Genetic diversity of eight local Belgian sheep breeds using pedigree and SNP data

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Background

- 8 (out of 9) local sheep breeds in Flanders are registered by SLE

  (non profit organization founded in 1993 to conserve local heritage breeds)

- EU directive 2016/2012 facilitated funding from the Flemish govenment to assess the status of “endangerment”

- Pedigree data and samples were obtained between July 2022 and January 2024 from flocks in Flanders

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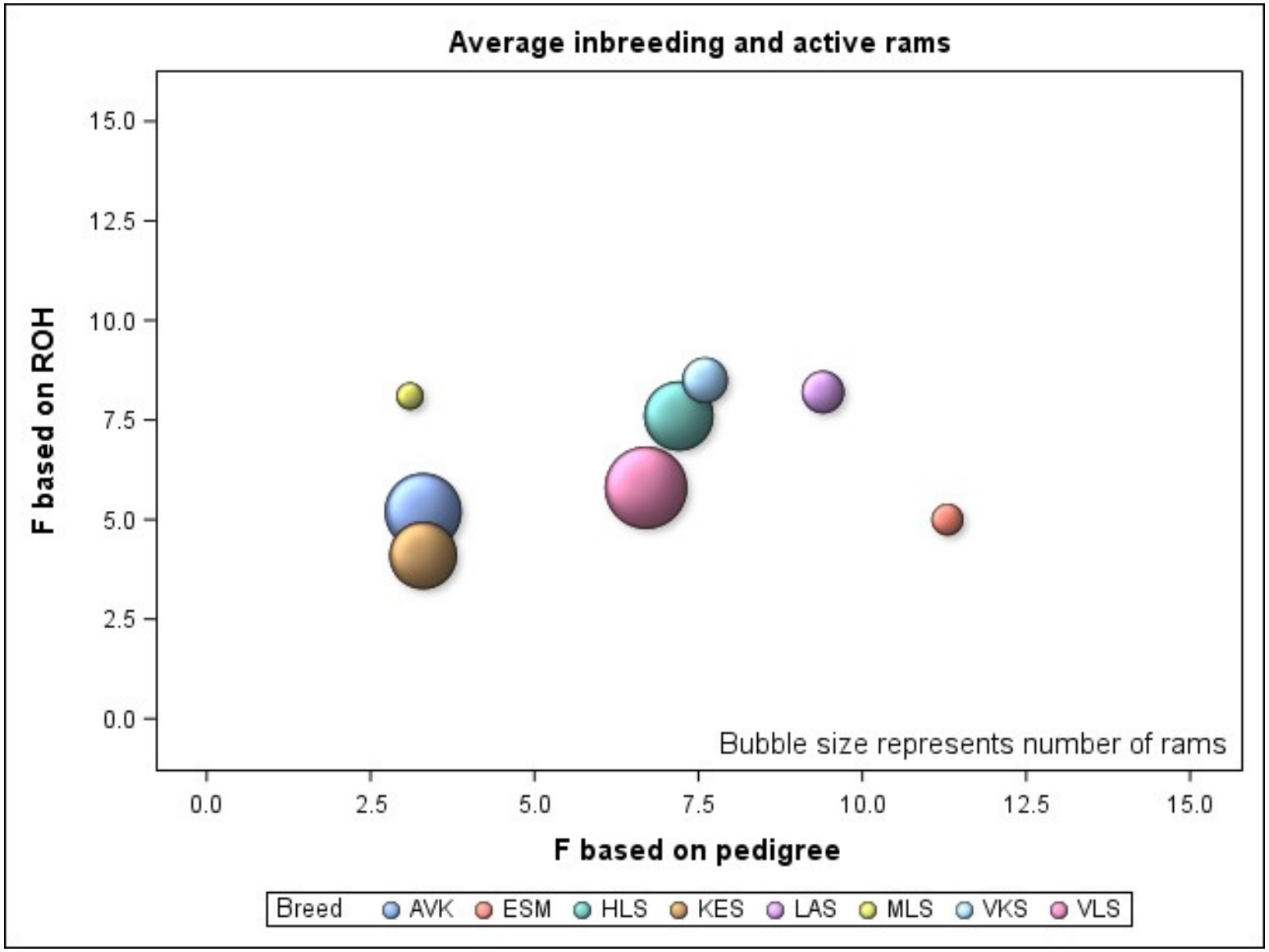
- Assess diversity (pedigree and genotypes)
- Elucidate relatedness between breeds
- Position the breeds globally




Pedigree data + genotypes

Breed name	Abbreviation	Pedigree	Active rams/ewes (2022/2023)	Genotyped animals	Genotyped flocks
Ardense voskop (Ardennais Rouge)	AVK	16,047	74 / 550	100	15
Entre-Sambre-et-Meuse	ESM	3,507	19 / 157	82	7
Houtlandschaap	HLS	8,861	62 / 474	75	15
Kempens schaap	KES	17,648	59 / 1,858	78	10
Lakens schaap	LAS	3,645	28 / 181	93	11
Mergellandschaap	MLS	2,203	16 / 143	100	9
Vlaams kuddeschaap	VKS	13,422	31 / 827	83	3
Vlaams schaap	VLS	12,672	84 / 865	76	12


Average inbreeding and active rams
F based on ROH
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Bubble size represents number of rams
0.0
2.5
5.0
7.5
10.0
12.5
15.0
F based on pedigree
Breed
AVK
ESM
HLS
KES
LAS
MLS
VKS
VLS

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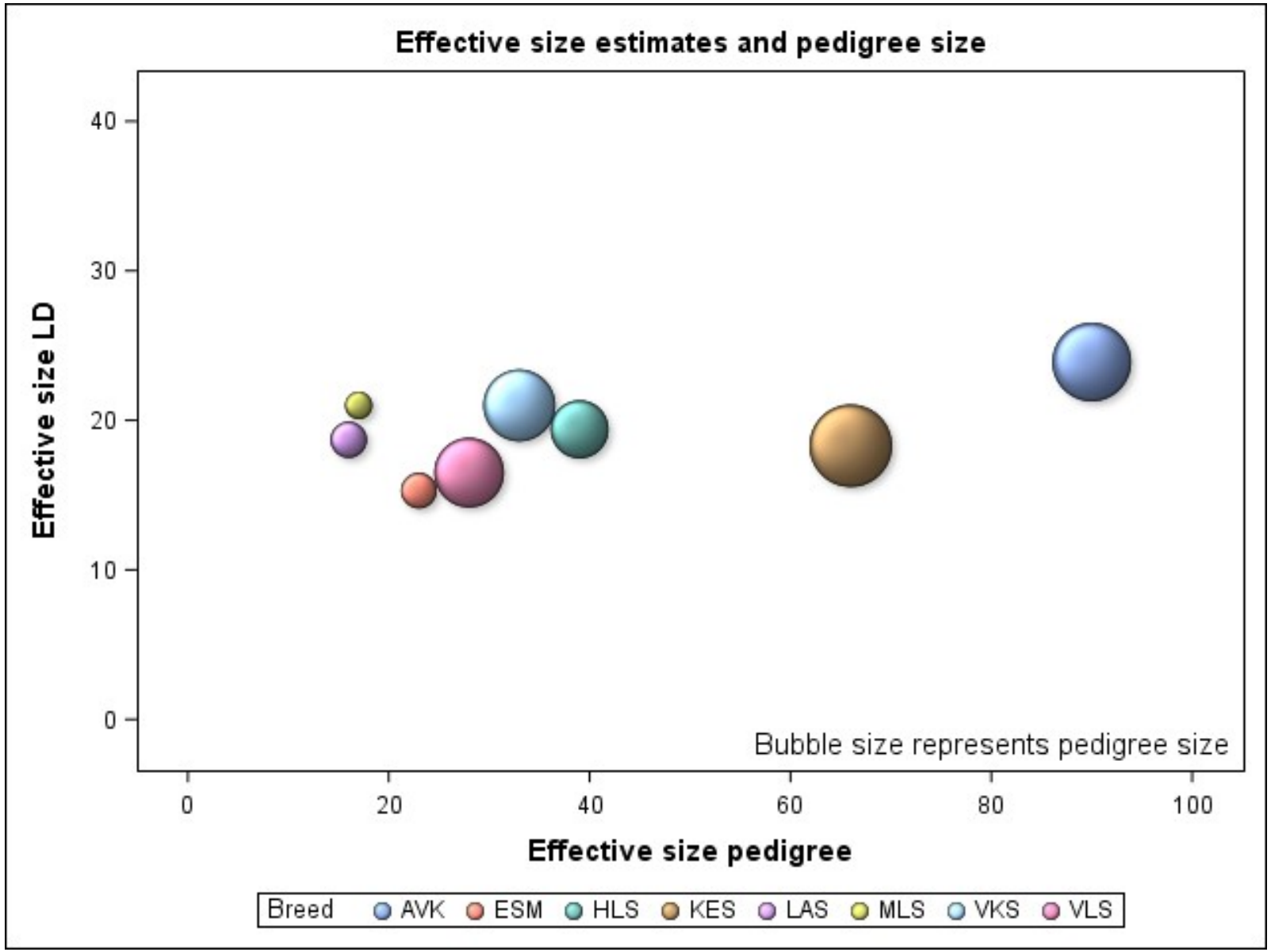
Effective size estimates and pedigree size
Effective size LD
40
30
20
10
0
Bubble size represents pedigree size
0
20
40
60
80
100
Effective size pedigree
Breed
AVK
ESM
HLS
KES
LAS
MLS
VKS
VLS

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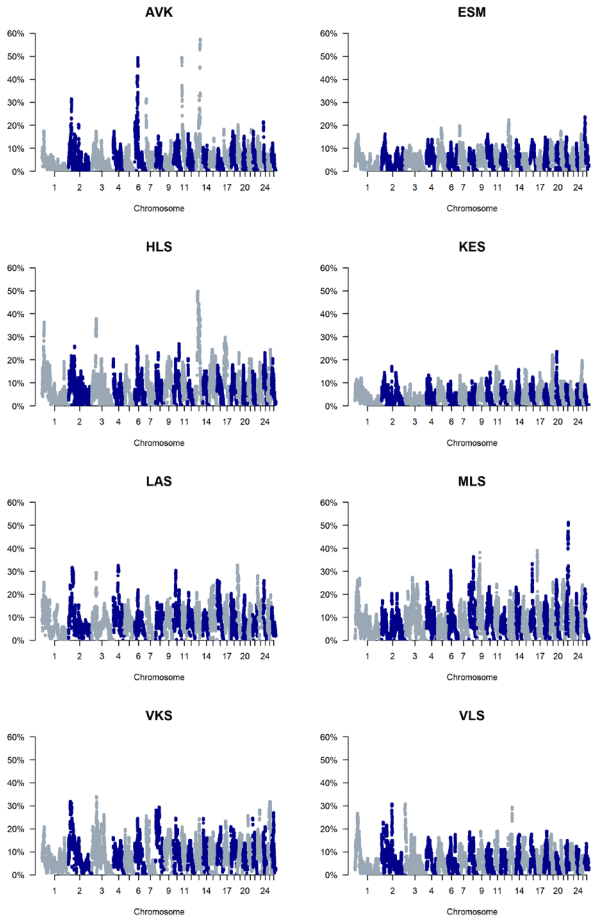
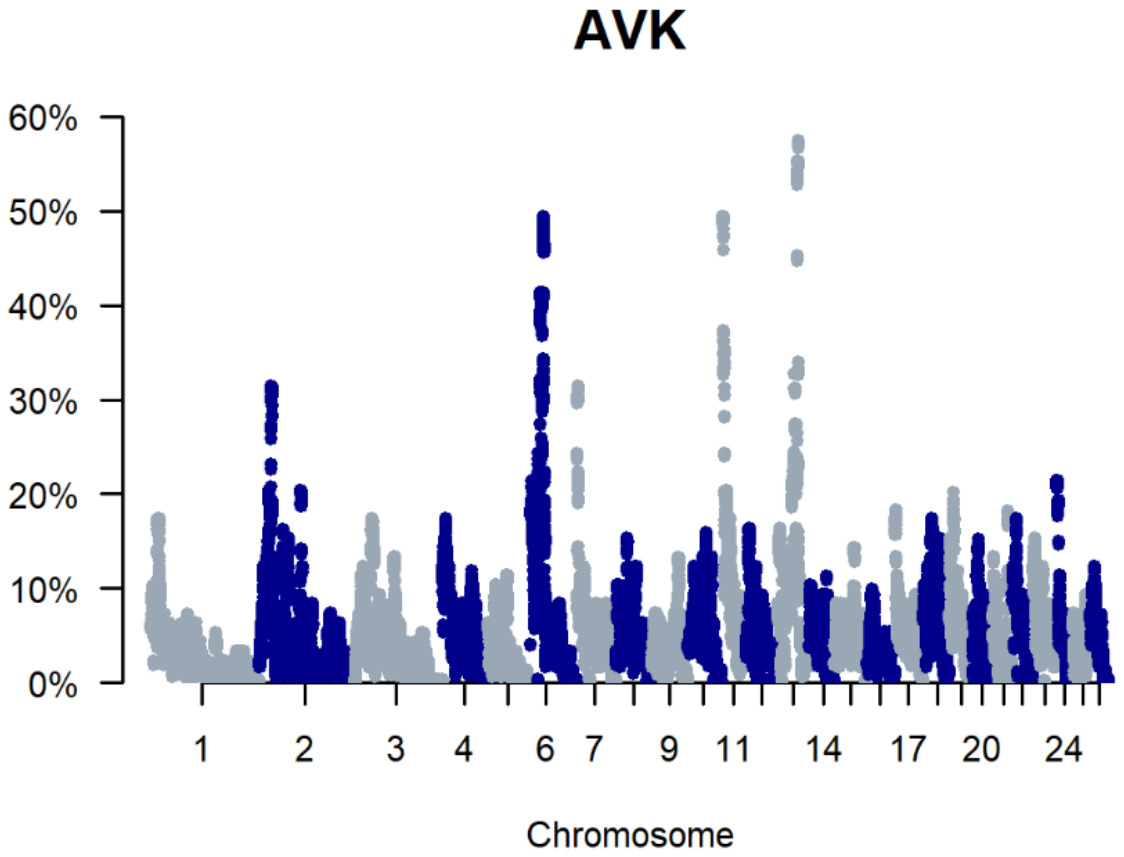
ROH-islands





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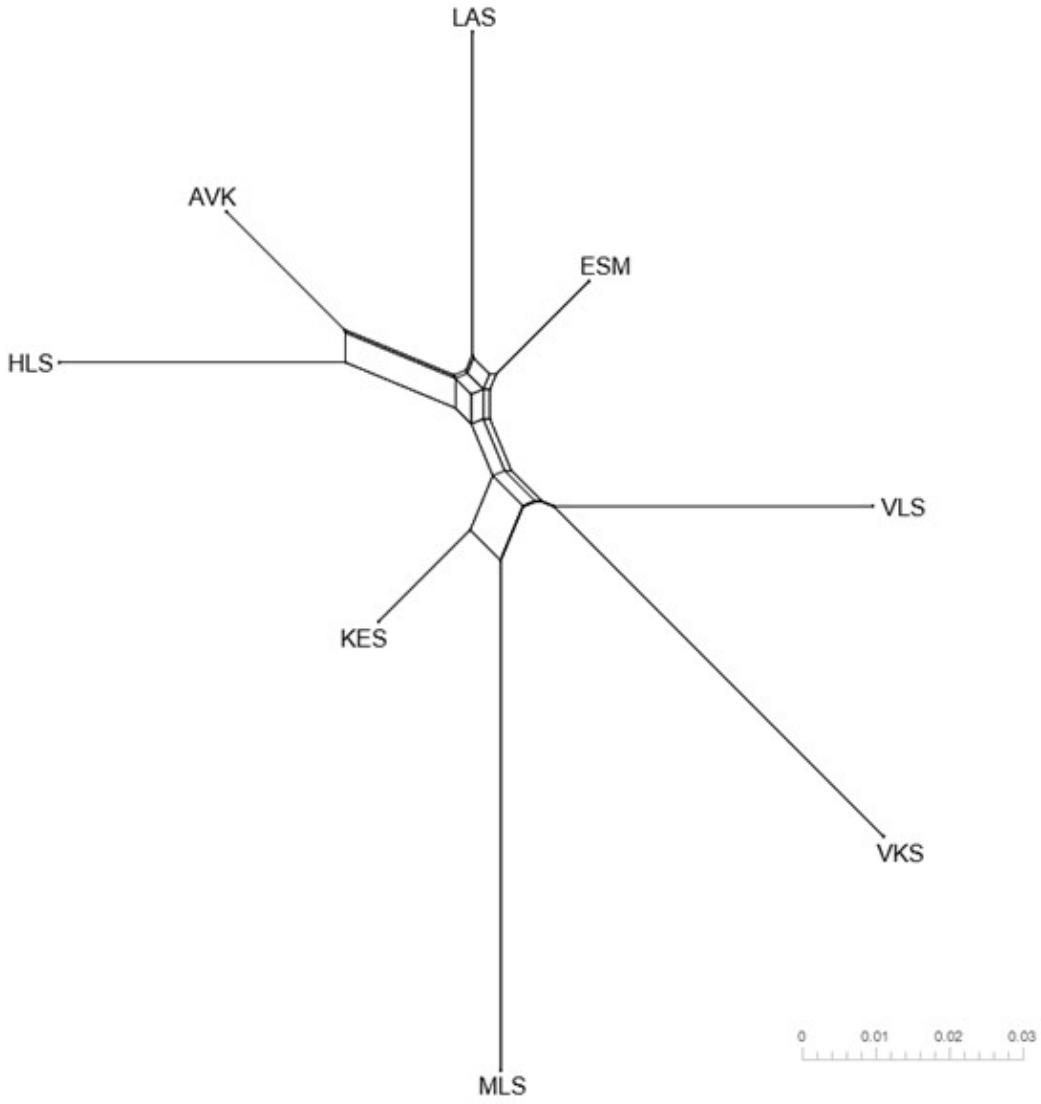
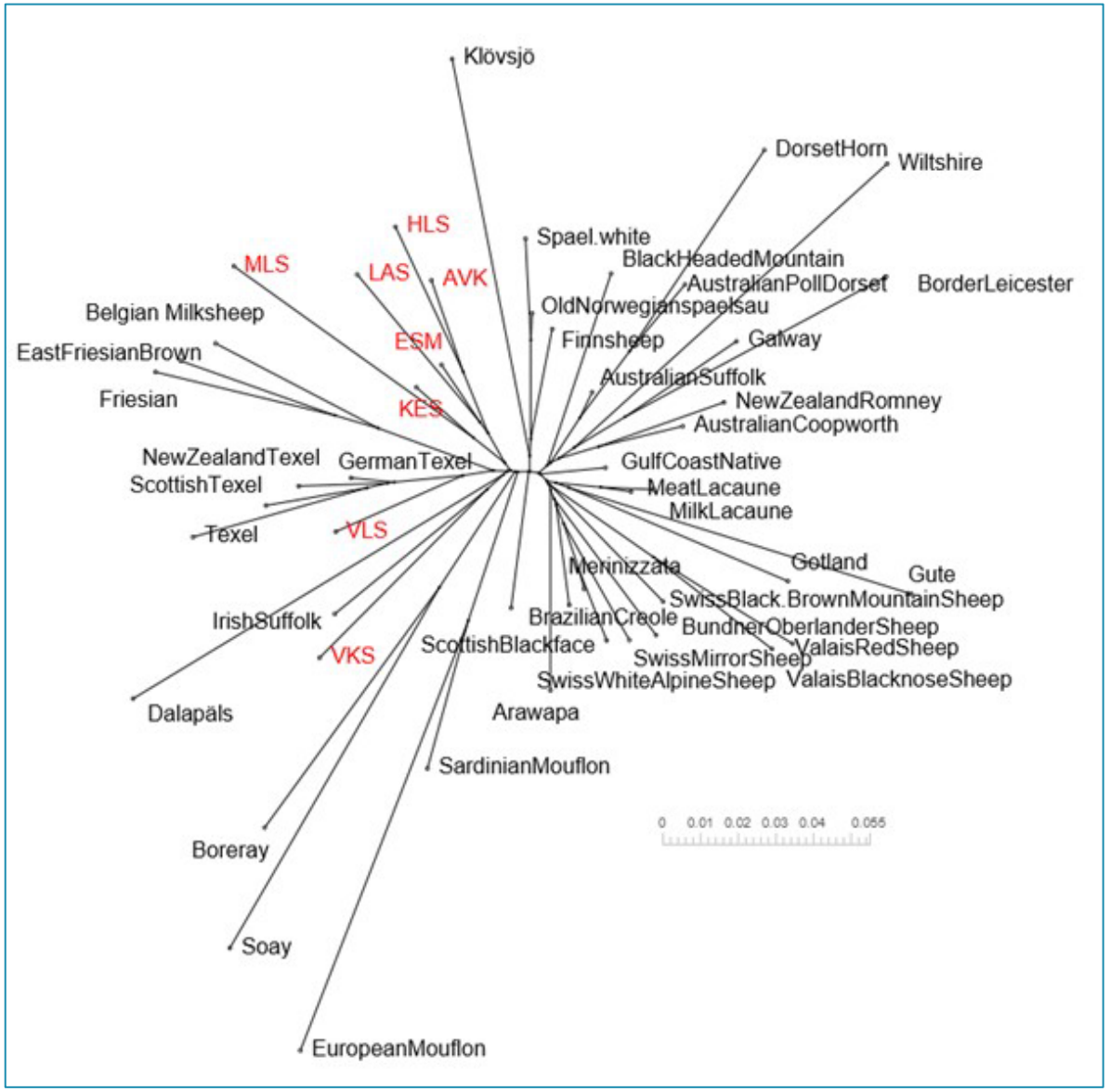


Fst distances between the 8 local breeds reflect the historical evidence

International positioning

- Using publicily available genotypes from 95 breeds
- Fst values, set resticted to 49 breeds
- 2 breeds fall in existing clusters, 6 breeds form new cluster



Kijas et al. (2012), Rochus et al. (2015), Ciani et al (2015), Meyermans et al (2020)

Conclusions

- All populations are considered as being endangered/at risk.
  Even when actual population numbers are relatively OK, the effective sizes (LD based) are at most 24.

- Pedigree derived information seems to be too (?) optimistic

- Animals from different breeds can be clustered quite well
  Positioning within international set of breeds confirms historical (written) sources or leads to new insights…

- Genotypes are a multi-tool and can serve several goals.
  In rare breeds, and especially in sheep, genotyping cost is prohibitive for individual sampling.

- Breeders of local breeds were quite willing to cooperate in the study were quite curious on the outcomes.
  Since then, several individuals requested help and advice for their own flock breeding scheme.

Acknowledgements

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