



Με τη χρηματοδότηση της
Ευρωπαϊκής Ένωσης
NextGenerationEU



ΥΠΟΥΡΓΕΙΟ ΓΕΩΡΓΙΑΣ
ΑΓΡΟΤΙΚΗΣ ΑΝΑΠΤΥΞΗΣ
ΚΑΙ ΠΕΡΙΒΑΛΛΟΝΤΟΣ

Intra-island patterns of genetic divergence in Cyprus Chios sheep: minimizing genetic background noise to enable more precise genetic improvement

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75th EAAP Annual Meeting
1/5 September 2024 - Florence, Italy

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Presentation Outline

- Introduction
 - Biodiversity – Food Security – Primary Sector
 - Cyprus
- Objective
- Genotypic data - Methodology
- Results
 - Tool Development
 - Investigating farms from Cyprus
- Conclusions

Introduction

Mediterranean



Introduction



- Temperature rise
- Lower precipitation
- Desertification
- Human Population increase
- Land use alternation

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Primary Sector



Introduction

Mediterranean



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- Lower precipitation
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- Land use alternation



Introduction



Traditional Halloumi Cheese



- Product of Sheep and Goat milk
- Halloumi is the third biggest source of income from exports
- Recently registered as Protected Designation of Origin product

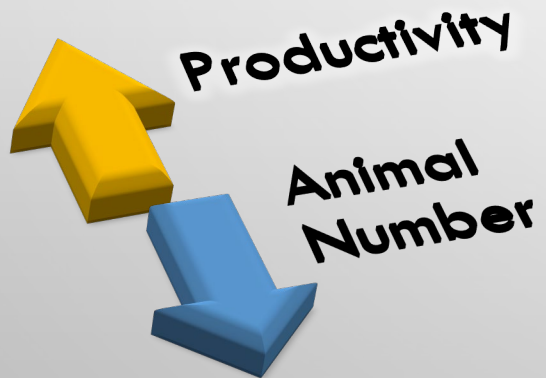
Introduction



Traditional Halloumi Cheese



- Product of Sheep and Goat milk
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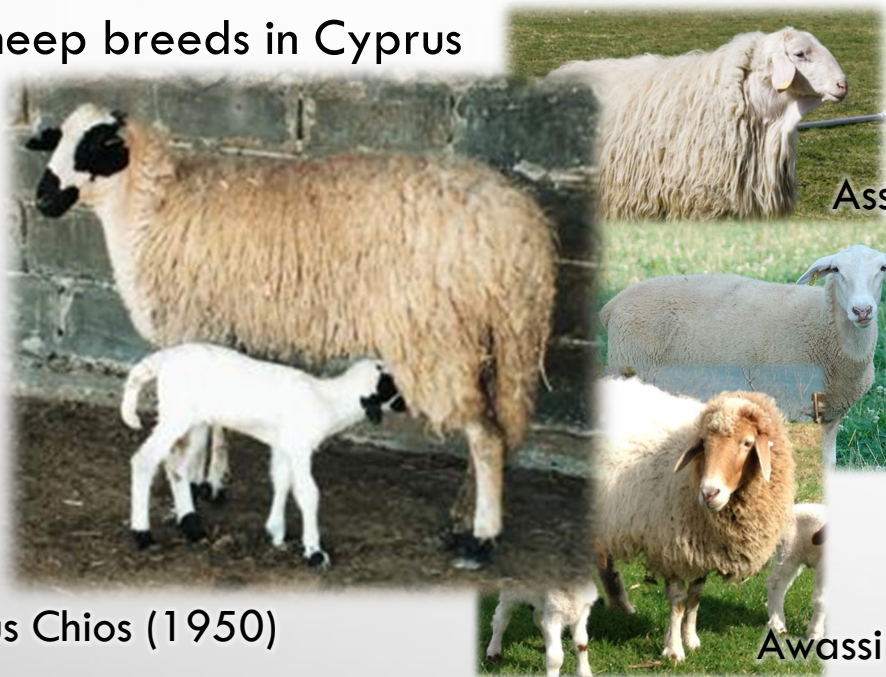
Arising Needs

1. Increase the production of sheep and goat milk
2. Improve Livestock management
3. Decrease farm expenses

Introduction

Sheep breeds in Cyprus

Local
Cyprus Chios (1950)



Assaf

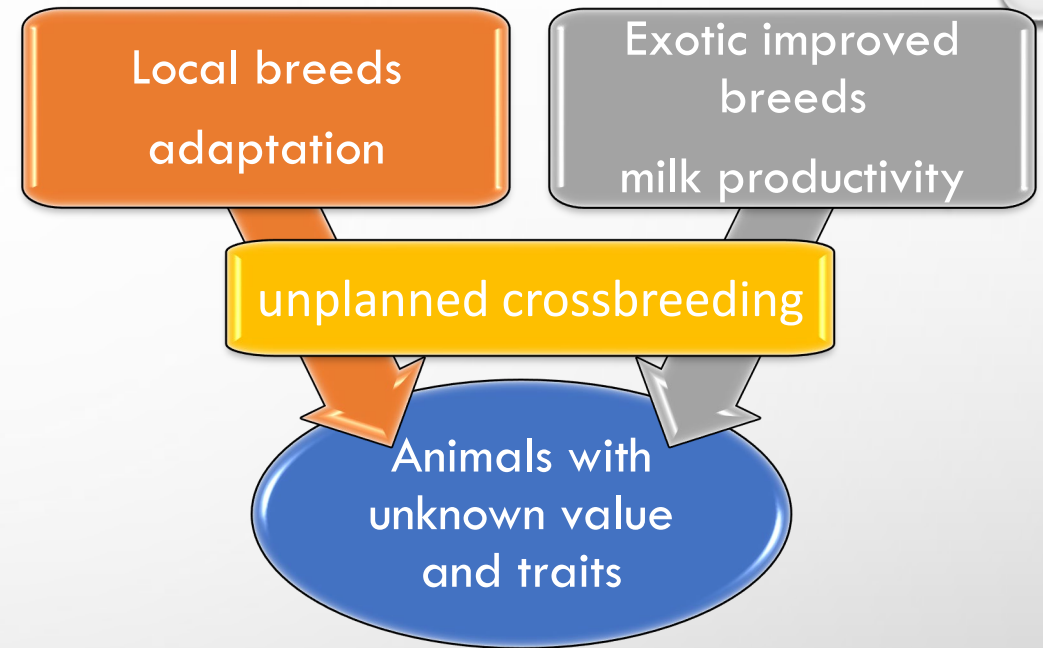
Lacaune

Awassi

Introduction

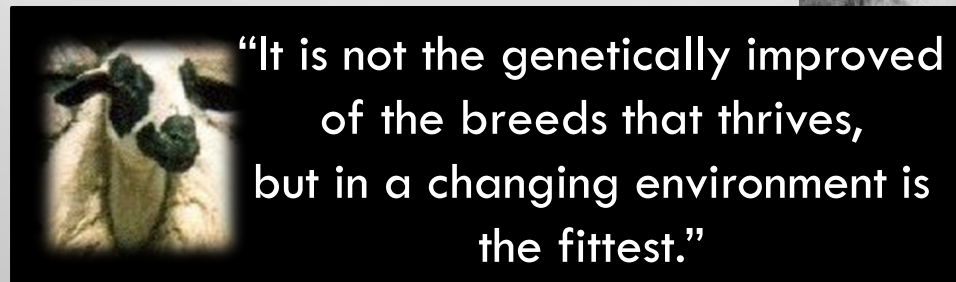
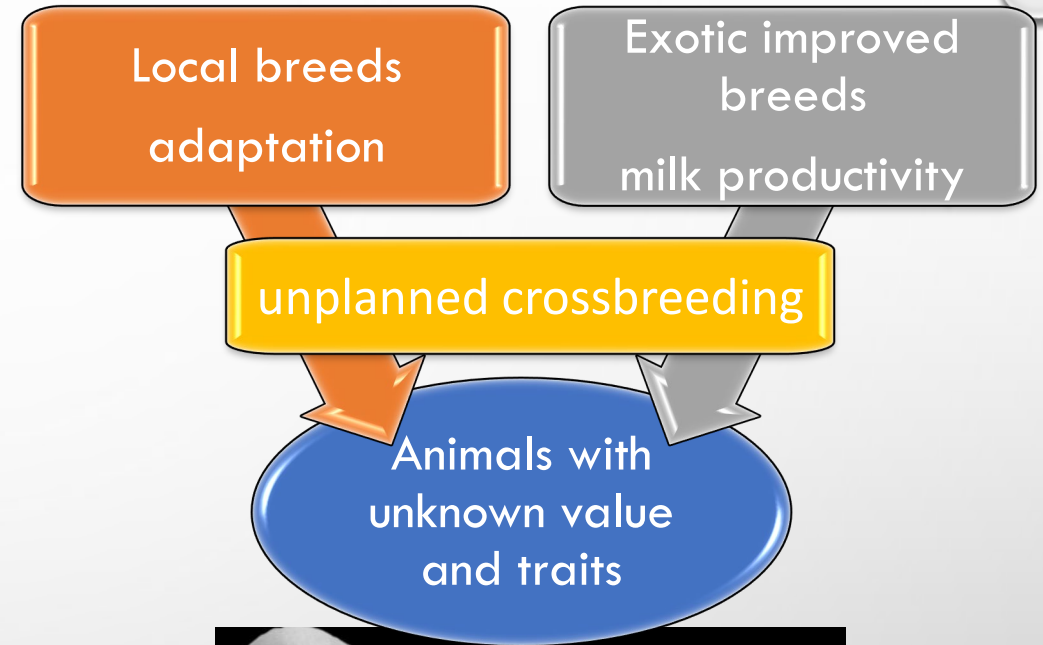
Sheep breeds in Cyprus

Local
Cyprus Chios (1950)



Introduction

Sheep breeds in Cyprus



Objective

Local Chios Cyprus breed

- More adapted
- Not yet genetically improved
- Gene pool drifting away

Conservation program of local breeds



Objective

Local Chios Cyprus breed

- More adapted
- Not yet genetically improved
- Gene pool drifting away

Conservation program of local breeds



Tool development to identify individuals from Chios Cyprus breed in a **quick** and **cost effective way** to genomically differentiate this local breed from the admixture population in local farmers' livestock in order to maximize the effect of the genetic improvement program.

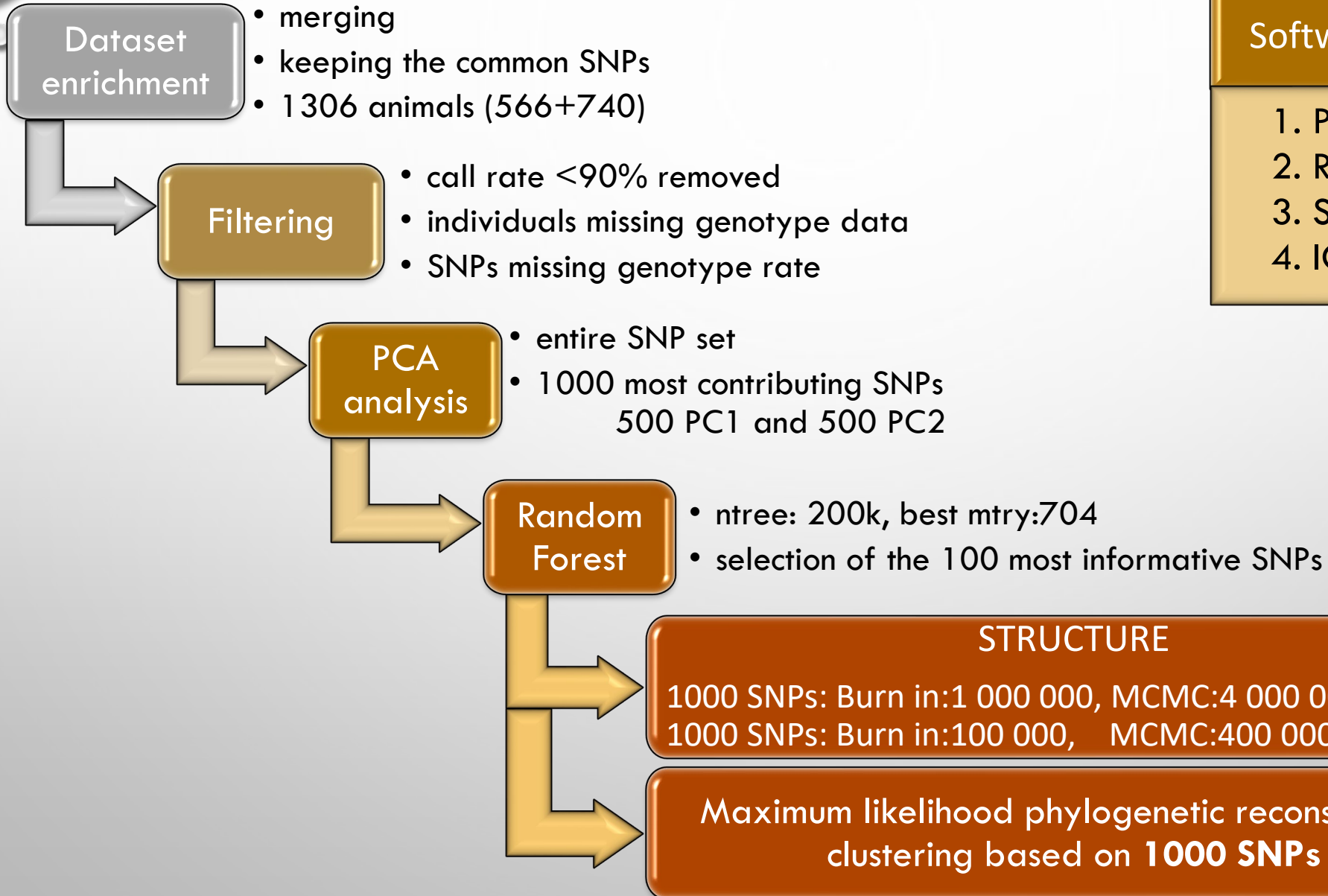
Genotypic Data

1. Cyprus Chios Sheep Ass. 566 blood samples
OvineSNP50v3 (63K) Illumina SNP microarrays
2. Mediterranean orientated breeds 740 samples
ISGC HapMap Illumina OvineSNP50 (49k)



Sheep Breed	Location
Black Headed Mountain	Spain
Castellana	Spain
Rasaaragonesa	Spain
Milk/Meat Lacaune	France
Rambouillet	France
Sardinian Ancestral Black	Italy
Altamura	Italy
Comisana	Italy
Leccese	Italy
Chios Greece	Greece
Chios Turkey (Sakiz)	Turkey
Karakas	Turkey
Improved/Local Awassi	Lebanon
AfecAssaf	Israel
Egyptian_Barki	Egypt
Chios Cyprus	Cyprus
Cyprus Fat Tail	Cyprus

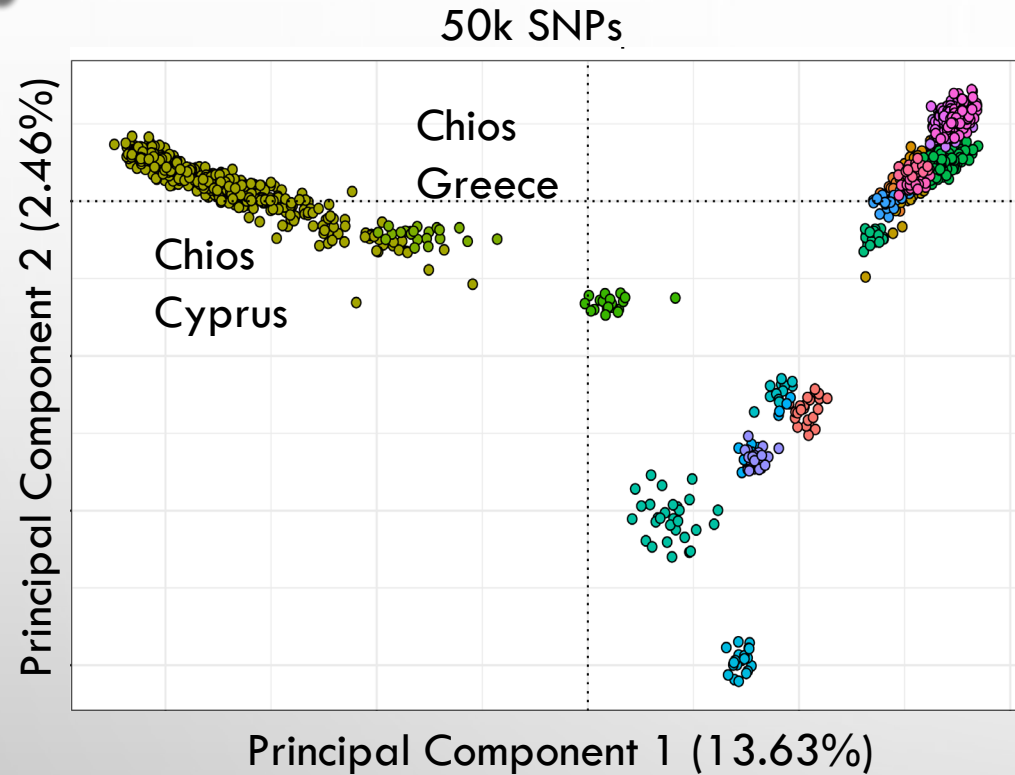
Methodology



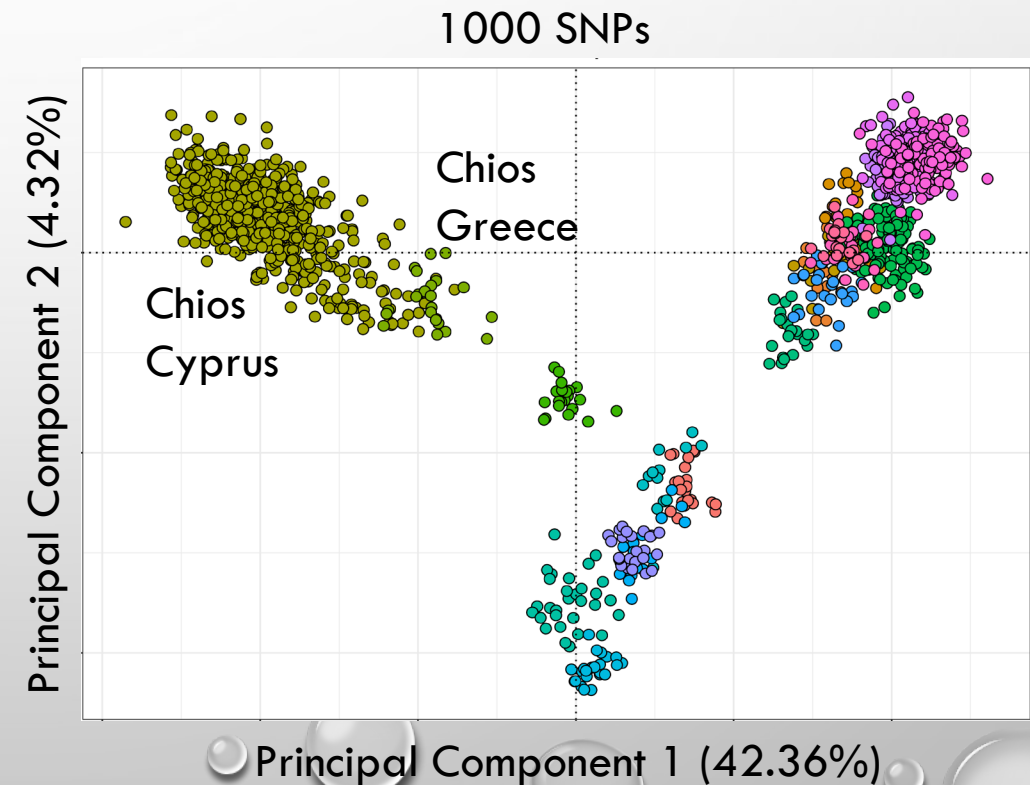
Softwares/Algorithms:

1. Plink-PCA
2. Random Forest
3. Structure
4. IQ-tree web server

Stratification of 20 Sheep breeds using PCA

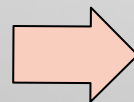


The information of the original 50k SNP set is retained in the 1000 set separating the ChCy and ChGr from the rest of the breeds in the analysis



50k SNP set

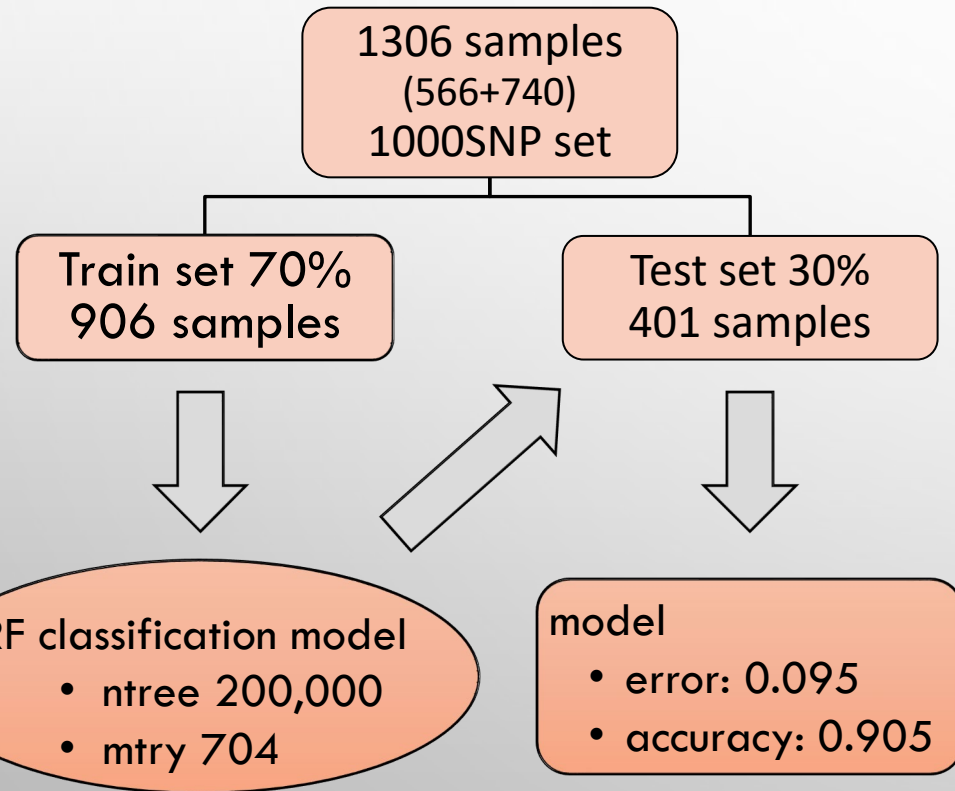
- 500 PC1 1st components
- 500 PC2 1st components



1000 SNP set

Random Forest classification model

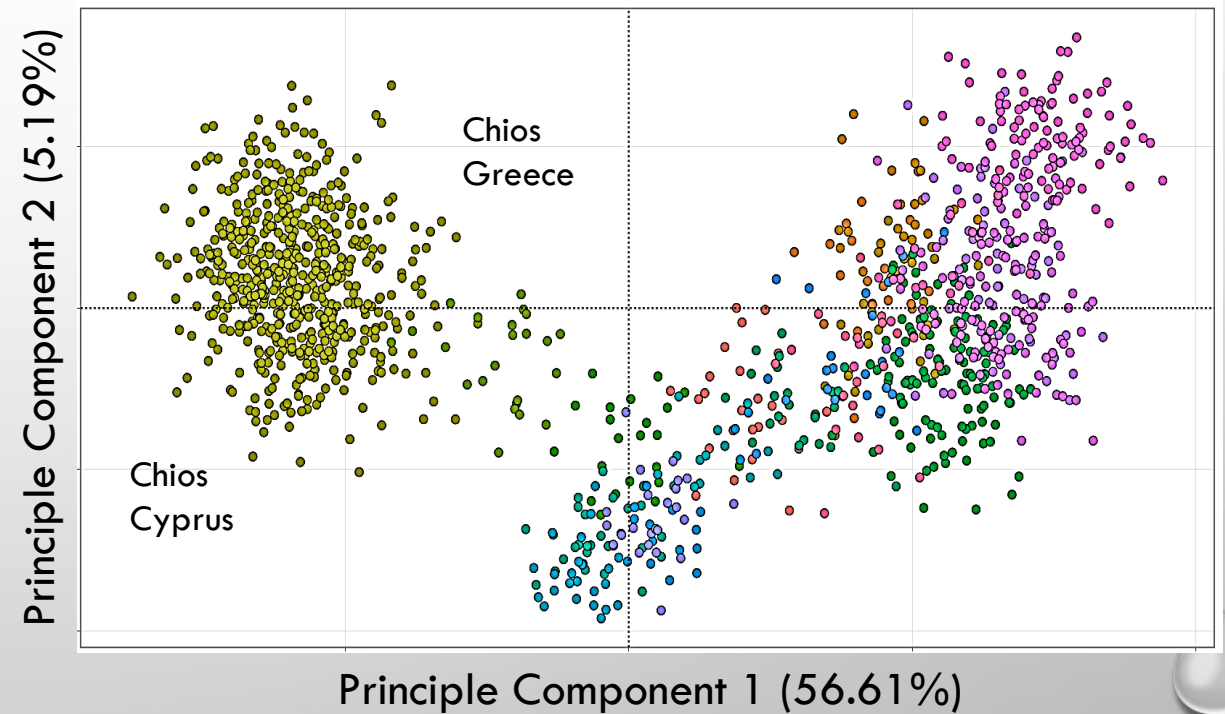
The model was built on the
1000 SNPs set



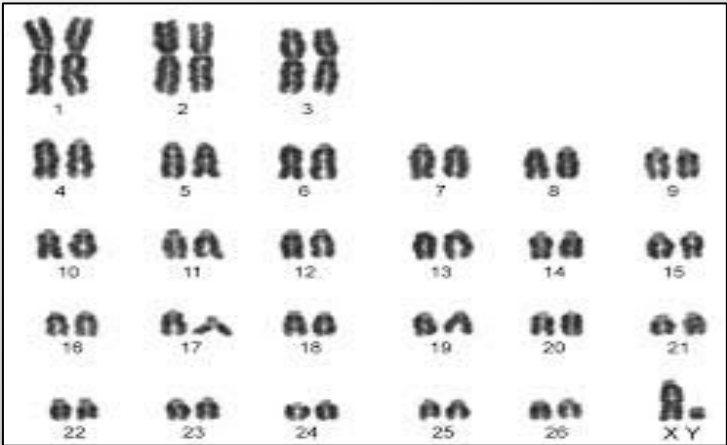
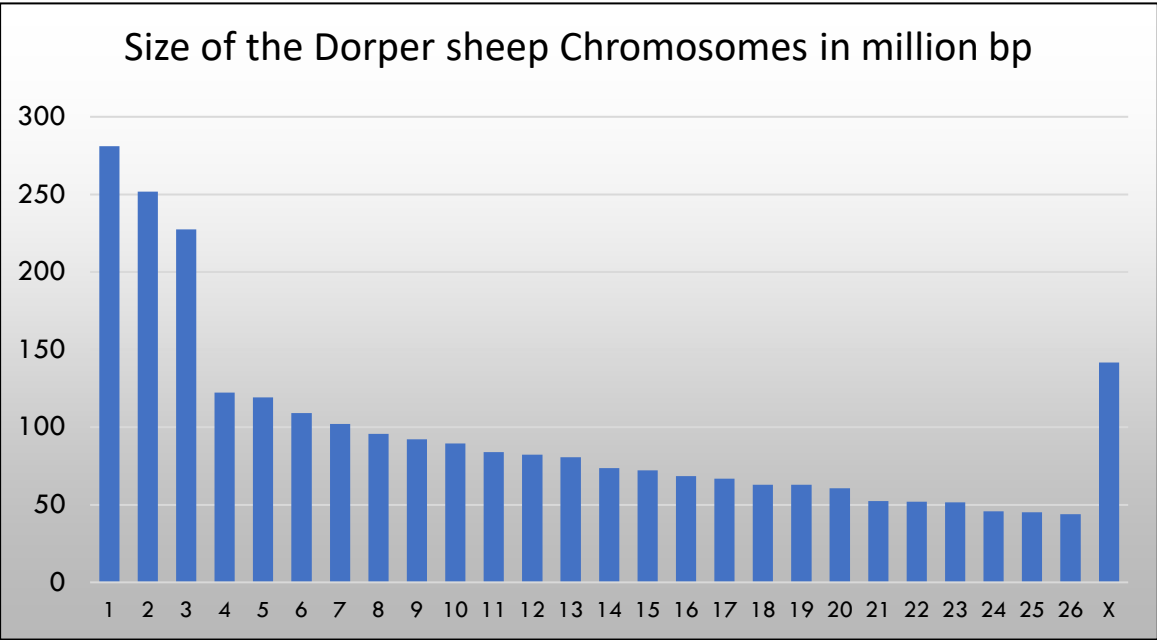
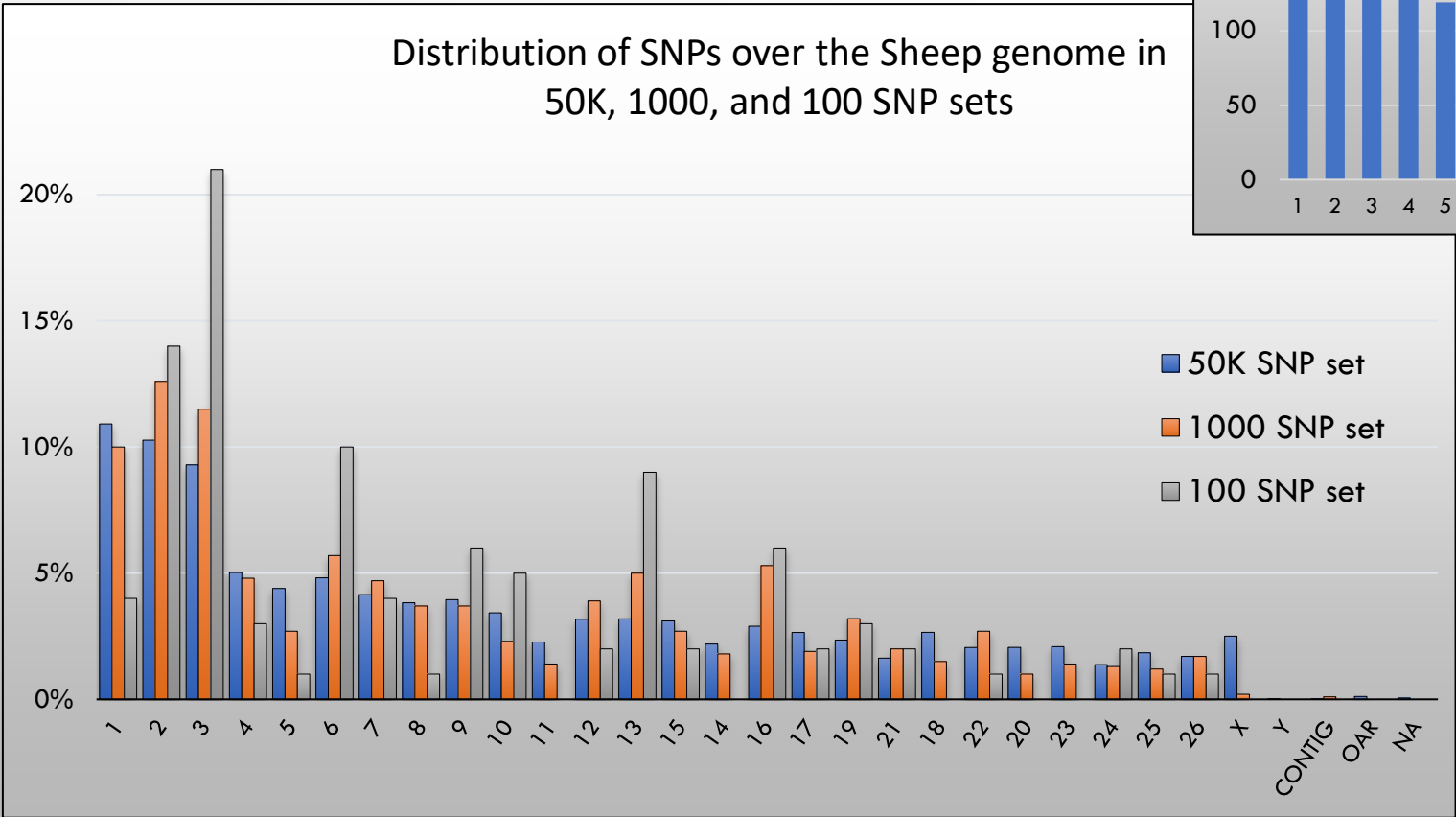
Chios_Cyprus: (171/8)

- error: 0.045
- accuracy: 0.955
- sensitivity: 1.0
- recall: 1.0
- F1: 1.0

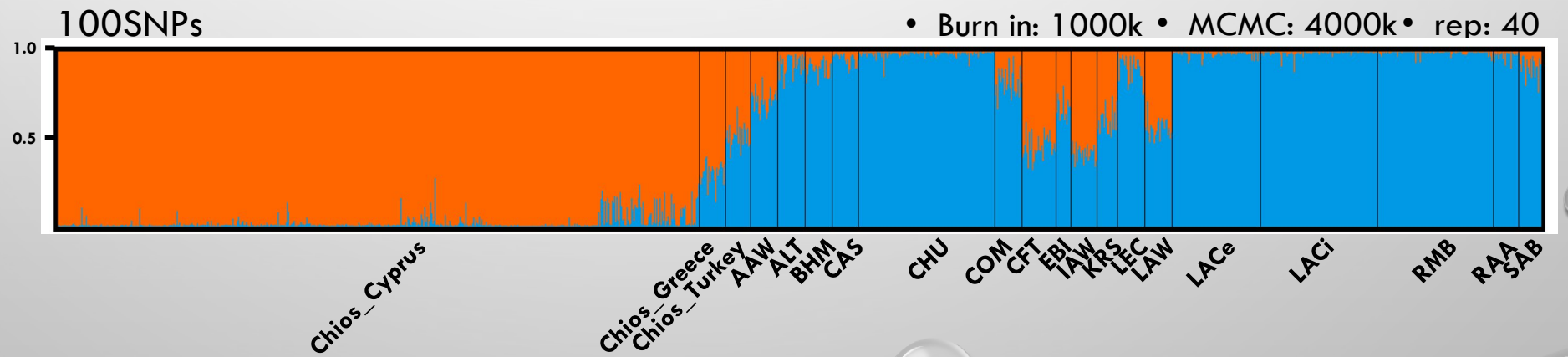
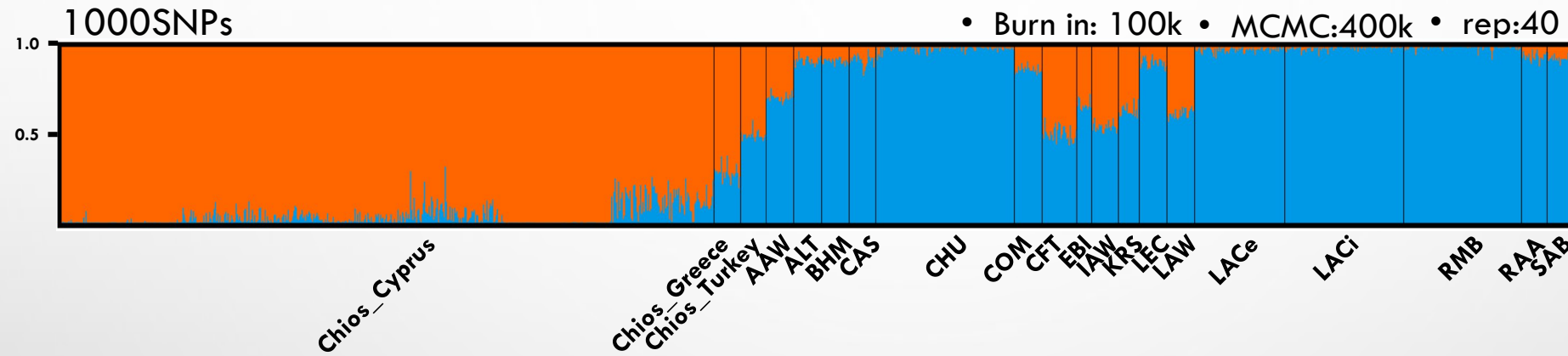
PCA 100 SNPs



Distribution of SNPs



Structure analysis of 20 Sheep breeds



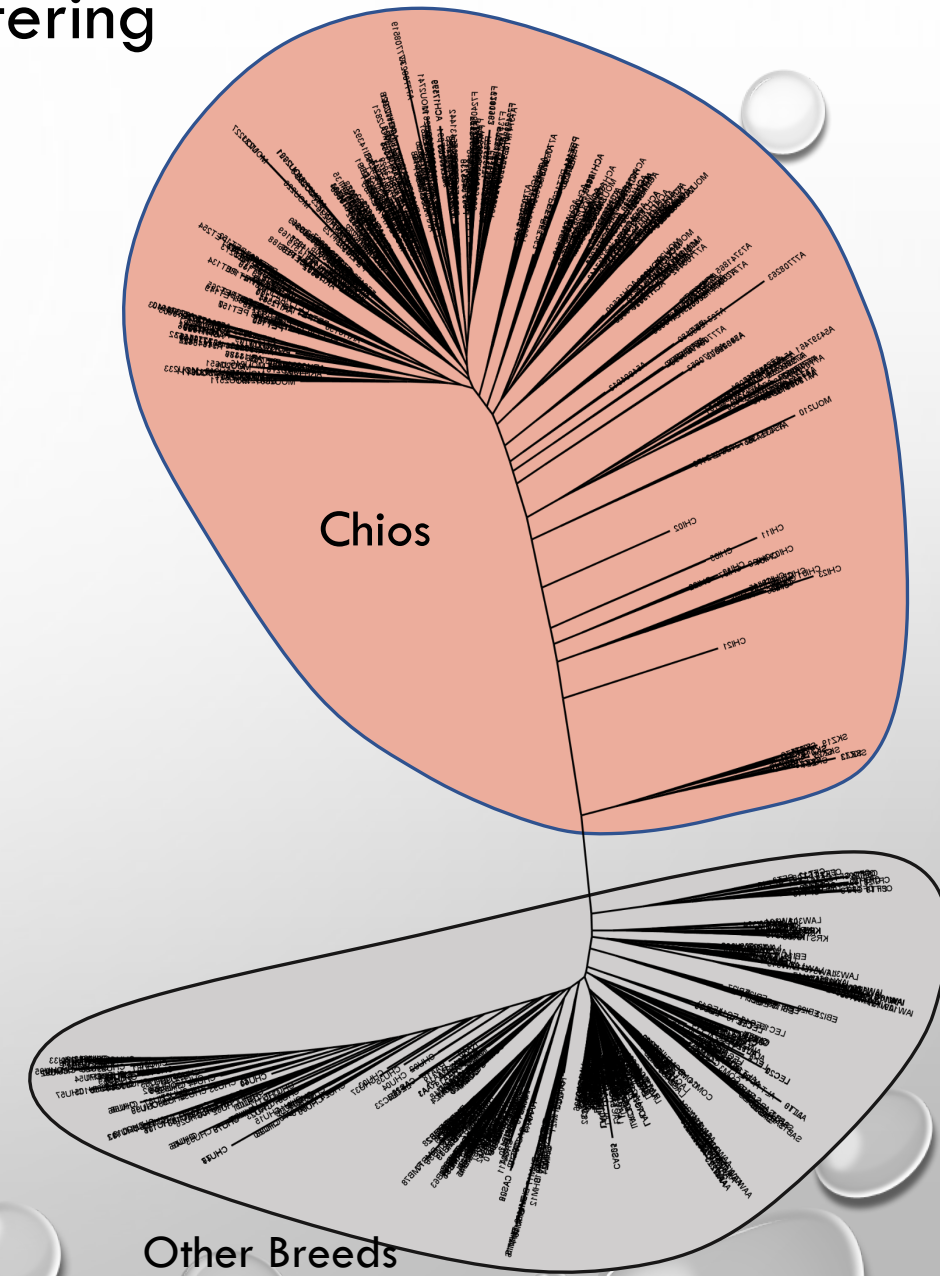
Maximum likelihood phylogenetic reconstruction/clustering

- 1000SNPs set
- Mediterranean Sheep Breed populations
- IQ-tree web server
- 1000 Bootstraps



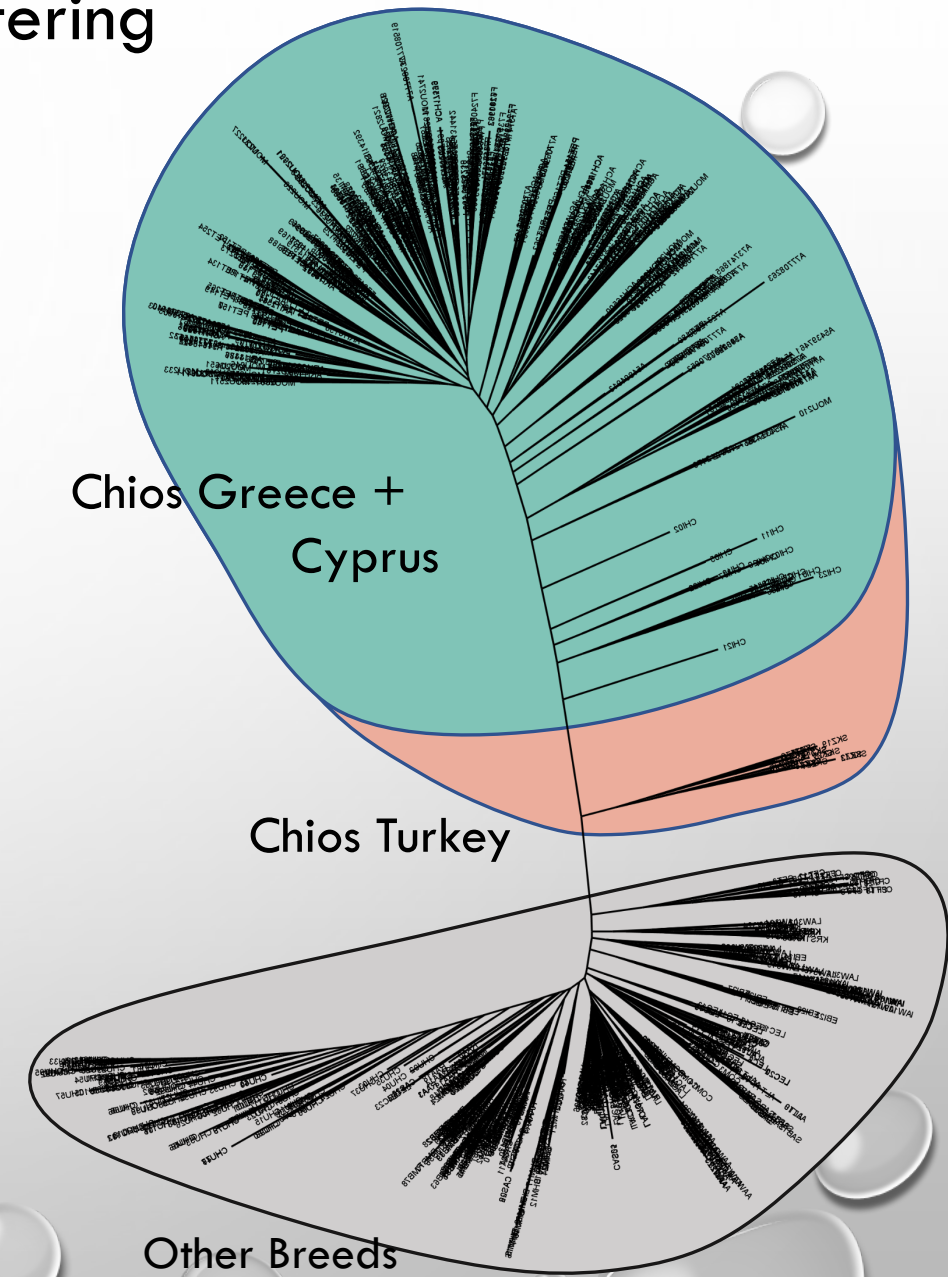
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Maximum likelihood phylogenetic reconstruction/clustering

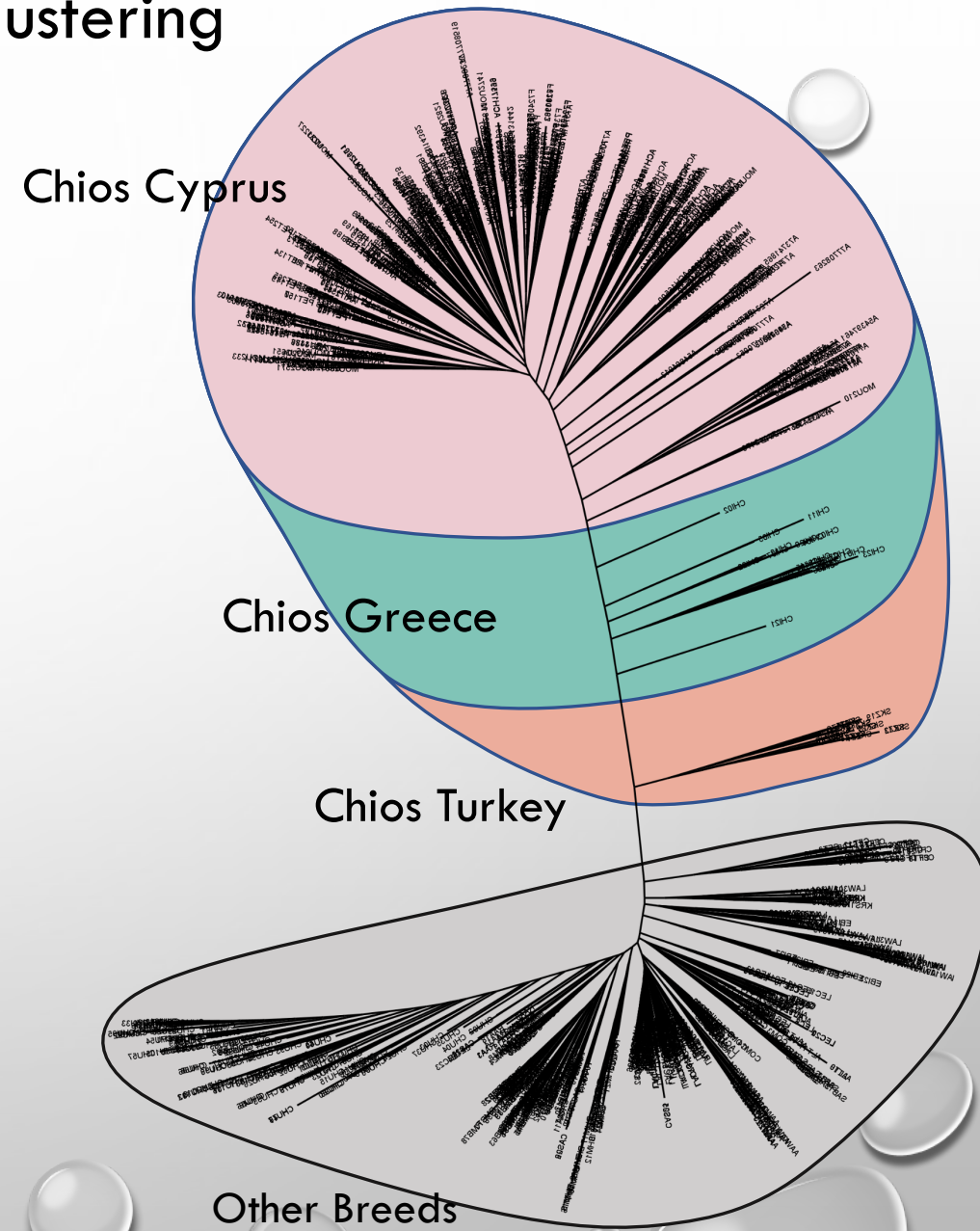
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Maximum likelihood phylogenetic reconstruction/clustering

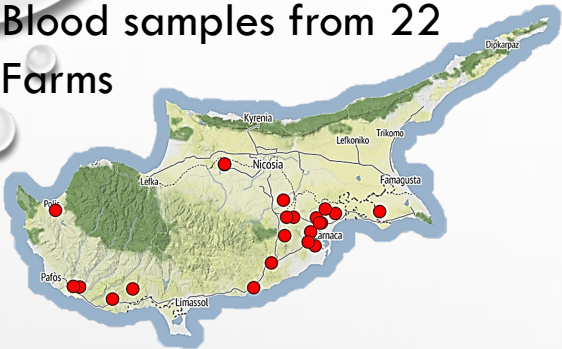
- 1000SNPs set
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**Regarding Cyprus Chios sheep
1000SNPs dataset it is adequate for
phylogenetic clustering at breed level**

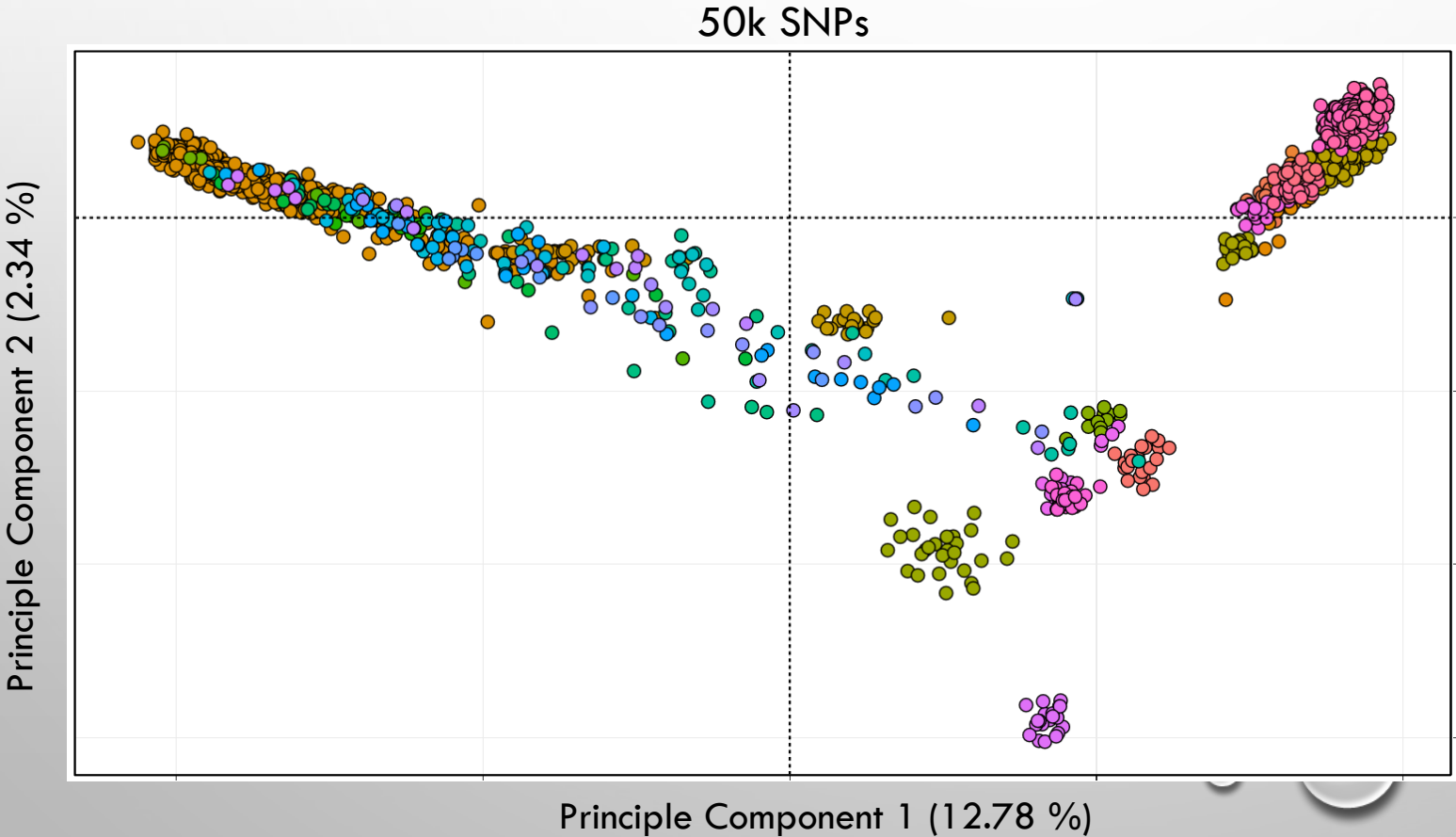


Investigating new data - PCA

Blood samples from 22 Farms



Reference DataSet & New DataSet



50k SNP set

1000 SNP set

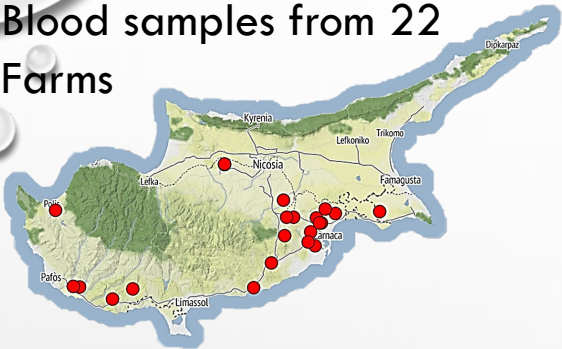
100 SNP set

Population Structure

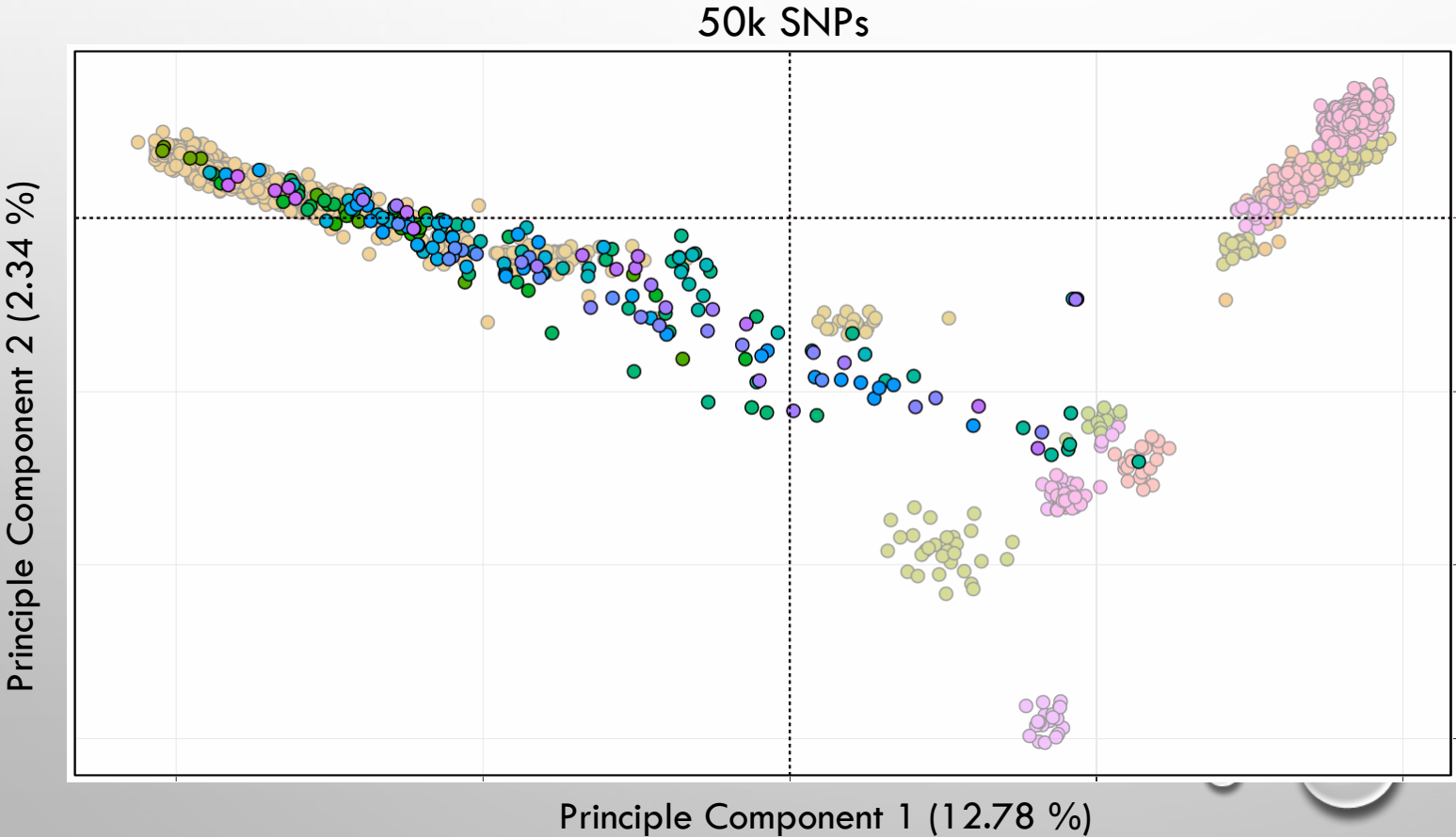
Selected animals

Investigating new data - PCA

Blood samples from 22 Farms



Reference DataSet & New DataSet



50k SNP set

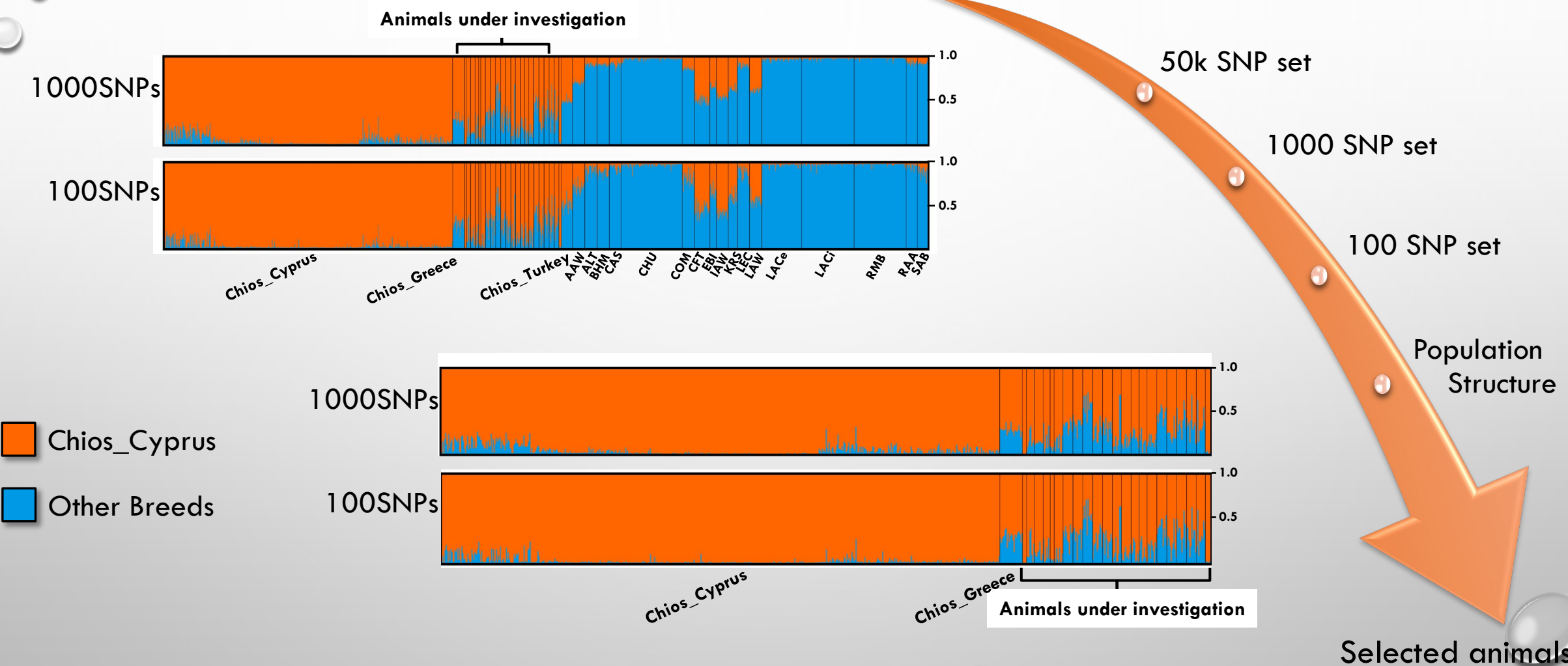
1000 SNP set

100 SNP set

Population Structure

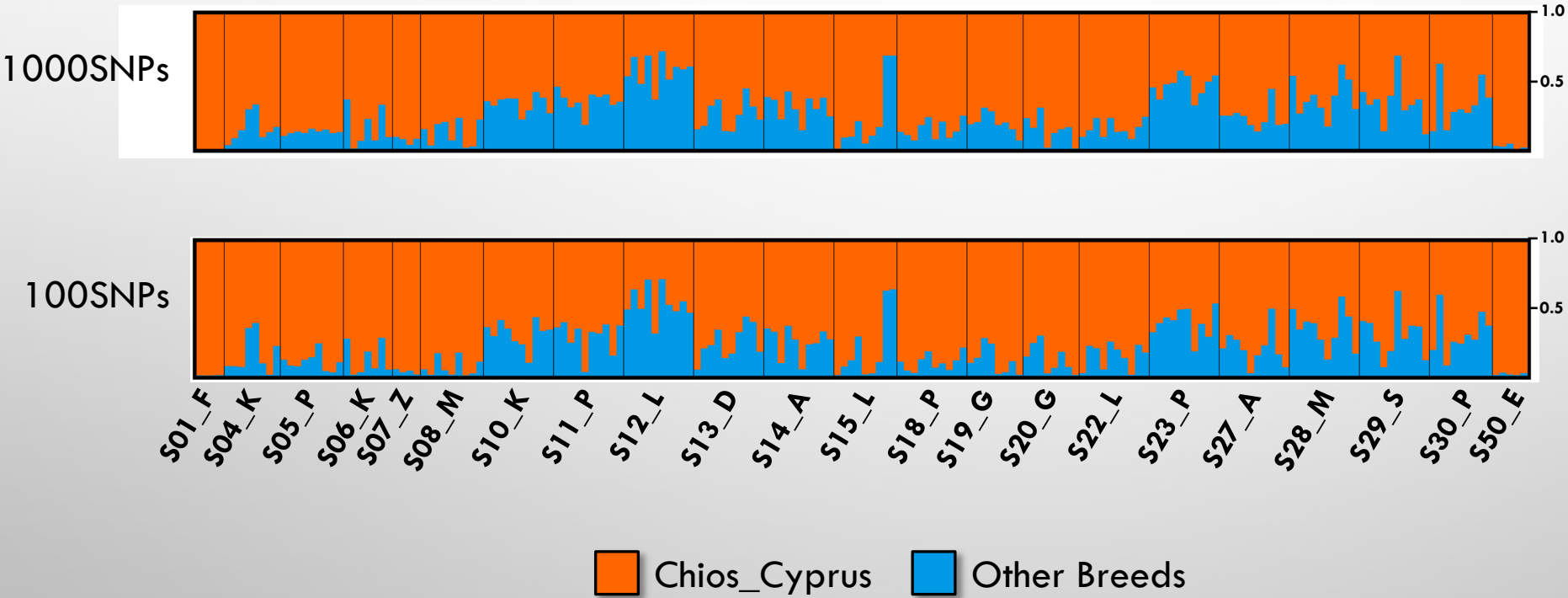
Selected animals

Investigating new data – Structure analysis



Investigating new data – Structure analysis

Reference DataSet &
New DataSet



50k SNP set

1000 SNP set

100 SNP set

Population
Structure

Selected animals

Conclusions

- PCA analysis sensitivity identifies the divergence between Chios Sheep and other breeds included in the analysis based on all three SNPs sets, (50k, 1000, 100)
- 1000-SNPs-set appears to be adequate for phylogenetic clustering at breed level regarding Cyprus Chios sheep
- Chios sheep are genetically distinct from all other Mediterranean sheep breeds
- Chios sheep from Greece appear to be genetically more similar to Cypriot breed followed by those of Turkey
- The 100 SNP set is adequate to genomically differentiate the local Chios Cyprus breed from the admixture population in the local farms and help the improvement program
- This tool could be used for identifying such small SNP sets for other breeds under conservation or improving programs

Acknowledgments



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Animal Production

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- Dr Theodoulakis Christofi
- Dr. Pantelis Savvides
- Panayiota Markou
- Dr. Savanna Andreou
- Dr Stavria Panayidou



Κυπριακή Δημοκρατία



Thank you!