



THE UNIVERSITY
of EDINBURGH



Exploring Global Cattle Genealogy with Tree Sequence

Gabriela Mafra Fortuna,

Jana Obsteter, Andreas Kranis and Gregor Gorjanc

EAAP Lyon, 2023

[@HighlanderLab](https://twitter.com/HighlanderLab)

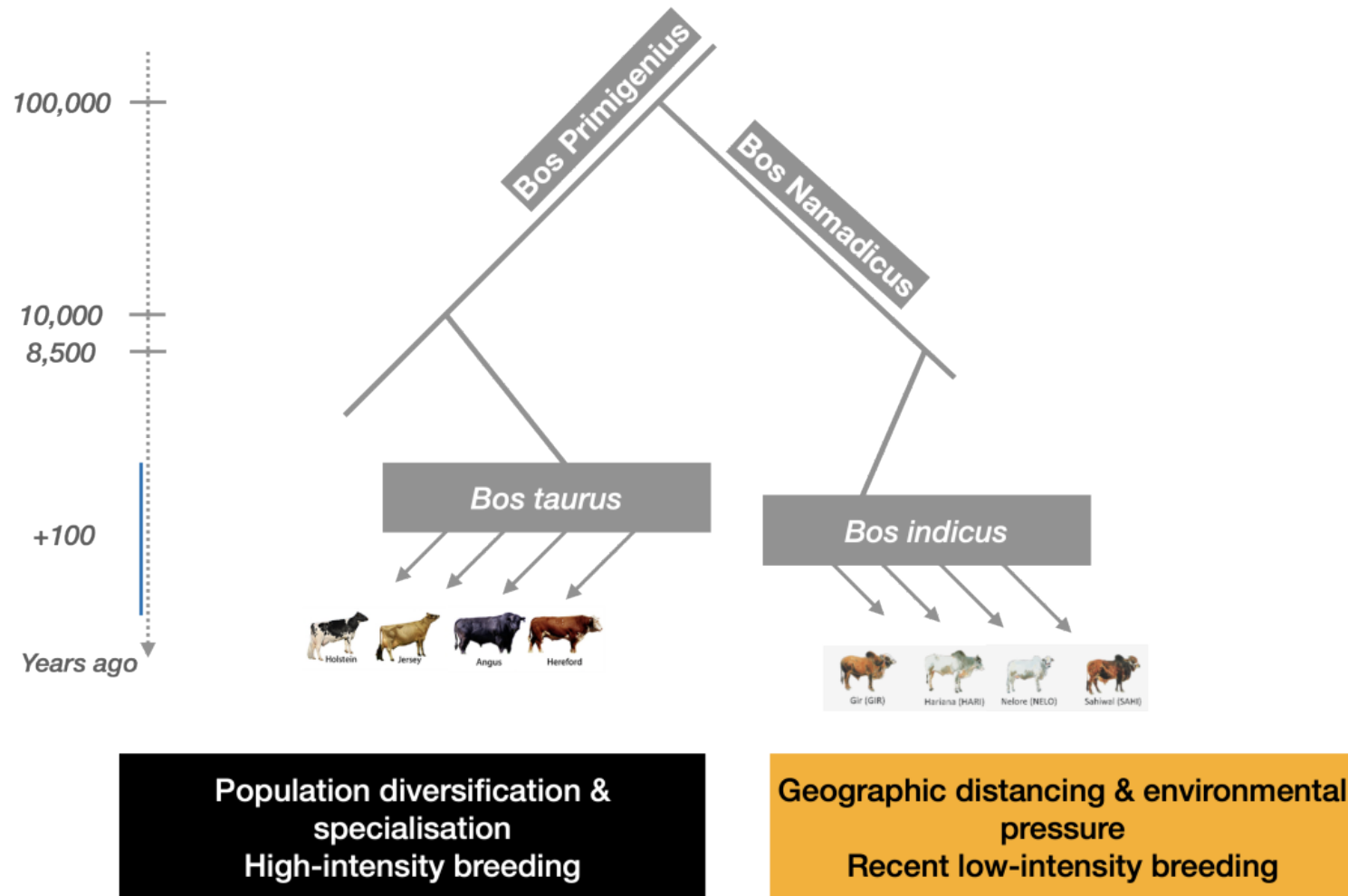


Acknowledgements



Overview

Improve genetic evaluation of taurine-indicine crossbred dairy cattle

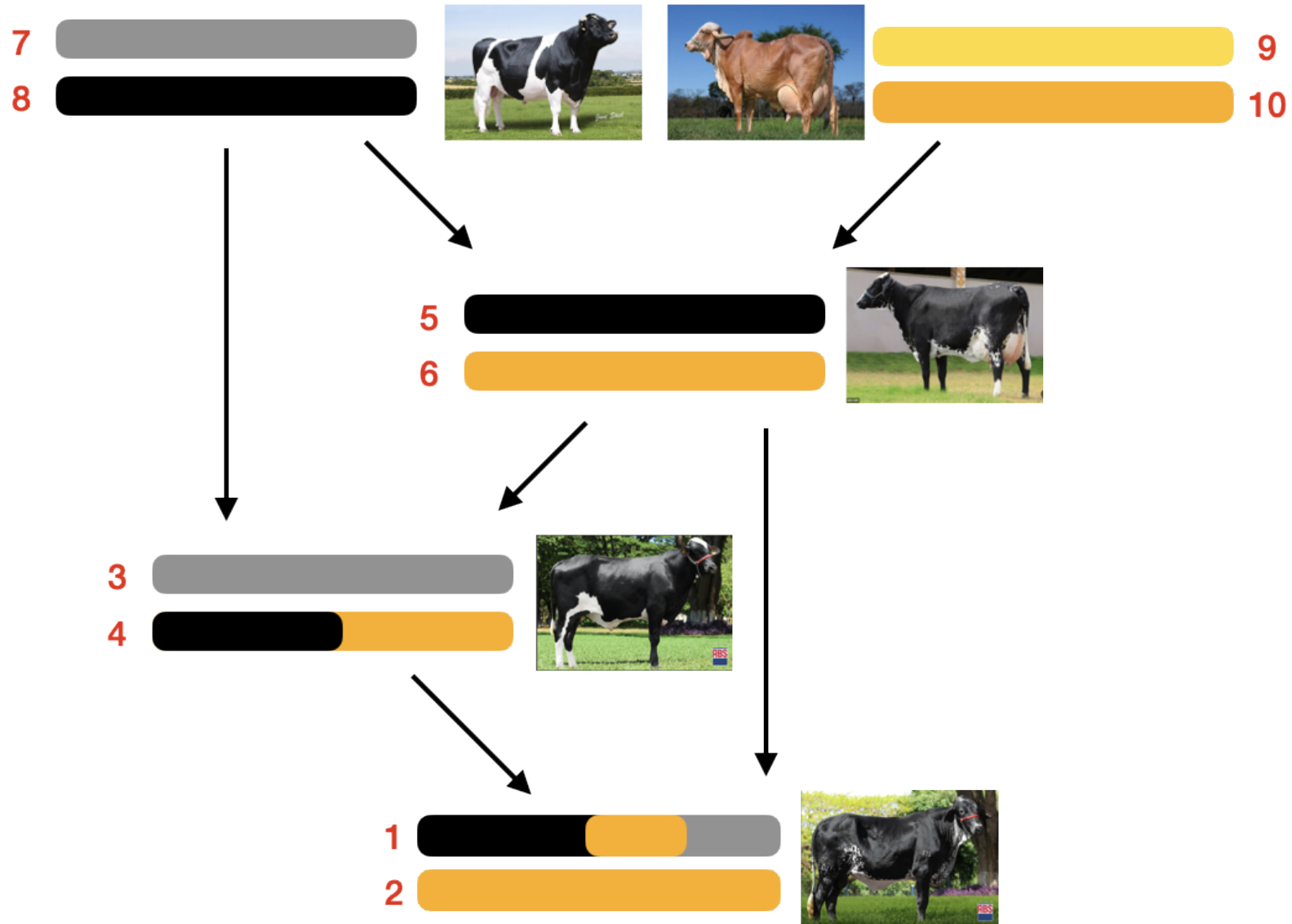


Overview

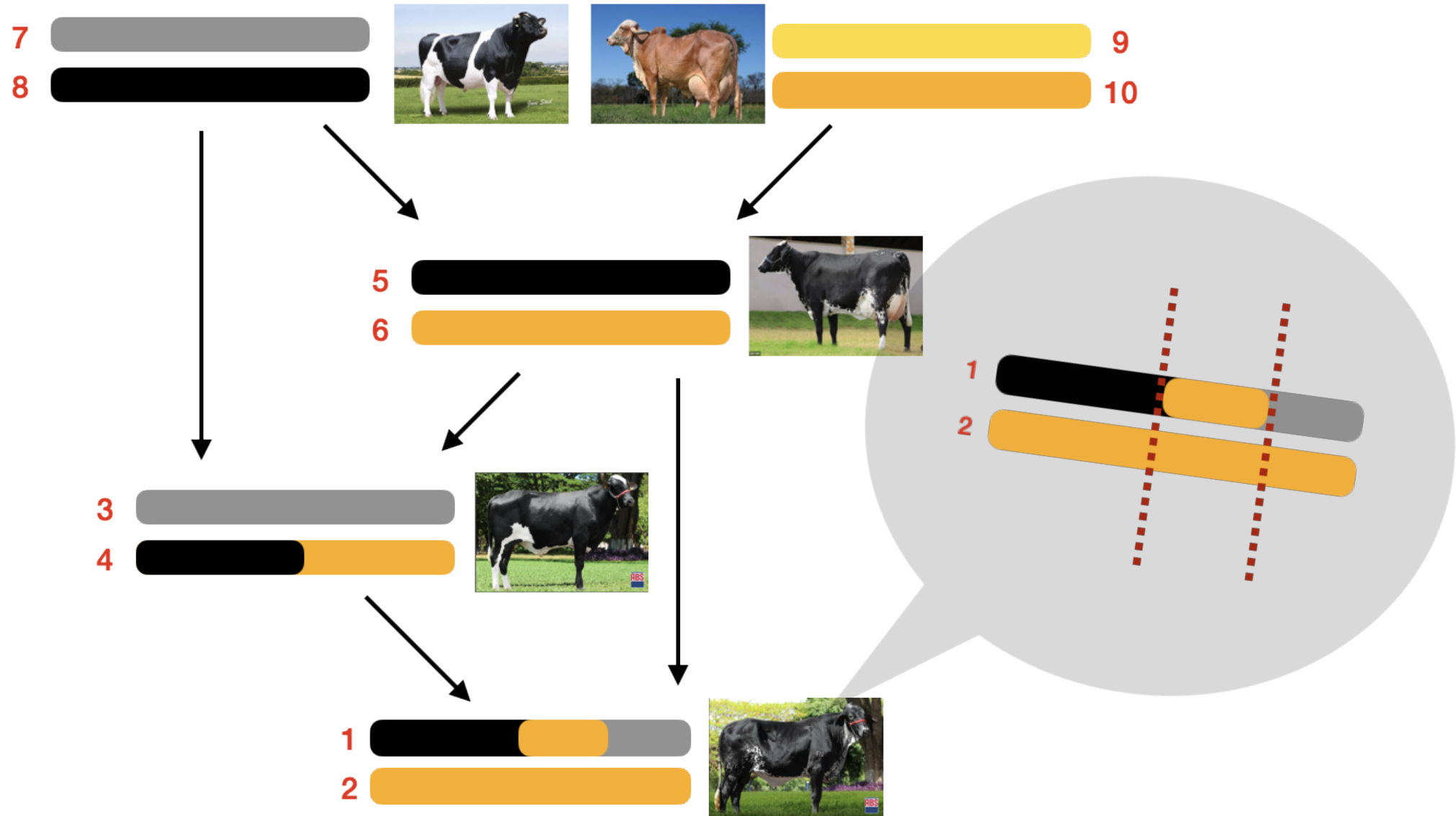
- Tropical dairy depends on crossbreds
- Brazil: 5th milk producer / 80% CB
- 2nd largest dairy herd, one of the largest crossbred herds
- How to improve crossbred evaluation?



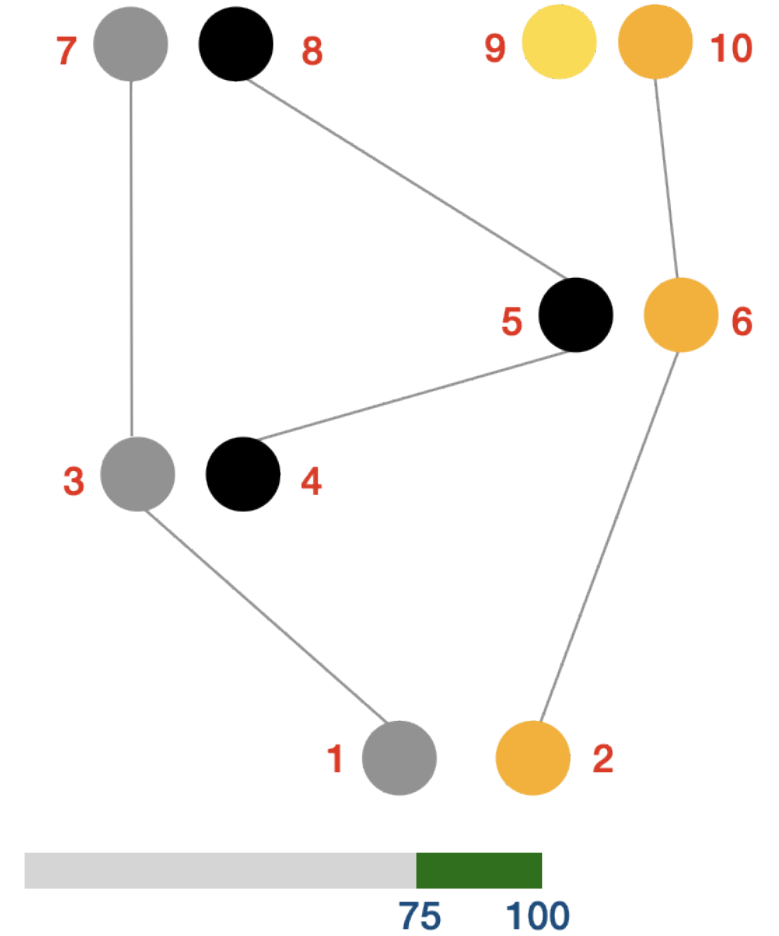
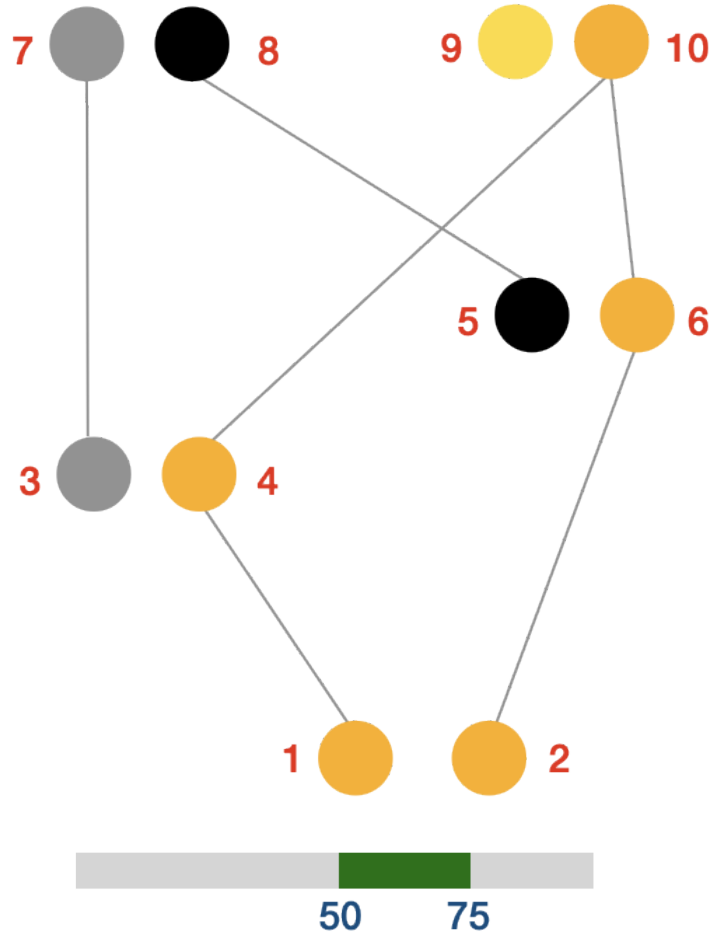
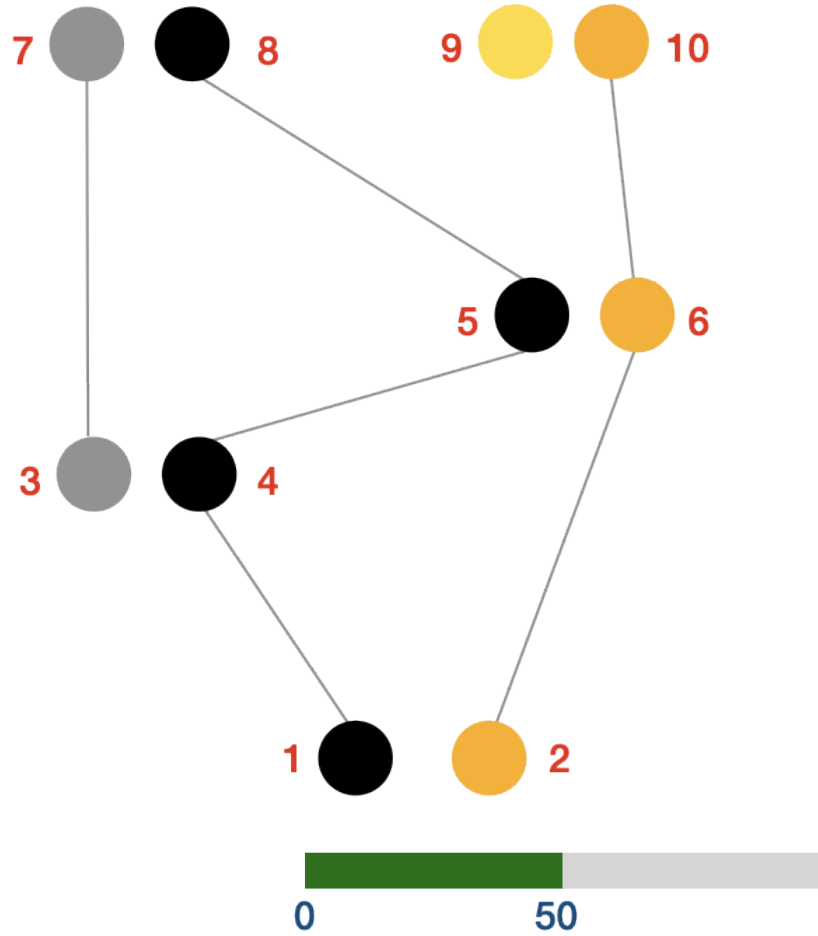
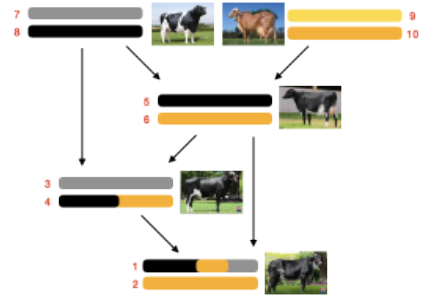
The genomic challenge



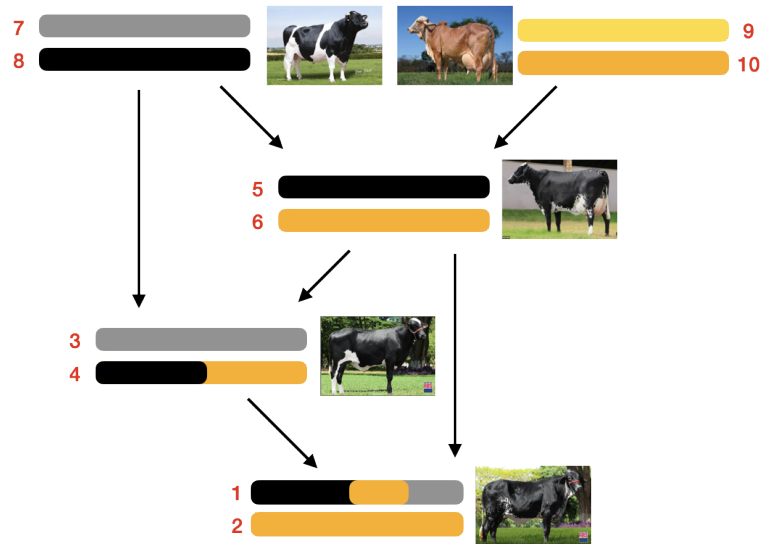
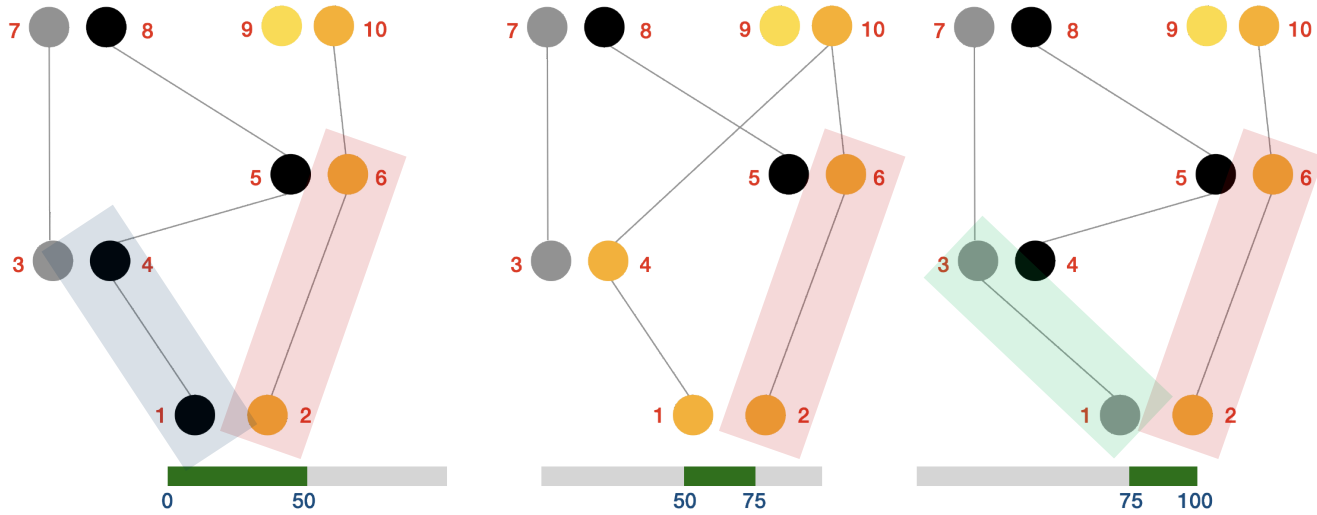
The genomic challenge



The genomic challenge



Tree sequence within a pedigree



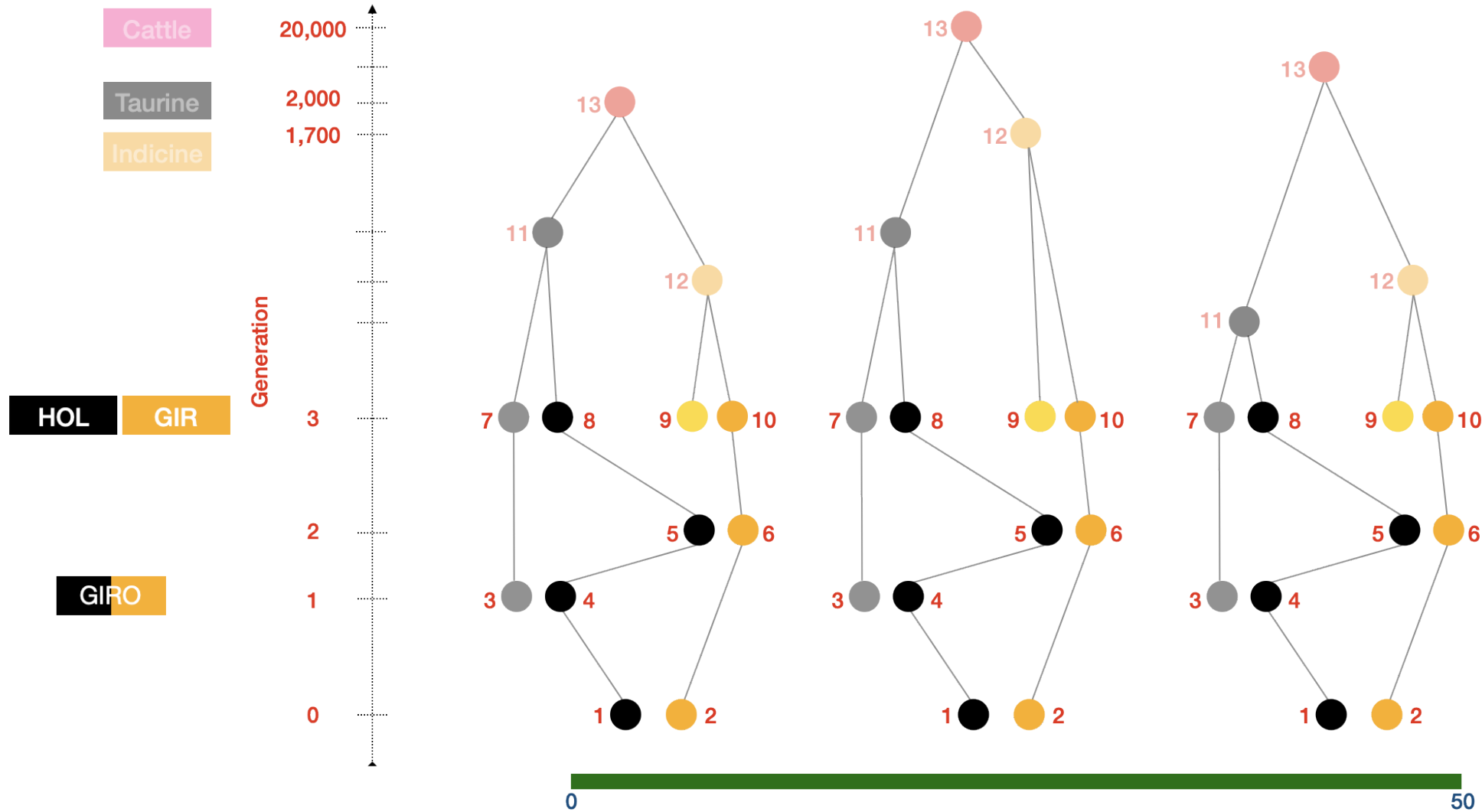
Nodes

Node	Time
10	3
9	3
8	3
7	3
6	2
5	2
4	1
4	1
3	1
2	0
1	0

Edges

Child	Parent	Left	Right
1	4	0	75
1	3	75	100
2	6	0	100
3	7	0	100
4	5	0	50
4	9	50	75
4	5	75	100
5	8	0	100
6	10	0	100

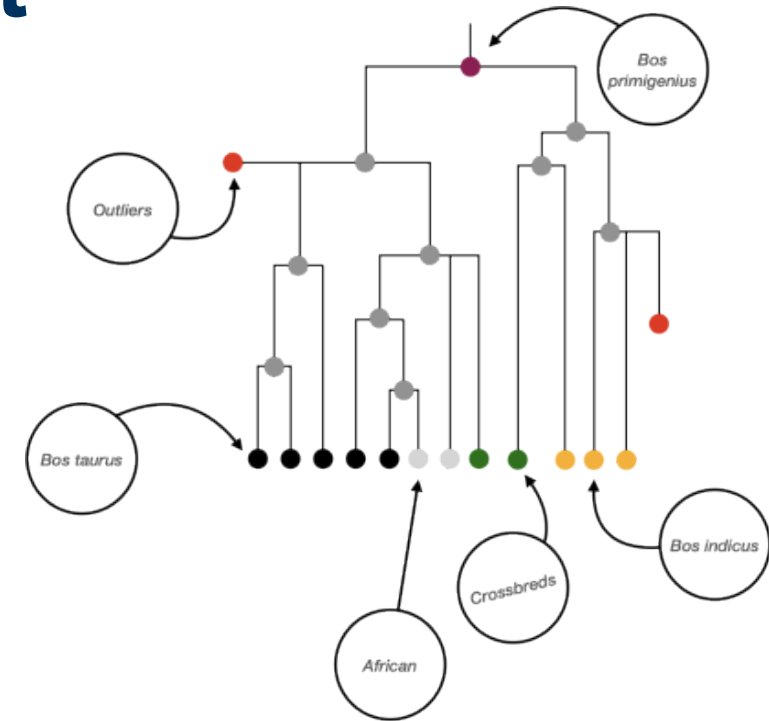
Tree sequence “recapitulation” (deep ancestry)



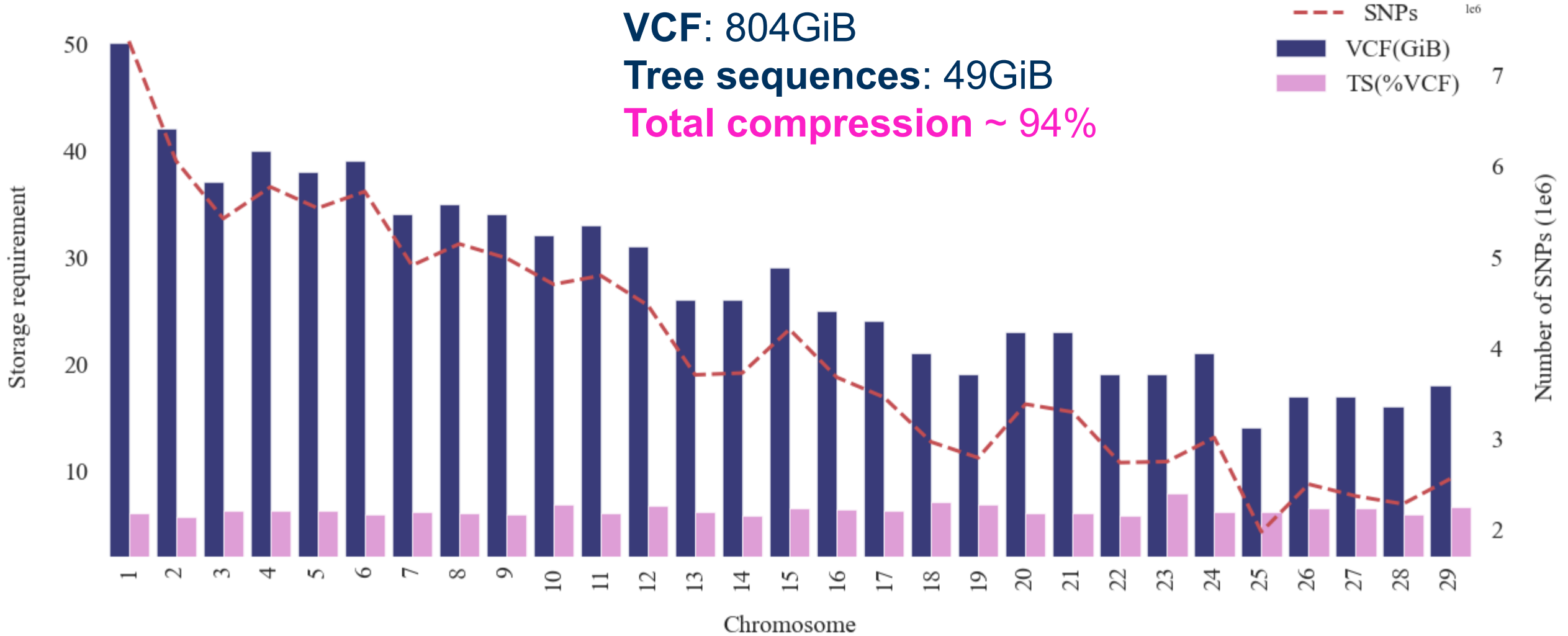
Global cattle whole-genome dataset

- 1K Bull Genome public data-set (Runs 8+9)
- 29 autosomal chromosomes ~116M variants

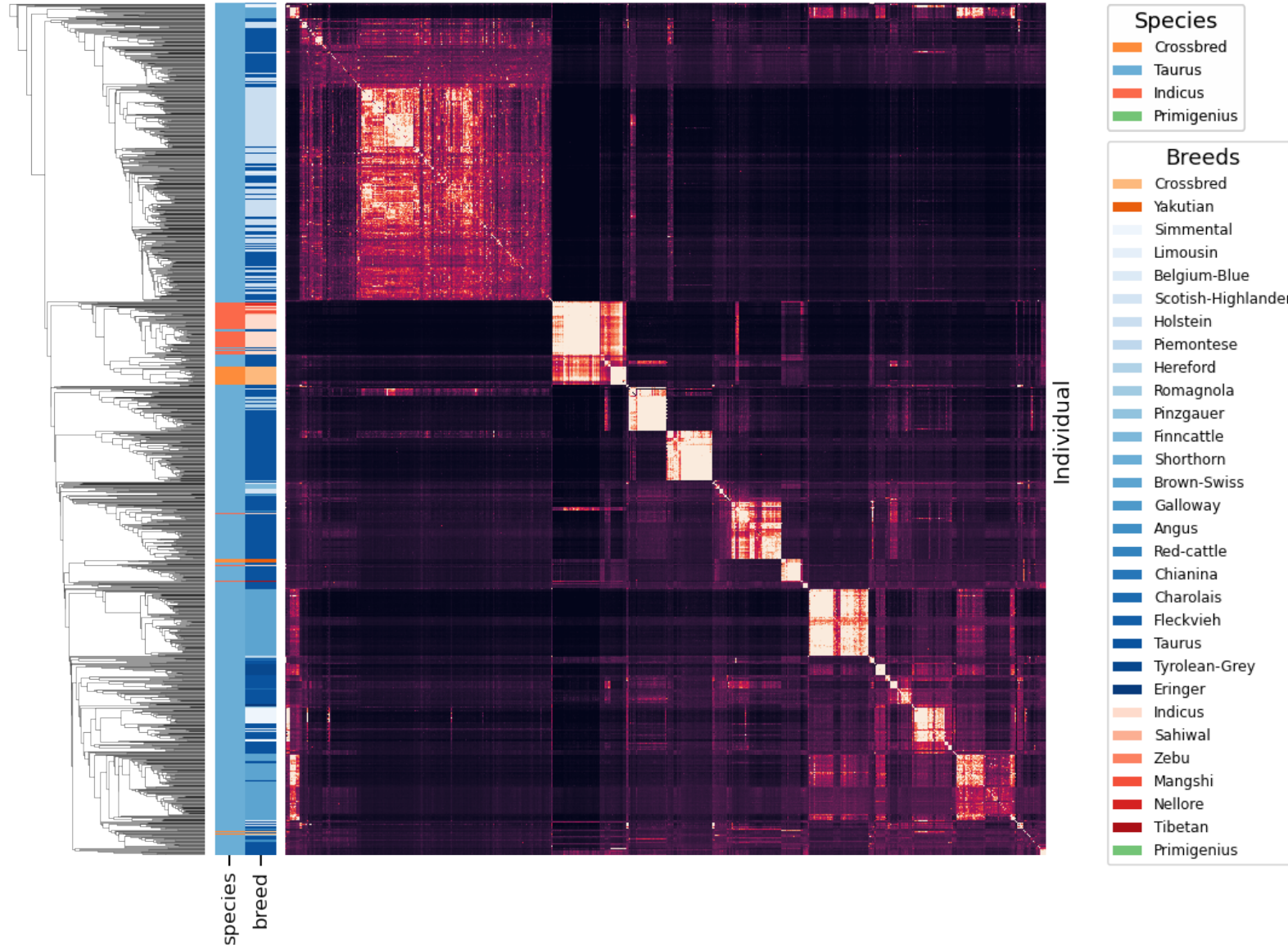
Subspecies	Breeds (r8)	Breeds (r9)	Ind (r8)	Ind (r9)
Bos taurus	58	28	1542	655
Bos indicus	13	18	103	150
African	4	16	15	102
Crossbred	17	-	112	-
Bos coreanae	1	-	33	-
Bos grunniens (outlier)	1	-	3	-
Bos primigenius	1	-	1	-
	95	62	1809	907
	157		2716	



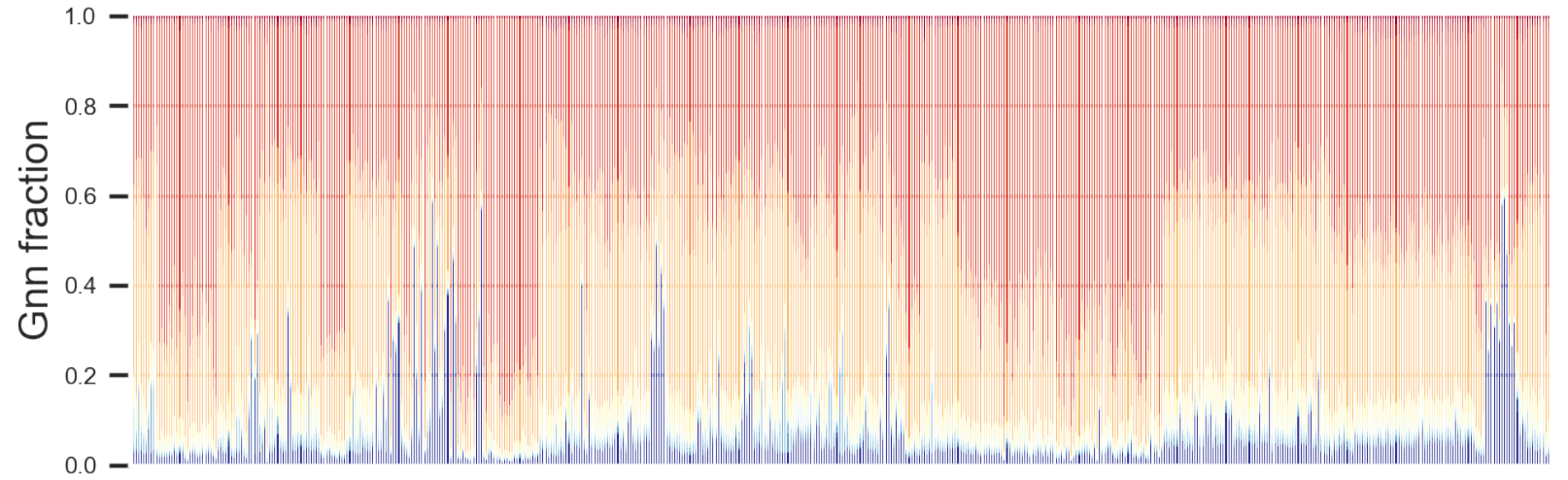
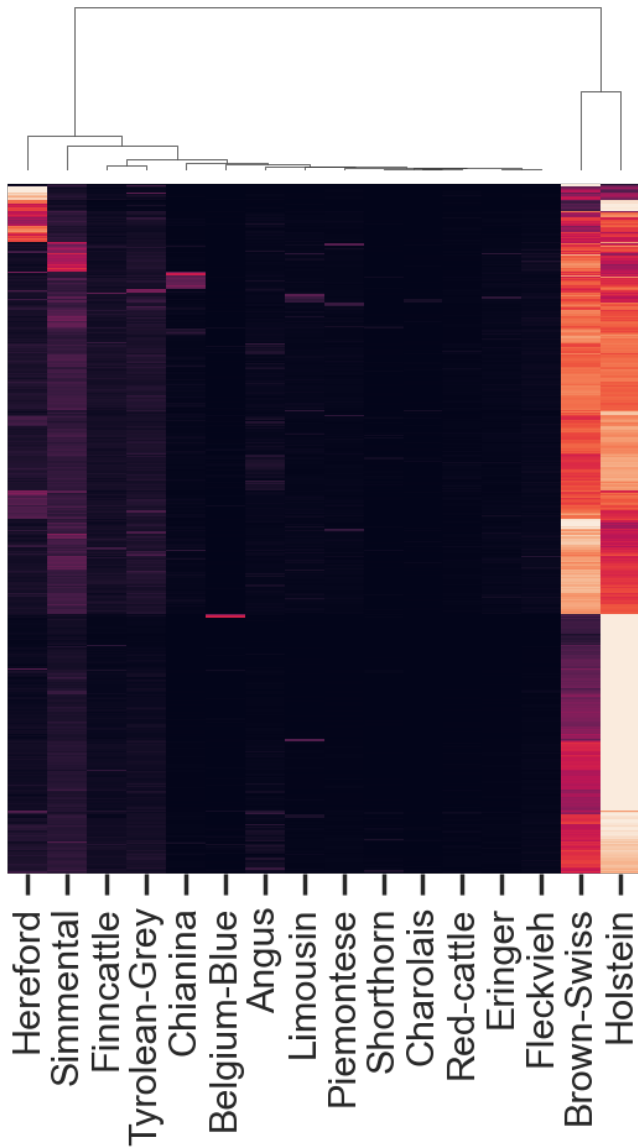
Tree sequence naturally represents genomic data



Population structure summary (Genealogical Nearest Neighbour)



Inferring breed proportions with Genealogical Nearest Neighbour



Bigger picture

- Girolando is a “simple” example of crossing system
- More complex admixture: African setting
- Crossing systems in the Global North:
 - taurine x taurine
 - Beef on dairy
- Next step:
Quantitative genetics within and across breeds & subspecies



THE UNIVERSITY
of EDINBURGH



Exploring Global Cattle Genealogy with Tree Sequence

Gabriela Mafra Fortuna,

Jana Obsteter, Andreas Kranis and Gregor Gorjanc

EAAP Lyon, 2023

[@HighlanderLab](#)

