

**European Gene Bank Network for Animal Genetic Resources (EUGENA)**

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**ABSTRACT:** European countries have established national gene banks for farm animal genetic resources. This paper describes developments in Europe regarding collaboration in the area of *ex situ in vitro* conservation programs for AnGR. National gene banks collaborate in EUGENA, the European Gene Bank Network for Animal Genetic Resources. The objective of this platform is a rational, efficient, regional, integrated conservation approach in Europe. 25 countries in Europe contributed to a survey to generate an overview of key characteristics of national gene banks, including legal and institutional aspects, history of collections, collection objectives, and documentation. The results of the survey showed similarities and differences between countries. This baseline information will be used for further development of the network of gene banks and for identification of issues for harmonization and collaboration at European level. Keywords: Animal genetic resources, Cryopreservation, Gene bank, *Ex situ in vitro* conservation, Europe

### Introduction

The Convention on Biological Diversity (CBD) in 1992 called on the Parties to take measures to effectively conserve and sustainably use their biological diversity. The provisions of the CBD were addressed specifically for farm animal genetic resources (AnGR) through the Global Plan of Action (GPA) for AnGR (FAO, 2007). The four strategic priority areas of the GPA provide a basis for enhancing the sustainable use, development and conservation of AnGR throughout the world. The GPA underlines the need for *in situ* and *ex situ* conservation strategies. *Ex situ in vitro* conservation of genetic material (cryopreservation) is an important complementary strategy to *in situ* conservation. Guidelines have been developed to support development and operation of national gene banks (FAO, 2012).

The majority of countries in Europe have developed *ex situ in vitro* gene banking strategies (see e.g. Hiemstra et al. 2010 for cattle breeds). In comparison to plant genetic resources, gene banking is relatively new to the livestock sector. Establishment and maintenance of gene bank collections is often perceived as costly, however Silversides et al. (2012) showed that gene banks can collect, hold and store material until needed at a fraction of the costs of maintaining *in situ* lines of poultry. A successful cryopreservation program requires the survival of the germplasm through cryopreservation and thawing procedures to have a high success rate in obtaining offspring that will fully represent the genetic diversity of

donor animals. Different type of genetic material can be stored, including semen, embryos, oocytes, gonadal tissue, primordial germ cells or somatic cells. Technical feasibility and cost-efficiency are important criteria in decision making and may be different between species.

Implementation of the GPA and establishment of national gene banks are national responsibilities, but there are clear advantages of collaboration in Europe, between countries at regional, sub-regional, or bilateral levels. This paper describes the development and state of national gene banks and regional collaboration in Europe.

### Development of EUGENA

At the European level, the European Regional Focal Point on Animal Genetic Resources (ERFP), a platform for collaboration of National Coordinators on AnGR established a Working Group on *Ex situ* Conservation of Animal Genetic Resources (ERFP, 2014). The main tasks of this Working Group are i) to exchange experiences and knowledge between European countries, ii) to support the establishment, further development, efficiency and effectiveness of the European national gene banks for farm animal genetic resources and iii) to jointly develop a European strategy for gene banking, documentation and other related issues.

In 2013 first steps have been taken to officially establish the European Genebank Network for Animal Genetic Resources (EUGENA). EUGENA is the network of gene banks in the European countries with the objective to support the *ex situ* conservation and sustainable use of AnGR in Europe under common terms of agreement. EUGENA is the platform of national gene banks operating under the umbrella of the ERFP at the regional level of Europe. In this context, a national gene bank for AnGR is defined as a repository for *ex situ* conservation and sustainable use of AnGR held by a host institution authorized and/or recognized by a national authority to fulfill these tasks. A gene bank may be constituted by one or more repositories collaborating as a network at the national level.

There are ample opportunities in terms of a more efficient, rational, long term regional integrated conservation approach at the European level. When resources are limited it is important to set priorities and to avoid both gaps and duplications of efforts. Through a regional approach quality standards of national gene banks could be further developed and enhanced. A regional portal or

documentation system should provide easy access to information about national collections.

The objectives of EUGENA are:

- to support gene banks in the European countries to fulfill their individual roles and objectives;
- to improve monitoring and assessment of AnGR kept in *ex situ* collections in European countries by sharing information on gene bank collections;
- to improve gene bank operations and procedures in the European countries by sharing information;
- to use synergies for *ex situ* conservation and sustainable use of AnGR by joint activities of gene banks in the European countries;
- to increase the efficiency of *ex situ* conservation of the genetic diversity of transboundary breeds;
- to promote harmonization of acquisition and access terms for *ex situ* conservation throughout the gene banks in the European countries;
- to facilitate a quality improvement in *ex situ* collections of the gene banks in the European countries;
- to create an element of the European research infrastructure for the conservation and sustainable use of AnGR;
- to facilitate a European approach for international cooperation and exchange of AnGR in the context of the Nagoya Protocol for Access and Benefit Sharing.

These objectives are also in line with AEGIS (ECPGR, 2008), the integrated gene bank system for Plant Genetic Resources in Europe.

### European national gene bank survey

25 European countries contributed to the ERFIP survey, collecting information about national gene banks across Europe. The survey contained questions about 1) the host institution(s), 2) the legal basis, 3) ownership of the material, 4) governance, 5) history of national gene bank, 6) gene bank objectives, and 7) documentation. Generating the overview was an important first step to facilitate further development of EUGENA, in order to show similarities and differences between countries and to identify issues for harmonization at the European level.

**Institutional and legal characteristics** Table 1 summarizes the main institutional and legal characteristics of European gene banks. In most of the cases, the host institution is a public or semi-public organization (including Ministry, Executive Agency, Research Institute, University or Genetic Resources Centre). In two countries it is a private organization hosting the gene bank collections. Five countries mentioned a network of different types of host institutions. In some countries, the formal or legal status of national gene bank collections is not fully clear at this point in time. Most common is that the ownership of gene bank collections rests with the host institution(s). National gene banks for AnGR are in most cases governed by a committee or a council that involves the major stakeholders.

**Table 1. Percentage (%) of countries indicating specific institutional and legal characteristics of their national gene banks**

Host institution for gene bank collections	
- public or semi-public institution	72%
- breeding association or AI centre	8%
- network of organizations	20%
Legal basis for national gene bank	
- national/regional law or regulation	38%
- agreement on (research) program	31%
- not mentioned	31%
Ownership of genetic material	
- public or semi-public ownership	56%
- breeding association or AI centre	8%
- provider or depositor	4%
- mixed public-private	32%

### Gene bank objectives and type of collections

Many countries follow the FAO Cryoconservation Guidelines (FAO, 2012) and indicated multiple objectives for the national gene bank. National gene bank collections consist of different collection categories, including ‘historical collections’, ‘core collections’ for long term conservation purposes, and ‘working collections’ for short/medium term use and *in situ* support.

Table 2 shows which species and what type of genetic material is covered by national gene bank collections. National gene banks have extensive semen collections, but also other type of material. Cattle, sheep, goat, pig, horse and chicken semen collections are the dominant species, both in terms of number of breeds and number of donor animals conserved.

**Table 2. Percentage (%) of countries indicating which type of species and which type of material are represented in their national gene bank collections**

Species represented in gene bank collections			
Cattle	92%	Rabbit	8%
Sheep	64%	Duck	8%
Goat	52%	Bee	8%
Horse	60%	Dog	4%
Pig	56%	Goose	4%
Chicken	20%		
Type of genetic material represented in gene banks			
Semen	84%	Ovarian cells/oocytes	20%
Embryos	44%	Gonadal tissue	4%
Embryonic cells	4%	Somatic cells/tissue	20%
DNA/blood	44%		

The majority of national gene banks were officially recognized between 1990 and 2010. Very often first collections were established already one or more decades before the official recognition.

**Documentation of gene bank collections** Nine European countries use the CryoWEB database for documentation of gene bank collections. Other countries

have dedicated national databases for gene bank collections or the information can be found in databases of breeding organizations or AI centers.

In order to integrate the information from national gene bank collections at the European level, the ERFPP decided to develop the European Register of Cryomaterial as part of the EFABISnet. EFABISnet is a regional European network of national AnGR databases, which enables collection, updating and automatic exchange of breeds data, and transfer of these data to the worldwide database of the FAO (DAD-IS).

The data in the European Register will be recorded per year per breed. Each record will include the number of semen, embryos, oocytes, somatic cells and DNA samples from a certain breed available in national gene banks in the respective year, the number of donors represented by each material type, and the total distinct male and female donors represented in the complete gene bank collection in that year.

As the data comes from various sources, a plain text file format was developed for the data input. For the countries using the CryoWEB software (Duchev et al., 2010), a special export tool was developed and implemented. Managers using other gene bank documentation systems have to develop specific to export such file.

At the regional level a set of outputs were developed to visualize and analyze the accumulated data. There is also a search tool, allowing users to extract and order data by various criteria.

#### **Harmonization of procedures and conditions for acquisition and access**

Due to institutional differences national gene banks use different procedures and conditions for acquisition material to be stored in gene banks and for providing access to gene bank material. Further work is needed to get a detailed overview of access and acquisition procedures currently applied in the national gene banks. Acquisition procedures include national objectives and strategies how to establish 'core collections' per breed. Also in the light of implementation of the Nagoya Protocol on Access and Benefit Sharing, there is need for further work towards development of model acquisition and access agreements.

#### **Future perspectives**

National governments are expected to further rationalize their national strategy how to conserve and sustainably use their genetic resources, including national gene bank strategies. Farm animal gene banks are in the process of capturing the still existing genetic diversity, taking into account the ongoing threats and progressing erosion of farm animal genetic diversity. Farm animal gene banks started their coordinated activities only recently, in particular in comparison to plant gene banks. At this moment not all valuable genetic diversity, under custody of breeders and researchers, has been cryopreserved in national gene bank for long term conservation purposes.

Besides complementing and enhancing gene bank collections, there is also a need to promote future use of gene bank collections through better characterization and documentation of collections. Characterization of gene bank collections and other sources of genetic diversity provide opportunities for pre-competitive research through public private partnerships between research organisations, breeding organisations and gene banks.

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