



ERFP



ANIMAL GENETIC RESOURCES STRATEGY FOR EUROPE

DRAFT

**ANIMAL GENETIC RESOURCES
STRATEGY FOR EUROPE**



ERFP

PREAMBLE

This document presents the first pan-European strategy for the conservation and sustainable use of animal genetic resources (AnGR). The strategy was developed by the European Regional Focal Point for AnGR (ERFP), and aims to streamline the actions to be adopted by the European countries to ensure the long-term availability and use of AnGR.

In 2007, the international community adopted the FAO's Global Plan of Action (GPA) for AnGR as the first international framework for the management of AnGR. The main responsibility for implementing the GPA's strategic priorities lies with national governments, although some of these priorities would also benefit from a regional approach. For EU countries, several AnGR-related legal acts and policies have been issued by the EU, but an integrated strategy for the management of AnGR in the European region has so far been lacking.

This need is addressed by the H2020 project GenResBridge, which aims to strengthen the conservation and sustainable use of plant, forest and animal genetic resources in the European region. One of the project's main objectives is to formulate a European Genetic Resources Strategy (EGRS) under the auspices of the three pan-European genetic resource networks: ECPGR (plants), EUFORGEN (forests) and ERFP (animals).

However, the EGRS takes an integrated, cross-sectoral approach to genetic resource management, without too much detail about each of the three distinctly different domains. Following a proposal by the EGRS project consortium, the ERFP decided to develop a domain-oriented strategy to additionally address the specific challenges associated with the conservation and sustainable use of AnGR and the need for stakeholder involvement. This European Strategy for AnGR is thus complementary to and in line with the EGRS.

This strategy is a joint effort of the ERFP network. It was developed with support from the ERFP Steering Committee and ERFP working group experts, and revised and approved by the national coordinators with the aim of facilitating the implementation of the GPA in the countries of the European region. The strategy is in keeping with the priorities of the GPA and the European policy framework. It also presents a set of Key recommendations.

We hope that this strategy will contribute to minimizing the loss of livestock genetic diversity and thereby ensure the sustainability and resilience of the European livestock sector.



Montserrat Castellanos Moncho
Chair of the ERFP Steering Committee

Contents

<i>Animal Genetic Resources Strategy for Europe</i>	2
<i>THE NEED FOR URGENT ACTION</i>	9
<i>CONSERVATION AND SUSTAINABLE USE OF AnGR</i>	12
2.1 Monitoring, characterization and performance recording	12
2.1.1 Information infrastructure for monitoring of AnGR.....	12
2.1.2 Characterization and performance recording	14
2.2 Sustainable use and genetic improvement of AnGR	16
2.3 Conservation of AnGR	18
2.3.1 In situ conservation of AnGR.....	19
2.3.2 Ex situ conservation of AnGR	21
<i>POLICIES, INSTITUTIONS AND CAPACITY BUILDING</i>	27
3.1 Policy and legal framework	27
3.1.1 European positions in global fora	28
3.1.2 Integration with EU policies	28
3.1.3 Novel European infrastructure	32
3.2 Actors, stakeholders and institutions	33
3.2.1 A diversity of private and public stakeholders.....	33
3.2.2 The ERF network and international cooperation	34
3.3 Education and awareness raising	35
3.4 Long term funding of the strategy	37
<i>ACKNOWLEDGEMENTS</i>	39

SUMMARY

Need for urgent action

Animal genetic resources (AnGR) include all livestock species, breeds and strains that are of economic, environmental, scientific and cultural interest to agriculture. Preserving the diversity of these resources is essential for ensuring sustainable livestock development, rural livelihoods, environmental stewardship and food security. Furthermore, AnGR are the genetic base for the livestock breeding programs needed to ensure current and future livestock production.

The aim of this strategy is to minimize the loss of livestock genetic diversity, to support breeding, diversification and innovation, and build resilience in the livestock sector.

Conservation and sustainable use of AnGR

Monitoring, characterization and performance recording

Monitoring and characterization are the foundations of sustainable AnGR management. To effectively preserve and sustainably use AnGR, complete national breed inventories need to be established, and subsequently supported by the periodic monitoring of trends and associated risks. Furthermore, policy-makers, breeders and other stakeholders need a good understanding of breed characteristics to make informed decisions about livestock sector development.

Important tools for AnGR documentation and monitoring are the Domestic Animal Diversity Information System (DAD-IS) at the global level, and its European node, the European Farm Animal Biodiversity Information System (EFABIS). Input from the national level to EFABIS is provided by the European National Coordinators. The EUGENA network of gene banks provides public access to data of gene bank collections at European level. However, the interoperability of the various databases is limited.

The strategy recommends several Key recommendations to improve the monitoring and characterization of AnGR in the European region, e.g., that National Coordinators, breeding organisations and gene banks should cooperate to improve the updating of EFABIS. It is also recommended to use available AnGR data to further develop indicators for monitoring the status and trends of AnGR, and to improve the inter-operability of databases used in AnGR management.

Sustainable use and genetic improvement of AnGR

The concept of 'sustainable use' refers to ensuring genetic improvement while at the same time maintaining genetic diversity (within a breeding population). 'Sustainability' thus implies preserving or even increasing the diversity of AnGR. The resulting genetic base is crucial for securing genetic improvement of breeding populations and developing new breeds

or lines. Securing the sustainable use of AnGR should be given high priority in the European region.

A variety of local breeds have characteristics that make them potentially valuable in the growing market of niche products or in the provision of a range of ecosystem and cultural services. However, many of these breeds are currently not sufficiently valued and thus play a minor role in global livestock production. Considering the increasing threats from climate change, biodiversity loss and other environmental challenges, the characteristics of local breeds should be valued accordingly.

The strategy recommends several Key recommendations to ensure the sustainable use and genetic improvement of AnGR, such as continuing to develop sustainable breeding programs for transboundary and local breeds, promoting innovation in breeding and AnGR management and better utilising AnGR to diversify livestock production systems. To promote the use of local breeds, the valuation of ecosystem services needs to be improved, and the incorporation of agro-ecological principles in AnGR management further developed.

Conservation of AnGR

The two main methods used to preserve AnGR are *in situ* and *ex situ* conservation. *In situ* involves the use of livestock in the production system in which the animals evolved or now are kept and bred. *Ex situ* implies that animals are not kept under normal management conditions. This can be either *in vivo*, e.g., as live animals kept in zoological parks, governmental farms, etc., or under cryogenic conditions (*in vitro*). Cryopreservation includes embryos, semen, oocytes, somatic cells or other tissues with the potential to reconstitute live animals in the future. *In situ* and *ex situ* conservation should be used as complementary methods.

In Europe, *in situ* conservation programs are well developed, although the coverage of *in situ* conservation for certain breeds is still incomplete. Taking into account the uncertainty of the future of local breeds, it is important that countries continue to develop *in situ* strategies and strengthen policies and regulations related to AnGR conservation. Successful *in situ* conservation requires a well-designed breeding program with emphasis on maintaining genetic diversity within the breed.

AnGR are conserved *ex situ in vitro* in gene banks. Many countries have established national gene bank collections of AnGR as a backup. However, even for commonly cryopreserved species such as cattle, the collection and documentation of material have typically been developed for international transboundary breeds, and may thus not be optimized for less common local breeds. A development that also needs attention is the ongoing transformation of gene banks into “bio-digital resource centres”.

The strategy recommends several Key recommendations to further develop the conservation of AnGR in Europe. Some of these focus on integrating *in situ* and *ex situ* strategies for long term conservation, e.g., by involving all relevant public and private stakeholders or specifically to ensure the conservation of transboundary breeds. For *in situ* conservation, which is closely linked to sustainable use, the strengthening of European networks is suggested.

For *ex situ* conservation, the strategy recommends to establish an official European inventory of all *ex situ* conservation facilities, stimulate European gene banks to build up core collections and support *in vivo* conservation, and initiate research on new cryoconservation technologies. In terms of the legislative framework for AnGR conservation, the strategy also proposes to develop derogations from national animal health regulations for the storage, use and distribution of gene bank material.

Policies, institutions and capacity building

Implementation of the European strategy for AnGR requires a coherent and coordinated policy and legal framework with commitments and instruments at national and pan-European level. This framework will facilitate and support the necessary actions for better conservation and sustainable use of AnGR.

Such a coordinated policy and legal framework should bring together the institutions and policies to enable a positive environment and promote transformative change to improve the effectiveness and efficiency of the conservation and sustainable use of AnGR, in the context of societally relevant, sustainable and resilient livestock production systems.

The instruments and measures needed to implement policies and to strengthen national and regional programs have to be sufficiently financed. To ensure the long-term funding it's recommendable to explore opportunities for establishing co-funding mechanisms and integrated investment plans.

There is a need to strengthen the necessary institutional and human capacities to enable all involved actors, stakeholders and institutions to meet their obligations and commitments according to their roles and competences. Novel European infrastructures should be established, including the European Reference Centre for AnGR as foreseen in the EU Animal Breeding Regulation.

Strengthening the role of the ERFP network and stronger support and coordination at European level would strengthen Europe's role as a key global player and provide benefits to all the actors.

International cooperation and coordination will facilitate the implementation of the FAO's GPA for AnGR and the achievement of the policy goals for conservation and sustainable use.

At the same time, it is essential to increase education and awareness on the fundamental roles and values of AnGR for society, ecosystems and the livestock sector.

For successful implementation of these actions, it is crucial to benefit from improved collaboration and engagement of all the specific actors in all value chains but also the general public with a communication strategy and creation of alliances.

THE NEED FOR URGENT ACTION

European countries have significant livestock sectors. The dominant livestock species in the region are cattle, pigs, sheep, goats and equines. A century ago, there was still a multitude of European local breeds that were adapted to the diverse production systems found throughout the region. In the second half of the 20th century, professional breeding organisations and the breeding industry in Europe developed innovative breeding programs to produce genetically improved breeding material. These programs have been a great success, as breeding is a substantial factor for the tremendous increase in livestock production efficiency that we have witnessed in those decades, in Europe and worldwide.

However, this success also has its price: many local breeds have been replaced by a few specialized, highly productive transboundary breeds. Additionally, breeds are facing the challenges of low within-breed genetic diversity and inbreeding. This development poses a major threat to the genetic diversity within the livestock sector, as animal genetic resources¹ (AnGR) are the genetic base for the livestock breeding programs needed to ensure current and future livestock production. According to the definition used by the FAO,² the term ‘AnGR’ not only includes the genetic base, but also covers the actual animal species and breeds that are used, or may be used in agriculture. In this strategy, ‘AnGR’ is used in both ways.

According to the FAO,^{3 4} a high proportion of global livestock breeds is at risk of extinction as a consequence of rapid changes in livestock production systems. Numerous threats to AnGR are described in the literature mentioned above, including changes to production systems caused by various socio-economic, political and environmental factors.

AnGR have many different values (genetic, environmental, socio- cultural, economic, scientific and ethical) and contribute to a range of ecosystem services.⁵ AnGR and livestock husbandry are integral parts of ecosystems and productive landscapes throughout the world. The contribution of AnGR to key agro-ecosystem functions such as nutrient cycling, seed dispersal and habitat maintenance is widely acknowledged.^{6 7} AnGR are also an important

¹ FAO website www.fao.org/

² <http://www.fao.org/3/y1100m/y1100m03.htm>

³ CGRFA/WG-AnGR-11/21/Inf.6. Status and trends of animal genetic resources – 2020

⁴ FAO, 2015. The Second Report on the State of the World’s Animal Genetic Resources for Food and Agriculture. FAO Commission on Genetic Resources for Food and Agriculture. Assessments. 2015

⁵ The Millennium Ecosystem Assessment (MEA) distinguished four groups of ecosystem services: provisioning services, regulating and habitat services, supporting services and cultural services. Livestock breeds are on one hand providers of ecosystem services and on the other hand dependent on ecosystem functions.

⁶ FAO, 2007. Global Plan of Action on Animal Genetic Resources. <http://www.fao.org/3/a1404e/a1404e00.pdf>.

⁷ Jackson et al., 2007. Utilizing and conserving agrobiodiversity in agricultural landscapes. Agriculture, Ecosystems and the Environment.

THE NEED FOR URGENT ACTION

part of our cultural heritage, since our farm animals have intrinsic value and unique characteristics that must be preserved.

In many ways, AnGR contribute to livelihoods, food security, rural development, cultural life and environmental management. AnGR can be kept in a wide variety of production environments, including areas in which crops cannot be grown. AnGR are particularly important for their ability to convert feed resources from meadows and pastures, and from by-products of arable production into high-quality human food. Furthermore, livestock also provide other products and services, such as wool, fur, leather, and draught power.

A variety of stakeholders and actors have impact on the use and conservation of AnGR. A distinguishing feature of AnGR (compared to, e.g., forest and crop genetic resources) is that AnGR are mainly privately owned and controlled. However, a long-term perspective on AnGR management requires collaboration between both public and private actors. Complementary strategies are needed to ensure the conservation and sustainable use of AnGR.

Due to the importance and the many roles of AnGR described above, a variety of global and European policies have been adopted. These include legal instruments and formal commitments that aim to ensure the conservation and sustainable use of AnGR. The challenge to secure AnGR for the future makes it even more necessary for the European countries to implement a common strategy.

DRAFT

CONSERVATION AND SUSTAINABLE USE OF ANGR

While many European countries are aware of the importance of AnGR, there is a clear need for better prioritization and coordination of measures to promote the conservation and sustainable use of these resources. Such measures will contribute to the long-term conservation and sustainable use of genetic diversity in livestock species and breeds, and to the transition that is needed in the livestock and agricultural sector towards sustainable, resilient and climate-friendly production systems.

2.1 Monitoring, characterization and performance recording

Monitoring and characterization are the foundations of sustainable AnGR management. The FAO's GPA for AnGR⁸ states that "Understanding the diversity, distribution, basic characteristics, comparative performance and the current status of each country's AnGR is essential for their efficient and sustainable use, development and conservation".

2.1.1 Information infrastructure for monitoring of AnGR

Complete national breed inventories, supported by periodic monitoring of trends and associated risks, are a basic requirement for effective strategies for the conservation and sustainable use of AnGR. Without such information, some breed populations and unique breed characteristics may decline significantly, or even be lost, before measures are taken.

An important tool for AnGR documentation and monitoring is the FAO's Domestic Animal Diversity Information System DAD-IS,⁹ a global database of livestock breed information. The European Farm Animal Biodiversity Information System (EFABIS)¹⁰ is the European information system for AnGR and serves as the source of European breed-related data for DAD-IS.

The National Coordinators¹¹ are responsible for monitoring status and trends of AnGR in their respective countries and regularly updating EFABIS with national data. This role involves

⁸ FAO, 2007. Global Plan of Action on Animal Genetic Resources. <http://www.fao.org/3/a1404e/a1404e00.pdf>.

⁹ Domestic Animal Diversity Information System (DAD-IS). <http://www.fao.org/dad-is/en/>

¹⁰ European Farm Animal Biodiversity Information System (EFABIS). [fao.org/dad-is/regional-national-nodes/efabis/en/](http://www.fao.org/dad-is/regional-national-nodes/efabis/en/)

¹¹ See page 17 in: <http://www.fao.org/3/ba0054e/ba0054e00.pdf>

CONSERVATION AND SUSTAINABLE USE OF ANGR

close cooperation with the breeding organisations, breed societies and gene banks providing the data.

Breed categories reported in EFABIS¹² are local, regional transboundary, and international transboundary breeds. The majority of breeds reported in EFABIS are local breeds. Besides the number of breeding animals per breed, countries are also expected to regularly add aggregated breed-related data of national gene bank collections.

Europe¹³ and North America are the regions with the highest proportions of reported breeds at risk with 53 % and 58 %, respectively. Globally, 28 % of all reported breeds are classified as being at risk.¹⁴

According to EFABIS, the frequency of updating and the degree of completeness vary considerably between European countries (Figure 1). Countries with a degree of data completeness below 20 % rarely provide population data, and thus, AnGR diversity trends cannot be monitored precisely. The national inventories need to be improved, e.g., by enhancing countries' capacities to regularly update and complement data in EFABIS.¹⁵

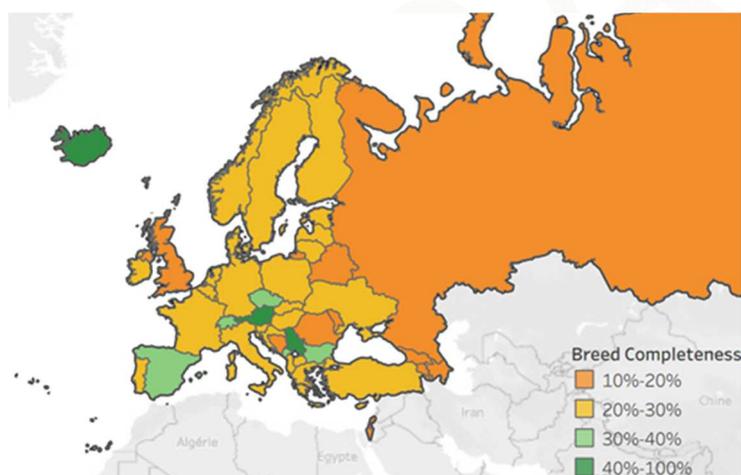


Figure 1: Degree of breed data completeness in EFABIS (EFABIS, footnote 10)

EFABIS also provides the information necessary for reporting on the SDG indicators 2.5.1¹⁶ and 2.5.2¹⁷ of the United Nation's Sustainable Development Goals.

¹² European Farm Animal Biodiversity Information System (EFABIS). fao.org/dad-is/regional-national-nodes/efabis/en/

¹³ Europe including the Caucasus.

¹⁴ European Farm Animal Biodiversity Information System (EFABIS). fao.org/dad-is/regional-national-nodes/efabis/en/

¹⁵ FAO. Detailed analysis of the factors influencing the reporting of information in the domestic animal diversity information system. CGRFA/WG-AnGR-11/21/Inf.7. <http://www.fao.org/3/cb4390en/cb4390en.pdf>

¹⁶ Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities.

¹⁷ Proportion of local breeds classified as being at risk, not-at-risk or at unknown level of risk of extinction.

CONSERVATION AND SUSTAINABLE USE OF ANGR

The analysis of SDG indicators (Figure 2) shows that the cryopreservation status is known for two thirds of local breeds in Europe. Only 133 local breeds have sufficient material to allow reconstitution in case of extinction (3.5 %). For breeds with known risk status, about 85 % of local breeds in Europe are at risk of extinction.

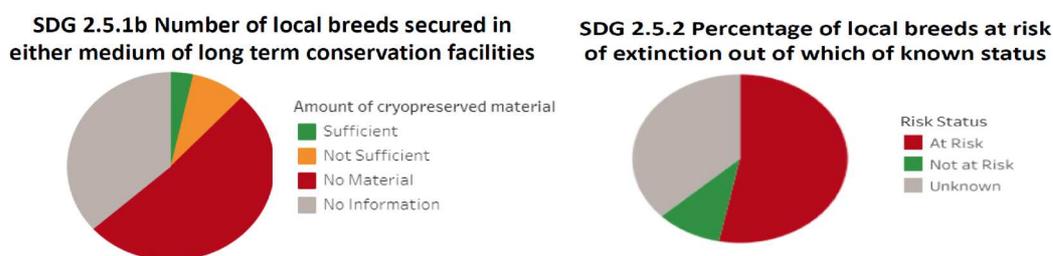


Figure 2: AnGR-related SDG indicators for Europe incl. the Caucasus (source: EFABIS, footnote 16)

The EUGENA network of gene banks (governed by the ERFP) provides public access to (meta) data of gene bank collections at European level. Recently, the Horizon 2020 IMAGE project developed a European data infrastructure for gene bank collections in collaboration with the European Bioinformatics Institute (EBI),¹⁸ which also facilitates access to gene bank samples and breed related genomic data in EBI databases.

The inter-operability of the various databases is limited. For example, the inter-operability between the EFABIS and EUGENA databases needs to be improved, and breed related population and gene bank data should be complemented with other breed/livestock system/location related data.¹⁹ This would enable the different stakeholders to fully explore the potential and value of AnGR, and to better monitor trends and risks.

Beyond these data and information systems, standards and protocols should be mutually compatible to facilitate the sharing of data and information on the status of breeds among countries and regions. This is required to globally monitor the status of breeds, and assist in setting conservation priorities within and beyond the national level, in particular for the development of joint strategies for transboundary breeds.

2.1.2 Characterization and performance recording

A good understanding of breed characteristics is necessary to guide decision-making in livestock sector development and breeding programs.²⁰ The information provided by inventories and trend and risk monitoring is necessary for policy-makers to determine conservation priorities and activities, whereas the results of characterization enable farmers to decide which breed(s) to use under prevailing production and environmental conditions. Comparative analysis of the performance of local and mainstream transboundary breeds – for both production and functional traits – is needed for informed strategic planning and policy development. In the absence of such analysis, local breed development may be ignored

¹⁸ BioSamples. <https://www.ebi.ac.uk/biosamples/>.

¹⁹ Including genomic, phenotypic, production system, location, climate, environmental, and IMAGE data

²⁰ FAO, 2007. The State of the World's Animal Genetic Resources for Food and Agriculture. <http://www.fao.org/3/a1250e/a1250e.pdf>

CONSERVATION AND SUSTAINABLE USE OF ANGR

in favour of the introduction of exotic germplasm. Furthermore, indiscriminate cross-breeding may take place that will result in the erosion of genetic diversity and the loss of local breeds.

There is a need to enhance and coordinate breed characterization research, and to improve the distribution of the results of characterization studies. Characterization, pedigree and performance recording is generally well advanced for mainstream transboundary breeds, but many local breeds lack sufficient pedigree and performance recording for relevant traits. From the perspective of AnGR management, the breeds that are used should be well-matched to their production environments.

The link between AnGR, production systems and agroecosystems is a key point for characterization. The term “production environment” refers to both the natural environment (climate, terrain, etc.), and to socio-economic factors. In this perspective, recording the geographical location and distribution of breeding populations should be considered relevant. For many breeds, phenotypic characteristics – such as degree of adaptation to specific diseases or climate change, or breed performance in specific production environments – have been inadequately studied. The implementation of georeferenced and socio-economic data in EFABIS can support an agroecosystem approach for the management of AnGR.

The development and implementation of sustainable breeding programs require pedigree registration, performance recording and both phenotypic and genomic characterization of individual animals. The availability of pedigree and phenotypic data is necessary to fully explore the potential of advanced technologies, e.g., for the prediction of breeding values for individual animals and genomic selection within-breed. A lack of continued investment in breeding programs, and limited pedigree, phenotypic and genomic characterization, would have a negative impact on the long-term conservation and sustainable use of breeds.

DRAFT RECOMMENDATIONS

for monitoring, characterization and performance recording (2.1):

- Improve the quality and frequency of updating EFABIS through close collaboration between National Coordinators, breeding organisations and gene banks.
- Further develop and implement indicators to monitor the status of, trends in and threats to the conservation and sustainable use of AnGR.
- Improve inter-operability of population and gene bank data with other relevant databases.
- Increase the proportion of inventoried AnGR that are characterized and evaluated using genomic and phenotypic techniques, and – if appropriate – make characterization data publicly available.
- Increase the number of studied traits to strengthen the characterization of livestock breeds, particularly local breeds, in their production environment.

2.2 Sustainable use and genetic improvement of AnGR

The European region considers that strengthening the sustainable use of AnGR should get high priority in the context of implementing the FAO's GPA for AnGR. The term 'sustainable use' primarily refers to ensuring genetic improvement while at the same time maintaining genetic diversity in sustainable breeding programs, as expressed in the phrase "conservation by (sustainable) utilization". Furthermore, there are opportunities to make better use of genetic diversity across and within breeds, through promoting more diversity in livestock production systems and encouraging the transition towards sustainable and resilient livestock systems.

A broad genetic base is relevant for the continued genetic improvement of breeding populations as well as for the development of new breeds or lines. AnGR provide the basis for the breeding and selection of livestock by farmers and breeding organisations. The process of breeding consists of the selection of desired phenotypes or genotypes for particular production environments, under consideration of consumer demands. Due to the selection process, the genetic composition of the breeding population changes over time. This involves a risk of losing genetic diversity. However, sufficiently safeguarding genetic diversity within species and breeds is of key importance. Maintaining genetic diversity is crucial for both numerically small local breeds and more mainstream transboundary breeds. That is why the results of breeding programs in terms of genetic gain and maintenance of genetic diversity should be evaluated regularly. The evaluation of genetic diversity within breeds should be the regular task of countries.

As stated in the EU Animal Breeding Legislation,²¹ selection and breeding have resulted in significant progress in the development of traits related to the productivity of farmed animals. This, in turn, has reduced production costs at farm and consequently at country level. However, this development has also led to some undesirable side effects, including animal welfare and environment-related issues. The application of genomics and the use of advanced information technologies such as precision livestock farming²² hold considerable potential achieving the objectives of sustainable animal breeding. The collection of data on a broader range of traits should be given more emphasis in breeding programs and greater prominence in the definition of selection objectives. In this context, genetic resources of all livestock breeds, including local breeds, should be considered as an important reservoir of genes that can potentially contribute to achieving animal welfare and sustainability goals.

There is a need to take greater advantage of the characteristics of local breeds, especially in light of climate change, biodiversity loss and other environmental challenges. Climate change will have various direct and indirect effects on livestock production. Effective selection programs may contribute to climate change adaptation and mitigation.

Grazing ruminants are subject to the direct effects of climate change at a greater extent than

21 Regulation (EU) 2016/1012 of the European Parliament and of the Council of 8 June 2016. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016R1012&from=sl>.

22 allows use of large data sets on alternative traits, which can be directly or indirectly related to animal welfare and sustainability issues.

CONSERVATION AND SUSTAINABLE USE OF ANGR

the monogastric species, for which farming is generally more industrialized. Animals can suffer from occasional heat stress during the summer season, even in northern Europe. There are differences among species, among breeds within species, and among individuals within breeds regarding heat stress tolerance. Moreover, occurrence, spread and frequency of animal diseases are also associated with climate change. Much of the potential of AnGR diversity remains untapped. For example, the inclusion of genetic elements in disease-control strategies has led to some success stories, but knowledge of the genetics of resistance and tolerance remains inadequate.

Conservation and sustainable use of local breeds can benefit from the transition towards agro-ecological practices supported by the EU Green Deal and Farm to Fork strategy. Despite that conservation and sustainable use of the local breeds must be a priority for all the actors involved in AnGR management, we have to underline that, currently, the vast majority of animal production is developed on the basis of a small number of mainstream transboundary breeds. The sustainable use of mainstream transboundary breeds is essential to guarantee the food supply of European citizens. The breeding programs for these breeds aim to increase production efficiency and reduce the negative impacts of animal production systems on the environment, whilst ensuring fair economic returns to farmers.

Many local breeds that are currently not valued in global livestock production have characteristics that make them potentially valuable in the growing market of niche products or in the provision of public goods and a range of ecosystem and cultural services. Furthermore, local breeds can be used in sectors that increasingly focus on extensive production systems, often linked to tourism and gastronomy. In terms of stimulating and funding such activities, the concept of payments for ecosystem services is an interesting development. The valuation and niche marketing of products from local breeds is becoming quite widespread in developed regions such as Europe, thus helping to sustain AnGR diversity and rural livelihoods.

In this context, breeding programs support the development of a diversity of production systems and rural livelihoods, and to maintain a diverse range of breeds, thereby securing AnGR for the future. However, in many countries, the underlying preconditions for effective breeding programs remain weak, particularly the organizational structures and the levels of knowledge and technical skills. Experience indicates that while breeding programs are sometimes initiated by governments and research organizations, the involvement of breeders' associations and/or commercial companies increases the likelihood that the breeding programs will be sustainable in the longer term.

DRAFT RECOMMENDATIONS

on sustainable use and genetic improvement of AnGR (2.2):

- Boost the development and implementation of sustainable breeding programs, including pedigree and performance recording, genetic evaluation and maintenance of within-breed genetic variation for both transboundary and local breeds.

- Promote innovations and new technologies in breeding and AnGR management.
- Promote better use of AnGR diversity in the diversification of livestock production systems.
- Incorporate agro-ecological principles in livestock sector development and AnGR management.

2.3 Conservation of AnGR

The methods that can be used for the conservation of AnGR are:

- *In situ* conservation: the continued use by livestock keepers in the traditional production system in which the livestock evolved or are now normally found and bred.
- *Ex situ in vivo* conservation: the maintenance of live animal populations not kept under normal management conditions (e.g., in zoological parks or governmental farms) and/or outside the area in which they evolved or are now normally found and bred.
- *Ex situ in vitro* conservation: the conservation under cryogenic conditions including, inter alia, the cryopreservation of embryos, semen, oocytes, somatic cells or tissues having the potential to reconstitute live animals later.

The Convention on Biological Diversity²³ emphasizes the complementarity of *in situ* and *ex situ* conservation. Long-term conservation of genetic diversity in AnGR cannot be guaranteed by *in situ* conservation approaches only. Exclusively relying on *in situ* conservation would result in a loss of genetic diversity due to selective breeding and/or genetic drift. For this reason, *in situ* and *ex situ* conservation should be used as complementary methods. Combining the two approaches provides a powerful and reliable conservation strategy.

In addition, the prioritisation of which breeds to conserve also requires consideration. A variety of methods and software are available for prioritizing breeds for conservation, but application of these methods is so far still limited.²⁴ Recently, data integration based on GIS has been introduced to integrate genetic, demographic and environmental factors.²⁵ Furthermore, the integration of different data sources with an increasing amount of genomic data is expected to support conservation decisions, both within and between breeds. In this context, maximization of preserved genetic variation based on neutral genetic variation alone may not be sufficient for conserving breed-level variation of important traits.²⁶ Additionally, there is also a need to assess the value of breeds, the cost of breed extinction and

²³ Convention on Biological Diversity, 1992. <https://www.cbd.int/doc/legal/cbd-en.pdf>.

²⁴ Boettcher et al., 2010. Objectives, criteria and methods for using molecular genetic data in priority setting for conservation of animal genetic resources. *Animal Genetics*.

²⁵ Joost et al., 2010. Integrating geo-referenced multiscale and multidisciplinary data for the management of biodiversity in livestock genetic resources. *Animal Genetics*.

²⁶ Hall et al., 2012. Prioritization based on neutral genetic diversity may fail to conserve important characteristics in cattle breeds. *Journal of Animal Breeding and Genetics*.

<https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1439-0388.2011.00949.x>

conservation costs.²⁷ Proper assessment of costs and potential benefits will contribute to the optimization of conservation measures.

2.3.1 *In situ* conservation of AnGR

Principally, conservation by sustainable utilization is the main strategy for all breeds and breeding populations. The key principles of sustainable use are already explained in chapter 2.2, including the implementation of sustainable and effective breeding programs and the marketing of breed related products and services. In this chapter, we take conservation as the entry point that is particularly relevant for breeds that are at risk of extinction.

In situ conservation is performed through the breeding and use of animal populations, so that genetic diversity is best utilized in the short term and maintained for the longer term. Successful *in situ* conservation requires a well-designed breeding program. For local breeds at risk there is little opportunity left for genetic improvement and specific conservation support measures are often needed for breed survival.

Breeding programs for breeds at risk should put more emphasis on maintaining within-breed genetic diversity, because when population size is small, genetic variants can get lost as a result of selection or genetic drift.

In situ conservation strategies should enable the breed to become self-sustainable.²⁸ *In situ* conservation allows the breed to continue to develop in the context of changes in production conditions, it facilitates breed evolution and adaptation to the environment, and provides opportunities to generate knowledge about breed characteristics. *In situ* conservation helps maintain indigenous knowledge about livestock systems and breeds, and creates possibilities for sustainable utilization of AnGR in rural areas. This approach allows the breed to maintain its cultural roles and often contributes to nature and landscape management. Disadvantages of *in situ* conservation are that breeds can be exposed to risks associated with catastrophic disasters and disease outbreaks in particular, when breeds are concentrated in only one area.

In many developed countries, the maintenance of local breeds is coordinated and supported by breeding organisations and breed associations. Such organizations are thus the leading actors in *in situ* conservation activities. In Europe, *in situ* conservation programs are well developed.²⁹ However, the coverage of *in situ* conservation activities for certain breeds is still incomplete. Conservation goals and priorities in such programs should be clearly defined and regularly reviewed.

27 Drucker at all., Economics of animal genetic resources use and conservation. FAO. 2015. The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture, edited by B.D. Scherf & D. Pilling. FAO Commission on Genetic Resources for Food and Agriculture Assessments. Rome (available at <http://www.fao.org/3/a-i4787e/index.html>)

28 EuReCa. Towards self-sustainable EUropean, REgional CATTLE breeds. Local cattle breeds in Europe: Development of policies and strategies for self-sustaining breeds. <https://www.regionalcattlebreeds.eu/publications/documents/9789086866977cattlebreeds.pdf>.

29 FAO, 2015. The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture. FAO Commission on Genetic Resources for Food and Agriculture. Assessments.

The financial resources for *in situ* conservation of local breeds at risk are often insufficient and do not cover opportunity costs to the farmer. Opportunity costs represent the farmer's loss of benefits when choosing local breeds over high-yielding breeds. Therefore, appropriate financial support for *in situ* conservation to compensate losses due to lower production and pay for the provision of ecosystem services provided by local breeds is needed. The maintenance of local breeds at risk under sustainable management by farmers is one of the most effective and practical ways of conserving those breeds. When a breed is self-sustainable and the market chain is well developed, conservation costs could approach zero.³⁰

To support *in situ* conservation, a diverse range of support measures, initiatives and networking activities are reported by countries in Europe. Examples include the development of niche markets for products of local breeds, establishment of ark farms³¹, initiatives for the management of landscapes³² and wildlife habitats, as well as touristic activities.

Farmers and livestock keepers are the key actors in *in situ* conservation of AnGR. Without active farmers, breeders and their networks, a breed cannot survive. The provision of direct financial incentives³³ to the keepers of at-risk breeds is more common in the European region than anywhere else in the world. The same is true for the use of at-risk breeds in the management of landscapes and wildlife habitats and their use in touristic activities. Niche marketing of breed products is well developed, facilitated by the existence of labelling schemes such as those operating in the European Union for protected designations of origin.³⁴

Taking into account the uncertainty of the future of local breeds, it is important that countries continue implementation and further development of *in situ* strategies and strengthen policies and regulations related to AnGR conservation. Improved valuation of breed-specific features, payments for ecosystem services, and professionalization of breeding and conservation programs are key elements that national governments need to consider when developing policies that can directly or indirectly affect the conservation of local breeds.

For transboundary breeds, countries should take initiatives to collaborate with neighbouring countries to strengthen their joint efforts, both *in situ* and *ex situ*. At pan-European level, countries and stakeholders can benefit from the development of a network of actors and *in situ* conservation sites, with the aim of sharing knowledge and experiences across countries.

30 Kor Oldenbroek (editor), 2007. Utilisation and conservation of Farm Animal Genetic Resources. Wageningen Academic Publisher.

31 <https://www.g-e-h.de/index.php/arche-projekt>; <https://www.arche-noah.at/english/projects/eu-project-grundvig>; <http://www.genska-banka.si/ark-mreza/>

32 https://www.animalgeneticresources.net/wp-content/uploads/2021/04/4_ERFP_Insitu_Democase.pdf

33 European Commission. Commission Regulation (EC) No 1750/1999 of 23 July 1999 laying down detailed rules for the application of Council Regulation (EC) No 1257/1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF). Off. J. Eur. Communities 1999, L 214, 31–52.

34 Regulation (EU) No 1151/2012 of the European Parliament and of the Council of 21 November 2012 on quality schemes for agricultural products and foodstuffs. <http://data.europa.eu/eli/reg/2012/1151/oj>

2.3.2 *Ex situ* conservation of AnGR

Complementary to AnGR maintained *in situ* or *ex situ in vivo*, AnGR are also conserved *ex situ in vitro* in public and/or private gene banks. Many countries have established national gene bank collections of AnGR as a backup. Cryoconservation is the main form of *ex situ* conservation of AnGR.

The most remarkable advantage of cryoconservation of genetic material in gene banks is its capacity to store reproductive material without deterioration. Nevertheless, gene banks have multiple functions in addition to the long-term conservation goal. Reproductive material from gene banks can be used to support *in vivo* conservation, as a backup in case of genetic or sanitary problems, to develop new lines/breeds, to modify and/or reorient selection or for research purposes.³⁵

The relevance of gene banks is recognized by the UN in the 2030 Agenda, specifically Sustainable Development Goal 2 (Zero Hunger) and more specifically indicator 2.5.1 (b) (see chapter 2.1.1).

Different initiatives have focused on strengthening *ex situ* conservation activities across Europe in the past. The IMAGE³⁶ project underlined relevant gaps in gene bank activities. The most noteworthy of these are the lack of or insufficient collections for many European breeds and the low transfer of material from gene banks to livestock breeding or breed conservation programs in Europe.

The European Gene Bank Network for Animal Genetic Resources (EUGENA), governed by the European Regional Focal Point (ERFP), is the other recent initiative to support *ex situ* conservation. EUGENA³⁷ supports the *ex situ* conservation and sustainable use of AnGR, and facilitates the implementation of the FAO's GPA for AnGR at national and pan-European level. Main objectives of EUGENA include exchanging knowledge and experiences, improving access to information about gene bank collections and facilitating the exchange of genetic material in Europe.

Ex situ in vitro conservation is developed by a wide variety of actors: governments, research institutions, universities, conservation NGOs, and private breeding companies. A number of studies in the past tried to establish an inventory of the facilities in Europe dedicated to cryoconservation, but the complexity of these activities prevented the compilation of a complete map of all the institutions involved. The most recent effort in this field was the ERFP's *Ad Hoc Action to support the development of EUGENA, to identify candidate EUGENA gene banks, and improve the information about the gene banks in Europe*, which identified 125 different *ex situ in vitro* collections. In the case of *ex situ in vivo* conservation, the lack of information is even bigger.

35 FAO, 2012. Cryoconservation of Animal Genetic Resources Guidelines. <http://www.fao.org/3/i3017e/i3017e.pdf>.

36 Innovative Management of Animal Genetic Resources (IMAGE) project, funded by the European Union's Horizon 2020 research and innovation program. <https://www.imageh2020.eu/>.

37 EUGENA – The European Genebank Network for Animal Genetic Resources. eugena-erfp.net/en/.

CONSERVATION AND SUSTAINABLE USE OF ANGR

Improving the knowledge about *ex situ* conservation activities of AnGR in Europe is a priority for ERFP and the EUGENA network in the years ahead. It is necessary to establish and strengthen information systems on *ex situ in vitro* gene banks and *ex situ in vivo* facilities in order to facilitate access to material and information about specific collections, so that breeders' associations, livestock industry and countries can make appropriate choices in their breeding and conservation programs, and to facilitate access for breeding and research. A complete register of the facilities working in *ex situ* conservation will allow better strategic planning and improved integration with *in situ* conservation, research and the activities of the breeding industry.

According to a survey by Leroy et al. (2019), many breeds in European countries have either no or insufficient material in gene banks. *Ex situ in vitro* programs should be established, implemented, or strengthened to initiate or expand collections for all breeds,³⁸ especially local breeds at risk. Complementary gene bank collections should be established for all breeds. When it comes to collecting genetic material, critically endangered, local breeds should have priority, although gene banks should also maximize genetic diversity across breeds in their collections. These actions are essential to improve the results of the SDG indicator 2.5.1 (b).

In addition, gene banks are critical facilities, and if possible, genetic material and data must be duplicated and stored in different locations to avoid loss from catastrophic events. National governments should establish backup collections of gene bank samples and databases at national or multinational level. Furthermore, other results of the IMAGE project³⁹ have shown that there is room for improvement in terms of optimizing the cost of *ex situ* conservation in Europe by taking advantage of collaboration between gene banks to increase effectiveness, both within and across countries. The exchange of genetic material and data between collections and countries should become a more common practice in the future.

Not all European countries have established regulations to officially recognize the institutions developing *ex situ* conservation activities. This lack of recognition is a challenge for strategic planning and implementation of AnGR conservation and a considerable obstacle to the coordination with other stakeholders. Official recognition allows better knowledge of *ex situ* conservation activities, increases confidence between all actors working in the AnGR domain, and facilitates strategic planning at national level.

As the results of the IMAGE project have shown, the use of material from gene banks must not be restricted to long-term conservation only. Cryopreserved reproductive material can be used to support *in situ* conservation activities and commercial breeding programs or the development of new genomic or reproductive techniques. Better integration between *in situ* and *ex situ* conservation is needed to optimize the use of the *ex situ* collections. Governments should thus promote the use of the material stored in gene banks and *ex situ in vivo* facilities in conservation and breeding programs and for scientific research. Breeders' societies and

38 Leroy et al. 2019. Cryoconservation of Animal Genetic Resources in Europe and Two African Countries: A Gap Analysis. *Diversity*, 11, 240.

39 De Oliveira et al. 2018. Optimizing *ex situ* genetic resource collections for European livestock conservation. *Journal of Animal Breeding and Genetics*.

CONSERVATION AND SUSTAINABLE USE OF ANGR

the breeding industry must have greater involvement in *ex situ* activities, and the integration between *in situ* and *ex situ* conservation should be expanded.

The relative development of reproductive technologies seems to be one of the main explanations for the varying extent of cryoconservation⁴⁰ between different species. Further research on reproductive technologies and cryopreservation procedures is needed, in particular for embryos and under-represented species in gene banks, such as rabbits and poultry. However, even for commonly cryopreserved species such as cattle, material collection and processing procedures have typically been developed for international transboundary breeds, and may thus not be optimized for less common local breeds.⁴¹ In the years ahead, institutions involved in AnGR conservation should undertake research to develop, standardize and implement reproductive technologies and cryopreservation procedures. The research should also contribute to decreasing costs, especially, for the conservation of embryos and under-represented species.

Few European countries have specific regulations for the collection of reproductive material intended to be stored in gene banks. The collection of material from local breeds is often difficult or impossible due to strict animal health regulations. To enable cryoconservation of all breeds, the collection of material from local breeds demands specific derogations so that a risk-appropriate balance between the protection of animal health and the conservation of AnGR can be achieved. To this end, governments should may establish specific national animal health regulations or derogations for gene banks.

Exchanging information on samples of individual animals stored in gene banks could help to avoid the unnecessary collection and storage of material from the same or related animals in multiple countries. In addition, information exchange improves the integration of gene banks with *in vivo* conservation programs, breeding activities and research. This information also enables governments to monitor their compliance with the SDG 2.5.1 (b) indicator. Information exchange among gene banks and DNA collections is crucial for the development of genomic techniques and their use in AnGR conservation and livestock breeding. It is therefore important to improve the exchange of information among gene banks and between these and other stakeholders (breeders' societies, conservation NGOs breeding industry, researchers, National Coordinators) to optimize the collection and use of the material. This recommendation is particularly relevant for transboundary breeds.

The enrolment of new countries and gene banks in EUGENA should be promoted to increase the amount of available information. This would enable improved coordination between countries for *ex situ* conservation of transboundary breeds. Another important role of EUGENA could be the development and implementation of quality management systems for gene bank strategies and operations.

40 Thelie, et al., 2018. Chicken semen cryopreservation and use for the restoration of rare genetic resources. *Poult. Sci.* 98:447–455.

41 Leroy et al. 2019. Cryoconservation of Animal Genetic Resources in Europe and Two African Countries: A Gap Analysis. *Diversity*, 11, 240

CONSERVATION AND SUSTAINABLE USE OF ANGR

Also, in terms of managing information on *ex situ* conservation collections, the institutions in charge of AnGR should facilitate the ongoing transformation and further development of gene banks into “bio-digital resource centres”. To allow for this transformation, countries should develop and implement dedicated national databases for gene bank collections and related genomic and phenotypic data, and provide access to publicly available gene bank data through the EUGENA portal.⁴² In addition, data analysis tools and interfaces for potential users could be developed and implemented to identify specific characteristics of material stored in gene bank collections. Such future actions must comply with European and national legal frameworks for intellectual property and data protection.

Gene banks are mainly hosted by public entities and funded by governments. Thus, to secure continued funding of the *ex situ* conservation activities, the general public must be informed about the efforts, results and value of the gene banks. Improving communication and raising awareness of the value of the *ex situ* collections should be a relevant activity in the next years.

DRAFT RECOMMENDATIONS

on in situ and ex situ conservation (2.3):

Integrated Key recommendations (in situ & ex situ)

- Develop and implement national strategies and action plans for integrated and complementary in situ and ex situ long term conservation strategies for AnGR, engaging all relevant public and private stakeholders in the process.
- Promote and support initiatives and collaboration for in situ and ex situ conservation of transboundary breeds.

In situ conservation

- Strengthen the European network for in situ conservation and management of local breeds at risk.
- Support breeders' associations and farmers to implement breeding programs for local breeds at risk.
- Strengthen and promote the valorisation of AnGR-related ecosystem services (e.g. landscape conservation) and livestock products.
- Increase the breeders' awareness of their role as key actors in the conservation of AnGR.
- Develop research towards better understanding of breed characteristics and features, in particular adaptation to specific ecosystems and farming systems.

⁴² EUGENA <https://www.eugena-erfp.net/en/>.

Ex situ conservation

- Establish and maintain an official European inventory of all ex situ conservation facilities.
- Stimulate European gene banks to ensure the long-term conservation of AnGR through core collections.
- Promote specific derogations from national animal health regulations for material intended to be stored in gene banks, as well as for its use and distribution.
- Develop and expand EUGENA, promote the enrolment of new countries and gene banks and implement quality management systems.
- Initiate research on the development, standardization and implementation of new cryopreservation technologies that cover all types of genetic material and species.
- Provide facilitated access to cryopreserved genetic material under the control of European countries and in the public domain, as well as – subject to applicable law – associated non-confidential data, for research, breeding and training.

DRAFT

POLICIES, INSTITUTIONS AND CAPACITY BUILDING

Implementation of the European strategy for AnGR requires a coherent and coordinated policy and legal framework with commitments and instruments at national and pan-European level. This framework will facilitate and support the necessary actions for better conservation and sustainable use of AnGR.

There is a need to strengthen the necessary institutional and human capacities to enable all involved actors, stakeholders and institutions to meet their obligations and commitments according to their roles and competences, raise awareness among all of them and support education. Implementing the strategy will require sufficient capacity building, funding and targeting the different actions and involved actors, to reach the long term sustainability of AnGR.

3.1 Policy and legal framework

A range of global and European policy and legal instruments directly or indirectly address the conservation and sustainable use of AnGR. However, there is currently a lack of focus on genetic resources and insufficient coordination between policy areas at national and European level. Fragmentation and scattered measures from different policies and actors may result in further loss of genetic diversity, as the current situation could lead to missed opportunities for the necessary transition and further development of the livestock sector. For instance, Member States are not required to develop and implement national strategies and action plans for AnGR conservation and sustainable use. Moreover, where such strategies are prepared, targets and timelines are not always clear and coordination is often lacking.

There are often no obligations and no legal basis for comprehensively managing and monitoring AnGR at national level. Limited coordination also prevents existing legislation from achieving its objectives for successful conservation and sustainable use of AnGR. Coherence, consistency and compatibility between relevant policies and subsidy schemes, together with strong, well-coordinated governance of the implementing actors, are crucial to ensuring the fulfilment of European and global commitments on AnGR.

3.1.1 European positions in global fora

At the global level, various international commitments are relevant for the conservation and sustainable use of AnGR, in particular the FAO's GPA for AnGR⁴³, the Convention on Biological Diversity (CBD),⁴⁴ and the UN Sustainable Development Goals (SDGs).⁴⁵ However, implementation of these international commitments at national and pan-European level should receive more attention. The FAO, after the last assessment of the state of implementation of the GPA,⁴⁶ strongly recommends to strengthen the institutional frameworks for the management of AnGR, and shows that current measures for improving AnGR management are insufficient.

The CBD has three objectives: conservation of biological diversity, sustainable use of its components, and the fair and equitable sharing of the benefits (ABS) arising out of the utilization of genetic resources and associated traditional knowledge. Target 13 of the CBD addressed the conservation of genetic diversity, including that of “farmed and domesticated animals”. The target specifies that strategies for minimizing genetic erosion and protecting genetic diversity should be (have been) in place by 2020.

The Nagoya Protocol⁴⁷ adopted in October 2010 provides a legal framework for regulating access to genetic resources and the fair and equitable sharing of the benefits arising from their use in research and development. Compliance and user control in the EU are subject to common rules laid down in Regulation (EU) No 511/2014⁴⁸ (EU ABS Regulation).

Conservation and sustainable use of AnGR at national and pan-European level will benefit from coordination at policy level. It is important to coordinate contributions of European countries to the FAO Commission on Genetic Resources for Food and Agriculture, the Convention on Biological Diversity, the Nagoya Protocol, and other international fora, within and across genetic resource domains.

3.1.2 Integration with EU policies

The conservation and sustainable use of AnGR is linked to numerous European strategies and policies, which are dealt with by various Directorates of the European Commission. However, there is no overall European policy or strategy providing a more general vision in which the conservation and sustainable use of genetic resources are coherently linked. There is a range

43 GPA FAO, 2007. Global Plan of Action on Animal Genetic Resources.

<http://www.fao.org/3/a1404e/a1404e00.pdf>.

44 Convention on Biological Diversity, 1992. <https://www.cbd.int/doc/legal/cbd-en.pdf>.

45 United Nations. The Sustainable Development Goals. <https://sustainabledevelopment.un.org/sdgs>

46 FAO, 2021. ITWG-AnGR working document: Review of implementation of the GPA for AnGR. CGRFA/WG-AnGR-11/21/2.

47 Nagoya Protocol. cbd.int/abs/.

48 Regulation (EU) 511/2014 of the European Parliament and of the Council of 16 April 2014 on compliance measures for users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0511&from=EN>.

POLICIES, INSTITUTIONS AND CAPACITY BUILDING

of policies and regulations that directly or indirectly have impact on the conservation and sustainable use of AnGR. The project “Preparatory actions on EU plant and animal genetic resources in agriculture”⁴⁹ funded by the European Commission recognized the need to support and strengthen the conservation and sustainable use of genetic resources within the EU. The project’s results helped to initiate the preparation of the European Genetic Resources Strategy (EGRS)⁵⁰ and the three domain specific strategies for plant, animal and forest genetic resources.

European policies and initiatives that play a role in the further development of AnGR management include:

The **European Green Deal**, the European Biodiversity strategy and the Farm2Fork strategy have set the scene for raising awareness on agrobiodiversity and the needed step-change for its conservation and sustainable management. In this context, the Council conclusions⁵¹ on the F2F Strategy provide a first step by inviting the European Commission to present an EU strategy for genetic resources for aquaculture, forests and agriculture.

FarmtoFork (F2F) is one of the main strategies within the European Green Deal. It is a new comprehensive approach to how the EU should value the sustainability of food production systems. F2F aims to reward farmers and other operators in the food chain who have already undergone the transition to sustainable practices, enable the transition for those lagging behind, and create additional opportunities for their businesses. The strategy also represents a big opportunity for reversing biodiversity loss. The use and marketing of local genetic resources are reflected in the F2F, thus underlining the reliance of farmers on diversity as a buffer against future impacts.⁵²

The implementation of the **EU Biodiversity Strategy** is facilitated by manifold legislations, particularly in the framework of Natura 2000. The current EU Biodiversity Strategy for 2030 presents a comprehensive, ambitious, long-term plan for protecting nature and reversing the degradation of ecosystems. It also highlights the need to facilitate the use of traditional varieties of crops and breeds to contribute to their conservation and sustainable use.⁵³

The **EU Common Agriculture Policy (CAP)**, including the **EU Rural Development Policy (RDP)**, aims to help farmers improve their environmental and climate performance through a more results-oriented approach, better use of data and analysis, improved mandatory environmental standards, new voluntary measures and an increased focus on investments in green and digital technologies and practices. The production systems of small-scale farms are very much linked to the conservation and utilization of rare breeds. Significant support for the

49 Preparatory actions on EU plant and animal genetic resources in agriculture; www.geneticresources.eu.

50 European Genetic Resources Strategy, ISBN 978-952-7426-44-9 (PDF)

51 Council Conclusions on the Farm to Fork Strategy, Council of the European Union, 2020. <https://data.consilium.europa.eu/doc/document/ST-11822-2020-INIT/en/pdf>.

52 EC 2020. A Farm to Fork Strategy for a fair, healthy and environmentally friendly food system. eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381

53 EC 2020. EU Biodiversity Strategy for 2030 – Bringing nature back into our lives. eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590574123338&uri=CELEX:52020DC0380

POLICIES, INSTITUTIONS AND CAPACITY BUILDING

conservation and sustainable use of AnGR may also be provided through measures encouraging innovation, knowledge transfer, eco-schemes, cooperation and improved farm advisory services.

The **post-2020 CAP**, including the new national strategic plans, is set to include the conservation, sustainable use and development of genetic resources in agriculture as one of the eligible actions. Three out of nine objectives concern areas in which genetic resources can play a vital role. Interactions between the CAP and AnGR management policies should be further explored.

The **EU Animal Breeding Regulation**⁵⁴ on zootechnical and genealogical conditions for the breeding, trade and entry into the EU of purebred breeding animals, hybrid breeding pigs and germinal products is an important regulatory framework for the conservation, improvement and sustainable use of AnGR. It defines purebred animals and is an important framework for their management by breed societies and official breeding organisations. The regulation contributes to the conservation of genetic diversity and breed improvement based on harmonized rules. It also includes specific derogations related to endangered breeds, e.g., specific conditions for breeding programs, admission in breeding books, upgrading and use of animals and germinal products and their collection or storage in centres at national level for preservation purposes, as well as rules for the set-up of breeding programs for breeds that are highly endangered or nearly extinct.

The European Breeding Regulation also creates a legal basis for setting up a European Reference Centre for AnGR (see chapter 3.1.3), not only for genetic evaluation but also for endangered breeds (Art. 29 and Annex IV). Specifically, this could enable harmonisation of the methods used by breed societies for the management of endangered breeds, and provide training, cooperation and support to all involved institutions and actors. According to recital number 54 of the EU-Animal Breeding Regulation, the Commission should take duly into account the activities of the ERFPP when establishing European Union reference centre for AnGR and describing their tasks.

Since the conservation and sustainable use of genetic resources require multiple and coordinated efforts in research and development, with the support of appropriate infrastructure, the **EU Research Framework Program** (Horizon Europe) is relevant for R&D on the long-term management of AnGR.

European Innovation Partnerships, including "Agricultural Productivity and Sustainability" (EIP-AGRI), are a relatively new approach launched by the European Commission to foster research and innovation in the EU. EIPs are multi-actor projects bringing together relevant parties at EU, national and regional levels. They focus on addressing challenges to benefit society, modernise sectors and markets, and can be relevant for the conservation and sustainable use of AnGR.

⁵⁴ Regulation (EU) No. 2016/1012 of the European Parliament and of the Council. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2016.171.01.0066.01.ENG.

POLICIES, INSTITUTIONS AND CAPACITY BUILDING

The **EU agricultural product quality policy regulation** establishes quality schemes contributing to rural development policy objectives for agricultural products. The quality product policy can benefit the conservation of animal breeds through promotion of their products, thus aiding the valorisation of AnGR that can provide high quality products linked to a specific geographical region. The policy thus also provides a good opportunity to stimulate the maintenance of pure breeds.

However, the regulation's focus on geographical region could limit activities linked to breed conservation. For example, the regulation does not permit certain activities to be carried out beyond the borders of designated regions. This, in turn, could interfere with conservation programs whose objective is to increase the population of breeds that often are kept across several regions.

The EU **Animal Health Law**⁵⁵ aims to prevent and control animal diseases that can be transmitted to other animals or humans. It has a major impact on breeding programs and the exchange of genetic material through the legal and regulatory requirements to prevent severe outbreaks of epidemic diseases.

The impact of transmissible animal diseases and subsequent control measures can be devastating for individual animals, animal populations, animal keepers and the economy. Small populations, such as rare breeds and species, may be endangered by standard disease control measures. The protection of such breeds and species may require modified measures to be taken by the competent authority.

The Animal Health Law allows national measures for the protection and exchange of germinal material from endangered breeds for conservation purposes or national use. The objectives of cryopreserving reproductive material in germplasm (cryobank) collections are quite different from those of conserving breeding material for commercial use. The regulation offers new possibilities for gene banks. More importantly, it recognizes specific procedures for the movement of germinal products between gene banks in different Member States to eliminate unjustified burdens, and provides an opportunity for competent authorities of countries to develop derogations for cross-border collections and national gene banks.

Finally, the management of genetic resources is also affected, both positively and negatively, by other EU legislative fields such as organic farming, promotion of EU farm products, state aid, food and market regulations, animal welfare and intellectual property.

For example, the EU legislation for organic farming supports the use of native and endangered breeds on organic farms with appropriate husbandry and reproduction practices, with regard to the animals' adaptability to local conditions, their vitality and their resistance to disease or health problems. According to the EU's policies and plans, the continued growth of the organic food market is foreseen, which thus implies that this market can be an important niche for AnGR.

⁵⁵ Regulation (EU) 2016/429 of the European Parliament and of the Council. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0429&from=EN>.

3.1.3 Novel European infrastructure

The EU-Animal Breeding Regulation foresees the possible establishment of an EU Reference Centre to promote the harmonisation of the methods used by breed societies, competent authorities or other authorities of the Member States for the preservation of endangered breeds or of the genetic diversity existing within those breeds. This Reference Centre for AnGR shall mainly work with the actors to facilitate this preservation and inform them about suitable methods. The full list of tasks is described in Annex IV Number 3 of the regulation.⁵⁶

The establishment of this reference centre is crucial for the future coordination and harmonisation of the management and sustainable use of AnGR. The reference centre is therefore a central element of this strategy, since many of its Key recommendations lie within the centre's designated tasks. This centre can support the European Commission, the European governments and their national programs in implementing the Animal Genetic Resources Strategy, and create improved institutional channels between the EU, national governments, the European genetic resources networks, the FAO and other international partners.

It should be emphasized that the work of the EU Reference Centre for AnGR will also support and strengthen the European Information and Coordination Centre for the conservation and sustainable use of agricultural genetic resources, as proposed by the ERGS.

The future development of the ERFPP and the designation of the EU Reference Centre⁵⁷ are strongly linked. For example, the ERFPP secretariat could be located at the reference centre and create further synergies between the work of the centre and the ERFPP network.

Better coordination and appropriately funded technical and research infrastructure for the conservation, documentation and sustainable use of genetic resources at national and regional levels will improve the current system. Strengthening institutional and human capacities are strategic priority areas of the FAO's GPAs, including for AnGR, taking into account the need for increased long-term investment in conservation and sustainable use of genetic resources.

DRAFT RECOMMENDATIONS

on policy and legal framework (3.1):

- Review the main European and national policies and instruments, with direct or indirect impact on AnGR, to identify needs and improve the integration of conservation and sustainable use of AnGR into relevant national and regional policies and regulations.
- Facilitate the implementation of the EU Animal Breeding Regulation 2016/1012 for the development of effective breeding programs.

⁵⁶ See page 65 in: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1012&from=EN>

⁵⁷ Regulation (EU) No. 2016/1012 of the European Parliament and of the Council. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2016.171.01.0066.01.ENG.

- Promote the designation of the European Reference Centre (ERC) for AnGR as foreseen in Article 29 of the EU Animal Breeding Regulation 2016/1012.
- Support the establishment of the European Coordination and Information Centre for conservation and sustainable use of plant and animal (agricultural) genetic resources.
- Foster collaboration and partnerships in research and innovation across countries, including through Horizon Europe and EIP instruments.
- Create or strengthen a European and national technical and research infrastructure to provide a long-term foundation for the conservation, documentation and sustainable use of AnGR in Europe.

3.2 Actors, stakeholders and institutions

A wide range of actors and stakeholders are involved in the conservation and sustainable use of AnGR, including representatives of national governments, research and educational institutions, non-governmental organisations, breeders' associations, farmers, hobby breeders and breeding companies. They play an important role in minimising the threats to AnGR and support the use and conservation of genetic diversity.

3.2.1 A diversity of private and public stakeholders

National governments and administrations are essential for the establishment and implementation of policy and legal frameworks for animal breeding and for conservation, promotion and sustainable use of AnGR. Authorities are responsible for the development of national/regional programs or strategies for the management and conservation of AnGR, as well as for implementing international commitments.

Breeding organisations, breeders' associations and farmers are the main private sector and civil society stakeholders, representing a wide range of professional and hobby farmers as well as the commercial breeding industry. *In situ* conservation of domestic animals (on-farm) is by definition carried out by farmers and other livestock keepers. The breeding of cattle, horses, sheep and goats is predominantly based on a cooperative model, while commercial poultry breeding is in the hands of a few large-scale breeding companies. European pig breeding has both characteristics. Globally, poultry and pig breeding is increasingly concentrated in a limited number of international breeding operations. The majority of poultry and pig farmers obtain breeding stock and/or germplasm from crossbreeding programs.

AnGR, i.e., mainly ruminant and equine species, play an important role in nature and landscape conservation through grazing. In addition, various organizations are crucial for the continued use of local breeds, e.g., by contributing to ecosystem services, tourism and gastronomy. In this context, European networks play an important role in the conservation and sustainable use of AnGR. Across all livestock species, local breeds are often supported by breeders' associations or by networks of small farmers and hobby breeders.

Research and education contribute to the conservation and sustainable use of AnGR, genetic evaluation, innovation, and technical assessment and support. Many conservation activities are also carried out on university farms where students are trained through research on animal genetics and physiology.

Gene banks can be public and/or private entities and institutions. They play an important role in the long-term conservation of AnGR and in supporting breeding programs and *in situ* conservation strategies.

Non-governmental organisations (NGOs) play an important role in breeding, conserving, raising awareness and promoting the use of local breeds. NGOs often emphasise important aspects of the animal breeding sector, and promote historical, cultural, and environmental characteristics of different breeds. A variety of NGO networks are active in the European region, such as SAVE and Slow Food.

3.2.2 The ERFP network and international cooperation

The European Regional Focal Point for Animal Genetic Resources (ERFP) aims to support *in situ* and *ex situ* conservation, documentation, information and sustainable use of AnGR, facilitate the implementation of the FAO's GPA for AnGR, and promote the coordination of activities and exchange of information and experiences. Beside the designated EU Reference Centre for AnGR, the ERFP is thus an important, if not even the most important, actor in implementing the Key recommendations of this strategy.

The ERFP mission is driven by the need to safeguard farm animal genetic diversity for future generations, in particular in the global context of food and nutrition security and climate change. A broad genetic basis is crucial for anticipating changes in production systems, markets and consumer preferences. At the same time, farm animal genetic diversity is part of our cultural heritage and an important aspect of diversity in nature and landscapes.

The specific objectives of the ERFP are to be the leading European network for the conservation and sustainable use of AnGR and to collaborate and create synergy with other civil society and private-sector networks. As a regional portal and information hub, the ERFP shares and disseminates information, experiences, knowledge and data on AnGR, and promotes the roles, benefits, values and services provided by AnGR to society. It also supports the National Coordinators for AnGR at national and European level, by providing expert support, developing and implementing strategies, initiating funding, organising regional projects and facilitating capacity building and networking within the European region.

Since the establishment of the ERFP secretariat in 1998, the secretariat has been rotating between different European countries and institutes, changing host country every four years. The ERFP assembly decided to explore options for a more permanent location and staff for the ERFP secretariat. This decision was made despite the fact that the rotational system had been a success. However, an increasing number of tasks, the implementation of a European strategy and ambitious activities developed by the ERFP create the need for a permanent

POLICIES, INSTITUTIONS AND CAPACITY BUILDING

secretariat, which could be linked to the proposed EU Reference Centre and European Information and Coordination Centre.

The ERFP has established a trustful and constructive relationship between the European governments through the network of National Coordinators. Regional Focal Points and regional networking have a vital role in building collaborative partnerships, coordinating regional management efforts in AnGR, further developing information sharing and enhancing technical cooperation, training and research. In Europe, this collaboration is coordinated by the ERFP. The ERFP also maintains an appropriate liaison with relevant governmental and non-governmental organisations and other European networks.⁵⁸

At the global level, the FAO CGRFA and ITWG-AnGR have important roles in collaboration and coordination activities within the AnGR network. A well-coordinated European system and AnGR strategy would facilitate the implementation of the FAO's GPA for AnGR in Europe as well as the integration with other policies.

The ERFP coordinates and supports the countries of Europe with the preparation of the meetings of the ITWG-AnGR as well as the meetings of the CGRFA.

DRAFT RECOMMENDATIONS

on actors, stakeholders and institutions (3.2):

- Engage the breeding sector and all other relevant actors, stakeholders and institutions in the implementation of the European AnGR strategy.
- Promote collaboration between actors in further development and implementation of national strategies and action plans.
- Strengthen the role of the National Coordinators, National Focal Points and the ERFP network in developing and promoting the conservation and sustainable use of AnGR in Europe.

3.3 Education and awareness raising

Both within the livestock sector and in society at large, it is important to promote education, training and awareness raising of the essential roles and values of AnGR. This also includes the emerging fields of access and benefit sharing, ecosystem services and climate change adaptation and mitigation.

Since policy-makers are essential for the development of an appropriate institutional framework for the conservation and sustainable use of AnGR, the general public can and

⁵⁸ Liaison partners include: European Commission (EC), European Federation of Animal Sciences (EAAP), SAVE Network (Safeguarding Agricultural Varieties in Europe), European Forum of Farm Animal Breeders (EFFAB). Regional networks such as: Nordic Genetic Resource Centre (NordGen), International Association for the Conservation of Animal Breeds in the Danubian Region (DAGENE). Other relevant organisations, such as the ECPGR and EUFORGEN genetic resource domains.

POLICIES, INSTITUTIONS AND CAPACITY BUILDING

should, help to influence the political agenda. People in all sectors of society are aware of the challenges arising from climate change, and increasing numbers are also trying to change things for the better, e.g., by making dietary adjustments, buying organic or high animal welfare products, or choosing local breed products from sustainably managed sources. A critical next step is to clearly formulate and communicate the importance of AnGR as part of these and other solutions.

More specific measures need to be implemented within the farming sector. A clear issue is training the next generation of farmers in AnGR management. This awareness needs to be raised firstly in agricultural education.

At a broader level, communication must underline the essential role of AnGR for food and nutrition security, product quality and choice, and the transition to a more sustainable and resilient livestock sector, as detailed in Chapter 1 of this strategy. These messages are to be conveyed to policy-makers and the general public alike. They need to promote the importance of AnGR as a buffer against the climate shocks that are increasingly impacting farming, forestry and other nature-based industries, as well as their long-term insurance value for future generations.

Highlighting the overall value of AnGR, i.e., their economic, environmental and social value, also conveys an important message to all stakeholders.

To achieve these goals, a number of different awareness-raising channels can be used at different levels: social media, public events or institutions (exhibitions, conferences, museums, zoos, schools), and other print and electronic media (books, brochures, posters, television, radio, etc). A vital part of awareness raising is also related to local breeds and the need to conserve those that are at risk of extinction.

DRAFT RECOMMENDATIONS

on education and awareness raising (3.3.):

- **Develop a communication strategy at European level and national level, raising awareness about the roles and values of AnGR, in society at large and among a wide range of stakeholders.**
- **Strengthen education on AnGR at various levels.**
- **Develop awareness raising activities in all value chains to strengthen the linkages between producers and consumers, including tourism and gastronomy alliances, environmental authorities and providers and users of ecosystem services.**

3.4 Long term funding of the strategy

For the conservation and sustainable use of AnGR, sufficient and accessible financing is crucial. Although the main responsibility for the conservation and sustainable use of genetic resources lies with national institutions, a number of funding instruments are also present at European level. However, the conservation, documentation and sustainable use of AnGR are frequently not given high priority, and there is insufficient long-term investment in AnGR conservation infrastructure, and inadequate support for their sustainable use. Many public institutions do not have dedicated budget lines for maintaining quality genetic resource collections and operating gene banks according to international standards. This situation is counter to Europe's ambition of supporting high quality research infrastructure and strengthening the region's global outreach.

Some income support for environmentally sound farming and the provision of public goods is provided via the CAP.⁵⁹ The CAP, particularly its European Agricultural Fund for Rural Development (EAFRD), aims to help tackle climate change, ensure the sustainable management of natural resources, and maintain rural areas and landscapes across the region.⁶⁰ Since 2006, the EAFRD, through the agri-environment-climate measures (AECM),⁶¹ has provided a degree of support for on-farm conservation of plant and animal genetic resources, as well as for sustainable forest management. However, the take-up of these funds differs among countries, depending on national priorities and the level of administration involved, and the maximum grants are in some cases too small to be effective.⁶²

Since genetic diversity in crops and livestock is in continuous decline, the positive impact of funding under the pre-2021 CAP on domesticated genetic resources is not evident across the region. Nine key objectives are foreseen for the post-2020 CAP,⁶³ and of particular note is the intention to increase competitiveness and agricultural productivity in a sustainable way, in which the role of research and innovation is given prominence.⁶⁴ This includes funding through EIP-AGRI,⁶⁵ as well as through the Horizon Europe program for research and innovation for the period 2021–2027.

Moreover, some support can come from measures encouraging innovation, better knowledge, transfer investments, quality schemes, cooperation and improved farm advisory services. However, these financing mechanisms do not provide for long-term coordinated actions for AnGR conservation and sustainable use across the region. Furthermore, they might not be a priority for some countries, creating a situation of inequality.

⁵⁹ eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32013R1307

⁶⁰ ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en

⁶¹ ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/financing-cap/cap-funds_en

⁶² op.europa.eu/en/publication-detail/-/publication/fb693d7d-370d-11e7-a08e-01aa75ed71a1/language-en/format-PDF/source-105962170

⁶³ ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en

⁶⁴ ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/cap-briefs-2-productivity_en.pdf

⁶⁵ ec.europa.eu/eip/agriculture/en

POLICIES, INSTITUTIONS AND CAPACITY BUILDING

To support the transition to more sustainable conservation and use of AnGR, significant long-term investment and appropriate financing measures are required across the regions, targeting the needs of the relevant actors and institutions. Farmers and breeders using and preserving endangered animal breeds should have priority in terms of funding, since they are crucial for the proper conservation of AnGR. Subsidies should come from the co-funding policies, but also as state aid for national financing.

DRAFT RECOMMENDATIONS

on long term funding of the Strategy (3.4.):

- Explore opportunities for establishing fund-raising mechanisms and integrated investment plans to ensure adequate and permanent EU co-funding instruments for the conservation and sustainable use of AnGR.
- Ensure long-term, targeted funding of actors, institutions, stakeholders and their networks for European and national activities related to the conservation and sustainable use of AnGR.

ACKNOWLEDGEMENTS

We would like to thank all National Coordinators and Working Group experts that contributed to the participation of the strategy with valuable comments and suggestions, in particular, the ERF *Ad hoc* action group members. Also, thanks to Karl Kerner of Biotext for proofreading and language editing.

Members of the ERF *Ad hoc* action group:

Danijela Bojkovski, Chair, Slovenia
Fernando Tejerina, Spain
Enrico Sturaro, Italy
Nina Saether, Norway

Secretariat

Coralie Danchin-Burge, France
Eleonore Charvolin-Lemaire, France

Steering Committee

Sipke-Joost Hiemstra, Chair, the Netherlands
Montserrat Castellanos Moncho, Spain
Christina Ligda, Greece
Jan Hendrik Schneider, Germany
Srdjan Stojanović, Serbia
Ruta Šveistienė, Lithuania



ERFP