

December 2006

Regional strategy for the *ex situ* conservation
of plant genetic resources in:

Eastern Africa

Disclaimer

This document has been developed by the Eastern Africa Plant Genetic Resources Network (EAPGREN). For more information about the network, see: [//www.asareca.org](http://www.asareca.org)

The objective of this Strategy is to provide a framework for the efficient and effective *ex situ* conservation of the most important crop diversity collections in the Eastern Africa region, and to promote the availability of these plant genetic resources for food and agriculture.

The Global Crop Diversity Trust (the Trust) provided support towards this initiative and considers the document, particularly those portions pertaining directly to the Trust's mandated areas of interest, to be an important input to the Trust's own planning and work. We expect the Strategy to continue to evolve, as appropriate, and for the Network to lead this on-going process.

The Regional Strategy is the strategy of the region. The Trust does not take responsibility for its contents or for the accuracy or completeness of the information contained in the document. Please direct specific questions and comments to the regional strategy coordinator mentioned in the document.

Global Crop Diversity Trust
December 2006

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1. Coordination

Regional Focal Person:	Abebe Demissie, Regional Coordinator
Name of organization:	Eastern Africa Plant Genetic Resources Network (EAPGREN) of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)
Name of Facilitators:	Henry Kamau /Kameswara Rao PGR Scientists, Bioversity International-SSA, Nairobi, Kenya
Countries involved:	Burundi, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Uganda
Crops/species involved:	21 crops and forage species included in the Annex I of the ITPGRFA and other non-Annex I crops of importance to the region

2. Executive Summary

Eastern Africa is endowed with considerable inter-and intra-specific diversity of crops and is the centre of origin and/or diversity for important cereals like sorghum, finger millet, pearl millet, wheat and barley. At present a total of approximately 134,158 accessions are being conserved by the different national gene banks in the sub-region. In the last two decades, attempts were made to strengthen the plant genetic resources (PGR) activities in the region and more recently, the Eastern African Plant Genetic Resources Network (EAPGREN) has been established in 2003 with the financial support from the Swedish International Development Cooperation Agency (Sida) with the primary function to mobilize resources and strengthen national programmes in the region to optimally conserve and use their plant genetic resources. However, these attempts are not adequate to ensure sustainable conservation and utilization of the PGR on a long-term basis, especially because a large number of the gene banks in the sub-region are built with bilateral funding, often with inadequate provision for continued financial support either by donors or host governments.

The importance of plant genetic resources to the member countries of EAPGREN is no longer a subject of contention. It is now recognized that plant genetic resources provides the major raw material for the agriculture enterprise which is the basis of the national economies in all the EAPGREN countries. Equally important is the fact that most of the member countries of EAPGREN are pursuing poverty reduction strategies that look at agriculture as the core strategy for achieving poverty alleviation and creating rural employment.

In addition to the value of PGR to meeting domestic economic, livelihood and employment needs, most of the countries have also signed and or ratified the International Treaty on Plant Genetic Resources for Food and Agriculture. The Treaty, among other things obliges the parties to put in place, policies, legislation and action plans to implement their commitments under the Treaty.

Consequently, both domestic interests and the international agenda provide compelling need for countries to engage in processes that enhance the conservation and sustainable use of plant genetic resources. The problem is that most of the EAPGREN member countries are confronted with major problems that inhibit them from making progress in this area. Although the political awareness and commitment to conservation and use of plant genetic resources are significant, the budget allocations by respective national governments are often inadequate due to prevailing economic hardships.

The Report on the State of the World's Plant Genetic Resources for Food and Agriculture highlighted that many *ex situ* germplasm collections in Africa are in a state of deterioration, facing severe constraints due to increased maintenance costs, etc. (FAO, 1998)*. Crop diversity, once lost, is impossible to replace and it is important that these collections be kept in a healthy state and continually accessible for use on sustainable manner.

In this context, the Global Crop Diversity Trust's (the Trust) initiative to support regional conservation strategies provides EAPGREN a window of opportunity to develop a regional conservation system and identify collections of priority for support complementing those from other donors and the national governments for sustainable conservation of important crop diversity from the sub-region. Therefore, the objective of this scheme is to develop the regional conservation strategy for Eastern Africa outlining the steps and resources needed to guarantee the safe management and continued availability of its most important crop diversity.

The goal of EAPGREN is to develop sufficient capacities in participating countries of the sub-region for effective conservation and sustainable utilization of their plant genetic resources, as a component of the broader vision of achieving food security, economic development and sustainable agricultural development. The network aims at strengthening collaboration, networking, and linkages between conservation and utilization of plant genetic resources at both national and sub-regional levels through the pooling of resources and use of comparative advantages available in the various institutions and countries.

The mission of the network is to harness, conserve, and to promote greater use of plant genetic resources for food security, improved health, and socio-economic advancement of the rural communities. This mission will be achieved through capacity building and developing sustainable linkages between plant genetic resources conservation and utilization among the various stakeholders including rural farming communities.

Implementation of the network activities is through five themes namely *Ex situ* Conservation, *In-situ* Conservation, Utilization, Information and Documentation, Policy and Public Awareness. Through these themes scientific support and opportunities will be provided to a wide range of stakeholders.

3. Introduction to the Trust

The Global Crop Diversity Trust (the Trust) aims to support the long-term maintenance of an efficient and effective arrangement for the *ex situ* conservation of the most important crop collections around the world. A first filter for eligibility is provided by the eligibility principles of the Trust. Meeting these principles is the minimum requirement for a collection to be eligible for support:

- The plant genetic resources are of crops included in Annex 1 or referred to in Article 15.1 (b) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)
- The plant genetic resources are accessible under the internationally agreed terms of access and benefit sharing provided for in the multilateral system as set out in the International Treaty
- Each holder of plant genetic resources for food and agriculture commits to its long term conservation and availability
- Each recipient of funds from the Trust shall undertake to work in partnership with the aim of developing an efficient and effective global conservation system

To achieve this ultimate goal, the Trust is supporting the development of conservation strategies that will guide the allocation of resources to the most important and needy crop diversity collections, assisting them to meet the criteria required for long term conservation funding. The conservation strategies are proposing the collections and conservation services and providers of priority for support by the Trust. The Trust is supporting two complementary and mutually reinforcing approaches to identifying and prioritizing eligible collections for upgrading and long-term conservation funding. One approach is to identify key *ex situ* collections of globally important crops (of Annex 1 of the ITPGRFA) on a region-by-region basis. The other is to prioritize collections on a crop-by-crop basis at the global level. The strategy should consider the most appropriate approach to managing the key collections, given their location and available resources, and the standards they should be expected to fulfil in the management of the given crop. Finally, it will propose a model for sharing responsibilities for certain activities amongst collection holders and service providers, and identify and prioritize collections for long-term conservation support. This process brings together the managers of plant genetic resources and other experts to develop and implement the most cost efficient and effective strategies for ensuring the long-term conservation and availability of the crops that are vital to the world's food security.

4. Goal of the regional conservation strategy

Sustainable conservation and utilization of crop genetic diversity for agricultural development and food security in Eastern Africa.

5. Objective

The efficient and effective conservation and utilization of Eastern Africa's plant genetic resources and identify priority collections eligible for long-term support from the Trust and their urgent upgrading and capacity building needs. The regional conservation strategy, will have the broad buy-in and support from all the key stakeholders, and will promote the

rationalization of conservation efforts at regional and global levels through encouraging partnerships and sharing conservation responsibilities, facilities and tasks and will link with the relevant global crop conservation strategies.

6. Outputs

- Diversity of regional priority crops conserved safely on a long-term basis
- Genetic diversity of priority crops characterized and documented
- Management of *ex situ* collections of priority crops improved
- Information sharing mechanisms strengthened within the network and linked to global initiatives
- Use of germplasm of priority crops by users optimized
- Capacity of national programmes in management of priority crop collections strengthened
- Stronger partnership and collaboration within EAPGREN and outside the region in *ex situ* conservation of PGRFA

7. Anticipated impact

The development of the regional strategy document will provide the framework for sustainable conservation of plant genetic resources leading to improved agricultural production and food security in Eastern Africa with direct implications to addressing the Millennium Development Goals related to food security and reducing hunger.

8. Intended beneficiaries

The primary beneficiaries are the PGR programmes in member countries of EAPGREN including Burundi, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan and Uganda. The secondary beneficiaries are the crop improvement programmes in the region through increased access to a wide range of crop genetic diversity to produce superior varieties with a spillover to neighboring regions. The ultimate beneficiaries are the farmers owing to improved agricultural productivity through agricultural research and development programs in the region and beyond.

9. Process of developing the regional conservation strategy

The process of developing the regional conservation strategy with EAPGREN was initiated during the 4th Steering Committee meeting in August 2004, Antananarivo, Madagascar. It was agreed that the strategy should be led by EAPGREN Coordinator and facilitated with the technical support of Bioversity International. At the 4th Regional Steering Committee (RSC), the network members were introduced to the regional and global crop conservation strategies of the Global Crop Diversity Trust. They proposed a preliminary list of most important crops of Annex 1 (of ITPGRFA) to the region and some areas that would require capacity building and support from the Trust. The RSC agreed on the process and timeline to develop the regional conservation strategy. A Task Force of four people (A. Demissie, H. Kamau, K. Rao and John Mulumba-Waswa) was established to undertake the activities towards the development of the strategy. The Task Force members collated existing information on collections of crops on Annex 1 of the Treaty held within the region and attempted to fill in

the gaps with a survey undertaken through the national coordinators in August 2005. The information included: collection holders; species, type and number of accessions of the individual collections; passport data where possible; any other relevant information available.

The main questions that were asked were:

- 1) Which crops on Annex 1 of the Treaty are of greatest importance to the agriculture of the region or to one or a few countries in the region?
- 2) Which of the identified above crops have the region as their primary or secondary centre of diversity?
- 3) Which collections of the crops identified are ‘most important’ in terms of size, extent/scope of diversity, concentration of wild relatives and other standards of the measurement of importance as defined by network members?
- 4) Among the collections identified, what collections meet the Trust’s eligibility principles?
- 5) Among the subset of collections identified that meet the Trust’s eligibility principles, which of these collections should be given first priority for receiving funding for upgrading and capacity building? The assignment of relative priority amongst collections could involve the consideration of the following points:
 - The extent, urgency and nature of actual or potential threats to the collection
 - The extent, urgency and nature of actual or potential threats to the crop in the field
 - The availability of alternative funding sources to support the conservation of a specific collection
 - Whether the collection is held in a genebank maintaining other eligible collections
 - The availability of other arrangements to support the conservation of identified priority collections

A preliminary assessment of the opportunities for collaboration was made for ensuring the most effective and efficient approach to conserving the eligible collections identified drawing on partners both within and outside of the region for the provision of conservation services. The senior managers of NARS were consulted in the respective countries for their views on the strategy and the most effective collaborative arrangements for sustainable conservation of the PGRFA in the region.

The consultation of the EAPGREN Network members during the 5th Steering Committee meeting in Khartoum, Sudan on 19-23 September 2005 was to validate and further discuss the preliminary assessment of crops and collections of most importance, of the possible collaborative arrangements and on the upgrading and capacity building needs of the priority collections. The goal of upgrading and capacity building is to enable the collections to put into place the structures, skills and policies needed in order to meet the criteria for receiving conservation funding over the long-term. Based on the outcome of these assessments, the strategy for an efficient and effective system of conservation of the collections has been identified in the context of the region.

In the Khartoum meeting a limited number of countries including Eritrea, Sudan, Burundi, and Rwanda participated. In the follow-up consultative meeting held in Nairobi on 12-13 November 2005. All the countries of the EAPGREN constituency were represented through the focal persons and their representative from the national agricultural research system. The current document was produced after the Nairobi meeting and the outcome of the consultation was circulated to the ASARECA community including to the members of the ASARECA highest policy making organ.

10. Crops of greatest importance

Crops of greatest importance were identified based on the ranking and weights in terms of importance/standing assigned to each of the following nine criteria by the EAPGREN Regional Steering Committee members at the 4th RSC meeting (31 Aug-3 Sept 2004), Madagascar and subsequently by the taskforce which met on 24-25 Jan 2005 in Nairobi.

- Threats of GE
- Centre of diversity
- Uniqueness
- Food security
- Status of PGR collections – health
- Status of characterization
- Conservation facilities – long term
- Safety duplication
- Regeneration needs

Table 1: Crops of priority to the region identified using the criteria set and the indicators of their importance.

Priority No.	Annex 1 crop/species	Countries in region	Factors / indicators of importance
1.	Sorghum	All	Domesticated from wild sorghum (<i>S. arundinaceum</i>) in the northeastern quarter of Africa. The main area of variation of the crop lies in eastern central Africa. Sorghum has distinct advantage of being drought-resistant and many subsistence farmers cultivate sorghum as a staple food crop - thus, it contributes to rural household food security. Sorghum is a multifunctional crop providing grain and stems as feedstock for sugar, alcohol, fuel and for poultry and livestock feeding.
2.	Finger millet	All	Important food crop in traditional low input cereal-based farming systems – Grown abundantly in upland areas of rift valley: Kenya, Uganda, Rwanda, Burundi. Thought to have originated from Uganda and neighboring Ethiopian highlands, where tremendous diversity exists in this region. Wild finger millet (<i>subsp. Africana</i>) is native to Africa.
3.	Pearl millet	Ethiopia, Eritrea, Kenya, Sudan	Pearl millet has a diffuse belt of origin extending from West Sudan to Senegal. Important food staple, particularly in the semi-arid areas where other crops tend to fail because of inadequate rainfall and poor soil conditions.
4.	Wheat	Ethiopia, Eritrea	Ethiopia is the secondary centre of diversity for durum wheat. Important genes were found for resistance to rust, dwarfing, very early heading and very late maturity. Six known species have been recorded from the region.
5.	Banana	All	Banana is a major food staple and a source of income for over 20 million people in eastern Africa. African bananas are grouped into three categories, including East African (mainly dessert) bananas, the African plantain bananas grown mainly in central and West Africa, and the East African Highland Banana, used for cooking and in beer preparation. The highlands of east Africa are an important center of diversity of cooking bananas.
6.	Sweet potato	Burundi, Kenya, Madagascar, Rwanda, Sudan Uganda	Africa represents a unique secondary site of genetic diversity for sweet potato. Sweet potato is a short-season crop which reliably provides food on marginal and degraded soils with little labor and few or no inputs from outside the farm. The crop is rich in carbohydrates, proteins and vitamins, and provides high cash income per unit of land and time.
7.	Cassava	Burundi, Kenya, Madagascar, Rwanda, Sudan Uganda,	Cassava has the ability to grow on marginal lands where cereals and other crops do not grow well; it can tolerate drought and can grow in low-nutrient soils. Cassava provides a basic daily source of dietary energy. Roots are consumed freshly boiled or raw and

Priority No.	Annex 1 crop/species	Countries in region	Factors / indicators of importance
			leaves are used as a green vegetable, which provides protein and vitamins A and B. Cassava starch is used as a binding agent, in the production of paper and textiles, and as monosodium glutamate, an important flavoring agent.
8.	Rice	Burundi, Ethiopia Kenya, Madagascar, Rwanda, Sudan, Uganda	Wadi rice (<i>Oryza punctata</i>) is indigenous to eastern Africa. It is a freely tillering annual commonly found in rain-flooded depressions. In Central Sudan, where wadi rice is widespread, the grains are boiled with water or milk and eaten as a staple. Other wild species indigenous to Eastern Africa include <i>O. longestaminata</i>
9.	Yam	Kenya, Rwanda, Sudan, Uganda,	Yams are cultivated throughout tropical Africa. There are at least 13 species occurring in the region. Among the cultivated species, <i>D. bulbifera</i> and <i>D. minutiflora</i> are native to East Africa. Other species of edible yams cultivated in East Africa are introduced and include <i>D. cayenensis</i> (yellow Guinea yam) from West Africa and <i>D. alata</i> (white yam) from Asia.
10.	Cowpea	Ethiopia, Eritrea, Kenya, Rwanda, Sudan, Uganda,	Northeastern Africa was proposed as the centre of domestication as high levels of diversity are found in the cultivated and wild cowpeas. It is a broadly adapted and highly variable crop, cultivated around the world for seed, and also as a vegetable - both as a leafy green and for green peas, cover crop, and for fodder. Cowpea is an extremely resilient crop, and is cultivated under some of the most extreme agricultural conditions in the world.
11.	Pigeonpea	Kenya, Uganda, Sudan, Ethiopia	Popular crop in the warm semi-arid and sub-humid tropics of eastern Africa. Subsistence farmers grow pigeonpea - often on poor soils and with few or no inputs. It is a hardy, drought-tolerant crop. The crop is consumed both in fresh form and as dried grain, and also is used as fodder for livestock. Mostly of vegetable-type with large pods/seeds in contrast to the Asian type pigeonpeas which are small seeded and used for making soup (dhal).
12.	Barley	Ethiopia, Eritrea	Ethiopia is the secondary centre of diversity for barley. Several traits like barley yellow dwarf virus resistance, high lysine resistance to powdery mildew, leaf rust, loose smut and barley stripe mosaic virus are unique to Ethiopia.
13.	Brassica spp.	Ethiopia, Eritrea	<i>Brassica carinata</i> (Ethiopian mustard) originated in Ethiopia where it is used both as a leaf vegetable and as an oilseed. It is known to be highly heat and drought tolerant, and could therefore be a potential oilseed crop for the dry areas.
14.	Faba bean	Ethiopia, Eritrea, Madagascar, Sudan	Most important pulse in Ethiopia. High protein content and resistance against chocolate spot were found in Ethiopian germplasm.
15.	Maize	All	Maize is the principal food staple, dominating the diets of rural and urban poor in eastern Africa. Maize ranks first in Ethiopia in total production and yield per hectare, and is the most important food crop grown and consumed in Kenya.
16.	Phaseolus	Burundi, Kenya, Madagascar, Rwanda, Sudan, Uganda	Second most important source of human dietary protein, and the third most important source of calories for over 100 million people in rural and poor urban communities in Africa. In eastern Africa, the two main areas of cultivation are the cool highlands of Kenya, Uganda, Tanzania, Rwanda and Burundi and the warmer mid-elevation areas of Ethiopia.
17.	Chickpea	Sudan, Eritrea, Ethiopia, Kenya	Ancient crop in Ethiopia and considerable diversity could be found. Disease resistance and drought tolerance found in Ethiopian collections after an initial screening.
18	Potato	Burundi, Eritrea Kenya, Madagascar, Rwanda, Sudan, Uganda	Potato is a short-season, high-value crop, grown for household consumption and as a cash crop mainly by small farmers.
189	Lentil	Ethiopia, Sudan	Important pulse crop in Ethiopia. Interesting characteristics found in the Ethiopian germplasm include: earliness, high seed yield, high harvest index, high number of seeds per pod and good

Priority No.	Annex 1 crop/species	Countries in region	Factors / indicators of importance
			cold tolerance.
20.	Pea	Ethiopia, Rwanda	Old crop in Ethiopia. Unique subspecies (<i>subsp. Abyssinicum</i>) developed in Ethiopia.
21.	Forages	Kenya, Ethiopia, Sudan, Eritrea	The Somali-Massai savannah and steppe are the center of origin and diversity for forage species included in Annex 1 of ITPGRFA

11. Collections of greatest importance of the priority crops

Questionnaire (metadata) was sent to the focal persons for PGR activities/Regional Steering Committee members in EAPGREN member countries to provide the following information on collections of the priority crops (crops listed in section 10 above) held in their genebanks.

- Number of accessions as on July 2005
- % of landraces
- % indigenous accessions
- Method of regeneration
- No. of traits characterized and % of accessions (i) fully, (ii) partially or (iii) not characterized
- No of traits and % accessions evaluated (i) fully, (ii) partially or (iii) not evaluated
- % of accessions with full passport data computerized
- % of accessions with characterization data computerized
- % of accessions safety duplicated and where
- % of accessions that need urgent regeneration
- % accessions with full passport data
- Number of accessions distributed in the last 3 years

Additional information obtained through the questionnaire included:

- Staff assigned to PGR activities (no. of scientists & expertise)
- Conservation facilities (Type of storage, conditions, total space, % occupation)
- Drying facilities (Type and age of equipment)
- Equipment for seed processing (moisture content determination, Germination testing, packing and sealing)
- Maintenance of facilities (Measures in place and technicians)
- Regeneration (Field size, green houses and size)
- Characterization (source of descriptors, non-availability)
- Seed health (facilities, staff)
- Documentation (No. of computers, software, passport data format)
- Budget (national and other sources)
- Linkages to users (Activities to promote use with farmers, breeders etc.

The data were rated according to their importance/standing and multiplied with a mean weight assigned by the members at the 4th RSC meeting (19-23 Sept. 2005) in Sudan. In the final analysis, each collection which was ranked for its value, quality and the threat (Annex 1) was presented for consultation and discussions and was finally endorsed by the Regional Steering Committee (RSC) full consultation meeting held in the Nairobi.

Collections of greatest importance and the collection holders are listed below (Table 2). The identification was essentially based on the analysis of data for criteria: whether the country is

centre of origin and/or diversity, size of collection, No. of landraces and indigenous accessions, % of wild species and useful traits reported for the country/collection.

Table 2: List of collections of greatest importance (value)

No.	Crop/ species	Current Holder(s) in order of importance	Priority and the factors/ indicators given for assigning first priority for support	Accession-level passport data available ¹
1	Sorghum	IBC, Ethiopia; ARC, Sudan; NGBK, Kenya	IBC, Ethiopia Factor/Indicators: Value based on size of collection, % landraces, unique diversity, and no. of useful traits reported	45%
2	Finger millet	IBC, Ethiopia; NGBK, Kenya; SAARI, Uganda	IBC, Ethiopia Factor/Indicators: Value based on size of collection, % of landraces and indigenous accessions, unique diversity	74%
3	Pearl millet	ARC, Sudan; IBC, Ethiopia; ARC, Eritrea	ARC, Sudan Factor/Indicators: Value based on unique diversity, % of landraces and indigenous accessions, no. of useful traits reported	65%
4	Wheat	IBC, Ethiopia; ARC, Eritrea; NGBK, Kenya	IBC, Ethiopia; Factor/indicators: Value based on size of collection, % landraces, unique diversity and no. of useful traits reported	33%
5	Banana	ISABU/IRAZ, Burundi; NARO, Uganda; ISAR, Rwanda	ISABU/IRAZ, Burundi Factor/indicators: Value based on % of indigenous accessions and wild species	80%
6	Sweet potato	NARO, Uganda; ISAR, Rwanda	NARO, Uganda Factor/indicators: % of landraces	0%
7	Cassava	NARO, Uganda	NARO, Uganda Factors/Indicator: important staple root crop in the region	50%
8	Rice	FOFIFA, Madagascar NGBK, Kenya; ISAR, Rwanda	FOFIFA, Madagascar Factor/Indicators: Value based on size of collection and % of landraces	35%
9	Yam	No/few assembled collections	Considered as one of the important root crops in the region	-
10	Cowpea	NGBK, Kenya; FOFIFA, Madagascar; ARC, Sudan	NGBK, Kenya Factor/Indicators: Value based on size of collection and % of landraces	80%
11.	Pigeonpea	NGBK, Kenya	NGBK, Kenya Factor/Indicators: Only collection in the region	80%
12.	Barley	IBC, Ethiopia; ARC, Eritrea	IBC, Ethiopia Factor/indicators: Value based on size of collection, % landraces, centre of domestication, and no. of useful traits reported	46%
13.	Brassicca spp.	IBC, Ethiopia	IBC, Ethiopia Factor/indicators: Value based on size of collection, % landraces, diversity	84%

¹ I.e. passport data on each accession, preferably compatible with the exchange format of the IPGRI/FAO Multi-Crop Passport Descriptors (available at: www.ipgri.cgiar.org/publications/pdf/124.pdf). Where available, all accession level data on eligible collections should be provided separately.

No.	Crop/ species	Current Holder(s) in order of importance	Priority and the factors/ indicators given for assigning first priority for support	Accession-level passport data available ¹
14.	Faba bean	IBC, Ethiopia; ARC, Eritrea; NGBK, Kenya	IBC, Ethiopia Factor/indicators: Value based on size of collection, % of landraces and indigenous accessions	84%
15.	Maize	NGBK, Kenya; IBC, Ethiopia	NGBK, Kenya Factor/indicators: Value based on size of collection, % of landraces	80%
16.	Phaseolus	NGBK, Kenya; ISAR, Rwanda; IBC, Ethiopia	NGBK, Kenya Factor/indicators: Value based on size of collection, % of landraces and indigenous accessions	80%
17.	Chickpea	IBC, Ethiopia	IBC, Ethiopia Factor/indicators: Value based on size of collection, % landraces, diversity and no. of useful traits reported	69%
18.	Potato	No assembled collections	Increasingly becoming an important crop in the region	
19.	Lentils	IBC, Ethiopia	IBC, Ethiopia Factor/indicators: Value based on size of collection, % landraces, diversity and no. of useful traits reported	66%
20.	Pea	IBC, Ethiopia	IBC, Ethiopia	75%
21.	Forage legumes	NGBK, Kenya; IBC, Ethiopia	NGBK, Kenya Factor/indicators: Value based on size of collection, % landraces, diversity and no. of useful traits reported	50-80%
22.	Forage grasses	NGBK, Kenya;	NGBK, Kenya Factor/indicators: Value based on size of collection, % landraces, diversity	50-80%

12. Collaboration for effective and efficient conservation in the region

To safeguard the important collections in the region, the following arrangements have been proposed:

- The region will have two types of ‘regional’ base collections – one for root and tuber crops and one for seed crops. In view of the differences in existing national capacities, lack of enabling policy frameworks and immediate facilitation mechanisms to establish the regional base collections, it has been proposed to have a system of safety back-up collections in place for important crop collections as a pilot learning process with sorghum and banana to be duplicated in Sudan and Uganda, respectively. On the basis of experience gained, regional base collections will be established following collaborative arrangements among the holders of the important collections and with other institutions involved in the management of the collections (service providers). This would allow for sustainable conservation of the crop diversity of importance to the region and widen the scope for further rationalization and enhanced utilization of collections through collaboration with institutes such as SPGRC and IARCs and crop networks within and outside of the region.

To establish the regional base collections the following will be taken into consideration:

- Which institution/s have the capacity and willing to provide for conservation of regional base collections of priority crops?
- What other institution/s would be providing other services to effectively manage and promote the use of the regional collections?

The success of the project will be demonstrated /measured by the extent of collaboration between the network country members in:

- The extent of the transfer of germplasm for long-term conservation to the designated regional institution(s),
- Scientifically sound management of the germplasm collections by the designated institution
- Government commitment of the country to support to the regional base collection/s

Designation of conservation responsibility will be on the basis of the following factors:

- Demonstrated capacity and capability (infrastructures, competency)
- Endorsement by the parent institution (if need be) to facilitate the holding of regional collection(s)
- Indication of the importance of the collection(s) to the country designated for long-term conservation
- Capacity and willingness to handle the collection within the framework of the IT and implementation of MTA and other related policy issues
- Official binding/commitment to ASARECA to perform the role of a base collection holder.
- The importance of the crop in terms of diversity of the species in the country.

On fulfilment of the above, the qualified institutions will be designated regional responsibilities to hold base collections of priority crops.

In addition to the above proposed collaboration for sustainable conservation of important collections of priority crops, other possible areas of collaboration at regional level are shown in the table 3 the various relevant national research institutions, sub-regional commodity networks and international research institutions will be involved in a collaborative manner to tap on their respective technical expertise.

Table 3: Areas and activities of collaboration at regional level

Area	Activities
Collecting	Joint collecting expeditions in cross-border species, including wild and weedy relatives
Storage and maintenance (seed, <i>in vitro</i> , field)	Develop methodologies for more effective/efficient conservation and management of problem accessions
Regeneration / multiplication	Facilitate for regeneration of difficult material through sharing of facilities and expertise
Characterization / evaluation	Develop regional core collections and evaluate germplasm for regionally important stress factors. Develop capacity in molecular characterization and plant systematics through appropriate collaborative arrangements with centre of excellence
Documentation / information sharing	Establish a regional hub/central data warehousing facility at EAPGREN HQ with linkages to existing ASARECA information networks like RAIN Promote utilization of important collections at a regional level by disseminating of information through publication of germplasm catalogues and information bulletins
Indigenous knowledge (IK)	Compile and disseminate information on IK on the management and utilization of crop diversity in the region
Health of germplasm	Improve national capacities on germplasm health issues through collaboration with centre of excellence

Area	Activities
Distribution / links to users	Strengthening linkages with crop/commodity networks, IARCs and NARS and farmers
Research	Collaborative arrangements for research to improve conservation and management of <i>ex situ</i> collections
Training	Organize training in priority areas such as germplasm management, health, molecular characterization, in vitro conservation, data analysis and policy
Policy	Collaboration with Genetic Resources Policy Initiative (GRPI)/Biodiversity

13. Policy and legal issues (access and availability of germplasm) in the region

EAPGREN was established and endorsed by the Association for Strengthening Agricultural Research in Eastern and Central Africa's (ASARECA) Committee of Directors (CD) in 1997 and became operational in May 2003. The Governance of the network is made up of a Regional Steering Committee and a Secretariat. The Regional Steering Committee is composed of representatives of the 8 participating countries' National Programmes, Sida, NGB, Biodiversity and the Coordinator. The Steering Committee meets on an annual basis to evaluate progress made and plan for the future. The implementation of the network activities are through five themes, one of which is "Policy and Public Awareness".

The situation of the EAPGREN countries vis a vis the ratification of the IT-PGRFA is detailed in Table 4. Until the recipient country of support from the Trust becomes a contracting Party to the International Treaty, the country will be requested, in order to be eligible for funding from the Trust, to sign an Interim agreement (Solemn Undertaking for Access), to ensure the material will be made available for the purpose of utilization and conservation for research, breeding or training in accordance with the terms and conditions set out in Part IV of the International Treaty (IT). This agreement should be signed by Official Level (Minister/Government Officer) responsible for PGR confirming no legal obstacles to the recipient institute fulfilling its undertaking.

Table 4: EAPGREN Countries and International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

	Country	Signature	Ratification	Accession
1.	Burundi	10/6/2002	28/4/2006	
3.	Eritrea	10/6/2002	10/6/2002	
2.	Ethiopia	12/6/2002	18/6/2003	
4.	Kenya			27/5/2003
5.	Madagascar	30/10/2002	13/3/2006	
6.	Rwanda	No info	No info	No info
7.	Sudan	10/6/2002	10/6/2002	
8.	Uganda			25/3/2003

14. Capacity-building and upgrading requirements and priority

List of potential areas and activities of priority for support were determined based on the analysis of the metadata collected through the national PGR program leaders. The capacity building and upgrading needs were grouped under two headings – regional level and country levels. These needs are over and above the support that countries are receiving through the network.

Table 5: Priority upgrading/Capacity building needs at regional and country levels

Area	Upgrading/ capacity building activity	Priority/ Comments
<i>Regional level</i>		
Safety backup collections	Infrastructure rehabilitation/expansion <ul style="list-style-type: none"> ▪ <i>In vitro</i> conservation of banana collections in Uganda ▪ Safety duplication of sorghum collections in Sudan 	1
Regeneration / multiplication	Support regeneration/seed multiplication for contributing to safety duplication and regional base collections. See Annex for details	2
Documentation / information sharing	<ol style="list-style-type: none"> 1. Establish a centralized regional germplasm data storage, handling and processing system at the EAPGREN Secretariat 2. Creating information sharing network between member countries and EAPGREN Secretariat 	3
Training	Support regional training programmes through collaboration institutions included in brackets: <ol style="list-style-type: none"> 1. Molecular characterization (BECA, Nairobi) 2. Basic PGR activities (IBC, Ethiopia; NGBK, Kenya) 3. <i>In vitro</i> conservation techniques (IRAZ, Burundi; NARO, Uganda) 4. Plant quarantine (KEPHIS, Kenya) 5. Data analysis (BIOVERSITY-SSA, Kenya) 6. Policy training (GRPI and ECAPAPA) 	4
Distribution / links to users	Promote use of elite germplasm through field days, demonstration plots etc. in collaboration with crop networks and extension services	5
Regional base collections –	Infrastructure rehabilitation/expansion at designated centers <ul style="list-style-type: none"> ▪ <i>In vitro conservation of R&T crops</i> ▪ <i>Seed collections (one or two centres as identified)</i> 	6
Characterization / evaluation	Develop and validate regional core collections for sorghum, finger millet, pearl millet, banana, cassava, beans and sweet potato	7
Collecting	<ol style="list-style-type: none"> 1. Planning meeting to identify cross-border collecting 2. Organize exploration and collecting missions 3. Targeted collection of Annex 1 crops to fill gaps from centres of origin (e.g. eggplant in Sudan) 	8
Indigenous knowledge	<ol style="list-style-type: none"> 1. Documentation of IK 2. Dissemination of IK through publications and other appropriate media 	9
Research	Develop and implement joint research plans to improve conservation and management of problem species/accessions	10

Area Country level	Upgrading/ capacity building activity	Priority/ Comments
Regeneration	<p>Clear backlogs in regeneration of important collections</p> <ul style="list-style-type: none"> ▪ <i>Ethiopia – Sorghum (3700), Faba bean (390), Brassica (330)</i> ▪ <i>Eritrea – Wheat (910), Barley (940)</i> ▪ <i>Kenya – Finger millet (1460), Cowpea (760), Pigeonpea (640), Forage legumes (1480), Forage grasses (460)</i> ▪ <i>Madagascar – Rice (6300)</i> ▪ <i>Sudan – Sorghum (980), pearl millet (310)</i> 	1 (in order of crops - Sorghum, finger millet, rice, wheat, pearl millet, cowpea, pigeonpea, barley, Phaseolus, faba bean, maize, brassica, forage legumes and forage grasses)
Characterization	<p>Clear backlogs in characterization of priority collections (number of accessions in parenthesis)</p> <ul style="list-style-type: none"> ▪ <i>Burundi – Banana (160)</i> ▪ <i>Ethiopia – Sorghum (2800), wheat (7500), finger millet (900), barley (2800), brassica (1100), faba bean (2070), chickpea (350), lentil (480), pea (580), lupins (490)</i> ▪ <i>Eritrea – Wheat (590)</i> ▪ <i>Kenya – Sorghum (3400), rice (522), finger millet (1100), pigeonpea (1190), cowpea (980), Phaseolus (2500), maize (200), forage legumes (1200), forage grasses (460)</i> ▪ <i>Madagascar – Rice (4725)</i> ▪ <i>Rwanda – Cassava (150), Phaseolus (1750)</i> ▪ <i>Sudan – Pearl millet (320)</i> ▪ <i>Uganda – Sweet potato (360)</i> 	2 (in order of crops - sorghum, wheat, rice, finger millet, barley, pearl millet, pigeonpea, cowpea, sweet potato, brassica spp. Faba bean, Phaseolus, maize, banana, cassava, chickpea, lentil, pea, forage legumes, forage grasses)
Equipment (listed in order of priority)	<ul style="list-style-type: none"> ▪ Strengthen regeneration capacity <ul style="list-style-type: none"> ▪ <i>Burundi (Greenhouse to acclimatize in vitro cultures)</i> ▪ <i>Ethiopia (Greenhouses/Glasshouses to regenerate critical accessions)</i> ▪ Strengthen seed processing capacity <ul style="list-style-type: none"> ▪ <i>Sudan (germinator)</i> ▪ <i>Kenya (Seed health testing).</i> ▪ Strengthen conservation capacity <ul style="list-style-type: none"> ▪ <i>Madagascar (freezers and drying facilities)</i> ▪ Strengthen documentation capacity <ul style="list-style-type: none"> ▪ <i>Ethiopia (additional Computers)</i> ▪ <i>Kenya (additional Computers)</i> ▪ <i>Madagascar (additional Computers)</i> 	3
Documentation	<p>Improve data quality and availability in collections with low percentage of passport data</p> <ul style="list-style-type: none"> ▪ <i>Ethiopia (sorghum, wheat, barley)</i> ▪ <i>Kenya (forages)</i> ▪ <i>Madagascar (rice)</i> ▪ <i>Uganda (Sweet potato, cassava)</i> 	4

15. Additional comments

15.1 General consideration

The EAPGREN countries are endowed with a great wealth of plant genetic resources and biodiversity. For example, the Ethiopian/Eritrean highland is a centre of origin and diversity of important crops such as wheat, barley, finger millet, brassicas, etc while the Somali-Masai area is known for its rich diversity of forage species which are not only useful to the region but also to the rest of the world for global food security. The PGR status analysis of region and the regional strategy development process under-scored the importance of the region in terms of the crops included in Annex I of the ITPGRFA. However, this great wealth of PGR indigenous to the sub-region has not been fully explored, are under-exploited, and highly vulnerable to genetic erosion.

In the last two decades, however, attempts mainly at the national level have been made in mobilizing resources and networking to more effectively address PGR related issues in the region. While these initiatives provide an important base upon which to build collaboration and networking in the region, they do not go far enough to ensure that plant genetic resources of the whole region are sustainably conserved and utilized. In recent years, the resources allocated for *ex situ* conservation have been observed to be shrinking.

In an effort to address the challenges, EAPGREN was established through the financial support from Sida to provide capacity building and networking support to network member countries. This project needs other complementary initiatives to further support the conservation and use of *ex situ* collection of the region

15.2 Specific areas of interventions

Characterization/Evaluation for enhanced utilization of germplasm

Value addition to germplasm collections is crucial in the promotion of utilization by breeders, researchers, local communities, farmers, etc. This activity needs to be supported to stimulate the utilization of the resources and contribute to food production and economic growth. To facilitate this, it is important that information is generated regarding their value, well packaged and disseminated to breeders, researchers and other users.

Characterization and regeneration of existing collections can be done simultaneously and selected specific trait such as diseases resistance, drought tolerance identified and recorded. Molecular characterization will be used to assist in the identification and removal of duplicates.

Germplasm movement and health

As a standard requirement, all countries require some level of monitoring and control of the movement of plant material across their borders. International quarantine standards for the movement of plant materials require that the materials are free from quarantinable diseases and pests. Individual national governments depending on their endemic disease prevalence have differing quarantine requirements. In their quarantine declarations, the countries must assert that the materials are free from specific diseases.

In order to facilitate germplasm movement and exchange in the region, the establishment or strengthening of existing quarantine facility may need to be considered with a view to effectively and efficiently contribute to germplasm movement and at the same time minimize the risk of spreading plant diseases in the region.

In-vitro conservation

The conservation of vegetatively propagated plants germplasm such as banana, cassava and potato pose considerable challenges. The application of *in vitro* methods or the use of cryopreservation provides alternative methods. The regional strategy identifies the need for capacity building of these alternative methods to address the conservation and sustainable use of the material in question.

Storage facilities/ safety duplications

The safety of conserved germplasm collections depends on the reliability of conservation facilities and also the level of duplication. However, not all countries are at the same level in terms of meeting their medium- to long-term conservation requirements. This strategy recommends collaboration between member countries on the basis of comparative strengths as one of the guiding principles to address this issue. Strengthening of the important regional collection holders and the promotion of safety duplication of the collections in other genebanks are needed to ensure the security of germplasm. Member countries agreed to render to each other this important service but some are too constrained for available space to equitably accept or store other regional collections on long-term basis. Support of this component of the strategy will facilitate the strong national programmes to avail space in their respective storage facilities to assist other national programmes to meet the long-term germplasm conservation and safety requirements.

Documentation & Information networking

Although the importance of plant genetic resources documentation is highly acknowledged by the national programmes, the EAPGREN baseline survey undertaken in 2004 indicated that it is probably the least implemented plant genetic resources activity in the sub-region. The implementation of the plant genetic resources documentation activity in the sub-region as a whole is greatly hampered by a wide range of constraints ranging from lack of appropriate equipment (hardware), management system (software), trained staff and standard formats. This generally makes the activity difficult to implement efficiently and the access of information which is crucial for germplasm utilization becomes very difficult. Addressing these challenges includes intervening and providing solutions in major problem areas especially in GR documentation, data management, access, sharing and exchange of genetic resources information and technical expertise within the region. The development of infrastructure and skills, the promotion and use of an integrated management system accompanied with mechanism for information sharing will provide an appropriate route for the enhanced germplasm utilization.

Non-Annex I crops

This strategy addresses itself to the Annex I crops of the ITPGRFA. Other equally important crop species which are of great regional and global importance occur in the region. Center of diversity for some of these species such as *Lathyrus*, okra, *Capsicum*, *water melon*, *Eragrostis tef*, etc (please see table below) are in the eastern Africa sub-region. These species are in most cases under-collected and there are wide gaps that need adequate attentions. The regional strategy becomes more complete when these other crop species are taken into consideration without which responding to the millennium development goals becomes illusive.

Table 6: Important non-Annex I crops

Species	Accessions	Country
Capsicum	249	Ethiopia
Carthamus	212	Ethiopia
Coriander	113	Ethiopia
Ensette	301	Ethiopia
Eragrostis	4675	Ethiopia
Eragrostis	105	Eritrea
Gouzotia	1178	Ethiopia
Linum	3433	Ethiopia
Melon	186	Sudan
Okra	366	Sudan
Rhcinus	448	Ethiopia
Sesamum	2469	Kenya
Sesamum	624	Ethiopia
Sesamum	194	Sudan
Trigonella	542	Ethiopia
Water melon	301	Sudan

Annex 1: National Crop Collections Ranking by Value, Quality and Threat

Importance	Threat	Quality
<ul style="list-style-type: none"> ▪ Diversity ▪ Size ▪ Landraces ▪ Wild spp ▪ Indigenous ▪ Useful traits 	<ul style="list-style-type: none"> ▪ Regeneration needs ▪ Safety duplication ▪ Reliable power supply ▪ Backup generator ▪ Human & Financial resources ▪ Govt. Commitment (Financial res.) 	<ul style="list-style-type: none"> ▪ Passport data ▪ Characterization data ▪ Evaluation data ▪ Regeneration method

Crop	Country	Value	Quality	Threat
Sorghum	Burundi (300)	6	4	6
	Ethiopia (9772)	1	2	1
	Sudan (3912)	2	3	5
	Eritrea (534)	4	6	3
	Kenya (5744)	3	1	2
	Rwanda (300)	5	5	4
	Millet, finger	Ethiopia (1831)	1	2
Eritrea (120)		4	3	2
Uganda (182)		3	4	4
Kenya (2927)		2	1	1
Millet, pearl	Sudan (716)	1	1	1
	Eritrea (200)	3	3	2
	Ethiopia (156)	2	3	4
	Kenya (491)	4	2	3
Wheat	Ethiopia (13328)	1	1	2
	Eritrea (913)	2	2	1
	Rwanda (150)	4	4	2
	Kenya (323)	3	3	2
Banana	Rwanda (99)	2	1	2
	Uganda (253)	2	3	4
	Sudan (402)	4	4	3
	Burundi (234)	1	2	1
Sweet potato	Uganda (150)	1	1	2
	Rwanda (135)	2	2	1
Cassava	Uganda (300)	1	1	1
Rice	Kenya (1066)	2	2	4
	Burundi (215)	4	4	2
	Rwanda (900)	3	3	3
	Madagascar (6300)	1	1	1
Yam	Ethiopia (48)			
Cowpea	Kenya (1518)	1	2	1

Crop	Country	Value	Quality	Threat
	Madagascar (161)	2	1	2
	Sudan (128)	3	3	3
Pigeon pea	Kenya (1281)	1	1	1
Barley	Ethiopia (15357)	1	1	2
	Eritrea (856)	2	2	1
<i>Brassica</i> spp.	Ethiopia (1410)	1	2	2
	Kenya (170)	2	1	1
Faba bean	Ethiopia (2072)	1	1	2
	Eritrea (173)	2	2	1
	Kenya (154)	3	3	3
Maize	Kenya (1655)	1	1	2
	Ethiopia (1181)	2	2	3
	Eritrea (193)	3	3	1
Phaseolus	Kenya (3368)	1	1	3
	Ethiopia (454)	3	3	4
	Rwanda (1960)	2	2	1
	Madagascar(367)	4	4	2
Chickpea	Ethiopia (1156)			
Potato	Not reported			
Lentil	Ethiopia (642)			
Pea	Ethiopia (1753)			
Forage legumes	Kenya (1478)			
	Trifolium (569)			
	Medicago (513)			
	Lupins (102)			
	Ethiopia (914)			
	Lathyrus (588)			
	Lupins (294)			
Forage grasses	Kenya (465)			

Annex 2: List of EAPGREN Steering Committee

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Annex 3. Provisional Terms of Reference for safety back-up holders

The aim of establishing safety back-up holders is to conserve and guarantee safe preservation of crop and wild plant genetic resources determined through the regional strategy from any accidental losses either from man-made or natural calamities.

The safety back-up holder shall be established by the national Government with assistance from the EAPGREN and the Trust and other sources.

The functions of the holder of the safety back up will be at regional level to hold the back-up collection of the member countries for the specie agreed upon by the Regional Steering Committee of EAPGREN;

Each EAPGREN Member country will make available its plant genetic resources according to its policies, regulations and national legislation.

The holder of safety back-up will not distribute plant genetic resources, as its role is to maintain the safety-back up collections. The safety back –up collection is not for distribution. Financial support for safety back-up holders shall be derived from national government contributions, donor organizations and the Trust.

Other issues to be considered in the future:

- Modalities of material transfer (Material Transfer Agreements -MTAs) – obligations of providers and recipients
- Financial issues in management of safety backup collections
- HR issues in management of safety backup collections
- Capacity issues for management of safety backup collections

Acronyms

ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
Bioversity	Bioversity International
CD	Committee of Directors
EAPGREN	Eastern African Plant Genetic Resources Network
FAO	United Nations Food and Agriculture Organisation
GR	Genetic Resources
GRPI	Genetic Resources Policy Initiative
IARCs	International Agricultural Research Centers
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
MTA	Material Transfer Agreement
NARS	National Agricultural Research Systems
NGB	Nordic Genebank
PGR	Plant genetic resources
PGRFA	Plant genetic resources for food and agriculture
RSC	Regional Steering Committee
Sida	Swedish International Development Cooperation Agency
SPGRC	SADC Plant Genetic Resources Center
Trust	Global Crop Diversity Trust