Genetic variation in Dutch sheep breeds

shaped by geography, history, use and genetic management

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Introduction

- Research:
  - Genetic distinctiveness of Dutch sheep breeds
  - Influence of history on genetic relationships between breeds
  - Genetic diversity within and between breeds
  - Unique contribution of each breed to total diversity

- 171 rams of 11 breeds genotyped with the 10K multispecies SNP chip (IMAGE project) (Crooijmans, Gonzalez Prendes, Tixier-Boichard, H2020 Image-Consortium)
- Rams of 10 native sheep breeds in genebank

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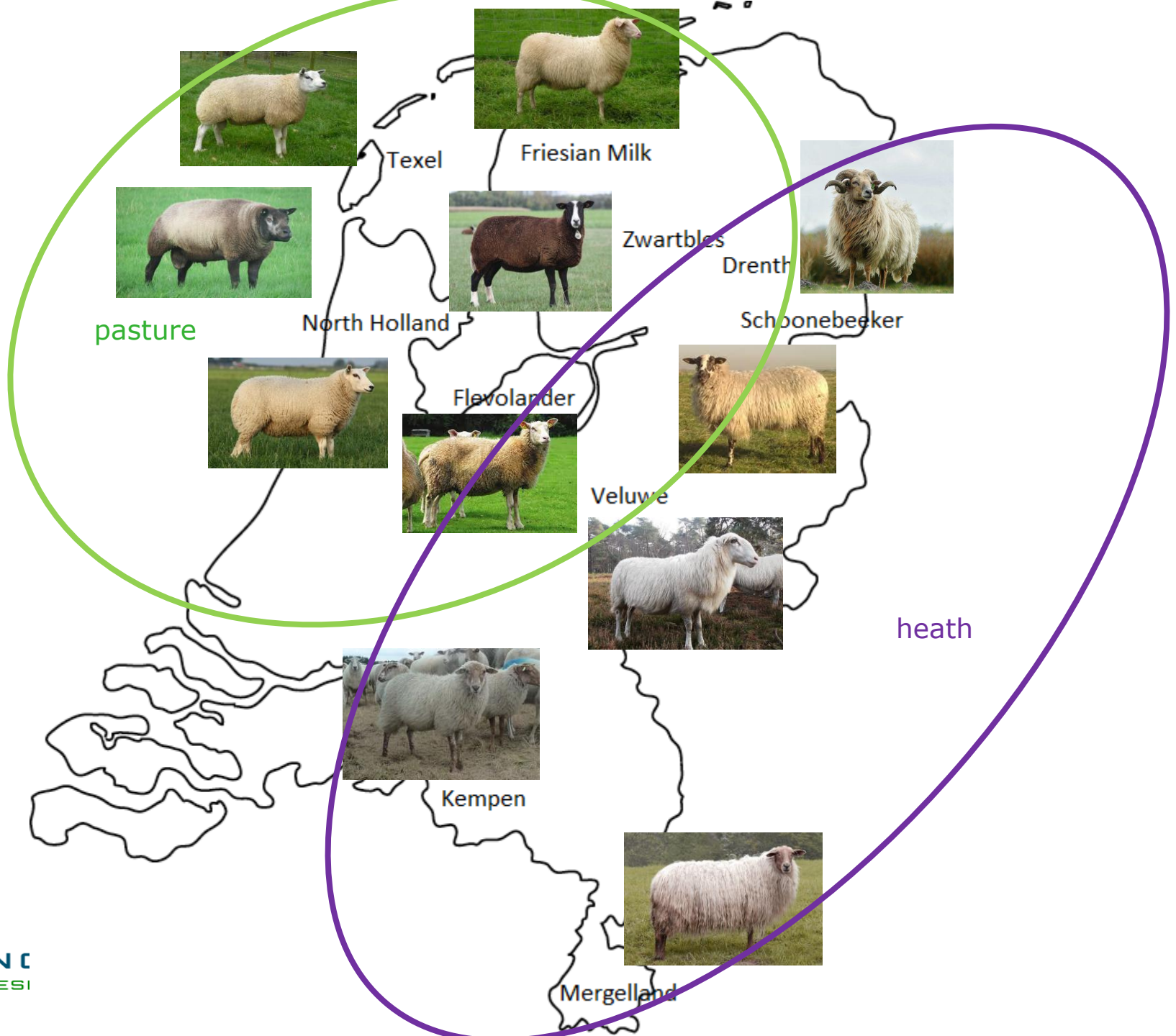
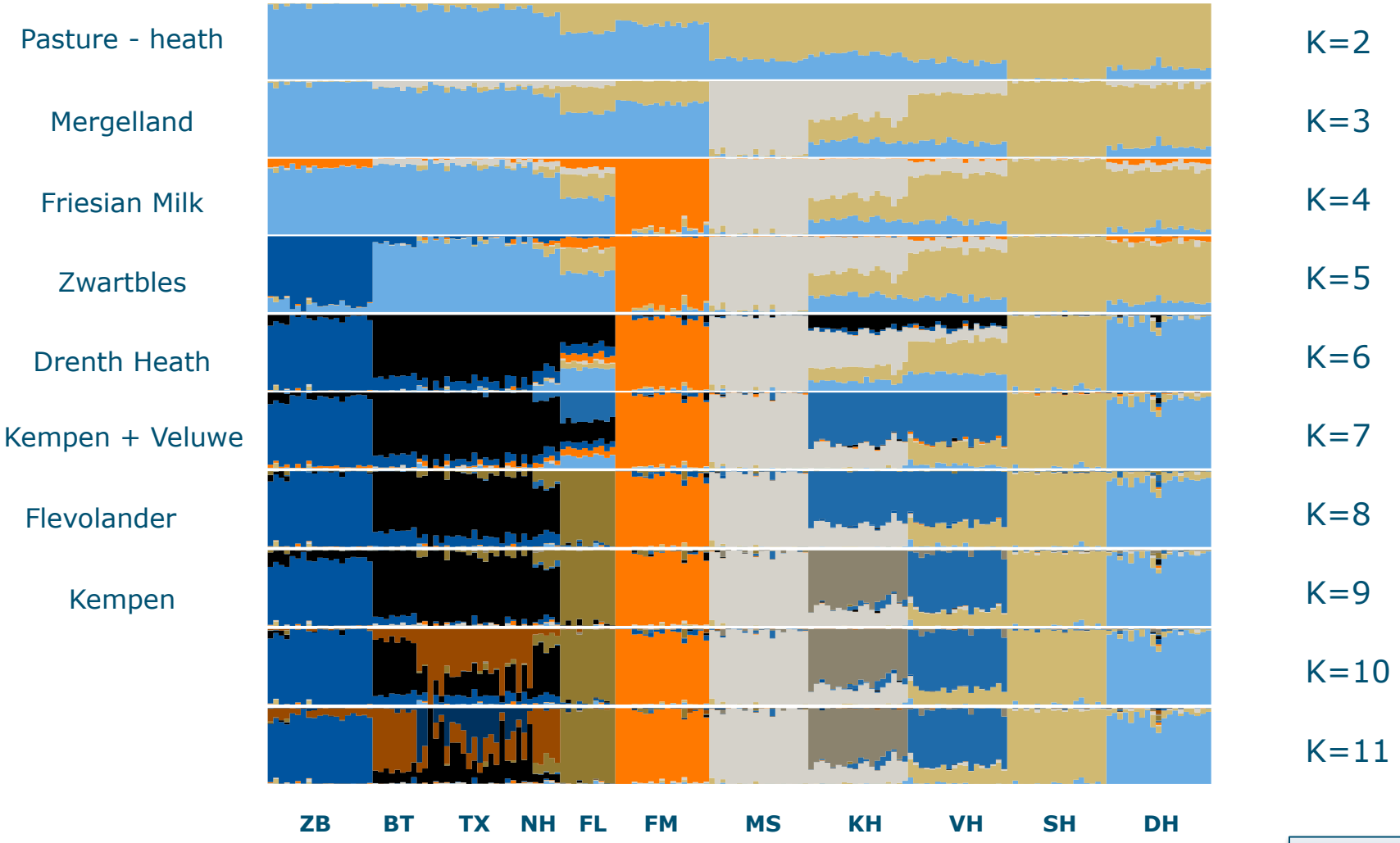
IMAGE
Innovative Management of Animal Genetic Resources


Texel
Friesian Milk
Zwartbles
Drenth
pasture
North Holland
Schoonebeeker
Flevolander
Veluwe
heath
Kempen
Mergelland

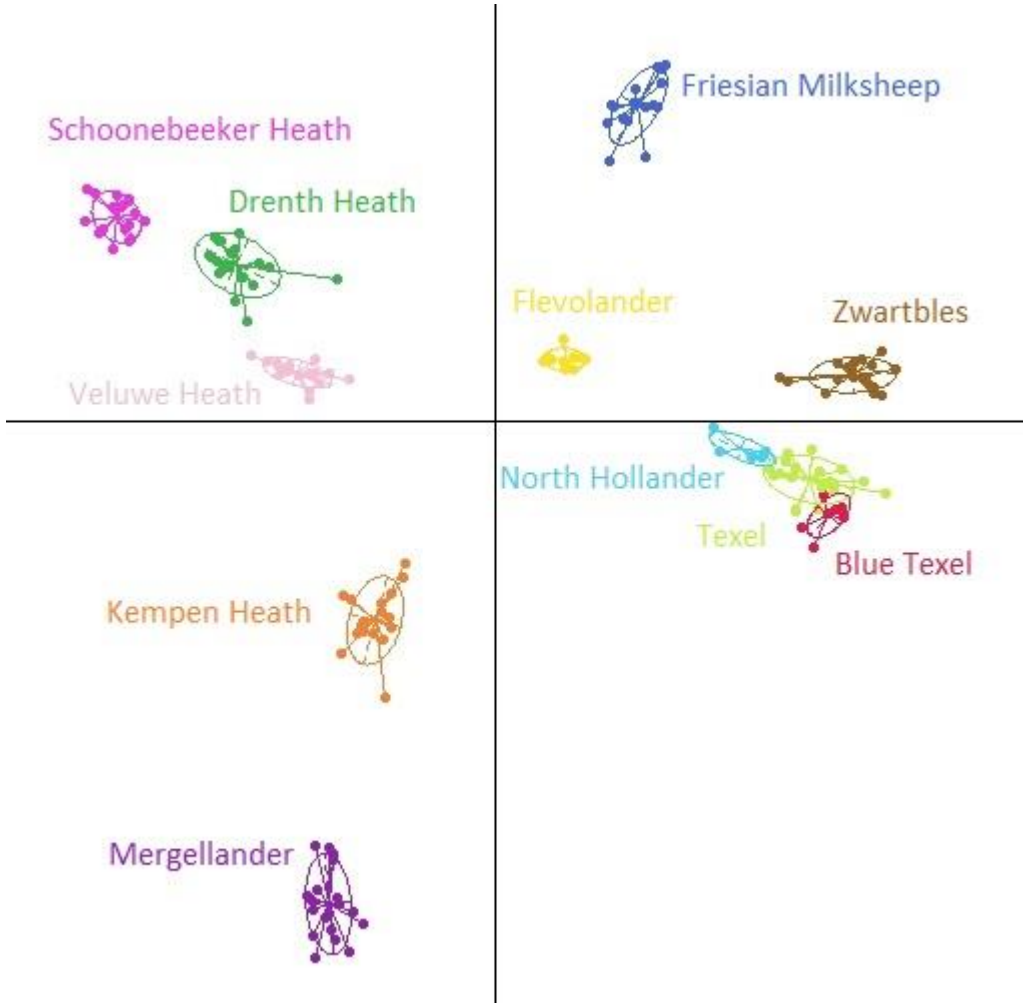
Genetic structure - Model based clustering



Genetic structure matches use

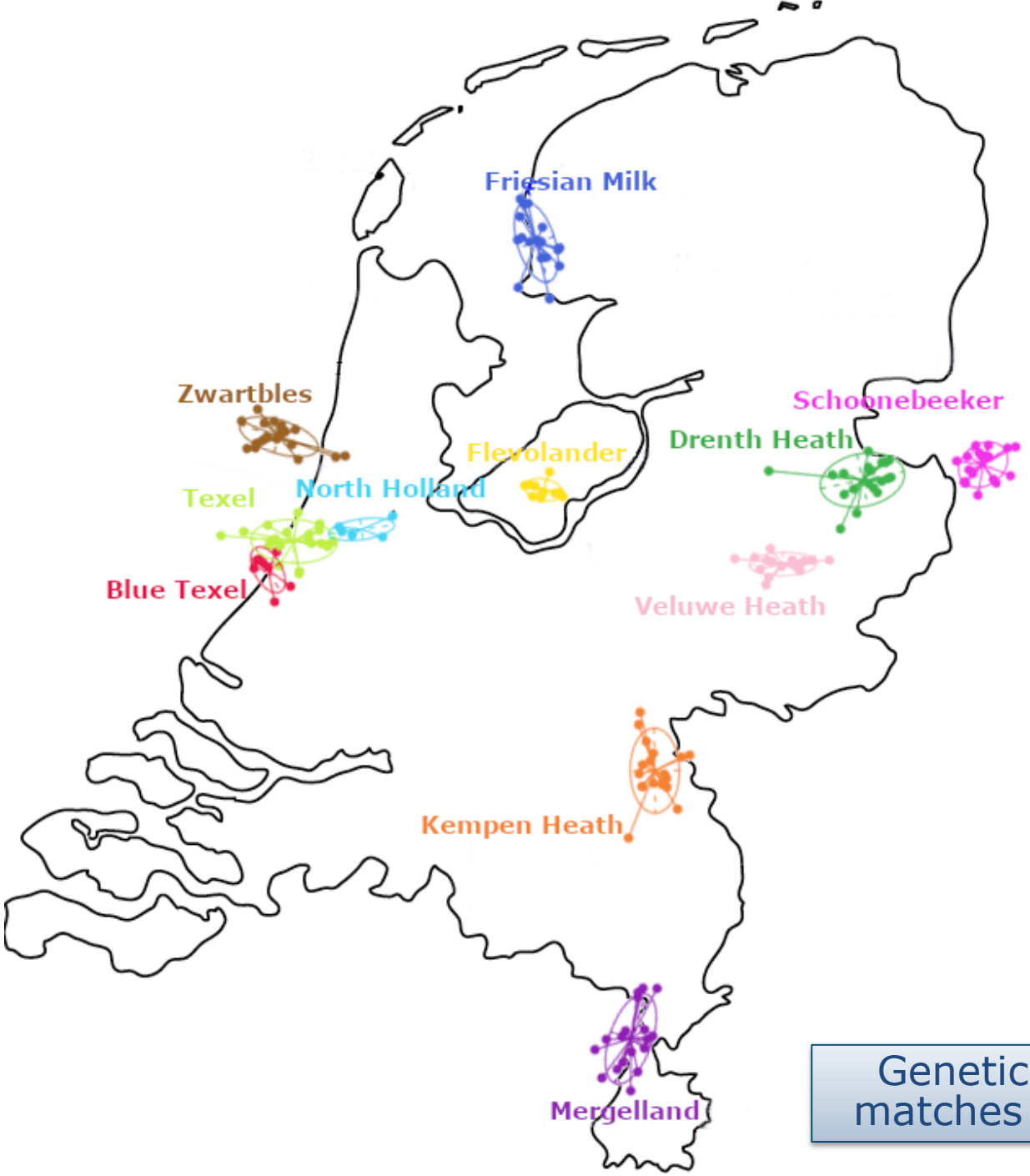
Genetic structure - PCA

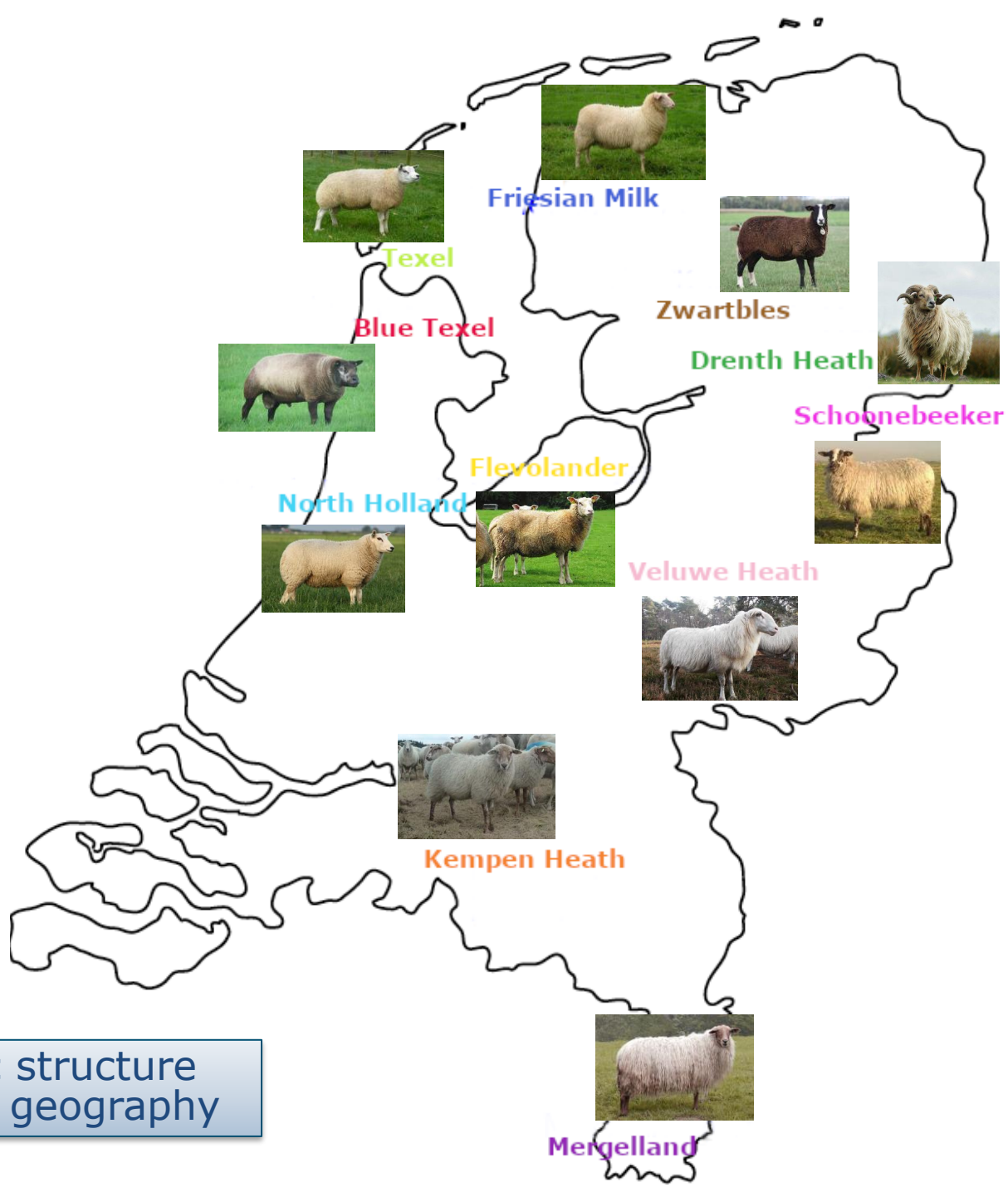
- Clear distinction between almost all breeds
- North Holland, Texel and Blue Texel breeds are overlapping slightly
- 5 heath breeds on the left and the 6 pasture breeds on the right
- Extensive - intensive
- Geographical distribution, north – south



PCA1
5.8% of the variation

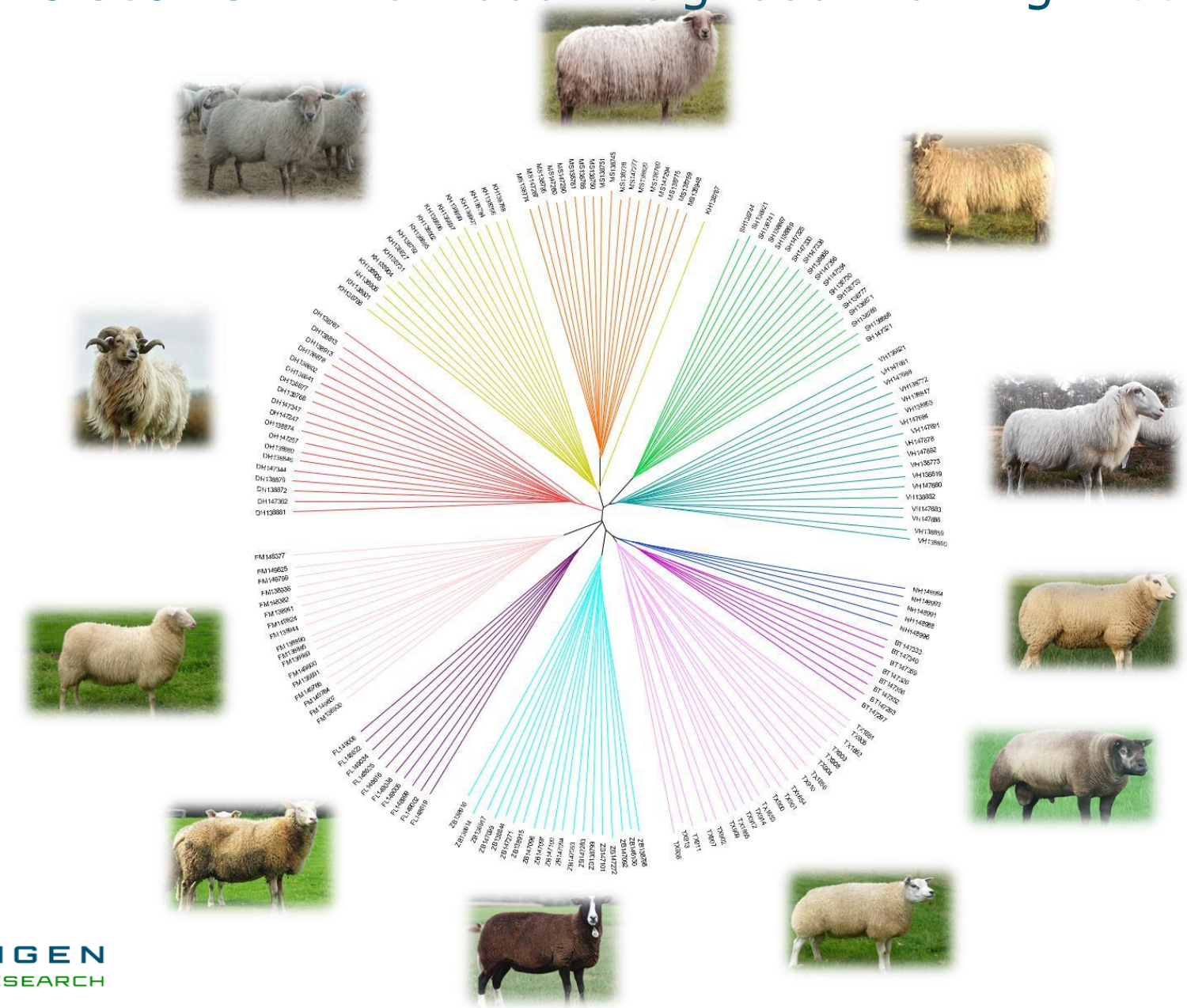
PCA2
4.1% of the variation





Genetic structure matches geography

Genetic structure - Individual Neighbour Joining Tree



Genetic diversity within breeds

- Average kinships within breeds
- Lower kinships are seen in either
  - Breeds with larger population sizes
  - Or breeds with genetic management
- Higher kinships are seen in breeds with small population sizes and small sample size in our study

Genetic variation matches genetic management

Breed	Av. Kinship
Zwartbles	0.68
Blue Texel	0.77
Texel	0.59
North Holland	0.81
Flevolander	0.64
Friesian Milk sheep	0.73
Mergelland Sheep	0.74
Kempen Heathsheep	0.60
Veluwe Heathsheep	0.60
Schoonebeeker Heathsheep	0.72
Drenth Heathsheep	0.63

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Genetic diversity between breeds - Contributions

- Kinships between breeds
- The average kinship is minimized by calculating the contributions of each breed (Eding et al)
- High contributions are seen in
  - larger breeds with high diversity
  - breeds with unique origins
- Low contributions are seen in
  - smaller breeds
  - breeds with high kinships with other breeds

Breed	Contributions
Zwartbles	7.44%
Blue Texel	1.78%
Texel	15.47%
North Holland	4.14%
Flevolander	18.53%
Friesian Milk sheep	9.54%
Mergelland Sheep	3.90%
Kempen Heathsheep	10.54%
Veluwe Heathsheep	8.47%
Schoonebeeker Heathsheep	6.99%
Drenth Heathsheep	13.20%

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Conclusion

- The Dutch sheep breeds are clearly distinctive.
- The genetic structure of sheep breeds matches their geography, history, use and genetic management.
- These insights are valuable for assessing the effects of selection and genetic management measures.
- Insight in the between breed relationships can be used to support the optimal use of the genebank material.

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