

Interaction between
German Gene Bank of Farm Animals
&
Field Populations
Two case studies



Steffen Weigend

Institute of Farm Animal Genetics
Friedrich-Loeffler-Institut
Neustadt-Mariensee
Germany

Genetics:

Christian Reimer
Johannes Geibel
Steffen Weigend

Hygiene & Reproduction:

Claudia Klein
Heiko Henning
Luciano Carvalheira

Current gene bank collection of sperm samples (June 2023)

Cattle

7 Breeds
261 Sires



Sheep



14 Breeds
213 Sires

Chicken

17 Breeds
4 exp. Lines
389 Sires



Pig



5 Breeds
115 Sires

Horse



5 Breeds
59 Sires

Honey bee (*A.m. carnica*)

94 Breeders
216 Samples



Goat

3 Breeds
18 Sires



From the Gene Bank back to the Field Population

The breed - German saddle-back



The Boar ,Odolf‘

born April 28th 2018

Semen frozen in 2019

- 1080 straws in total
=> 34 insemination doses



- Popular post war in the former GDR
- Conservation scheme since 1975

Daily growth ~ 800-850 g
23.8 Piglets weaned/ year
Suitable for outdoor housing

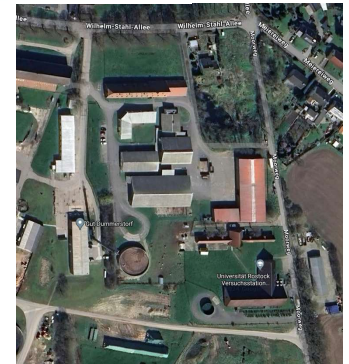
<https://www.g-e-h.de/rassebeschreibungen/50-schweine/162-deutsches-sattelschwein>

The recipient – FBN Dummerstorf



Saddle-back Herd

- 20 sows
in conservation scheme
 - 2.38 matings per year
 - 11.8 piglets born alive
- Permanent veterinary surveillance
- Associated with University of Rostock



The Boar ,Odolf‘



July 2023

- Shipping, accompanying document with key figures of the samples
=> Total motility (CASA) : 31.9% => sufficient sperm in insemination dose (3x10⁹ motil)

The litters

- Synchronized pairing scheme
- 5 doses used to date
 - 1st insemination:
 - 12 live born/11 weaned piglets (11/2023)
 - 2nd insemination:
 - 11 weaned piglets (01/2024)
 - 3rd and 4th inseminations
 - not successful with the same sow
 - 5th inseminations in 03/2024



© A. Vernunft
(FBN Dummerstorf)

- Male piglets tested at the station in Jürgenstorf
- Female piglets tested for fattening performance in herd.

Genomic characterisation and prioritization of sheep samples in the German Gene Bank

A case study

East Frisian milk sheep



<https://schafe-schuetzen.de/zuechter-ostfriesisches-milchschaef/>

- originated in East Frisia; around 1850; adaptable and robust
- main areas in Germany are Lower Saxony and Saxony
- Risk status in Germany: 'BEO' (Cat. III) - ♂ 121; ♀ 2366

Bentheimer Landschaf



<https://tiergarten-kleve.de/nachwuchs-bei-den-gefaehrdeten-bentheimer-landschafen/>

- originated in the counties of Bentheim and Lingen in south-western Lower Saxony around 1864
- largest German moor and heathland sheep
- Risk status in Germany: 'BEO' (Cat. III) - ♂ 121; ♀ 2997

Genomic characterisation and prioritization of sheep samples in the German Gene Bank

A case study

East Frisian milk sheep

Bentheimer Landschaf

- SNP - Genotyping of gene bank and field samples (samples of two herds)
(Affymetrix Image Multispecies Array - ~10k SNPs/ species)

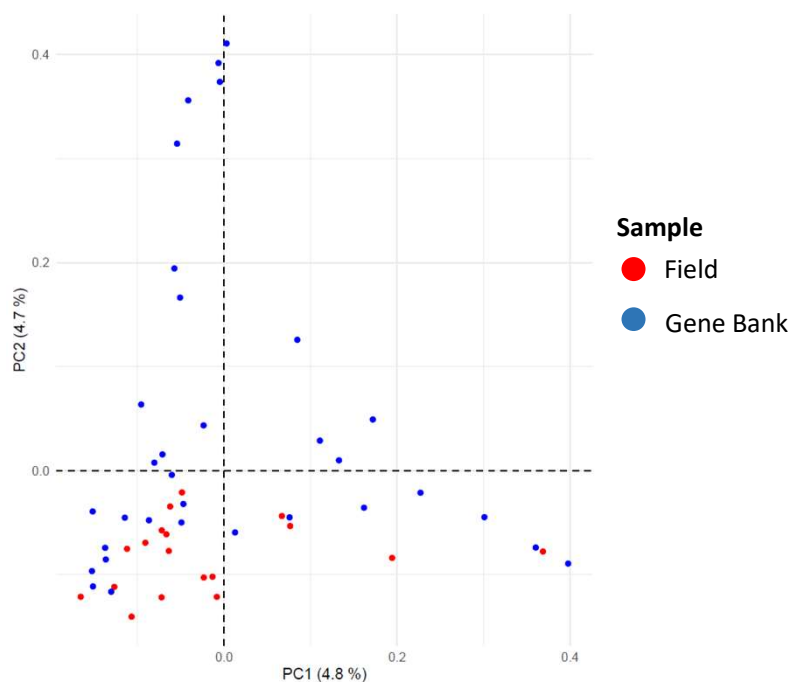


	East Frisian milk sheep	Bentheimer Landschaf
Gene bank	33	27
Field Samples	20	20

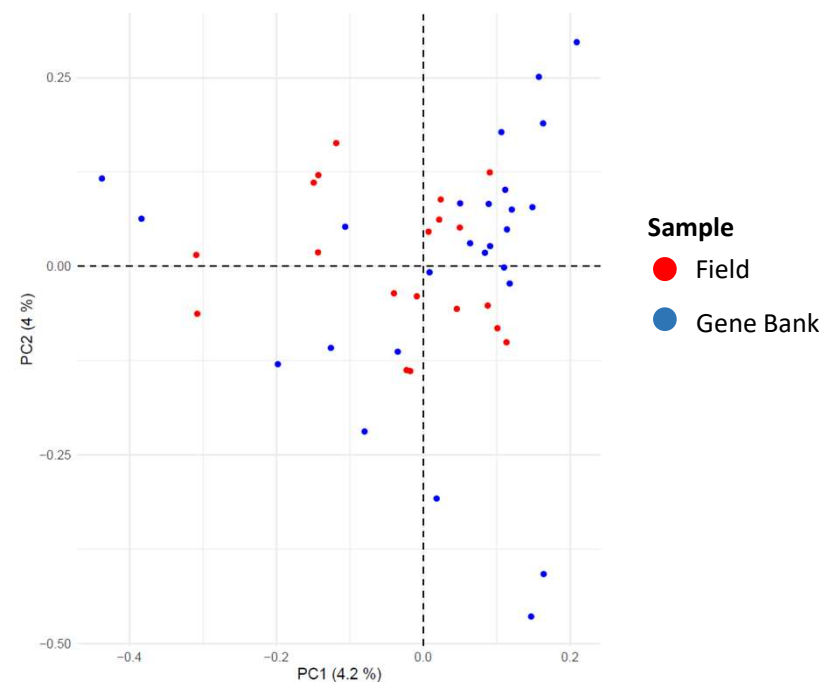


Gene bank vs. field diversity

East Frisian milk sheep



Bentheimer Landschaft



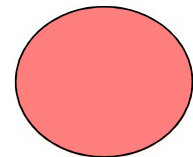
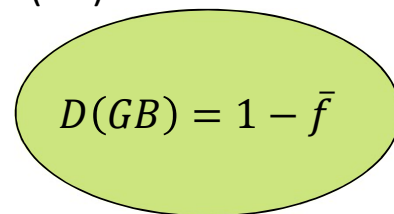
Prioritization of field samples to be collected to optimize the collection of gene bank content

Optimized extension

Based on the average **Kinship** \bar{f} of individuals within a set

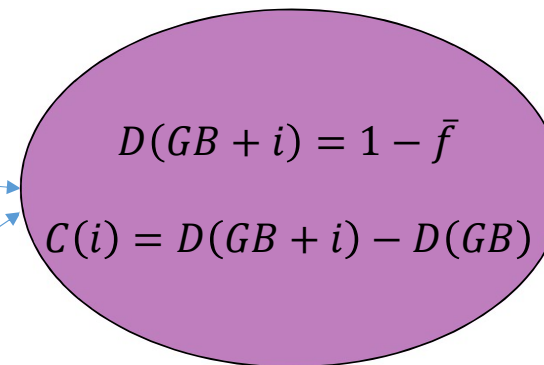
=> Principle: Core Set/Safe Set Analysis (Eding et al. 2002)

Gene Bank (GB) Collection



$$D(i) = 1 - \bar{f}$$

+



New individual

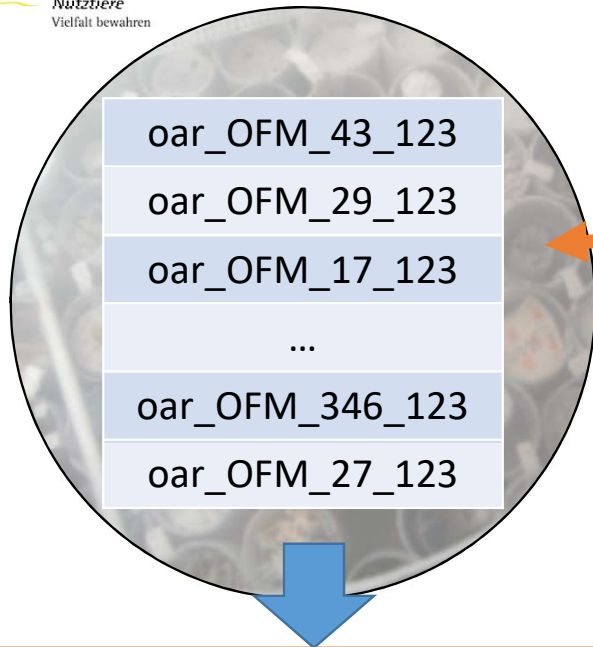
=> Add to GB

Conditions:

- Basis – **Molecular information** (pedigree information possible)
- Information of **Gene bank & field samples** available
- **Dynamic process** - Sequential addition

Sequential Safe Set East Frisian Milk Sheep

Lowest relationship=
highest diversity



	Gene bank + animal	relationship
1	oar_OFM_67_123	0.0134
2	oar_OFM_62_123	0.0138
3	oar_OFM_73_123	0.0140
4	oar_OFM_65_123	0.0140
5	oar_OFM_57_123	0.0140
	...	
19	oar_OFM_66_123	0.0154
20	oar_OFM_74_123	0.0156

	Gene bank new + animal	relationship
1	oar_OFM_73_123	0.0115
2	oar_OFM_57_123	0.0116
3	oar_OFM_65_123	0.0117
4	oar_OFM_61_123	0.0117
5	oar_OFM_69_123	0.0117
	...	
19	oar_OFM_74_123	0.0130

$relationship = 0.0161$

German Genebank of Farm Animals

**Central element of German animal breeding
for the conservation and use of animal genetic resources**



Thank you for your attention