BID Africa 2017 – Small Grant Template
Final narrative report

Instructions

- Fill the template below with relevant information. **please indicate the reason of the delay and expected date of completion.**
- Use the information included in your project Full proposal (reproduced in annex III of your BID contract) as a baseline from which to complete this template
- The information provided below must correspond to the financial information that appears in the financial report
- Sources of verification are for example direct links to relevant digital documents, news/newsletters, brochures, copies of agreements with data holding institutions, workshop related documents, pictures, etc. **Please provide access to all mentioned sources of verification** by either providing direct link or sending a copy of the documents.
- This report must first be sent as a **Word document** to BID@GBIF.org and be pre-approved by GBIFS
- Once this report is pre-approved in writing by GBIFS, it must be signed by the BID project coordinator and sent by post to:

  The Global Biodiversity Information Facility Secretariat (GBIFS)

  Universitetsparken 15

  DK-2100 Copenhagen Ø

  Denmark

Template

1. Table of Contents

This programme is funded by the European Union

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2. Project Information

2.1. Project Coordinator: Institution/network/agency name:

World Vegetable Center

2.2. Main contact person and role:

Maarten van Zonneveld, genebank manager

2.3. BID proposal identifier:

BID-AF2017-0310-SMA

2.4. Project title:

Digitizing national vegetable databases to improve food and nutritional security in Eastern Africa

2.5. Start date and end date of the reporting period:

1 Nov 2017 - 31 Dec 2018

2.6. Country in which the activities take place:

Tanzania, Zambia, Burundi, Taiwan

3. Overview of results

3.1. Executive summary

Give a short summary of the activities implemented and the outcomes of the project for the reporting period (500 words maximum)

The project resulted in the publication of three datasets of vegetable germplasm with 4,078 data points from 14 countries in East and South Africa, including Zambia, Burundi and Tanzania. Two of the three datasets contain passport data of historic collections of vegetable germplasm for *ex situ* conservation in African genebanks. A third dataset contains information on seed kit distribution to re-introduce traditional vegetables to farmers for agricultural diversification and resilient seed and production systems. These three data sets together therefore represent interactions between genebanks and farmers through time. Genebanks safeguard agricultural biodiversity from farmer fields in case this germplasm gets lost over time because of urban migration or natural disasters. At the same time, genebanks

can distribute and re-introduce this agricultural biodiversity again to farmers to improve their food security.

The dataset of seed distribution of traditional vegetables represents the largest germplasm distribution from a genebank to farmers so far. The dataset has been described in a scientific article, which is in press in the journal Plant Genetic Resources – Characterization and Utilization, and will be published in the coming months. The results from this dataset have been presented in two workshops as an example of how genebanks can better collaborate with farmers to develop resilient seed systems: first, during the annual meeting of international genebanks organized by the Crop Trust from 2-8th of November 2018 in Fortaleza, Brazil, and second during the Asian Seed Congress on November 14th 2018

The three datasets will help to improve the understanding of the distribution of traditional vegetables in East Africa. In general, these vegetables are underrepresented in genebank collections and their *in situ* conservation status is unclear. Therefore, during this project, the distribution of 113 prioritized traditional vegetables has been mapped to prioritize areas for further germplasm collections in Africa. This was accomplished by comparing existing data from GBIF, the Genesys genebank database (https://www.genesys-pgr.org) and WIEWS genebank database (http://www.fao.org/wiews/en/).

The study revealed that the most important hotspots of traditional vegetables are found in Cameroon, southeast Ghana and south Togo. These areas show high levels of species richness after correction by resampling without replacement. Therefore, we suggest, in addition to efforts to conserve traditional vegetables in East Africa, which was the focus of this project, to emphasize conservation and characterization of traditional vegetables in West Africa. The results of the study are being prepared for submission to a scientific journal.

A capacity building workshop hosted by the World Vegetable Center on data preparation and publication strengthened the collaboration between genebanks in East Africa to share information and to publish on GBIF for a general public. It will be important to expand this vegetable network to West Africa.

Five of the six project partners are registered at GBIF, and the registration of a six partner is still in progress. This will encourage them to continue publishing data on GBIF. This project has stimulated continuous improvement of biodiversity data management to support agricultural diversification for sustainable production, food security and healthy diets.

3.2. Progress against expected milestones:

Give an overview of all the expected milestones for your project from the beginning until now (see Annex V of your contract)

Expected milestones/activities	Completed? Yes/No	Explanatory notes	Sources of verification
Completed capacity self-assessment questionnaire	Yes	The self-assessment questionnaire was completed and submitted on time, before	Self-assessment questionnaire has been sent to BID and an acknowledgement was received

for data holding institutions https://www.gbif.org/document/82785/self-assessment-guidelines-for-data-holding-institutions (EN) https://www.gbif.org/document/82813/modele-dauto-evaluation-pour-les-institutions-detentrices-de-donnees (FR) (***Early Progress report milestone***)		the deadline of 22 November 2017	(document is attached)
At least one national data publishing institutions are registered with GBIF.org Guidelines to become a publisher: https://www.gbif.org/become-a-publisher (***Early Progress report milestone***)	Yes	Five of the six project-partner organizations have been registered at GBIF.	www.gbif.org
At least one person from the project team has completed the certification process following the BID Capacity Enhancement workshop on Data Mobilization organized as a part of the BID programme Africa 2015 or the BID programme Africa 2017 (***Early Progress report milestone***)	Yes	Dr. Tsvetelina Stoilova attended the BID Capacity Enhancement workshop on Data Mobilization, a part of the BID programme Africa 2017. Mr. Lourance Mapundo attended the second BID capacity enhancement workshop. He is in the process of completing the certification process.	Use Case 2 was sent on 22 December 2017. Dr. Tsvetelina Stoilova has completed the practical exercises of Use Case 3 and sent the results to BID before the deadline of 31 January 2018.
Knowledge dissemination activities have been scheduled following the first BID Capacity Enhancement workshop (***Early Progress report milestone***)	Yes	The workshop for knowledge dissemination was conducted from 28 May to 1st June.	Workshop for mobilizing data was conducted in May 2018, according to the planned project activities and partner organization agreement.
At least one dataset has been published to GBIF.org	In the process	The vegetable data sets were planned to be published after the	As the Tanzanian node is still under reparation, we are looking

(***Midterm report milestone***)		workshop in May 2018.	for an alternative way to publish the dataset. GBIF assistance is needed for this.
The data users identified in the full proposal have documented their intended use of the mobilized data and provided early feedback (***Midterm report milestone***)	Yes	The digitized and published data of traditional vegetables will be used by researchers, students and all other users from ISABU-Burundi; NPGRC; NMAIST; HORTI - Tanzania; SPGRC-Lusaka, Zambia; World Vegetable Center; all users from sub-Saharan Africa.	Three datasets have been published online of which one dataset is included in a data paper.
All mobilized data have been published to GBIF.org **(Final report milestone)**	Yes	The datasets of ISABU-Burundi; SPGRC-Lusaka, Zambia; and World Vegetable Center have been published. The dataset of NPGRC is not yet published, and World Vegetable Center supports them to publish their dataset as soon as possible. NMAIST and HORTI – Tanzania did not have significant datasets of vegetable germplasm for publication.	GBIF.org database
All published data meet the minimum requirements outlined in the Data Quality Requirements available at https://bid.gbif.org/en/community/data-quality/ **(Final report milestone)**	Yes	Data of the published datasets is checked by the GBIF secretariat	GBIF.org database
The training outcomes of the project have been documented, including the number of people receiving certification through the BID Capacity Enhancement workshops, the number of people trained in nationally organized events, and the evaluation of the impacts of these training activities	Yes	The training outcomes of the project have been documented	Report of the capacity building workshop has been developed

(Final report milestone)			
Final capacity self-assessments for national biodiversity information facilities have been completed with sustainability plans. https://www.gbif.org/document/82785/self-assessment-guidelines-for-data-holding-institutions (EN) https://www.gbif.org/document/82813/modele-dauto-evaluation-pour-les-institutions-detentrices-de-donnees (FR) **(Final report milestone)**	Yes	Capacity self-assessments have been filled in by all institutions, which published datasets	Self-assessments have been sent to nodes@gbif.org
All uses of the mobilized data have been documented **(Final report milestone)**	Yes	The dataset of distribution of traditional vegetables has been used in presentations of the annual genebank meeting and the Asian Seed Congress 2018. This presentation was presented as a source of verification because it refers to the seed kit distribution, for which the dataset was published as a data paper. The dataset of this paper has been published on GBIF https://www.gbif.org/dataset/b5d15a8b-0500-4d8b-b156-9da14da494cc. The seed kit example was given during the congress on how to promote germplasm exchange of traditional vegetables for sustainable use of germplasm of traditional vegetables. This presentation was part of an international workshop on access and benefit-sharing, which was	http://www.mediafire.com/file/t1p1s0yefy0s190/ITPGRFA_4_Maarten_van_Zonneveld.pdf/file

		part of the Asian Seed Congress.	
Best practices and lessons learned have been documented **(Final report milestone)**	Yes	A first lesson is that communication between data providers and GBIF nodes is crucial for data uploading. Therefore, 5 basic steps have been defined for data uploading has been developed (Annex 1). For this project, the key GBIF node was TANBIFF. Therefore, the representatives of the GBIF node were invited to the capacity-building workshop on the 28 May to 1 June 2018 unfortunately, representatives of TANBIFF were not able to participate and no effective communication was established. As an alternative for uploading data, the Taiwanese GBIF node was contacted, which kindly supported in uploading the data to GBIF. The communication with TANBIFF has been re-taken and TANBIFF has supported with the registration of NPGRC on GBIF. A second lesson is that learning to upload data to GBIF requires more than one capacity training. This was underestimated in the project. Two persons were trained in South Africa to disseminate the information to the other participants in a capacity-building workshop. After the project ending, for the NPGRC, an extra one-morning second training session was organized on March 13th to upload their data to GBIF. The data was prepared and now follows the DarwinCore Standards. The next step is to upload this data online with	Five key points to upload data to GBIF (Annex 1). Endresen DTF, Gaiji S, Robertson T (2009) DarwinCore germplasm extension and deployment in the GBIF infrastructure. Proceedings of TDWG (2009), Montpellier, France. Biodiversity Information Standards (TDWG), 67, 78.

		support of TANBIFF. This lesson is not documented but a crucial lesson A third and final lesson learned is that many variables relevant for genebank management and in situ conservation of agricultural biodiversity are not represented in the GBIF DarwinCore. It starts with the meaning of catalogue number. Is this the accession code or the collector code? Probably it is the accession code. There are many more questions with other fields from germplasm collections. My recommendation would be to implement the DarwinCore germplasm extension into GBIF to upload agricultural biodiversity data. Endresen et al. (2009) have documented these recommendations.	

3.3. Project deliverables and activities

Refer to the table in section 2.2 "Deliverables, activities and reporting criteria" of your BID full proposal. Provide updates on the status of each of planned deliverables. In the event of unexpected delay, please provide detailed explanatory notes and indicate planned completion date. Add as many rows as needed.

Deliverable	Related activity	Completed? Yes/No	Explanatory notes	Sources of verification
Digitize germplasm information; produce datasets with high-quality metadata of vegetable collections from Burundi, Tanzania and Zambia; and make these datasets available online in a database	Make available digitized germplasm databases on traditional vegetable species from Burundi, Tanzania and Zambia in high-quality format	Yes	The project partners were asked to digitize germplasm information and produce datasets with high quality metadata of vegetable collections from Burundi, Tanzania and Zambia after completing the capacity-building	Every participant provided feedback from the capacity-building workshop planned for the end of May and provided information on

			workshop.	status of his data.
Publish one article in a peer-reviewed journal; make data freely available online through the GBIF.org portal.	Organize database in standardized format to be published on the GBIF.org website and in one article	Yes. Paper is in press	The data needed to be published on the gbif.org portal through a Tanzanian or a node in another country. The paper will be published at the end of the project (December 2018).	Germplasm databases will be published in a scientific article after publishing the data on the gbif.org portal.
Build capacity for database management through a training workshop covering theoretical and practical knowledge and skills.	Training workshop will be conducted with partners from Burundi, Tanzania and Zambia. This training workshop will cover both theoretical topics on data digitizing, cleaning, editing and publishing, and a practical session (demonstrations and practical exercises.	Completed	A training workshop has to be completed after the two capacity enhancement workshops organized by BID.	Was conducted from 28 May to 1st June 2018, according to the project work plan and the partner organization agreement. Annex 2 provides the report of the capacity building workshop has been attached in annex 2
Create a network for vegetable information management among data holders and researchers from different African organizations in sub-Saharan Africa.	Document and share workshop with theoretical and practical knowledge	Yes	The network among data holders from different countries and organizations in Sub-Saharan Africa were established during the project duration.	Participants from different organizations are in communication to continue to collaborate on germplasm conservation, exploration, collection, and distribution. Annex 3 provides a correspondence between Maarten van Zonneveld of WorldVeg and William Chrispo Hamisy of

				NPGRC about the next steps in collaboration.
Integrate biodiversity information into a policy- and decision-making process by inviting policy and decision makers to the workshop.	Integrated training workshop with different stakeholders.	Yes	Government representative Innocent Ritte from the Meru District Council participated in the capacity-building workshop and is part of the discussion on policy and decision making to improve production and consumption of traditional vegetables.	Participants met and discussed on biodiversity information and related topics with different stakeholders during the workshop.
Identify various threats for conservation diversity of traditional vegetable species.	Identification of various threats for traditional vegetable species	Yes	Crubbens and Denton (2004) have been followed as a reference to identify threats of traditional vegetables. A few traditional African vegetables are threatened at species level, especially tree vegetables such as baobab (*Adansonia digitata*) and *Gnetum africanum*, and some wild vegetables such as *Crassocephalum rubens* (Crubbens and Denton 2004). For other vegetables, local landraces are under threat because of 1) loss of indigenous knowledge; 2) Loss of food habitats; and 3) Introduction of new vegetables (Keller et al. 2005). The role of women is key to enhance the use of traditional vegetables (Wooten et al. 2005; Padulosi et al.	Crubbens G, Denton O (2004) Plant Resources of Tropical Africa. 2 Vegetables, PROTA foundation, Wageningen, Netherlands. Keller, GB, Mndiga H, Maass BL (2005) Diversity and genetic erosion of traditional vegetables in Tanzania from the farmer's point of view. Plant Genetic Resources: 400-413. Wooten S (2003) Losing ground: Gender relations, commercial horticulture, and

			2011). Africa may still be rich in vegetable landraces because of the low introduction of improved varieties. It is therefore one of the last continents to collect germplasm of vegetable landraces.	threats to local plant diversity in rural Mali." Women and plants, gender relations in biodiversity management and conservation. pp 229-242. Padulosi S, Heywood V, Hunter D, Jarvis A (2011) Underutilized species and climate change: current status and outlook. In: Yadav SS, Redden RJ, Hatfield JL, Lotze-Campen H, Hall A (eds) Crop adaptation to Climate Change, 1st edn. Wiley-Blackwell, Oxford, UK, pp 507–521

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3.4. Datasets published on GBIF.org

Refer to the table in section 2.4 "Biodiversity data mobilization plan" of your BID full proposal. If the dataset is not yet published, please indicate the name of the institution that is expected to host the data when published in the column "DOI or URL/Planned hosting institution". Add as many rows as needed.

Dataset title	Publishing institution	DOI or URL/Planned hosting institution	Date/expected date of publication	Explanatory notes
Worldveg seedkit distribution of traditional vegetables in East Africa	WorldVeg	https://www.gbif.org/dataset/b5d15a8b-0500-4d8b-b156-9da14da494cc	28th of January 2019	This dataset includes information for **over 183,000 records** of seed samples. The dataset has been condensed with the use of the field "organismQuantity" to 421 lines. Each line stands for a larger number of records of seed samples that farmers used to establish home gardens to increase the diversity in their farming systems.
Vegetable germplasm passport data of the genebank collection of the Agricultural Research Institute of Burundi	ISABU	https://www.gbif.org/dataset/d83793f0-b48b-4842-b584-8ad65d73daf3	28th of January 2019	This dataset of **1,148 records** is larger than the initially 707 records that were planned for uploading
Vegetable germplasm passport data of the SADC	SADC	https://www.gbif.org/publisher/7153690e-8766-4546-97cb-b032463418c9	28th of January 2019	This dataset of **13,143 records** is larger than the initially 739

Plant Genetic Resource Centre				records that were planned for uploading.
	NPGRC		April 2019	NPGRC has prepared the dataset of **996 records** for uploading. NPGRC still needs to get an IPT account to upload the data. This dataset has been smaller than the 56,100 NPGRC records estimated in the proposal because by mistake in the initial estimation, also cereals were included in the number of genebank records estimated.

3.5. Examples of use of biodiversity data available through GBIF

Data mobilised through the BID programme, ultimately, should guide natural resource conservation and management policy. We require you to report on how you have integrated these data into these policy-making processes. You may want to refer to the section 2.5 "Plan to support the integration of biodiversity information into policy and decision-making process" of your original proposal as a reminder of your original commitments.

As part of that process, we request you to provide us with a summary of how you have used these data within the decision-making process and we have included some guiding questions below to help with that process. Please note that if your dataset has been combined with other datasets in analyses that guide the decision-making process, then this should be recorded too.

Linking genebanks to farmers for resilient seed systems

Recently, there has been a lot of discussion about resilient seed systems in Africa and the role of genebanks in contributing to these seed systems (Westengen et al. 2018). In

response to this discussion, a compiled dataset of seed packs of traditional vegetables distributed by WorldVeg and partners has been published in GBIF (Figure 1). The dataset of seed distribution of traditional vegetables represents the largest germplasm distribution from a genebank to farmers so far. The results of the seed kit distribution were presented during the Annual Genebank Meeting of international genebanks, which was held on November 2-8 2018 in Fortaleza, and during the Asian Seed Congress, November 14th 2018. The dataset is presented to the international community of plant genetic resources scientists in a scientific article, which is in press for publication (Stoilova et al. 2019). This article will contribute to the discussion on how genebanks can help promoting the use of traditional vegetables by farmers in African countries, and how this strengthens local seed systems in Africa.

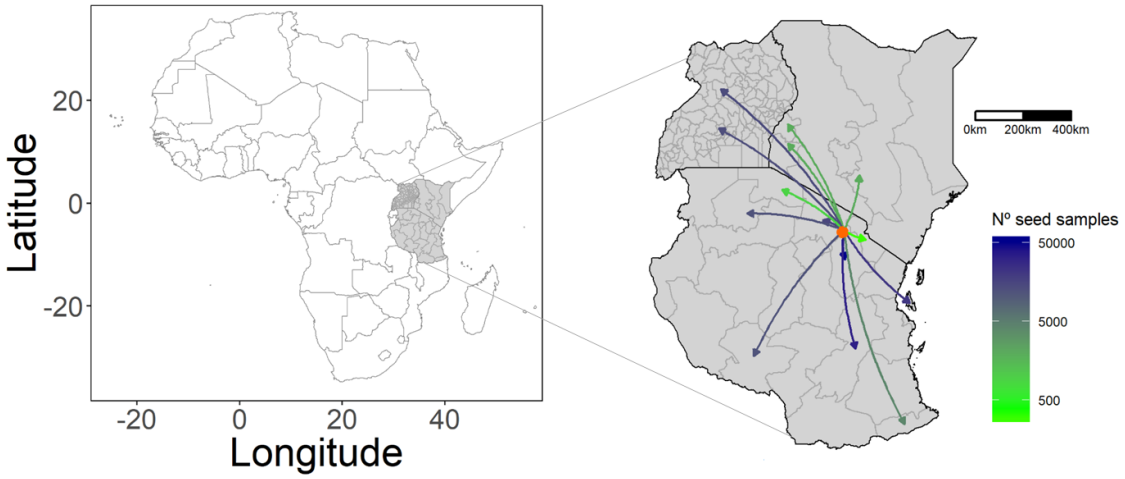

Figure 1. Distribution of seed samples in vegetable seed kits in Tanzania, Kenya, and Uganda.

The case generated a lot of discussion among genebank managers on how to enhance the utilization of germplasm maintained by genebanks to make seed systems more resilient and to promote agricultural diversification. One of the discussions has been on what type of material transfer agreement is required to transfer germplasm from the genebank to farmers in such a way that this complies with current seed policies in the countries where germplasm is distributed. For this, WorldVeg has now prepared a Material Transfer Agreement for direct use only for small-scale farmers.

Hotspots of vegetable diversity

In addition, an analysis of species richness of traditional African vegetables was carried out across Africa using occurrence data from herbaria, which are shared through GBIF, and with passport data from genebanks, which are shared through FAO WIEWS and are published in GBIF. For this analysis, 113 traditional African vegetables with two or more out of four key references were prioritized from the 378 listed species (Annex 4; African Orphan Crop Consortium 2018; Crubbens & Denton 2004; Dinssa et al. 2016; Guarino 1997). After data

cleaning following van Zonneveld et al. (2018), 84,533 records from GBF and 3,140 records from WIEWS were included in the analysis.

Geographic patterns of vegetable species richness defined by circular neighborhood analysis (Figure 2) as described previously for the estimation of allelic richness (Thomas et al. 2012; van Zonneveld et al. 2012). A cell resolution of 30 arc min-grid (54 km at the equator) and a circular neighbourhood of 3 degrees diameter was chosen for the continent-wide study. The circular neighbourhood procedure generated a dataset with 1,333,984 presence records. To reduce sampling bias, correcting by resampling without replacement was carried out with 100 bootstrapped subsampling. A threshold of 50 presence records per cell, was used for resampling. All cells with less than 50 presence records were removed leaving large sampling gaps in Namibia, Angola, Congo, South Sudan, Sudan, Somalia and North Africa.

According to the four references, the most important traditional African vegetables were: Spider plant (*Cleome gynandra*); Jute mallow (*Corchorus olitorius*); Ethiopian mustard (*Brassica carinata*); African eggplant (*Solanum aethiopicum*); Roselle (*Hibiscus sabdariffa*); Amaranth (*Amaranthus cruentus*).

Most important hotspots of traditional vegetables were in Cameroon, southeast Ghana and south Togo, because these areas showed high levels of species richness with and without correction. What still needs to be done is climate modelling with the Ensemble modelling package in R Statistical Software to look for possible hotspots of vegetable diversity in areas with poor sampling coverages such as in Congo and South Sudan.

The analysis will be used to target areas for germplasm collection missions with national partners to rescue traditional vegetables and corresponding traditional knowledge before they extirpate because of urban migration and land use change.

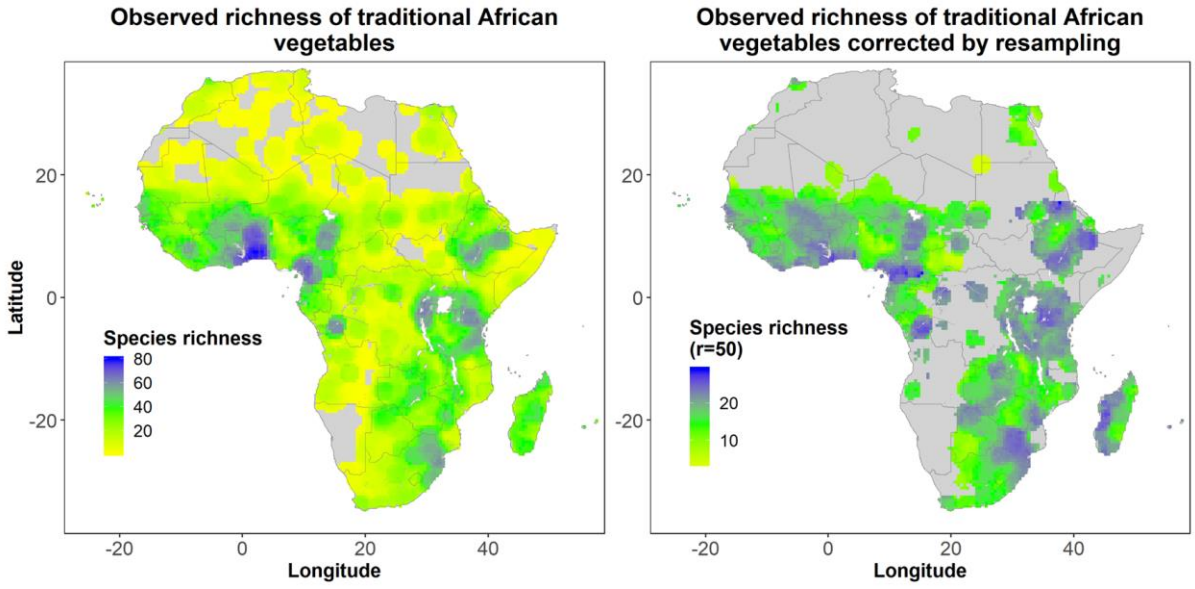

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Figure 2. Maps of sampled species richness of 113 traditional vegetables with and without correcting by resampling without replacement with a minimum number of 50 presence records per cell.

Future perspectives

Genebanks publish both on GBIF and Genesys. It is recommended to better align data requirements of both data repositories. An attempt to coordinate data requirements has been made 10 years ago by integrating germplasm terminology in GBIF, which resulted in the DarwinCore germplasm extension (Endresen et al. 2009). I think there is a lot of potential for GBIF to become involved in *in situ* conservation monitoring of plant genetic resources and in this way complement *ex situ* conservation monitoring by FAO and the Crop Trust.

References

African Orphan Crop Consortium (2018) http://africanorphancrops.org/meet-the-crops/

Crubbens, GTH, Denton OA (2004) Plant Resources of Tropical Africa. 2 Vegetables, PROTA foundation, Wageningen, Netherlands.

Dinssa FF, Hanson P, Dubois T, Tenkouano A, Stoilova T, Hughes J, Keatinge JDH (2016). AVRDC—The World Vegetable Center's women-oriented improvement and development strategy for traditional African vegetables in sub-Saharan Africa. European Journal of. Horticultural Science 81: 91-105.

Endresen, D. T. F., Gaiji, S., & Robertson, T. (2009). DarwinCore germplasm extension and deployment in the GBIF infrastructure. Proceedings of TDWG (2009), Montpellier, France. Biodiversity Information Standards (TDWG), 67, 78.

Guarino L (1997) Proceedings of the IPGRI International Workshop on Genetic Resources of Traditional Vegetables in Africa. IPGRI, Rome Italy.

Stoiova T, van Zonneveld M, Roothaert R, Schreinemachers P. (2019) Connecting genebanks to farmers in East Africa through the distribution of vegetable seed kits. Plant Genetic Resources. doi:10.1017/S1479262119000017 *In press*.

Thomas E, van Zonneveld M, Loo J, Hodgkin T, Galluzzi G, van Etten J (2012) Present-day spatial diversity patterns of *Theobroma cacao* L. in Tropical America reflect a combination of long-standing human influences superimposed on genetic differentiation in Pleistocene refuges. PLoS ONE 7: e47676.

van Zonneveld M, Scheldeman X, Escribano P, Viruel MA, Van Damme P, Garcia W, Tapia C, Romero J, Sigueñas M, Hormaza JI (2012) Mapping genetic diversity of cherimoya

(*Annona cherimola* Mill.): application of spatial analysis for conservation and use of plant genetic resources. PLoS ONE 7: e29845.

van Zonneveld M, Thomas E, Castañeda-Álvarez NP, Van Damme V, Alcazar C, Loo J, Scheldeman X. (2018) Tree genetic resources under threat in South America: a spatial assessment to prioritize populations for conservation. Diversity and Distributions. doi: 10.1111/ddi.12724.

Westengen OT, Skarbø K, Mulesa TH, Berg T (2018) Access to genes: linkages between genebanks and farmers' seed systems. Food Security 10:9–25. doi: 10.1007/s12571-017-0751-6

Description

Has your project been successful in integrating data within the policy-making process?

Response: The data from the seed kit dataset has been used to show how amaranth varieties have been widely adopted by farmers for production in Tanzania and Kenya (Ochieng et al. 2019):

This comes from Ochieng et al. (2019):

"In Kenya, WorldVeg and JKUAT collaborated to develop advanced amaranth lines of leaf, grain- and dual type that were evaluated and distributed to public institutions and private seed companies for further improvement or direct release. The variety 'Madiira 1′ (also known as 'Ex-Zim' in Tanzania and 'KK Mrambi' in Kenya) and 'Madiira 2′ (also known as 'AM38′ in Tanzania and 'KK Livokoyi' in Kenya), were particularly promising. These varieties have not been officially released, but have been widely adopted by farmers as a result of seed kit distribution projects by WorldVeg and various other organizations. For instance, van Stoilova et al. (2019) reported that WorldVeg distributed 31,989 packages of amaranth seed to farmers in Tanzania from 2013–2018."

Where did the demand for these data come from?

Response: There has been a lot of discussion about resilient seed systems in Africa and the role of genebanks in contributing to these seed systems by distributing seeds to farmers (Westengen et al. 2018).

If yes, which policies have been developed using your data?

Response: After discussion of the dataset during the annual meeting of international genebanks, the conclusion was that no suitable material transfer agreement exists to distribute germplasm from genebanks directly to farmers. Normally breeders or researchers request germplasm, not farmers. As a result, WorldVeg is developing an improved material transfer agreement to distribute directly germplasm to farmers (Annex 5).

If no, what were some of the challenges you faced in getting your data into those processes?

Response: WorldVeg has started with the policies for germplasm distribution at the WorldVeg genebank.

Did you have a biodiversity data integration plan from the beginning of your project? If so, did you have to adapt your plan as the project progressed and why did you have to make those alterations?

Response: This was not part of the integration plan at the beginning of the project and came after discussions between the old and new project coordinator, respectively Tsvetelina Stoilova and Maarten van Zonneveld.

In what format are your data being used i.e. what were the analyses, if any, that you needed to perform on the data to ensure that they was in a format accessible to policy-makers?

Response: There has been no communication with national policy makers because this is part of discussions on international germplasm exchange.

What level of communication has there been with the relevant policy stakeholders i.e. by which means? With what regularity? And, how critical have these interactions been for the development policy-relevant analyses?

Response: There has been no communication with national policy makers because this is part of discussions on international germplasm exchange

What additional support (resources, tools, network, training) would be needed for your project to ensure the flow of information from mobilisation to decision-making?

Response: Workshops should be organized with policy makers, farmer organizations and other relevant stakeholders for both seed kit distribution to farmers as well as the prioritization of geographic areas for conservation actions for traditional vegetables.

How would you improve on your own processes in the future to improve data integration in the future?

Response: The best way is to publish as soon as possible data on GBIF so that the data can be used for analysis and presented to policy makers.

Data may serve other purposes other than for policy-making and these are as valuable. How was your data used for other purposes e.g. development of training materials, scientific publications, communication activities etc?

Response: The dataset is part of a publication, which is in press in the scientific journal Plant Genetic Resources (Stoilova et al. 2019).

References

Ochieng J, Schreinemachers P, Ogada M, Dinssa FF, Barnos W, Mndiga H (2019) Adoption of improved amaranth varieties and good agricultural practices in East Africa. Land Use Policy 83: 187-194.

Stoilova T, van Zonneveld M, Roothaert R, Schreinemachers P. (2019) Connecting genebanks to farmers in East Africa through the distribution of vegetable seed kits. Plant Genetic Resources. *In press*.

Westengen OT, Skarbø K, Mulesa TH, Berg T (2018) Access to genes: linkages between genebanks and farmers' seed systems. Food Security 10:9–25 . doi: 10.1007/s12571-017-0751-6

Supporting materials

As part of our reporting, we request you to provide us with a copy of any materials highlighting data use on your dataset, either on its own or in combination with other datasets. This could be in the form of:

- Reports – governmental, ministerial, non-governmental organisations, international policy-making bodies
- Policy briefs
- Scientific publications
- Outputs from analyses that will be used in the future e.g. species distributions maps and other spatial analyses
- Education/communication materials

Please provide a valid dataset to the doi. Where the doi is not known, please state why.

Name of resource	Type of resource i.e. report, policy brief, scientific publication, analysis output, education materials, communication materials, other (please specify)	Dataset doi	Link to document or publication citation
Stoilova T, van Zonneveld M, Roothaert	ISI-indexed scientific publication	doi:10.1017/S14792621190	https://doi.org/10.1017/S1479262119000017

R, Schreinemachers P. (2019) Connecting genebanks to farmers in East Africa through the distribution of vegetable seed kits. Plant Genetic Resources		00017	
van Zonneveld M. Global exchange of vegetable genetic resources. International Treaty on Plant Genetic Resources for Food & Agriculture (ITPGRFA) Workshop. Asian Seed Congress 2018. November 14th 2018	Presentation in international policy workshop		http://www.mediafire.com/file/t1p1s0yefy0s190/ITPGRFA_4_Maarten_van_Zonneveld.pdf/file
Geographic patterns of species richness of traditional African vegetables	Outputs from analyses that will be used in the future e.g. species distributions maps and other spatial analyses		Maps are being prepared for scientific publication

3.6. Events organized as part of the project

List all the events that have been organized as part of your project. Please provide links to any documents or webpages documenting the use in the "Sources of verification" column. Add as many rows as needed.

Full title	Organizing institution	Dates	Number of participants	Sources of verification
Capacity building workshop	World Vegetable Center	28 May to 1 June 2018	12	https://avrdc.org/germplasm-curators-dig-into-data/

4. Updated calendar for the BID project implementation and evaluation period

The calendar should be completed in the same way as in the Full Project Proposal, but should include any expected changes. Provide reasons for any expected changes in section 4.1 'Explanatory Notes'.

Implementation period start date and end date (01/04/18 -31/12/18)																
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**Notes**
BID capacity enhancement workshop – data mobilization and publication (online training - participation is mandatory)																The Workshop was conducted in December 2017.
BID capacity enhancement workshop – data use (online training - participation is mandatory)				x												Second workshop was conducted in April 2018.
Workshop on capacity building - digitizing of national vegetable databases					x											The Workshop is going on from 28 May to 1st June 2018.
Digitize germplasm information; produce datasets with high-quality metadata of vegetable collections from Burundi, Tanzania and Zambia; make these datasets available online in a database						x	x	x								Digitized information from Burundi, Tanzania and Zambia prepared for online publishing on gbif.org portal (June-August 2018).
Document biodiversity database management knowledge in training materials and handouts; share with research organization from sub-Saharan African countries							x	x								Documenting knowledge on biodiversity data management (July-August 2018).

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Early progress narrative report	x														Early progress narrative report, 31 January 2018.
Final financial and narrative reporting									x			x			Final financial and narrative reports (October 2018).
One article submitted and published in peer-reviewed journal												x			One article is in press (December 2018).

4.1. Explanatory notes:

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5. Sustainability plans

Explain the approach that will be taken to ensure the sustainability of the project's results after the end of your project (500 words maximum)

World Vegetable Center will develop further actions to safeguard and use traditional vegetable in Africa. The map of hotspots of traditional vegetables will help to target areas for germplasm collection. WorldVeg will contact national partners in these countries to discuss how to safeguard this diversity.

The publication of the seedkit dataset will provide visibility for the distribution of seed kits. This dataset will increase in the coming years as projects will demand seed kits to distribute traditional vegetables to farmers.

6. Beneficiaries/affiliated entities and other cooperation

6.1. Relationship with project partners

Please describe the relationship between your project coordinating team/institution and your project partners, and with any other organisations involved in implementing your BID project.

The project has strengthened the relationships between the genebanks of WorldVeg, ASUBI, NPGRC, and SADC. After the project coordinator, Tsvetelina Stoilova left, Maarten van Zonneveld became the new coordinator. The fact that Maarten operated from Taiwan and had to learn how to publish data through the IPT after he took over, led to delay in the project implementation.

There has been good communication with the GBIF secretariat and with the GBIF node in Taiwan. Unfortunately, representatives of the GBIF node in Tanzania did not participate in the capacity building workshop in Arusha, Tanzania in the last week of May 2018, even though they were kindly invited. This has made it difficult to publish data through the Tanzanian node. It would be good to strengthen collaboration between the Tanzanian GBIF node node and the Tanzanian institutes, which participated in this project.

6.2. Links to other projects and actions

Where applicable, outline any links and synergies you have developed with other actions, e.g. GBIF nodes, other BID funded projects, etc. If your organization has received previous grants in view of strengthening the same target group, to what extent has your BID project been able to build upon/complement the previous project(s) ?

This project has linked directly to WorldVeg's activities to target conservation actions for traditional vegetables in Africa. GBIF data has been used to identify hotspots of traditional vegetables to target germplasm collections with national partners from African countries.

7. Visibility

Please refer to the BID guidelines.

7.1. Visibility of the BID project and European Union

How is the visibility of your BID project being ensured?

Short summary

The European Union, BID, and GBIF are acknowledged in the metadata of the published datasets and during the capacity building workshop following the BID guidelines. The European Union, BID, and GBIF will also be acknowledged following BID guidelines in the scientific article, which is in press. A Newsletter article has been published in the Fresh Newsletter of Worldveg about the capacity building workshop https://avrdc.org/germplasm-curators-dig-into-data/

Sources of verification

World Vegetable Center (2018) Germplasm curators dig into data

https://avrdc.org/germplasm-curators-dig-into-data/

The datasets, which were published:

https://www.gbif.org/dataset/b5d15a8b-0500-4d8b-b156-9da14da494cc
https://www.gbif.org/dataset/d83793f0-b48b-4842-b584-8ad65d73daf3
https://www.gbif.org/publisher/7153690e-8766-4546-97cb-b032463418c9

Signature _____

Name of the contact person for the BID Project:

_____

Date report sent by email in Word format to bid@gbif.org for pre-approval:

_____

Date report sent by post to GBIF Secretariat: _____

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Annex 1

Five steps to upload your data to GBIF

Step 1. Contact BID@gbif.org for contact data of nearest GBIF node for data uploading.

Step 2. Contact GBIF node to check if your organization is registered at GBIF. If not, please ask the GBIF node to register your organization.

Step 3. Contact GBIF node to apply for IPT account and ask for IPT Website to upload data to GBIF.

Step 4. Clean passport data and organize following the DarwinCore Standard https://www.gbif.org/darwin-core.

Step 5. Use login and password to enter the IPT account to upload data on the IPT Website.

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Annex 2

Capacity building towards digitization of national vegetable databases to address regional and national priorities in food and nutritional security in Eastern Africa.

Programme for BID-AF2017-0310-SMA project 28 May - 1st June 2018

Tsvetelina Stoilova, Maarten van Zonneveld

National genebanks in East and Southern Africa conserve various food plants, but lack online databases documenting their collections. Access to seed, passport and characterization data is essential for effective germplasm conservation, and for the use of vegetable diversity for variety development. Geographical information of the location of the accessions is crucial to guide collecting missions and select germplasm based on agro-climatic adaptation. Germplasm databases group accessions according to taxonomy, and geographic and thematic data information, and must be updated once additional data on the entries become available. To establish and maintain national germplasm databases, curators need to have database management skills. The main objective of the project is to train germplasm curators from Burundi, Tanzania and Zambia on digitizing information for national germplasm databases with a focus on indigenous vegetables to improve data availability and sharing.

The biodiversity information project aims to increase availability of national biodiversity data through GBIF.org.

Through the project implementation five - days training workshop on main principles of data management: data digitizing, cleaning, editing and publishing was conducted at World Vegetable Center, Eastern and Southern Africa based in Arusha, Tanzania from 28 May to 1 June.

Project activities completed:

Data mobilization workshop

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Day	Activity	Responsibility	Time
Monday Morning May 28th	**Registration**		8.30
	Welcome address from Regional Director		9.00
	INTRODUCTION	Trainers	
	Presentations from the participants		
	WorldVeg presentation on the project activities and achievements	Tsvetelina	
Monday Afternoon May 28th	**DATA mobilization and standardizing**	Tsvetelina	
	Presentations, Data mobilization and digitization		
	Open Refine		
	Exercises, Use case 1		
Tuesday morning May 29th	**DATA FORMATTING**		8.30
	Decision making – traditional vegetables, cultivation and consumption. Presentation and followed by discussion	Innocent Ritte	8.30
	Introducing to Darwin Core - presentation	Tsvetelina	10.30
Tuesday afternoon May 29th	Exercises using Use Case 1 HS, excel sheet	Trainers	
	Presenting results	Trainers	
Wednesday morning May 30th	**GIS INTRODUCTION**	Maarten	8.30
	Presentation Maarten		
	Exercises GIS manual		
Wednesday afternoon May 30th	**DATA QUALITY AND CLEANING**	Maarten	
	Presentation Maarten		
	Exercises on GIS programme and presenting their results	Trainers	
Thursday morning May 31st	**PUBLISHING**	**Tsvetelina**	8.30
	Presentation on using IPT to publish	Trainers	
	Exercises on publishing data using test mode of IPT	Trainers	
Thursday afternoon May 31st	**GIS AND IUCN CONSERVATION STATUS**	Maarten/ Lourance	
	Presentation Maarten/ Lourance		
	Exercises GIS manual		
Friday morning June 1st	**PREPARATION OWN ANALYSIS**		8.30
Friday morning- after tea	Presentations from the participants	**Trainers**	
	Presentations on publishing from each of the participant using their own data		
	Feedback discussion		
Friday afternoon	**Visit to NPGRC and ECHO East Africa**		14.00

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Group Photo, BID workshop 28 May – 1st June, 2018

The workshop was held in Arusha, Tanzania at World Vegetable Center, Eastern and Southern Africa. We received total of 16 participants from seven organizations (Table 1). One of the participant was representing local government and he presented the status of crop cultivation at the district level and new trends for increasing traditional vegetables growing to improve food security of the populations.

Maarten van Zonneveld provided information on digitization and cleaning data section and georeferencing and presenting data in GIS. The participants were attracted by the mapping section using DIVA GIS programme. Some of the participants were able to generate a map for crop distribution using their data. The other topics of the curriculum like, data mobilization and digitization, introduction to Open Refine and Darwin Core and Basic concept of publishing data were facilitated by Tsvetelina Stoilova.
Most of the participants heard for the first time about GBIF and got information on publishing and using data from the gbif.org website.

The first day three of the participants, Dr. Kapange (SPGRC), Dr. Bigirimana (ISABU) and Dr. Hamisy (NPGRC) presented their genebank activities and databases. Ms. Sophia Kasubi from ECHO East Africa attended this workshop as they maintain data and collection of local plants and play significant role for seed distribution to the farmers.

The presentations given on **Day 1** were **on main objectives of our project**, **basic principles of publishing data and data mobilization** (Presentations 1, 2 attached). The participants received information about GBIF and importance of publishing biodiversity data. The explanations were given on different datasets, occurrence, checklist and sampling event. It was very well explained why the data have to be

published and become publicly available for use from different researchers and Institutions. The availability of data will allow to do a more accurate assessment of species distribution and threats of biodiversity.
The next presentations was focused on data **digitization and planning**. The digitization helps to preserve our data. Digitized format is better for use and increase visibility of the Institutions/ organizations holding the data. The information explained the importance of each step: planning for mobilization, clustering the components and make a good project plan. For all activities we have to select the right stakeholder's - resources and to use them to achieve our goal. The equipment which will need for project implementation has to be bought before project start, and train people how to use it. Good planning includes timeframe for the project activities, in which phase of the project life they need to be done: before, during or after the project implementation.
The same day the session for **Open Refine** programme was introduce to the participants. The programme was installed to each computer and participants were trained how to use it and supervised during the exercises. For this purpose we used the BID CE Workshop, Session 10. Hard and soft copies were shared with each participant.

Day 2 started with presentation of Mr. Innocent Ritte, from Meru District Council. He gave information on crops cultivation at district level and role of traditional vegetables for food security of the populations. Mr. Ritte explained that the Government still does not focus on traditional vegetables as complimentary nutrient food. The main constraint is seeds, which are not available in the market and it is difficult to find them at the right time before rainy season. He explained that the government still does not have policy for the traditional crops, but farmers are interested to grow them as the market demand is increasing during the last decade. It is necessary to continue working on awareness creation on traditional vegetables and importance for consumption and as a source for income. The farmers have to be aware about the importance of conserving local plants and their seeds to ensure any problem can be solved in the future.
The next session was on introduction to **Darwin Core Standard**. The participants understood why it is important to use the standards instead everyone use different sheets and way of recording. Biodiversity information standards (TWDG) realized in the 80s the need for taxonomic information to have standards that are similar worldwide.
Using Darwin Core Standard, the data can be easily published. Darwin Core Standard provides standardized descriptors for sharing biodiversity data. It plays a fundamental role in the sharing, use and reuse of open-access biodiversity data. The Darwin Core Standard is the most common standard used.
The participants were able to do exercises on the Excel spreadsheet which was distributed to them. They were asked to fill with their own data. At the end of this session every participant had an opportunity to present his exercised work and discussed the terms which was not enough clear to them. All participants took part of the discussion. Many participants were concerned about the missing information in their data.

Day 3 consisted a one-day GIS training including data import, data cleaning, connecting climate data to passport data, georeferencing, and the development of species richness maps. The program DIVA-GIS was installed on each of the computer and participants received a manual as well. DIVA-GIS offers several analysis to show geographic patterns of diversity of crops. The sources of the geographical coordinates were also given to the participants. Some of them were able to generate map on some crop distribution using their data.

The participants in the afternoon were involved in exercises to learn how to use the program and to make species richness maps.

On **Day 4** the participants learned how to publish data on GBIF using the Integrated Publishing Toolkit (IPT). For the purpose of exercising IPT test mode was used. All the participants had to organize their own data and try to publish them.

Day 5 was the last day in which every participant presented his/her results and published their data in the IPT test mode. Almost all the participants had successfully published their data and we agreed on their real publishing process to start immediately after the workshop.

Last 15 minutes were given to the participants to share their opinion for the workshop. According to their feedback the most interesting part was GIS program and presenting data for crop diversity using this program. All participants appreciated the course on data mobilization which will improve their knowledge for collecting and publishing data. Some of them shared their impression of this information about data which they did not consider so important before this workshop. The information enabled them to share and make visible their data. Network building was also mentioned as part of the workshop.

In the afternoon the participants visited the National Plant Genetic Resources Centre (NPGRC) and ECHO East Africa.
A story from the workshop was published on WorldVeg website, with link:
https://avrdc.org/germplasm-curators-dig-into-data/

Annex 4

Importance from high (4) to low (1)	Species	AOCC 2018[1]	PROTA 2004[2]	Dinnsa et al. 2016[3]	Guarino et al. 1997[4]
4	*Cleome gynandra*	1	1	1	9
54	*Corchorus olitorius*	1	1	1	6
64	*Brassica carinata*	1	1	1	4
74	*Solanum aethiopicum*	1	1	1	4
84	*Hibiscus sabdariffa*	1	1	1	3
4	*Amaranthus cruentus*	1	1	1	2
3	*Abelmoschus esculentus*		1	1	6
3	*Cucurbita maxima*	1	1		5
3	*Bidens pilosa*		1	1	4
3	*Citrullus lanatus*	1	1		3
3	*Solanum macrocarpon*		1	1	3
3	*Amaranthus dubius*		1	1	2
3	*Basella alba*	1	1		2
3	*Celosia argentea*	1	1		2
3	*Telfairia occidentalis*	1	1		2
3	*Abelmoschus manihot*	1	1		1
3	*Allium cepa*	1	1		1
3	*Crotalaria ochroleuca*	1	1		1
3	*Gnetum africanum*	1	1		1
3	*Lablab purpureus*	1	1		1
3	*Momordica charantia*	1	1		1

[1] Vegetables listed in the list of the African Orphan Crop Consortium (http://africanorphancrops.org/meet-the-crops/)
[2] Vegetables listed in PROTA. Crubbens, G. T. H., and O. A. Denton. "Plant Resources of Tropical Africa. 2 Vegetables, PROTA foundation, Wageningen, Netherlands." (2004).
[3] Vegetables listed in Dinssa et al. 2016. AVRDC—The World Vegetable Center's women-oriented improvement and development strategy for traditional African vegetables in sub-Saharan Africa. Eur J Hortic Sci, 81(2), 91-105.
[4] Number of countries where the vegetables is reported according to Guarino et al. (1997) Proceedings of the IPGRI International Workshop on Genetic Resources of Traditional Vegetables in Africa. IPGRI, Rome Italy.

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3	*Moringa oleifera*	1	1		1
3	*Talinum fruticosum*	1	1		1
3	*Cucumis sativus*		1	1	1
3	*Solanum scabrum*	1	1	1	
2	*Vigna unguiculata*		1		7
2	*Portulaca oleracea*		1		6
2	*Amaranthus hybridus*			1	5
2	*Solanum americanum*		1		4
2	*Amaranthus spinosus*		1		3
2	*Amaranthus thumbergii*		1		3
2	*Amaranthus graecizans*		1		3
2	*Cleome monophylla*		1		3
2	*Corchorus tridens*		1		3
2	*Lagenaria siceraria*		1		3
2	*Vigna unguiculata*		1		3
2	*Asystasia gangetica*		1		2
2	*Asystasia mysorensis*		1		2
2	*Capsicum annuum*		1		2
2	*Coccinia grandis*		1		2
2	*Colocasia esculenta*		1		2
2	*Commelina africana*		1		2
2	*Commelina benghalensis*		1		2
2	*Corchorus trilocularis*		1		2
2	*Cucumis melo*		1		2
2	*Cucurbita maxima*		1		2
2	*Cucurbita pepo*		1		2
2	*Ipomoea eriocarpa*		1		2
2	*Luffa cylindrica*		1		2
2	*Sechium edule*		1		2
2	*Vernonia amygdalina*		1		2
2	*Adansonia digitata*		1		1
2	*Amaranthus caudatus*			1	1
2	*Amaranthus viridis*		1		1
2	*Brassica juncea*		1		1
2	*Brassica nigra*		1		1
2	*Brassica oleracea*		1		1
2	*Cassia obtusifolia*	1			1
2	*Ceratotheca sesamoides*		1		1
2	*Chenopodium album*		1		1
2	*Cleome hirta*		1		1
2	*Commiphora rostrata*		1		1
2	*Corchorus fascicularis*		1		1
2	*Corchorus aestuans*		1		1

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2	*Corchorus asplenifolius*		1		1
2	*Crotalaria brevidens*		1		1
2	*Cucumeropsis mannii*		1		1
2	*Digera muricata*		1		1
2	*Emilia coccinea*		1		1
2	*Emilia sonchifolia*		1		1
2	*Erucastrum arabicum*		1		1
2	*Ficus sycomorus*		1		1
2	*Gnetum buchholzianum*		1		1
2	*Hibiscus cannabinus*		1		1
2	*Hibiscus physaloides*		1		1
2	*Ipomoea aquatica*		1		1
2	*Ipomoea aquatica*		1		1
2	*Ipomoea batatas*	1			1
2	*Jacquemontia tamnifolia*		1		1
2	*Kedrostis pseudogijef*		1		1
2	*Launaea cornuta*		1		1
2	*Launaea taraxacifolia*		1		1
2	*Leptadenia hastata*		1		1
2	*Moringa stenopetala*		1		1
2	*Nasturtium officinale*		1		1
2	*Oxygonum salicifolium*		1		1
2	*Oxygonum sinuatum*		1		1
2	*Pentarrhinum insipidum*		1		1
2	*Pentodon pentandrus*		1		1
2	*Phaseolus lunatus*	1			1
2	*Phaseolus vulgaris*		1		1
2	*Plectranthus monostachyu*		1		1
2	*Portulaca quadrifida*		1		1
2	*Pterocarpus mildbraedii*		1		1
2	*Rumex abyssinicus*		1		1
2	*Sesamum alatum*		1		1
2	*Sesamum radiatum*		1		1
2	*Sesamum calycinum*		1		1
2	*Solanecio biafrae*		1		1
2	*Solanum lycopersicum*		1		1
2	*Sonchus oleraceus*		1		1
2	*Urera cameroonensis*		1		1
2	*Urtica massaica*		1		1
2	*Vigna subterranea*	1			1
2	*Amaranthus blitum*	1	1		
2	*Amaranthus hypochondriacus*		1	1	
2	*Amaranthus tricolor*	1	1		

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2	*Crassocephalum rubens*	1	1		
2	*Solanum anguivi*		1	1	
2	*Solanum villosum*		1	1	
1	*Ipomoea batatas*				5
1	*Manihot esculenta*				5
1	*Cajanus cajan*				3
1	*Amaranthus lividus*				2
1	*Amaranthus sparganicephalus*				2
1	*Balanites aegyptiaca*				2
1	*Cucumis ficifolius*				2
1	*Manihot esculenta*				2
1	*Piper guineense*				2
1	*Sesamum indicum*				2
1	*Tamarindus indica*				2
1	*Adenia cissampeloides*				1
1	*Aeollanthus pubescens*				1
1	*Aerva lanata*				1
1	*Afzelia quanzensis*				1
1	*Albizia antunesiana*				1
1	*Allium ascalonicum*				1
1	*Allium ursinum*				1
1	*Aloe maculata*				1
1	*Amorphophallus abyssinicus*				1
1	*Bauhinia thonningii*				1
1	*Calamus deerratus*				1
1	*Ceiba pentandra*				1
1	*Coccinia abyssinica*				1
1	*Coccinia trilobata*				1
1	*Cocos nucifera*				1
1	*Commelina forskaolii*				1
1	*Commelina imberbis*				1
1	*Cucumis dipsaceus*				1
1	*Cyanthillium cinereum*				1
1	*Cyphia glandulifera*				1
1	*Dioscoreophyllum cumminsii*				1
1	*Ensete ventricosum*				1
1	*Eruca sativa*				1
1	*Feretia apodanthera*				1
1	*Galinsoga parviflora*				1
1	*Gongronema latifolium*				1
1	*Guizotia abyssinica*				1
1	*Gymnanthemum coloratum*				1
1	*Hydnora abyssinica*				1

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1	*Hyptis pectinata*				1
1	*Ipomoea alba*				1
1	*Ipomoea mombassana*				1
1	*Justicia insularis*				1
1	*Kedrostis gijef*				1
1	*Laccosperma secundiflorum*				1
1	*Lagenaria siceraria*				1
1	*Laportea aestuans*				1
1	*Launaea cornuta*				1
1	*Phoenix reclinata*				1
1	*Piper umbellatum*				1
1	*Plectranthus edulis*				1
1	*Pterocarpus santalinoides*				1
1	*Pterocarpus soyauxii*				1
1	*Raphia hookeri*				1
1	*Rumex usambarensis*				1
1	*Searsia natalensis*				1
1	*Searsia tenuinervis*				1
1	*Senna insularis*				1
1	*Sesbania sesban*				1
1	*Solanum distichum*				1
1	*Sphenostylis stenocarpa*				1
1	*Taraxacum campylodes*				1
1	*Tribulus cistoides*				1
1	*Tribulus terrestris*				1
1	*Tribulus pentandrus*				1
1	*Vatovaea pseudolablab*				1
1	*Vigna membranacea*				1
1	*Vigna trilobata*				1
1	*Vitex doniana*				1
1	*Xanthosoma brasiliense*				1
1	*Xanthosoma sagittifolium*				1
1	*Zanthoxylum chalybeum*				1
1	*Rumex nepalensis*		1		
1	*Alepidea peduncularis*		1		
1	*Allium fistulosum*		1		
1	*Allium sativum*		1		
1	*Allium ampeloprasum*		1		
1	*Alternanthera littoralis*		1		
1	*Alternanthera sessilis*		1		
1	*Apium graveolens*		1		
1	*Artanema longifolium*		1		
1	*Arthrocnemum pachystachyum*		1		

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1	*Asparagus flagellaris*		1		
1	*Asparagus officinalis*		1		
1	*Astragalus atropilosulus*		1		
1	*Baccharoides filigera*		1		
1	*Barleria opaca*		1		
1	*Begonia macrocarpa*		1		
1	*Benincasa hispida*		1		
1	*Beta vulgaris*		1		
1	*Bidens bipinnata*		1		
1	*Bidens schimperi*		1		
1	*Borassus flabellifer*		1		
1	*Borassus madagascariensis*		1		
1	*Borassus aethiopum*		1		
1	*Brassica napus*		1		
1	*Brassica rapa*		1		
1	*Canavalia gladiata*		1		
1	*Caralluma edulis*		1		
1	*Cardamine trichocarpa*		1		
1	*Caylusea abyssinica*		1		
1	*Cayratia debilis*		1		
1	*Cayratia gracilis*		1		
1	*Celosia trigyna*		1		
1	*Ceratopteris thalictroides*		1		
1	*Cercestis mirabilis*		1		
1	*Ceropegia papillata*		1		
1	*Chenopodium giganteum*		1		
1	*Chenopodium murale*		1		
1	*Chenopodium opulifolium*		1		
1	*Cichorium endivia*		1		
1	*Cissus dinklagei*		1		
1	*Cissus palmatifida*		1		
1	*Cissus producta*		1		
1	*Cleome rutidosperma*		1		
1	*Cleome viscosa*		1		
1	*Cnidoscolus aconitifolius*		1		
1	*Coccinia adoensis*		1		
1	*Coccinia sessilifolia*		1		
1	*Convolvulus farinosus*		1		
1	*Corallocarpus bainesii*		1		
1	*Costus phyllocephalus*		1		
1	*Crassocephalum crepidioides*		1		
1	*Crotalaria juncea*	1			

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1	*Crotalaria natalitia*		1		
1	*Cucumis africanus*		1		
1	*Cucumis anguria*		1		
1	*Cucumis hirsutus*		1		
1	*Cucumis metuliferus*		1		
1	*Cucumis myriocarpus*		1		
1	*Cucumis zeyheri*		1		
1	*Cucurbita ficifolia*		1		
1	*Cucurbita moschata*		1		
1	*Cyclanthera pedata*		1		
1	*Cynanchum schistoglossum*		1		
1	*Cyphomandra betacea*	1			
1	*Cyphostemma adenocaule*		1		
1	*Daucus carota*		1		
1	*Dictyosperma album*		1		
1	*Dinophora spenneroides*		1		
1	*Dioscorea abyssinica*		1		
1	*Dioscorea burkilliana*		1		
1	*Dioscorea praehensilis*		1		
1	*Dioscorea cayennensis*		1		
1	*Diplocyclos palmatus*		1		
1	*Duosperma crenatum*		1		
1	*Dypsis baronii*		1		
1	*Dypsis mananjarensis*		1		
1	*Edithcolea grandis*		1		
1	*Emilia lisowskiana*		1		
1	*Emilia prenanthoidea*		1		
1	*Eruca vesicaria*		1		
1	*Erythrococca bongensis*		1		
1	*Gisekia pharnaceoides*		1		
1	*Gongronema angolense*		1		
1	*Guizotia scabra*		1		
1	*Gymnosporia heterophylla*		1		
1	*Gynura pseudochina*		1		
1	*Halosarcia indica*		1		
1	*Haumaniastrum caeruleum*		1		
1	*Hewittia malabarica*		1		
1	*Hibiscus acetosella*		1		
1	*Hibiscus asper*		1		
1	*Hibiscus calyphyllus*		1		
1	*Hibiscus diversifolius*		1		
1	*Hibiscus mechowii*		1		

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1	*Hibiscus rostellatus*		1		
1	*Hibiscus surattensis*		1		
1	*Hibiscus trionum*		1		
1	*Hoodia currorii*		1		
1	*Impatiens irvingii*		1		
1	*Impatiens niamniamensis*		1		
1	*Ipomoea obscura*		1		
1	*Isonema infundibuliflorum*		1		
1	*Justicia flava*		1		
1	*Justicia ladanoides*		1		
1	*Kedrostis leloja*		1		
1	*Lactuca inermis*		1		
1	*Lactuca sativa*		1		
1	*Lagenaria sphaerica*		1		
1	*Laportea ovalifolia*		1		
1	*Lasimorpha senegalensis*		1		
1	*Lemuropisum edule*		1		
1	*Lepidium sativum*		1		
1	*Lepistemon owariense*		1		
1	*Ludwigia abyssinica*		1		
1	*Ludwigia erecta*		1		
1	*Luffa acutangula*		1		
1	*Marsilea minuta*		1		
1	*Melochia corchorifolia*		1		
1	*Micrococca mercurialis*		1		
1	*Momordica balsamina*		1		
1	*Momordica foetida*		1		
1	*Momordica rostrata*		1		
1	*Myrianthus arboreus*		1		
1	*Nidorella microcephala*		1		
1	*Ophioglossum reticulatum*		1		
1	*Orthanthera jasminiflora*		1		
1	*Oxygonum alatum*		1		
1	*Oxygonum atriplicifolium*		1		
1	*Pastinaca sativa*		1		
1	*Pedalium murex*		1		
1	*Pentanisia schweinfurthii*		1		
1	*Persicaria attenuata*		1		
1	*Persicaria decipiens*		1		
1	*Persicaria senegalensis*		1		
1	*Pisum sativum*		1		
1	*Plectranthus esculentus*	1			
1	*Plectranthus rotundifolius*	1			

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1	*Polygonum plebeium*		1		
1	*Pouzolzia guineensis*		1		
1	*Praecitrullus fistulosus*		1		
1	*Psophocarpus grandiflorus*		1		
1	*Psophocarpus scandens*		1		
1	*Psophocarpus tetragonolobus*		1		
1	*Psychotria eminiana*		1		
1	*Pteridium aquilinum*		1		
1	*Raphanus raphanistrum*		1		
1	*Ravenea robustior*		1		
1	*Rheum × hybridum*		1		
1	*Rorippa madagascariensis*		1		
1	*Rumex vesicarius*		1		
1	*Samolus valerandi*		1		
1	*Schouwia purpurea*		1		
1	*Scorzonera hispanica*		1		
1	*Secamone stuhlmannii*		1		
1	*Senna obtusifolia*		1		
1	*Sericostachys scandens*		1		
1	*Sesamum angolense*		1		
1	*Sesuvium portulacastrum*		1		
1	*Smithia elliotii*		1		
1	*Solanum anomalum*		1		
1	*Solanum grossedentatum*		1		
1	*Solanum melongena*		1		
1	*Solanum schumannianum*		1		
1	*Solanum tarderemotum*		1		
1	*Solanum torvum*		1		
1	*Solenostemon rotundifolius*		1		
1	*Sonchus asper*		1		
1	*Spinacia oleracea*		1		
1	*Stenochlaena tenuifolia*		1		
1	*Stylochaeton hypogaeus*		1		
1	*Talinum caffrum*		1		
1	*Talinum paniculatum*		1		
1	*Talinum portulacifolium*		1		
1	*Talinum triangulare*		1		
1	*Tetragonia tetragonioides*		1		
1	*Thunbergia lancifolia*		1		
1	*Trianthema portulacastrum*		1		
1	*Trichosanthes cucumerina*		1		
1	*Triplochiton zambesiacus*		1		

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1	*Triumfetta annua*		1		
1	*Triumfetta cordifolia*		1		
1	*Triumfetta pentandra*		1		
1	*Triumfetta rhomboidea*		1		
1	*Tulbaghia alliacea*		1		
1	*Tylosema esculentum*	1			
1	*Urera cordifolia*		1		
1	*Urera obovata*		1		
1	*Urtica simensis*		1		
1	*Valerianella locusta*		1		
1	*Vicia faba*	1			
1	*Vigna luteola*		1		
1	*Vigna radiata*	1			
1	*Zornia glochidiata*		1		

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Annex 5

MTA$_3$

No._____

Material Transfer Agreement

for direct cultivation (MTA$_3$)

The Asian Vegetable Research and Development Center, also known as the World Vegetable Center ("**WorldVeg**") transfers genetic material ("**Material**") and related information as specified in Annex 1 to this agreement to the **Recipient**, subject to the terms and conditions set forth in this Material Transfer Agreement for direct cultivation ("**Agreement**"):

1. The Recipient is an organization involved in [the promotion of vegetable diversity in the diets of school children in Myanmar and is desirous of obtaining the Material from WorldVeg for the purpose of supplying the Material to schools in Bagan for cultivation in school gardens under a project funded by USAID entitled "*Promotion of vegetable seed kits for school gardens in 25 schools in Bagan, Myanmar*"].

2. The **Recipient** undertakes that the **Material** shall be used for **direct cultivation** in [home and school gardens and/or in farmers' fields] only ("**the Purpose**"). The Recipient must inform any subsequent recipient of the Material of the Purpose and ensure that the Material is not used for any chemical, pharmaceutical, non-food or commercial purposes including for commercial seed production or sale.

3. If the **Recipient** transfers the **Material** and related information supplied under this **Agreement** to a third party, the **Recipient** shall do so in accordance with the terms and conditions of this **Agreement**.

4. The **Recipient** shall not claim any intellectual property or other rights that limit the access to and further use of the **Material** provided under this **Agreement**, or its genetic parts or components in any way.

5. The **Recipient** is encouraged to acknowledge **WorldVeg** as the provider of the **Material** and quote the crop code specified in Annex 1 in any publication where the **Material** has been used as a part of cultivation. **WorldVeg** further encourages the **Recipient** to provide acknowledgment to **WorldVeg** in the form stated in Annex 2.

6. The **Recipient** shall send **WorldVeg** a copy of any non-confidential data, report or publication which describes work carried out using the **Material** and **WorldVeg** shall be entitled to use all such data, report and publication for research, breeding and training.

7. **WorldVeg** does not warrant the title, safety, quality, viability or purity of the **Material** nor the accuracy of passport or other data provided with it. The phytosanitary condition of the **Material** is only warranted as described in the attached phytosanitary certificate.

8. The **Recipient** assumes full responsibility for complying with the **Recipient** nation's quarantine and biosafety rules and regulations as applicable to the import and release of the **Material**.

9. A processing and shipping fee will be charged for the **Material**.

10. The **Material** and related information will be supplied by **WorldVeg** to the **Recipient** after receipt of the signed MTA and payment of the processing and shipping fee.

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Name of Recipient: _____

Title: _____

Institution: _____

Mailing Address: _____

_____

Tel: _____

Fax: _____

Email: _____

Date: _____

Signature: _____

Please return the signed MTA promptly to the following address:

Genetic Resources and Seed Unit **GRSU No.**

_____

World Vegetable Center

P.O. Box 42 **QI No.**

_____

Shanhua, Tainan 74199

TAIWAN **Date**

_____

E-mail: seedrequest@worldveg.org

Fax: (+886-6) 583-0009

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