



MINISTRY OF AGRICULTURE
OF THE CZECH REPUBLIC

National Programme on Conservation
and Utilization of Plant, Animal
and Microbial Genetic Resources
Important for Food and Agriculture
for the period 2023–2027



**NATIONAL PROGRAMME
ON CONSERVATION
AND UTILIZATION OF PLANT,
ANIMAL AND MICROBIAL
GENETIC RESOURCES IMPORTANT
FOR FOOD AND AGRICULTURE
FOR THE PERIOD 2023–2027**



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The National Programme on Conservation and Utilization of Plant, Animal and Microbial Genetic Resources Important for Food and Agriculture for the period 2023–2027 was prepared by the team of authors led by the Ministry of Agriculture of the Czech Republic, which included experts from the Ministry of Agriculture of the Czech Republic, Czech Agrifood Research Center, Institute of Animal Science and other external experts and consultants.

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I. General section – The National Programme on Conservation and Utilization of Plant, Animal and Microbial Genetic Resources Important for Food and Agriculture for the period 2023–2027

1. Introduction

The Ministry of Agriculture of the Czech Republic (MoA) introduces the National Programme on Conservation and Utilization of Plant, Animal and Microbial Genetic Resources Important for Food and Agriculture (National Programme, NPGR) for the period 2023–2027.

The updated NPGR builds on the previous thirty years of successful programmes on the conservation of genetic resources (GR) for food and agriculture and in particular the preceding phase of 2018–2022. The new NPGR focuses on the increasing demand for the evaluation and characterization of GR, the study of genetic diversity, and the identification of particularly valuable genotypes, especially as donors of various traits related to resistance, quality, or other significant properties. This will lead to an expanded understanding of the genetic diversity of crops, animals and microorganisms. In the new period, the NPGR will primarily focus on information management. The quality and quantity of data in the NPGR information systems will be improved, data from related international projects will be incorporated, and interconnected at the European and global levels. The quality, quantity and interconnection of phenotypic and genotypic data will enable the creation of specialized data analyses, sophisticated selections, and predictions of breeding-relevant traits and genes. This will not only enhance the use of the data, but also use of GR for further applications in breeding, research and other areas.

The NPGR for the period 2023–2027 is based on the following current needs: (1) – to ensure the long-term conservation of a sufficiently large diversity at the level of traits and genes in organisms important for nutrition, agriculture and food security; (2) – to provide information on these materials, including detailed evaluation, through an information system for the users and recipients of GR in the area of research, breeding, education and various other areas. The importance of conserving GR and their practical use is increasing in parallel with advances in genetics and biotechnology, particularly due to the urgent need to respond quickly to the adverse impacts of climate change and shifting environmental conditions. This necessity is becoming increasingly relevant not only on a global scale but also at the local and national levels.

The NPGR covers a wide range of organisms. It includes conserved plant genotypes, including modern, obsolete and regional varieties as well as landraces and crop wild relatives of cultivated plants. Another part consists of selected native or domesticated species, breeds, and breeding lines of animals that have not been bred for intensive livestock production and still retain valuable and original traits and characteristics. The NPGR also encompasses pathogenic microorganisms

found in the Czech Republic that affect cultivated plants and livestock, as well as microorganisms important for food and other applications in the agricultural and food sectors. Additionally, the NPGR includes insect species and other invertebrates that play a significant role in agriculture.

Ensuring the conservation of agrobiodiversity is conditioned by the effective cooperation among the state administration bodies, research institutions, universities, private and non-governmental organisations (NGOs). Therefore, one of the main objectives of the NPGR is to create the basic conceptual framework for the period of 2023–2027, which defines the priorities in the field of conservation and sustainable use of agrobiodiversity in the Czech Republic and sets out specific tasks and activities for individual stakeholders that participate in the implementation of the NPGR. These activities build on the previous phase of the National Programme, aiming to further strengthen collaboration among the partners as well as other users of the GR.

The NPGR reacts to the growing importance of international cooperation and emphasizes the shared responsibility of states to protect the world's natural heritage. Effective collaboration with foreign partners requires standardization of GR management in accordance with the internationally adopted practices. The NPGR is therefore linked to a number of national strategic and legal documents and its priorities take into account the existing international commitments as defined within the Sustainable Development Goals 2030, documents adopted by the UN Food and Agriculture Organization (FAO), The Kunming-Montreal Global Biodiversity Framework (GBF), the European Green Deal, the European Biodiversity Strategy for 2030, the European Commission's Farm to Fork Strategy, the European Genetic Resources Strategy and other relevant documents.

2. The definition of biological diversity

Biological diversity (biodiversity) means the variability of all living organisms, including their ecosystems and the ecological complexes of which they are an integral part; it includes diversity within species, among species and the diversity of ecosystems.

3. The role of biodiversity in the agricultural sector

Biodiversity of all organisms along with their ecosystems and agricultural diversity (hereinafter also referred to as agrobiodiversity) represents a fundamental sources of productivity of

all agricultural systems. Among other benefits, they enable adaptation to changing environmental conditions and preserving essential ecosystem functions. Agrobiodiversity is also understood as the diversity of organisms that are used or have the potential to be used, directly or indirectly, for agricultural production – both food and non-food production.

Biodiversity and agricultural systems are closely connected. Agriculture depends on ecosystem services and processes, such as maintaining soil fertility, pollination, natural pest and disease control, soil regeneration or the self-cleaning ability of water resources. The functioning of these processes is unconditionally dependent on the preservation of biodiversity. From the biodiversity perspective, areas with extensive farming systems are of exceptional importance. These systems can act as semi-natural habitats, protecting the soil, allowing the cultivation of a broader range of regional varieties and crops and breeding of traditional animal breeds that still carry their original characteristic quality traits. The associated soil microorganisms and the plant microbiome ensure the overall stability of the ecosystem.

Over the past hundred years, agriculture has shifted towards more intensive farming practices and most agricultural land is now managed with high or higher intensity. These systems now form the staple basis of most agricultural production. To maintain high productivity in agricultural systems and achieve optimal and stable quality while reducing energy and chemical inputs, it is crucial to preserve diversity at all levels – species, varieties, breeds, etc. Keeping high levels of diversity is also important for reducing the negative impacts of intensive farming, such as soil degradation, water contamination by pollutants, low resilience of cultivated crops to climate changes, and other biotic and abiotic stressors, and ultimately also increasing public expenditures required to cover damages and losses in agricultural production and yields.

The biological and genetic diversity within crop species, livestock and their wild relatives play a key role in the ability of agriculture to adapt to climate change, withstand new pests and pathogens and serve as a source of newly bred crop varieties, animal breeds and lines capable of maintaining sufficiently high yields even under new conditions of climate change. The loss of genetic diversity reduces the availability of GR, thus limits the opportunities for further breeding. A narrow breeding base of resources diminishes the ability to adapt to climate change, weakens resilience to the spectrum of pests and pathogens, resulting in a reduction of the ability to ensure a sufficient food supply.

The loss of biological and genetic diversity may pose a significant threat in some areas to the long-term sustainability of agriculture in certain areas, precisely due to the disruption of ecosystem relationships and services on which agriculture depends, including soil processes, natural pest and disease control and pollination.

4. Genetic resources for food and agriculture and their value

GR for food and agriculture include that part of biodiversity that has developed within agricultural systems mainly through intentional man-made activities, e.g. selection and later breeding of crops and breeds of livestock. This category encompasses modern varieties and breeds, breeding lines, regional varieties, as well as related wild species and primitive forms of crops and livestock, which can be used for breeding, research, education, food processing and biotechnologies. GR also involve freshwater fish species, whose farming and breeding in aquaculture have historically been an inseparable part of the agri-food sector in the Czech Republic due to its landlocked position. Similarly, honeybees – our most important pollinators – are part of the NPGR. The GR of microorganisms and small invertebrates (MGR) play a significant role in production, protection, processing and use. Ultimately, GR conserved under the NPGR represent the Czech Republic's contribution to the global protection of biodiversity.

It is extremely difficult to determine the value of GR in financial terms. For example, the value of global agricultural production and the ecosystem services provided by pollinators for pollinating plants alone is estimated at \$235–577 billion per year¹. However, insect pollinators, as a certain visible and economically better quantifiable group, cannot be considered separately. Insects and other invertebrates, together with soil microorganisms, are in the natural environment part of several other ecosystem services and play essential roles, for instance, in nutrient cycling, the decomposition of organic matter or as a part of the system for natural control and balance preventing outbreaks of populations of many other species. Hence, the use of biodiversity is closely linked to economic performance in various areas of human activity, and its loss always has a direct negative impact on gross domestic product (GDP).

GR are unique and irreplaceable sources of genes for further improving the biological and economic potential of productive organisms in agriculture. They are directly in both plant and livestock sectors, the food industry, conventional, organic and modern breeding or gene engineering. Their importance is growing further with the rapid development of genomics and related biotechnologies. GR also belong to the cultural heritage and are an important part of the stability and quality of in rural environment and landscape.

GR and their wild relatives and ancestral species are constantly threatened by the global loss or degradation of natural habitats and the unification of crop varieties and breeds leading to genetic erosion.

MGR form the basis of many branches within of the food industry. The most significant ones include brewing yeasts, cheese and yoghurt cultures and yeasts used for baking.

¹ IPBES (2016): Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Bonn, Germany. ISBN 978-92-807-3568-0.



Pathogenic microorganisms preserved as GR are used, for example, in the production of vaccines against livestock diseases, for protection of economically important crops from plant diseases, in the study of pathogenicity, in the development of diagnostic methods, and in breeding crops for disease resistance.

Therefore, there is a constant need for their long-term conservation, study and characterization. The conservation and sustainable use of GR are ensured and managed in many countries by the relevant national programmes based on the principle of national sovereignty over GR, i.e. the principle anchored within the CBD. The principles of GR conservation and utilization are intensively monitored at the international level by FAO. The basic prerequisite for effective and sustainable use of GR is their availability for users together with the relevant information.

5. The international strategic and legal framework of the National Programme

The **Sustainable Development Goals 2015–2030 (SDGs)** represent the UN Development Programme to 2030. All UN member states, including representatives of civil society, business and academia, took part in their formulation. They were adopted at the UN Summit on 25 September 2015 in New York as part of the document “Transforming our World: The 2030 Agenda for Sustainable Development”. GR are included within Goal 2 “*End hunger, achieve food security and improved nutrition and promote sustainable agriculture*” and specific Subtarget 2.5 “*By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed*”.

The **Convention on Biological Diversity (CBD)** was internationally agreed upon in 1992 with the Czech Republic joining in March 1994. The CBD is kept in the Collection of International Treaties of the Ministry of Foreign Affairs under No. 134/1999 Coll. The main goals of the CBD are the conservation of biodiversity at all levels, the sustainable use of its components, and access to GR. Currently, within the framework of the CBD, a proposal for a new global strategy (Post-2020 Global Biodiversity Framework) is being discussed, which will define political priorities and specific activities to support biodiversity until 2030.

The **Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity** was adopted under the framework of the CBD in October 2014. The Protocol establishes rules

on access to GR and the fair and equitable sharing of benefits from their use. The Czech Republic became the Party in August 2018. Fulfilling the rights and obligations of the Protocol creates the preconditions for avoiding situations of access and utilisation of GR without the provider’s consent. Such behaviour is often described as ‘biopiracy’.

The **International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)** was negotiated in 2001. Its aim is the conservation and sustainable use of all plant GR for food and agriculture and also, in line with the principles of the CBD, to ensure a fair and equitable sharing of benefits derived from the use of GR for sustainable agriculture and food security. The Czech Republic became the Party in June 2004. The ITPGRFA is kept in the Collection of International Treaties of the Ministry of Foreign Affairs under No. 73/2004 Coll.

The **FAO Global Plan of Action for Animal Genetic Resources²** was adopted in 2007 and has 4 strategic priorities: (1) – characterization, inventory and monitoring of trends and associated risks, (2) – sustainable use and development, (3) – conservation in natural conditions (*in situ*) and in genebanks (*ex situ*), (4) policies, institutions and capacity-building – establishing a policy on the use of GR and building capacity for its fulfilment. The implementation of the Global Plan of Action is assessed in two-year intervals at the regular meetings of the FAO Commission on Genetic Resources for Food and Agriculture.

The **Second Global Plan of Action for Plant Genetic Resources³** was completed and adopted by FAO in 2012 and is divided into 4 priority activities: (1) – *in situ* conservation and management, (2) – *ex situ* conservation, (3) – sustainable use, (4) – building institutional and human capacities. The implementation of this Global Plan of Action is assessed in two-year intervals again at the meetings of the FAO Commission on Genetic Resources for Food and Agriculture. The Third Global Plan of Action for Plant Genetic Resources is in 2022 before its finalization and publication.

The Global Seed Vault in Svalbard is a plant GR bank operated by the Norwegian government in collaboration with the Nordic Genetic Resource Center (NordGen) and the international organisation Global Crop Diversity Trust. The overall goal of this joint initiative is to ensure the long-term conservation of a broad diversity of seeds in case of unexpected catastrophes – whether climatic, war-like or other. The Czech Republic has already deposited a total of 1,463 materials of plant GR in this global repository.

Fulfilling the objectives of the NPGR is in accordance with a number of other international documents and published recommended procedures, such as the FAO Genebank Standards for Plant Genetic Resources for Food and Agriculture (FAO 2014), the European Cooperation Programme for Plant Genetic Resources (ECPGR), the Quality Management System for a European Genebank Integrated System (AEGIS) and other.

² FAO 2007. Global Plan of Action for Animal Genetic Resources for Food and Agriculture. Rome. ISBN 978-92-5-105848-0.

³ FAO. 2012. Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture. Rome. ISBN 978-92-5-107163-2.

6. The European strategic and legal framework of the National Programme

The **EU Biodiversity Strategy to 2030** was adopted by the European Commission in 2020. The Strategy is one of the key strategies for the implementation of the European Green Deal. The area of GR is mainly addressed in section 2.2.2. of the nature restoration plan: *“The decline of genetic diversity must also be reversed, including by facilitation the use of traditional varieties of crops and breeds. This would also bring health benefits through more varied and nutritious diets. The Commission is considering the revision of marketing rules for traditional crop varieties in order to contribute to their conservation and sustainable use.”* GR are also covered under the EU Commitments in section 4.1, for example: *“Fair and equitable sharing of the benefits from the use of genetic resources linked to biodiversity.”*

The European Genetic Resources Strategy is designed as the main outcome of the GenRes Bridge project (www.genres-bridge.eu) and encompasses plant, animal, and forest GR. The goal is to strengthen the conservation and sustainable use of GR in Europe, which forms the foundation for sustainable agriculture and forestry, food and nutrition security, climate change adaptation, and the support of the European bioeconomy and competitiveness.

Regulation (EU) No. 511/2014 of the European Parliament and of the Council 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 to the Convention on Biological Diversity in the Union.

Commission Implementing Regulation (EU) 2015/1866, laying down detailed rules for the implementation of Regulation (EU) No. 511/2014 of the European Parliament and of the Council as regards the register of collections, monitoring user compliance and best practices.

Guidance from the Commission (EU) on the scope and main obligations under Regulation (EU) No. 511/2014 of the European Parliament and of the Council on compliance measures arising from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Utilization to the Convention on Biological Diversity by users in the Union.

7. The national strategic and legal framework of the National Programme

The **Strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030** was approved by the Government of the Czech Republic on May 2016. Its main purpose is to set the basic framework for strengthening the development of the agrarian sector. GR for food and agriculture are in the document addressed within the connection to plant and animal commodities and in the area of agricultural research.

The **Biodiversity Conservation Strategy of the Czech Republic 2016–2025** was approved by the Government of the Czech Republic in March 2016. The area of genetic resources for food and agriculture is specifically dealt with in Objective 3.6 *“Sustainable Utilization of Genetic Resources”*.

The **Strategy for Adapting to Climate Change in the Czech Republic** was approved by the Government of the Czech Republic in October 2015. In September 2021, the Government of the Czech Republic approved the revised Strategy for Adapting to Climate Change for the period 2021–2030. The content of the document is based on the European Commission’s White Paper *“Adapting to Climate Change: towards a European framework for action”* (2009) and aligns with the EU Adaptation Strategy. The Adaptation Strategy also comprehensively addresses the agricultural sector. GR for food and agriculture is specifically included in the section 3.2.3.2., *“Genetic Resources, Research, Breeding, and Agricultural Biotechnology”*.

The **National Action Plan for Adapting to Climate Change** was approved by the Government of the Czech Republic in January 2017 and is the implementing document of the Strategy for Adapting to Climate Change in the Czech Republic (2015). The updated Action Plan for the period 2021–2025 was approved by Government Resolution No. 785 in September 2021. The Action Plan is structured according to the manifestations of climate change-long-term drought, floods, rising temperatures, extreme meteorological events, and natural fires. The area of GR for food and agriculture is specifically dealt with in the framework of Strategic Objective 4: *“Safeguarding and conserving genetic resources in agriculture”* and Strategic Objective 8: *“Ensuring the sustainability and production function of agriculture in order to reduce the negative impacts of climate change”*.

Act No. 154/2000 Coll., on breeding, stirpiculture and record keeping of farm animals and on amendments to some related laws (Breeding Act), and **Act No. 148/2003 Coll.**, on the conservation and utilization of plant genetic resources and microorganisms important for food and agriculture (the Act on genetic resources of plants and microorganisms).

Decree No. 72/2017 Coll., on animal genetic resources, and **Decree No. 458/2003 Coll.**, implementing the Act on genetic resources of plants and microorganisms.

8. The objective and goals of the National Programme

The main goal of the NPGR is to ensure the long-term conservation of the GR of plants, animals, microorganisms and invertebrates important for food and agriculture, in accordance with national legislation, international commitments and the needs of GR users, with the aim of supporting the sustainable development of agriculture in the Czech Republic, adapting to climate change and preserving the quality of rural areas.



In order to achieve the main goal, the following specific objectives have been set:

- 1) To ensure the protection and long-term conservation of GR included in the NPGR using appropriate and up-to-date conservation methods.
- 2) To collect historical, current and new GR important for food and agriculture preferably of Czech origin, including the repatriation of original Czech materials from abroad, and to rationally enlarge collections of GR with new material from abroad following the needs of their users.
- 3) To ensure the evaluation and characterization, i.e. to gain the knowledge of genetic diversity of GR to assess their potential for improving the biological potential and useful properties of crop varieties, species and breeds of animals and strains of microorganisms and invertebrates.
- 4) To maintain comprehensive records and documentation on the GR conserved and provided in publicly accessible information systems and participate in the international exchange of information.
- 5) To guarantee the availability of GR stored in the Czech Republic for users in research, breeding and education, and provide the GR and relevant information to domestic and foreign users in compliance with national and European legal requirements and other international obligations.
- 6) To create the conditions for the efficient and sustainable use of GR in line with the needs of agricultural practice, commodity processors and consumers and in support of the environmental functions of agriculture and adaptation to climate change.
- 7) To guarantee the international commitments of the Czech Republic in the field of GR and agrobiodiversity and thus participate globally in the protection of GR and the fair and equitable sharing of benefits arising from their use.

9. The content of the National Programme

The NPGR encompasses activities whose practical outcome is the long-term conservation of GR using up-to-date and modern conservation methods, as well as the provision of GR and relevant information to users in accordance with the conditions set by national legislation and international commitments. This framework ensures equal access to GR for all users. The NPGR is implemented through the following areas of activity:

9.1 Collecting of GR

The collection of GR in *ex situ* collections, repositories, and breeding facilities. The acquired materials of plant, microorganisms and invertebrates GR are typically categorized into collections, repositories, or breeding programs according to species, genera, or groups of GR of microorganisms. Each participant in the NPGR is responsible for the management of individual collections and repositories of GR (hereinafter referred to as NP participants), with coordination ensured by an authorized person⁴. The collection of genetic and biological material of animal origin is managed by a designated person and other entities that are participants in the NPGR.

9.2 Recording and documentation of GR

The authorized person, designated person, and NPGR participants are responsible for keeping the records and documentation of GR within the respective information systems and in accordance with the requirements, standards and methodological procedures established for these systems. The authorized and designated persons are also responsible for data preparation, creation of databases and the overall functionality of the information system, as well as for its development and compatibility with relevant international information systems. The authorized and designated persons perform annual inventories of GR samples, the result of which is part of the Annual Report.

9.3 Characterization and evaluation of GR

The characterization of GR is based on their detailed description, which allows their unambiguous identification and is a key area in working with gene pools. In addition to taxonomic classification, it includes basic biological characteristics, especially morphological, phenological and further biochemical traits (such as the content of significant compounds). The characterization of GR includes molecular-genetic characteristics (e.g., detecting alleles of important genes) and the results of *-omics* technologies, which are of great importance for verifying the identity of material and for breeding. On the other hand, evaluation of GR focuses primarily on biologically and economically significant traits, including resistance to diseases and pests, it is species-specific, purpose-driven and tailored to the needs of users. For microorganisms, standard strain characterization procedures are specifically based on identification, morphological description, and the determination of biological, biochemical, molecular-genetic, and technological properties. The characterization and evaluation of plant and microorganism GR are continuously ensured by NPGR participants responsible for individual collections and repositories. For animals, evaluation is carried out at the level of the GR animal owner, breeder associations, and the designated person. The collected data are submitted for further processing to the appointed or designated person and entered into the relevant information systems. Detailed procedures for the characterization and evaluation of individual GR groups are described in the binding technical framework⁵ and relevant legal regulations.

⁴ See the chapter Structure of the NPGR.

⁵ Framework Methodology of the National Programme for the Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity, Framework Methodology of the National Programme for the Conservation and Utilization of Microorganism and Small Livestock Genetic Resources Important for Food and Agriculture, Species and Breed-Specific Conservation Methodologies for Animal Genetic Resources.

9.4 Conservation of GR

The conservation of the plant and microbial GR is mainly ensured in *ex situ* conditions, i.e. in genebanks and culture collections, field collections, *in vitro* collections, cryobanks or storage at low temperatures and collections with living arthropods and invertebrates. Where possible, *in situ* (for wild species) and on-farm (landraces) conservation are used. The animal GR (AGR) are primarily conserved *in vivo* as live animals at the owners' facilities, while reproductive or biological material is conserved *ex situ* in genebanks. The aim of conservation is to maintain the viability and genetic basis of GR while keeping the regeneration ability and minimizing genetic erosion as much as possible.

9.5 Utilization and availability of GR

GR are used for the genetic improvement of productive organisms in agriculture, and biotechnology, and for expanding the genetic basis of these organisms, primarily in the field of breeding, research, education, crop protection against diseases and pests, nature protection and landscape management, museology, etc. The authorized, designated persons and NPGR participants provide requested samples of the GR to users in accordance with national regulations and internationally accepted standards. The relevant information (passport data, descriptive data or other information) is also available through national information systems online.

9.6 International cooperation and implementation of accepted international commitments

Meeting the international commitments is addressed on the basis of adopted agreements, research, information and educational projects and other requirements that are set by international organizations.

10. The structure of the National Programme

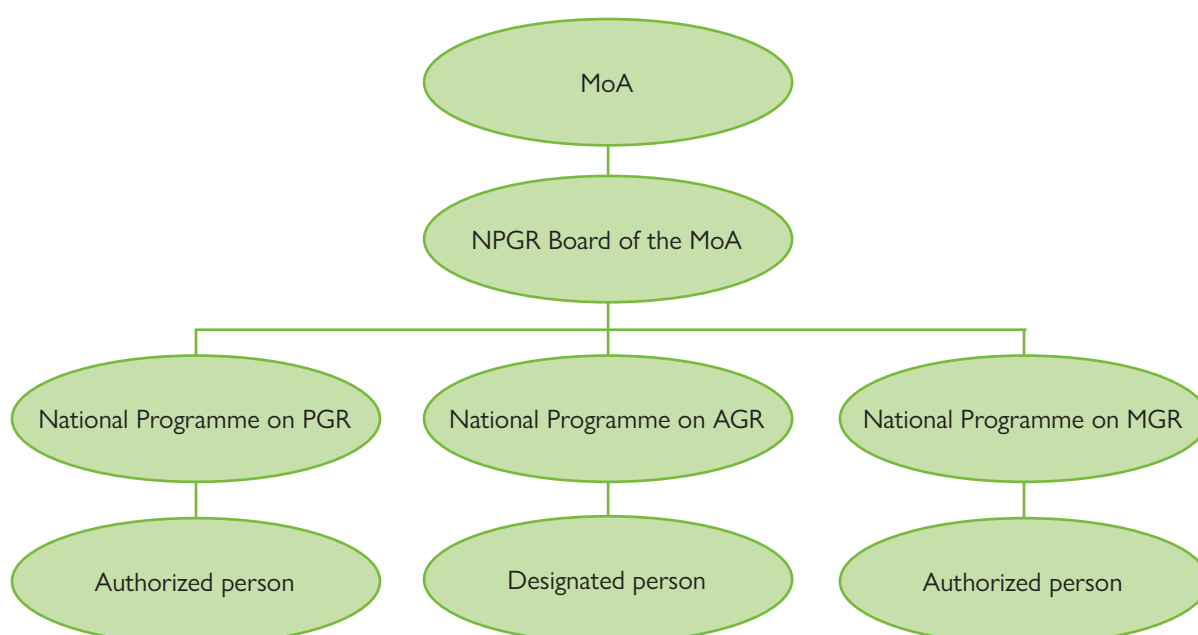
Due to biological specificities of the GR used in agriculture and the specific procedures for their management, the objectives of the NPGR are implemented in three separate sub-programmes for plants, animals and microorganisms (see Fig. 1):

- 1) **The National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity** (National Programme on Plant GR; NPPGR), which is governed by Act No. 148/2003 Coll., on Plant Genetic Resources and Microorganisms.
- 2) **The National Programme on Conservation and Utilization of Animal Genetic Resources Important for Food and Agriculture** (National Programme on Animal GR; NPAGR), which is governed by the Breeding Act No. 154/2000 Coll.
- 3) **The National Programme on Conservation and Utilisation of Microorganisms and Invertebrates of Agricultural Importance** (National Programme on Microorganism GR; NPMGR), which is governed by Act No. 148/2003 Coll., on Plant Genetic Resources and Microorganisms.

11. The organization of the National Programme

MoA carries out the state administration role of the NPGR through the relevant competent department, responsible for the agenda of GR important for food and agriculture, in

Fig. 1: The structure of the National Programme and its sub-programmes





accordance with the valid Organizational Rules. In carrying out its state administration duties, the MoA follows applicable laws and international obligations in this area. The MoA has established the Board of the National Programme (NPGR Board of the MoA) as its expert, consultative, and advisory body. The aim of the Board is to create the necessary substantive, organizational, and financial framework to ensure legislative requirements and fulfil the objectives defined in the NPGR.

In accordance with Act No. 154/2000 Coll. and No. 148/2003 Coll. (see Chapter 7), a designated person (for NPPGR and NPMGR) and an authorized person (for NPAGR) are responsible for guaranteeing individual subprogrammes of the NPGR. The designated and authorized persons submit proposals for the coordinator and its deputy to the responsible department of the MoA.

The NPGR is non-discriminatory and open, its participants can be natural persons or legal entities and public organizations that conserve GR. New species (groups) of GR may be included as needed. The procedures for including a participant in the NPGR are governed by the Breeding Act and the Act on Plant and Microorganism Genetic Resources, as well as this document. The organizational arrangements of individual subprogrammes differ in some aspects and are described in detail in the “Structure and Organization” sections of each subprogramme.

12. Financing

Maintaining the functionality and effectiveness of the NPGR requires its stable and long-term financing. Funding to support the NPGR is provided from the state budget by means of the MoA, in the form of subsidies. The total amount is approved by the Government of the Czech Republic and the Chamber of Deputies of the Parliament of the Czech Republic as part of the annual budget approval. The conditions for providing and using the financial support are laid down within the Principles annually published by the MoA.

Based on the amendment to Act No. 252/1997 Coll., on Agriculture, as amended, and the amendment to Act No. 256/2000 Coll., on the State Agricultural Intervention Fund and on the amendment of certain other acts (the Act on the State Agricultural Intervention Fund), as amended, the administration of subsidy programmes under the Guidelines establishing the conditions for granting subsidies pursuant to Sections 1,2 and 2d of Act No. 252/1997 Coll., on Agriculture, as amended, was fully transferred in 2020 to the competence of the State Agricultural Intervention Fund –

with the exception of Subsidy Programme No. 6 – Genetic Resources.

The NPGR does not favour any of its participants in a competitive environment. GR registered in the NPGR are not primarily intended for generating the economic profit. The financial support is aimed at partial cover of the operating costs of activities covered by this programme, for compensating the economic losses caused by conserving GR that have limited production, for the additional work related to meeting the requirements of the relevant methodologies and for ensuring the activities concerning the long-term conservation of GR, documentation, characterization, database management, raising public awareness and compliance with the international obligations. NPGR participants accept the commitment to cover the rest of the operating costs from their own financial resources.

The funds are provided to the individual NPGR participants annually upon their applications and after discussing the priorities in the respective sub-programme Boards and recommendations made by the authorized or designated persons. All requests for funds are subject to standard control mechanisms set by the MoA. In addition, the relevant state and European control authorities and tax authorities can inspect both the financial and material aspects of the NPGR.

13. Duration of the National Programme

Pursuant to Section 14(1) of Act No. 154/2000 Coll. and Section 3(1) of Act No. 148/2003 Coll., the NPGR is announced by the MoA for a period of five years. This NPGR will therefore be valid from 1st January 2023 to 31st December 2027. If necessary, the MoA may update the NPGR and subsequently publish its revision in the form of a numbered supplement.

14. Action plan for implementing the National Programme

Based on the structure and content of the FAO Action Plans, specific activities were identified for each sub-programme that are relevant to addressing the issue of GR in the Czech Republic. A detailed description of the activities is elaborated in the subsequent Action Plan, which includes a more detailed specification of the activities, the responsibility for their implementation, expected outcome, form of processing, critical assumptions for implementation and the timetable for carrying out these activities.

II. Specific section – subprogrammes

A. The National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity

1. Mission and aims

Plant genetic resources (PGR) used for food and agriculture represent an important part of global genetic diversity. PGR are cultivated varieties and landraces, breeding materials, genetic lines, related wild species and ancestral species to crops. The sum of these materials is referred to as the gene pool of a species (crop). PGR are of extraordinary value to humans, whether they are used in traditional agriculture, breeding, gene engineering or in biotechnology in general. PGR are a unique and irreplaceable source of genes for further improving the biological and economic potential of crop varieties.

Besides the safe long-term conservation of already collected PGR, attention is paid to a qualified and rational expansion of the collections. The initial activity is identifying the missing PGR in the collections (gaps). Depending on the crop or species, e.g. the lost landraces, obsolete or primitive varieties are sought. The losses can be generally supplemented by the repatriation of crops from PGR collections outside the Czech Republic. In addition, National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity (NPPGR) participants collect new varieties mainly of Czech origin, taking into account the crop, species, local and geographical priorities and, especially those with traits such as resistance to biotic and abiotic stressors or other valuable breeding traits that may be missing in current collections. In justified cases, valuable foreign-origin PGR relevant to breeding may also be included. Collection missions mainly focus on landraces, crop wild relatives and other PGR, especially from places with high plant diversity (hot spots).

In the coming years, the NPPGR will be more focused on the evaluation and characterization of PGR (field trials, laboratory tests) to increase the value of PGR for users. The number of traits assessed is species-specific, ranging from 20 to 90 traits/crop. The growing attention is dedicated to the characterization of PGR using genetic and protein markers. With respect to climate change and its impact on agroecosystems, it is desirable to pay attention to traits such as tolerance to abiotic stressors (notably drought, high/low temperatures and their fluctuations) and resistance to biotic stressors. The collected experimental data are processed and presented in relevant PGR in the information system so that they are available to users, especially in research, breeding, and educational/academic institutions.

In line with both domestic and international priorities, an important part of the NPPGR is also the promotion of agrobiodiversity for the sustainable development of agriculture, including its non-productive functions. Practical activities in this area mainly focus on agro-environmental measures to enhance species di-

versity, collection of wild gene pool for the use of regionally adapted species-rich mixtures for grassing, broadening the genetic base for newly bred varieties using wild species. Additional activities include selecting suitable species and varieties for alternative use, domestication of wild species to diversify cultivated crops and improvement of soil fertility etc. While the GR for these purposes are obtained mainly by collecting expeditions, the information on the potential use of wild species is gathered by botanical research and monitoring of the populations of targeted species in natural habitats. The required research is conducted through applied agricultural research projects or other types of research initiatives. The NPPGR thus serves as the basic source of experimental materials and information for the related agricultural research projects.

The development and implementation of *in situ* and on-farm conservation methods have so far been underrepresented in the Czech Republic, and more activities will be focused on them within the new phase of the NPPGR. In the case of on-farm conservation, several practical implementations have taken place, primarily in cooperation with the national park administrations and NGOs, based either on historical materials preserved in their original localities or on materials provided by the NPPGR. On-farm conservation is implemented in accordance with the published On-farm Conservation Methodology (Holubec et al., 2020), which states that all on-farm conservation areas must be recorded in the NPPGR Germplasm Resources Information Network – GRIN Czech information system. As part of active cooperation with the Czech Union for Nature Conservation (ČSOP), germplasm orchards will continue to be used as on-farm conservation sites. *In situ* conservation will be carried out in accordance with the *In situ* Conservation Methodology (still in manuscript) and based on the conditions published under the ECPGR. Ensuring *in situ* conservation requires close collaboration with the Ministry of the Environment of the Czech Republic. However, these activities are also necessary outside of protected areas, in cooperation with landowners, i.e. farmers, NGOs, local governments, and other stakeholders.

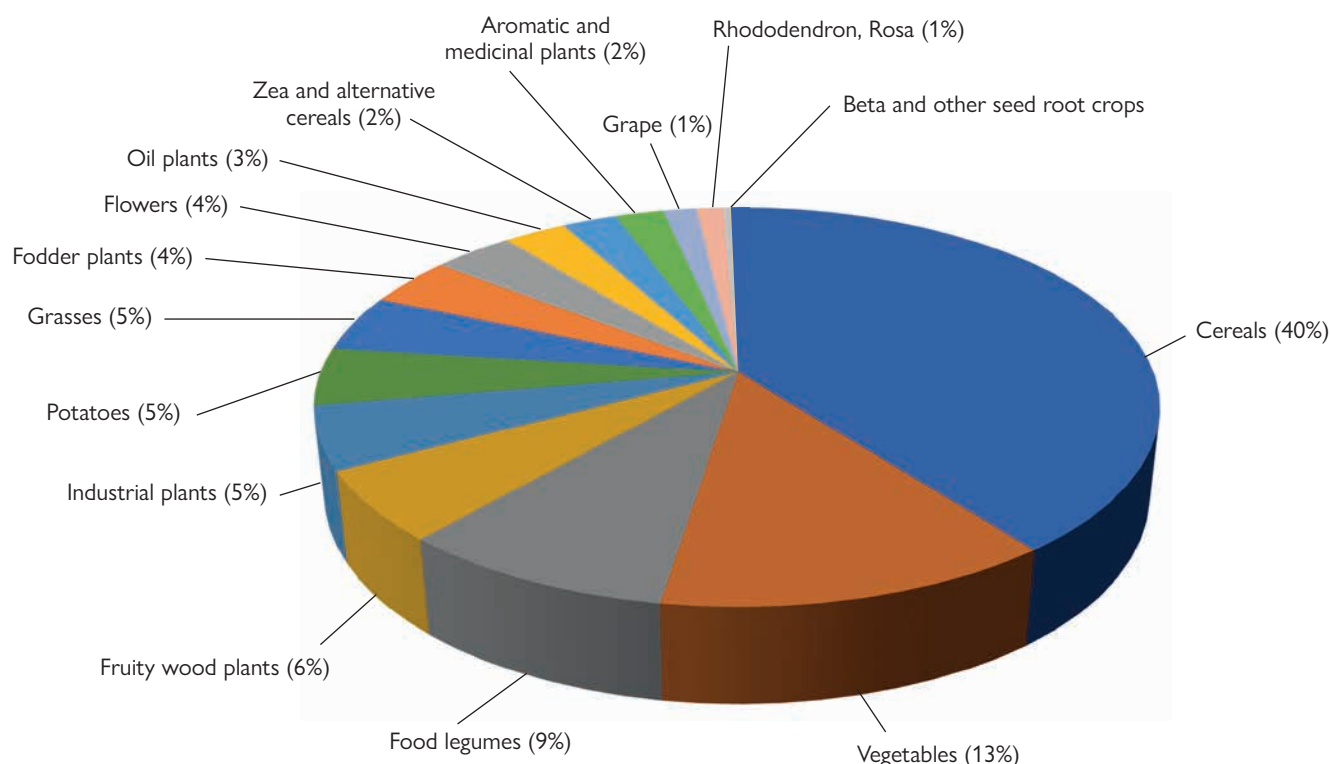
2. The state of the collections

As of 1st January, 2022 a total of 56,474 plant GR (PGR) has been gathered in Czech collections, with a predominant share of cereals, vegetables, forage crops, legumes, and fruit plants (see Fig. 2). Seed propagated collections represent 82%, while vegetatively propagated species account for 18%. This ratio has been maintained over the long term.

The species diversity of Czech collections includes 1,173 species of both cultivated and wild plants – more information is available at: <https://grinczech.carc.cz/gringlobal/search.aspx>.

Considering enlarging the collections with new PGR resources the strategy focuses mainly on PGR of domestic origin (to ensure their preservation for future generations) and enrichment of collections with sources of new genetic diversity, either in response to user demand or driven by changes in agroecosystem conditions.

Fig. 2: Structure of crop accessions held in collections



3. Structure and organisation

The **authorized person** is the Czech Agrifood Research Center (CARC), a public research institute located in Drnovská 507/73, 161 00 Praha 6 – Ruzyně, which pursuant Act⁶, to ensure the coordination of the NPPGR and related activities. The authorized person has the right to conclude contractual agreements with NPPGR participants and other entities with the aim of implementing the NPPGR and its objectives (see Fig. 3).

The coordination of the NPPGR is carried out by the **coordinator**, who manages the sub-programme and the relevant activities of its participants, is responsible for its implementation and the results achieved, represents the sub-programme with the MoA and other entities and acts also as a representative of the Czech Republic in the field of PGR and agrobiodiversity in international negotiations and meetings. The coordinator is appointed by the MoA.

Participants to the NPPGR are holders of **collections of crops or their parts**. Each comprehensive crop collection is represented by its curator as the **responsible person (guarantor)**. Within the PNPPGR, there are 16 participants belonging to 12 legal institutions (see Annex 5).

The advisory and consultation body of the authorized person and all participants is the **NPPGR Board**. The Board members include representatives of NPPGR participants and interest groups and are appointed by the authorized per-

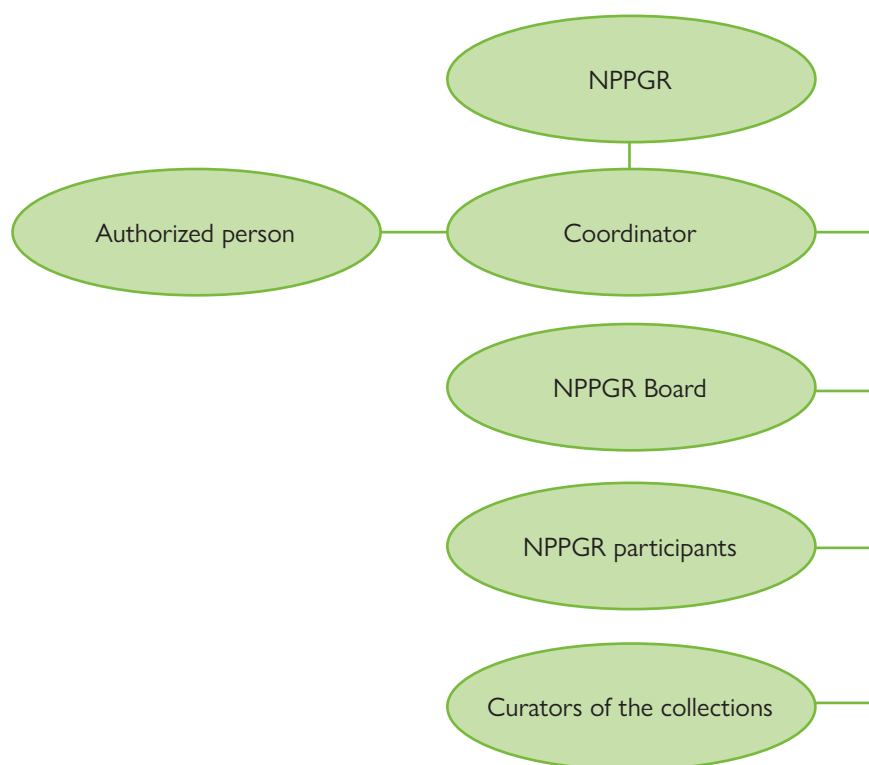
son's statutory representative. The mandate of the Board and its members is given by the Statute and the Rules of Procedure. It is chaired by the coordinator or its deputy. The Board also functions as the expert group for the needs of the MoA and other public administration authorities, it discusses the expert methodologies, evaluates the activities of NPPGR participants, comments on the applications of new applicants for participation in the NPPGR, discusses and approves budget issues and expresses its views on international cooperation and other topical issues in the area of PGR.

The NPPGR implementation is guided by the Framework Methodology of the National Programme of Plants (2017), available also at: <https://www.gzr.cz>. This is complemented by specialized methodologies for individual groups of crops, prepared by the responsible institutions managing the respective collections. The Framework Methodology is binding for all NPPGR participants, as are the provisions of this NPPGR.

In addition to coordination and related activities, the CARC provides support services for all participants. These services include the operation of the national information system GRIN Czech, maintenance of the NPPGR website (www.gzr.cz) and conservation of all seed samples in the genebank, as well as their distribution to users. GR of vegetatively propagated species are conserved at the participants responsible for the respective collections. All GR provide samples and information to users based on the Standard Material Transfer Agreement (SMTA).

⁶ Act No. 148/2003 Coll., on the conservation and utilization of plant genetic resources and microorganisms important for food and agriculture.

Fig. 3: The organizational chart of the National Programme for Plant Genetic Resources



4. Specific methodological activities

In accordance with international standards (FAO Second Global Plan of Action for Plant Genetic Resources, Genebank Standards for Plant Genetic Resources⁷, FAO ITPGRFA, etc.), the activities for the conservation and utilization of plant GR are divided into the following stages:

4.1 Enlarging the collections

The strategy of rational enlarging of collections with new PGR has not changed fundamentally in recent years. Only a limited number of carefully selected accessions are incorporated into collections, and focus on:

- collection and rescue of PGR of domestic origin (new, endangered, lost and repatriated, or not yet included), based on monitoring activities and the GR conservation strategy of the Czech Republic,
- enlarging of collections with new genetic diversity, in accordance with the needs of research and plant breeding, as well as with the demand for increasing crop diversity in agricultural practice,
- acquisition of donors of economically and biologically valuable traits for use in breeding and research.

The collections are supplemented according to a pre-defined strategy and objectives, with an emphasis on quality and the addition of new traits that are missing in current collections. The limitation of the collection growth and thus the associated mul-

tiplication and evaluation of new plant GR allows reallocation of some funds to other necessary activities. One of the reasons for the limited enlargement is also the increasing difficulty in acquiring PGR from potential donors abroad, particularly in the case of newly bred varieties and evaluated gene donors. However, these materials are highly sought after by users.

The most valuable GR are domestic materials provided by breeders and researchers. The most user-demanded materials are new varieties provided by foreign donors obtained through exchange with foreign genebanks. A significant source of new genetic diversity also comes from domestic and international collection expeditions carried out with partner research institutions. In accordance with the methodology of the NPPGR, the expeditions focus on acquiring higher quality and more extensive samples, better representing the original population.

4.2 Documentation and recording system

The CARC gene bank participates in A European Genebank Integrated System (AEGIS), where, in collaboration with the collection curators, original Czech materials are flagged in the European Search Catalogue for Plant Genetic Resources (EURISCO) database. As of 1st January 2022, a total of 1,713 accessions have been recorded.

The GRIN Czech information system, which was modified and optimized by transforming the GRIN-Global system. This system is freely available to all interested parties from genebanks worldwide. All data on plant GR within the NPPGR recorded in the GRIN Czech system are available at: <https://grinczech.carc.cz/gringlobal/search.aspx>. For the needs of the curators

⁷ FAO. 2014. *Genebank Standards for Plant Genetic Resources for Food and Agriculture*. Rev. ed. Rome. E-ISBN 978-92-5-108262-1.



working with the system, a question-and-answer webpage is available, where curators can directly submit their queries.

While passport data are recorded for all PGR accessions in national collections, descriptive data, crucial for users, are available for approximately 70% of active accessions with varying levels of detail. Descriptive data are the results of PGR evaluation (field trials, laboratory tests) and are supplemented with additional characteristics (identified genes, genetic markers), which are recorded in a standardized format within the system, thus further enhancing the practical value of the PGR.

The Coordination at the CARC Gene Bank provides methodological training for collection curators of the NPPGR and has also repeatedly hosted the global GRIN-Global Workshop organized by the Global Crop Diversity Trust and ECPGR.

4.3 The study and evaluation of GR

Evaluation of PGR is a basic prerequisite for their effective practical further utilization and is therefore one of the core activities of the NPPGR. To build a database of descriptive data for the GRIN Czech information system, PGR are characterized and evaluated in three-year field trials in accordance with the national standard sets of descriptors specifically developed for each crop or genus. The preparation of new standard sets of descriptors (or just a minimum set of descriptors) is a prerequisite for broadening the description of the collections. Results from the field observations are complemented by laboratory tests, depending on the crop species and the current needs. The number of traits assessed is crop-specific and increases with the importance of the crop. At present, there is a significant increase in the need to assess PGR for the presence of traits for resistance to biotic and abiotic stressors (resistance to drought, resistance or tolerance to pathogens and pests).

Detailed passport and characterization data enabling clear PGR identification as well as detecting genetic diversity are becoming increasingly important for the management of collections. Besides morphological features, genomic and proteomic approaches and methods are increasingly used for this purpose.

The research on PGR undergoes rapid development, particularly through the use of molecular methods, for characterization and evaluation of PGR. Most of these activities cannot be financed directly through the NPPGR and is therefore dependant on individual grant-funded projects.

4.4 Conservation of PGR

The precondition for the conservation of PGR is its periodic regeneration. Maintaining viable seeds is achieved by slow drying of seeds at a temperature of 20 °C and their long-term storage at -18 °C. Of a total number of 45,776 available generatively propagated PGR, 43,503 are stored in the main CARC genebank, i.e. 96%. Vegetatively propagated species are conserved in field genebanks and *in vitro* cultures. For selected species, cryopreservation is also used for safety duplication.

The most commonly used method for conserving vegetatively propagated PGR (more than 10,000 accessions) is field genebanks (e.g. permanent plantings of orchards, vineyards and hop fields, as well as perennial vegetables, forage crops, grasses, and flowers, etc.), where the permanent cultures are preserved according to the Framework Methodology of the NPPGR.

A safer and cheaper method is *in vitro* preservation using the “slow growth” method of explant cultures. Naturally, this method does not allow the assessment of PGR during conservation, and thus, independent field tests are necessary for their evaluation. *In vitro* conservation is used either as a single method (potatoes) or in combination with field collections (some ornamental plants and vegetables, hops, grapevines, and other species to a limited extent). The technology used is species-specific, as are the intervals necessary for regeneration. Standard methodological approaches for *in vitro* conservation of particular species are part of the Framework Methodology.

A promising and safe conservation method is the cryopreservation of meristems, dormant buds, or plant tissues in liquid nitrogen. The main advantage of this method is safe and practically unlimited long-term storage with minimal risk of damage to the PGR during storage. Additionally, it enables the preservation of pathogen-free materials in species that are prone to rapid contamination by pathogens (especially with viruses and phytoplasmas) under field conditions. Certain limits exist in terms of the requirement for technical equipment, labour and material costs, and the need to develop species-specific cryoprotocols. The cryobank provides technical services for these needs and guarantees the status of conserved samples through the methodical and technological development of cryopreservation. The cryobank does not offer regular services to users of PGR in the sense of applicable legal standards. It is rather an internal service within the NPPGR framework and international cooperation (safety duplication).

5. Conditions for inclusion in the National Programme for Plant GR

A general condition for participation in the NPPGR is the ownership of PGR that have not already been dealt with as a collection (or part of a collection) by another NPPGR participant. If a collection of the same crop (species) already exists in the Czech Republic, the owner of the PGR is requested to hand over such resources to the collection in the manner and under the conditions agreed upon with the curator of the collection concerned. This procedure eliminates duplications, saves public financial resources and guarantees compliance with international standards. A general condition is also the applicant's consent with the organizational and methodological procedures resulting from being part of the NPPGR, including of its PGR in the national information system as well as the guarantee of the availability of PGR concerned for users.

The specific professional and technical requirements for participation in the NPPGR are regulated by the Act No. 148/2003 Coll.⁸ and by implementing Decree No. 458/2003 Coll.⁹.

⁸ Act No. 148/2003 Coll., on the Genetic Resources of Plants and Microorganisms.

⁹ Decree No. 458/2003 Coll., which implements the Act on Plant and Microorganism Genetic Resources.

6. International cooperation

Activities related to the monitoring, conservation and use of biodiversity have a global character and international cooperation and coordination are therefore essential. The basic document for ensuring the conservation and sustainable use of biodiversity is the CBD and, in the case of food and PGR, the Second FAO Global Plan of Action for Plant Genetic Resources. Both documents are continuously updated and serve as the strategic foundation for the conservation and use of PGR worldwide.

The Czech Republic is a contracting party to the ITPGRFA, which entered into force on 29th June 2004. The ITPGRFA currently has 149 Member Parties, including all EU member states. Since 2006, the Czech Republic has been providing PGR from NPPGR to users under this Treaty through Standard Material Transfer Agreement (SMTA) for the purpose of research, breeding and education.

Another important globally active organization is the Alliance of Biodiversity International and CIAT¹⁰. Organizationally, it is one of the international centres of the Consultative Group on International Agricultural Research (CGIAR) with a focus on GR for food and agriculture and the conservation and use of agrobiodiversity. This organization actively collaborates with FAO, the GCDT, and fosters a broad expert environment for addressing current issues concerning the plant GR for food and agriculture.

In Europe, the key project is the ECPGR, which was established as the successor organization to International Board for Plant Genetic Resources/International Plant Genetic Resources Institute (IBPGR/IPGRI) and is currently managed within the CIAT. The ECPGR has been operating successfully since 1980, with nearly all European countries participating and the Czech Republic involved since 1983. The ECPGR consists of crop and thematic working groups, and its main objectives include maintaining the EURISCO, increasing the volume and quality of data, including from *in situ* and on-farm conservation, implementing the virtual European Genebank (AEGIS), supporting *in situ* and on-farm conservation of crop wild relatives and local varieties, and evaluating plant GR within the European Evaluation Network (EVA) project.

The Czech experts are involved in the ECPGR work, especially through the crop and thematic working groups. Some institutions have undertaken additional responsibilities, e.g. the management of selected European crop databases and guaranteeing international collections. NPPGR participants guarantee the following specific activities for the ECPGR:

- The National Coordinator coordinates the participation of NPPGR institutions in the ECPGR working groups, disseminates information to the NPPGR participants and provides feedback to the Steering Committee.
- The genebank in CARC serves as the National Contact Point to EURISCO and actively participates in its Advisory Committee.

- The Genetic Resources for Vegetables, Medicinal and Special Plants team in CARC Olomouc leads the ECPGR Allium Working Group, acts as the guarantor of the international collection of vegetatively propagated garlic and shallot crops (*Allium* sp.) and ensures the international cryopreservation of European garlics from the EURALLIVEG (Vegetative Allium, Europe's Core Collection, Safe and Sound) project.

In recent years, NPPGR institutions have also been collaborating in international projects. In 2021, Czech partners participated in 8 such international projects related to PGR, of these, 1 project had a Czech coordinator, and 7 projects were carried out in collaboration:

- ECOBREED (CARC Prague, buckwheat collection) (<https://ecobreed.eu/project/>),
- AGENT (CARC Prague, wheat and winter barley collection, Agricultural Research Institute, Ltd. Kroměříž, spring barley collection; <https://www.agent-project.eu/>),
- EUCLEG (Research Institute for Fodder Crops Ltd., Troubsko, alfa-alfa collection) (www.eucleg.eu),
- EUREKA (Hop Research Institute Co., Ltd., Žatec) (<https://h2020eureka.eu>),
- PTC – Autonomous plant tissue culture (Potato Research Institute Havlíčkův Brod, Ltd.),
- Norwegian funds (CARC Prague, cryobiology),
- TA ČR (OSEVA PRO Ltd., analysis of resistance of rape-seed to viral pathogens),
- ECPGR (Research and Breeding Institute of Pomology Holovousy Ltd.), GRIN Global (CARC Prague, coordination).

In addition, there are also agreements and bilateral cooperation programmes between various Czech and foreign institutes, which focus on PGR. The cooperation agreement between the NPPGR and Slovakia is of particular importance. It focuses on mutual insurance of the safety duplication of selected PGR and cooperation on their regeneration and evaluation. Safety duplication of seed-propagated crop samples is also ensured through an agreement with the Norwegian government for storage in the Svalbard Global Seed Vault.

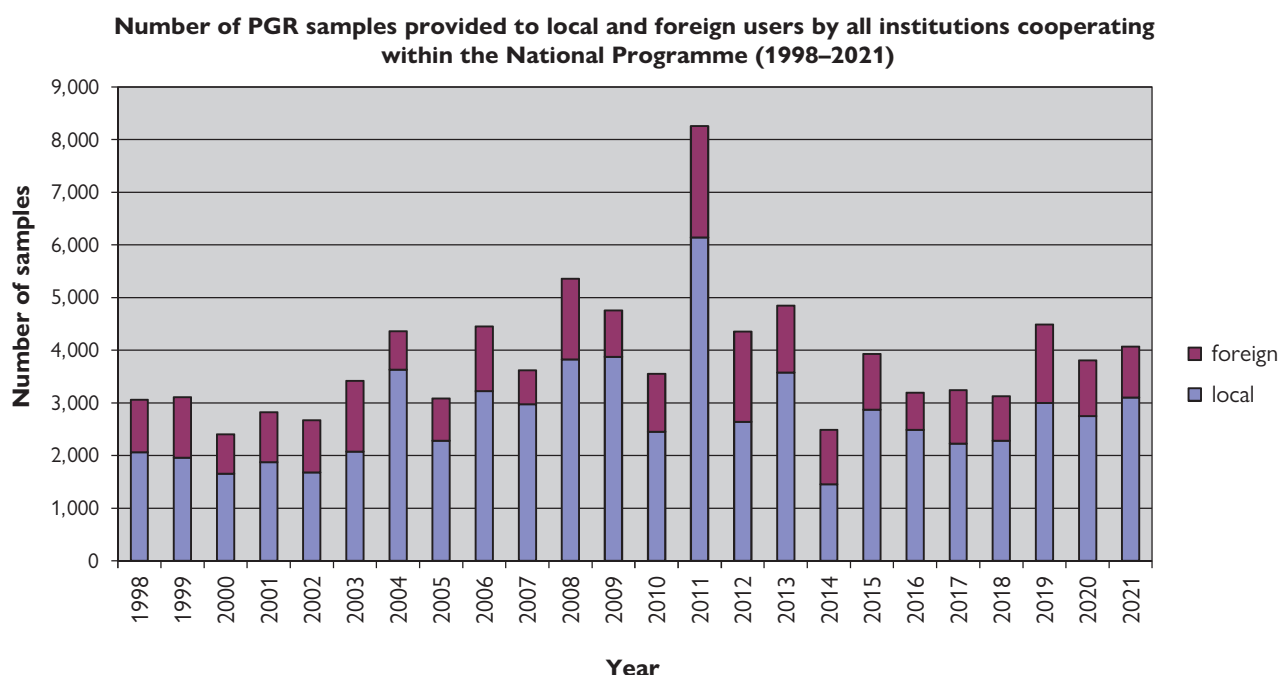
7. Utilization of GR and the services provided

According to Act No. 148/2003 Coll., on Genetic Resources of Plants and Micro-organisms, samples of PGR are provided to users free of charge for the purpose of breeding, research and education, but not for direct commercial use. This principle is in compliance with the ITPGRFA and the conditions for the transfer and use of PGR are governed by the SMTA.

In the GRIN Czech information system, users order PGR online upon their registration. They usually accept the SMTA conditions electronically at the time of ordering – using the “click-wrap” procedure for signing the agreement. The user is

¹⁰ The Alliance of Biodiversity International – CIAT, was established through the merger of the Biodiversity International and the International Center for Tropical Agriculture.

Chart 1: Distribution of PGR samples to users



obliged to utilize PGR samples only for research, educational and breeding purposes defined within the SMTA. Acceptance of the SMTA is a mandatory condition for the distribution of PGR. Basic information about the user and the provided PGR samples is reported to the ITPGRFA system.

All NPPGR participants provide users with samples of PGR: the seed genebank, the field and *in vitro* genebank and collection curators through their direct contacts with PGR users. The distribution of PGR depends on the user's requirements and varies in different years (see Chart 1).

B. The National Programme on Conservation and Utilization of Animal Genetic Resources Important for Food and Agriculture

1. Mission and aims

Livestock farming is an essential part of several agricultural ecosystems. The conservation of the genetic diversity of breeds and species is crucial to the resilience and flexibility of these systems. Although livestock breeding in the Czech Republic and other European countries has concentrated over the last decades mainly on a rapid increase in production and productivity, it concerned only some of the most suitable species and animal breeds. Highly productive genetic material was subsequently introduced into less intensive farming systems, often at the expense of locally adapted and genetically highly variable breed populations.

Highly productive animal breeds are often achieved only at the cost of losing other valuable characteristics, such as longevity, resistance to diseases and adverse environmental effects or nat-

ural reproductive abilities. In other words, some historically older breeds of animals did not undertake intensive production breeding. These have retained several valuable features such as adaptability to the environment, resistance to climatic conditions and certain diseases, good reproductive and maternal characteristics and the ability to make the best use of local food sources.

The mission and aim of the National Programme on Animal Genetic Resources (NPAGR) is to pay more attention to those livestock species and breeds that are historically native to the Czech Republic, have adapted to the local conditions over a long time, are not numerous and are endangered. The aim is to map their traits and characteristics and their use in alternative and non-productive agricultural activities, landscape and nature conservation or improving the health and resistance of other breeds, thus helping them to adapt to ongoing changes in the environment.

Working with animal genetic resources (AGR) is by nature long-term, conservative and based mainly on maintenance to preserve original genes and characteristics. Nevertheless, new methods such as molecular genetics, genomics, advanced information systems and cryopreservation are now used as well. The MoA, the Institute of Animal Science (IAS), and the Board on Animal Genetic Resources are responsible for coordinating and fulfilling the requirements and plans arising from the NPGR.

The procedures and measures focused on the long-term conservation of AGR are based on the relatively detailed monitoring of the development of populations as well as certain individual animals. The protection regimes are set depending on the population's size and development trend and range from monitoring and support for *in situ* breeding, via *in vivo* or *ex situ* controlled breeding, to regeneration in the form of targeted individual mating using cryopreserved material and embryo transfer. *In vivo* breeding is continuously replenished by creating a deposit of cryopreserved material.

2. The current state of animal GR

Unlike the PGR, most of the AGR are privately owned and belong to many individual owners and breeders. A significant part of AGR is maintained in small-scale rural family-like or hobby farming, which is strongly influenced by social development, and the number of these breeders is steadily decreasing. The size of individual herds varies greatly, from a few to hundreds of animals (see Annex I). Each individual represents a unique GR. Breeding and selection are governed by collective decisions made by breeder's associations. Breeding of AGR is not fully competitive from an economic standpoint compared to production breeds or hybrids and is therefore largely dependent on some compensation for economic losses.

Fish GR are preserved by replenished broodstock of 120 individuals, with each species having two, or at most three, broodstock groups (see Annex 2). Replenishment is carried out exclusively through artificial breeding with specific technical and breeding measures, such as egg incubation in a separate incubation environment or at a different time than the eggs intended for production (market) purposes.

The Carniolan honeybee is maintained permanently in recognized breeding colonies at several locations. Replenishment of bee colonies is carried out through targeted insemination or natural mating. The colonies provide genetic material for the replenishment of the GR itself, as well as for the breeding public.

The development of the population of all GR, the number of breeders, the number of broodstock groups, and the number of bee colonies are updated annually in the report on AGR, which is available at www.genetickézdroje.cz/publikace. The basic methods of preserving AGR include living individuals (*in vivo*) and the preservation of cells, tissues, hair, saliva, blood, or genetic material in genebanks (*ex situ*).

2.1 *In vivo* conservation of GR

Cattle

Both cattle breeds – Česká červinka (Czech Red) and the original unbred type of Český strakatý cattle (Czech Original Red-Pied) have been regenerated. From their original state of being critically endangered they now ceased to be directly threatened. The regeneration projects will continue also in the future, mainly in the form of embryo production, rearing breeding bulls from embryo transfer, placement of bulls at insemination stations, collection of semen, cryopreservation of insemination doses and the increase of female population.

Sheep and goats

Both sheep breeds are stabilized. Valaška (Valachian Sheep) was even successfully regenerated within the original colour variants. The status of both goat breeds is now stable. However, the development of farm cheese production and the import of intensive milking breeds poses a threat especially to the white breed. Therefore, it will be necessary to focus more on cryopreservation.

Pigs

The size of the Přestické Černostrakaté (Přeštice Black-Pied pig) population has been stabilized while the main focus is now on measures related to preservation of the breed's structure (genetic diversity), health and the economic use of its positive qualities.

Horses

The population of four conserved breeds is stable, although it is necessary to focus on several current issues. The Hucul horse shows low reproductive activity, and the average age of mares is increasing. These factors are rather unsatisfactory as they do not give favourable prospects for the future. For cold-blooded breeds the issue of precise differentiation of the Noriker sub-populations (Noriker – Silesian Noriker) and the absence of a breeding system based on the basic principles of working with small populations, is still not resolved. A separate problem is also the lack of system settings for the practical use of cold-blooded workhorses.

Poultry

The supported breed Czech Goose is fully maintained in hobby farms. Therefore, several problems caused by this traditional breeding system persist, such as determining breeding priorities and keeping a pedigree of the population. Cryopreservation has not been fully methodically developed, and the poultry populations are posed to several threats, such as the avian influenza infection. One of the measures will therefore need to be the establishment of isolates to protect the most vulnerable parts of the population.

Since 2008, the NPGR has also included closed initial poultry lines used within the recognized breeding farms in the Czech Republic. It concerns a total of 16 laying hen lines, 8 lines of ducks and 3 goose lines, as well as 4 basic groups of inbred lines and 2 outbred lines of domestic chickens.

The purpose and goal of including these populations in the category of GR is the ongoing potential risk of the emergence of dangerous poultry diseases and the protection of this breeding material against its possible destruction.

Small animals

Rabbit and nutria breeds are also fully maintained *in vivo* in small holdings. Breeds originally protected for their fur due to their unique colour genotypes are also partly usable as a source of meat and the NPAGR also focuses on the characterization and genotyping of these characteristics. Cryopreservation has yet to be methodically developed.

In addition to agricultural and other utility animals, the NPGR also includes populations of animal species that are important for nature conservation, ongoing research, and the provision of ecosystem services. These include populations of selected fish species and the Carniolan honeybee. Fish GR in aquaculture are stabilized and maintained in the form of broodstock groups *in situ*, with cryoconservation also managed. In connection with the currently developing FAO program for aquaculture, further necessary activities in this sector will be formulated. Bee GR are still maintained through controlled reproduction (insemination) with performance monitoring in breeding farms.

2.2 Storing GR *ex situ* – cryopreservation

Within the framework of NPAGR, breeds of cattle, pigs, sheep, goats, horses and fish are included in the cryopreservation programme. An overview of the cryopreserved material is provided in the Annex 3. The aim of the preservation programme is also to extend the type of genetic material stored (oocytes and somatic cells) for those species, where there is not yet developed a sophisticated cryopreservation method for gametes (rabbits, coypu, poultry).

Apart from cattle and pigs, the selection of individuals and the collection of samples of genetic material for cryopreservation is primarily given by their availability or the willingness of their owners to provide such samples. Therefore, it will be necessary to work together with the breeders' associations to develop a system of targeted selection of individuals for cryopreservation and to strengthen capacities for routine use of methods of sampling and cryopreservation and the subsequent application of the genetic material.

Genomic collections of biological material (see Annex 4) are primarily intended for use in research on GR. It will also be necessary to develop a targeted collection system to enlarge this material. More detailed information on cryopreserved and genomic material is annually published in the Report on AGR, available at: www.genetickézdroje.cz/publikace.

At present, the following genebanks are involved in the NPAGR:

- the cryobank operated within the Czech Moravian Breeders' Corporation in Hradištko, which stores deep-frozen

insemination doses and the embryos of cattle, horses, pigs, sheep and goats,

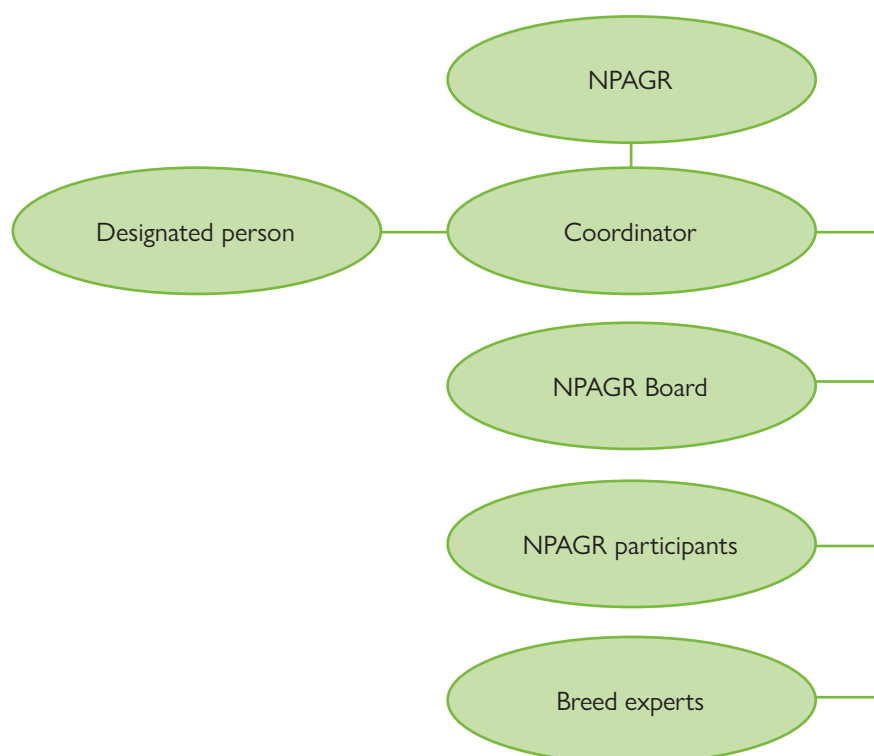
- the cryobank operated within the University of South Bohemia – Research Institute of Fish Culture and Hydrobiology in Vodňany, which stores deep-frozen insemination doses of fish,
- the bank operated within the IAS in Uhřetěves, which stores DNA, somatic cells and animal tissues and contains also the work-deposit of deep-frozen insemination doses of pigs, sheep and goats in Kostelec nad Orlicí.

3. Structure and organization

The **Designated person and coordinator** is the IAS according to § 14 (4) (a) of the Breeding Act¹¹ ensures the overall coordination of the NPAGR. The National Reference Centre for Animal Genetic Resources operates within the IAS and is responsible for coordinating activities and implementation of measures aimed at achieving the objectives of the NPAGR. This Centre is represented by the coordinator, whose duties are international activities, cooperation with the MoA, carrying out checks and addressing possible and emerging issues. The designated person also assesses the NPAGR annually following the provisions of the applicable legislation.

The Board of Animal Genetic Resources is the advisory body of the designated person. The Board is chaired by the coordinator or his/her deputy and acts following its Statute and the Rules of Procedure. The Board consists of representatives of breeders' associations, experts for relevant animal species or breeds, representatives of the MoA and other invited persons (see Fig. 4).

Fig. 4: The structure of the National Programme on Animal Genetic Resources



¹¹ Act No. 154/2000 Coll., on cultivation, breeding and registration of livestock and on the amendments to certain related laws.

Animal species or breed experts are appointed by the statutory body of the designated person upon a proposal from the relevant breeders' association and upon consultation with the MoA. The expert guarantees that all information about the particular species/breed is up-to-date, is responsible for the Methodology for the conservation of the particular species/breed, participates in meetings of the Board, communicates with the programme participants, submits data and information about the current status and possible problems of the species/breed to the coordinator, creates annual reports, provides on-line access to up-to-date information and, within its remit, addresses current issues.

The relevant **Breeders' Association** looks after each breed or species of AGR in the course of its day-to-day activities. The association's rights and obligations are given by the Breeding Act and Decree on AGR. One of the core activities is keeping the herd book or similar breeding evidence.

NPAGR **participants** are most often owners of animals, breeders' associations, and the legal entities operating the genebanks as well as the Designated person. Participants voluntarily undertake to meet the conditions of the relevant legislation and the methodologies for the conservation of animal species/breeds.

The administration process enabling the inclusion of animal species/breed into the NPAGR, the inclusion of new programme participants as well as the recording of AGR in herd books or breed evidence books are governed by the Breeding Act and related methodologies for conservation of particular animal species/breed.

The MoA issues a formal decision when including a new participant in NPAGR or extending such an existing decision. The relevant applications must be approved by the Designated person and delivered to the MoA no later than 31st July of the given year.

4. Specific methodological activities

4.1 *In situ* conservation

The aim of *in situ* conservation is a dynamic way of conservation in normal production conditions, which allows the natural development of populations, their coevolution with pathogenic microorganisms, adaptation to changing climatic and natural/living conditions and minimalization of the effects of modern technologies (dehorning, early weaning and artificial calf nutrition, caged poultry breeding).

In contrast to normal breeding, the conditions required for breeding of AGR are those most similar to the conditions in which the breed evolved, e.g. allowing a natural paddock or grazing for the Přestice Black-Pied Pig; the relevant amount and quality of nutrition, which must correspond to the normal dynamics of the growth and development of animals. These requirements are usually incompatible with modern production technologies. An example can be given by the GR of the Czech Red breed (cattle), where according to the methodology for preserving this breed, an extensive breeding system is applied. This system is crucial for maintaining healthy growth, development, and the animal's adaptability and grazing abilities.

The aim of selection is not to enhance the production traits, the main aim is to stabilize the utility traits (maintenance breeding) or to change them to the original state – for example, the original degree of fattening in the Přestice Black-Pied Pig, which changed significantly under the influence of selection in the 1980s.

For groups of individual animals included in the conservation nucleus, the breeding is organized by the principles of breeding small populations to preserve a specific genetic diversity within the breed. Individuals undergo pure-breed mating following the set plan. The aim is to gain offspring with the characteristics that would enable to include them again in the group of GR, taking into account a wider set of utility traits during their selection. For some GR, e.g. workhorses, it is, therefore, necessary to insist on the original manner of use or at least to verify their genetically based talents for this manner of use – character, manageability, willingness to work, etc.

For every breed included in the NPAGR, there is a designated expert that develops in cooperation with the relevant breeders' association a methodology for the conservation of AGR. This methodology stipulates inter alia:

- the breeding method, performance check, assessing traits and selection, which may differ from approved classic breeding programmes,
- the recommended way and technology of keeping animals,
- the recommended way of assessing the population's state and trend (monitoring),
- the extent and manner of keeping documentation on the GR by the owner,
- the bodies responsible for implementing the procedures set out in the methodology.

4.2 *Ex situ* conservation

The strategy for *ex situ* conservation aims to preserve genotypes threatened by elimination as a result of selective pressure and the spread of "the most efficient" individuals. The combination of *in situ* and *ex situ* approaches represents the optimal solution for the conservation, or if necessary, the regeneration or reconstruction of breeds with large or small population numbers. The development of a genebank is a long-term project involving several processes. The current state and knowledge of the dynamics of the conserved population, determining the purpose of the genebank and, last but not least, the financial stability allowing its operation are crucial.

The main purposes of a genebank are the following

- safety deposition – as the reconstruction of the breed in case of any unforeseeable event or catastrophe happens,
- active support for *in vivo* conservation programmes – cryopreserved insemination doses are used to minimize inbreeding,
- conserving rare or important genotypes – use for corrective mating or developing utility traits according to market demand,
- conserving biological material for research and development, especially in the form of genomic collections.



5. Monitoring and evaluation of animal GR

5.1 Classification of breeds/populations according to their adaptation to local conditions

Locally adapted breeds are considered to be breeds that have been in the Czech Republic for a sufficiently long time to have genetically adapted to local production conditions. A sufficiently long time is considered at least 40 years plus 6 generations. That is approximately 80 years for cattle and horses, 60 years for sheep and goats and 50 years for pigs. If it concerns a relatively closed population, i.e. with no or minimal crossing with another breed, which has developed into a distinctly different type from the original breed during that time, then it can be considered a new (purebred) breed.

Autochthonous or native breeds can be defined as originating and initially recognized in a given country (i.e. in the country of origin) and existing in the country where they were bred. In 2009, the FAO Commission on Genetic Resources for Food and Agriculture established a timetable and format for reporting on the state and development of AGR based on the GPA. The report is based on CBD indicators for trends in the genetic diversity of domesticated animals and is processed every two years. Examples of diversity indicators are the number of locally adapted breeds, the percentage of the locally adapted breeds in the total population of the species and the number of breeds classified with the status of endangered, unknown and with no risk. At the same time, it is desirable to monitor animals not registered in herd books (with no pedigree) because they could be useful for reconstructing a particular breed in case of any unforeseen situation.

5.2 Identifying endangered breeds – indicators used

The primary indicator is the **total population capable of reproduction** (number of animals). However, the data on the immediate population size needs to be addressed in relation to time, i.e. the trend of the population's numerical development.

Moreover, the effective population size indicator (N_e), which is often used as a measure of the threat, requires data on the number of breeding males (including any cryopreserved insemination doses) and is not fully accurate in systems with controlled reproduction (systems with no random mating). The decisive indicator is thus the number of females (see Table 1), which is used for the classification of the threat status. The most serious is "critical" status signalling a direct threat and the need for immediate active conservation measures. It is followed by "action" needed, which requires a managed regeneration programme, and "warning" status, which should be the reason for elaborating further management measures for the breed.

It is essential to assess the values of all these indicators in relation to other factors affecting the population's reproductive potential: fertility rate, the generation interval, the ratio of males and females and, last but not least, the extent to which the breed is used for purebred breeding.

Apart from population size and trend, the status of the breed could also be influenced by other factors such as a limited number of herds (breeds) and/or **concentration of animals on a limited territory**. This factor is particularly important for the Czech Republic due to its size, and with regards to the fact that in case of an outbreak of a serious epidemic disease, the remedial (elimination) measures could affect extensive areas of the country. For similar conditions, a concentration of 75% of the breed within a 25 km radius is considered as critical and a 50 km radius is considered as warning.

The FAO Guidelines for the Conservation of Genetic Resources *in vivo*¹² provide for the determination of the endangerment category in a more detailed table, taking into account more factors.

Another important factor is the rate of genetic erosion that can arise as a result of inbreeding, genetic drift, the introgression of foreign genes, etc. Among these factors, the most serious is the **rate of increase in inbreeding between generations** rather than the absolute level of inbreeding, because the degree of severity of inbreeding differs among species/breeds. The **introgression of foreign genes** is classified as critical if it exceeds 12.5% in any generation, a level of 2.5% indicates the warning status.

In addition to these measurable indicators, it is necessary to consider other causal factors, such as the overall trend in developing livestock production, the socio-economic situation, demographic developments – the proportion of the population engaged in breeding (including hobby breeders) and the age of breeders.

Table 1: Criteria for determining the risk of threat – number of females¹³

Threat status	species			
	sheep and goats	horses and donkeys	cattle	pigs and poultry
critical	300	200	150	100
action	3,000	2,000	1,500	1,000
warning	6,000	4,000	3,000	2,000

¹² FAO (2013). *In vivo* conservation of animal genetic resources. FAO Animal Production and Health Guidelines. No. 14., Rome (<http://www.fao.org/docrep/018/i3327e/i3327e.pdf>)

¹³ Breeds at Risk. Criteria and Classification. Report from a seminar 16–17 February 2010, Lawrence Alderson <http://www.ela-europe.org/ELA%20teksten/home/breeds%20at%20ros.pdf>.

Table 2: Recommended FAO criteria for determining the risk of endangerment

reproduction capacity	no. of males	number of breeding stations						
		≤100	101–300	301–1,000	1,001–2,000	2,001–3,000	3,001–6,000	>6,000
high*	≤5							
	6–20							
	21–35							
	>35							
low**	≤5							
	6–20							
	21–35							
	>35							

critical
 endangered
 vulnerable
 no risk

high reproduction capacity * = pigs, rabbits, poultry

low reproduction capacity ** = horses and donkeys, cattle, sheep and goats

Table 3: Indicators of endangered breeds

Summary overview of indicators of endangered breeds				
category	numerical indicator*	geographical concentration indicator**	genetic indicator of inbreeding***	genetic indicator of introgression****
Critical	<100–300	<12.5	>3	>12.5
Action	<1,000–3,000	<25	>2	>7.5
Warning	<2,000–6,000	<50	>1	> 2.5

* the number of females able to reproduce by species (see Table 1)

** radius where 75% of the breed is found

*** increase in inbreeding per generation

**** % occurrence of foreign genes

6. Inventory, characterization and documentation

6.1 Documenting of breeding data

The data for the global monitoring and development of AGR are stored in the FAO Global Databank – the Domestic Animal Diversity Information System (DAD-IS). It provides access to a database of information, and photographs, and allows the analysis of livestock breed diversity at national, regional, and global levels, including the status of breeds in terms of their risk of extinction. FAO DAD-IS currently contains data from 182 countries on 40 species. The total number of national populations recorded is more than 15,000, of which approximately 8,800 are described as local breeds (i.e. reported only in one country). More information is available at www.fao.org/dad-is.

The European Federation for Animal Science (EAAP) created a database to monitor a wide range of European breeds. These are data describing breeds in general, including the size of populations and their structure over time. Both databases are interconnected and countries are obliged to update data on their breeds every year.

6.2 National database of breeds

A comprehensive list of **breeds** represented and used in the Czech Republic, documenting their immediate status (published in the DAD-IS system) contains 22 breeds of cattle, 9 breeds of goats, 36 breeds of sheep, 21 breeds of horses, 9 breeds of pigs, 6 breeds of rabbits, 3 breeds of geese, 2 breeds of ducks and Guinea fowl and 17 breeds of hens. The inventory is based on data registered by relevant breeders' associations. Several breeds of small animals and poultry kept in unregistered hobby farms are not included here; therefore it is not possible to estimate their range and diversity. The data are updated based on information provided once a year to the coordinator by the relevant breeders' association in the following format.

Basic data set

- name of breed – consolidated international name according to EFABIS (European Farm Animal Biodiversity – Information system) catalogue,
- identification of the subject managing the breed (recognized breeders' association),
- description of the basic morphological features,
- information on performance,
- information on existing *in situ*, *ex situ* (*in vitro*) conservation programmes.

Table 4: The format used to fill in data to the national breeds database

Extent of the population (if a numeric value is not known, give the range from – to)	Origin of data (Central register, census, estimate, etc.)	Data reliability in %
Extent of purebred breeding in population in %		
Number of females intended for reproduction		
of which females registered in Herd Book		
No. of breeding males		
of which males used in reproduction		
of which males used for insemination		
No. of farms (breeds)		
No. of animals per farm (breed) (range from – to)		

6.3 Description and characterization of breeds

The description (**phenotypic characterization**) identifies the diversity of populations and describes their external and production characteristics. Information on the population's geographical distribution is an integral part of the phenotypic characterization. Data objectivity must be ensured by obtaining realistic data for at least 30 males and 100 females. Additionally, **molecular-genetic characterization** data are used to clarify the genetic basis of phenotypes, inter-breed variability and similarities between breeds. The objectivity of the results depends on the selection of individuals used for the analyses – the minimum number should be at least 40 individuals and include the widest spectrum of the population, if possible geographically dispersed and with no connection by blood. To ensure compatibility and the possibility of integrating these data at the international level, it is necessary to use ISAG (International Society for Animal Genetics)¹⁴ standards and markers. The rapid development of molecular methods requires their continuous implementation (for example SNP (Single nucleotide polymorphism) chips).

Knowledge of the production environments in which performance is achieved is essential for the correct interpretation of their values. Therefore, a set of **descriptors of the production environment** was developed¹⁵. This makes it possible to assess their current, but especially, potential future uses in various production systems.

6.4 Early warning and response system

The basis of the system will continue to be the number of reproduction-active females and males, the trend of the in-breeding value and the trend in the number of herds/breeds. For breeds with a strong local connection to the geographical range is also taken into account. The introgression of foreign genes is practically irrelevant, because only individuals with a value below 12.5% are recognized as a GR and in all cases, measures have been taken to continuously reduce this value.

However, many breeds of small animals and poultry are not registered, so the total population range can only be estimated. Thus, the conservation regime covers only registered purebred individuals of these populations and it is as such considered to be the breeding nucleus and GR. Regarding small numbers of these breeds, they all fall into the category of critically endangered. Revitalization projects have been processed, implemented and are continuously evaluated for all critically endangered breeds.

To assess the status and development of populations of AGR and the effectiveness of the NPAGR, the breed experts submit data to the coordinator, if possible for the entire breed population (see Table 5).

The effective population size of 50 individuals is generally considered to be the critical limit for the long-term survival of a species, while 400 individuals (males and females) participating in breeding for a given year can be considered the small-size population. In small-size populations, the breeding should be managed along the **following principles**:

- making use of the largest possible number of breeding males; the proportion of breeding males in the population is maintained at a minimum of 10%; for one generation interval it is necessary to have at least 15 breeding males for mammals and 25 for poultry,
- breeding males with the genetic relationship at the maximum of 25% are used for breeding during natural mating, while in case of insemination it is only 12.5%,
- at least one son from each breeding male is included into the breeding programme, while not more than one son from the same father is included into the breeding programme from the same mother,
- mothers are used for reproduction as long as possible, while all daughters from each mother are used for reproduction,
- in case of insemination, an even number of mothers inseminated by particular breeding males is maintained,

¹⁴ FAO 2011. Molecular genetic characterization of animal genetic resources. FAO Animal Production and Health Guidelines No. 9. <http://www.fao.org/docrep/014/i2413e/i2413e00.pdf>

¹⁵ FAO/WAAP. 2008. Report of the FAO/WAAP Workshop on Production Environment Descriptors for Animal Genetic Resources, held in Caprola, Italy, 6–8 May 2008, edited by D. Pilling, B. Rischkowsky & B. Scherf. <http://dad.fao.org/cgi-bin/getblob.cgi?sid=-1,593>.

Table 5: Data for assessing the state of populations of AGR

Requested data	Evaluated indicators*
number of active breeding males in given year (with the record keeping on reproduction)	length of active use of breeding males (in years)
	percentage of active breeding males in population (% of all included)
number of breeding males used in the form of insemination doses	insemination intensity (% of the total reproduction)
number of active breeding females in given year (with the record keeping on reproduction)	length of active age of females (in years)
age of females at first birth (in months)	generation interval (in months)
number of births and number of offspring produced at one birth	
Summary indicators:	
number of newly included breeding males in given year	
number of newly included breeding females in given year	
number of included daughters per mother	
number of included daughters and sons per individual breeding males	
number of registered breeds/farms	
size of genetically effective population Nef*	
increase in inbreeding factor per generation	

* $Nef = 4 \times M \times F / (M + F)$, where M = number of males used in breeding in the given year and F = number of females reproduced in the given year.

- the smaller the population size, the smaller is the number of females mating with the same male,
- setting of the maximally allowed level of genetic relationship (usually 6.25%).

7. International cooperation

The protection, conservation and use of biodiversity have a global character and therefore international cooperation and coordination of activities is absolutely essential. It is also a prerequisite for ensuring the availability of GR.

The Global Plan of Action (GPA) was adopted by the international community of the 169 countries at the FAO International Technical Conference on Animal Genetic Resources for Food and Agriculture in 2007. The GPA established 23 Strategic Priorities aimed at addressing the threat of genetic erosion of AGR and ensuring their sustainable use. The countries thus confirmed their joint and individual responsibility for the sustainable use and development of these resources. Measurable and time-bound specific objectives have been developed for implementation, which assess progress in their fulfillment. Ongoing evaluation of the GPA implementation, based on national reports, is conducted by FAO at two-year intervals. More information is available at <https://www.fao.org/cgrfa/topics/animal-genetic-resources/en>.

The Czech Republic has been actively involved in FAO activities for a long time, including collecting of data and preparing necessary information for FAO, as well as working in the FAO Commission on Genetic Resources for Food and Agriculture and through its expert activities.

A key FAO project in Europe is the European Regional Focal Point for Genetic Resources (ERFP)¹⁶, which has been successfully running since 1996, with the Czech Republic as the founding member. Its operational programme is funded by contributions from participating countries. The Working Groups (WGs) provide the technical and advisory information needed to implement the GPA and were established with the long-term programmes. In contrast to WGs, Task Forces (TF) are platforms being set up only temporarily in order to discuss and address specific issues, where the common approach of the European region is needed as a response to urgent issues in the sector of AGR.

The coordinating office of the NPGRA also collaborates with the Ministry of the Environment on the agenda related to the adoption of the Nagoya Protocol on access to GR and the fair and equitable sharing of benefits arising from their use.

8. Use of animal GR and the services provided

The conservation and utilization of AGR means specifically the management of those GR currently not commonly used, endangered or neglected and used in the future as a source of specific genes. In a broader sense, it includes all activities related to the management of GR such as inventorying, monitoring and characterization of these resources, and their sustainable development, and allows access to a wider range of these resources, in particular for research and development. The information about individual breeds, methodologies for their conservation and data on their development are published in the annual reports at <https://genetickezdroje.cz/>.

¹⁶ European Regional Focal Point for Animal Genetic Resources, <https://www.animalgeneticresources.net/>.



C. The National Programme on Conservation and Utilization of Microbial Genetic Resources and Invertebrates of Agricultural Importance

1. Mission and aims

Microorganisms open up solutions to issues like health and nutrition, the environment and poverty for the global population. They represent the largest proportion of global biodiversity with great ecological and economic value. They are the foundation of all ecosystems, decomposing plant and animal debris in the soil to release the basic nutrients for plant growth, creating mutually beneficial relationships with agriculturally important as well as wild plants. They have direct benefits for humanity, as drug producers, bioagents in the fight against pathogens and pests and for decontaminating and decomposing waste. Their conservation, identification, characterization and sustainable use are crucial if we are to exploit the potential of global microbial diversity. It is estimated that we have only discovered a fraction of the microbial world, and thus the possibilities for discovering new antibiotic substances or finding economically significant microorganisms for industrial use are enormous.

The key issues to the use of the global potential of microbial diversity are knowledge, taxonomic identification, detailed characterization of its biological features and sustainable use including strategy for long-term preservation.

Ensuring the safe and sustainable use of microbial diversity for the future is essential for society in general. Culture collections play an important role in providing biological material for further research, education and development. Their task is demanding; it includes genomics, post-genomics and other emerging disciplines in bioinformatics, which puts high demands on the qualifications of human resources and the technical equipment of the collections.

Given the steady increase in the volume of information on stored GR, it is necessary to ensure that new data are added to public databases so that they are available to users together with GR.

2. The current state of collections

The National Programme on Conservation and Utilization of Microbial Genetic Resources and Invertebrates of Agricultural Importance (NPMGR) culture collections maintain an extremely wide range of organisms. The number of actively held accessions reached 9,000 strains (9,652 strains in 2021), which corresponds to nearly 1,200 species or lower taxonomic ranks. Other possibilities for expanding collections were outlined in the Methodology for Identifying Missing Genetic Resources in Microorganism Collections and Strategies

for Filling the Identified Gaps¹⁷ (Komínek et al, 2021). Implementation of this strategy depends on the available capacities of each collection. The preserved GR can be grouped into prokaryotic organisms (domains Archaea and Bacteria) and eukaryotic organisms (Algae, Animalia, Chromista, and Fungi), and also include acellular organisms such as viruses and viroids.

Most microorganisms gathered in the frame of NPMGR are important for humans, either as pests in agriculture (phytopathogenic and zoopathogenic viroids, viruses, phytoplasmas, bacteria, fungi, insect pests, mites and nematodes) or, on the contrary, as beneficial agents in agriculture and food industry (bacteria including rhizobia, fungi including yeasts and others (see Chart 2).

Plant crops can be damaged by many different phytopathogenic microorganisms and pests during their growing season, which disrupt their integrity and physiological features. As a result these disturbances, crop yields typically decrease, and the quality of harvested products deteriorates. Among the most common issues in crop protection are changes in the characteristics of harmful organisms (e.g. the development of resistance to protection agents, overcoming genes of resistance in host plants, changes in pathogenicity), or the spread of harmful organisms to new, non-native areas. Animal viruses and zoopathogenic bacteria are the causative agents of diseases in animals of varying economic and epidemiological importance, whether they affect livestock, wildlife, or animals in hobby farms. Early detection, identification, and understanding of the characteristics of pathogenic organisms can help reduce the impact of diseases on agricultural production.

A large part of the accessions are viruses and viroids pathogenic to agricultural crops such as potatoes, ornamental and fruit trees, hops and other plants. In culture collections, other pathogens of cultivated plants are kept including obligate and facultative biotrophic and necrotrophic phytopathogenic and saprotrophic fungi, and fungus-like organisms, phytopathogenic phytoplasmas and saprotrophic bacteria, phytopathogenic mycoplasmas, and tools for their detection and diagnostics (antibodies, antibody-producing hybridomas). Another group of pathogenic microorganisms are zoopathogenic viruses and bacteria including the tools for their diagnosis (antibody-producing hybridomas).

The NPMGR collections also include strains of microorganisms significant for biotechnology, primarily industrial fermentation processes (brewing, distilling, yeast, and dairy fungi, including yeasts and bacteria), fungi producing important enzymes or used in dietetics, bacteria useful for food analytical purposes or for the degradation of difficult-to-break-down substrates (e.g. keratinolytic or cellulolytic bacteria), and fungi that can be used as edible or medicinal. A separate group consists of nitrogen-fixing bacteria used as alternative fertilizers.

An important group included in the NPMGR are autotrophic microorganisms (algae and cyanobacteria). These conserved

¹⁷ Komínek, P. et al. (2021): Metodika identifikace chybějících genetických zdrojů ve sbírkách mikroorganismů a strategie zaplnění zjištěných mezer. Uplatněná certifikovaná metodika. VÚRV Praha. ISBN: 978-80-7427-353-7.

Chart 2: Representation of individual microorganism strains preserved in the NPMGR collections (as of January 2022)

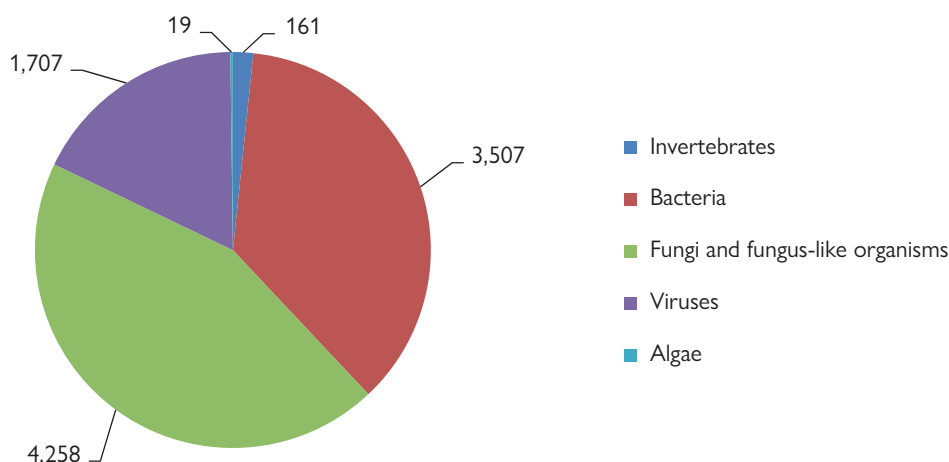
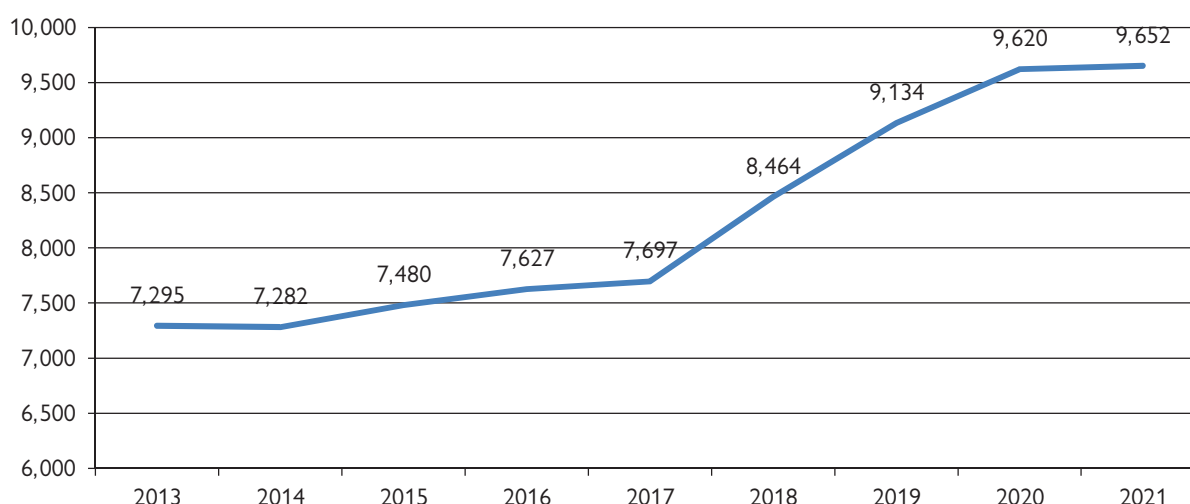


Chart 3: Development of the number of microorganism strains included in the NPMGR



strains are a source of knowledge, among other things, about the production of technologically significant secondary metabolites or biomass rich in nutrient components. Cyanobacteria, as one of the dominant autotrophic groups of microorganisms, colonize virtually all habitats, including manmade ones. Thus, they are also found in growing areas, in the aquatic environment, they are also known from breeding facilities, but can even act as significant contaminants of food or agricultural products. The strains kept in the culture collection serve as reference strains and, in specific cases, as bioindicators of the state of the environment.

3. Structure and organization

The **authorized person**, in accordance to § 6 (2) of the Act No. 148/2003 Coll., on the Genetic Resources of Plants and Microorganisms and its Implementing Regulation No. 458/2003 Coll., responsible for the coordination of the NPMGR and related activities, is the CARC (see Fig. 5).

The coordination activities are carried out by the **coordinator** who manages the sub-programme and relevant activities of its participants, is responsible for the progress of its imple-

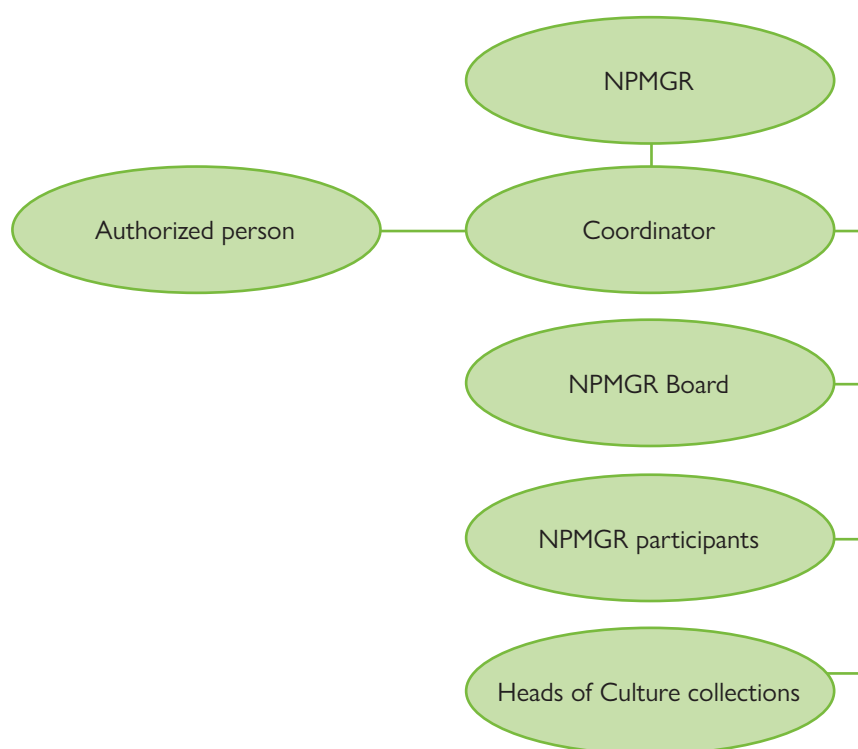
mentation and the results achieved and represents it in negotiations with the MoA and other entities. The coordinator is appointed by the Minister of Agriculture.

The **individual collections** are kept by the **participants** of the **NPMGR**, represented by the **heads of the collections** as the **responsible persons (guarantors)**. Other people (curators) may be entrusted with the responsibility for sub-collections. The head of a collection can also be the curator of a collection.

As of 31st December 2021, there were 22 culture collections of microorganisms and small invertebrates located at 12 legal entities, which are organizations engaged in research activities within the agricultural sector and in education in agricultural and related fields. The authorized person has the right to conclude independent contractual relationships with NPMGR participants and other entities with the aim of implementing the NPMGR and meeting its objectives.

The consultative and advisory body of the authorized person (CARC) is the Board of the NPMGR. The Board members are proposed by statutory representatives of the participants

Fig. 5: The structure of the NPMGR



and are then officially appointed by the authorized person (CARC) statutory representative. The Board is chaired by the **coordinator** and works in accordance with its Statute and Rules of Procedure. The Board is a platform for scientific and professional discussions on MGR, biodiversity and contributes to the promotion of GR. It also fulfils the function of an expert group for the needs of the MoA. Its opinions serve as recommendations.

The coordination office of the NPMGR manages information systems including SQL (Structure Query Language) database of all strains of microorganisms within the NPMGR. Additionally, the coordination office provides a web page available at www.microbes.cz linked to the application connected to the database.

Besides information systems and databases, the coordination office runs the Central Laboratory of the NPMGR. The laboratory provides cryoconservation and lyophilization services for microorganism strains to all NPMGR participants. Other services include characterization of collection strains, e.g. analyses of secondary metabolites or taxonomic sequences.

The activities of the collections meet the international standards for working with microorganisms. The activities are governed by approved expert methodologies for individual collections, which are part of the overall **Framework Methodology for NPMGR**.

Conditions for inclusion in the NPMGR

A general condition for including a new participant in the NPMGR is the ownership of MGR that has not been part of the collection, group of microorganisms or individual microorganisms in the NPMGR. The culture collection must

contain a significant number of MGR important for food and agriculture. If such a group of microorganisms already exists in the NPMGR, a set of unique GR may be included in the existing NPMGR culture collection in a manner and under the conditions agreed upon with the head of the relevant collection and the coordinator. This procedure eliminates duplication and saves public financial resources. A general condition is also the applicant's consent to include the relevant GR in the system, including a guarantee of their availability for users and respect for the organizational and methodological procedures resulting from participation in the NPMGR. The specific requirements for taking part in the NPGR are given in Act No. 148/2003 Coll., on the Genetic Resources of Plants and Microorganisms and its Implementing Regulation No. 458/2003 Coll.

4. Specific methodological activities

Currently, the long-term conservation of most MGR is carried out by several procedures with a preference for cryopreservation (deep freezing in liquid nitrogen or at temperature below -140°C) and lyophilization (freeze-drying under low pressure). These conservation methods are the best for minimizing the risks of genetic changes. In cases where only one conservation method can be used (e.g. cryopreservation for cell lines), accessions should be duplicated and the duplicates stored in self-contained technical equipment (e.g. two different freezers, Dewar vessels). If the first two methods cannot be used to conserve the strains, microbial strains are maintained under reduced temperature or in the form of live and active cultures under ambient temperature. Different types of microorganisms often require specific conservation methods to ensure their optimal viability, stability, regeneration and purity. The optimal conservation methods are known for many

groups of microorganisms, however, there are still a number of genera and species that are not kept in the culture collections over the long term. This presents room for optimizing the protocols on long-term storage.

Furthermore, there is an emphasized need to ensure the conserved MGR are not threatened by unexpected events, such as electric power failure, failure of technical equipment, or natural disasters. For these reasons, strains (including associated documentation) should be safely conserved in self-contained technical equipment, in another building or, ideally, in another location (a safety deposit, e.g. contractually at another legal entity, in the authorized person's central laboratory).

A wide range of organisms are the subject of preservation and conservation within the NPMGR. The high heterogeneity of gathered microorganisms is reflected in the methodology that is often specific for a given higher taxon. Moreover, within lower taxa there are also different conservation and characterization procedures. All accessions of microorganisms are conserved solely in the *ex situ* form. Methodological approaches and technological demands are also conditioned to the fact, whether the collection accessions are included in any risk groups and subject to legal measures and constraints.

Strains of microorganisms can be classified according to their mode of life and nutrition into obligate/facultative parasitic (biotrophic, necrotrophic), saprotrophic and autotrophic. The mode of nutrition determines the possibilities for conserving the strains. Saprotrophic and facultatively parasitic strains are usually cultivated on artificial or semi-natural media. Biotrophic parasitic organisms are typically maintained and propagated exclusively on living intact hosts or host cells.

4.1 Conservation

To maintain optimal long-term vitality, viability and genetic stability of strains, it is essential to store the strains in a metabolically inactive state. The preferred methods of preserving strains in a metabolically inactive state are lyophilization and cryopreservation. Conserving strains in a metabolically active state is only permitted if the given strain cannot be conserved otherwise or as a supplementary method for short-term conservation. Specific conservation methods of MGR are:

- **Lyophilization**

By freeze-drying cell samples under low pressure, their metabolic activity is reduced, which is a basic requirement for the long-term storage of the strains without altering their properties. This method is commonly used method for bacteria, yeasts and for filamentous fungi producing a sufficient amount of spores. In a lyophilized state, these strains can be conserved for several decades. Plant viruses capable of mechanical transmission are preserved in plant tissues or their homogenates using this method.

The lyophilization of individual species depends on the type of protective medium used, as well as the speeding rate and

temperature of freezing prior to lyophilization. The sublimation of frozen water (the transition from solid to gaseous state) occurs in a lyophilizer under low pressure and temperature. The lyophilisates are conserved in vacuum-sealed glass vials or tubes, typically in a specified number of duplicates and are kept at about 4 °C. The viability of the lyophilisates is always checked after the lyophilization process, with further monitoring carried out according to a set recovery plan.

- **Cryopreservation**

In general, cryopreservation is the preservation of organisms at temperatures below -20 °C. For microbial material, cryopreservation specifically involves storing living cells or organisms at ultra-low temperatures, in liquid nitrogen (-196 °C) or its vapours (at a maximum of -140 °C)¹⁸, or in deep freezers at -150 °C. Cryopreservation involves freezing and storage at temperatures below -140 °C, followed by thawing (melting) to a temperature suitable for the multiplication of the given organism. The proper execution of these processes is critical to the viability of the biological material. Inert materials, protective media or simply cultivation media are used as cell carriers. Prepared samples are frozen in programmable devices following specific protocols, which differ among different groups of microorganisms, and are subsequently stored in liquid nitrogen containers. Activation is then performed by thawing and subsequent placing on solid agar medium, liquid medium or through the inoculation of host cells.

The storage of certain groups of microorganisms (particularly bacteria) in liquid nitrogen is generally straightforward with a high probability of culture survival. For other groups (e.g. some species of fungi and fungus-like organisms) it is necessary to carry out further research and verify suitable protocols for safe and long-term storage.

- **Replication in host organisms**

Storage on living host organisms

Phytopathogenic viruses, viroids, and phytoplasmas which cannot be stored outside the living host plant due to their instability are regularly inoculated or kept *in vivo* in perennial woody plants in the technical isolation facilities or in indicator plants in the greenhouse cubicles of phytotron. Vectors (Auchenorrhyncha or aphids) with a precisely defined time for uptake and inoculation suction are used to transmit them into a new host, or they are transmitted mechanically by the sap of infected plant with the addition of various transfer buffers or by cutting and grafting.

Biotrophic pathogens from the orders Erysiphales (powdery mildews) and Peronosporales are inoculated onto the living tissues of host plants, either onto plant seedlings (*Bremia lactucae*, *Hyaloperonospora parasitica*, *Plasmopara halstedii*, *Golovinomyces orontii*, *Podosphaera xantii*) or on the leaves of the host plants (*Blumeria graminis*, *Pseudoperonospora cubensis*, *Golovinomyces cichoracearum*, *Oidium neolycopersici*) at intervals determined by their life cycle. The conservation of these

¹⁸ Benson, E. E., Johnston, J., Muthusamy, J., & Harding, K. (2008). Physical and engineering perspectives of *in vitro* plant cryopreservation. In *Plant Tissue Culture Engineering* (pp. 441–476). Springer Netherlands.



biotrophic strains occurs in climate boxes with controlled light and temperature conditions.

These traditional methods of conserving biotrophic microorganisms are not only energy-, space-, and labour-intensive, but they also expose the preserved materials to the real risk of undesirable contamination by other isolates and pathogens. Similarly, they can represent a potential source of infection for other materials, which is especially critical while working with quarantine-relevant pathogens.

Conserving and replicating viruses in host tissue cultures

The preservation of viruses in plant tissue cultures is a very effective method for preserving the viruses difficult to transmit mechanically, such as those of woody plants and small fruits, or those that are non-mechanically transmissible. Within the NPMGR, all isolates of potato viruses and viroids and some fruit tree viruses are stored in explant cultures. These cultures are further continuously maintained in *in vitro* conditions.

Propagation of animal viruses is carried out by inoculating selected cell cultures or chicken embryos which are susceptible to infection by the given virus. In rare cases, experimental infection of susceptible animals may be required.

• Preservation of arthropods and invertebrates

The preservation of animal pests of agricultural crops, warehouse commodities and their antagonists differs between specific groups (type of artificial diet, nutrient plants, standard conditions for the entire life cycle).

Sucking arthropod pests of crops are primarily conserved on living host plants (e.g. cereals, beans, tomatoes, potatoes, etc.), which ensure optimal conditions for their development. For chewing pests, commercially available artificial holidic diets are also used. Pests are reared under controlled temperature and photoperiod conditions to ensure optimal conditions for reproduction. For species that require a diapause for a certain part of the year, this is ensured by placing the resting stages into conditions of low temperatures and constant darkness (climabox).

The conservation and propagation of phytoparasitic nematodes (Nematoda) is carried out on their original host plants. Collection isolates are maintained in a gene bank. The accessions of stem nematode (*Ditylenchus dipsaci*), a phytoparasitic quarantine organism, are preserved using cryopreservation methods.

Stored product pests and their natural enemies are kept in a metabolically active state. Stored product insects are maintained in rearing containers under optimal temperature and humidity conditions, on diets adapted to the species requirements. A wide range of raw materials and food products (e.g. wheat, barley, oat flakes, glycerine, groats, yeast, textiles, dried milk, fur, etc.) is used for their diets, which are mixed in various combinations and proportions according to the specific requirements of individual species.

Stored product mites are propagated in special closed rearing chambers. The rearing chambers are placed in desiccators under different levels of relative air humidity (typically 75–85% relative air humidity), which is optimal for a given species. Air humidity is maintained using saturated salt solutions. The temperature in the rearing chambers is kept within the range of 20–27 °C and is ensured using air-conditioned rooms or thermostats.

The predators and parasitoids of stored product insects and mites that have the potential to be used in biological pest control are reared on their natural hosts, based on species-specific preferences. For this purpose, certain insects and mites are propagated in large quantities as a source of natural food.

4.2 Characterization

Strains are regularly revived according to the plan of regeneration and their microbiological homogeneity, viability, vitality and the stability of those properties for which the strain is preserved are monitored (macroscopically and microscopically). It is clear that the properties of cultures maintained on solid media with high metabolic activity need to be verified more frequently than those preserved by cryopreservation or lyophilization.

The standard characterization procedures for NPMGR strains are based on identification, morphological description, and determination of biological, biochemical, molecular-biological and technological properties. Within culture collections, organisms are characterized using tests of desired properties (for beneficial microorganisms), pathogenicity and virulence (for harmful microorganisms) and other specific tests.

4.3 Recording and documentation

The central NPMGR database enables the storage and updating the information on collection accessions via a web interface, while also allowing the public to search the preserved data. Documentation on microbial genetic resources is kept for each accession of the culture collection (collection strain) in accordance with § 17 of the Act No. 148/2003 Coll., on Plant Genetic Resources and Microorganisms. Data on individual accessions from all collections are stored in the public central database available at the website www.microbes.cz. The documentation on the stored collection accessions is updated regularly, at least once a year.

The MGR documentation contains data used for the unambiguous identification of a collection accessions (e.g. the registration number of the collection strain/culture, the valid scientific name of the taxon, the history of the strain, data on the strain's determination and origin, specific cultivation conditions, the conditions for providing the strain to other subjects), as well as other relevant information that define and characterize the given strain of the microorganism (e.g. metabolite production, resistance to active biotic substances, host pathogenicity, presence of specific genes, technological properties). The documentation of preserved strains may also include, for example, photographic documentation, molecular analyses and information on changes in taxonomic classification. Last

but not least, data required by legal requirements relating to stored collection accessions are also recorded.

5. International cooperation

NPMGR participants engage in international activities, including membership in international organizations, the provision and exchange of strains and information, and participation in specialized conferences and workshops. In many cases, the collections are members of national (e.g. National Library of Medicine Database Maintenance Project) and international organizations that bring together genetic resource collections of microorganisms, such as the World Federation of Culture Collections (WFCC), with registration in the World Data Center of Microorganisms (WDCM), and the European Culture Collections' Organization (ECCO).

Collection staff are members of national and international professional and scientific organizations, such as the Czech Phytopathological Society, the Czech Scientific Society for Mycology, the Czechoslovak Society for Microbiology, the International Society for Horticultural Science, EUCARPIA, PVY-Wide organization, the International Council for the Study of Virus and Virus-like Diseases of the Grapevine, the International Working Group on Legume and Vegetable Viruses (IWGLVV), the European Foundation for Plant Pathology, or the International Committee on Systematics of Prokaryotes.

6. Utilization of GR and the services provided

The NPMGR culture collections store characterized strains of microorganisms and invertebrates, which serve as reference samples for a wide range of users, primarily government laboratories – as well as for the further development of detection methods, veterinary bio-products, and for educational purposes. A broad spectrum of pathogens is used by breeders to identify new genes and verify existing GR for crop resistance. Stock of storage pests and insect pests without pesticide resistance are indispensable for further research, including testing of new plant protection products or for applications in food and agricultural storage facilities.

For the purpose of breeding, research and education, the right to use a given MGR (i.e. the granting of a non-exclusive license) is provided free of charge. However, costs related to handling, its reactivation, shipment, dispatching and other costs associated with providing a genetic resource may be charged to the requester.

Strains of microorganisms and small invertebrates maintained within the NPMGR collections are provided upon request to Czech and international institutions engaged in basic and applied research, breeding institutes, universities, colleges and secondary schools and government bodies. Each year, between 700 and 900 strains are distributed to both domestic and foreign users. As part of international cooperation and information exchange, the collections share data on preserved accessions, manage publicly accessible databases, and supply strains abroad.

The majority of the provided accessions are used in research projects and as study materials. Each year, microbial strains are utilized in dozens of basic and applied research and development projects whose outcomes include not only scientific publications, but also utility models and patents. Strains have, for example, been developed for whey fermentation to produce ethanol and food-grade biomass.

By providing genetic material, the collections contribute annually to the production of a substantial number of original scientific publications, professional publications, methodologies and contributions to proceedings, as well as information on strains of microorganisms used to make contributions for the professional public and in practice, presented at conferences, workshops and seminars (in 2021, this amounted to 132 outputs).

6.1 Procedure for ordering and distributing genetic resources

Strains are distributed based on a written order delivered by e-mail, electronically or in person. The collection process is in accordance with applicable legislative requirements (e.g. in the case of quarantine organisms) and their internal regulations. Upon receiving an order, communication typically takes place between the applicant and the collection to agree on the form of the GR to be provided, the delivery date and, where appropriate, the signature of a declaration on the use of GR and consent to the conditions for providing the strains (Material Transfer Agreement, MTA). Some collections include this declaration and consent within the Protocol/Confirmation of Receiving Strains, while other collections require only a written order; further communication with the client then takes place informally. The provision of zoopathogenic microorganisms from the CAPM (The Collection of Animal Pathogenic Microorganisms) collection, both within the Czech Republic and abroad, is administratively more demanding.

The form in which a GR is distributed, depends on the possibilities for cultivation, conservation, legal requirements and the collections' internal regulations. Phytopathogenic viruses are typically supplied in the form of fresh, dried or lyophilized leaves or other plant parts of host plants. Potato virus isolates are exclusively distributed to users only in the form of *in vitro* plants cultivated under aseptic conditions on nutrient media. Viruses of fruit trees and ornamental plants are provided, upon agreement with the applicant, in the form of infected herbaceous indicators or host plants. The processing time for such an order may take up to two months. Living or dried plant material containing the requested strain of viruses is usually handled within five working days.

Zoopathogenic microorganisms (viruses and bacteria) are typically provided in the form of a lyophilized material. In exceptional cases, the Collection of Zoopathogenic Microorganisms can also deliver cultures in either a frozen or an active form, or only isolated nucleic acid.

In vitro culturable microorganisms are delivered either metabolically inactive or in an active state after regeneration. Delivery of metabolically inactive strains of microorganisms enables processing of the order within days, usually five working days.



Rust fungi are provided to users in the form of urediniospores in micro test tubes or cellophane bags (propagated inoculum from multiple isolates for field infections).

Arthropods and other small organisms are provided in an appropriate form according to the organisms' taxonomic group and intended use. Live individuals are distributed in plastic test tubes (e.g. booklice and mites) or in larger plastic packages in the case of beetles, moths and cockroaches. For educational purposes, collections provide samples of 50–150 individuals, while for research purposes, a composite population (tens to hundreds of individuals, depending on the species) is provided.

6.2 Information associated with genetic resources

Applicants are always provided with basic information about the strains (data on the strains' isolation, cultivation and origin). Most collections provide additional information upon request, in accordance with the stated purpose of strain use. Applicants are usually informed of this possibility in the protocol.

Additional information provided may include strain characterization (typically in the form of a citation of a publication where the required information is detailed), growth properties, macro- and micro-characteristics, taxonomic data, formation of a specific metabolite, etc.

6.3 Number of microbial GR provided and sample size

In general, collections do not limit the quantity of MGR provided, as long as the number corresponds to the purpose of use stated in the application. Some collections limit a single order to a maximum of 10 to 20 strains. The determination of the number and size of the MGR sample is carried out by the collection curator according to § 11a of Decree No. 458/2003 Coll., which implements the Act on Plant and Microbial Genetic Resources.

Records of provided MGR are maintained continuously at the level of collection curators. Documentation is usually kept both in written and electronic form. A list of provided strains, their use in research, and presentation in publications is included in the annual report.

Over the past four years, the most frequently provided strains to users have been:

- Zoopathogenic microorganisms (292 strains),
- Dairy microorganisms (198 provided strains),
- Agriculturally significant basidiomycetes (191 strains),
- Phytopathogenic and other agriculturally important fungi (193 strains),
- Brewing microorganisms (119 strains).

D. Annexes

1. The current status and development of AGR populations

Species/breed	2010	2015	2019	2020	2021
Czech Red Cattle	94	105	199	219	249
Czech Original Red-Pied Cattle	20	60	90	83	85
White Shorthaired Goat	2,372	2,725	2,515	2,641	2,337
Brown Shorthaired Goat	1,246	1,370	1,121	1,156	998
Valachian Sheep	437	860	1,162	1,239	1,206
Šumava Sheep	2,800	2,450	2,404	2,282	2,123
Přeštice Black-Pied Pig	209	360	382	406	328
Kladruber Horse	414	490	587	589	593
Hucul Horse	164	168	172	167	163
Bohemia-Moravian Belgian Horse	444	479	541	517	542
Silesian Noriker Horse	281	334	418	433	449
Czech Goose	187	170	223	260	273
Rabbits: Moravian White of Brown Eye	110	100	72	73	72
Czech Solver	66	94	53	51	47
Moravian Blue	144	173	143	164	153
Czech Spotted	293	305	287	293	257
Czech White	155	157	133	132	127
Czech Gold	133	72	74	53	50
Czech Guard Hair	35	42	52	55	52
Nutria: Bohemian Standard Type	117	107	110	103	123
Moravian Silver Nutria	73	42	92	95	90
Přeštice Multicolour Nutria	72	56	55	56	48

2. Number of nucleic shoals of fish

Species/year	2010	2015	2019	2020	2021
Common Carp	15	13	13	13	13
Tench	4	4	5	5	5
Wet Catfish	4	4	4	4	4
Rainbow Trout	8	8	8	8	9
Brown Trout	2	2	2	2	2
Maraena Whitefish	1	1	0	0	0
Northern Whitefish	2	2	2	2	2
Sterlet Sturgeon	3	2	2	2	2
European Sturgeon	1	0	1	1	1

3. Extent of cryopreserved material as of 31st January 2021

Central cryobank Hradištko			
Breed	Embyos/number of oocytes	Seminal doses	
		Number of donors	Number of doses
Czech Red Cattle	453/3	16	17,875
Czech Original Red-Pied Cattle	1,366/32	38	25,545
Kladruher Horse	0/14	44	2,340
Hucul Horse	0	9	508
Silesian Horse	0	12	614
Bohemian-Moravian Belgian Horse	0	20	1,068
Přestice Black-Pied Pig	0	33	1,582*
White Shorthaired Goat	0	17	1,597
Brown Shorthaired Goat	0	10	304
Šumava Sheep	0	58	1,116
Valachian Sheep	0	15	283
Cryobank Kostelec nad Orlicí			
Breed	Embyos/number of oocytes	Seminal doses	
		Number of donors	Number of doses
Přestice Black-Pied Pig	0	94	19,055*
Pig CVM	0	8	668*
White Shorthaired Goat	0	12	213
Brown Shorthaired Goat	0	3	75

* French Straws

4. Collection of genomic material in genebank of the IAS

Species and breed		Number of samples
Cattle	Czech Red Cattle	954
	German (Hessen and Westphalian) Red Cattle, Polish Red Cattle	42/25
	Czech Original, Red-Pied Cattle	715
Pig	Přestice Black-Pied Pig	59
Sheep	Šumava Sheep	3,728
	Valachian Sheep	982
	bred Valachian Sheep	161
Goat	White Shorthaired Goat	1,629
	Brown Shorthaired Goat	846
Horse	Kladruher Horse	840
	Silesian Horse	595
	Bohemian-Moravian Belgian Horse	701
	Hucul Horse	329
Poultry	Czech Goose	217

Species and breed		Number of samples
Rabbit	Moravian Blue Rabbit	6
	Czech Spotted Rabbit	6
	Czech Silver Rabbit	6
Nutria	Bohemian Standard Type	24
	Přeštice Multicolour Nutria	6
	Moravian Silver Nutria	3

5. Participants to the NPPGR

Participant, address	Activities, collections
Czech Agrifood Research Center Drnovská 507 161 00 Praha-Ruzyně Tel.: +420 233 022 406 e-mail: dagmar.janovska@carc.cz, vojtech.holubec@carc.cz	NPPGR Coordination National genebank; long-term, medium-term conservation of seeds of all generatively propagated species in the active collection and also selected PGR as duplication in the basic collection, PGR information system, providing services to collection investigators curators and users of PGR, collection of wheat (including wild species), winter barley, triticale, buckwheat, amaranth, millets, setaria and other minor cereals, maize, sunflower, sugar and fodder beet, ECPGR – European Wheat Database (EWDB), associated membership in AEGIS.
Czech Agrifood Research Center Genetic Resources of Vegetables and Special Crops Olomouc Šlechtitelů 892/29 779 00 Olomouc-Holice Tel.: +420 585 208 964 e-mail: olomouc@carc.cz	Collection of vegetables, spices, aromatic and medicinal plants, field genebank – vegetatively propagated species; activities within Haná Region Centre, international garlic collection (<i>Allium</i> sp.); associated membership in AEGIS.
Czech Agrifood Research Center Viticulture Research Station Karlštejn 267 18 Karlštejn Tel.: +420 702 087 808 e-mail: radomira.stralkova@carc.cz	Part of grapevine collections; field genebank – grapevine; associated membership in AEGIS.
Czech Agrifood Research Center Physiology and Cryobiology of Plants Drnovská 507 161 00 Praha-Ruzyně Tel.: +420 233 022 362 e-mail: milos.faltus@carc.cz	Safety duplication of selected species for active field or <i>in vitro</i> collections; or international exchange of PGR with other cryobanks. Collaboration with foreign cryobanks.
Agricultural Research Institute Ltd., Kroměříž Havlíčkova 2787 756 41 Kroměříž Tel.: +420 573 317 111 e-mail: zavrelova@vukrom.cz, vukrom@vukrom.cz	Collection of oats, rye and spring barley; associated membership in AEGIS.
AGRITEC, Research, Breeding & Services, Ltd. Zemědělská 16 787 01 Šumperk Tel.: +420 583 382 302 e-mail: krobotova@agritec.cz	Collection of peas, beans, vetches, faba bean, lupins, soybean, lens, chickpeas; collection of flax and hemp. International Flax Database (ESCORENA), associated membership in AEGIS.
OSEVA PRO Ltd. Grassland Research Station Rožnov-Zubří Hamerská 698 756 54 Zubří 698 Tel.: +420 571 658 195 e-mail: raab@oseva.cz, zubri@oseva.cz	Collection of grasses, including wild ecotypes, flowering meadow phytocoenosis, ornamental grasses. ECPGR – European database – <i>Trisetum flavescens</i> , <i>Arrhenatherum elatius</i> ; associated membership in AEGIS.

Participant, address	Activities, collections
OSEVA PRO Ltd. Research Institute of Oil-seed Crops Opava Purkyňova 10 746 01 Oprava Tel.: +420 553 624 160 e-mail: opava@oseva.cz; rychla@oseva.cz	Collection of rapeseed, field mustard, mustard, poppy and other oil plants apart from sunflower.
Research and Breeding Institute of Pomology Holovousy Ltd. Holovousy 129 508 01 Holovousy Tel.: +420 491 848 202 e-mail: pavel.pech@vsuo.cz, info@vsuo.cz	Collection of fruit trees: cherries, sour cherries, plum, apple, pear and other berry fruits, field genebank – vegetatively propagated fruit trees and bushes, associated membership in AEGIS.
Mendel University in Brno Faculty of Horticulture Valtická 337 691 44 Lednice na Moravě Tel.: +420 519 367 244 e-mail: tomas.necas@mendelu.cz	Collection of apricot trees, peach trees, almonds, grapevine (part of collection); selected vegetatively propagated species of vegetables and ornamental species, field genebank – vegetatively propagated fruit trees, grapevine and selected vegetable species; associated membership in AEGIS.
Research Institute for Fodder Plants, Ltd. Zahradní 1 664 41 Troubsko Tel.: +420 547 227 380-4 e-mail: vymyslicky@vupt.cz, vupt@vupt.cz	Collection of fodder crops: alfa alfa, clover, other fodder crops (including prospective wild species) – except grasses; associated membership in AEGIS.
Potato Research Institute Havlíčkův Brod, Ltd. Dobrovského 2366 580 03 Havlíčkův Brod Tel.: +420 569 466 244 e-mail: ptacek@vubhb.cz	Collection of potatoes (including wild and related species), <i>in vitro</i> collection of potatoes; associated membership in AEGIS.
Hop Research Institute Co., Ltd. Kadaňská 2525 438 01 Žatec Tel.: +420 415 732 111 e-mail: nesvadba@chizatec.cz	Collection of hops; field genebank – field collection of hops.
Landscape Research Institute Květnové náměstí 391 252 43 Průhonice Tel.: +420 296 528 111 e-mail: vukoz@vukoz.cz	Ornamental trees and selected species of flowers, field genebank – vegetatively propagated decorative plants.
AMPELOS, WINE BREEDING STATION ZNOJMO, Ltd. Vrbovec 274 67 124 Vrbovec Tel.: +420 515 230 103 e-mail: info@ampelos.cz	Part of grapevine collection, field genebank – grapevine, thermophilic varieties.
Institute of Botany of the Czech Academy of Sciences Zámek 1 252 43 Průhonice Tel.: +420 271 015 111 e-mail: ibot@ibot.cas.cz	Collection of irises, peonies and day-lilies (selected genetic resources of domestic origin), field genebank – Iris, Paeonia and Hemerocallis.

6. Participants to the NPAGR

Species	Breed	Breeders' associations and other responsible bodies
Cattle	Czech Red Cattle	Czech Fleckvieh Breeders Association Radešínská Svatka 193 592 33 Radešínská Svatka e-mail: svaz@cestr.cz www.cestr.cz
	Czech Original Red-Pied Cattle (native type)	Institute of Animal Science Přátelství 815 104 00 Praha-Uhřetěves Tel.: +420 267 009 612 e-mail: matlova.vera@vuzv.cz www.genetickezdroje.cz
Horses	Kladruher Horse	National Stud at Kladruhy nad Labem 533 14 Kladruhy nad Labem Tel.: +420 466 933 832 e-mail: kladruhy@nhkladruhy.cz www.nhkladruhy.cz
	Bohemian-Moravian Belgian Horse	Association of Unions of Horse-breeders U Hřebčince 479 397 01 Písek Tel.: +420 731 482 476 e-mail: info@aschk.cz www.aschk.cz
	Silesian Noriker	Institute of Animal Science Přátelství 815 104 00 Praha-Uhřetěves Tel.: +420 267 009 612 e-mail: matlova.vera@vuzv.cz www.vuzv.cz www.genetickezdroje.cz
	Hucul Horse	Association of Hucul Horse Breeders Pražská 607 530 02 Pardubice Tel.: +420 466 335 302 e-mail: jelineking@seznam.cz
Pigs	Přeštice Black-Pied Pig	Pig Breeder's Association Bavorská 856/14 155 41 Praha 5 e-mail: ingo@schpcm.cz www.schpcm.cz
		Institute of Animal Science – Pig Breeding Department Komenského 1243 Kostelec nad Orlicí Miroslav Rozkot Tel.: +420 494 323 291/106, +420 731 650 835 e-mail: vuzvkostelec@tiscali.cz www.vuzv.cz

Species	Breed	Breeders' associations and other responsible bodies
Goats	White Shorthair Goat	Association of Sheep and Goats Breeders Flock book for goats Chovatelů 500 252 09 Hradištko Tel.: +420 777 754 813 e-mail: pkkoz@schok.cz www.schok.cz
	Brown Shorthair Goat	
Sheep	Šumava Sheep	Association of Sheep and Goats Breeders Flock book for sheep Malhostovice-Zlobice 55 666 03 Malhostovice Tel.: +420 777 754 801 e-mail: vystrcilova@schok.cz www.schok.cz
	Valachian Sheep	
Rabbits	Czech Spotted	Czech Breeders Association Maškova 3 182 53 Praha 8 – Kobylisy Tel.: +420 284 684 147 e-mail: kralici@cschdz.cz www.cschdz.eu
	Czech White	
	Czech Red	
	Czech Solver	
	Czech Black Guard Hair	
	Czech Gold	
	Moravian Blue	
	Moravian White of Brown Eyes	
	Moravian Silver	
	Přeštice Multicolour	
Nutria	Bohemian type of standard	Nutria Breeders Association Dlouhá Ves 24 582 22 Chair of the association Jan Neubauer Dlouhá Ves 115 582 22 Příbyslav Tel.: +420 723 255 498, +420 734 164 734 e-mail: neubauerdv@seznam.cz
	Moravian Silver	
	Přeštice Multicolour	
Poultry	Czech Goose	Czech Breeders Association Maškova 3 182 53 Praha 8 – Kobylisy e-mail: drubez@cschdz.cz www.cschdz.cz
	experimental line of hens	DOMINANT CZ Milan Tyller Voleč 119 533 41 Lázně Bohdaneč Tel.: +420 602 642 557 e-mail: tyller@dominant-cz.cz www.dominant-cz.cz
	source populations for hybridization programmes	



Species	Breed	Breeders' associations and other responsible bodies
Fish	Common Carp (11 lines)	Czech Fish Farmers Association Pražská 495/58 371 38 České Budějovice
	Tench	
	Rainbow Trout	Research Institute of Fish Culture and Hydrobiology University of South Bohemia in České Budějovice Faculty of Fisheries and Protection of Waters Zátíší 728/II 389 25 Vodňany e-mail: sekretar@frov.jcu.cz www.frov.jcu.cz
	Brown Trout	
	Wels Catfish	
	Maraena Whitefish	
	Northern Whitefish	
	Sterlet Sturgeon	
	European Sturgeon	
Bees	Carniolan Honey Bee	Czech Beekeeper Association Křemencova 8 115 24 Praha 1 Tel.: +420 224 934 082 e-mail: info@vcelarstvi.cz
		Bee Research Institute at Dol Máslovice – Dol 94 252 66 Libčice nad Vltavou Tel.: +420 734 858 244, +420 220 940 480, +420 220 941 259 e-mail: beedol@beedol.cz www.beedol.cz

7. Participants to the NPMGR

Collection – address, responsible person, contact details	Scope and focus of the collection
Czech Agrifood Research Center Coordination of the sub-programme Petr Komínek Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 442, +420 702 087 653 e-mail: petr.kominek@carc.cz	Coordination of the sub-programme, administration of the MIGR information system, management of the Central Laboratory.
Czech Agrifood Research Center Collection of plant pathogenic viruses Jana Brožová Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 388 e-mail: jana.brozova@carc.cz	Viruses and phytoplasmas of fruit trees, grapevine, cereals and vegetables. 95 strains, registered in the WDCM, member of ECCO and WFCC.
Czech Agrifood Research Center Collection of phytopathogenic and agriculturally beneficial bacteria Iveta Pánková Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 289 e-mail: iveta.pankova@carc.cz	Phytopathogenic, economically significant and other accompanying bacteria (e.g. the genera Agrobacterium, Clavibacter, Dickeya, Erwinia, Pantonea, Pectobacterium, Pseudomonas, Streptomyces, Xanthomonas). 274 strains, registered in the WDCM, member of ECCO and WFCC.
Czech Agrifood Research Center Collection of soil bacteria Veronika Řezáčová Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 308 e-mail: veronika.rezacova@carc.cz	Beneficial soil and other associated bacteria, primarily bacteria of the genera Rhizobium, Bradyrhizobium, Sinorhizobium and Azotobacter. 543 strains, registered in the WDCM, member of ECCO and WFCC.
Czech Agrifood Research Center Collection of agriculturally important fungi David Novotný Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 373, +420 702 087 691 e-mail: david.novotny@carc.cz	Phytopathogenic, potentially phytopathogenic, mycotoxigenic and potentially toxigenic fungi, edible and medicinal fungi, and other fungi of agricultural importance. 810 strains, registered in the WDCM, member of ECCO and WFCC.
Czech Agrifood Research Center Collection of biotrophic fungi Alena Hanzalová Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 243 e-mail: alena.hanzalova@carc.cz	Phytopathogenic fungi Puccinia triticina, Puccinia Striiformis, Puccinia graminis, Blumeria graminis, Tilletia laevis, Tilletia controversa and Tilletia caries. 1,154 strains, registered in the WDCM, member of ECCO and WFCC.
Czech Agrifood Research Center Collection of Invertebrate crop pests Jiří Skuhrovec Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 332 e-mail: jiri.skuhrovec@carc.cz	Species of animal pests from the classes Insecta, Diplopoda, Acari, Isopoda, Mollusca and Nematoda. 35 strains.



Collection – address, responsible person, contact details	Scope and focus of the collection
Czech Agrifood Research Center Breeding collections of storage insects and mites Radek Aulický Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 233 022 360 e-mail: radek.aulicky@carc.cz	Insect and mite species (the most represented groups: Coleoptera, Blattodea, Acarina, Psocoptera, Lepidoptera). 126 strains.
Czech Agrifood Research Center Collection of edible and medicinal macromycetes Irena Petrželová Šlechtitelů 11 783 71 Olomouc-Holice Tel.: +420 585 208 966 e-mail: irena.petrzelova@carc.cz	Edible and medicinal species of basidiomycetes and ascomycetes. registered in the WDCM, member of ECCO and WFCC. 137 strains.
Czech Agrifood Research Center Collection of industrially utilizable microorganisms Radko Pechar Drnovská 507 161 06 Praha-Ruzyně Tel.: +420 296 792 251 e-mail: radko.pechar@carc.cz	Fungi including yeasts and bacteria suitable for fermentation processes, the production of enzymes or dietetics and other applications. 156 strains.
Potato Research Institute Havlíčkův Brod, Ltd. Collection of potato viruses Martin Kmoch Dobrovského 2366 580 01 Havlíčkův Brod Tel.: +420 569 466 231 e-mail: kmoch@vubhb.cz	Potato viruses and viroids (potato spindle tuber viroid, potato virus Y, potato virus A, potato virus M, potato virus X, potato virus S and other viruses). 555 strains.
Research and Breeding Institute of Pomology Holovousy, Ltd. Collection of Fruit Trees Viruses Lucie Valentová 508 01 Holovousy Tel.: +420 493 692 821 e-mail: lucie.valentova@vsuo.cz, info@vsuo.cz	Viruses, viroids and phytoplasmas of fruit trees and soft fruit. 256 strains.
Landscape Research Institute Collection of ornamental plant viruses Dita Šetinová Květnové náměstí 391 252 43 Průhonice Tel.: +420 296 528 368 e-mail: setinova@vukoz.cz	Viruses and viroids of ornamental plants. 115 strains.
Landscape Research Institute Czech collection of phytopathogenic oomycetes Markéta Hrabětová Květnové náměstí 391 252 43 Průhonice Tel.: +420 296 528 234, +420 296 528 368 e-mail: hrabetova@vukoz.cz	Phytopathogenic oomycetes (genus Phytophthora and Pythium). 647 strains.

Collection – address, responsible person, contact details	Scope and focus of the collection
Hop Research Institute Co., Ltd. Collection of hops pathogens Petr Svoboda Kadaňská 2525 438 46 Žatec Tel.: +420 415 732 121 e-mail: svoboda@chizatec.cz	Pathogenic viruses and fungi of hops. 59 strains.
Veterinary Research Institute, Brno Collection of animal pathogenic microorganisms Markéta Reichelová Hudcova 70 621 32 Brno Tel.: +420 533 332 131 e-mail: reichelova@vri.cz	Zoopathogenic bacteria and animal viruses, 2,124 strains, ECCO member and record in WDMC.
Milcom a.s. Collection of dairy microorganisms Laktoflora® Oldřich Elich Soběslavská 841 390 01 Tábor Tel.: +420 381 252 980 e-mail: sbirka@vum-tabor.cz	Lactic fermentation bacteria, fungi including yeasts, and other bacterial dairy cultures, 993 strains, record in WDMC.
Milcom a.s. Collection of dairy and bakery contaminants Oldřich Elich Soběslavská 841 390 01 Tábor Tel.: +420 381 252 980 e-mail: sbirka@vum-tabor.cz	Bacteria and fungi contaminating dairy and bakery facilities, 87 strains.
Research Institute of Brewing and Malting Collection of brewery microorganisms Petra Kubizniaková Lípová 511/15 120 00 Praha 2 Tel.: +420 224 900 132 e-mail: kubizniakova@beerresearch.cz	Brewer's yeasts and bacterial contaminants of brewery production, wild and wine yeasts, 357 strains, record in WDMC.
Palacký University in Olomouc Faculty of Science – Department of Botany Collection of phytopathogenic microorganisms Aleš Lebeda Šlechtitelů 27 783 71 Olomouc Tel.: +420 585 634 800 e-mail: ales.lebeda@upol.cz	Phytopathogenic fungi, selected phytoplasmas, viruses and economically significant cyanobacteria and algae. 267 strains.
Institute of Microbiology of the Czech Academy of Sciences Collection of economically significant Basidiomycetes for agriculture Ivana Eichlerová Vídeňská 1 083 142 20 Praha 4 – Krč e-mail: eichler@biomed.cas.cz	Basidiomycetes (especially from the order Agaricales and Polyporales), 358 strains, record in WDMC.



Collection – address, responsible person, contact details	Scope and focus of the collection
Charles University, Faculty of Science CCF Culture Collection of Fungi Alena Kubátová Albertov 6 128 43 Praha 2 Tel.: +420 221 951 656 e-mail: alena.kubatova@natur.cuni.cz	Food contaminants, toxigenic fungi, plant pathogenic fungi, entomopathogens and fungi of biotechnological potential. 335 strains, ECCO and WFCC member, record in WDMC.
Masaryk University, Faculty of Science Brno Czech Collection of microorganisms Ivo Sedláček Kamenice 5, E25 building 625 00 Brno Tel.: +420 549 496 922 e-mail: ivo@sci.muni.cz	Non-pathogenic bacteria contaminating food and food processing facilities, microscopic fungi associated with food, 204 strains, member of ECCO and WFCC, registered in the WDMC.

List of acronyms and abbreviations

AEGIS	A European Genebank Integrated System
AGR	animal genetic resources
BRI	Bee Research Institute
CAPM	The Collection of Animal Pathogenic Microorganisms
CARC	Czech Agrifood Research Center
CIAT	Alliance of Biodiversity International and the International Center for Tropical Agriculture
CBD	Convention on Biological Diversity
CGIAR	Consultative Group for International Agricultural Research
CISTA	Central Institute for Supervising and Testing in Agriculture
CMBC	Czech-Moravian Breeders 'Corporation
CT	Crop Trust
ČSOP	Czech Union for Nature Conservation
DAD-IS	Domestic Animal Diversity – Information system
DNA	Deoxyribonucleic Acid
EAAP	European Federation for Animal Science
ECCO	European Culture Collections' Organization
ECPGR	European Cooperative Programme for Plant Genetic Resources
EFABIS	European Farm Animal Biodiversity – Information system
ERFP	European Regional Focal Point
EUCARPIA	European Association for Research on Plant Breeding
EUGENA	European Gene Bank Network for Animal Genetic Resources
EURALLIVEG	Vegetative Allium, Europe's Core Collection, Safe and Sound
EURISCO	European Search Catalogue for Plant Genetic Resources
EVA	European Evaluation Network
EVIGEZ (PGRD)	Plant Genetic Resources Documentation
FAO	Food and Agriculture Organization of the United Nations
GBF	Kunming-Montreal Global Biodiversity Framework
GCDT	Global Crop Diversity Trust
GPA	Global Plant of Action
GR	genetic resources
GRIN-Global	Global Germplasm Resource Information Network
GRIN-Czech	Documentation system for PGR within the NP
GDP	Gross Domestic Product
IAS	Institute of Animal Science



IBPGR	International Board for Plant Genetic Resources
IPGRI	International Plant Genetic Resources Institute
ISAG	International Society for Animal Genetics
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
ITWGLVV	International Working Group on Legume and Vegetable Viruses
MGR	microbial genetic resources
MoA	Ministry of Agriculture of the Czech Republic
MTA	Material Transfer Agreement
Ne	Effective population size
NGOs	Non-governmental organisations
NordGen	Nordic Genetic Resources Center
NPAGR	National Programme on Conservation and Utilization of Animal Genetic Resources Important for Food and Agriculture
NPGR	National Programme on Conservation and Utilization of Plant, Animal and Microbial Genetic Resources Important for Food and Agriculture
NPMGR	The National Programme on Conservation and Utilization of Microorganisms and Invertebrates of Agricultural Importance
NPPGR	The National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity
PGR	plant genetic resources
RIFCH	Research Institute of Fish Culture and Hydrobiology
SDGs	Sustainable Development Goals
SCHCHK	Association of Cold-Blooded Horse Breeders
SMTA	Standard Material Transfer Agreement
SNP	Single nucleotide polymorphism
SQL	Structure Query Language
TAČR	Technology Agency of the Czech Republic
TF	Task Forces
UN	United Nations
U.S.	United States
WDCM	World Data Centre for Microorganisms
WFCC	World Federation for Culture Collections
WGs	Working Groups

Notes

Dotted lines for writing notes.



A blue-tinted photograph showing a close-up of a hand sowing seeds into a field of young plants. The hand is holding a small amount of seeds, and the plants are growing in rows.

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