AHA Strengthening national capacities towards the development of a national Gene Bank strategy

Guidelines on Practical Recommendations

Guidelines on Practical Recommendations for the Development of Genebanks of Animal Genetic Resources

Christina Ligda
Reproduction and Animal Breeding, Veterinary Research Institute, Thessaloniki

ERFP *ex situ* WG meeting, Toledo, 22 May 2023

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Participants AHA:

Lumturi Papa (Albania)
Beate Berger (Austria)
Michele Teixer Boichard (France)
Dimitrios Tsiokos (Greece)
Sharon Walshe (Ireland)
Gustavo Gandini (Italy)
Anna Caroline Holene (Norway)
Ewa Sosin (Poland)
Rosa Lino (Portugal)
Srdjan Stojanovic (Serbia)
Tina Flisar (Slovenia)
Christina Ligda (Greece) – Lead
Fernando Tejerina (Spain) - Lead

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Background :

Despite the awareness raised by the GPA, the ERFP WG *ex situ*, EUGENA, the IMAGE project, several initiatives at national level and the recognition of the urgent need to proceed with a national plan for *ex situ* conservation of AnGR complementary to the ongoing in situ conservation programs, there are still **significant drawbacks that impede this development**.

Objective:

- To strengthen the national capacities for the management of AnGR and specifically on the *ex situ* conservation actions (development of a national GeneBank).
- Assess current situation, needs and barriers and define solutions and priorities to support national efforts towards the development of a national cryo-conservation strategy.

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Guidelines:

The set of guidelines of good practices on *ex situ* conservation strategies that is developed on the basis of the information collected and analysed through this AHA aims to support the activities in the European countries by providing practical examples of solutions on similar gaps.

These guidelines should be considered as a set of actions already implemented and could be used in similar cases as proposed, or by building on these, new initiatives.

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Steps:

1. Collect information concerning the genebanking strategies in Europe, analyse the data collected and assess the situation of the participating countries.
2. Identify the drawbacks on the *ex situ* conservation, following a "Metaplan" procedure. From a list of drawbacks identified in the countries, a list of 27 final drawbacks were ranked by the members of the AHA. The drawbacks were grouped in 4 categories (Funding, Organization, Technical, Policies).
3. on-line Workshop to analyse and group the solutions.

The guidelines of practical recommendations were developed on the basis of these solutions

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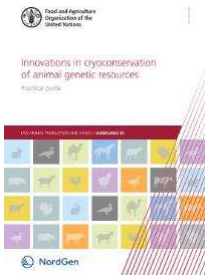
How to use the guidelines:



The guidelines are complementary to the other general documents, as the recent Innovations in Cryoconservation of Animal Genetic Resources-Technical Guideliness by FAO (https://www.fao.org/documents/card/en/c/cc3078en)

The recommendations are classified in four sections:

- **Policies**: regulations on the conservation of AnGR and capacity building.
- **Funding**: sources for financial support and its organization for the development of the *ex-situ in vitro* conservation.
- **Organization of the livestock sector**: improve the structure and operation of the breeders societies and support for the individual breeders to drive the *ex situ in vitro* conservation.
- **Technical**: all kind of resources for the operation of genebanks, human capacities and procedures to improve the *ex situ in vitro* conservation of AnGR.

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Policies *(FAO Guidelines, Sections 1, 9)*

Establishment / strengthening of relevant structures

1. Establish a National Advisory Committee for AnGR and a National Focal point for AnGR.
2. Develop a National Plan of Action/ National Strategy for the conservation, development and sustainable use of AnGR, in liaison with the Sustainable RD Policy.
3. Underline the global commitments on conservation of the biodiversity (CBD and Agenda 2030) to show the competent authorities their liability in the development of the *ex situ* conservation.
4. Improve data collection on ex situ conservation activities in the country.
5. Include SDG 2.5.1.b as an indicator to be followed by the National Institute of Statistics.
6. Establish a structure/organization/institution responsible for the organization/regulation of the genebanking of AnGR, connecting all relevant actors with a long-term mandate.

Box 1: Organization and coordination in France in the field of ex situ conservation to enrich the French National Cryobank collections.

Each breed of ruminants in France is organised in a Selection Organism for the management of the selection or preservation program of this breed. This structure gathers mostly breeders but also other partners such as the AI centres sometimes, which are involved in the production of semen and diffusion of genetic progress. Some breeding programs are using cryopreserved material on a daily basis as for dairy cattle or goat, and, to a lesser extent beef cattle. For the other species, cryopreserved material is not used routinely.

Many specific actions have been coordinated across this last 20 years thanks to different projects to organise collections of cryopreserved material (most of the time semen) for breeds of a wide range of species, including aquatic ones. The coordination of this type of action was facilitated by the creation of the French National Cryobank in 1999.. The Ministry of Agriculture is financing this organism as the genetic resources preservation is a regalian mission. Research organisations (INRAe mostly), technical institutes for livestock species and federations representatives of the breeders are also involved in the French National Cryobank. The advantage of gathering a wide array of different domains representants is that it is quite easy to have the person able to get the information and the good contact for the different actions. The CRB-Anim project was a good example of that synergy as it allowed an important increase in the diversity of the material stored in the French Cryobank whether it is in number of species represented (inclusion of numerous fish species as well as shell and oyster for instance) or in term of diversity inside the species.

To continue the work done as this project is now finished and in order to pursue the enrichment in cryopreserved reproductive material, the Ministry of Agriculture asked to the National Cryobank to write a strategic plan for cryopreservation. The aim of this plan will be to specify how much genetic material is theoretically needed to reconstitute a breed according to the species and underline what is currently missing in the stocks. New collections will then be organised following these priorities, one of the key issue yet to be solved being the funding of the future collections.

Author: Delphine Duclos.

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Policies *(FAO Guidelines, Sections 1, 9)*

Establishment / strengthening of relevant structures

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Policies *(FAO Guidelines, Sections 1, 9)*

Legal framework

1. Set the legal framework for the process of official recognition for breeders´ associations.
2. Set up a legal framework for the regulation of the genebanking of AnGR, covering: mission, recognition regulations, rights and obligations, ownership / distribution and access rights, national network of genebanks, MTA/MAA, duplicate location
3. Cooperation with the animal health services to approve exceptions for the genebanking to the animal health law case by case, or general exceptions for all major species (i.e collection in farm/on the field, old material).

Box 2: Exceptions in the animal health regulations for germinal products intended to be stored in genebanks in Spain.

A derogation allows the collection of reproductive material intended to be stored in genebanks without complying with these regulations (mostly to collect semen directly from farms), **provided that these activities did not pose a risk to public or animal health.**

Procedures have been developed by the units in charge of Animal Health and AnGR in the Ministry of Agriculture, with the experts of the regional governments. The common elements of which are:

- Collection must take place on **farms which are classified as officially disease-free under EU rules on intra-Community trade**. This condition is only waived in the case of animals which are genetically highly relevant for the conservation of the breed.
- The donor will be subject to **the same serological tests** as those laid down in the EU's intra-Community trade regulations, and in addition, etiological tests will be carried out to detect pathogens in the semen.
- In the case of **serial collections over several days, the donor must remain isolated** and samples must be taken at the beginning and end of the collection period.
- The **material must be stored separately** and await the analytical results (**embargo periods**), and the **straws and package are marked with and specific code.**
- If any of the **tests are positive, the collected material must be destroyed**, except in extreme cases where its storage is justified by a genetic expert. In these cases, strict storage and requirements for use are established.
- **Collections may only be carried out by specifically authorized centers/teams under official control**.

Author: Fernando Tejerina.

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Policies *(FAO Guidelines, Sections 1, 9)*

Communication / Networking and international cooperation

Communicate widely to authorities, i.e., by technical meetings / articles and technical notes

1. Strengthening cross-border, regional and international cooperation, i.e. breeding programs of transboundary endangered breeds, avoiding duplicates to save funds. The cooperation must be led by the NFP in each country.
2. Enrolment and active participation in EUGENA and raise the awareness on this network.

Box 3: International cooperation for the implementation of genebanks. Nordgene.

NordFrost networking project (2021-23) has presented a roadmap that aims to further strengthen Nordic collaboration in the conservation of farm animal biodiversity. This roadmap aims to **enhance and harmonize gene banking activities** as well as to define the best practices and knowledge gaps in management of AnGR among Nordic countries.

NordGen Farm Animals has also a short - and long-term action plan for its role in cryoconservation of the Nordic AnGR that highlight:

- need to follow the achievements of the frontier in gene banking and disseminate the latest technologies, expertise, and services available to the national stakeholders.
- endorse collaboration between authorities and look for new cooperation opportunities.
- harmonize collection policies and protocols based on the common Nordic goals.
- collect and process Nordic metadata.
- explore models for the joint long-term backup genebank for AnGR

On the European level, NordGen has an active role in the *in situ* and *ex situ* WGs of ERFP. NordGen introduces Nordic perspective to ERFP network and implements the state-of-art achievements of the ERFP in Nordic collaboration. NordGen also collaborates with FAO to disseminate the most recent achievements in gene banking of AnGR on the global level.

Author: Jaana Peippo.

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Funding (FAO Guidelines Sections 1, 3, 4)

Strategic analysis to ensure the long-term commitment of public funding including

1. Cost-benefits analysis, technical and practical feasibility, compare with potential losses.
2. Prioritize the use of the funds - conservation priorities.
3. Adapt the targets to the real situation of breeds in each country.
4. Integration of *ex situ* activities with funding tools as the RDPs, OGs, specific aids.
5. Use of state aids (Art. 30, Regulation (EU) 2022/2472) to fund the expenses to collect and storage germinal products
6. Establishment of the genebank, storage and collection activities are covered directly by the budget of the departments that hold the collections. Ring-fence funding, for the maintenance of the genebank, for the collection of the material.
7. The long-term funding for the information system.
8. A unity of voice of the breeding sector-research institution is necessary for presenting a case to get funding, increase the funding or plan the strategy of funding.
9. Clear distinction between funds for conservation and funds for research.

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Box 4: Funding genebanks in the Rural Development Programme of Portugal.

Bank of Portuguese Animal Germplasm (BPGA, Banco Português de Germoplasma Animal). The **National Institute of Agrarian and Veterinarian Research (INIAV) and the Directorate General for Food and Veterinary Medicine (DGAV) manage the BPGA**, assisted by a **Commission** composed by nine representatives of the animal breeding sector (**breed associations, technicians and academic**). The **BPGA funding is obtained through both public and rural development programmes** (PDR 2020 and PDR2030) financial support. INIAV and DGAV provide the facilities, qualified technical staff and running costs (budget of the Ministry of Agriculture and Food). PDR 2020 and PDR2030 attribute a fee for *ex-situ* conservation actions concerning: a) the annual maintenance of genetic material in the BPGA (**0.08 € for each dose and year**), and b) the collection of genetic material for the BPGA (**10 000€ for each breed and year**), attributed to breed associations that delivery cryopreserved genetic material to the BPGA collection, according to published guidelines. **This support is not available for all breeds each year. On average, each breed can benefit from this support every 2 years.**
Author: Rosa Lino Neto.

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Funding (FAO Guidelines Sections 1, 3, 4)

Breeding organizations

1. Involve breeding organizations in the funding of the genebanks.
2. Start setting up collections without much funding by gathering surplus stocks from AI centers.
3. Support to breeders owning endangered breeds (RDP), also the option to collect germinal products from these breeds.
4. Breeders' societies of local breeds provide the farmer that sell a male for AI-production a small grant to make it more attractive to contribute.
5. Set-aside system in the procedure to grant subsidies to breeder' societies, provided that part of the funds can only get if the society develops *ex situ* activities, including the duplication of the collections in a national genebank.
6. Free serological/PCR analyses in the public Animal Health Laboratories for samples from donors of germinal products intended to be stored in a genebanks.

Research opportunities

1. Participate in international projects to strengthen national capacities for the implementation of cryo-conservation.
2. Exploit the opportunities offered by research projects, with focus on initiating the collections.
3. Promote a better funding from EU research programmes to support projects in relation with AnGR (cryoconservation).
4. Promote public/private partnerships for the funding of genebanks.

Box 5: Involvement of private and public actors in the genebank development in Norway.

Norway has a long tradition of using frozen semen in the commercial breeding work. From the 1980's, frozen semen has also been used in Norwegian breeding for sheep and goats. Today frozen semen is used in all breeding programs for cattle, sheep and goat, in the active breeding populations as well as in the native endangered breeds. The breeding organisations also store semen for long-time storage in their genebanks.
The genebanks are owned by the breeding organizations, so far there is no public cryo genebank for AnGR in Norway. The breeding organizations are co-operatives, that is, they are owned by their members, Norwegian livestock farmers.
The semen is collected at AI-stations. Most of the doses are for commercial sale, and some of the doses are stored for long-time storage. Many of today's native and endangered breeds have storage of frozen semen from the days when the breeds were commercial breeds. This has been a "life-saver» for these breeds.
Important criteria for the males of endangered breeds that are being selected for semen production are **well documented kinship, and that they and their mothers are good representatives for the breed**. To insure this, the selection is a cooperation between private and public actors; breed societies, the respective breeding organization and Norwegian Genetic Resource Centre. In addition, Norway has implemented a tool for the endangered native cattle breeds to check the relationship to the already existing AI-bulls. In this way we can select bulls that widen the gene pool in the cryo genebank.
It has been easier and more obviously to develop genebanks for breeds and species that use frozen semen in the active breeding work. It seems to be a challenge to develop gene banks for species where the breeding work doesn't use frozen semen, and thereby has the possibility to finance gene bank for longtime storage.
Author: Anna Caroline Holene.

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Diapositive 11

ΧΛ0 Provide support
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Organization of the livestock sector (FAO Guidelines Sections 1)

Legal framework

1. Organize the sector in breeding societies/cooperatives responsible for the breeding programmes in accordance with the EU regulation, where relevant. Population size monitoring and facilitate tools for pedigree registrations.
2. Develop extension services, capacity building for breeders and foster the knowledge transfer from experts to breeders.
3. National Genebanks should prioritize their activities on endangered breeds. Integration between *in situ* and *ex situ* conservation. Use new EU Breeding regulation (Regulation 1012/2016) to set in the breeding programme the cryoconservation activities. Also work in the *ex situ* collection of material of the mainstream breeds / integrate a back up collection in the breeding programmes.
4. Technical incentives or reduction in fees by breeders societies for breeders collaborating with the *ex situ* collection activities.

Funding

1. Establish long term funding for breeders' associations of local breeds by RDP measures, or national aids (Art. 30, Regulation (UE) 2022/2472)
2. Promotion of ex situ conservation through financial support of breeders' associations.

Cooperation

1. Communication between Research Institutes, Departments of Reproduction and Artificial Insemination, Regional Centres for AnGR and Breeders Associations, to improve cooperation and complementarity of the actors.
2. Develop specific projects to foster the involvement of breeders' societies in genebank activities.
3. Increase awareness of Breeders, Breeders Societies and AI companies on the role of *ex situ* conservation by distinguishing cryopreservation for preservation / cryopreservation for industrial dissemination.
   a. case studies showing **benefits of *ex situ*** (lost variants, health risks) and the **links of genebanks with in situ conservation** and breeding programmes (limit inbreeding; conserve while fertility is good).
   b. Meetings and workshops, official webpages, articles, press releases, radio interviews, TV reports, etc.
4. Promote the exchange of information, between involved entities, useful for setting priorities;
5. Involvement of the entities conducting the evaluation of utility and breeding value to co-decide about the material stored in genebank
6. Direct participation of institutes or public centres experts in animal reproduction in breeding programmes. Breeding programmes (conservation) should have the advice of an expert in genetics
7. Rare breed umbrella society is on board with the development of a genebank.

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Technical issues (FAO guidelines: Section 3, 5, 6, 7, 8, 10)

Capacity building

1. Investment in infrastructures and equipment to establish laboratory facilities and equipment necessary for cryo-conservation.
2. Human capacities building and training on the methods of testing, storage of samples in liquid nitrogen, and the necessary documentation for their description and identification.
3. Development of a diploma or any official document recognising the skills of AI technicians in cryoconservation for a range of species.
4. Organization of these activities around a plan for the capacity building and training.
5. Support the Universities and Institutes in their tasks in relation with AnGR.
6. Continue to use strategies to overcome differences among different areas of the country.

Cooperation

1. Inventory of institutions hosting a collection and their material.
2. Exchange of material between genebanks of transboundary endangered breeds and use EUGENA to facilitate these exchanges.
3. Intensify cooperation with universities and research institutes for the improvement of conservation methods, both at national and international level. Focus these efforts in the improvement of methodologies for cryoconservation in "difficult species" (lacking of routine techniques).
4. Promotion of research projects and technical development.

Box 7: How to become an inseminator in France?.

To become an inseminator, there are different training courses depending on the type of animals to be inseminated:
- for ruminants (cattle, sheep or goat), you must pass the certificate of aptitude for insemination technician functions (CAITF)
- for horses, it is a certificate of aptitude for the functions of equine inseminator (insemination licence) or certificate of aptitude for the functions of equine centre manager (insemination centre manager's licence).

To obtain the CAITF, the exam has a theoretical and a practical part. The legislation specify that the future inseminator has to be able to:
- carry out the act of insemination while respecting animal welfare, hygiene and safety rules and regulations
- manage the semen deposit in compliance with regulations and hygiene rules.

Most of the candidates choosing this formation already have a 2-year post-baccalaureate specialisation in animal production and the course is carried out under a professional training contract, when the candidate already has an employer. Two centres in France offer training to prepare for this exam.

Author: Delphine Duclos.

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Technical issues (FAO guidelines: Section 3, 5, 6, 7, 8, 10)

Genetics

1. Proper identification system of animals, herd book and data recording.
2. Promote cryoconservation before a breed will be in a critical status.
3. Develop molecular tests for pedigree testing.
4. Analysis of demographic, genealogical and performance data kept by Breeders Associations to set priorities.

Information Systems

1. Develop and operate a suitable Database for genebanks.
2. Regular collection of information of the material stored in institutions hosting genebanks in the National Database for AnGR.

Reproduction technology,

1. Where gaps in methods for freezing semen occur (like poultry), experts from countries with success on the specific species have been addressed to transfer knowledge.
2. Local breeds benefit from the expertise on *ex situ* conservation applied on commercial breeds (cattle, sheep and goat).

Sanitary aspects

1. Recognize molecular tests to assess the sanitary status of the material collected instead of that of the entire flock or breed.
2. Organization and distribution in different locations to safeguard the duplicates. Duplicate collections, demands good links with AI stations and breeding centres.

Box 9: Ex situ in vitro conservation method of the female genome in poultry species.

Unlike mammals, in **avian species** the females are the heterogametic. **The egg and embryo, which can contain the *w* chromosome, cannot be frozen**. Most of the reproductive biology techniques developed so far in birds to preserve genetic material have focused on sperm and embryonic cells. If we use only the sperm, the female genome left out from the in vitro gene conservation practice. Although the female gametes are unfreezable due to the huge amount of vitellus as well as their special physico-chemical traits, **the first 24 hours after hatching the structure of the ovary allows its cryopreservation, cutting and transplantation of the gonadal tissue**. The primary oocytes are located marginally in the ovary and at this age they are in a developmentally dormant state after hatching. This makes the freezing possible, as the biochemical properties of vitellus have not caused a problem yet.

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Closing Remarks

- This is a collective output of the AHA and the ex situ WG
- Next step is to make use of this material, together with the FAO Guidelines or other material (technical documents, reports, articles)
- Promote cooperation and exchange within the network and within the actors in each country

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Thank you!

Lumturi Papa (Albania)
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Ad Hoc Action

Strengthening national capacities towards the development of a national Gene Bank strategy

A questionnaire was designed with the following structure:

Part A. GENERAL INFORMATION.

- Organization of the AnGR management and Ex situ conservation (National Plan of Action, Advisory Committee, Genebanks, EUGENA…).
- Breeds with material/ sufficient material stored in genebanks.

Part B. ASSESSMENT OF CURRENT SITUATION (EX SITU CONSERVATION).

- Role of different actors in the Ex situ conservation, human and technical capacities, collections of public bodies (ministries, regional governments, AI public centers, research Institutes) and private bodies (breeding societies, private companies, NGOs).
- Ex situ conservation in breeding programs.
- Legal framework.
- Organizational aspects of Genebank.
- Technical aspects.
- Funding.

11 answers from: Albania, Austria, France, Greece, Italy, Norway, Poland, Portugal, Serbia, Slovenia and Spain.

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Ad Hoc Action

Strengthening national capacities towards the development of a national Gene Bank strategy

Key findings from general information (Part A) and role of actors in ex situ conservation (Part B).
In all countries many breeds have no material or not sufficient material in gene banks, this is the most relevant gap in the ex situ conservation activities. The situation varies by country and some have more developed collection than others.
In general countries with more developed collections have designed an AnGR Plan of Action, have National Advisory Committees, National Genebanks and/or registers of Genebanks.
Regional/breeding associations Genebanks are not always essentials for the ex situ conservation strategies (country dependent).
The ministries (Agriculture) have a central role in the organization of AnGR conservation strategies. In several cases by delegating the functions in other organizations.
The main actors in the ex situ conservation strategies are public AI centers, research institutions/universities and breeders associations.
Other actors (Private companies, NGOs, ….) have less relevant in the current ex-situ conservation strategies

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Ad Hoc Action

Strengthening national capacities towards the development of a national Gene Bank strategy

Key findings from assessment of current situation (Part B)
The development of collections between species follow different speeds: Cattle, sheep, goats are more advanced, followed by pigs (issues with fertility), rabbits, poultry (differ among countries), horses (less experience)
Type of material: semen is the most common material and collections of embryos and oocytes are less developed, depending on species and human capacities per country.
In endangered breeds with small population size the concern is on the genetic diversity aspects, which makes more difficult the selection of donors.
Available funds, very small number of males in some breeds and a lack of a prioritization limits the collections of sufficient material per breed
Written agreements between Breeding Associations and Genebanks are essential tools, to reach theses agreements is recommended stablish a decision making process.
In some countries, breeding programs have as objective (or obligation) to contribute to the Genebank, not in all.
The support from AI Public Centres is a key element, but in some countries developing GeneBanks is not a priority for their AI Public Centres.
EU Regulations on national aids and on Rural Development Programs allow the funding of genebanks, but not all countries take advantage of these regulations
Derogations in Animal Health Regulation for the use of old material or collection on field are highly recommended.

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Key findings from assessment of current situation (Part B)
Identification of every institution that is working on ex situ activities is a relevant step to organize and coordinate these institutions in a common strategy.
The research projects could play a key role in the collection of material.
Ex situ conservation demands a regulation and a coordination among the actors involve.
Other relevant gaps: Financial support (and priorization for weakest breeder associations), human and technical capacities, awareness of ex situ conservation, dissemination among farmers, information systems, commitment and set priority on the *ex situ* conservation activities.

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Category new	PROPOSALS OF DRAWBACKS AND OBSTACLES FOR DEVELOPMENT EX SITU CONSERVATION.	Albania	Austria	France	Greece	Italy	Norway	Poland	Portugal	Serbia	Slovenia	Spain	Total
Funding	Lack of funding for ex-situ conservation.	20	16	13	14	20	20	10	20	20	18	13	186
Technical	Lack of infrastructures, lab and human capacities, total or partial (either depending on the species (i.e available for the cattle / not for other species), or on the population size (i.e not available for endangered breeds))	9	18	17	7	15	18	6	15	12	20	9	146
Policy	Ex situ conservation is low priority in governamental policies.	14	2		20	19	9	13	19	7	11	13	127
Policy	Poor/lack of coordination between the actors (within Public bodies, and between Public / Private) involve in ex situ conservation activities and lack of accurate knowledge of all existant collections.	18	3		19	16		4	10	3	17	20	110
Organisation of livestock sector	Low interest of breeder societies in ex situ conservation activities	17	17	10	10	13		12	12	18	10	18	138
Policy- funding	Unexploited funding opportunities (at national or European level) for ex situ activities.	4	8	16	16	11	10	15	4	5	13	5	107
Organisation of livestock sector	Private companies/AI centers not involve in the ex situ conservation activities, even if they have big collections of material, because they do not find their economic interest	15	10			10	16	14	6	17	6	11	105
Funding	Not stability in the source of the funding, and possible cuts in the future.		20	8	8	12	19	20	14		2		103
Policy - society	Low level of public awareness, in general and in the farmer's community in particular, about the conservation of AnGR.	3	13	1	13	2	8	17	18		7	17	99
Policy - legal	Absence of a regulation on ex situ conservation activities (i.e no recognition an institution as a Genebank)	13			17	18	15	19		16			98
Technical	Gaps in methods for freezing semen and unsufficient fertility of frozen semen in some species (i.e. horse, poultry)		15	15			17	16	9		9	16	97
Organisation of livestock sector	No integration of ex-situ conservation activities with in situ conservation.	12		5	15	7	5	5	5	14	14	14	96
Technical	Extremely small number of males in the population intended to be preserved.	10	9	14	5	3	1		17	11	12	12	94
Organisation of livestock sector	Weak structure of the breeders associations and poorly developed breeding programs, which not allow the development of ex situ conservation activities.	19		4	18	9	3			19		18	90

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Category new	PROPOSALS OF DRAWBACKS AND OBSTACLES FOR DEVELOPMENT EX SITU CONSERVATION.	Albania	Austria	France	Greece	Italy	Norway	Poland	Portugal	Serbia	Slovenia	Spain	Total
Policy - society	Lack of awareness on EUGENA activities	11	12				12	18	8	10	1	3	75
Technical	Lack of technical knowledge and experienced technicians, facilities and equipment in different regions of the country (incluiding specific problems in islands)	6	4	18	3	17			16			10	74
Policy	Bureaucratic burdens in terms of financial planning and in agreements between the government and breeders associations to develop genebanks.	2	11			14	13	7		15	4	7	73
Policy	Coordination among countries in case of transboundary breeds which avoid duplicate efforts.	7	19	7		5		2	3	9	15	1	68
Policy -legal	Restrictions from the Animal Health laws in collections on the field or use of old material.		1	19	11	6	4	9	1	8		2	61
Technical	Difficulties in the development of new biotechnologies (ET, IVF, freezing of oocytes, gonad grafting, etc.).	8	14	6			7	8	7	2	8		60
Organisation of livestock sector	Breeders reluctance to allow the collection of material from their animals, afraid to loose ownership on their animals.		6	12	9			1	13		5	8	54
Organisation of livestock sector	The farmers are not organized in breeding associations, which are necessary to establish herd books and for the implementation of conservation programs.	16		3			14			13	3		49
Technical	Problems with storage of duplicate collection (i.e no other premises available).		5		6	8		3	11		16		49
Technical	No modern databases in genebanks to manage the information and allow the interoperability with other databases (i.e. breeders associations database to choose the donors).			2	2	1	2	11		1	19	6	44
Technical	Unknown sanitary status of the local population to be preserved	1		20	4	4	6			6			41
Policy - legal	Problems to establish the property of the material stored and the possible uses allowed for this material		7	11	12				2	4		4	40
Technical	Lack of information on the population (pedigree) or on the animals (age, pedigree) intended to be preserved.	5		9	1		11						26

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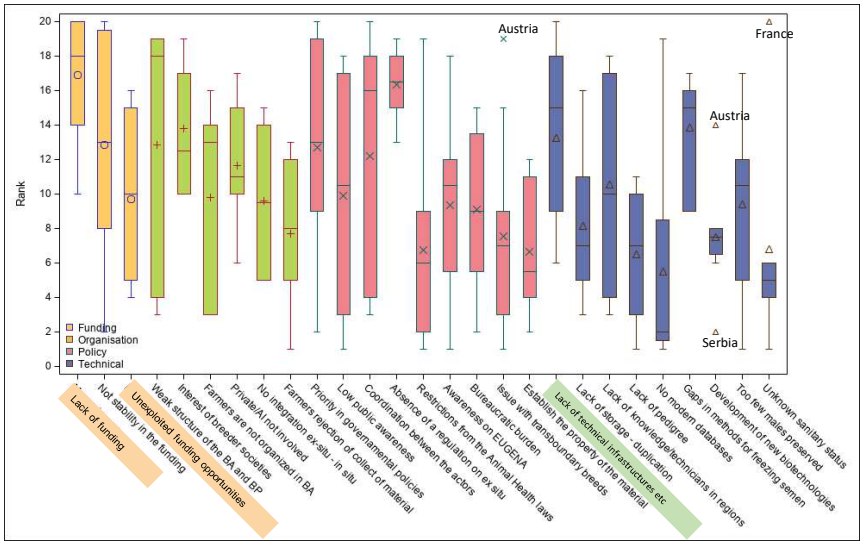

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