Strengthening the network of AnGR Gene Banks in Europe - EUGENA

NordFrost webinar "why gene banking" 23.06.21

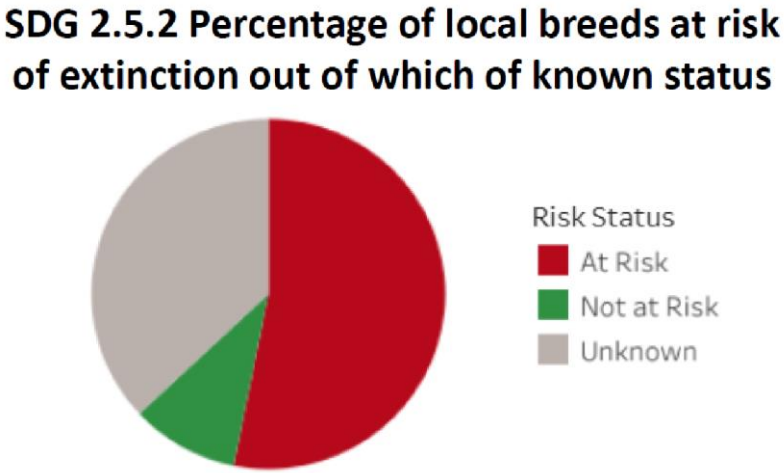
Sipke Joost Hiemstra
Director - Centre for Genetic Resources, the Netherlands (CGN)

ERFP

EUGENA

WAGENINGEN
UNIVERSITY & RESEARCH

Farm animal genetic diversity in Europe



FAO DAD-IS

- Between breed genetic diversity
  - Large proportion of breeds is "at risk"
- Within breed genetic diversity
  - Effective population size (Ne) is often low
- Complementary *in situ* and *ex situ* conservation strategies are needed

FAO Global Plan of Action for Animal Genetic Resources

Strategic Priority 9 - Establish or strengthen ex situ conservation programmes

1. **Set and regularly review ex situ conservation priorities and goals**.

2. **Establish or strengthen national and regional facilities for ex situ conservation**, in particular cryogenic storage. Support the efforts of countries within a region that have opted to establish a regional facility.

3. Establish modalities to **facilitate use of genetic material stored in ex situ gene banks** under fair and equitable arrangements for storage, access and use of animal genetic resources.

4. Develop and implement measures to secure ex situ collections from loss of genetic diversity resulting from disease outbreaks and other threats, in particular by **establishing backup samples**.

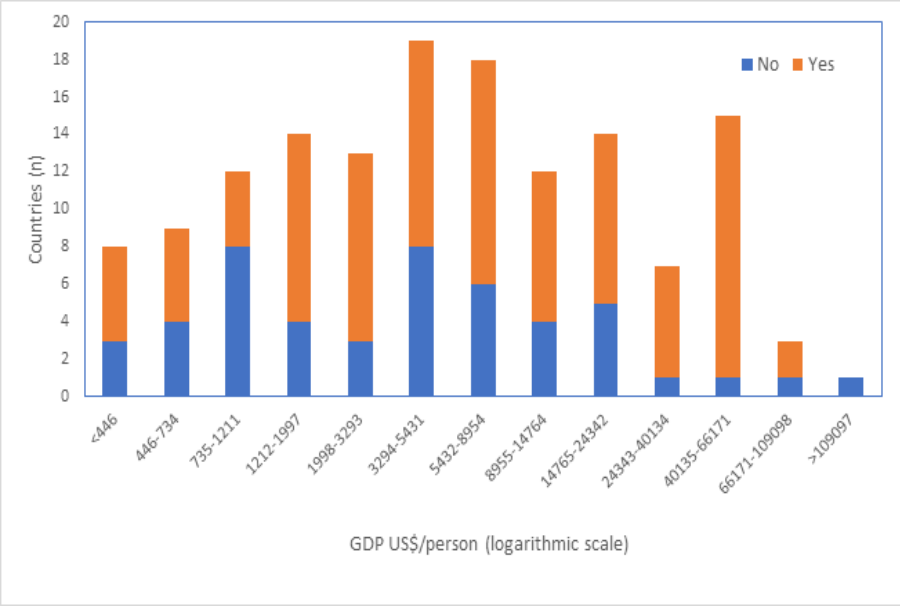
5. Identify and fill **gaps** in ex situ collections.

6. Develop procedures for replenishment of genetic material taken from genebanks, by systematically developing **links with live populations**, or establishing in vivo populations of breeds at risk at off-farm locations, such as zoos and parks.

WAGENINGEN
UNIVERSITY & RESEARCH

Genebank is key element in national strategy for conservation and sustainable use of AnGR

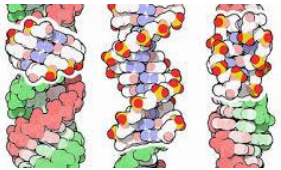
- Many countries are developing gene banks
- Complementarity of *in situ* and *ex situ approaches*



INNOVATIONS IN CRYOCONSERVATION OF ANIMAL GENETIC RESOURCES – DRAFT TECHNICAL GUIDELINES (FAO, 2021)

WAGENINGEN UNIVERSITY & RESEARCH

Why gene banks? Loss of genetic diversity will ....



- Threaten global food and nutrition security
- Reduce the possibility to adapt to climate change
- Result in less options to improve the sustainability of agriculture
- Reduce the options to improve the quality of our our food
- Erode our agricultural landscapes and threaten our bio-cultural heritage

Food and Agriculture Organization of the United Nations

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

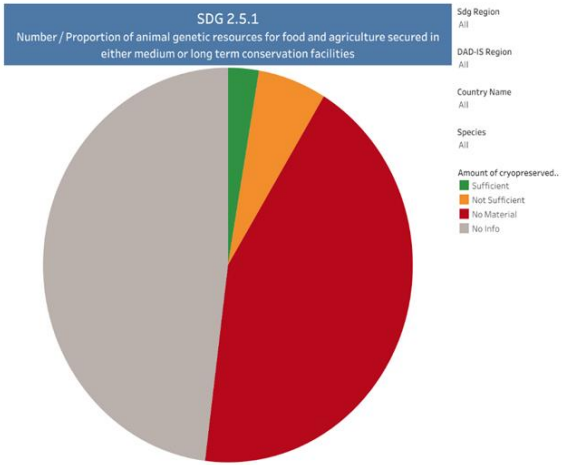
WAGENINGEN
UNIVERSITY & RESEARCH

SDG indicator 2.5.1.b

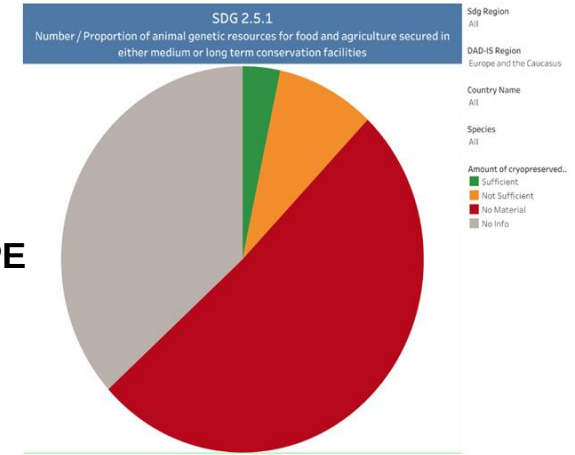
Target 2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed

Indicator 2.5.1.b - Number of animal genetic resources for food and agriculture secured in medium or long term conservation facilities

Global

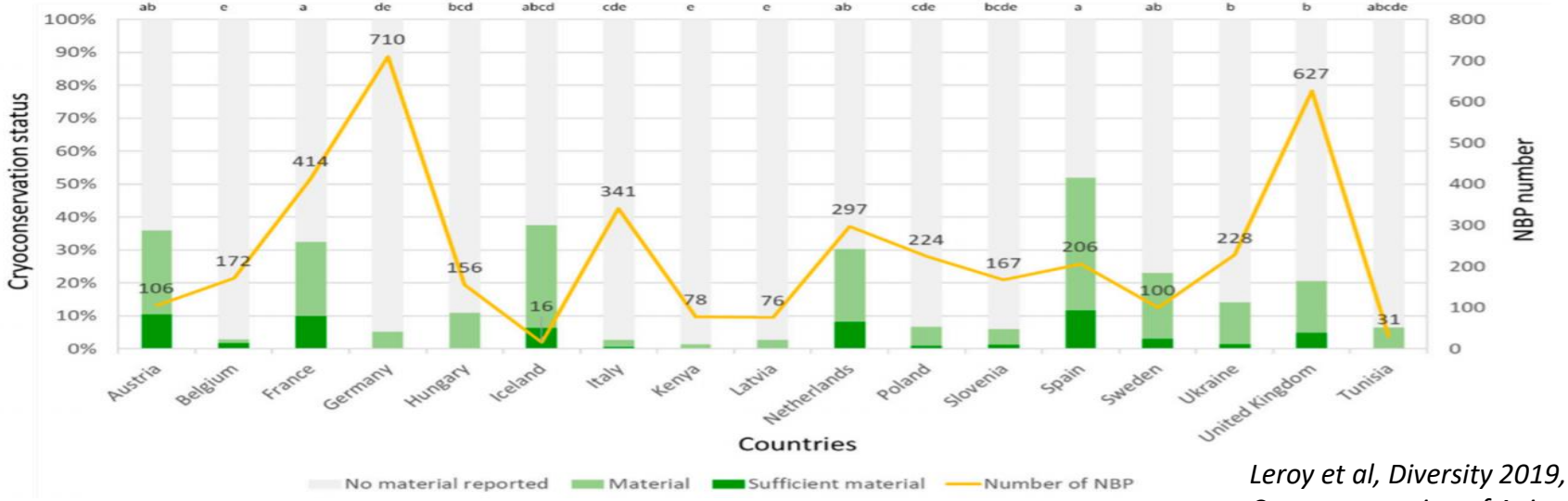


EUROPE



Further development of gene bank collections needed

- Many breeds “at risk” have very limited samples stored in gene bank
- All breeds need regular back up storage in gene banks (before becoming at risk)



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

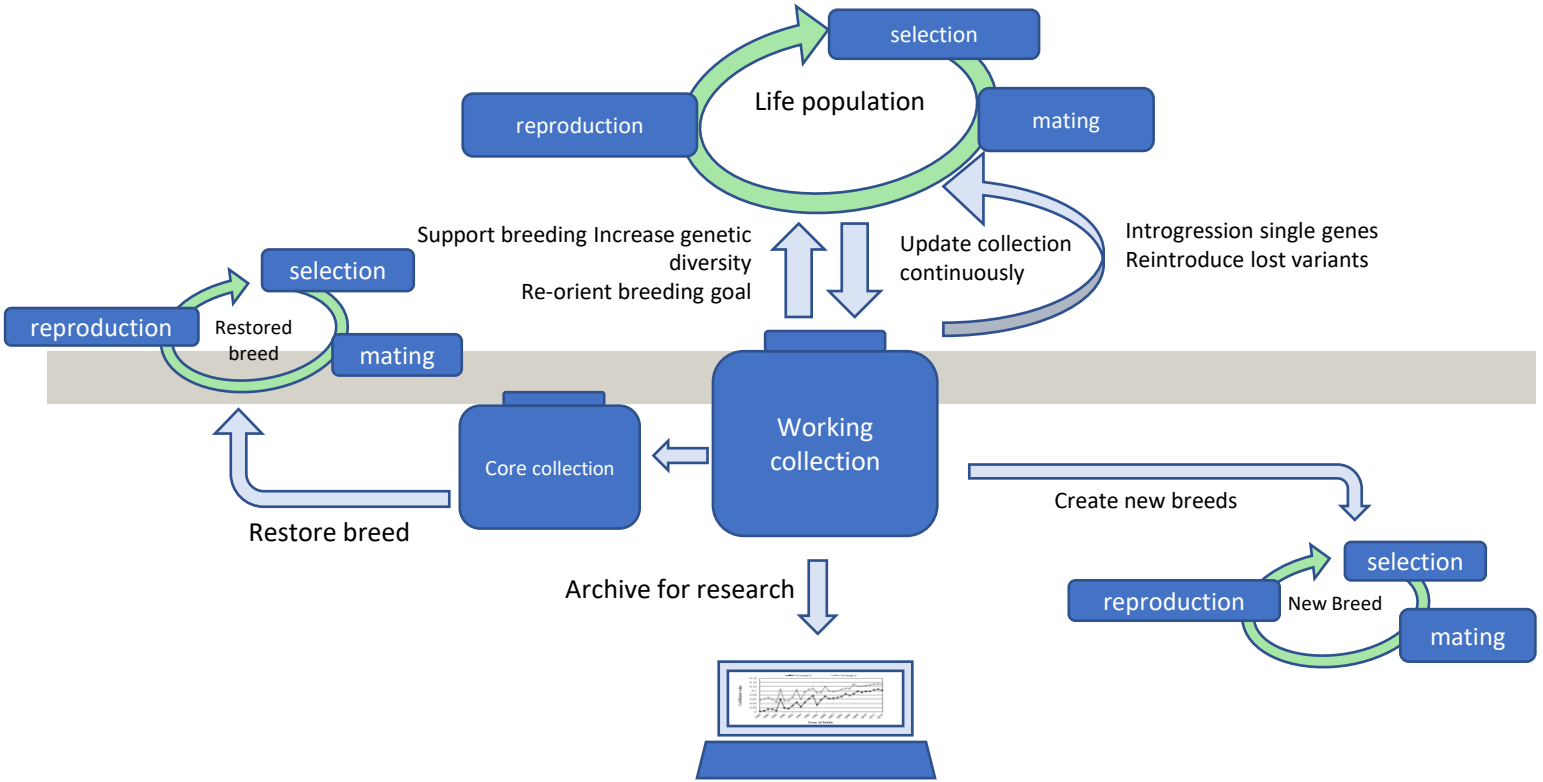
WAGENINGEN
UNIVERSITY & RESEARCH

Developing the Gene Bank Strategy

- Objectives
- Governance
- Sampling
- Storage
- Information management
- Utilization

INNOVATIONS IN CRYOCONSERVATION OF ANIMAL GENETIC RESOURCES – DRAFT TECHNICAL GUIDELINES (FAO, 2021)

Objectives/use of gene bank collections



WAGENINGEN
UNIVERSITY & RESEARCH

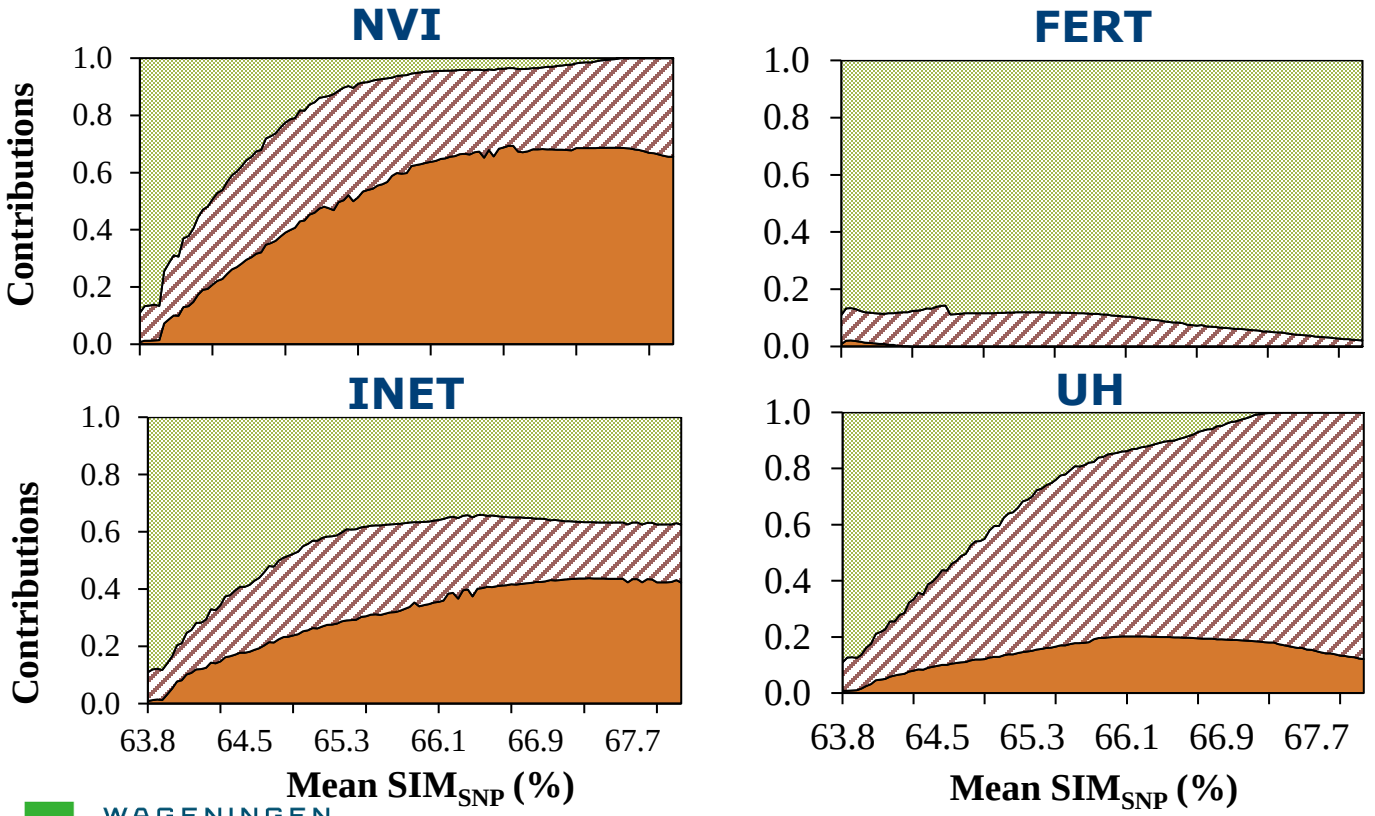
INNOVATIONS IN CRYOCONSERVATION OF ANIMAL GENETIC RESOURCES – DRAFT TECHNICAL GUIDELINES (FAO, 2021)

Gene banks - **not only conservation**…

- Gene banks are the most trusted means for long term conservation of AnGR
- Support to the *in situ* conservation programs of endangered breeds
- Support breeding programs or breeding companies or breeders societies
- Tool for the researchers

WAGENINGEN
UNIVERSITY & RESEARCH

Holstein Friesian: Future value of genebank? (OC)



Harmen Doekes et al. 2018

VYB

YB

CBG

WAGENINGEN UNIVERSITY & RESEARCH

IMAGE
Innovative Management of Animal Genetic Resources

Sampling: choosing breeds and donor animals

- RISK APPROACH:
  - Breeds at risk / endangered breeds
  - Population size N / Effective population size Ne (Ne < N)
- DIVERSITY APPROACH:
  - Prioritize breeds with a higher diversity for future uses
  - Maximize diversity of donor animals within breeds
  - Use of molecular tools or pedigree data
- UTILITY APPROACH :
  - Prioritize breeds and donor animals with useful characteristics

Comparison of **germplasm types** according to various factors influencing their utility

Type of germplasm	Ease of acquisition	Cryopreservation expertise	Collection costs[a]	Utilization expertise	Utilization costs
Semen	2	3	1	1 to 3[b]	1 to 5[b]
Oocytes	5	5	5	4	3
Embryos	5	5	5	4	2
Gonads	2	2	2	5	3
PGCs[c]	4	1	1	5	3 to 5[d]
Somatic cells	1	1	1	2 to 4[e]	5[e]

INNOVATIONS IN CRYOCONSERVATION OF ANIMAL GENETIC RESOURCES – DRAFT TECHNICAL GUIDELINES (FAO, 2021)

Governance of the Gene bank

- Stakeholder identification
- Institutional and funding commitments
- Governance structure
- Decision-making
- Data policy

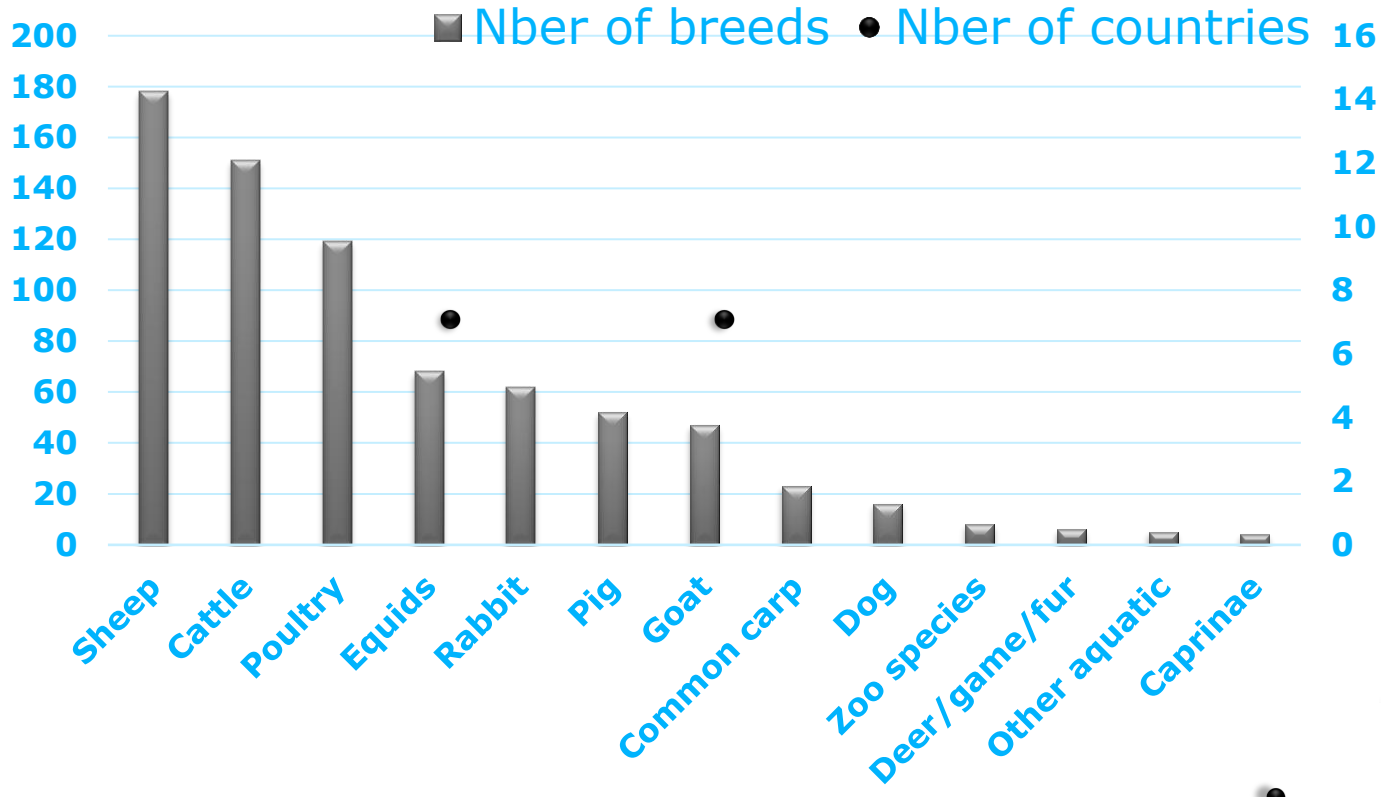
INNOVATIONS IN CRYOCONSERVATION OF ANIMAL GENETIC RESOURCES – DRAFT TECHNICAL GUIDELINES (FAO, 2021)

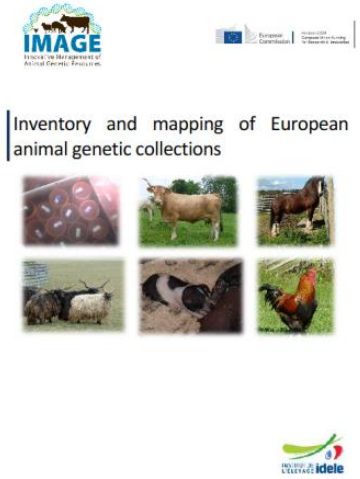
Dutch Genebank – Did we meet our objectives ?

- **Sufficient** genetic material (>25 donor animals/breed) of native Dutch breeds stored?
- Core collections established?
- Mainly semen collections. Annual growth 2% per year (number of donors)

Species	Breeds	Donors	Doses	Years of sampling
Cattle	22	6,378	253,629	1966-2018
Chicken	31	270	18,662	1985-2009
Dog	7	19	612	1988-2012
Duck	3	67	1,591	2011-2013
Goat	6	82	6,476	2005-2018
Goose	1	11	102	2013-2014
Horse	13	253	4,538	1979-2018
Pig	33	767	21,946	1995-2018
Rabbit	8	62	1,957	2014-2015
Sheep	11	336	31,567	2001-2018
10 species	135	8,245	341,080	1966-2018

IMAGE gene bank survey: Germplasm collections





WAGENINGEN
UNIVERSITY & RESEARCH

IMAGE
Innovative Management of Animal Genetic Resources

WELCOME

on the Web portal of EUGENA, the European Genebank Network for Animal Genetic Resources

Read more about EUGENA

Read more about EUGENA Portal

EUGENA brings together gene banks under the umbrella of the European Regional Focal Point for Animal Genetic Resources with the objective to support the ex situ conservation and sustainable use of the livestock in Europe

11 Countries

9 Gene Banks

959362 Samples

EUGENA

ERFP

Definition of gene bank (EUGENA)

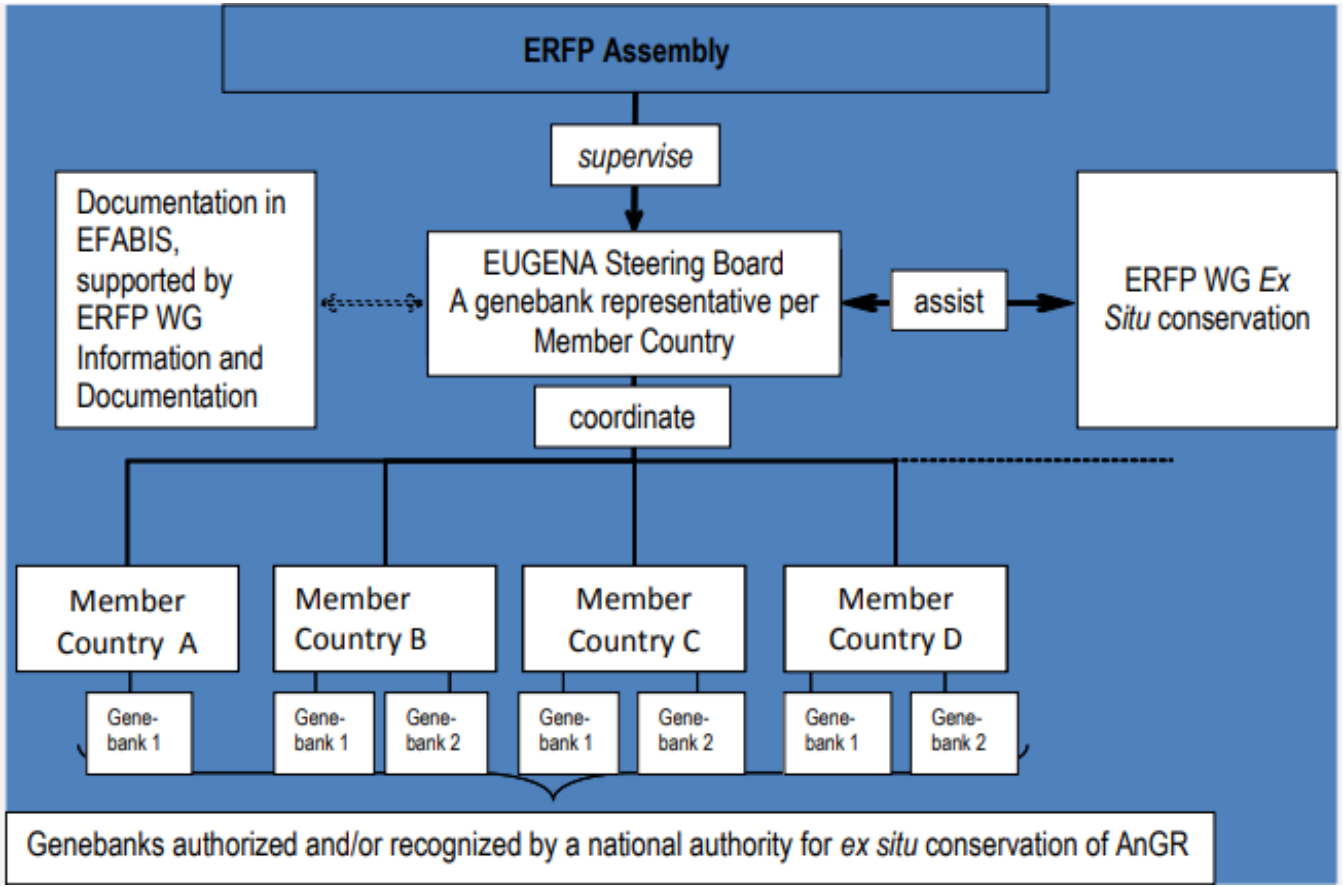
EUGENA ToR: A genebank for AnGR is a repository for ex situ conservation and sustainable use of AnGR held by a host institution authorized and/or recognized by a national authority to fulfill these tasks. A genebank may be constituted by one or more repositories (in vitro or in vivo) collaborating as a network.

Regulation (UE) 2020/686: means a repository of animal genetic material for ex situ conservation and sustainable use of genetic resources of kept terrestrial animals, held by a host institution authorised or recognised by the competent authority to fulfil these task

EUGENA objectives

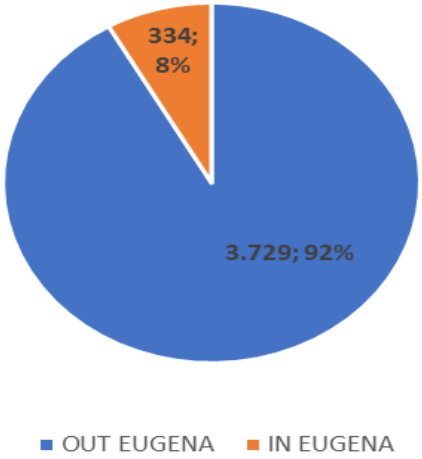
- to support national genebanks to fulfil their individual roles and objectives
- to improve monitoring and assessment of AnGR kept ex situ
- to improve genebank operations by sharing information
- to use synergies for joint activities of genebanks in European countries;
- to increase the efficiency of ex situ of transboundary breeds;
- to promote harmonization of acquisition and access terms for ex situ
- to facilitate quality improvement of genebanks in Europe
- to create an element of the European research infrastructure
- to facilitate international cooperation and exchange of AnGR (ABS context)

EUGENA Structure

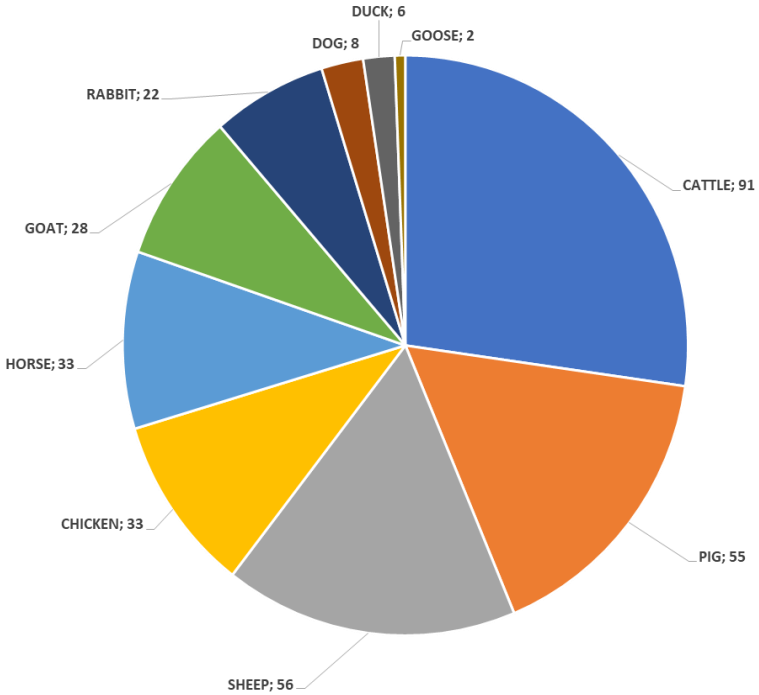


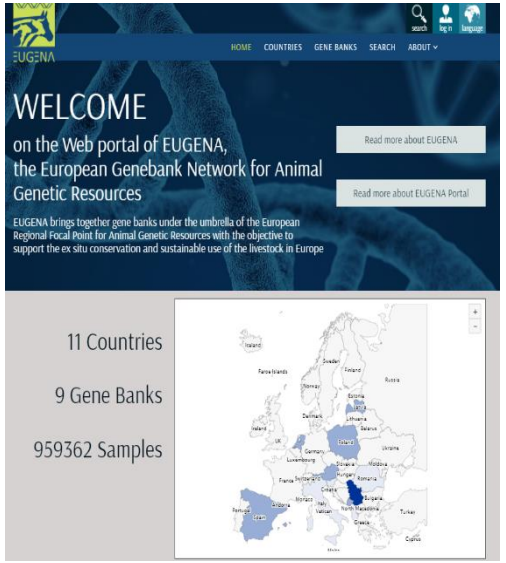
EUGENA

EUROPEAN BREEDS IN/OUT EUGENA



BREEDS PER SPECIE IN EUGENA. 2021





EUGENA

Summary

- Genebanks are strategic facilities for the conservation and sustainable use of AnGR – Long term national strategies needed
- Genebank strategy to be supported and funded by major stakeholders
- "One size does not fit all" – gene bank should best serve national and stakeholder needs
- There is a lot of gaps to fill – periodic *rationalization* of strategy is needed
- EUGENA is a tool to recognize and to enhance the work of Genebanks in Europe

Thank you for your attention

WAGENINGEN
UNIVERSITY & RESEARCH

EUGENA ERFP