AFRICAN UNION
INTERAFRICAN BUREAU FOR ANIMAL RESOURCES

Regional Animal Genebanks for Africa:

A strategy to ensure the sustainability and efficient maintenance of important animal genetic resources

Why Animal Gene Banks?

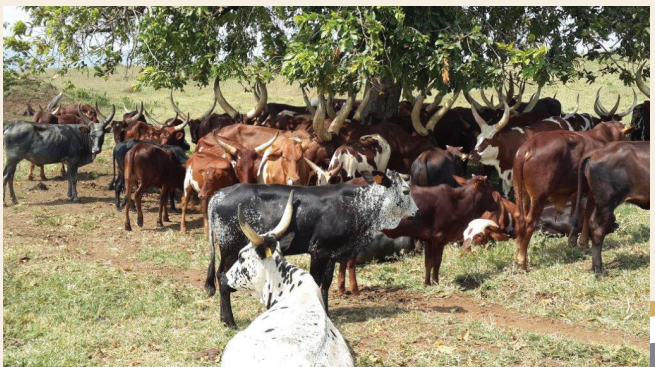
Animal genetic resources for food and agriculture are essential for Africa's food security, and contribute to the livelihoods of millions of people. Recognizing the importance of gene banking in the conservation of animal genetic resources, governments and the international community have agreed, through *the Global Plan of Action (GPA) for Animal Genetic Resources*, on the need for concerted and collaborative action at regional and continental levels.

Animal genebanks provide storage facilities for germplasm (a collection of genetic resources for an organism), albeit with different objectives and involvement of stakeholders and institutional frameworks. Sustainable conservation of animal genetic resources depends on effective and efficient management of genebanks through the application of standards and procedures that ensure the continued survival and availability of these resources. A genebank should not be regarded only as a repository

for safe keeping of material. Ease of access to animal germplasm and information is just as important as genebanks are about sharing of genetic materials.

The Global Plan of Action for Animal Genetic Resources underlines the importance of animal genetic resources for the development of livestock production to meet future challenges. The Strategic Priority 10 of the GPA highlights the need to establish national conservation policies, and establish or strengthen in situ and ex situ national conservation programmes.

The conservation of animal genetic resources in Africa is based upon two complementary approaches, in situ and ex situ conservation. In situ conservation entails the active breeding of animal populations for food and agricultural production in such a way that genetic diversity is optimally utilized in the short term and maintained for the longer term. Activities that support in situ conservation include performance recording schemes, development of breeding programmes and management of genetic diversity within animal populations. In situ conservation also includes steps taken to ensure the sustainable management of ecosystems used for agriculture and food production. Ex situ conservation is carried out through the long-term storage of semen, which is a relatively simple and cheap method for preserving genetic variation (genetic differences both within and among populations). Another method of ex situ conservation is through embryo and tissue culture for the conservation of entire genotypes (the sum total of genes transmitted from parent to offspring), including for critically endangered local breeds. There are differences between countries on how ex-situ conservation schemes are organized.



Reasons for Creating Genebanks for Africa

Most indigenous livestock conservation projects are guided by socio-economic factors under the existing production systems. The conservation of animal genetic resources can be achieved through an integrated approach balancing in situ and ex situ conservation strategies. In situ conservation approaches are preferable where maintenance and management of the animal genetic resources is the best available livelihood option for the farmers involved. However, in vitro conservation (freezing of embryos, semen, oocytes, somatic cells or tissues) is urgently required to provide a secure back-up for animal genetic resources. This serves to protect against various threats that can drive animal genetic resources to extinction faster than monitoring can identify the threat and faster than alternative conservation approaches can respond to them.

Africa has a wide base of animal species and livestock breeds consisting of indigenous breeds, adapted exotic breeds and breeds introduced for commercial production. However, the threatened status of these

indigenous breeds requires urgent attention and development of conservation strategies (both in situ and ex situ). These valuable indigenous breeds need to be conserved through cryopreservation technology (a process where cells, tissues, or any other substances are preserved by cooling to sub-zero temperatures) for the purpose of maintaining gene pool diversity, restoring breeding-lines, global trading in genes and for the rescue of rare and endangered breeds for future breeding programmes.

The AU-IBAR strategy

The African Union Inter-African Bureau for Animal Resources (AU-IBAR) is developing a strategy for the use of animal resources genebanks so as to ensure the sustainability and efficient maintenance of important animal genetic resources. This strategy is largely based on providing a platform to Member States and regional economic communities (RECs) to address animal genetic resources conservation issues. The activities will include supporting institutions that hold collections which are threatened, while paying special attention to facilitating the use of conserved animal genetic resources germplasm, sharing information, knowledge and expertise, addressing socio-economic and cultural aspects, as well as collaborating with other organizations and institutions on the management of animal genetic resources. The strategy focuses on the establishment of regional genebanks in each of the five African Union regions namely South, North, East, West and Central Africa, and conserving animal genetic resources germplasm in each regional genebank to which country members will be contributing. Further, a network of genebanks will be established to serve as a coordinating mechanism to promote conservation and exchange of animal genetic materials.

The Case for Regional Animal Genebanks

The regional approach to organizing conservation of animal genetic resources across countries shows a clear advantage in that regional animal genebanks could play several key roles namely: i) provide cryo-conservation facilities for countries lacking national genebanks; ii) provide back-up storage for national genebanks (i.e. a second location for security purposes); and iii) store material from trans-boundary breeds. Regional animal genebanks could provide a uniform methodology for identification and evaluation of breeds to be preserved. They would also be ideal for the collection, freezing, shipping and storage of germplasm; and the long term care, documentation and security of the samples.

The key steps required in a programme to establish regional animal genebanks across Africa will include:

- inventory and characterization of livestock populations with special attention to indigenous types
- identification of priorities and mobilization of resources in support of conservation

- development and support of genebanks for threatened populations
- development and maintenance of genebanks
- evaluation and utilization of diverse genotypes, including those imported from other countries
- collaboration with other national and international programmes.

Whereas plant genetic resources conservation strongly depends on a multi-lateral system of international seed banks (including security backups), such a framework for international collaboration in conservation for animal genetic resources, does not yet exist. International genebanks for animal genetic resources are practically non-existent in Africa. However, support for such banks is fast growing. Regional animal genebanks with several centres holding split samples would be ideal owing to the advantages of low cost and long term security. Indeed, several fora have recommended the development of regional animal genebanks in Africa. Such genebanks will invariably include the movement of animal genetic resources across borders and possibly changes in ownership. Countries will therefore be required to have Material Transfer Agreements. Legal agreements would enable countries to place genetic material collections in these genebanks without compromising access, control or ownership of the materials and allow equitable sharing of benefits. Some cross-border collaboration and agreements on animal genetic resources that already exist in different regions of the continent could be exploited. Regional animal genebanks will be well placed to serve the interests of the smaller countries with limited national resources that may not be able to support national animal genebanks. This regional approach will contribute to increasing cost-efficiency and reducing duplications between national genebanks.

Animal Genebank Locations - Physical and Virtual

Networks of "virtual genebanks" have great potential to assemble animal genetic resources, provide sufficient capacity, and transfer material with applicable international legal agreements. Being part of such an international network could be effective and efficient for the different countries and regions, as this network could provide security for the germplasm as well as ensure their legally controlled and accurately monitored distribution. In its coordinating role, the virtual network could locate, document, evaluate, describe and exchange collections, and improve communications and training. By joining regional genebanks and regional and international networks, African countries stand to benefit from collective evaluation, sharing, secure conservation of germplam and funding which they cannot achieve with their own resources.

Potential Locations of Regional Animal Genebanks in Africa

Assessments conducted across the African continent have identified several promising initiatives, in each region, that were recommended to serve as regional animal genebanks. The proposed locations of the animal genebanks in the different regions are:

- In West Africa (Bobo Dioulasso, Burkina

Faso): the Centre international de recherche-développement sur l'élevage en zone sub-humide (CIRDES).

- In Southern Africa (Gaborone, Botswana): the Gene Bank for Animal Genetic Resources at the Department of Agricultural Research (DAR).
- In Eastern Africa (Entebbe, Uganda): the National Animal Genetic Resource Centre and Data Bank (NAGRIC & DB).
- In Central Africa (Bambui, Cameroun): the Centre Régional de Recherche Agricole de Bambui-Mankon.
- For North Africa, a future mission will advise on the facility that should be selected to serve the purpose.
- A separate animal gene bank that will serve the needs of a backup to provide security against accidental loss will be under the Mandate of the African Union Commission and will be established at the African Union Pan African Veterinary Vaccine Centre (AU-PANVAC). AU-PANVAC will serve as the Laboratory for the African Union Commission and will hold samples of each region, thus providing for an African ownership and security against accidental loss.

Creating an African Animal Network of Genebanks

Considering the limited number of operating animal genebanks, the high costs of establishing and running them, and the lack of technical expertise and resources, another option for creating the African Animal Network of Genebanks could be an approach based on the European Network of Genebanks model. This would be a Virtual Genebank that operates as a network of already existing genebanks (in situ/ex situ national or regional conservation initiatives). Such a system would facilitate access to animal genetic resources for members of the Network. The main elements proposed for establishing the Network are:

- Creating a national expert group, with the broad involvement of all stakeholders
- Establishing a strong linkage between the networks and the national programmes
- Ensuring coordination at all stages of meetings: preparation before participation, analysis of results and when proposing recommendations. Exchange of information is key, to be conveyed through meetings, email, Internet and Intranet.

The African Animal Network of Genebanks will contribute to the conservation and sustainable use of animal genetic resources in Africa, by promoting cooperation between genebanks, thus using synergies. Participating countries within the different regions would be responsible for the overall management of their genebanks. The shared aspects may include technical requirements and standards, software and database.

Linking Gene Banks with Data Banks for Efficient Documentation

An important lesson from experiences with the plant genetic resources genebanks

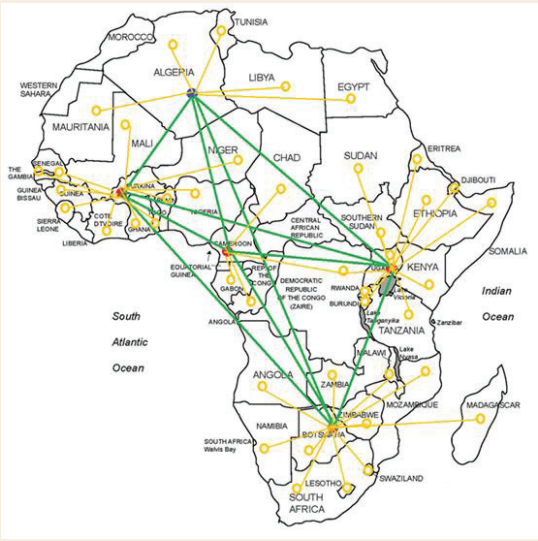
is that good documentation and good organization are critical. Otherwise, the task of accessing accumulated materials of which little is known regarding genetic characteristics or environmental background becomes formidable, and genebanks remain underutilized. Passport and pedigree information should be recorded at the time of collection by technicians from national institutions. Regional institutions play an important role in developing standard descriptions and enabling agreement on the minimal set of essential information recorded. Standard procedures will facilitate the use of genebanks over time. Design and management of data banks should be done in harmony with genebanks to ensure that essential data are available. This implies that the same institutional infrastructure supports both data and genebanks. Data banks not associated with genebanks or active populations can contribute to historical studies but not much more.

Challenges of the Policy and Regulatory Context of the Genebanks

Among the factors contributing to the paucity of multi-country animal genebanks are lack of funding, regulations on international exchange of genetic material and a lack of consensus on procedures for the operation of genebanks. Because trans-boundary animal breeds are targeted in the activity, coordination between countries is required. This means having discussions with the countries and institutions in the regions both to inform them and identify those who may want to store semen and/or embryos of their endangered trans-boundary breeds in the regional genebanks.

Although regional animal genebanks could be a viable approach to conserving animal genetic resources in Africa, this would need lengthy and difficult negotiations. Cooperation between countries should be facilitated if national genebanks operate under internationally agreed legal protocols (Nagoya Protocol). All the signatory countries of the Convention on Biological Diversity should ensure that any international transfer of animal genetic resources is consistent with the terms of the Nagoya Protocol on Access and Benefit-Sharing. The Nagoya Protocol recognizes the importance of genetic resources for food and agriculture and their special role for food security (Article 8). The regional animal genebanks should be located in national facilities and be supplemented with the necessary equipment, training and supplies. Animal health protocols also serve to ensure that animal diseases are not spread via regional animal genebanks, and that accurate comprehensive records of the

Potential locations of genebanks in Africa



health status of the animals from which the samples are taken are kept. Legal protocols will ensure that the samples in a regional animal genebank remain in the ownership of the country of origin with provision made for appropriate access by interested parties presenting valid claims for its use. Users will also be expected to replenish the genebank when possible with semen or embryos from the regenerated animals.

Ownership and Access

Difficult questions arise concerning the ownership of local breeds distributed across the borders, common lands and nations. Who has the right of approval (and under what circumstances) for collection, preservation and distribution? If payments are made, who should receive them - the farmer from whose farms collections were made, the national treasury in the country of origin, the programme which collected and stored the materials, or those who funded the programme? It is expected that the protocols will include aspects such as the payments for the value of the samples or the animals, and ownership of the samples that will remain with the country of origin. The FAO Guidelines for cryo-conservation of animal genetic resources will inform the development of common technical standards for operation of the animal genebanks. The most difficult issues confronting conservation efforts are likely to be the question of who has access and for what purposes. These issues have highlighted the sometimes conflicting interests of private and public sector institutions. Nor is it apparent that the rights of livestock breeders and farmers always coincide.

Important Issues to Consider when Setting up Regional Genebanks

To gain wide support for conservation efforts, national programmes must facilitate collaboration among governmental research and extension agencies, non-governmental organizations (NGOs) and the private for-profit sector. Programmes will involve both technical and policy elements. Successful collaboration among diverse interests will need careful coordination.

Some important issues to consider when planning to develop, strengthen and support the proposed regional genebanks facilities are:

- Conservation efforts must be well planned to achieve the desired outcomes and efficient use of scarce human and financial resources. The plans will also provide an essential framework to coordinate actions among the diverse organizations, agencies and institutions.
- The most pressing need is to develop policy and guidelines for cryopreserved animal genetic resources where material is held in regional genebanks. Similar needs will arise if live animal populations are maintained outside their country of origin at the request of that country. In other situations, animal genetic resources are already exchanged under a variety of commercial arrangements and existing zoo-sanitary and biosecurity regulations,

and as such there is no consensus on the need for new arrangements to regulate exchange and trade in animal genetic resources.

- The various methods of conservation are complementary, with dynamic interactions among them. There is need to develop a framework that will guide decision-making at national, regional and continental levels on a suitable combination of conservation strategies. The framework should be based on the severity and speed of the threats to animal genetic resources, the value of the animal genetic resources and the capacity for action.
- Capacity development is needed for cryopreservation, including the development of human and technical resources. Most of the countries visited have little or no existing capacity for cryopreservation.
- A strong network is essential for the success of a continental conservation effort. Training is needed for national scientists, administrators and other stakeholders to have the capacity to operate and manage national fully functional animal genetic resources programmes with a national recording system. Further development of animal genetic resource data and information systems is of high priority for many countries, in order to enable analysis of population trends and support management of conservation programmes at the national level.

The Way Forward

The resources to be contributed by each participating country to the Regional Animal Genebanks will include staff that will identify endangered breeds and collect and ship semen and embryos to the regional genebanks. Other contributions of the countries operating the regional centres will be laboratories for handling the samples, physical facilities for housing the storage containers and provision of staff and office facilities for recording systems.

It is expected that the special equipment needed for operating an animal gene bank, such as liquid nitrogen plant and storage and shipping containers, will be provided under the AU-IBAR Genetics Project. The operation of the regional animal genebanks during the project implementation years, during which most of the currently endangered breeds will be collected, is expected to be supported financially by the Genetics Project. Eventually, the cooperating countries in the region will take over the genebanks when the project phases out.

AnGR
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