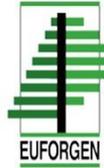


GenRes Bridge



GenRes Bridge - Joining forces for genetic resources and biodiversity management

Observations and conclusions based on one cycle of three animal genebank peer reviews:

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817580





Pilot: Livestock Genebank Peer Reviews

Observations and conclusions based on one cycle of three animal genebank peer reviews.

Background

Complementary to *in situ* conservation, countries in Europe have established genebanks for the (long term) *ex situ* conservation of farm animal genetic diversity. The FAO Global Plan of Action on Animal Genetic Resources, as well as the UN Sustainable Development Goals (Target 2.5) recognize the relevance of genebanks for the conservation and sustainable use of genetic resources.

Within Europe, the European Regional Focal Point (ERFP) initiated the development of the European Genebank Network for Animal Genetic Resources (EUGENA). The aim of EUGENA and ERFP is to exchange information, knowledge and experiences between genebanks and countries, to support further development and professionalization of national genebanks, and to create a network that collectively conserves animal genetic resources in genebanks.

To streamline and to strengthen the conservation and sustainable use of genetic resources in Europe in different domains (plant, animal and forest genetic resources) and to explore cooperation between domains, ERFP cooperates in the EU Horizon 2020 funded GenResBridge project¹.

Within GenResBridge project a system of peer reviews has been set up aiming to improve the quality of European genebanks by simply having the experts of these genebanks visit each other, giving full transparency about the facilities and protocols, and having discussions about these. Reviewers provide recommendations to the hosting genebank.

A pilot of these genebank peer reviews is being organised in the second half of 2021, involving the French national Cryobank at Institut de l'Élevage and French National Laboratory for Health Control of Breeding Animals (Paris, France), the Dutch national genebank at Centre for Genetic Resources, the Netherlands at Wageningen University & Research (Wageningen, the Netherlands) and the Slovenian national genebank at University of Ljubljana, Biotechnical Faculty (Ljubljana, Slovenia) focussing on the animal genetic resources (AnGR) collections.



Figure 1: Liquid nitrogen tanks, ordered per species at Wageningen, the Netherlands.

The reviews were held on September 13th and 14th in France, September 15th and 16th in the Netherlands and on October 5th and 6th in Slovenia. The review committee consisted of Danijela Bojkovski (National genebank of Slovenia at University of Ljubljana, Biotechnical Faculty), Delphine Duclos (French national genebank at Institut de l'Élevage), Marjolein Neuteboom, Mira Schoon and Sipke Joost Hiemstra (Dutch national genebank of Centre for Genetic Resources, the Netherlands at Wageningen University & Research). After each visit a report was written with observations and recommendations.

¹ www.genresbridge.eu. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817580

Observations

The following general observations and conclusions are based on one cycle of three national animal genebank peer reviews.

The concept

The overall impression of the genebank reviews was that this is a very useful exercise, both for the hosting genebank and its staff, and for the reviewers visiting another genebank. Comparison of the three national livestock genebanks clearly shows both similarities and differences between the genebanks. Sharing experiences and knowledge was beneficial for all three genebanks and resulted in new ideas and inspiration. The reviews generated critical questions, useful suggestions and constructive recommendations.

The recommendations listed in the individual reports will help the genebanks to further develop their work and priorities.

Team size and team composition

The review team visiting a genebank consisted of between one and three experts of the other two countries. The choice of three relatively different genebanks in this first cycle of reviews was very positive; two genebanks with long experiences but still very different organizational structures versus one younger genebank; one genebank already with a certified quality management system, the second in the process to obtain this and the third not having this objective for the moment.

A team of three genebanks was an adequate number. It limits the number of visits to the other countries and one as a host, but still allows having a review team of at least two reviewers during the visits. This group size of three genebanks allows in depth discussions and a trustworthy atmosphere to share all aspects. In addition, it is recommended that the review team consists of experts which have different expertise and background. Hence, participating genebanks could make available between one and three staff members to visit other genebanks for the purpose of the peer review. The most profitable is when the receiving genebank can involve all relevant staff in the review process.

Groups up to a maximum of four to five genebanks would also be possible. For larger groups a rotational system could be implemented, for example ten participating genebanks where each genebank is visited and reviewed by two experts.



Figure 2: Review group and hosts at main storage facility of French national cryobank at LNCR.

Transparency

All the participating genebanks gave complete transparency, in terms of access to information, facilities and staff. This resulted in excellent discussions about strengths and opportunities for improvements. The trustworthy atmosphere in combination with the transparency is the key to success of such a peer review approach.

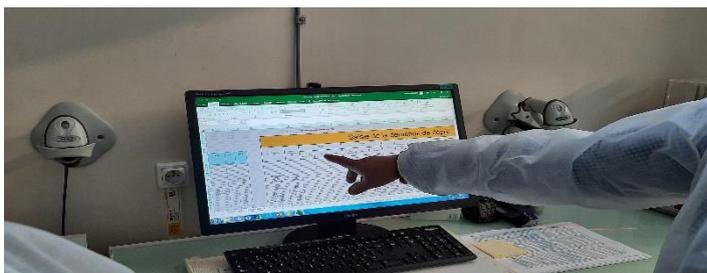


Figure 2: All facilitating genebanks gave complete transparency in all databases, documents and protocols.

Reporting

Review reports are short and to the point, listing only major observations and associated recommendations. Having longer reports would require too much time from the reviewers and small details are already discussed during the meeting. For reporting, it was useful to share and discuss the first observations of the reviewers already at the end of the review meeting.

The report was further elaborated after the meeting via email, and if necessary via online meetings. All members of the review panel contributed to the report, agreeing on who will take the initiative to writing up the.

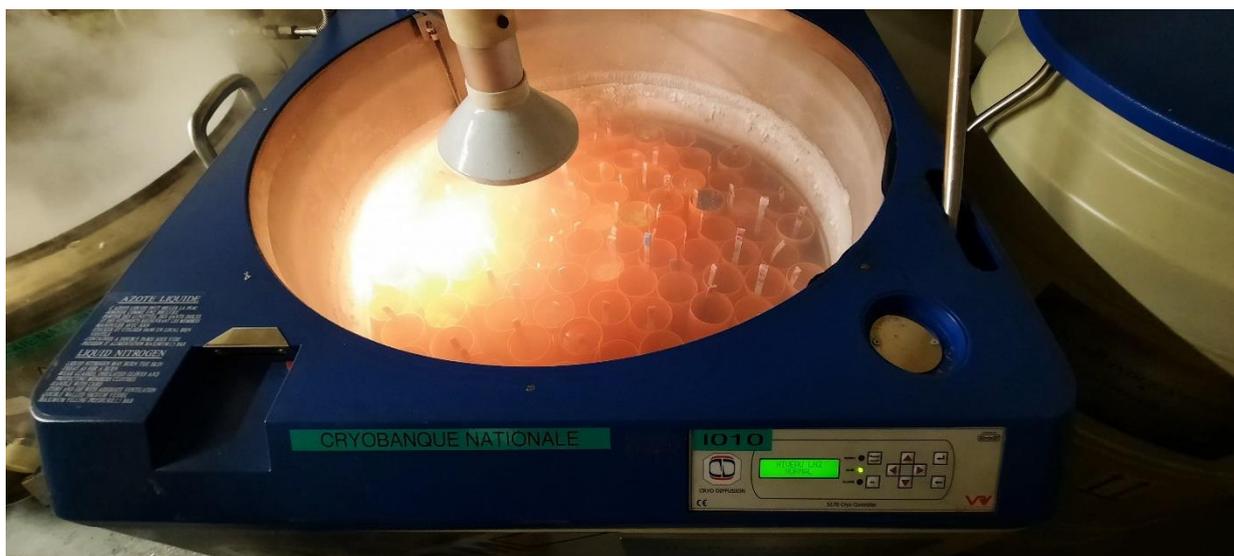


Figure 3: The liquid nitrogen tanks at the French national cryobank at LNCR were accommodated with mobile suction and light systems.

Funding

This first round of peer reviews was co-funded by the GenResBridge project. A well-functioning and sustainable peer review system requires funding, especially when more genebanks are involved. In particular, funding is needed to cover travel costs. Local costs could be largely covered by the hosting genebank.

Personal observations of members of the review panel

Personal observations Marjolein Neuteboom (Wageningen, the Netherlands)

By joining the review panel, I hoped to gain new insights from reviewing other genebanks in combination with getting recommendations from the panel when visiting our genebank. This expectation was definitely fulfilled. All genebanks function differently and these differences created great discussions about the positive and negative aspects of these differences. We discussed, for example, on whether or not the genebank should have full ownership of the stored material and how to organize duplicate collections. Also differences in practices were discussed, resulting in sharing of specific protocols which would not have been shared otherwise. For example we did not have good results with freezing epididymal boar semen yet, while Slovenia is actively doing this. This happened to be the other way around for epididymal ram semen. We agreed to share protocols. The final recommendations help us in prioritizing our future actions. Sharing knowledge and experiences by visiting other genebanks should also be extended to the technical people working in the genebank, as this is very specialized work and there are not many "peers" around except at other genebanks, often across borders.

Personal observations Danijela Bojkovski (Ljubjana, Slovenia)

Collaborating in this peer review of genebanks was really a huge challenge, especially when you are opening your door to the experts of the most developed and organized genebanks in Europe. Our genebank is probably still developing and material untouchable. We got information on really practical and important issues such as security, organization of storage, health aspects and simple management practices. For me, it was valuable to get advice about ownership of the material, which is not considered when taking material from breeders. Most important aspect of the visit was also to share knowledge and information on the future developments.

Personal observations Delphine Duclos (Paris, France)

The experience of these three peer reviews was very interesting. Each genebank has its own strengths and weaknesses and it was very useful to share them to better understand how each genebank is working and have new ideas for our own genebank. The main point for me was to see how other countries manage to be more pragmatic to obtain genetic material whereas we are faced with an overly strict interpretation of the European sanitary legal framework. The priority for small local breeds is to obtain genetic material, even though the quality and the sanitary controls are not the same as for commercial purposes. We will have to work particularly on this aspect.

Conclusions

The following conclusions were drawn, unanimously, by the reviewers involved in the first cycle of genebank peer reviews:

- The genebank peer reviews are an excellent way of sharing knowledge and thereby very useful for both reviewers and the hosting genebank itself.
- Preparing for the review via the genebank self-assessment report was useful, both for the reviewers to have a first impression of the genebank, and for the hosting genebank itself as a good starting point for the presentations and discussions. The self-assessment template could be further improved on the basis of the pilot-review experiences.
- Take some time for the final discussion at the end of each visit and to finish with a joint SWOT-analysis is a good way to round up all topics. By talking through the strengths and weaknesses of the genebank in question it also gives an excellent starting point for the review report and to draw up most important conclusions, advice and recommendations.
- Involving three genebanks in one round of peer reviews was effective, however other team sizes could work as well. Larger group size would require a slightly different set-up and the trustworthy atmosphere related to the transparency on all aspects should be considered.

November 23rd 2021

Danijela Bojkovski, Delphine Duclos, Marjolein Neuteboom, Sipke Joost Hiemstra, Mira Schoon



Report of the Peer Review of the French National Cryobank

September 13th to 14th 2021, Paris, France

Introduction

Complementary to *in situ* conservation, countries in Europe have established genebanks for the (long term) *ex situ* conservation of farm animal genetic diversity. The FAO Global Plan of Action on Animal Genetic Resources, as well as the UN Sustainable Development Goals (Target 2.5) recognize the relevance of genebanks for the conservation and sustainable use of genetic resources.

Within Europe, the European Regional Focal Point (ERFP) initiated the development of the European Genebank Network for Animal Genetic Resources (EUGENA). The aim of EUGENA and ERFP is to exchange information, knowledge and experiences between genebanks and countries, to support further development and professionalization of national genebanks, and to create a network that collectively conserves animal genetic resources in genebanks.

To streamline and to strengthen the conservation and sustainable use of genetic resources in Europe over different domains (plant, animal and forest) ERFP cooperates in the EU Horizon 2020 GenRes Bridge project². Funded by GenRes Bridge, a system of peer review has been set up aiming at improving the quality of European genebanks by simply having the experts of these genebanks visit each other in their genebanks, giving full transparency about the facilities and protocols, and having discussions about these. Reviewers provide recommendations to the hosting genebank.

A pilot of these Genebank Peer Reviews for livestock genebanks was organised in the second half of 2021, involving the French national Cryobank (Paris, France), the Dutch national genebank (CGN-WUR, Wageningen, the Netherlands) and the national genebank of Slovenia (Ljubljana, Slovenia). The first review was held from 13th and 14th September, in Paris, France.

The review committee consisted of Danijela Bojkovski (University of Ljubljana, Slovenia), Marjolein Neuteboom, Mira Schoon and Sipke Joost Hiemstra (CGN-WUR, the Netherlands).

Organisation of the review

The review was organised by Delphine Duclos, Executive Secretary of the French national Cryobank, and employed by the *Institut de l'Élevage*. The review took place at the *Institut de l'Élevage* in Paris, and the primary storage site at LNCR (French National Laboratory for Health Control of Breeding Animals) near Paris. Representing *Institut de l'Élevage*, Coralie Danchin-Burge (researcher, former Executive Secretary of the French national Cryobank, and currently acting Secretariat for ERFP) also joined the review. From LNCR side, David Briganti (stock manager at LNCR) and Laurence Guilbert-Julien (director of laboratory at LNCR) welcomed the review panel at the primary storage site.

A self-assessment was carried out by Delphine Duclos and sent to the review panel ahead of the peer review visit to Paris. The visit consisted of several presentations made by Delphine Duclos and Coralie Danchin-Burge and a tour through the main storage site and facilities by David Briganti (Stock manager),

² This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817580

followed by discussions and interaction with the review panel. At the end of the visit (second day) the review panel shared their observations and draft recommendations, followed by a final general discussion.

Observations, conclusions and recommendations

Organisation

The French national Cryobank has a Governing Board of twelve partners, including commercial breeding organisations, breeding associations and research institutes. With the foundation of the *Groupement d'Intérêt Scientifique* (GIS), general objectives have been agreed upon between the partners of the Governing Board of the GIS. The Governing Board is the decision making body. One of the twelve partners is elected as the chair, and *Institut de l'Élevage* has a mandate from the Ministry of Agriculture to employ the executive secretary of the genebank, this decision has to be approved by the Governing Board as well.

The partners of the GIS operate within a general framework, without setting specific goals for a determined period of time. Besides the signatory members of the GIS, the French national Cryobank has agreements with depositors (AI organisations and breed societies), and with a range of (mirror) storage sites across the country (depending on species). The president of the GIS signs the agreements with depositors and storage sites.

The French national Cryobank is dependent of the *in kind* contributions of employees of the members of the GIS. Two half-time persons are directly payed by the cryobank, the executive secretary and the stock manager. The regular source of funding of two half time staff, equipment and liquid nitrogen comes from the Ministry of Agriculture. This is supplemented by regional or national project funding, e.g. from *Centre de Ressources Biologiques pour les Animaux Domestiques* (CRB-Anim) infrastructure project.

Recommendation 1: Limited mandate and limited regular funding from Ministry of Agriculture makes the national cryobank rather dependent of project funding or *in kind* contributions. This also influences priority setting, which may not be completely in line with long term public interests. A stronger long term mandate of public tasks of INRAE/IDELE could further strengthen the position of the French national Cryobank.

Policy Development and Quality Management System

A general policy document, including medium and long term goals, is missing. Such a document will be required for obtaining ISO 9001:2015 certification. The French national Cryobank is planning to obtain ISO 9001:2015 certification in the coming years. This policy document would include a clear vision on breeds to pro-actively acquire genetic material. Currently rare local breeds seem to be underrepresented in the interests of the Board of GIS which could result in bias towards commercial breeds. Due to national veterinary legislation, the main material stored in the cryobank is collected at (commercial) AI-stations. A substantial proportion of total genetic diversity will not be covered by this material as for several breeds, mainly local rare breeds, will use natural mating for the majority of breeding. The French genebank strategy would benefit from specific measures or derogations in the national animal health legislation, that will provide better opportunities to cryopreserve genetic material of breeds with higher risks of extinction or local breeds without any cryopreserved material for the moment.

An overall risk assessment in the medium to long term should be considered. An important aspect of such an assessment would be to discuss different options regarding the ownership and access rules of the stored material.

Recommendation 2: Carry out an overall risk assessment in the medium and long term. The current conventions between providers of genetic material and the French national Cryobank could be revisited in particular with regard to ownership and access rules. It might not be sufficient to state ownerships in a 100 years. Juridical advice might be needed to evaluate the ownership status based on the current agreements.

Recommendation 3: The current national animal health regulatory framework for AI centers may limit the genebank to meet its objectives. Necessary derogations or exemptions in the national animal health law should be explored and discussed with the veterinary authorities.

Storage of the material and collection management

The entire collection is stored under optimal long-term storage conditions in liquid nitrogen at -196°C. The storage was very well organized at the primary storage site near Paris. Also the forms that are used to check the material when it arrives looked detailed and well documented. Half of the genetic material is stored at (species specific) mirror sites across France, which is a very good and secure system. These mirror sites run rather independent from main storage site, while good communication between the main site and mirror sites is important.

The whole cryobank collection has an EU sanitary status, except horses. To allow more influx of different types of material, for example from males of particular breeds which cannot be stationed at an AI centre, the cryobank could have separated storage tanks without this high EU status. Genetic material stored in these tanks can contribute to national use but cannot be exported for international use. However, under specific conditions it is allowed to exchange this type of genetic material between genebanks.

Recommendation 4: As Excel documentation system is very prone to man-made mistakes and communication and exchange of data between different databases is difficult. We advise to aim for the development of an integrated information system for tracking and tracing of samples and of animal data. Consider joining the ERFIP initiative for developing a new database for cryobanks.

Recommendation 5: Start uploading the (meta) genebankdata into EFABIS/EUGENA and the IMAGE/EBI database.

Access and Distribution

The public database is very detailed and informative about the whole collection, including number of doses and quality. The procedures in CRB-Anim are very clear and the system easily creates the MTAs and MAAs, although in some cases there may be too many steps for the user. The genebank works with 3 types of classifications (Type 1: rare breeds, Type 2: original animals or lines and Type 3: selected breeding stock). We feel Type 1 could get a higher priority but this is currently difficult because of funding limitations. Governmental funding is required for establishing Type 1 collections. The cryobank is working with species groups organised with CRB-Anim. This is a good structure, however coordination across species groups is also important.

So far, distribution of genebank material to users is very limited, and is only possible via the breed

societies. Use of genebank material could be promoted by better communication about the genebank collections and about the opportunities towards breeders, either directly or via the breed societies.

Recommendation 6: (Governmental) funding for establishing genebank collections for rare breeds is advised.

Recommendation 7: Expand communication strategy towards breeders to create more awareness about the objectives of the genebank, possibilities for collaboration and to promote (future) use of genetic material stored in the cryobank.

Documentation

For the registration of genetic material, documentation and collection management, multiple systems are used. At the local sites Excel-sheets are used to document where the material is stored, which is prone to man-made mistakes and server back-ups are crucial. The storage information is shared by the stock manager with by Delphine who needs to include the information in the national database Cryobase and then exported to the CRB-Anim database. LNCR (the institute that also hosts the genebank collections) has its own software to handle and register material. There may be opportunities to adjust this software in order to make it functional for the cryobank collection as well, and possibly create direct links. to national databases such as Cryobase and CRB-Anim as well. Currently no data is uploaded to EFABIS/EUGENA.

Recommendation 8: Development and implementation of a new modern database is essential. The new tools developed should allow interoperability and data optimization between different databases.

Final conclusion

The French national Cryobank is an impressive and excellent infrastructure. The governance structure is well organised and there is a very good collaboration with the different sectors. The legislative framework is good, although for the long term continuity it may be a threat that it is not specifically mentioned in the legislation who is responsible for the genebank. Furthermore, derogations in national animal health law, for the genebank to collect, store, freeze and distribute genetic material of local (rare) breeds, would provide additional opportunities to increase the genetic diversity conserved.

The staff is very competent but continuity of staff is a risk with the small team and high level of expertise. In case of leaving of a staff or board members, replacement of the persons will not be easy. Expanding the structural budget for personnel and genebank activities is highly recommended. This would also allow more time for implementing adequate quality standard like ISO 9001:2015.

Final remarks

The reviewers highly appreciated the well organised review visit. The sharing of expertise and experiences was fluent and very useful for all participants. As this was the first visit of the series, this was an excellent start and setting the standard for the other reviews.

October 21th, 2021

Danijela Bojkovski, Sipke Joost Hiemstra, Mira Schoon and Marjolein Neuteboom



Report of the Peer Review of the Dutch national Genebank at CGN

September 15th to 16th 2021, Wageningen, The Netherlands

Introduction

The Convention on Biological Diversity and UN 2030 Agenda recognized the importance of the *ex situ* conservation of genetic material in genebanks. The Sustainable Development Goal 2 (Zero Hunger) and more specifically indicator 2.5.1 (b) are devoted to the material stored in the genebanks. Many breeds in European countries have either no or insufficient material stored in the genebanks (Leroy et al., 2020). For that, *ex situ in vitro* programmes should be established, implemented, or strengthened to initiate or expand collections for all breeds, especially local breeds *at risk*.

Genebanks are critical facilities, therefore development and implementation of quality management systems for genebanks is very important, as well as research to develop, standardize and implement reproductive technologies and cryopreservation procedures. The research should contribute to the effectivity and efficiency of the genebank operations.

Exchanging knowledge and experiences, improving access to information about genebank collections, and facilitating the exchange of genetic material in Europe, is the main aim of European Genebank Network for Animal Genetic Resources (EUGENA), the European Genebank Network, governed by the European Regional Focal Point (ERFP).

Results of the Innovative Management of Animal Genetic Resources (IMAGE) project have also 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 genebanks 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. To streamline the conservation activities in Europe over different domains (plant, animal and forest) ERFP cooperates in the EU Horizon 2020 GenRes Bridge project³.

In the framework of ERFP and with the support of Genres Bridge, a system of peer reviews has been set up aiming at improving the quality of European genebanks by simply having the experts of these genebanks visit each other in their genebanks, giving full transparency about the facilities and protocols, and having discussions about these.

A pilot of these genebank peer reviews is being organised in the second half of 2021, involving the French national Cryobank at Institut de l'Élevage and French National Laboratory for Health Control of Breeding Animals (Paris, France), the Dutch national genebank at Centre for Genetic Resources, the Netherlands at Wageningen University & Research (Wageningen, the Netherlands) and the Slovenian genebank at University of Ljubljana, Biotechnical Faculty (Ljubljana, Slovenia) focussing on the animal genetic resources (AnGR) collections.

Organisation of the review

The review was organised by the team of Centre for Genetic Resources, the Netherlands (CGN) at Wageningen University & Research (WUR): Mira Schoon, Marjolein Neuteboom and Sipke Joost Hiemstra.

³ This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817580

The organised meeting rooms, on-site transportation, and everything else to make the review run optimally.

The review took place on Wednesday 15th of September and Thursday 16th by Delphine Duclos (Institut de l'Élevage, manager of the French national genebank) and the genebank manager Danijela Bojkovski (National genebank of Slovenia, Ljubljana).

During these days, the evaluators visited the genebank facilities, listened to presentations and exchange with CGN staff, and visited a native breeds farm that regularly used genetic material from the CGN genebank. At the end of the visit on Thursday morning, the reviewers presented and discussed their first impressions with the hosts (Mira Schoon, Marjolein Neuteboom) and the director of CGN (Sipke Joost Hiemstra).

Observations, conclusions and recommendations

Organisation

The Centre for Genetic Resources, the Netherlands (CGN) is part of Wageningen University & Research. CGN carries out statutory research tasks on behalf of the Dutch Ministry for Agriculture, Nature and Food Quality (LNV) related to the conservation of genetic diversity of livestock species and breeds (animal genetic resources) that are important for agriculture for long-term conservation.

Livestock species include cattle, pig, horse, sheep, goat, chicken, dog, duck, goose, pigeon and rabbit. Cattle, pig, horse, sheep, goat and chicken are the most important livestock species for the Netherlands. Recently, the Ministry of Agriculture (Dutch Ministry) decided to extend the scope with aquatic genetic resources.

CGN operates financially on the basis of 5-year programmes. Statutory tasks are financed by the Ministry LNV, and also includes some basic/strategic research. CGN-AnGR also participates in additional projects, funded by the EU, companies, etc.

Establishment and maintenance of genebank collections is the major part of the AnGR programme of CGN. In total six to eight part time staff is working for CGN-AnGR. Other tasks of CGN, next to or parallel to genebank related activities, are policy advise and supporting breed societies to implement sustainable breeding programs.

Agreements with WUR enables CGN to use all available technologies and facilities (e.g. genebank lab, genebank storage, equipment, offices).

Observation 1: Embedding of CGN within WUR is a complex structure, however in this structure CGN can make optimal use of the infrastructure of human resources of WUR and also students can be easily involved.

Policy Development

CGN and its director Sipke Joost Hiemstra has a significant role in the international and European arena of Animal Genetic Resources. He is involved in the various debates on the policy and strategy as well as valuable member and present chair of ERFP.

No specific national law on genetic resources is in place, only a genetic resources policy document "The Source of existence" was written in 2002. The international obligations CBD, FAO GPA, Nagoya Protocol,

SDG's, EU policies and legislation are the basis for the CGN mandate and commissioning of the programme to CGN by the Dutch Ministry of Agriculture, Nature and Food Quality.

Recommendation 1: Establishment of a national law or clear mentioning of the role of CGN and its genebanks in national policies could strengthen the position of CGN and its role.

CGN Quality Management System

CGN has implemented a Quality Management System (QMS) according to NEN-EN-ISO9001:2015 and most of its activities have been certified. This requires annual external and internal audits.

CGN's experience is that the introduction of a quality management system leads to a significant improvement in the quality and efficiency of its work. Procedures are discussed and periodically improved when needed. During the implementation of the quality management system, CGN has identified several critical processes without adequate protocols, which have been discussed and provided with solutions. In addition, a quality management system makes it easier to introduce protocols and procedures to staff or to inform (new) colleagues and guests about procedures.

The CGN Quality Manual includes sections on management, organization, personnel, and ways to analyse and improve genebank procedures. A clear risk assessment is also used to identify the major risks and try to plan actions to prevent them. All these documents are included in a specific software: iCOLOGIC.

The Quality Manual also describes the actual technical procedures. The manual contains detailed information about all the activities within the animal genebank, about MAA and MTA documentation and storage procedures (ordering, testing, storing, access, distribution, etc.).

Recommendation 2: Guidelines and procedures on sampling, storage and management have been established for each species for different steps. English versions would be very useful for other genebanks and in case of foreign employees. There is a lot of documents in the information system iCOLOGIQ, which can be difficult to find for new staff. Meta information of all procedures and links to the specific documents would be beneficial.

Storage of the material

Reliable cryo-conservation methods and protocols are essential to ensure the quality of genebank material. CGN has developed and continues to improve methods for cryo-conservation of sperm, embryos, oocytes, ovarian tissue or primordial germ cells from various animal species. The entire collection is stored under optimal long-term storage conditions in liquid nitrogen at -196°C.

The core collection contains all Dutch livestock breeds, with a focus on the conservation of native breeds, especially endangered native breeds. A sufficient number of donor animals and a sufficient amount of genetic material to allow the recovery of a population is the main objective of a core collection. CGN has developed a calculation programme that calculates for each species how much sperm and/or how many embryos should be stored per breed and per donor animal. Much attention is paid to careful selection of donor animals to ensure genetic diversity within a breed. To achieve this, they work with breed associations and specific breeders.

In addition to livestock species, the mandate of the CGN has recently been expanded to include the establishment of reserve collections for aquatic species used in aquaculture.

In case of unexpected events, a duplicate of the collection is kept in another location (mirror site) at the Veterinary Faculty in Utrecht to protect the collection. This second collection site is already quite full, therefore not the entire collection is stored at the mirror site, which poses a high risk to the stored material at the main storage site.

Recommendation 3: The mirror storage facility should be increased as the place is now insufficient. Alternative options should be explored as soon as possible, including the potential future possibility to exchange duplicate collections between (neighboring) countries.

Collection Management

The CGN collections are managed by a project leader who is responsible for all activities related to the animal genebank and cryoconservation related projects. CGN has a dedicated expert for the collection and storage of the material. Depending on the situation and the type of animal, material is also acquired from other parties, e.g. AI-centres. The donor animals are tested for certain diseases before and, if necessary, after the collection of the material.

All protocols and procedures for collection and storage are in place: acceptance criteria, various tests, quality standards before and after freezing, etc.

The specific derogation from the ministry authorizing the CGN to collect bull semen of breeds at risk is very useful, even if regular collection at AI centres should be privileged.

Access and Distribution

The stored material can only be used for breeding and research purposes. The information about the material stored in the AnGR genebank and the visibility of the material is excellent and available on the website www.genebankdata.cgn.wur.nl. Here the animal ID can be found and for further information the CGN staff can be contacted.

The decision on what to store and what can be used is made by the genebank project leader and head of CGN-AnGR. They also consult with experts and breeding organizations. They have also established general criteria that must be met in order to issue the stored material. The same is done for all species.

Recommendation 4: It would be useful to clarify on the website the real possibilities to use each material, based on number of doses and quality. The idea of a color code (green: available, orange: available with some precautions, red: only for very specific projects) seems good and should be implemented.

Documentation

The current Cryoweb documentation system is outdated and not very user friendly. The database is still functional, but a new information system is planned as part of the new 5-year programme. The new database should allow linking and updating between different databases. In another database www.genebankdata.cgn.wur.nl information is available on the stored material per species and per breed, but not on the type of stored material stored and the quality.

Recommendation 5: Development and implementation of a new modern database is essential. The new tools developed should allow interoperability and data optimization between different databases.

Final conclusion

The CGN Animal Genetic Resources genebank is well organized with dedicated and well trained staff and excellent facilities to conserve the valuable AnGR collection. There is good collaboration with breeding organizations and various stakeholders as well as researchers. Space constraints for the mirror site are due to be addressed in the near future, so further investment in facilities is required. A communication strategy for both the general public and breeders should be further developed. Development of a modern database infrastructure with tools and user interfaces is planned in the next five years.

Final remarks

The reviewers appreciated the transparency and sharing of expertise, procedures and information given by the hosts during the review. The discussion was extremely useful for the genebanks, which are not as developed as they were at CGN. The hospitality of the hosts, the positive atmosphere and the richness of exchanges suggest that reviews such as this would help other genebanks to develop and adopt similar quality standards.

September 30th, 2021

Danijela Bojkovski, Delphine Duclos



Report of the Peer Review of the Slovenian National Genebank

October 5th and 6th 2021, Ljubljana, Slovenia

Introduction

The Convention on Biological Diversity and UN 2030 Agenda recognized the importance of the *ex situ* conservation of genetic material in genebanks. The Sustainable Development Goal 2 (Zero Hunger) and more specifically indicator 2.5.1 (b) are devoted to the material stored in the genebanks. Many breeds in European countries have either no or insufficient material stored in the genebanks (Leroy et al., 2020). For that, *ex situ in vitro* programmes should be established, implemented, or strengthened to initiate or expand collections for all breeds, especially local breeds *at risk*.

Genebanks are critical facilities, therefore development and implementation of quality management systems for genebanks is very important, as well as research to develop, standardize and implement reproductive technologies and cryopreservation procedures. The research should contribute to the effectivity and efficiency of the genebank operations.

Exchanging knowledge and experiences, improving access to information about genebank collections, and facilitating the exchange of genetic material in Europe, is the main aim of European Genebank Network for Animal Genetic Resources (EUGENA), the European Genebank Network, governed by the European Regional Focal Point (ERFP).

Results of the Innovative Management of Animal Genetic Resources (IMAGE) project have also 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 genebanks 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. To streamline the conservation activities in Europe over different domains (plant, animal and forest) ERFP cooperates in the EU Horizon 2020 GenRes Bridge project⁴.

In the framework of ERFP and with the support of Genres Bridge, a system of peer reviews has been set up aiming at improving the quality of European genebanks by simply having the experts of these genebanks visit each other in their genebanks, giving full transparency about the facilities and protocols, and having discussions about these.

A pilot of these genebank peer reviews is being organised in the second half of 2021, involving the French national Cryobank at Institut de l'Élevage and French National Laboratory for Health Control of Breeding Animals (Paris, France), the Dutch national genebank at Centre for Genetic Resources, the Netherlands at Wageningen University & Research (Wageningen, the Netherlands) and the Slovenian genebank at University of Ljubljana, Biotechnical Faculty (Ljubljana, Slovenia) focussing on the animal genetic resources (AnGR) collections.

Organisation of the review

The review was facilitated by Danijela Bojkovski, manager of the Slovenian genebank, who organised meeting rooms, on-site transportation and everything else, and colleague Tina Flisar, responsible for the data collection and management.

⁴ This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817580

The review took place on Tuesday October 5th and Wednesday October 6th and members of the review panel included Delphine Duclos (Institut de l'Élevage, manager of the French national genebank) and the genebank manager of the Dutch national genebank Marjolein Neuteboom and her colleague Mira Schoon (CGN, Wageningen, the Netherlands).

During these days, the reviewers visited the genebank facilities at the Faculty of Veterinary medicine, listened to presentations, and visited the storage site for cattle which is situated in a commercial AI centre. At the end of the visit on Wednesday, the reviewers presented and discussed their first impressions with the hosts (Danijela Bojkovski and Tina Flisar).

Observations, conclusions and recommendations

Organisation

The organisation of the Slovenian national genebank is complex: the manager and two additional employees are part of the Biotechnical Faculty. They are in charge to implement the National Programme for Animal Genetic Resources Conservation through the Public Service. It is funded by the Ministry based on a long-term programme of seven years, with annual decisions about the budget per year. There is no room to prepare new or additional funding and write advanced project plans within the AnGR programme. None of the other departments working alongside with the genebank have 'spare' room to start this either, or lack intrinsic values for this specific topic.

The programme is supervised by an Expert Council of 22 experts from five breeding organisations, research institutes and including a representative of the ministry.

The management of the national genebank is one of the main components. The three persons in charge of the public service are also supported by various experts in collection and freezing, selection and performance recording, herdbook management and research related to cryoconservation and sustainable breeding. Main part of the collection and freezing of the material is done at the Faculty of Veterinary Medicine for all species except the only native cattle breed of Slovenia, for which there is collaboration between the genebank and a commercial AI centre.

Recommendation 1: Structure is complex and make sometimes decisions difficult to take, it could be more efficient to give more independency to the manager of the genebank.

Recommendation 2: The 7-year programming including budget is excellent for planning and security. However, some flexibility when assigning the annual budget would be welcome to allow for unexpected costs.

Policy Development

Since 2002, the Livestock Farming Act indicates: *'The Republic of Slovenia provides and maintains "genetic reserves" for individual species, breeds and lines of domestic animals in the form of minimal doses of semen, ova or embryos.'* Several rules for the conservation of livestock biodiversity have also been written between 2004 and 2014 giving for example, the minimum number of males and females to preserve, but these rules are not always very clear.

The list of breeds to conserve was expanded in 2021 with two breeds. As the budget for all breeds is

already tight for conservation of the current list, it is advised to increase the budget according when expanding number of breeds to avoid dilution of the conservation activities per breed.

Observation 1: The mention of the “genetic reserves” in the national regulation is a good point for the maintenance of the future of the genebank funding and interest.

Recommendation 3: Addition of breeds to the list for conservation, should only occur together with a proportional increase of the budget.

Quality Management System

There is no Quality Management System (QMS) in place for the National Slovenian genebank and currently no plans for the near future to focus on this certification. Many of the vital collection, freezing and storing procedures are executed by the external Veterinary Faculty and by commercial AI centre.

Recommendation 3: To develop and write down guidelines and protocols on sampling, storage, registration and management for each species for different steps. First of all to standardize all procedures and to identify critical processes and reduce the risk of loss of expertise with change of staff. Secondly, when a QMS certification is needed, major part of the preparations are already provided. A quality management system can help to introduce protocols and procedures to staff or to inform colleagues and guests about procedures.

Storage of the material

The national Slovenian genebank has special derogations for collection and storage of semen outside an approved AI centre. The Faculty of Veterinary Medicine executes the major part of collection, freezing and storage for most species, sheep, goat, pig, horse and poultry. It is also in charge of the main site and the mirror site, located at the same campus, though in another building. The collaborations and agreements with the persons affiliated with the Faculty of Veterinary medicine are very good, the use of expertise and facilities is highly beneficial for the genebank. There are some issues with the size of the rooms where the nitrogen tanks are stored as the main room was not big enough for additional collections to come. There are three new tanks, already purchased, which cannot be used for the moment due to lack of space and air-conditioning problems. The alarm system for the oxygen level was not working in the main storage room and non-existing at the mirror site.

For the semen collection of cattle, the genebank is working with the AI centre Preska, a commercial collection centre for cattle semen. In collaboration with the national genebank they execute the semen collection, freezing and storage of the Cika cattle, the only local cattle breed in Slovenia. The relations and agreements with the AI centre are good.

A third storage site is located at the Biotechnical faculty, where the office of the genebank is located, these only consist of regular freezers for conservation of DNA and tissue. The bovine material is only marginally stored in duplo, with ten straws per bull.

Recommendation 4: The rooms where the material is stored should have a controlled access (at least the door locked) and equipped with a safety system (oxygen alarm). The storage facilities should be increased to be able to expand the collections. Exploration of further collaboration with the AI station is advised for storage of the other species.

Recommendation 5: The current mirror site is in another building at the same campus of the main storage location. In case of fire, the risk that both buildings will be lost is high. An actual mirror site, completely distinct from the main site will reduce these risks immediately.

Collection Management

The prevision of what priorities will be given for the collection of material next year are approved annually by the expert council of 22 members. Thus, the planning of the future collections is well organised and the choices are clear. The collaboration with all stakeholders is good.

It is very useful that herdbook registration is done by the same organisation, giving easy access to the relevant data to analyse the populations, which is very useful for the management of the collection. To better exploit this data, extra personnel would be needed.

The national genebank is the only place where they collect and freeze semen of local goat and sheep breeds. Due to limited storage capacity, all genetic material of male ruminants collected (ejaculates or epididymal) is partitioned in ten straws, despite concentration and number of doses per straw. The concentration is measured and recorded for each batch of straws, in case of future use the number of doses per straw can be calculated.

The genebank pays the breeders a set price to collect semen at the Faculty of Veterinary medicine, or they pay for the castration of boars and collect epididymal semen of the testicles. No documents are signed (MAA or MTA), only the invoices are a proof for the ownership of the material.

All material is directly added to the collection in the right location. Using a quarantine period in a separate tank would reduce the risk for the whole collection of a species in case of a disease outbreak.

Recommendation 6: Even if the priority for the moment is to store material for the long run, usage of the stored material is as important to consider right now. It might be worth to consider half of the material stored in doses and half of the material 'in bulk' straws.

Recommendation 7: Strong recommendation to set up standard MAA / MTA for ownership of collected material.

Access and Distribution

The conditions to use the material for the future have not been detailed for the moment as the priority is given to increase the collections. Particularly, the documents that will be necessary are not written now. But the exception for the use of this material is already mentioned in the national legislation.

As the concentration of the semen in the straws is not always standardized for small ruminants and above the concentration of a commercial straw, the person in charge at the Faculty of Veterinary medicine has provided to use one straw to inseminate several ewes. The logistic will have to be well organised not to waste semen at the moment of use.

Documentation

The genebank is using the Cryoweb documentation system. Since a new employee started last year the database has been improved a lot with more complete and correct information. The database is functional, but not very user-friendly. There is the possibility to cooperate in a common government digitalization project which might help to develop a new database, connected to other national databases. They have done a good information system mapping to detail their needs for the new system, all players and roles, needed information and suppliers of data, specifics of data and animal owners, services and samples are systematically written down in terms of needs and responsibilities.

Observation 2: The detailed information system will help to choose the new system for the management of the collection.

Final conclusion

The Slovenian national genebank is well organised with dedicated persons. Even though the facilities to conserve the collection are not optimal, there are very good collaborations with storage facilities, breeding organisations and other stakeholders involved. The link with researchers from the Faculty of Veterinary medicine are good but could be developed. A good communication strategy is existing for presenting the local breeds and their products for the general public. More focus can be put on the tasks related to the genebank to present the work done on *ex situ* conservation as well, for example on the website about the local breeds.

Final remarks

The reviewers appreciated the transparency and sharing of expertise, procedures and information given by the hosts during the review. The discussions were very interesting. The hospitality of the hosts, the positive atmosphere and the richness of exchanges suggest that reviews such as this would help other genebanks to develop their own structure.

November 5th, 2021

Delphine Duclos, Marjolein Neuteboom, Mira Schoon