Rationalization and further development of European livestock genebank collections

S.J. Hiemstra, P. Boettcher, G. Leroy, D. Moran and C. Danchin-Burge
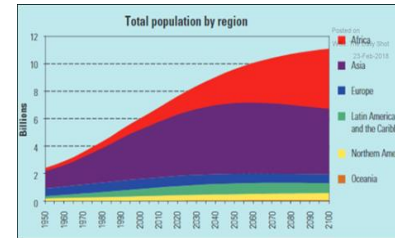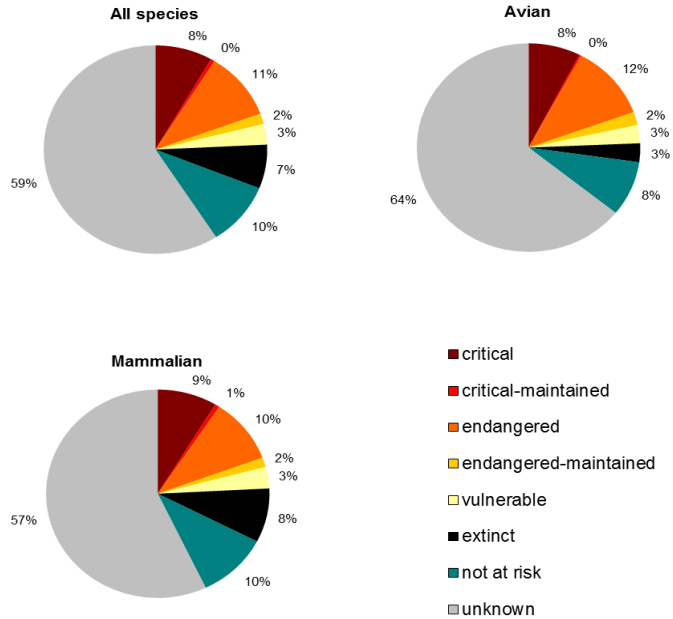
Proportion of the world's breed by risk status category

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Global trends and challenges

(FAO, 2018)

Livestock genebanks needed - long term conservation

- Complementary *in situ* and *ex situ* strategies

- Insurance back-up

- Different stakeholder perspectives

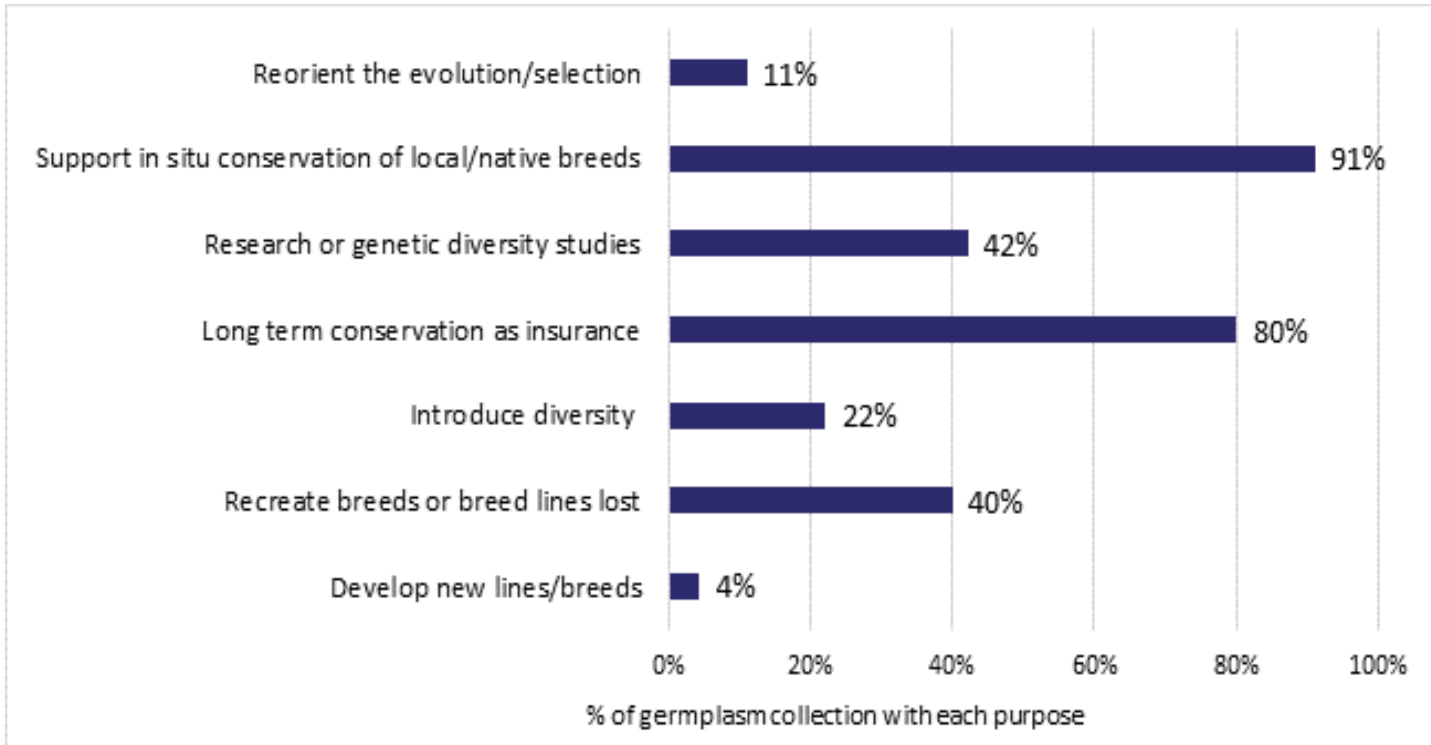- National strategies and pan-European coordination

EU Horizon 2020 IMAGE project:

→ Current status of gene banks in Europe?

→ Needs for further development of gene banks?

Gene bank objectives – IMAGE gene bank survey

Reorient the evolution/selection — 11%
Support in situ conservation of local/native breeds — 91%
Research or genetic diversity studies — 42%
Long term conservation as insurance — 80%
Introduce diversity — 22%
Recreate breeds or breed lines lost — 40%
Develop new lines/breeds — 4%

% of germplasm collection with each purpose

Inventory and mapping of European animal genetic collections

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IMAGE
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Animal Genetic Resources
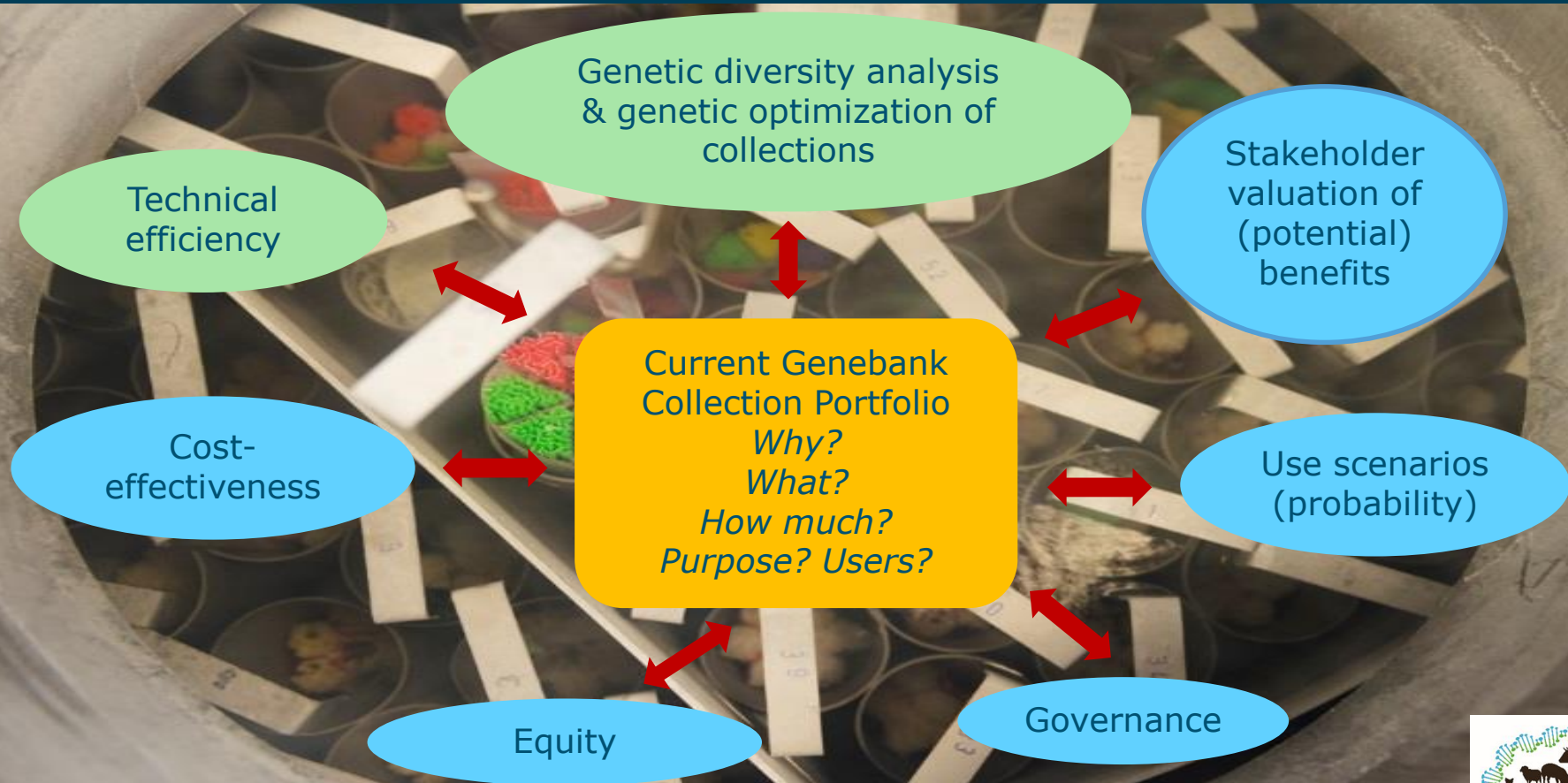
Number of breeds and countries per species (survey)

Rationalization of genebank collections: Questions

Genetic diversity analysis & genetic optimization of collections

Technical efficiency

Stakeholder valuation of (potential) benefits

Current Genebank Collection Portfolio
Why?
What?
How much?
Purpose? Users?

Cost-effectiveness

Use scenarios (probability)

Equity

Governance

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Dutch Genebank – To what extent do we meet 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

Gap analysis – DAD-IS & IMAGE survey data

- **Gaps** in cryocollections ?
  - Species
  - Countries
  - Breed categories:
    - Breeds <u>at risk</u> *versus* breeds <u>not at risk</u>
    - <u>Local</u> *versus* <u>transboundary</u> breeds

- **SDG 2.5.1** – <u>Sufficient material</u> to allow breed reconstitution from gene banks ?
  - 15.9% of breeds in DAD-IS have cryomaterial stored
  - Only 4.3% of breeds in DAD-IS have sufficient material
  - Ruminants and Pigs **>** Equids **>** Rabbit and Avian species

Leroy, G, Boettcher, P., Besbes, B., Danchin-Burge, C., Baumung, R. and Hiemstra, S.J.

Cryoconservation status ?

- No Material
- Material
- **Sufficient Material**

By breed category
- Local
- Transboundary
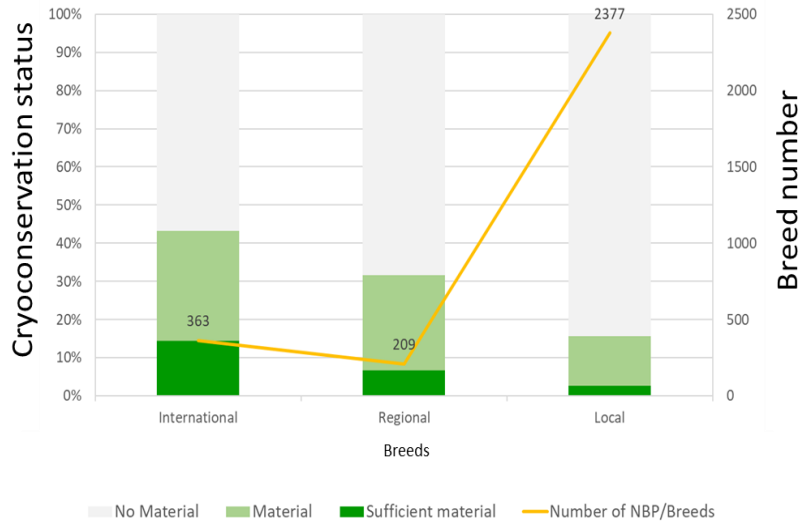
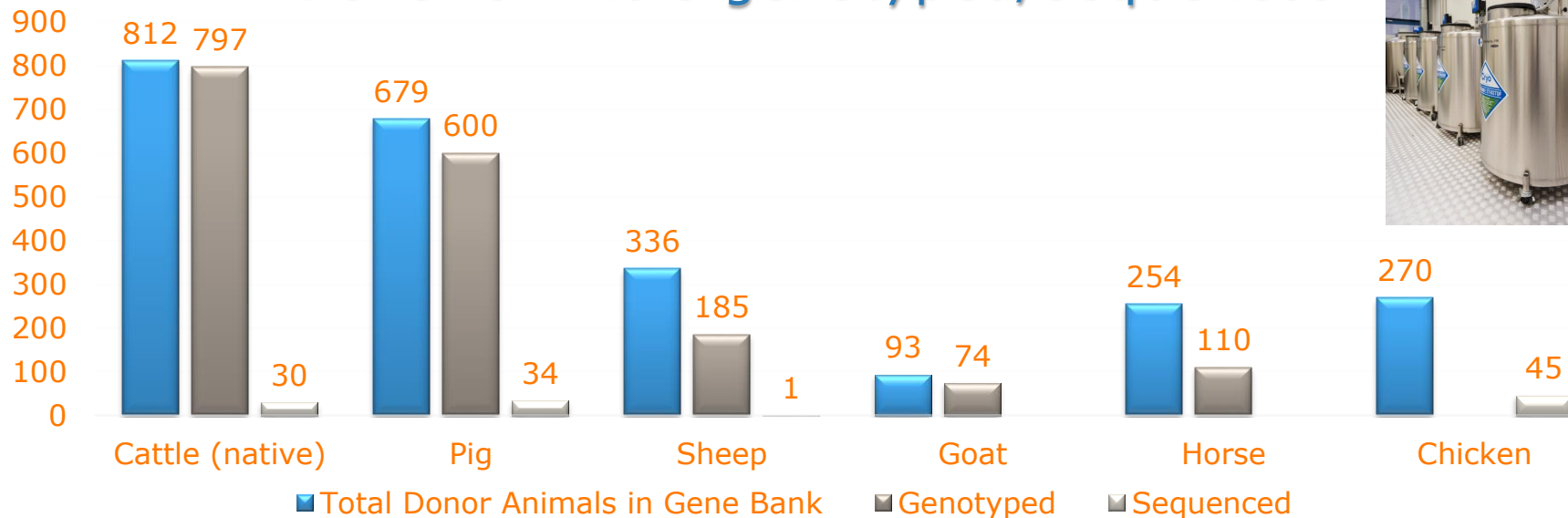By breed risk status
- At Risk
- Not At Risk

(Leroy, G, Boettcher, P., Besbes, B., Danchin-Burge, C., Baumung, R. and Hiemstra, S.J.)
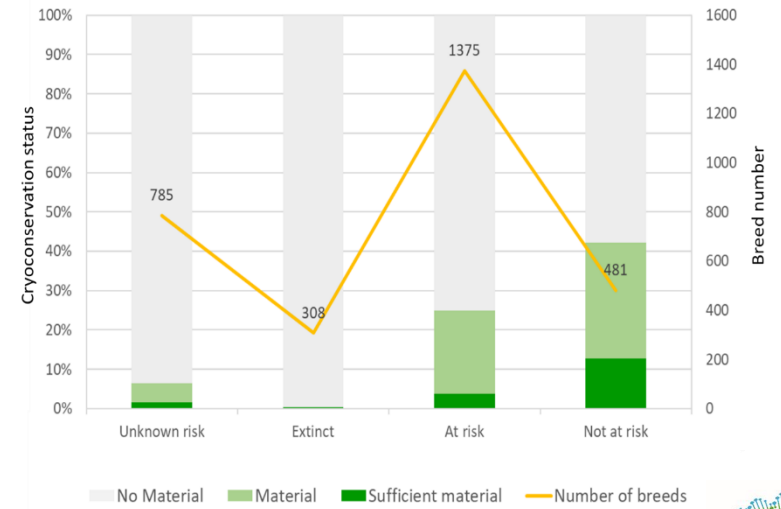
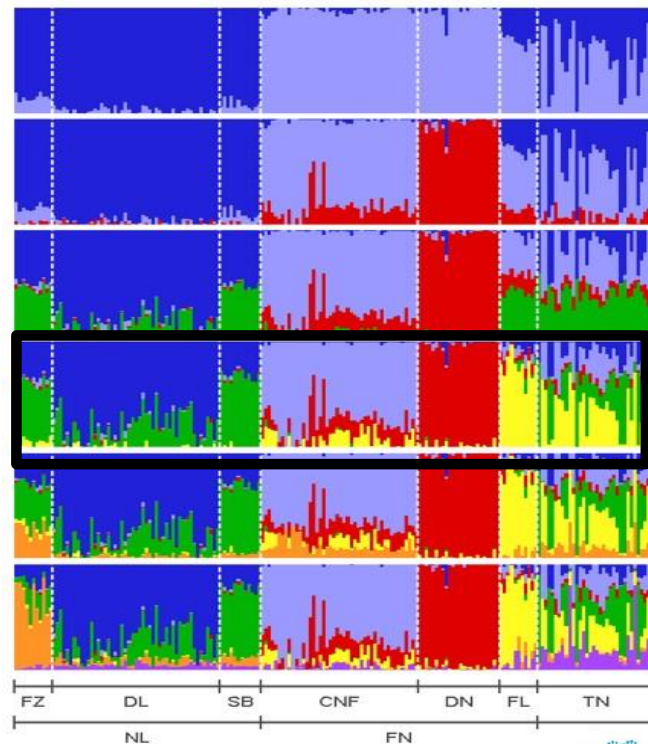# Genetic diversity captured in Dutch livestock genebank? (CGN2019) – Use of Genomic Data

Donor animals genotyped/sequenced

Species	Total Donor Animals in Gene Bank	Genotyped	Sequenced
Cattle (native)	812	797	30
Pig	679	600	34
Sheep	336	185	1
Goat	93	74	
Horse	254	110	
Chicken	270		45

Case study genomic analysis – Genetic diversity after consolidation of Dutch landrace pig breeding lines

- Current Landrace population is admixture

- Contribution of different Dutch and Norwegian/Finnish lines varies per individual

- Currently less genetic diversity present

- Recommended to conserve lines in gene bank before consolidation

Hulsegge et al. 2019

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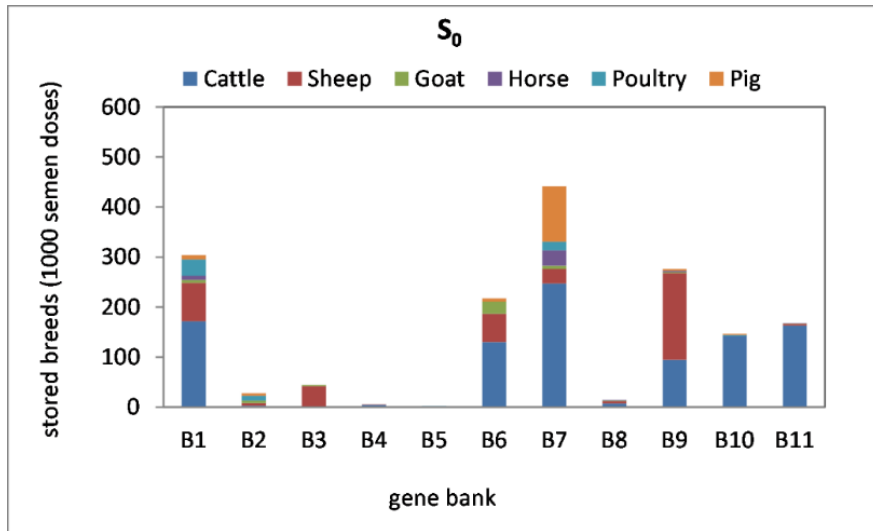# Quality Management Systems: IMAGE genebank survey

- Quality management procedures
  - 30 % of Genebanks have established a Quality Management System
  - 17 % have formal certification – mainly ISO
  - 35 % have formal cryoconservation goals
  - 50 % have identified the major risks to their collections
- Collecting, processing, storage and documentation
  - 59 % of banks use MTAs for (part of) incoming samples
  - 88 % follow specific SOP for processing and freezing
  - 49 % have a database for monitoring collections (e.g. CryoWEB, Animal GRIN)
- Least compliance was for distribution of outgoing material
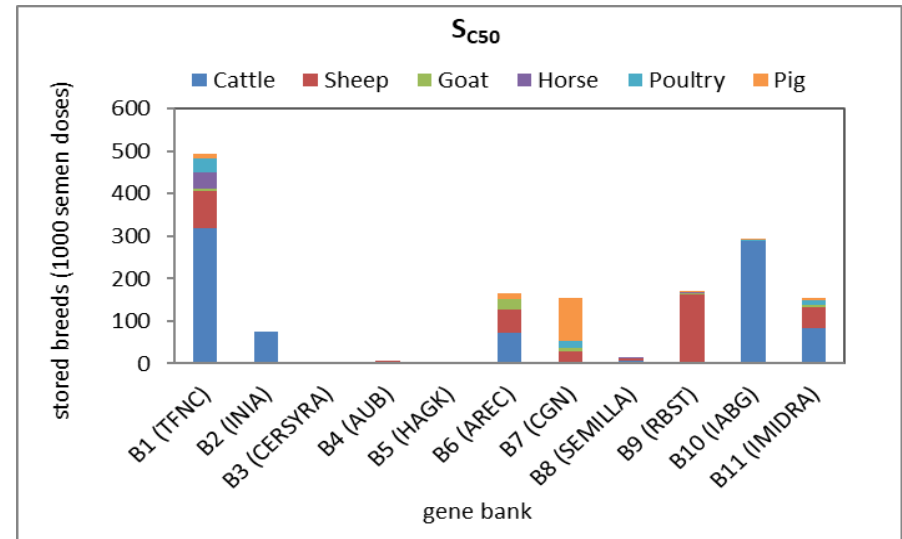 - 24 % have formal procedures for access to material (distribution policy)

(Zomerdijk, F., Hiemstra, S.J., d'Arbaumont, M., Tixier-Boichard, M. & P. Boettcher)

Costs optimization model

Current breed conservation *Vs* **Optimal**

Cost: 22.3 M EUR

Cost: 18 M EUR   ↓20%

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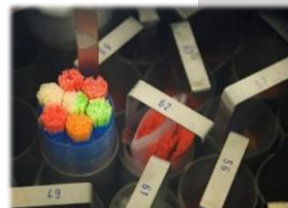Governance

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Enhance further development and professionalization of Livestock Genebanks - through the European Gene Bank Network for Animal Genetic Resources (EUGENA)

- Support *ex situ* conservation and national gene bank development

- Share information, knowledge and expertise

- Facilitate access to AnGR kept in genebank collections

- European portal/register for gene bank collections

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

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

Read more about EUG
Read more about EUGENA

5 Countries
7 Gene Banks
798032 Samples

Recent
New member gene bank from Spain
>> Read more
Serbia joined EUGENA

Featured species

Thank you for your attention

Post-graduate course:

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Wageningen, 9-13 December 2019

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- Diversity across breeds
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- Martien Groenen, Wageningen University
- Gabor Meszaros, BOKU, Vienna
- Christian Reimer, Georg-August-University, Göttingen
- Michele Tixier-Boichard, INRA Jouy-en-Josas
- Jack Windig, Wageningen Research

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