories for firewood and craft production. However, planting tree species to procure food, fodder, medicine and wood for rural populations still remains unpracticed. This is due to the lack of good reproductive material (particularly seeds) and a lack of knowledge on silvicultural techniques. In order to expand the knowledge in these fields, since 1990 the Forest Resources Program of L'Institut d'Économie Rurale (IER – The National Agricultural Research Institute) has undertaken experiments on the biology and the silviculture of local species, including agroforestry and natural forest stand management and restoration. Technologies have been developed for: seedling production in nurseries, planting of local species, the assistance of natural regeneration, forest enrichment and improvement of fallow fields. In addition, a Forest seed and Herbarium laboratory was created in the Regional Agronomic Research Centre of Sikasso Mali (Centre Régional de Recherche Agronomique Sikasso) through the collaboration between IER (Mali) and the Royal Botanic Gardens, Kew (RBG Kew, UK), as part of the MSBP program. The activities of this collaboration have contributed to the collection and conservation of seeds of more than 850 indigenous plants of Mali. Since 2007, multiplication and reintroduction activities have been initiated for the sustainable conservation and management of seed collections, as part of the 'Useful Plants Project (UPP)' funded by the RBG Kew.

Goal, Purpose and Outputs of Project

The aim of the UPP is the sustainable management of plants by communities and plant biodiversity preservation. The objectives were:

- to identify useful plant species or/and threatened plant species;

- to collect and conserve plant material (seeds, plants, cuttings, bulbs, etc.) of those species;
- to create and maintain arboretums of medicinal and woody plant species;
- to restore and enrich natural habitats with useful plants in collaboration with community organisations;
- to investigate the chemical compounds of medicinal plants and to confirm their biological efficacy.

The project activities were carried out in the regions of Sikasso and Mopti. During the first phase of the project, more than 300 useful plants species were identified through community surveys. Based on communities' requirements, 5 ha of arboretums have been planted with 45 species which procure medicines, food and wood. Two traditional stands (sacred forests) were restored and enriched by planting 12 species in empty areas. To improve medicinal plant exploitation, samples of ten highly exploited plant species were analyzed to determine their chemical compounds.

The present report, intended for the workshop planned at RBG Kew (UK) between the 22nd and 24th of July 2014, is a synthesis of the activities and results of the second phase of the project (UPP2).



Fig. 1: Geographical map of Mali.

Materials and Methods

Project Outputs/Indicators

Output 1. Project planned, monitored and implemented effectively

During the second phase of the project, meetings were undertaken with targeted communities to identify and plan activities. Initially, actions to consolidate the achievements of the first phase were determined with the seven partner communities. It was agreed which new and old activities were to be monitored.

Output 2. Species conserved *ex situ*

The approach and the protocols of the MSB's program were used for seed collection and conservation. The targeted species were those identified through the community surveys. Harvested seeds have been used to produce seedlings and to supply village nurseries. Samples of seeds were conserved in freezers and in a ventilated room in the IER laboratory. Germination tests were conducted in the laboratory using: i) grow-bags containing sterilised river sand and ii) Petri dishes containing filter paper and/or agar (when small seeds were tested).

Output 3. Species propagated and conserved in the communities

Species chosen for propagation and conservation mainly provide communities with medicines, wood or food. Partner communities were retained from UPP1 to carry out this propagation activities, based on their commitment, organisation and the availability of secured plots of land. The project has also supplied seeds and seedlings to the forestry service, NGOs, schools, associations and members of the covered regions. The experimental design of the field activities was dependent upon the species and objectives. Plots have been monitored and maintained by the communities. Survival rate and growth rates have been assessed at the beginning and at the end of the rainy season.

Output 4. Sustainable use and income generation from useful plants

Income generation activities consist of intercropping (the cultivation of cash crops within plantations of targeted species) and fruit processing. Every year women of the community of Ifola produced peanuts, soya and sesame seeds between lines of important trees. Members of the Ifola women association were trained to process and produce soap of *Carapa procera* and *Khaya senegalensis*. In addition, two women groups from Filamana and Kokélé were trained in the skills needed to harvest and dry leaves of *Lippia multiflora*.

Output 5. Information disseminated and project promoted

Project results were disseminated through IER and Conseil National de la Recherche Agricole (CNRA) annual meetings (Program Committee and Scientific Commission), as well as through workshops, biannual reports produced for RBG Kew and through community exchange visits.

Results/Achievements

Output 1. Project planned, monitored and implemented effectively

Project activities have been extended to include new partners. The partnership with Département de la Médecine Traditionnelle (DMT – The Traditional Medicine Department) provided phytochemical analyses of extracts of ten plants with the purpose of elucidating the effectiveness of their active compounds. The project supported the establishment of copses for two partners: for “Jeune Chambre Internationale” (a humanitarian organisation), and for “Lycée Mgr de Mont Clos” (a secondary school at Sikasso). Arboretums were created in four village association sites, whilst three sacred forests under traditional rules were enriched by planting useful species. During this phase, 20 particular members of the communities got seeds and seedlings from the project.

Output 2. Species conserved *ex situ*

Plants and seeds were collected in four regions of Mali using the protocols established by the MSBP programme. In total, 270 targeted species selected from the prioritisation surveys have been collected. Seeds were conserved in the laboratory at Sikasso and at the same time some seedlings were produced and distributed to be planted in community plots. In some villages and/or coalition of villages, communities have complex local conventions on how to improve resource management, which establish traditional laws for some species. For instance, harvesting dead wood, fruits and fodder may be free, whilst harvesting fresh wood and cutting protected species is forbidden. Fruits from field trees belong exclusively to household members.

Output 3. Species propagated and conserved in the communities

From 2011 to 2012, 5.5 ha of copse with 21 species planted were established in four community plots. A total of 22.8 ha of sacred woods were also restored by planting species, which have socio-cultural uses in ritual ceremonies. Planting achievements are shown in table 1.

Table 1a: Community plots and plantations of medicinal and food species planted since 2008 (UPP1 and UPP2)

Sites	Year	Area (ha)	Number of species	Number of plants	Organisation partner
Zégoua	2008	1	25	702	Therapists of "Kènèya Djèkulu"
Kougué	2008	1	23	642	Plant breeders "Faso Jigi"
Ifola Men	2009	1	19	614	Forest farmers
Yanfolila	2009	1	18	418	Biological cotton producer
Tori	2009	0,5	12	120	Association "Rural family house"
Ifola Women	2011	2	2	416	Processing Women Association
Katélé	2011	1	9	225	Association of plant breeders
Sesso	2012	1,5	9	230	Planting Women Association
Kokélé	2012	1	5	660	Rural Women Association
Total		10		4,027	

Table 1b: Sacred woods and community forests enriched with useful species planted since 2008 (UPP1 and UPP2)

Sites	Year	Area (ha)	Number of species	Number of plants
Zégoua	2008	8	6	180
Founa	2009	30	9	650
Fourou	2011	11,5	11	950
Kolôgo	2012	4,5	8	285
Koumantou	2012	6,8	7	640

Table 2 shows statistics for measured variables (survival, mean height and mean stem base diameter) of seedlings at the different planting sites.

Table 2a: Survival rate, mean height and mean stem base diameter of seedlings produced at Katélé

Species	Survival rate (%)		Mean height (cm)		Mean stem base diameter (cm)	
	6 months	18 months	6 months	18 months	6 months	18 months
<i>Cola cordifolia</i> (grafted with <i>C. nitida</i>)	100	95	30	37	0,5	1
<i>Tamarindus indica</i>	100	30	37	46,8	0,2	0,4
<i>Vitellaria paradoxa</i>	89	80	12	13,5	0,2	0,3
<i>Ziziphus mauritiana</i> (synonym of <i>Ziziphus jujuba</i>)	100	100	33	33,1	0,2	0,2

Table 2b: Survival rate, mean height and mean stem base diameter of seedlings produced at Ifola women. * planting before 2011

Species	Survival rate (%)		Mean height (cm)		Mean stem base diameter (cm)	
	6 months	18 months	6 months	18 months	18 months	6 months
<i>Moringa oleifera</i>	100	50	75	102	2,2	3,5
* <i>Parkia biglobosa</i>	100	100	125,7	166,3	2,7	3,8

Table 2c: Survival rate, mean height and mean stem base diameter of seedlings produced at Kokélé

Species	Survival rate (%)		Mean height (cm)		Mean stem base diameter (cm)	
	6 months	18 months	6 months	18 months	18 months	6 months
<i>Carapa procera</i>	90	80	51,7	61,6	0,4	0,6
<i>Elaeis guineensis</i>	100	95	42	45,6	0,8	1,2
<i>Lippia multiflora</i>	90	30	40,3	45	0,2	0,3
<i>Pentadesma butyracea</i>	95	88	57,1	63,3	0,4	0,6

Table 2d: Survival rate, mean height and mean stem base diameter of seedlings at Sesso

Species	Survival rate (%)		Mean height (cm)		Mean stem base diameter (cm)	
	6 months	18 months	6 months	6 months	18 months	6 months
<i>Adansonia digitata</i>	100	100	57,5	64,3	1	1,5
<i>Anthocleista kerstingii</i> (synonym of <i>Anthocleista djalonensis</i>)	100	100	40	42,8	0,5	0,9
<i>Carapa procera</i>	100	87	55	63,1	0,4	0,9
<i>Elaeis guineensis</i>	100	100	36	41,8	1,4	2,6
<i>Mangifera indica</i> (Kent)	100	100	124	138,3	1,6	2,4
<i>Mangifera indica</i> (Keit)	100	100	115	130,4	1,8	2,5
<i>Moringa oleifera</i>	90	60	188	275,1	3,2	4,8
<i>Tamarindus indica</i>	100	90	15	17,2	0,2	0,4
<i>Vitellaria paradoxa</i>	100	100	8	8,1	0,2	0,3

Output 4. Sustainable use and income generation from useful plants

Two stands of *Lippia multiflora* in Filamana (Yanfolila) were identified and are being sustainably harvested for use by women from the community. Women of Ifola community were trained on how to process and produce soap from *Carapa procera* and *Khaya senegalensis*. Cash crops like peanuts, soya and sesame have been intercropped within arboretums and its sale allowed women to make deposits into their associations' savings fund. At Yanfolila and Kougué, products of *Andropogon gayanus* and *Cymbopogon giganteus* were sold to generate income to maintain the community plots and to pay for some of the associations' small expenditures.

Efficiency and biological actions of chemical groups of studied plants

Phytochemical studies of ten species identified the presence of important active compounds. The study of their biological efficacy on three illnesses (pain, fever and malaria), which are common in rural areas, showed that only *Moghania faginea* (Synonym of *Flemingia faginea*) does not have a curative effect on them. Table 3 shows the properties of these plants.

Table 3: Analgesic, antipyretic and antimalarial properties of the ten investigated species

Species	Studied organs	Pathology		
		Pain	Fever	Malaria
<i>Alchornea cordifolia</i>	Leaves			X
<i>Anthocleista djalonensis</i>	Trunk barks, leaves		X	
<i>Erythrina senegalensis</i>	Trunk barks, roots	X		
<i>Evolvulus alsinoides</i>	Entire plant	X	X	
<i>Gymnosporia senegalensis</i>	Leaves			X
<i>Moghania faginea</i> (synonym of <i>Flemingia faginea</i>)	Leaves			
<i>Stylosanthes erecta</i>	Leaved stems	X		
<i>Strychnos spinosa</i>	Roots	X		X
<i>Swartzia madagascariensis</i> (synonym of <i>Bobgunnia madagascariensis</i>)	Leaves, roots			X
<i>Vitex simplicifolia</i> (synonym of <i>Vitex madiensis</i> subsp. <i>madiensis</i>)	Leaves, roots	X		

Output 5. Information disseminated and project promoted

For IER's usual annual meetings (Program Committee) three research reports were written. Five biannual reports have been produced and sent to RBG Kew. A paper on the conservation of medicinal plants in Mali was submitted for publication in the Samara newsletter. A planting day was organised in Zégoua community in 2011 for the celebration of the International Year of Forests. Products (seeds, plants and herbarium vouchers) were displayed in the two agricultural trade fairs held at Sikasso. A presentation on the medicinal plant activities conducted by IER and DMT was given by therapists from Zégoua during the 11th African day of Traditional Medicine held at Bamako the 31st September of 2013. Leaflets of 25 useful plants are being finalised in conjunction with the team at RBG Kew. Table 4 displays the results achieved during the second phase of the project.

Table 4: Results for the project per each indicator divided by phase (2007-2014)

Quantitative indicators	UPP 1	UPP 2	Total	Constraints
New partnerships	9	6	15	
Cumulative target list with useful species	300	420	420	
Seed collections made	339 (263 species)	90 (56 species)	429 (270 species)	
Seed collections banked in country	252 (224 species)	0 (0)	252 (224 species)	
Seed collections banked at the MSB	165 (148 species)	0 (0)	165 (148 species)	
Seed collections tested		115 (70)	60 (150)	

Species propagated	45 (25,000 seedlings)	47 (118,245 seedlings)	93 (143,245 seedlings)	
Propagation protocols produced	10	10	20	
Communities/community groups involved in the project	7	3	9	1 community from UPP1 is ceased to be involved in the project
Managed areas, e.g. sacred forests involved in planting activities	2	2	4	
Research on species		27		
Species (seeds/seedlings/part of plants) promoted for income generation		12		

Discussion

During this second phase (UPP2), many communities were interested in participating in the project activities. These communities communicated their ideas and requirements to the IER office team at events like trade fairs, community exchange visits and open days. Following these discussions, six criteria were picked to be used to decide whether a community participates in the project. Other communities, pilot farmers, NGOs, technical institutes and schools, have still contacted the project to request plants for afforestation activities. The project supported these participants by providing them with seeds and seedlings as well as technical advice. In Kokélé, Ifola and Séso communities the project activities were carried out with women's groups which included all women in the villages. This participation has allowed women to improve their household conditions. In Kokélé, the group are important plant breeders who are very motivated to promote local species in rural and urban areas. They possess very good propagation skills and have planted plots with exotic species and local fruit species. The three communities working to restore sacred forests are already very well known and respected in the field of forest restoration.

The ethnobotanical survey carried out in 2007 identified 300 species useful to the communities. Of these species, 43% were collected during the first phase (UPP1) and 37% during the second phase (UPP2). Political instability in northern Mali contributed to the reduced number of collections in UPP2. A total of 70% of the collected species were conserved in the seed bank

in Mali and 10% were also duplicated at the RBG Kew in the UK. Conserved species were those with a very high germination rate (> 80%) as classified by the Research Station on the Biology of Native Species (Yossi et al. 1988).

Planted useful species in community plots have proliferated well. Only two of the 21 species planted showed low survival rates (30% at 18 months), and these were *Tamarindus indica* at Katélé and *Lippia multiflora* at Kokélé. The former was due to the presence of weed competition in the plot, while the later was due to the type of the vegetation where the seedlings were planted (e.g. wild harvested individuals of *L. multiflora*). A drought following the planting season meant conditions were difficult for survival. *Moringa oleifera* survival rates were also low at 18 months (30% at Séso and 50% at Ifola). For the other species, the plant survival rate after 18 months of establishment ranged between 50 to 100%. Very high survival rates were observed for *Vitellaria paradoxa* (100% at Séso and 89% at Katélé).

Measurements of mean height and mean stem base diameter varied considerably according to the species. For example, the height reached by seedlings of *Vitellaria paradoxa* after two seasons was low (mean height < 20 cm). On the other hand, a very successful species was *Mangifera indica*, two varieties ('Kent' and 'Keitt') of which showed high seedling survival rates with both optimal height and stem base diameter growth.

The purpose of the arboretums was to provide fruits, medicines and wood materials to local communities. Improved fruiting varieties presented to the communities were extremely appreciated. Grafted plants of *Cola cordifolia* and *Cola nitida* were established at Katélé community, *Ziziphus mauritiana* (Synonym of *Ziziphus jujuba*) was grafted with two Indian varieties ('Seb' and 'Gaulla') and *Tamarindus indica* was grafted with a more succulent variety which has larger pods. At present, none of the plants have produced fruits. Grafted plants usually need more than two years to start producing fruits. During the monitoring process, flowers have only been observed on *Ziziphus mauritiana*. *Adansonia digitata* was planted at Séso because of the commercial uses its leaves in the region.

Conclusions and Recommendations

The sustainable management of useful plants still remains a major concern for communities in Mali. In order to address this problem better knowledge of seed physiology and silviculture

techniques are required. The project's results during its two phases revealed the real importance of useful plants to community lives in Mali. Most of the useful plants and their uses were identified through the project activities. Seeds of the most important useful plants were harvested and are being conserved in *ex situ* seed banks. Communities of the three regions of Mali (Sikasso, Ségou, Mopti) were assisted by the project to create arboretums of important fruit species. Improvement of scientific understanding of medicinal plants and its dissemination to therapists has reduced the collection pressures on some plants. Improving communities' capacity has encouraged some social groups (such as women) to participate in the management and promotion of useful species. Communities engaged well with all project activities including: seed and seedling harvest, propagation activities, income generation, and improvement of the organisational capacity of socio professional groups. For the sustainable management of useful plants in the wild it is important to satisfy the communities' current needs without compromising those of future generations. Hence, plots with useful plants were established in many communities; however satisfying requests for additional plots in the future will be also important. Replicating and expanding these actions requires support. Planting activities were greatly appreciated by the communities. In order to ensure the future sustainability of the project it is crucial to provide further support to communities in the next stage related to profitable production from the established plots. Integration of useful plants into the production systems of local households is highly recommendable. In the future, the support of socio professional groups should ideally continue since many communities displayed a high interest in continuing working with them, and many useful species are still waiting to be collected and propagated. If more funding becomes available, communities should be encouraged and supported to preserve plant biodiversity located in surrounding community wild areas.

Acknowledgement

At the end of this second phase of the project, we would like to thank Kew Gardens for their invaluable financial and technical support. We would also like to make special mention to the different partner communities (women and men) for their collaboration and their willingness to carry out activities. Thanks are also due to all local and administrative authorities as well as technical institutes, NGOs and particular individuals acting in the different project regions, for their cooperation and various kinds of support.

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Annexes - Mali

Annex 1: Logframe of the project.

Logframe for second phase of project MGU - the Useful Plants Project (UPP) in Mali - (April 2011 - September 2014)			
Objectives	Indicators	Means of Verification	Assumptions
Overall Project Goal	Welfare of local communities improved and useful important plants safeguarded from extinction in Latin America and Africa		
	Capacity of local communities in Latin America and Africa to conserve and use sustainably useful plant species enhanced	Dissemination material, workshop documents and facilities in Latin America and Africa for plant conservation and sustainable use enhanced in local communities	
Project Purpose	Conservation and sustainable use of plants for human wellbeing		
	At least 75 seed collections of priority useful plant species made and held to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK	Seed collections registered in the seed banks in country and in Kew's Millennium Seed Bank in the UK	Access agreements and permits are available; all project partners are committed and provide consistent support to the project; seed conservation is scientifically feasible for the target species
	30 priority useful plant species (3,000 plants) grown in 9 local communities	Propagation documents	Plant propagation is scientifically feasible for the target species
		Priority useful plant species maintained by the local communities in community/home/school gardens	Community members are engaged and provide time and land for growing and maintaining priority useful plant species in the communities

	Conservation and sustainable use of at least 2 priority useful plant species supported <i>in situ</i> (managed areas)	Priority useful plant species planted <i>in situ</i> (managed areas of <i>Acridocarpus monodii</i> , <i>Lippia multiflorum</i>)	Relevant stakeholders engaged and managed areas made available for <i>in situ</i> conservation
		Monitoring data and scientific material (reports/thesis/papers)	Research is feasible for priority useful plant species; students and extra staff are made available in country and at Kew
	Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining.	Long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Tools and infrastructures that enable long term promotion of knowledge and use of plants. Income generation data from useful plant species or their plant products	Policy makers are supportive of the use of traditional knowledge and indigenous useful plants. Sustainable harvesting of useful plants; new partners engaged to support the socio-economic aspects of the project; market for useful plant species available
	Information about useful plant species shared more widely and project promoted at the local, national and international level	Dissemination material and publicity about project	Extra staff are made available in country and at RBG Kew to disseminate material and promote project
Project Outputs			
Output 1: Project planned, monitored and implemented effectively			
	Existing partnerships consolidated and at least 5 new relevant partnerships established and integrated into the project within 6 months (September 2011)	Correspondence and agreements with relevant partners	All agreements are available; all project partners are committed and provide consistent support to the project; funds are available in country without delay from start of project

	Project documents (logframe, budget, management structure and work plan) agreed and finalized per country with partners within 6 months (September 2011)	Correspondence and project documents for each country (logframe, budget, management structure and work plan)	Project successfully integrated into partners' institutional programmes; good communication is maintained with all project partners
	Country reports (mid and annual reports) submitted to RBG Kew and general report submitted to donor every six months	Country reports and general reports; RBG Kew management meeting minutes	
	Project reviewed by the 2nd year of the project	Project workshop and report	
	Target list of 20 useful species agreed in each country within 6 months (300 cumulative with UPP1 species)(September 2011)	Lists of targeted useful plant species with relevant information (use, distribution, conservation status) updated and incorporated into the 'Useful Plants Project' database	Extra staff are made available in country and at Kew to maintain and update lists of useful plant species and the 'Useful Plants Project' database
Output 2: Species conserved <i>ex situ</i>			
		Country Databases/Excel Spreadsheets and 'Useful Plants Project' database updated	
	At least 60 seed collections of priority useful plant populations made and held to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK by the 3rd year of the project	Seed collections registered in the seed banks in country and in Kew's Millennium Seed Bank in the UK	Access agreements and permits are available; all projects partners are committed and provide consistent support to the project; seed conservation is scientifically feasible for the target species
	Quality of 60 seed collections assessed through seed testing (viability, germination, storability) in Kew's MSB by the 3rd year of the project	Data on seed testing (viability, germination, storability)	Extra staff from RBG Kew are made available for seed testing

	50 priority useful species (100,000 seedlings) propagated (propagation protocols for 20 species finalised for the UPP book)	Propagation protocols	Propagation is scientifically feasible for the targeted species; trials are successful
Output 3: Species propagated and conserved in the communities			
	2 additional communities (to the existing 7 communities) engaged and integrated into the project within 6 months (September 2011)	Workshop documents and agreements with communities	Community members are committed to the project and make available their time and land for project
	50 priority useful species (50,000 seedlings) planted and maintained in 9 local communities	Priority useful plant species maintained by the local communities in community/home/school gardens	Communities are committed to the project and provide time and land for targeted useful plants
	Capacity of local communities to propagate and conserve plants enhanced through training and the improvement of local facilities	Training material and enhanced facilities for plant propagation and conservation	Community members are receptive to training and interested in propagating and conserving useful plant species
	At least 3 priority useful plant species planted <i>in situ</i> (managed areas)	Priority useful plant species planted <i>in situ</i> (managed areas)	Propagation is scientifically feasible for the targeted species; trials are successful; relevant stakeholders are engaged and managed areas are made available for <i>in situ</i> conservation of priority useful plant species
	Research on at least 2 useful plant species to enhance their conservation and sustainable use in the local communities	Monitoring data and scientific material (reports/thesis/papers)	Research is feasible for priority useful plant species; students and extra staff are made available in country and at RBG Kew to research priority useful plant species

Output 4: Support to <i>in situ</i> conservation and use			
	Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining	Development of long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Development of tools and infrastructures that enable long term promotion of knowledge and use of plants	Policy makers are sympathetic and supportive of the use of traditional knowledge and indigenous useful plants
	Sustainable use and marketing (product, pricing, place) of at least 10 useful plants (part of plants) or their plant products promoted for income generation in all collaborative communities	Entrepreneurs trained; income generation data from useful plant species or their plant products	Sustainable harvesting of useful plants; new partners engaged to support the socio-economic aspects of the project; market for useful plant species available
Output 5: Sustainable use and income generation from useful plants			
	Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining	Development of long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Development of tools and infrastructures that enable long term promotion of knowledge and use of plants	Policy makers are sympathetic and supportive of the use of traditional knowledge and indigenous useful plants
	Sustainable use and marketing (product, pricing, place) of at least 10 useful plants (part of plants) or their plant products promoted for income generation in all collaborative communities	Entrepreneurs trained; income generation data from useful plant species or their plant products	Sustainable harvesting of useful plants; new partners engaged to support the socio-economic aspects of the project; market for useful plant species available

Output 6: Information disseminated & project promoted			
	Information derived from the first phase of Project MGU compiled, updated, organized and disseminated at the local, national and international level	Volume 1 of book on Project MGU published at Kew and further material published in country in collaboration with RBG Kew (e.g. books/manuals; species leaflets, booklets, posters, press and scientific articles)	Extra staff are made available in country and at RBG Kew to disseminate material and promote project
	Project exposure enhanced through the generation of publicity material at the local, national and international level by the end of project	Development of a UPP- specific logo and generation of publicity material (e.g. press articles, project webpage, videos, radio interviews)	

Annex 2: List of communities/community groups and schools with activities carried out in each of them since 2007.

Community / Community group / School	Locality	Number of people involved	Activities carried out (e.g. workshops, seed collecting, propagation, planting, income generation activity)
Thérapeutes de "Kènèya Djèkulu"	Zégoua	85	Propagation, planting, seed collecting
Pépiniéristes – Planteurs "Faso Jigi"	Kougué	300	Propagation, planting, income generation, seed collecting
Exploitants forestiers villageois	Ifola	110	Propagation, planting
Producteurs de coton biologique	Yanfolila	70	Propagation, planting
Association "Maison familiale rurale"	Tori	300	Propagation, planting, seed collecting
Association femmes transformatrices	Ifola	200	Planting, income generation
Association femmes rurales	Kokélé	250	Planting, income generation
Association femmes planteurs	Sesso	150	Planting, income generation
Organisation traditionnelle du village	Zégoua	All community	Propagation, planting
Organisation traditionnelle du village	Founa	All community	Propagation, planting
Organisation traditionnelle du village	Fourou	All community	Propagation, planting
Organisation traditionnelle du village	Kolôgo	15	Propagation, planting
Organisation traditionnelle du village	Koumantou	All community	Propagation, planting

Annex 3: List of community/school gardens, woodlots, sacred forests and number of species and seedling planted since 2007, as applicable.

Community/school gardens, woodlots, sacred forests	Locality	Surface (specify unit used: m² or hectares)	Number of species planted	N of seedlings planted	Notes
Thérapeutes de "Kènèya Djèkulu"	Zégoua	1 ha	25	702	
Pépinéristes – Planteurs "Faso Jigi"	Kougué	1 ha	23	642	
Exploitants forestiers villageois	Ifola	1 ha	19	614	
Producteurs de coton biologique	Yanfolila	1 ha	18	418	
Association "Maison familiale rurale"	Tori	0,5 ha	12	120	
Association femmes transformatrices	Ifola	2 ha	2	416	
Association femmes rurales	Kokélé	1 ha	5	660	
Association femmes planteurs	Sesso	1,5 ha	9	230	
Organisation traditionnelle du village	Zégoua	8 ha	6	180	
Organisation traditionnelle du village	Founa	30 ha	9	650	
Organisation traditionnelle du village	Fourou	11,5 ha	11	950	
Organisation traditionnelle du village	Kolôgo	4,5 ha	8	285	
Organisation traditionnelle du village	Koumantou	6,8 ha	7	640	

Annex 4: Sustainable use and income generation from useful plants.

Species	Uses	Communities / Community groups / Schools involved	Income generation activity
<i>Lippia multiflora</i>	Al	Kokélé	Planting
<i>Cola cordifolia</i> grafted with <i>Cola nitida</i>	Al	Katéle	Planting
<i>Ziziphus mauritiana</i> (Synonym of <i>Ziziphus jujuba</i>) graft	Al	Katéle	Planting
<i>Mangifera indica</i> graft	Al	Sesso	Planting
<i>Adansonia digitata</i>	Al	Sesso	Planting
<i>Vitellaria paradoxa</i>	Al	Katéle	Planting
<i>Tamarindus indica</i>	Al	Katéle	Planting
<i>Parkia biglobosa</i>	Al	Ifola (femmes)	Planting
<i>Glycine max</i>	Al	Ifola (femmes)	Planting, mustard factory
<i>Sesamum indicum</i>	Al	Ifola (femmes)	Planting
<i>Khaya senegalensis</i>	Cos	Ifola (femmes)	Soap making
<i>Carapa procera</i>	Cos	Ifola (Femmes)	Soap and oil extraction

Al = Food

Cos = Cosmetic

Annex 5: List of people/organizations who have contributed to the project since 2007.

Researchers and technicians

Names	Functions	Percentage of time	Organization
Abdoul K SANOGO	Coordinator UPP Mali	60%	IER
Sidi SANOGO	Coordinator MSB Mali	25%	IER
Sory I SIDIBE	Collector / Database (BRAHMS)	75%	IER
Harouna YOSSI	Administrator IER Sikasso	5%	IER
Bokary A Kelly	Statistics / reports	10%	IER
Konongolo COULIBALY	Animation / Propagation	10%	Eaux & Forêts
Seydou SIDIBE	Plots supervisor / fencing	5%	Eaux & Forêts
Réné DACKOUCO	Seed collection	25%	IER
Mme Rosalie DIABATE	Seed processing / Germination tests / leader of womens' groups	35%	IER
Prof. Drissa DIALLO	Faculty member / Administrator	5%	DMT
Prof. Rokia SANOGO	Faculty Member in charge of research	10%	DMT
N'Golo BALLO	Technician in charge of collections and preparation	15%	DMT
Yaya TRAORE	Driver	25%	IER
Ousmane OUOLOGUEM	Driver	30%	IER
Labass TOGOLA	Driver	45%	IER

Participants and facilitators in rural communities

Names	Functions	Communities	Sites
Daouda OUATTARA	Participant	Keneya-jèkulu	Zégoua
Zoumana OUATTARA	Nurseryman / farmer trainer	Keneya-jèkulu /CPPKE	Zégoua
Nianan COULIBALY	Participant / Nurseryman	Faso-Jigui	Kougué
Tiékoré SIDIBE	Participant / Nurseryman	Coton Bio	Yanfolila
Lamine SANOGO	Participant / Nurseryman	Exploitants forestiers	Ifola
Papoussé YOSSI	Participant	Maison Familiale	Tori
Mme Ténin DIARRA	Participant	Association femmes transformatrice	Ifola
Mme Mariame DEMBELE	Participant	Association Gnissigui-ton	Sesso
Mme Samaké Fadima Camara	Participant	Association Benkadi	Kokélé
Yacouba Ballo	Participant	Association villageoise	Kolôgo
Bakary Doumbia	Participant	Association villageoise	Koumatou
Sanoussi Goïta	Participant	Association villageoise	Founa
Lassina Koné	Participant	Association villageoise	Fourou

Annex 6: List of dissemination material since 2007.

Research reports

- 6 research reports presented to the Comité de Programme de l'IER
- 2 research reports submitted to the Commission Scientifique du Conseil National de la Recherche Agricole (CNRA) of Mali

Popular articles

- 1 article (audiovisual) on conservative exploitation techniques of medicinal plants
- 1 article (audiovisual) on the approach and achievements of the UPP project

Workshops and presentations

- Presentations on the activities of the UPP project for the 9th and 11th journées de la médecine traditionnelle Africaine
- Presentation on sustainable harvesting techniques of medicinal plants for the cultural and artistic festival of the Municipality of Koumantou

5

The MGU –Useful Plants Project, Mexico



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Abstract

Within Mexico, the Useful Plants Project (UPP) was initially developed in 2007 in San Rafael, Coxcatlán, Puebla. In 2011 the project expanded to two other communities of the same region (San José Tilapa and Guadalupe Victoria / Pueblo Nuevo). Activities such as seed collection, plant propagation and phytochemical, physiological and ethnoecological studies were carried

out. A total of 266 plant species were collected, of which 182 are useful plants. About 20 species were recognized as high priority species by the community members. These species were propagated by the present project together with community members in a nethouse/greenhouse built for the project in the region. A total of 87 workshops and meetings with authorities and members of the communities were carried out in order to organize the project and to select the main target species. Plant physiology studies have significantly expanded the knowledge about the propagation of several species in rural areas, and phytochemistry studies have confirmed the efficacy of the traditional knowledge of several plants used to produce medicines in the region. Additionally, ethnoecological studies documented the spatial and temporal availability of useful perennial plants as well as the human impact on several annual and perennial plant species. All activities have also allowed the training of several hundred school children and adults in the region as well as 24 university students. Results are being published in 11 scientific articles and one book chapter. Furthermore, among the most important result of the project is the opening up of new horizons for future research and teaching activities at the Universidad Nacional Autónoma de México (UNAM) and in the three communities involved.

Introduction

Rationale

The project is led by the Facultad de Estudios Superiores Iztacala (FES Iztacala)-UNAM, and it has been carried out in the three communities that form the Comisariado Ejidal San José Tilapa (Guadalupe Victoria/Pueblo Nuevo, San Rafael and San José Tilapa). The project is located in the region of Coxcatlán Municipality (state of Puebla) and is part of the Tehuacán-Cuicatlán Biosphere Reserve which is located in the states of Puebla and Oaxaca in south-central Mexico (see Figure 1). The area was chosen because of its ethnobotanical importance and because of its relevance to the biological and archaeological history of the domestication of corn.

The altitudinal range of the area is between 860 and 910 m above sea level, and the climate is semi-arid to arid with a mean annual temperature of 22°C and an annual rainfall of 394,6 mm. The dominant vegetation is a thorn scrub forest which includes species like *Acacia cochliacantha*, *Bursera aptera*, *B. morelensis*, *Ceiba aesculifolia* subsp. *parvifolia* and *Pachycereus weberi*.

The communities of San Rafael and Pueblo Nuevo are small villages (261 and 437 inhabitants respectively), while San José Tilapa is a small and more urbanized town of 1,977 inhabitants. The first step of the project (UPP1) was carried out only in the community of San Rafael.

The reasons for situating the project in this area were:

1. Project researchers had nearly ten years of ethnobotanical experience in San Rafael. This facilitated the collation of relevant information on the use and management of plants from the study site as well as on the efficacy of healing properties of some of them (e.g. Blanckaert, 2001; Rosas-López, 2003; Blanckaert *et al.*, 2004; Canales *et al.*, 2005, 2006; Casas *et al.*, 2006; Rodríguez- Arévalo *et al.*, 2006; Avendaño *et al.*, 2009, among others).
2. Previous studies revealed that, at least in San Rafael, a total of 368 plant species are commonly used by local people.
3. These studies also contributed to students' work through the completion of one bachelor degree (Rosas-López, 2003) and three graduate thesis (Avendaño, 2007; Blanckaert, 2001; Canales, 2005), as well as several publications (Blanckaert *et al.*, 2004; Canales *et al.*, 2005, 2006; Rodríguez- Arévalo *et al.*, 2006; Avendaño *et al.*, 2006, 2009).
4. Since 1998, several members of the project carried out studies on plant growth and development in other parts of the Valley of Tehuacan-Cuicatlán, including many of the species that thrive in the project site.
5. Due to the ecological characteristics of the site, it was clear that the project would be a positive addition to the seed conservation program of arid zone species carried out for several years jointly by the Royal Botanic Gardens, Kew (RBG Kew) and Unidad de Biotecnología y Prototipos (UBIPRO), Department of the Facultad de Estudios Superiores Iztacala, UNAM (FES Iztacala-UNAM).

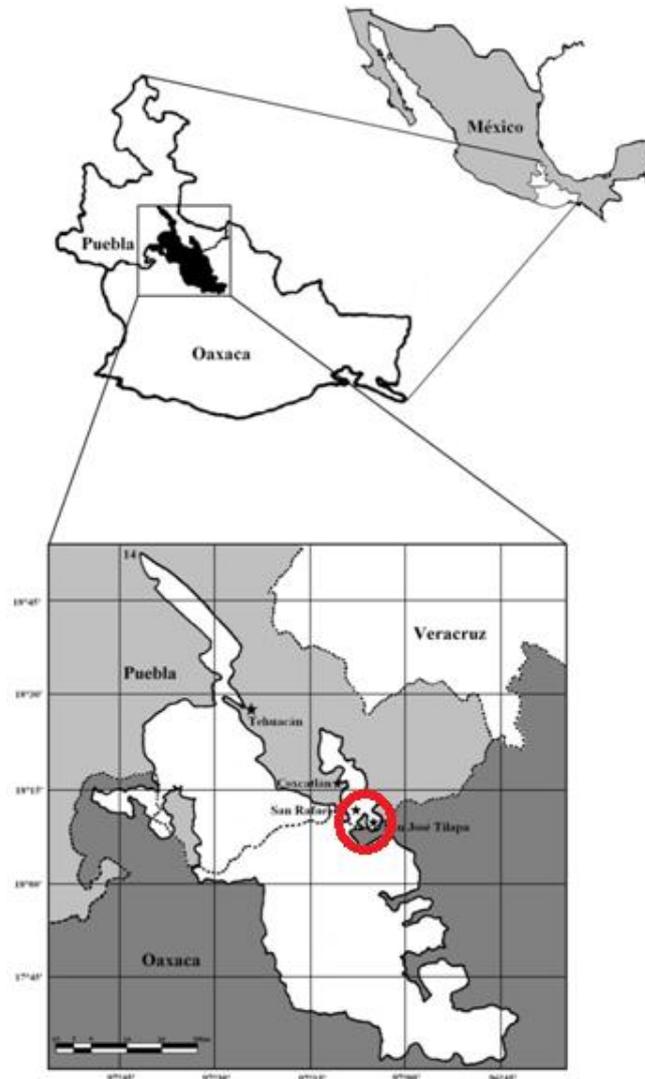


Fig. 1: Location of the communities involved in the project.

Summary of results of phase 1 (UPPI)

This phase of the project was developed in the community of San Rafael. Among the activities carried out were seed collection, phytochemical and physiological studies, and plant propagation. A total of 178 plant species were collected, of which 121 belonged to 36 families. From them, 134 species are represented by seed collections in the FES Iztacala-UNAM seed bank, and 101 in the Millennium Seed Bank (MSB) at the RBG Kew. Germination tests were performed for 115 of the seed collections. Ninety six of the species collected are useful plants, and 17 are among the ones recognized as high priority species by the community members of San Rafael. Nineteen of these species (all medicinal) were submitted to phytochemical studies, which corroborated the existence of plant compounds which justify their traditional medicinal use in San Rafael. The physiological studies focused on five species: *Amphipterygium*

adstringens (Anacardiaceae), *Castela erecta* (Simaroubaceae), *Ceiba aesculifolia* subsp. *parvifolia* (Malvaceae), *Gymnosperma glutinosum* (Compositae) and *Lippia graveolens* (Verbenaceae). These species were propagated in the greenhouses at FES Iztacala-UNAM and/or the nethouse/greenhouse built with project funds in San Rafael. It was possible to establish the optimal conditions for seed germination for *Castela erecta*, *Gymnosperma glutinosum* and *Lippia graveolens*, and at the same time recognize the effects of different levels of irradiation and watering regimes on the metabolite contents of these plants. Additionally, eight other species were also propagated in the San Rafael nethouse/greenhouse.

Complementary to the collecting activities, some ethnoecological studies were performed to identify the distribution, abundance and availability of useful plants in the various environmental units recognized locally in San Rafael. Training activities in greenhouse management and propagation techniques were carried out in the community with 22 students participating in field and/or laboratory activities of the project.

The results of our research activities have been published in three scientific papers (Albino-García *et al.*, 2011; Lira *et al.*, 2009, Serrano-Perales *et al.*, 2009). Six Bachelor's students (Eleno-Medina, 2010; Hernández-Hernández, 2010; Hernández-Montoya, 2009; Jaury-Castillo, 2009; Martínez-Elizalde, 2009; Rivera-Yañez, 2010), as well as two Master's students (Moreno-Rodríguez, 2009; Orozco, 2010) have obtained their degrees. Additionally, one PhD student who started her research in the first phase of the project obtained her degree in 2013 (Serrano-Perales, 2013).

Goal, Purpose and Outputs of the Project (UPP2)

1. To document the ethnoecological information of useful plants in the area and to collect seeds for their cultivation and conservation in seed banks. The most important useful native plant species are selected jointly by FESI Itzcala, UNAM and the communities, considering mainly their medicinal use and other important uses (e.g. food, fuels and materials).
2. To support the conservation and sustainable use of selected species through research:
 - i) to determine the biological activity and different phytochemical compounds of the species in order to contribute to the validation of the associated traditional knowledge in the communities, and
 - ii) to study the physiology and propagation of the species in greenhouses and orchards.

3. To improve infrastructure in the communities (e.g. to build a rural greenhouse) and to train local people in plant conservation and propagation techniques.
4. To propagate endemic plant species of high importance to communities, especially those with high conservation priority (with low population density or distributed in fragmented populations). To reintroduce selected species and to develop restoration projects in the region, as well as to promote ecotourism activities linked to the sustainable use of the plants.

The expected outputs were:

Output 1: Project planned, monitored and implemented effectively

Output 2: Species conserved ex situ

Output 3: Species propagated and conserved in the communities

Output 4: Sustainable use and income generation

Output 5: Research and capacity building

Output 6: Information disseminated and project promoted

Materials and Methods

Seeds were collected and processed using the procedures of both RBG Kew and FES Iztacala-UNAM seed banks. Workshops and meetings were organized in order to develop community agreements. Laboratory studies (plant physiology and phytochemistry) were completed, propagation procedures were established, and ethnobotanical and ethnoecological methods were carried out. The members of various laboratories of UBIPRO that participated in the project are as follow: seven plant physiologists, five phytochemistry, one ecologist and three natural resource managers.

In addition, three members of the FES Iztacala-UNAM's Seed Bank participated in the project: one field technician and two members responsible of the propagation and training workshops. From the 19 people involved in the project only six (one collector, one coordinator of the collecting activities, one field technician, one laboratory assistant, and the two responsible of propagation and workshops) have been hired using project funds.

Project Outputs/Indicators

Output 1: Project planned, monitored and implemented effectively

- Existing partnerships consolidated and at least one new relevant partnership established and integrated into the project within six months.

Output 2: Species conserved *ex situ*

- Target list of 100 useful species with relevant information agreed in each country within one year.
- At least 200 seed collections of priority useful plant populations made and held according to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK by the third year of the project.
- A total of 100 seed collections assessed through seed testing (viability, germination, storability).

Output 3: Species propagated and conserved in the communities

- Twenty priority useful species (20,000 seedlings) propagated by the third year of the project.
- Reintroduction assays for, at least, six propagation protocols.
- Capacity building to local people in three communities by means of five-six workshops in plant propagation and conservation (enhanced through training and the improvement of local facilities).
- School programme enhanced through the involvement of three schools and 100 children in the communities.

Output 4: Sustainable use and income generation

- At least 20 priority useful plant species promoted to income generation.

Output 5: Research and capacity building

- At least five priority useful species will be studied.

Output 6: Information disseminated and project promoted

- Scientific papers, one field guide, one press article, six technical sheets of useful plant species, three posters, one paper of wide circulation and one book chapter on UPP1 will be produced.

Results

Output 1: Project planned, monitored and implemented effectively

An agreement was signed to develop the project over a three year period at the end of 2011. This followed numerous meetings with the authorities and representative members of the three communities of the Comisariado Ejidal of San José, found in the Biosphere Reserve Tehuacán-Cuicatlán Tilapa, and a meeting with RBG Kew (Dr Tiziana Ulian) held on 13 October 2011. The agreement included provision for: the collection of seeds and specimens of useful plants; propagation and conservation training for the community members, including workshops with children and young people at their schools and visits to the seed bank in FES Iztacala-UNAM; and research activities on physiology, phytochemistry, ethnoecology and ecological restoration. The schools of the three communities were:

- San José Tilapa: Frida Kahlo and Rubén Darío Kindergardens, Francisco Ferrer Guardia Elementary/Primary school, Secundaria Técnica No. 95 High school and Preparatoria Fray Pedro de Gante High school.
San Rafael: Niños Artillero Kindergarden, and Aquiles Serdán Elementary/Primary school.
- Guadalupe Victoria / Pueblo Nuevo: Nezahualpilli Kindergarden and Florencio Villareal Elementary/Primary school.

The objectives, goals and budget of the project were approved by RBG Kew. The second phase of the project started in November 2011. Partnerships with the two new communities in the area (San José Tilapa and Guadalupe Victoria), together with the authorities and local representatives of the Biosphere Reserve Tehuacan-Cuicatlán have been consolidated since the start of UPP1. Additionally, agreements were developed with professors of the following universities during the development of the project:

- Facultad de Ciencias, UNAM (Dr Zenón Cano and M.C. Iván Castellanos).

- Universidad de Alicante of Madrid Spain (Dr Pedro Villar and his Masters student Marián Mendoza).

In both cases these institutions collaborated in the development of diagnostic projects for the restoration of certain areas. Marián Mendoza obtained his degree with the results of this research. Additionally, two PhD students of FES Iztacala were incorporated to the project and completed Physiology laboratory training at Wakehurst Place, RBG Kew, under the supervision of Dr Hugh Pritchard, Dr Louise Colville and Dr Charlotte Seal.

Mid and annual reports have been sent to RGB Kew. A review of the project was completed by RBG Kew (Dr Paul Smith, Dr Tiziana Ulian and Dr Efisio Mattana) on September 2013 when several meetings were held (which included discussions and the presentation of posters and talks, both in FES Iztacala and the three communities). More recently, in April 2014, Dr Efisio Mattana and Alex Hudson visited the project, providing technical advice and helped to consolidate the chapter of the book on UPP1 and the project database, respectively. The final part of the second phase of the project is due to conclude close to the end of 2014.

Output 2: Species conserved *ex situ*

During the first phase of the project a workshop was held with community members of San Rafael to select their 100 most important plant species. This list was used to decide the species to be conserved at the seed banks and to be propagated in the local greenhouse. During the field work of UPP2, the list was corroborated and extended following interviews with community members of Guadalupe Victoria and San José Tilapa. The communities choose many of the same species which was expected because they share the same climate and vegetation, and there are close ties between the communities with a lot of interaction and relationships.

During the second phase of the project a total of 108 seed collections (102 species) have been collected and stored in the seed bank of FES Iztacala-UNAM. Germination tests were performed for 24 of these, and 132 have been duplicated in RBG Kew's MSB. In addition to those obtained in UPP1 (101 useful plant species banked), 296 seed collections have been made of 266 useful species. Considering that in UPP1 germination tests were completed on seeds of 115 species, overall, germination tests have been completed for 139 useful species of the region.

It is important to mention that in 2013 the authorities of the Comisariado Ejidal unilaterally banned access to collect seeds, although other activities could continue. In response to this, the collection strategy for useful plants was changed so that, since the end of 2013, the collector of the project was incorporated into the collection team of the FES Iztacala-UNAM seed bank, and collections were carried out in other parts of the Tehuacán-Cuicatlán Biosphere Reserve.

Output 3: Species propagated and conserved in the communities

These activities were only carried out in UPP2 with great success. A total of 28,932 plants of 21 priority useful plant species were propagated, although, unfortunately only 5,963 of 16 species survived (Table 1). From them, 1,500 seedlings of *Ferocactus latispinus*, *Neobuxbaumia tetetzo* and *Pachycereus weberi* were planted by children in community home gardens at the three communities. The students of the Fray Pedro de Gante High School (in San José Tilapa) have also started a Botanic Garden with 30 plants of *Amphipterygium adstringens*, *Ceiba aesculifolia* ssp. *parvifolia*, *Jatropha neopauciflora*, *Neobuxbaumia tetetzo*, *Pachycereus weberi* and *Prosopis laevigata* which were donated by the project. These results were achieved due to the school programme developed in the three communities, in which nine schools of the region, as well as students and professors of FES Iztacala were involved.

Table 1. Results of propagation activities.

Species	2012		2013		2014	
	Seeds germinated	Survival plants	Seeds germinated	Survival plants	Seeds germinated	Survival plants
1 <i>Agave kerchovei</i>	0	0	800	82	900	39
2 <i>Agave macroacantha</i>	400	64	0	0	0	0
3 <i>Amphipterygium adstringens</i>	800	60	400	80	0	0
4 <i>Bursera aptera</i>	0	0	100	11	0	0
5 <i>Castela tortuosa</i>	120	0	0	0	0	0
6 <i>Ceiba aesculifolia</i>	0	0	400	72	450	17
7 <i>Escontria chiotilla</i>	0	0	1000	250	0	0
8 <i>Ferocactus latispinus</i>	0	0	1000	250	0	0
9 <i>Gymnosperma glutinosum</i>	0	0	0	0	450	0
10 <i>Hylocereus undatus</i>	1000	0	0	0	0	0
11 <i>Jatropha neopauciflora</i>	400	123	0	0	200	28
12 <i>Lippia graveolens</i>	825	2	0	0	0	0

13	<i>Myrtillocactus geometrizans</i>	80	0	0	0	0	0
14	<i>Neobuxbaumia tetetzo</i>	4000	472	2000	278	2562	850
15	<i>Opuntia</i> sp.	200	0	0	0	0	0
16	<i>Pachycereus weberi</i>	1250	437	3000	1200	1520	862
17	<i>Parkinsonia praecox</i>	0	0	200	70	0	0
18	<i>Plumeria rubra</i>	0	0	0	0	75	55
19	<i>Prosopis laevigata</i>	1500	200	400	78	200	120
20	<i>Stenocereus pruinosis</i>	800	24	0	0	0	0
21	<i>Stenocereus stellatus</i>	0	0	1000	218	900	27
Total		11375	1382	10300	2589	7257	1998

Although it was not possible to carry out the reintroduction assays, two diagnostic projects for restoration were completed. The first diagnostic project was developed by two collaborators from the Universidad de Alicante and one Professor from FES Iztacala-UNAM, which proposed a strategy of active restoration. The second diagnostic project proposed by two professors and students of Facultad de Ciencias, UNAM, outlined a passive restoration strategy. During the visit of RBG Kew team members to the communities in September 2013, the results and suggestions of both of these projects were presented to the authorities of the Comisariado Ejidal. It has not been decided which will be carried out. Nevertheless, in June 2014 a group of people ('ejidatarios') of San José Tilapa showed interest in the active restoration. They asked the project for 172 plants of *Prosopis laevigata* and 28 plant of *Jatropha neopauciflora* to start a reintroduction plot in an ancient rubbish dump and another selected site. These activities will be monitored at least for the next three months by a project student of Universidad del Mar, Campus Puerto Escondido, Oaxaca.

In relation to the capacity building of local community members, 87 workshops and similar activities were held in the three communities. These workshops were focused in plant propagation and conservation activities, as well as in the preparation of some natural products and food. The workshops were performed mainly in the local greenhouse located in the community of San Rafael, as well as in the schools or in the field. Approximately 2,500 people (children, young people and adults) attended these workshops.

Output 4: Sustainable use and income generation from useful plants

Although income generation is a valuable output to this kind of project, it was not possible to consolidate a "UMA" (Unidad de Manejo para la Conservación y Aprovechamiento

Sustentable de la Vida Silvestre = Management Unit for Conservation and Sustainable Use of Wildlife) officially required by Mexican government (SEMARNAT) to carry out this activity. Although numerous meetings were held during UPP2 with authorities and people of the region as well as authorities of the Biosphere Reserve, only some individuals or small groups showed interest in establishing a UMA. Hence, it was not possible to have a joint initiative and agreement between the authorities and the people involved due to the low interest showed. It was also planned to create an ecotourism program, which would include the sale of propagated plants and other products, as well as guided visits to the Cueva del Maiz, the greenhouse, local farms, and the restoration sites. Development of this initiative might continue in the future as there are difficulties at present. Meetings will continue until the end of the project.

Output 5: Research and capacity building

During the last seven years (UPP1 and UPP2) one of the most important goals of the project was to carry out research and capacity building, as joint activities. Thus, several students (bachelor, master and doctorate) have been continuously incorporated into the different areas of interest of the project. These areas are: plant physiology, phytochemistry, ethnoecology and recently ecological restoration. Studies in plant physiology have been completed regarding the conservation and the content of secondary metabolites found in some species, for example with *Castela tortuosa* (Simaroubaceae), *Gymnosperma glutinosum* (Compositae) and *Lippia graveolens* (Verbenaceae). Studies about seed aging and deterioration of several species of Cactaceae have also been completed. Several studies on the phytochemistry of species have been completed to evaluate their therapeutic properties. These numbers far exceeded the five species initially planned for research activities. In ethnoecology, several studies have been done regarding spatial and temporal availability of perennial useful species as well as the impact of human management on several species of annual and perennial plants (for example *Agave kerchovei*, *Amphipterygium adstringens* and useful weeds growing in cultivated fields). Finally, two research projects regarding the identification of places where active or passive restoration could be targeted using propagated plants from our greenhouse have also been concluded. Most of these studies were done by students, whose theses are listed in Annex 7.

Table 2: List of species (and topics) studied in the whole project.

A = Antibacterial activity; B = Antifungal activity; C = Antioxidant activity; D = General toxicity; E = Analgesic activity; F = Anti-inflammatory activity; G = Scaring activity; H = Contents of carbohydrates, lipids, proteins and vitamin C; I = Phytochemical screening; J = Photo protective and antioxidant effect; K = Domestication studies; L = Physiology studies; M = Demographic studies; N = Propagated in the project; O = other studies. Values marked as ✓ indicate that the activity took place and, where appropriate, obtained positive results, while the x indicates negative results.

Species	Activities															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
<i>Agave kerchovei</i>	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓	✓	
<i>A. macroacantha</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-	
<i>Amphipterygium adstringens</i>	✓	✓	✓	✓	x	x	x	x	✓	✓	-	-	-	✓	✓	
<i>Bursera aptera</i>	✓	-	✓	-	-	-	-	-	✓	✓	-	-	-	✓	-	
<i>B. arida</i>	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	
<i>B. biflora</i>	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	
<i>B. fagaroides</i>	✓	-	-	-	-	-	-	-	✓	-	-	-	-	✓	-	
<i>B. morelensis</i>	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	-	-	-	✓	-	
<i>B. schlechtendalii</i>	✓	-	-	-	-	-	-	-	✓	-	-	-	-	✓	-	
<i>B. submoniliformis</i>	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caesalpinia melanadenia</i>	✓	-	-	✓	-	-	-	-	-	✓	-	-	-	-	-	
<i>Castela tortuosa</i>	-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	-	
<i>Ceiba aesculifolia</i> ssp. <i>parvifolia</i>	✓	✓	✓	✓	x	x	x	x	✓	✓	✓	-	-	✓	✓	
<i>Cordia curassavica</i>	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>C. globosa</i>	✓	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	
<i>Cyrtocarpa procera</i>	✓	✓	✓	✓	x	x	x	✓	✓	-	-	-	-	-	-	
<i>Escontria chiotilla</i>	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	
<i>Ferocactus latispinus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	
<i>Gymnolaena oaxacana</i>	✓	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	
<i>Gymnosperma glutinosum</i>	✓	✓	✓	✓	x	x	x	x	✓	✓	-	✓	-	✓	-	
<i>Hylocereus undatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓	

<i>Jatropha neopauciflora</i>	✓	✓	✓	✓	×	×	×	×	✓	✓	-	-	-	✓	-
<i>Lantana camara</i>	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lippia graveolens</i>	✓	-	✓	-	-	-	-	-	-	✓	-	✓	-	✓	-
<i>Myrtillocactus geometrizans</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-
<i>Neobuxbaumia tetetzo</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓
<i>Pachycereus weberi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	✓	-
<i>Porophyllum tagetoides</i> (Synonym of <i>Porophyllum linaria</i>)	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
<i>Prosopis laevigata</i>	-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	-
<i>Stenocereus stellatus</i>	-	-	-	-	-	-	-	-	-	-	✓	-	-	✓	-
<i>Stenocereus pruinosus</i>	-	-	-	-	-	-	-	-	-	-	✓	-	-	✓	-

Output 6: Information disseminated and project promoted

Beside the workshops, a number of other materials (posters, brochures and flyers about the project and the importance of the project's valuable species) have been developed and disseminated to the communities. Project results have been presented in symposia and congresses, and 11 scientific articles and one book chapter have been published. Additionally, the project is contributing towards the book of the results of UPP1 and it has finished a calendar containing 12 Cactaceae species together with their uses. Publications and other dissemination and promotional materials are listed in Annex 7.

Table 3: Results for the project per each indicator divided by phase (2007-2014)

Quantitative indicators	UPP 1	UPP 2	Total	Constraints
New partnerships	1	2	3	
Cumulative target list with useful species	117	400	400	
Seed collections made	188 (178 species)	108 (102 species)	296 (266 species)	During a great part of 2013 the authorities banned the access to collect seeds in the region
Seed collections banked in country	142 (134 species)	78 (73 species)	220 (195 species)	
Seed collections banked at the MSB	107 (101 species)	132 (97 species)	239 (186 species)	Delay in the processing of the seeds
Seed collections tested	115	24 (24)	139	

Species propagated	0	16 (5,963 seedlings)	16 (5,963 seedlings)	Propagation activities were not performed in UPP 1
Propagation protocols produced	0	15	15	
Communities/community groups involved in the project	1	2	3	
Species planted and maintained in local communities/schools	0	7 (1,530 seedlings)	7 (1,530 seedlings)	
Local communities/schools involved in planting activities	1	3	3	
Community/school gardens/woodlots where planting activities have been carried out	0	4	4	
Capacity of local communities enhanced through workshops, training events, nurseries		87 workshops		
School programme enhanced through the involvement of schools		9 schools		
Children involved in school programmes in the communities		300+		
Research on species	19	20	31	No

Discussion and Conclusions

About 85 – 90% of the objectives planned for the project were completed, which is probably due to an unbalanced production in each of the project phases. For example, in UPP1 it was difficult to communicate or motivate community members of San Rafael to perform conservation and propagation activities. Additionally, it was difficult to get the community to use the nethouse/greenhouse in a definitive way. These issues were solved in UPP2 since there were a high number of training activities with communities at workshops, talks, etc. Workshops and training activities in the three communities allowed us to provide: i) guidance in the use of the nethouse/greenhouse, ii) training in propagation techniques, and also iii) to form close relationships with the community members. The involvement of students in the project contributed significantly to expand the number of people trained to the highest level in Mexico on aspects related to *ex situ* conservation. It is believed that these activities have opened new horizons for future research and teaching in our university. The academic performance related to publications was on average the same across the two phases of the project, with a slight

increase in production of thesis and publications in UPP2. More importantly physiological and phytochemical studies significantly expanded the knowledge and understanding about the propagation of several plant species in rural conditions. Studies also confirmed the existence of a phytochemical basis of the traditional knowledge of several medicinal plants used in the region. Although there were problems with seed collection, the number of species targeted was almost achieved. However, there are still many other useful plant species of the region poorly represented in the seed banks of Mexico and RBG Kew. Internal political problems in the region were the main obstacle to the commercialization of plants and other products, and solutions to these issues are far from the reach of the present project. However, these problems may be overcome in the long term.

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To the people (especially children, women and school teachers) and authorities of the three communities (San Rafael, Guadalupe Victoria / Pueblo Nuevo and San José Tilapa) of the Comisariado Ejidal de San José Tilapa for allowing us to carry out the project, and to the authorities of the Biosphere Reserve Tehuacan-Cuicatlán authorities for their help to solve different problems with people in the communities. Special thanks to "Mrs. MGU" for the financial support but especially for the idea to do a project like this in our country.

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Annexes - Mexico

Annex 1: Logframe of the project.

Logframe for Second Phase of Project MGU-the Useful Plants Project (UPP) in Mali (April 2011-September 2014)		
Objectives	Indicators	Activities
Project Outputs		
Output 1: Project planned, monitored and implemented effectively		
	At least 1 new partnership (Agreement) incorporated into the project within six months.	To explore and establish partnership with authorities from the Tehuacán-Cuicatlán Valley (VTC) Biosphere Reserve, in order to support ecotourism activities related to the conservation and sustainable use of useful plants.
	2 new communities (San José Tilapa and Guadalupe Victoria), in addition to the community of San Rafael, to be engaged within six months.	To present, discuss and launch second phase of project with communities and local authorities.
	Project documents (project description, logframe, budget, staff chart, work plan) completed within six months.	To agree and finalize project documents (project description, logframe, budget, staff chart, work plan).
		To identify and include personal supporting school programme and community workshops.
	Mid and annual reports (activities and budget report and species list updated) compiled every six months.	To prepare and submit mid and annual reports (activities and budget report and species list updated).
	Project reviewed by the end of the second year.	To participate to project workshop and contribute to report.

	At least one joint proposal complementing project and matching funds by the first year.	To write and submit a project to FIRCO or other instances on income generation component.
Output 2: Species conserved <i>ex situ</i>		
	When possible, at least 200 seed collections (3,000 seeds per collection) made and orthodox seeds held to international standards in FESI-UNAM Seed Bank (Mexico) and duplicates stored at RBG Kew's Millennium Seed Bank (MSB) (UK).	To maintain and update database with target sp. list and relevant information (conservation status, distribution, use and life form).
		To collect seed collections of priority useful plants species from areas of influence of communities.
		To involve people from the communities in seed collecting activities (Output 4).
		To process and hold orthodox seed collections to international standards in FESI-UNAM Seed Bank (Mexico) and to store duplicates in the MSB (UK).
	At least 100 seed collections tested.	To carry out germination tests of seed collections and share results with RBG Kew and vic.
Output 3: Species propagated and conserved in the communities		
	20 priority useful plant species (5,000 seedlings) propagated, planted and maintained in the communities.	To select priority useful plant sp. with the communities for propagation.
	Capacity building delivered in the communities through 5-6 workshops or training events.	To train communities in plant propagation during workshops and training events.

		To propagate priority useful plant sp. in the greenhouse in San Rafael.
	Reintroduction trials for at least 6 priority useful plant species.	To carry out reintroduction trials for priority useful plant sp. (i.e. sp. with low population density or with fragmented populations or important for the local people).
		To record and compile information for priority useful plant species (species information, conservation and propagation) and produce species technical information sheets (Output 6).
	At least 3 schools (100 children) from the communities involved in the project.	To provide training and produce school material relevant to plant use, conservation and propagation (Output 6) for schools in the communities.
Output 4: Support to <i>in situ</i> conservation and use		
	At least 20 useful plants promoted for income generation.	To provide support to the authorities of the VTC Biosphere Reserve for ecotourism activities e.g. preparation of walking routes, capacity building for future guides and dissemination material (Output 6).
		To involve people from the communities in seed collecting activities (Output 2).
		To trial sell of priority useful plants sp. propagated in the greenhouse of San Rafael.

Output 5: Sustainable use and income generation from useful plants		
	At least 5 priority useful plant species researched.	To conclude the phytochemical and ethnoecological studies.
		To carry out studies on the biochemical and ecophysiological processes involved in the aging of the seeds and about the procedures of priming for the recovery of the aged germplasm.
		To carry out studies to determine the profiles of accumulation of secondary metabolites.
		To involve undergraduate students in the project lab. and field activities for their thesis.
	Capacity building for 5 undergraduate students and joint supervision of 2 PhD students by UNAM and RBG staff.	To co-supervise (FESI-UNAM and RBG Kew) and train two PhD students, including exchange visits and joint publications (Output 6).
Output 6: Information disseminated & project promoted		
	<p>Dissemination of information at different levels :</p> <ul style="list-style-type: none"> • 5 thesis and 5 scientific articles (2 Phytochemistry, 1 Ethnoecology, 2 Plant Physiology) • 6 species Technical Information Sheets • 1 Book guide of useful plants of VTC • 3 posters (medicinal, food and rare plants) • At least 1 leaflet with biological and anthropological information on corn domestication <p>Project exposure enhanced through:</p> <ul style="list-style-type: none"> • Chapter on Mexico in UPP1 book • At least one press article about UPP2 	<p>To publish research outcomes in thesis and scientific articles.</p> <p>To elaborate and prepare divulgation and didactic material on use, conservation and propagation of useful plant species.</p> <p>To contribute to chapter on Mexico for UPP1 book and to foment media exposure about UPP2.</p>

Annex 2: List of dissemination material.

Scientific articles

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6

The MGU –Useful Plants Project, South Africa



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Abstract

Within South Africa, the UPP2 project was undertaken after the successful completion of its first phase (UPP1) which came to an end in 2011. The project was planned in May 2011, having accepted and reviewed the comments received from UPP1. The gaps identified were factored

into the planning. The project could only be implemented from March 2012 following the lengthy process of finding a suitable candidate to implement the project (the previous project manager and the assistant officer all left South African National Biodiversity Institute (SANBI)). With a new project officer and assistant, the project was satisfactorily implemented and, despite being one year behind schedule, almost all deliverables have been achieved. In South Africa the pressure is mounting on medicinal plants in part because their trade amounts to over R2 billion per year (South African Rand). Sixteen indigenous species and four indigenous fruit trees were selected for targeting of project activities in phase 2. These were in addition to the 120 priority species selected for phase 1 in the Lowveld of Mpumalanga, South Africa. The indigenous fruit trees were added following a request from a community and the project review with the UK project team. The relevant information for these species has been added to the database. During UPP1, 101 species were collected of which 94 were banked. Another 40 species were collected during UPP2 (two still to be collected) of which 18 were banked at the Royal Botanic Gardens, Kew's (RBG Kew) Millennium Seed Bank (MSB). Processes are underway to send in the remaining bankable species. During UPP1 a total of 100 species were propagated, and 99 germination tests and 101 propagation protocols were finalized. Another 33 species were propagated during UPP2. Propagation protocols were still being developed for UPP2 at the time of writing this report. A total of 30 medicinal plant species (three during UPP2) have been planted in a medicinal plant section in the Lowveld National Botanic Garden (LNBG) which is used for community education of school groups. 5,100 plants have been planted at the twelve different school gardens. Project was reviewed annually, with the UPP UK team. A number of workshops were conducted in the communities and LNBG facilities, and propagation manuals were developed in both English and Siswati. Posters, pamphlets and species identification labels were developed for dissemination of information about the project species. Plants propagated were donated to community schools.

Introduction

Rationale

Phase 2 of the project was planned using the comments received from the evaluation of the Phase 1. The review identified a limited involvement of the communities in the project, but on the other hand a strong emphasis on scientific output. This as it may, the reliance of the communities on traditional medicine was still prevalent and integration of communities into the project received much attention during this phase of the project.

Medicinal trade – an overview

The traditional medicinal plant trade in South Africa is a multi-million rand industry (Mander, 1997) with the trade in Kwazulu-Natal alone conservatively estimated at R500 million. Estimates dating back to 1997 indicated that more than 27 million people use traditional medicine in South Africa (Mander, 1997). This demand has steadily been growing due to an increase in urbanization and rising unemployment. It was reported in the TRAFFIC report of 1998 that many traditional medicinal practitioners have indicated that they are experiencing shortages in popular plants and this has led to intensification of the gathering network on a national and later even an international scale.

Trade, harvesting, medicinal plant propagation and nursery management are not new concepts to science. In the last decade there has been intensive research to investigate the collective impact of wild medicinal plant harvests, habitat destruction, economic conditions and the effect of climate change on species loss and the impact of this on livelihoods in South Africa (Williams *et al.*, 2007; Botha *et al.*, 2004; Mander, 1997 and Cunningham, 1998).

Studies done by Williams *et al.* in 2007 indicated that there are about 176 medicinal plant species traded in the Lowveld of Mpumalanga, of which 33% are imported from the two neighbouring countries of Mozambique (86%) and Swaziland (14%). According to Williams (2007), vendors interviewed in Mpumalanga indicated that they supply the markets in Gauteng, but studies indicated that only 3% of the plants on the Gauteng markets originated from Mpumalanga. What is however significant is that 42% of the plants that were traded in Gauteng markets were imported from Kwazulu-Natal (KzN). Medicinal plants in KzN have been under severe pressure for extended periods and some species have become locally extinct in that province (Gordon-Gray as quoted by Crouch *et al.*, 2000). Mpumalanga is the geographical crossroad between Limpopo, Durban, Gauteng, Swaziland and Mozambique (Botha *et al.*, 2004) and the resulting near-depletion of the medicinal plants in KzN could lead to a significant increase in harvesting in Mpumalanga.

Project area

The UPP/SA is based in the Lowveld National Botanical Garden, Mpumalanga, South Africa (Figure 1 and 2). The project focussed on the three tribes living around Nelspruit town: the Swatis, the Shangaans, and the Sothos. The Ndebele tribe is located on the north-western side

of Nelspruit on the highveld (mainly grassland), while the other three tribes are all located on the Lowveld (savannah bioregion).

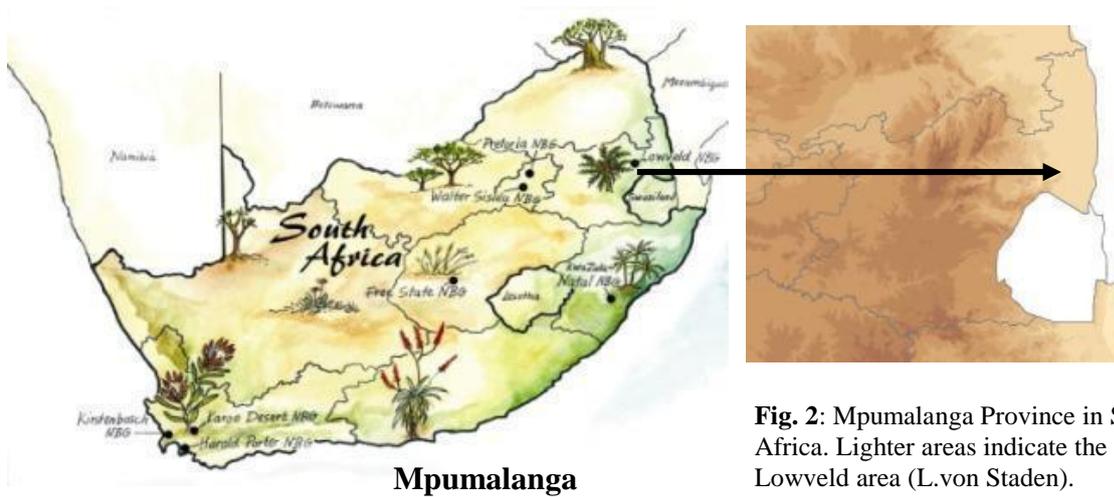


Fig. 1: Map of South Africa indicating the National Botanical Gardens.

Fig. 2: Mpumalanga Province in South Africa. Lighter areas indicate the Lowveld area (L.von Staden).

Main threats to plant species in Lowveld of Mpumalanga

The top five threats to species in the Lowveld of Mpumalanga are (Threatened Species Database; SANBI 2009):

- The direct effect of alien invasive species competition
- Habitat loss due to agriculture
- Harvesting and gathering for medicinal purposes
- Habitat loss due to extraction – mining
- Habitat loss due to infrastructure development

South Africa has fully assessed its entire flora during official national Red Listing between 2003 and 2008, and thus the 120 medicinal plant species targeted for the UPP/SA project have all been recently investigated. The official status of these species ranges from Critically Endangered to Least Concern but declining (Raimondo *et al.*, 2009). In many instances harvesting methods are destructive since bulbs/tubers and roots are used. Although bark harvesting can be done using a sustainable method, this is often not currently practiced (see appendix 1 for details).

Criteria used to select priority species

The selection of priority species was achieved after carrying out community workshops together with the traditional healers from the three tribes that make up the Ehlanzeni District Municipality of Mpumalanga Province. In these workshops the community members were invited to provide information on species they need, but which they find hard to find nowadays. The lists were then consolidated into one, with the information being gathered and collated in the project database. A literature review was carried out to verify the species and to provide further information on their uses.

The following criteria were used to determine which 120 species should be targeted:

- **Known medicinal use.** Since the medicinal plant industry is very prominent in South Africa, it was decided to limit the priority species to those with a known medicinal use.
- **Level of endemism.** Plants that are endemic to Mpumalanga and/or South Africa were given a higher priority than more widely distributed plants.
- **IUCN Red List Threatened status.** Any medicinal plant which had a Red List status of Critically Endangered, Endangered or Vulnerable, according to the 2009 IUCN assessment, was included in the list.
- **Information on preference and availability from traditional healers and gatherers.** Throughout the project traditional healers and gatherers were asked which plants they favour, and which plants are becoming harder to find.
- **Occurrence in Lowveld of Mpumalanga.** Climatic conditions vary rather dramatically between the Highveld and Lowveld of Mpumalanga, and plants from the respective areas do not generally grow well when planted under different conditions. The Highveld experiences very cold, frosty winters while the Lowveld is mild and frost free during the same period.

Seed collection

Once the 20 priority species were selected, information regarding their distribution, habitat and habits was collected. Consequently the species were grouped according to priority, flowering and seeding periods. Field trips were conducted to the localities to inspect the size of populations and to collect herbarium specimens. Afterwards the target plants were monitored until seeds were ready to be harvested for conservation and propagation. One of the target species, *Bersama lucens*, did not produce seeds during the two seasons under observation. The

reserve owner was asked to assist with the monitoring of this species, however no seeds were ever found. As a result, a representative species in the LNBN did produce seeds and these were used for propagation (and not banked).

In UPP2 a total of 43 priority species seed collections were made, with the remaining two species (edible wild fruit species) still monitored and which will be collected before the end of 2014.

Propagation

Each species was studied individually with the help of Mr. Willem Froneman, control horticulturist at LNBN, to determine the most suitable propagation method. Although the main aim was to collect seeds for conservation and propagation purposes, some groundcover species were propagated by cuttings because of their urgent need for establishment in community gardens. It was important to ensure that the propagation methods were suitable for the local communities, as often they have limited or no access to resources such as water, plant containers and compost or fertilizer.

In instances where numerous seeds were collected, propagation experiments were expanded to include investigations into the effects of changes to various factors, such as soil medium, different types of containers and pre-sowing treatments. All aspects of the propagation trials were carefully recorded and are currently being consolidated into a final propagation protocol for each species.

***In situ* conservation support**

Dioscorea strydomiana was targeted for *in situ* conservation. The local conservation authority, Mpumalanga Tourism and Parks Agency's (MTPA) Plant Conservation Department, was requested to participate in the initiative because of permit requirements and their extensive experience with similar initiatives. In a meeting with the South Africa UPP team, the UPP UK team, SANBI Walter Sisulu National Botanic Garden, as well as the conservation authority teams, it was agreed that a UK horticultural student would assist with the propagation and initial trials. A lack of available funds meant the student work did not proceed, however the collaborative project is to continue in a different format.

Community workshops and education

Traditional healers and surrounding schools were encouraged to work together after the first workshop to identify the plant species relevant to each group of traditional healers. Joint workshops were organised with school environmental clubs and the traditional healers with training in plant propagation techniques. Three workshops were conducted, each time with a different tribe. School environmental clubs were further trained on garden designs and maintenance. For the workshops, the total number of learners at the schools was 9,339 while 2,954 were actively involved in the project. Teachers also use the school gardens informally as education tools; hence the number of beneficiaries of the project at the school is indefinable. In 2012, the International Biodiversity Day was celebrated at the LNBSG, with attendance of traditional healers and the schools and with a tour to the UPP's Medicinal Garden.

Promotional materials were produced to enhance information dissemination. Forty A1 posters of *Warburgia salutaris* were re-printed, 50 A1 posters of Big Five trees (*Trichilia emetica*, *Kigelia africana*, *Olea europaea* subsp. *africana* (Synonym of *Olea europaea* subsp. *cuspidata*), *Warburgia salutaris* and *Syzygium cordatum*) were printed following their development and 225 pamphlets of *Flueggea virosa* subsp. *virosa* were developed and printed. A number of labels were developed for the school gardens, which included 423 laminated (temporary) labels and 344 Vinyl and Chromadek versions. Fourteen info boards were also developed for the schools.

Medicinal plant garden at LNBSG

National Botanical Gardens in South Africa are widely used for educational purposes by local school groups, the general public and even international visitors. A section in the LNBSG was developed during UPP1 phase to illustrate the UPP project, as well as the importance of medicinal plants in South Africa's culture. During UPP2, more plants propagated by the project have been planted in this garden and new sections have been added according to specific use themes. Some of the seedlings which are too small to be transplanted will be housed in the nursery for another year. Plants in the medicinal garden have been grouped according to known medicinal uses with interpretive signs for each group, for example all those used to cure headaches are together with relevant information, etc. The medicinal garden is to be enlarged due to public demand and because of the number of plants available in the nursery. A traditional hut is to be constructed which will link indigenous plants to human life and this will be

consolidated with further interpretation and demonstration activities. The UPP project will also be explained inside the hut with links to other participating countries.

Materials and Methods

The useful plant species list was updated for the UPP2 after the data gathered through interviews carried out with the traditional healers on the plants that they use to treat people (important medicinal plants in Mpumalanga), and to provide us with the knowledge of local plant names in Siswati. Scientific names and plant uses were first gathered through literature review using the internet and the traditional healer's knowledge, and subsequently targeted for seed collection. After collection, seeds were propagated at the LNBSG's nursery and the resultant seedlings were planted at the schools and communities for conservation and education purposes.

The following UPP book species: *Gomphocarpus physocarpus*, *Cordyla africana*, *Gunnera perpensa*, *Trichilia emetica* and *Zanthoxylum capense* were targeted for collection for the MSB.

Project Outputs/Indicators

Output 1: Project planned, monitored and implemented effectively

- Seven existing partnerships were to be consolidated and four new relevant partnerships established and integrated into the project.
- Project documents (logframe, budget, management structure and work plan) were agreed and finalized.

Output 2: Species conserved *ex situ*

- Cumulative target list of over 167 useful species was compiled.
- Twenty seed collections of priority useful plant populations were made and held to international standards in seed banks in country, and duplicated in RBG Kew's Millennium Seed Bank (MSB).

Output 3: Species propagated and conserved in the communities

- Eighteen of the targeted species (*Antidesma venosum*, *Argyrobium tomentosum*, *Bersama lucens*, *Clivia miniata*, *Coddia rudis*, *Cussonia spicata*, *Flueggea virosa*, *Gerbera ambigua*, *Harpephyllum caffrum*, *Hermannia depressa*, *Hippobromus pauciflorus*, *Justicia capensis*, *Lanea discolor*, *Maerua rosmarinoides*, *Maesa lanceolata*, *Peltophorum africanum*, *Trichilia dregeana* and *Vangueria infausta*) were collected and propagated from seeds. Twelve additional species (*Argyrobium wilmsii*, *Bulbine capitata*, *Bulbine frutescens*, *Bulbine natalensis* (Synonym of *Bulbine latifolia*), *Carpobrotus edulis*, *Cissus quadrangularis*, *Dovyalis caffra*, *Gazania krebsiana* subsp. *serrulata*, *Haplocarpha scaposa*, *Lopholaena coriifolia*, *Pittosporum viridiflorum* and *Plumbago zeylanica*) were collected and propagated either as cuttings or seeds. Propagation protocols were produced for the following 21 priority useful species: *Antidesma venosum*, *Argyrobium tomentosum*, *Argyrobium wilmsii*, *Bersama lucens*, *Clivia miniata*, *Coddia rudis*, *Cussonia spicata*, *Drimia altissima*, *Flueggea virosa* subsp. *virosa*, *Gerbera ambigua*, *Harpephyllum caffrum*, *Hermannia depressa*, *Hippobromus pauciflorus*, *Maerua rosmarinoides*, *Maesa lanceolata*, *Lopholaena coriifolia*, *Peltophorum africanum*, *Pittosporum viridiflorum*, *Strychnos henningsii*, *Trichilia dregeana* and *Vangueria infausta*).
- Four additional communities/community groups were engaged and integrated into the project (Buffelspruit community, Phiva community, Vukuzenzele Medicinal Nursery and KaMhlushwa Traditional healers) in addition to the existing five communities/communities group (Ebutsini cultural village, Alexandra community, Mvangatini community, Mgwanya college of Education, Phambanisa community).
- Capacity of local communities to propagate and conserve plants was enhanced through training and the improvement of local facilities. Three propagation workshops were conducted in three different areas (Buffelspruit, Phiva and Thulamahashe). One training event took place at the LNBBG. An event to celebrate Arbor Day was held at Alexandra Primary School. Three consultative meetings were conducted at the beginning of the project in Buffelspruit, Phiva and Thulamahashe. Plantings was carried out between 2012 and 2014 at 13 communities/schools (Alexandra P. School, Hillaria Mthetwa Sec School, Enkhokhokhweni, kaMhluswa P. School, Mahlatsi Sec School, Mphiti P School, Mvangatini P. School, Njabulo P. School, Kwa jelusa P. School, Phambanisa Primary School, Tendeleni P. School, Mgwena College of Education, Ebutsini Cultural

Village). Planting was carried out at a smaller scale, following specific requests, at five additional communities/schools (Penryn College, Saselani P. School, LNBN Environmental Education Centre, Sukuma P. School and Rhanzekile P. School).

- The school programme was enhanced through the involvement of 2,954 students at 11 schools (Alexandra P. School, Hillaria Mthetwa Sec School, Enkhokhokhweni P. School, Mhluswa P. School, Mahlatsi Sec School, Mphiti P School, Mvangatini P. School, Njabulo P. School, Kwa-jelusa P. School, Phambanisa P. School and Tendeleni P. School). All the schools combined had 9,334 children enrolled from the local communities.
- Research on at least one useful plant species (*Hypoxis hemerocallidea*) has been started in order to enhance its conservation and sustainable use by local communities. Germination test are being re-run as initial tests were of low germination rates. Research has also begun on *Dioscorea strydomiana* propagation and restoration activities.

Output 4: Information disseminated & project promoted

- Leaflets on *Flueggea virosa* subsp. *virosa* have been designed and distributed to communities. Posters of *Warburgia salutaris* have also been distributed, whilst over 300 labels and nine story boards with SANBI and MSB logos have been designed and distributed to schools to use in their medicinal gardens.
- BIG FIVE species (*Kigelia africana*, *Olea europaea* subsp. *africana* (Synonym of *Olea europaea* subsp. *cuspidata*), *Syzygium cordatum*, *Trichilia emetica* and *Warburgia salutaris*) were also selected and a poster with information on their use was produced.

Results/Achievements

Output 1: Project planned, monitored and implemented effectively

Table 1: Information on partners, collaborators and project management

Partners	Collaborators	Project management	Activities	Period
Commercial Timber Company	York Timbers	Research PSG on the locality of <i>Argyrobium tomentosum</i>	<i>Argyrobium tomentosum</i> collection	2012-2014
Department of Water Affairs (DWAF)	Kwena Dam	Pretoria herbarium collection data	<i>Hermannia depressa</i> collection	2012-2013

Limpopo Tourism Parks Agency (LTPA)	Legalameetse Nature resort		<i>Trichilia dregeana</i> monitoring	2012-2014
Mpumalanga Tourism Parks Agency (MTPA)		Collection Permit applications	Issuing of collection permits, information on plants localities	2007-2014
Plants Specialist Group (PSG)	Buffelskloof Nature Reserve	Research on plants localities		2012-2014
Department of Education	Targeted schools		Planting in the schools	2007-2014
MTPA	Mountainland Nature Reserve	Plants localities by MTPA	Plants monitoring	2013-2014

Table 2: Results for the project per each indicator divided by phase (2007-2014)

Quantitative indicators	UPP 1	UPP 2	Total	Constraints
New partnerships		7		
Cumulative target list with useful species	128	167	167	
Seed collections made	101 (100 species)	43 (40 species)	144 (132 species)	
Seed collections banked in country	101 (100 species)	17 (17 species)	118 (116 species)	<i>Peltophorum africanum</i> has not been duplicated in the country
Seed collections banked at the MSB	94 (94 species)	20 (18 species)	114 (107 species)	3 species (<i>Antidesma venosum</i> , <i>Vangueria infausta</i> & <i>Annona senegalensis</i>) to be banked. <i>Trichilia dregeana</i> & <i>Clivia miniata</i> cannot be banked (recalcitrant seeds) <i>Cordia rudis</i> and <i>Justicia capensis</i> have been sent to Cape Town
Seed collections tested	91	21	112	
Species propagated	100 (5,821 seedlings)	33 (7,700 seedlings)	127 (13,521 seedlings)	
Propagation protocols produced	101	21	122	
Communities/community groups involved in the project	4	5	9	
Species planted and maintained in local communities/schools	72 (7,769 seedlings)	91 (5,100 seedlings)	98 (12,869 seedlings)	Including planted at LNBSG
Local communities/schools involved in planting activities		13	13	Including UPP1 schools
Community/school gardens/woodlots where planting activities have been carried out	13	5	17	5 additional schools
Capacity of local communities enhanced through workshops, training events, nurseries	17 workshops / training events	10 workshops / training events	27 workshops / training events	This include consultation meetings and international Biodiversity visits

School programme enhanced through the involvement of schools		13		UPP2 new schools
Children involved in school programmes in the communities		2,954		9,334 total number in the schools
Species planted <i>in situ</i>		1 (270 seedlings)		
Managed areas, e.g. sacred forests involved in planting activities		1		
Research on species		2		

Discussion

The UPP2 phase of the project has been running for just over two years with encouraging results.

Implications of the results/achievements on conservation and management of species.

The working list of 20 species in UPP2 involved research and, very importantly, their identification by the end-users. Therefore, these are the plants they value and use. While each tribe had extended and differing lists, the collated list is those common denominators from all tribes. The training workshops gave communities the option to continue to trade in these species without relying on mother earth for their supply. Initially communities did not freely share their knowledge with the project officers, treating them instead with suspicion. However, information on useful plants started to be openly provided once the project developed, and relationship and trust started to build up.

All the information gathered during the project which are directly relevant to the conservation of the particular species were compiled in consultation with the authorities, hence the project is recognized by the authorities.

Implications of results on people and conservation in Mpumalanga.

Schools that participated in the project are still actively involved. They are taking care of the plants and therefore it is likely they will survive in these communities. The school gardens are appreciated by the schools as well as the department of education and the wider community members who visit them. There is still more to be done, considering Mpumalanga has over 2,000 schools which could also benefit from the establishment of these gardens.

The involvement of officials from the Department of Education improves the likelihood that other schools will want to replicate garden establishment activities. Already, several schools have requested gardens and since they cannot all be accommodated, smaller plant donations have been provided to them.

Recommendations

Propagation and cultivation

- To develop propagation protocols for additional medicinal species in the Lowveld of Mpumalanga.
- To propagate and cultivate selected medicinal plant species for the establishment of medicinal plant gardens in other local community/at local community schools.
- To cultivate large quantities of medicinal plants to facilitate the establishment of living collections of medicinal plants for conservation purposes.

Conservation

- To collect seeds from additional medicinal plants for *ex situ* conservation in the MSB or to supplement banked collections where previous collections are small.
- To elucidate reasons why some of the 120 targeted UPP species did not produce sufficient seed for collection.
- To establish *in situ* living collections/gene banks in natural habitat sites in the community/community schools, in collaboration with the conservation authority.

Community education

- To continue to conduct workshops on propagation and cultivation of medicinal plants.
- To conduct workshops on new topics like threats and conservation; sustainable harvesting practices, etc.
- To conduct training sessions on establishing and maintaining medicinal plant gardens in communities.
- To carry out educational visits of school groups/community members to GLOW.
- To create information materials on project topics to disseminate to community schools.

Research

- To complete the ongoing research of *Dioscorea strydomiana* and *Hypoxis hemerocallidea*.

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Annexes – South Africa

Annex 1: Logframe of the project.

Logframe for Second Phase of Project MGU-the Useful Plants Project (UPP)- (April 2011-September 2014)			
Objectives	Indicators	Means of Verification	Assumptions
Overall Project Goal	Welfare of local communities improved and useful important plants safeguarded from extinction in Latin America and Africa		
	Capacity of local communities in Latin America and Africa to conserve and use sustainably useful plant species enhanced	Dissemination material, workshop documents and facilities in Latin America and Africa for plant conservation and sustainable use enhanced in local communities	
Project Purpose	Conservation and sustainable use of plants for human wellbeing		
	At least 10 seed collections of priority useful plant species made and held to international standards in seed banks in country and duplicated in Kew's Millennium Seed Bank (MSB) in the UK. 10 additional species to the UPP1 target of 120. Selection criteria will be determined for the additional species to ensure relevancy for the community, conservation and UPP2. These collections will be made from as many populations as possible.	Seed collections registered in the seed banks in country and in Kew's MSB in the UK	Access agreements and permits are available; all project partners are committed and provide consistent support to the project; seed conservation is scientifically feasible for the target species

	A number of plants from species from UPP1 grown at the Lowveld NBG established in medicinal plant gardens in 3 additional communities.	Planting records	Plants mature for planting; Community able to accommodate plants;
	Ten priority useful plant species (6,000 medicinal/useful plants) grown in 3 local rural communities (2 Additional communities to UPP1)	Propagation documents	Plant propagation is scientifically feasible for the target species; Propagation protocols provided to community; Propagation techniques to include seed as well as vegetative propagation.
		Priority useful plant species maintained by the local communities in community/home/school gardens	Community members are engaged and provide time and land for growing and maintaining priority useful plant species in the communities. SANBI does not have the capacity to provide the land to communities. Assistance can be provided to establish home, community and school gardens as well as knowledge transfer on propagation. Plants can be made available to communities and schools to assist in the initial establishment of gardens.
	Conservation and sustainable use of at least 1 priority useful plant species supported <i>in situ</i> (managed areas). This could include informally protected areas for plants such as school gardens or other safe sites where plants are grown and safeguarded close or in the natural habitat.	Priority useful plant species planted <i>in situ</i> (managed areas). To include informally protected areas.	Relevant stakeholders engaged and managed areas made available for <i>in situ</i> conservation

		Monitoring data and scientific material (reports/thesis/papers)	Research is feasible for priority useful plant species; students and extra staff are made available in country and at Kew
	Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining.	Long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Tools and infrastructures that enable long term promotion of knowledge and use of plants.	Policy makers are supportive of the use of traditional knowledge and indigenous useful plants. Sustainable harvesting of useful plants; new partners engaged to support the socio-economic aspects of the project; market for useful plant species available. The bioprospecting law in South Africa does not allow commercialisation of indigenous plant products in the capacity of this project.
	Information about useful plant species shared more widely and project promoted at the local, national and international level	Dissemination material and publicity about project	Extra staff are made available in country and at RBG Kew to disseminate material and promote project

Project Outputs			
Output 1: Project planned, monitored and implemented effectively			
	Existing partnerships established in UPP1 consolidated and at least 5 new relevant partnerships established and integrated into the project within 6 months (November 2011).	Correspondence and agreements with relevant partners	All agreements are available; all project partners are committed and provide consistent support to the project; funds are available in country without delay from start of project
	Project documents (logframe, budget, management structure and work plan) agreed and finalised with partners within 6 months November 2011)	Correspondence and project documents for each country (logframe, budget, management structure and work plan)	Project successfully integrated into partners' institutional programmes; good communication is maintained with all project partners
	Country reports (mid and annual reports) submitted to Kew and general report submitted to donor every six months	Country reports and general reports; RBG Kew management meeting minutes	
	Project reviewed by the 2nd year of the project (May 2013)	Project workshop and report	
Output 2: Species conserved <i>ex situ</i>			
	Target list of 10 (additional species to UPP1) useful species agreed within 6 months (November 2011)	Lists of targeted useful plant species with relevant information (use, distribution, conservation status) updated and incorporated into the 'Useful Plants Project' database	Extra staff are made available in country and at Kew to maintain and update lists of useful plant species and the 'Useful Plants Project' database
		Country Databases/Excel Spreadsheets and 'Useful Plants Project' database updated	

	At least 10 (additional to UPP1) seed collections of priority useful plant populations made and held to international standards in seed banks in country and duplicated in Kew's MSB in the UK by the 3rd year of the project (May 2014)	Seed collections registered in the seed banks in country and in Kew's MSB in the UK	Access agreements and permits are available; all projects partners are committed and provide consistent support to the project; seed conservation is scientifically feasible for the target species
	Quality of 10 seed collections assessed through seed testing (viability, germination, storability) in Kew's MSB by the 3rd year of the project (May 2014)	Data on seed testing (viability, germination, storability)	Extra staff from RBG Kew are made available for seed testing
Output 3: Species propagated and conserved in the communities			
	20 priority useful species propagated	Propagation protocols	Propagation is scientifically feasible for the targeted species; trials are successful
	2 additional communities (to the existing 12 communities) engaged and integrated into the project within 6 months November 2011).	Workshop documents and agreements with communities	Community members are committed to the project and make available their time and land for project
	10 priority useful species (6,000 seedlings) planted and maintained in 3 (2 additional to UPP1) local communities. These priority species will include species from UPP1 and UPP2.	Priority useful plant species maintained by the local communities in community/home/school gardens	Communities are committed to the project and provide time and land for targeted useful plants
	Capacity of local communities to propagate and conserve plants enhanced through training and the improvement of local facilities	Training material and enhanced facilities for plant propagation and conservation	Community members are receptive to training and interested in propagating and conserving useful plant species

	School programme enhanced through the involvement of 3 schools and 2000 children (number to be finalised by study by new appointment in August) in the communities.	School material (e.g. species portraits, posters) and priority useful plant species maintained in school gardens	School teachers committed and actively involved in the project
	At least 1 priority useful plant species planted <i>in situ</i> (managed areas). And informally protected areas including fenced school grounds in the natural habitat of the target plant.	Priority useful plant species planted <i>in situ</i> (managed areas)	Propagation is scientifically feasible for the targeted species; trials are successful; relevant stakeholders are engaged and managed areas are made available for <i>in situ</i> conservation of priority useful plant species
Output 4: Support to <i>in situ</i> conservation and use			
	Research on at least 1 useful plant species to enhance their conservation and sustainable use in the local communities. Useful species could also include species selected in UPP1	Monitoring data and scientific material (reports/thesis/papers)	Research is feasible for priority useful plant species; students and extra staff are made available in country and at RBG Kew to research priority useful plant species
	Sustainability of UPP programmes in partner countries ensured through strategic partnerships, mainstreaming activities and enabling users to be self-sustaining	Development of long term partnerships, agreements and policy documents incorporating the value and use of indigenous useful plants. Development of tools and infrastructures that enable long term promotion of knowledge and use of plants	Policy makers are sympathetic and supportive of the use of traditional knowledge and indigenous useful plants
Output 5: Sustainable use and income generation from useful plants			
	Information derived from the first phase of Project MGU compiled, updated, organised and disseminated at local, national and international levels by November 2012	Volume 1 of book on Project MGU published at Kew and further material published in country in collaboration with Kew (e.g. books/manuals; species leaflets, booklets, posters, press and scientific articles)	Extra staff are made available in country and at Kew to disseminate material and promote project

Output 6: Information disseminated & project promoted			
	Project exposure enhanced through the generation of publicity material at the local, national and international level by the end of project (May 2014)	Development of a UPP- specific logo and generation of publicity material (e.g. press articles, project webpage, videos, radio interviews)	

7

Summary of SWOT (Strengths Weaknesses Opportunities and Threats) analysis

Question

What is RBG Kew’s role in conservation and livelihoods?

Working Group 1

Participants: Iain Taylor (RBG Kew, UK), Kate Gold (RBG Kew, UK), William Omondi (KEFRI, Kenya), Lucy Shai (LNBG, South Africa), Kola Mogotsi (BCA, Botswana), Tim Pearce (RBG Kew, UK), Efisio Mattana (RBG Kew, UK).

Outcome of discussion

Strengths	Weakness	Opportunities	Threats
<ul style="list-style-type: none"> -Fundraising opportunities; -Capacity building in communities through Kew and local partners; -Tangible benefits in the communities through partnership approach; -Research & development; -Partnership approach. 	<ul style="list-style-type: none"> -Capacity building (infrastructure); -Focus in plants may limit the interest of communities on the projects (communities have other priorities); -Kew can only address the initial part of the value chain; -UPP not strongly linked with other organizations in the country (e.g. NGO) that can complement Kew’s projects; -In some cases, poor links between Kew projects in the same country/institution 	<ul style="list-style-type: none"> -Donor interest; -Favourable policy environment; -Consortium building. 	<ul style="list-style-type: none"> -Research and development attention on conventional agriculture; -Limited scattered impact?
Recommendations	<ul style="list-style-type: none"> 1 – Work in a broader consortium to address interrelated priorities to increase the impact. 2 – Be able to demonstrate more tangible impacts in our projects. 3 – Benefits and sharing agreements to be improved. 		

Working Group 2

Participants: Moctar Sacande (RBG Kew, UK), Rokia Sanogo (IER, Mali), Stuart Cable (RBG Kew, UK), Peter Giovannini (RBG Kew, UK), Cesar Flores (UNAM, Mexico), Samodimo Ngwako (BCA, Botswana), Paolo Ceci (Italy), Alex Hudson (RBG Kew, UK).

Outcome of discussion

Strengths	Weakness	Opportunities	Threats
<ul style="list-style-type: none"> –Experience of Kew in conservation (technical expertise); –Facilities availability; –Resources to support collections, e.g. human resources, training/capacity building in country (e.g. technicians, farmers, universities), funds (linked to Kew which acts as a catalyst); –Kew is international; –Model created by Kew has been used for promotion in countries and development of new proposals separate to Kew’s work but based on it; –Kew connection support local administrations to be more efficient; –Provides a network of partners. 	<ul style="list-style-type: none"> –Sciences missing (e.g. anthropologists, economists, other social scientists); –Political intervention between communities and science; –Communication and visibility of the projects impacts; –Funding limits (time limitations); –Staff turnover (less community engagement); –Transfer to larger applications (e.g. National Policy); –Measuring the impacts of livelihoods (taking effective baselines). 	<ul style="list-style-type: none"> – Protect TK; –Increase the importance of TK and improve its use; –Improve socioeconomic value of TK; –Kew has the potential to act as a repository of non-published information, acting as a bank of knowledge; –Support in understanding the protection and opportunities to communities of IPR; –Reputation of Kew increases the visibility of projects; –Support standardization; –Publications. 	<ul style="list-style-type: none"> –Loss of TK; –Institutional changes; –Institutionalization of results; –Lack of future funding due to an overreliance on Kew for funds; –Loss of partners from projects as a result of funding issues; –Sustainability and survivorship of project.
<p>Recommendations</p>	<ol style="list-style-type: none"> 1 – Ensure findings and results are known to the government and policy makers. 2 – To support further funding in country to ensure project sustainability. 3 – Ensure the continued contribution and participation of communities. 4 – To continue the work on UPP with Kew’s partners. 5 – Research to be issue driven by partners and communities. 		

Working Group 3

Participants: Jonathan Timberlake (RBG Kew, UK), Paul Smith (RBG Kew, UK), Ellie Wade (RBG Kew, UK), Elinor Breman (RBG Kew, UK), Chikelu Mba (FAO), Avhatakali Mamatsharaga (SANBI), Milagre Nuvunga (MICAIA).

Outcome of discussion

Strengths	Weakness	Opportunities	Threats
<ul style="list-style-type: none"> –Knowledge about global plant resources (access to large databases and collections and expertise); –Excellent reputation; –Experience working with different partners (government, Universities, NGOs); –Experience with high level government agreements (MoUs, etc.) and negotiation; –Existing partnerships; –Attract funding; –Long-term country programmes with multiple projects; –Caliber of staff and Kew’s wider family; –Kew’s (and partner’s) infrastructure. 	<ul style="list-style-type: none"> –Kew ‘best kept secret’ in development and agriculture; –Potential partners might feel too small to approach Kew; –Assumptions about conditions where work; –Lack of social science expertise; –Not plugged in to development funding; –Using science based model when building livelihood projects; –Measuring livelihood impact. 	<ul style="list-style-type: none"> –Move back to Kew’s applied science roots; –Move into policy for longer and greater wide ranging impact; –Climate change, MDG, food security and nutrition (new possibilities); –Build stronger leadership and vision in livelihoods and developments. 	<ul style="list-style-type: none"> –Defra funding; –UK government policy; –Kew board of governors; –Political instability in country; –Donor funding fickle; –Turnover of partner staff.

Working Group 4

Participants: Tiziana Ulian (RBG Kew, UK), Serene Hargreaves (RBG Kew, UK), Alex Monro (RBG Kew, UK), Oliver Whaley (RBG Kew, UK), Stefano Padulosi (Bioversity, Italy), Rafael Lira (FESI-UNAM, Mexico).

Outcome of discussion

Strengths	Weakness	Opportunities	Threats
<p>–Kew is good at the baseline information, e.g. strong in data (taxonomic information, ethnobotany, common names, ethnobotanical surveys, strengthen the identity of the people in a culture), linking people, plants and cultures;</p> <p>–Kew has a network of global partnerships and experience in local areas (e.g. for example with policy makers, NGOs and local authorities);</p> <p>–Able to work at all levels in country (from community’s right through to local and national governments);</p> <p>–Kew has a long-term connection and relationship with remote communities (e.g. Asia, Africa, Middle East and Latin America);</p> <p>–Kew staff have individual close relationships in country;</p> <p>–Multidisciplinary of the projects (e.g. linking forestry, agriculture, seed conservation, botany, ecology);</p>	<p>–Kew is not a development organisation (but instead a ‘research for development organisation’) and is unable to do everything;</p> <p>–Lack of research and project staff collaboration;</p> <p>–Limited capacity to deal with political changes (Kew is weak at informing political decisions and agendas);</p> <p>–Few strategic analyses of risk in place (risk analyses need to be undertaken at levels other than projects);</p> <p>–Lack of structure and transparency in systematic monitoring and evaluation;</p> <p>–A long term funding strategy and structure needs to be developed to manage gaps and hiatuses in funding (e.g. we will work in this country for 10 years and raise pots of money within that strategic plan);</p> <p>–Lack of corporate strategic vision;</p>	<p>–To leverage the potential of linkages with cultural development and sustainable livelihood systems;</p> <p>–Scope for expanding on-going research and consolidating research at all levels;</p> <p>–To focus on our strengths and inform strategic vision;</p> <p>–To consolidate work around our strengths;</p> <p>–To present the case to philanthropists and potential funders for conservation of agriculture and biodiversity;</p> <p>–To create better mechanisms to promote our work;</p> <p>–To continue to work with areas in conflict (even through NGO’s and local people).</p>	<p>–Money (cutting of funds, internally and externally);</p> <p>–Biodiversity has not been seen as integral for sustainability;</p> <p>–No corporate vision or strategy for this type of work;</p> <p>–The people taking the decisions are not addressing the user’s needs;</p> <p>– Stakeholders not being taken into account when defining strategic vision (including rural communities).</p>

<p>–Kew has global recognition and an international reputation;</p> <p>–Kew worked with others to provide the foundation for seed banking information (developing the standards from other work studies for seed conservation);</p> <p>–Capacity building (technical expertise and multi-level inter-disciplinary training);</p> <p>–Kew is non-commercial and has a rigorous approach to policy and compliance (leading to enhanced trust);</p> <p>–Kew is responsive to opportunities and problems.</p>	<p>–Kew’s vision not responsive to global needs;</p> <p>–Lack of understanding of the rest of the value chain;</p> <p>–There are few partnerships with social sector and development organisations (lack of a Kew social scientist);</p> <p>–Work focused on small scale drivers of landscape change (need to think about large scale drivers of change, e.g. miners, ranchers);</p> <p>–Lack of capacity to promote work and therefore to influence and inform policy for long term change;</p> <p>–Lack of good enough models for scaling up (Kew is used to work with small scale projects);</p> <p>–Work is not properly disseminated (lack of a scientific editor);</p> <p>–Lack of a participative approach to monitoring.</p>		
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