

# Genetic connectedness: it is all about forming strong relationships

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# Today's talk

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- Connectedness

- What is it?
- Why does it matter?
- How much is needed?

- In practice

- The data
- Their summary
- Their implications

- Summing up



# What is connectedness?

- Genetic evaluation is about parsing

$$P = G + E$$



## Genotype (EBV)

- WWT: 4.32 kg
- PWWT: 8.66 kg
- PFAT: -2.76 mm
- PEMD: 2.00 mm



Cal Urbigkit photo

It's all about  
forming  
relationships

# Genetic relationship

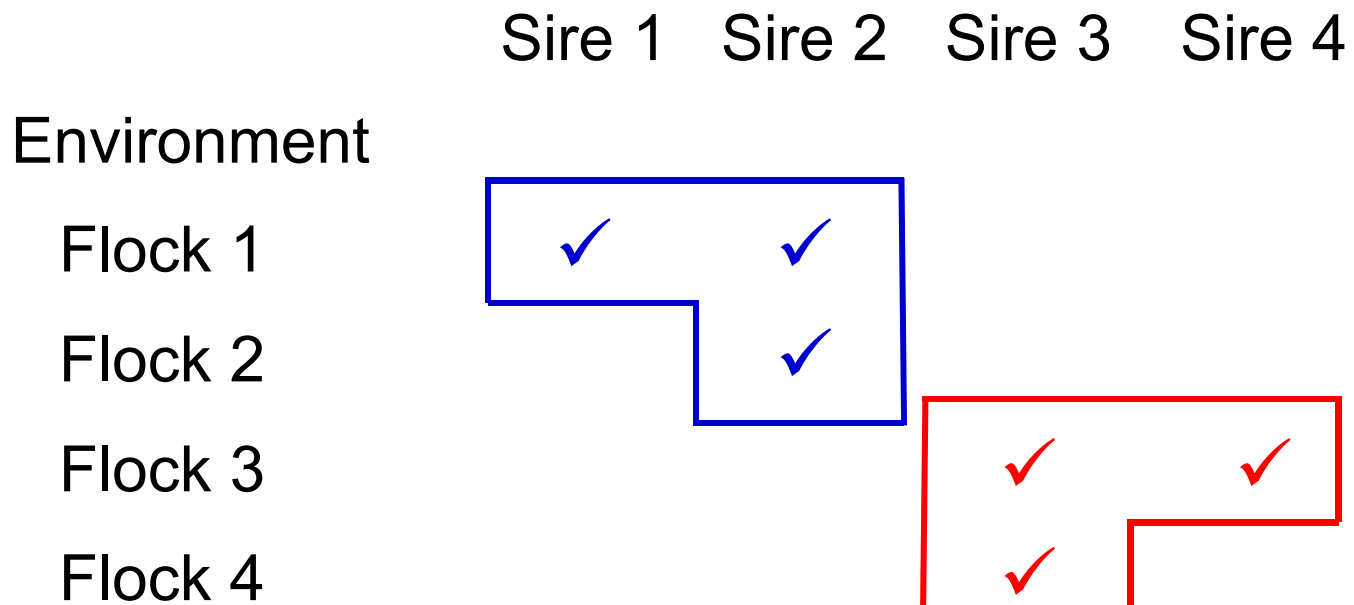
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	Sire 1	Sire 2
Environment		
Flock 1	✓	✓
Flock 2		✓

Connected

# Genetic relationship

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Disconnected



# Why does it matter?

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- Seedstock flocks sizes generally small
  - Few animals to choose among within flock, which slows genetic progress
  - May wish to step outside one's own flock to source new genetics



# Why does it matter?

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- Seedstock flocks sizes generally small
- Seek fair comparisons of genetic merit of animals across flocks
  - But flocks spread over a wide geographical region
  - ... and husbandry differences among flocks can mask genetic differences



# Why does it matter?

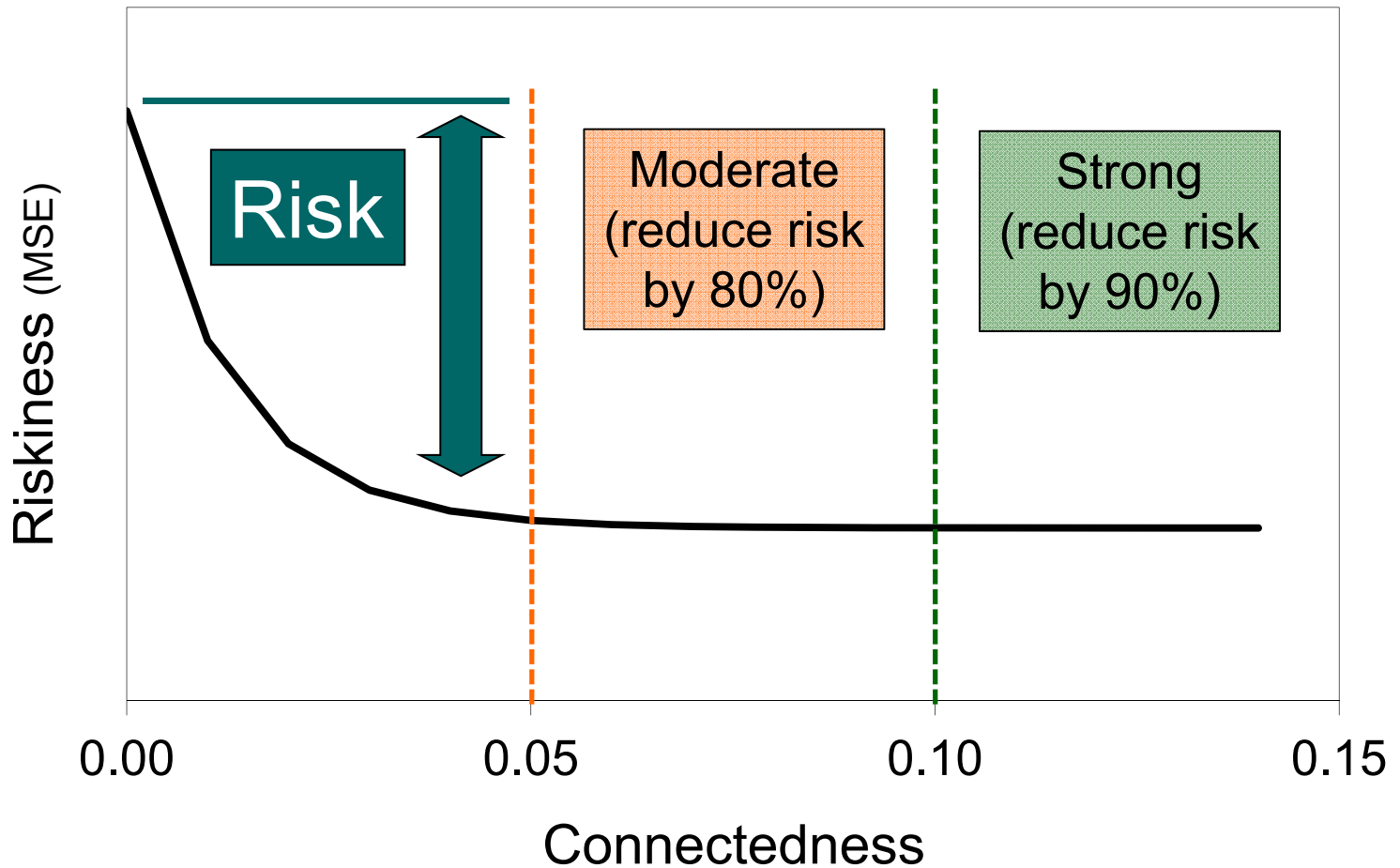
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- Connectedness describes risk when comparing EBV of animals in different flocks
  - Degree of risk depends on how well flocks are genetically related
- Since such risk is bounded, aim is for sufficient connectedness

Connectedness is different from accuracy



# How much is needed?



(Lewis et al, 1999, 2005; Kuehn et al., 2008, 2009)

# In practice

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- Connectedness evaluations in NSIP
  - Dorset
  - Hampshire
  - Suffolk





# The data

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## ○ Pedigree

- Dorset
  - Since 1978
- Hampshire
  - Since 1972
- Suffolk
  - Since 1972

## ○ Weaning weight

- Dorset
  - Since 1986
- Hampshire
  - Since 2002
- Suffolk
  - Since 1983

“Active” flocks: weights recorded  
in 2014, 2015 and/or 2016



# Pedigree

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<b>Variable</b>	<b>Dorset</b>	<b>Hampshire</b>	<b>Suffolk</b>
No. animals	18,179	6,463	55,599
No. sires	717	302	2,989
No. dams	4,173	1,472	13,534
No. flocks	33	15	105
<i>Sire family size</i>			
Median	5	6	5
Average	22.6	19.7	16.8
Largest	246	218	355



# Weaning weight<sup>†</sup>

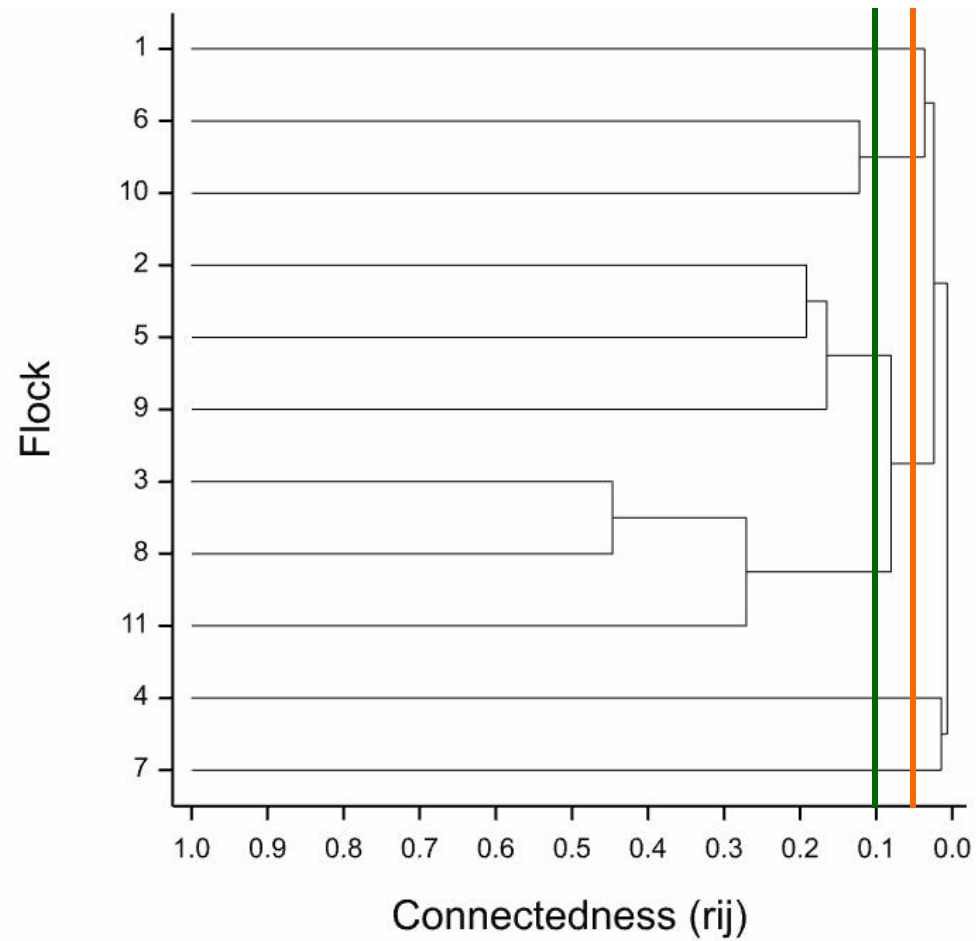
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<b>Variable</b>	<b>Dorset</b>	<b>Hampshire</b>	<b>Suffolk</b>
No. lambs	11,610	4,423	36,409
<i>No. flocks</i>			
Total	31	14	101
Active <sup>‡</sup>	11	11	18
<i>Average</i>			
Age (day)	65.3	65.7	63.0

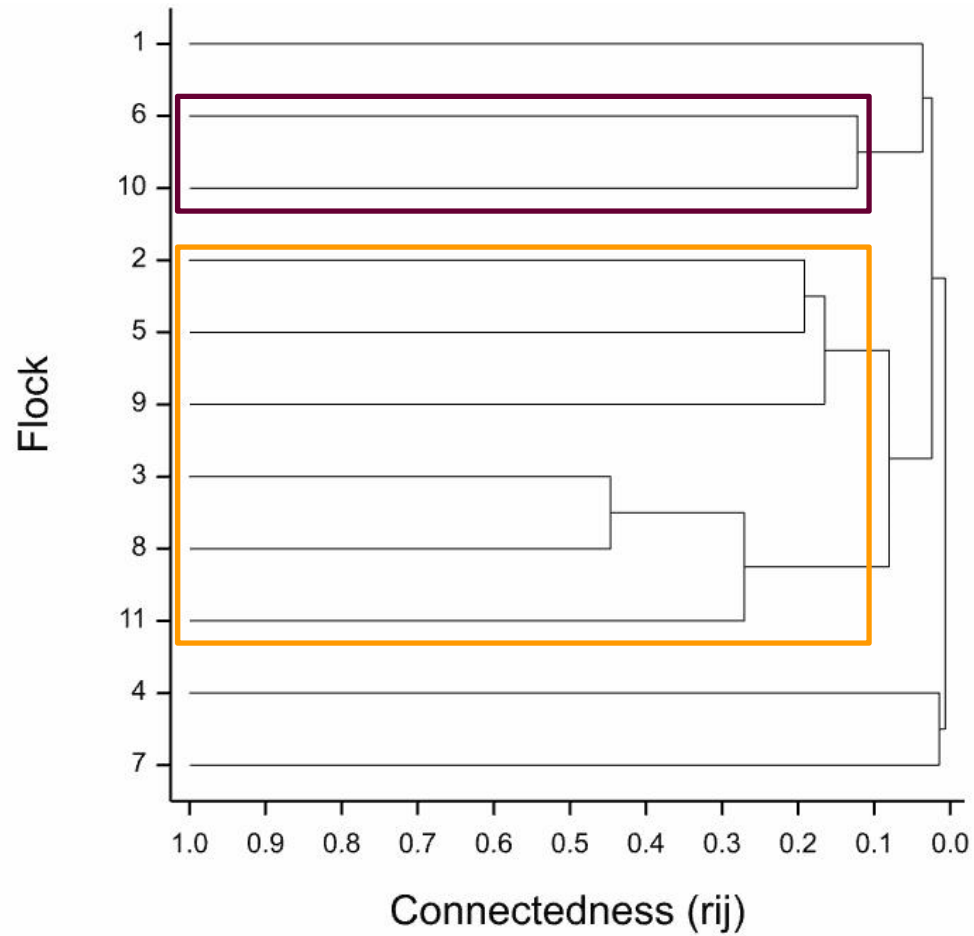
† Heritability of 0.15

‡ Weights recorded in 2014, 2015 and/or 2016

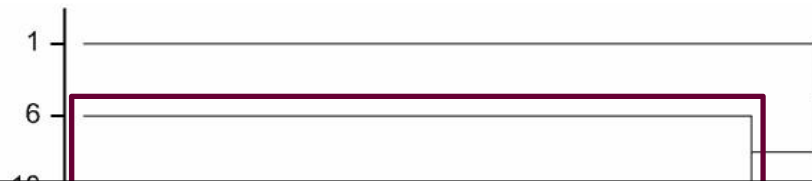
# Dorset connectedness



# Dorset connectedness

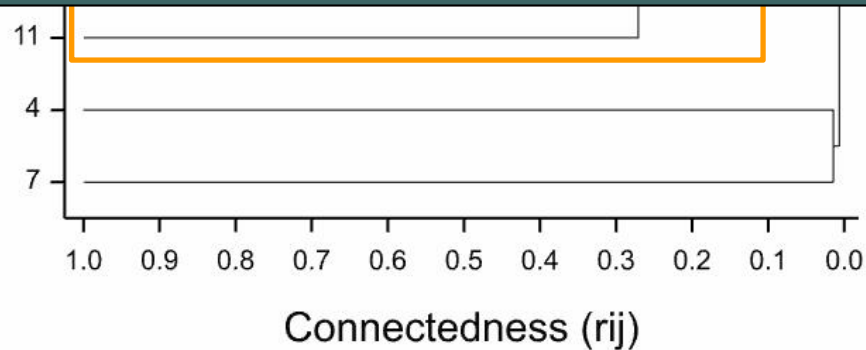


# Dorset connectedness



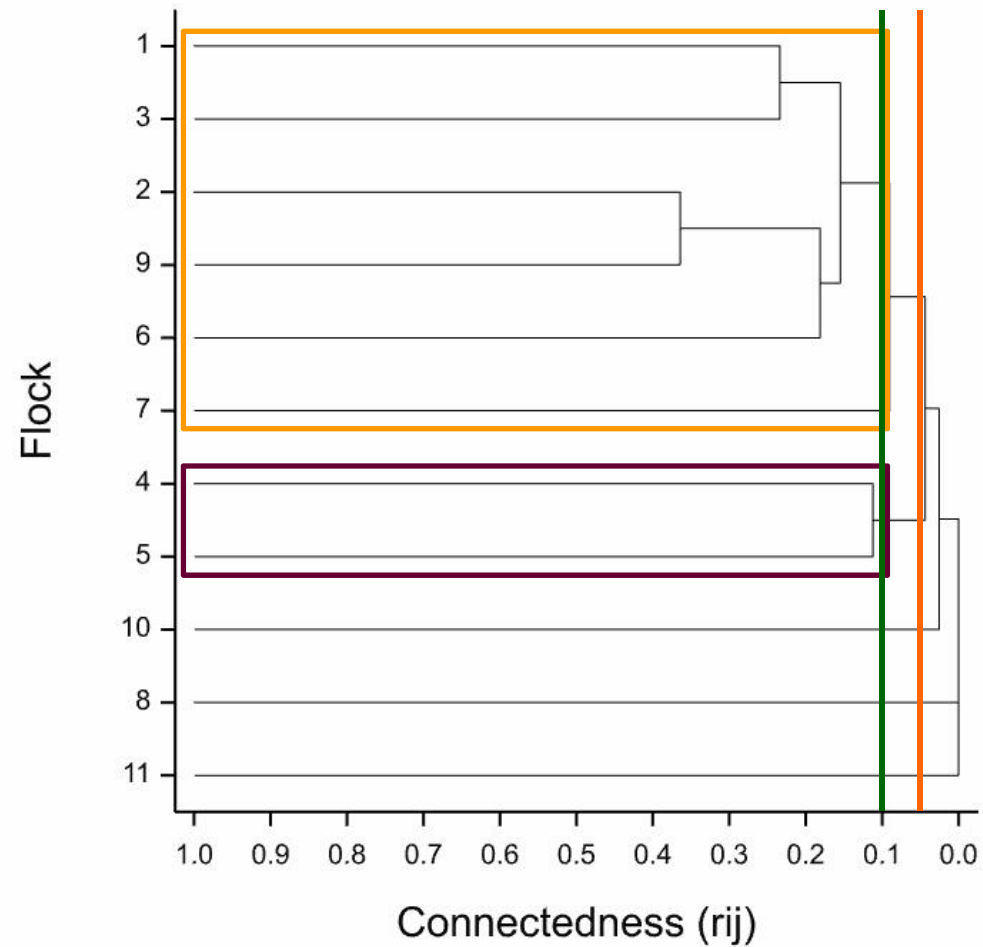
## Implications:

- One main cluster of 6 flocks
- More reliable comparison of EBV could be achieved by greater exchange of rams with flocks in this cluster

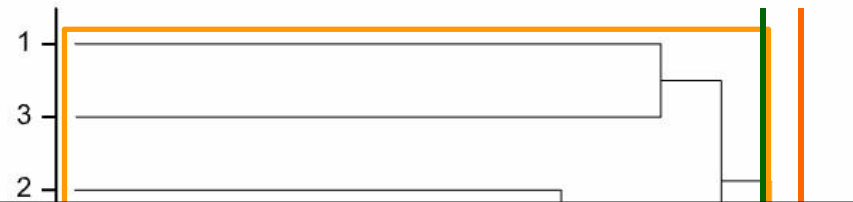




# Hampshire connectedness

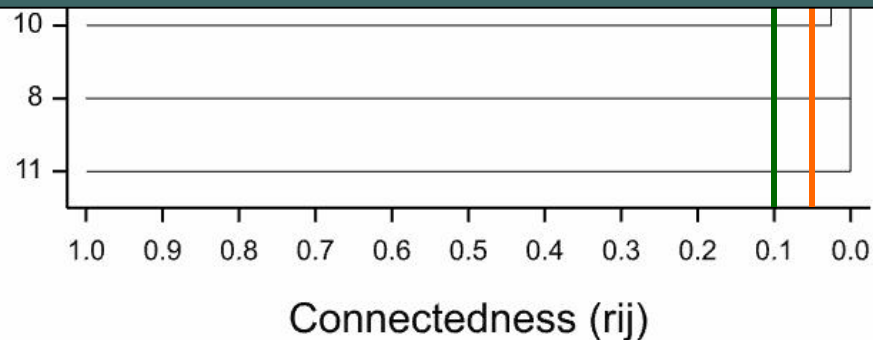


# Hampshire connectedness

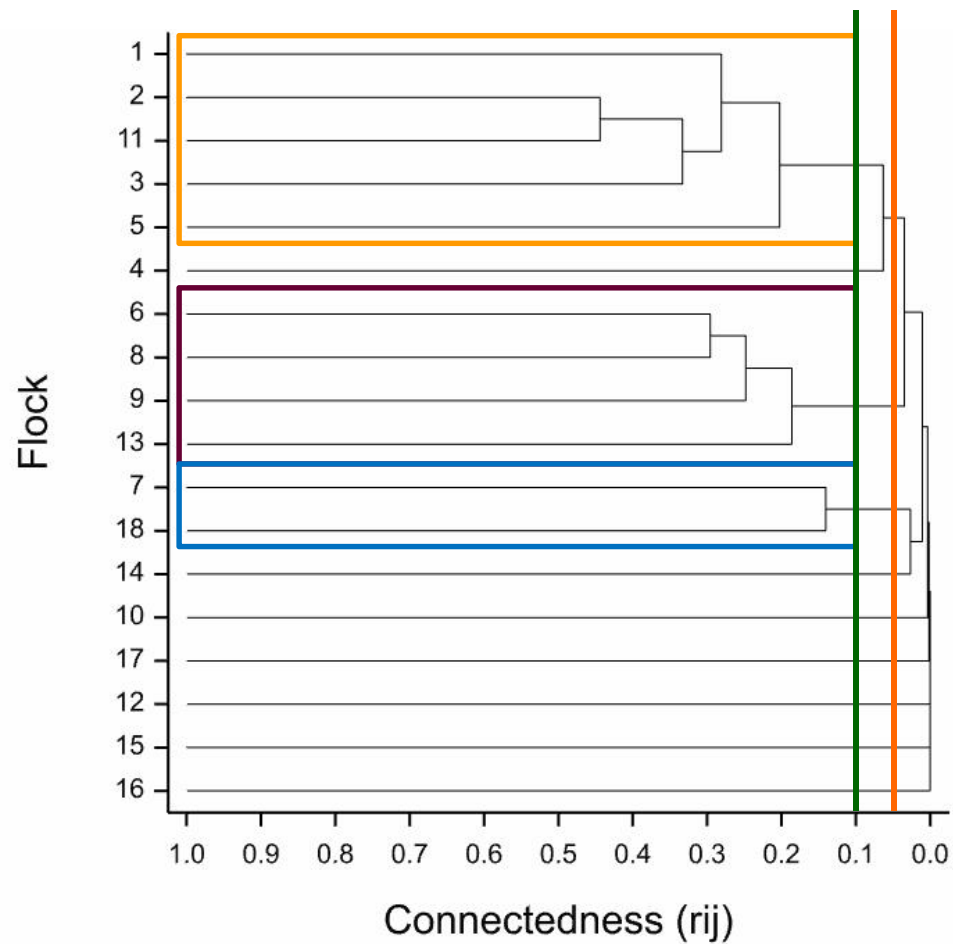


## Implications:

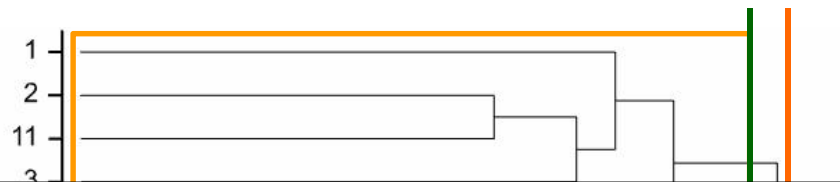
- One main cluster of 6 flocks
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# Suffolk connectedness

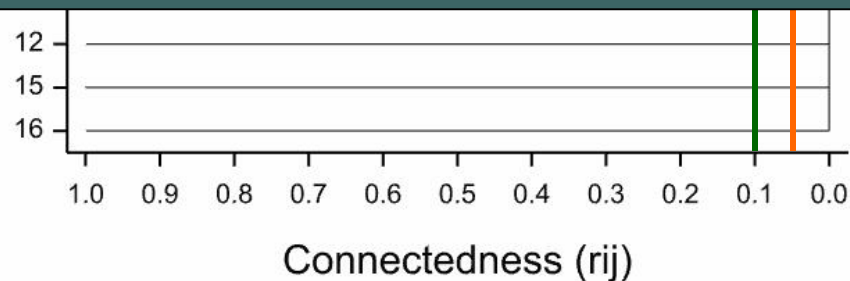


# Suffolk connectedness



## Implications:

- Two main separate clusters, perhaps reflecting different biological types
- If comparisons between clusters & with other flocks deemed a priority, greater exchange of rams would reduce risks





# Summing up

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- Connectedness matters in across-flock genetic evaluations
  - Flocks often differ genetically and environmentally (e.g., husbandry)
  - If connectedness among flocks is insufficient, comparisons of EBV across flocks become risky



# Summing up

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- Connectedness can be used to define the dynamics of a breeding program
  - Delineate differences among breeding objectives
  - May be useful for identifying flocks and individuals useful for strategic genotyping

# Summing up

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- Connectedness is determined for an individual trait
  - Often a weight trait (e.g., weaning; post-weaning)
- If recording norms for alternative traits differ, connectedness levels may also differ
  - e.g., time required for expression of litter size





# Summing up

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- Increasing connectedness in its own right is not a goal
  - If sufficient, producers have flexibility to focus on other priorities in their breeding programs
- However, if connectedness is tenuous, it is worth implementing strategies to improve genetic relationships
  - Source rams from well-connected flocks with a long history in NSIP



# Thanks for listening

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- I appreciate the support from ASI and the Let's Grow committee, and from NSIP



Questions?