

# Tailoring a terminal sire breeding program for the west

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Ron Lewis, Department of Animal Science,  
University of Nebraska-Lincoln

Utah Wool Growers Association  
Leading Edge Sheep Production – Part II

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# My talk

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- Some principles
  - Breeding values
  - Selection index
- What's key?
  - Growth
  - Carcass
  - Longevity & fitness
- A couple of examples
  - New Zealand
  - United Kingdom
- Where we are
  - Genetic gains
  - Connectedness
- Opportunities
  - Potential scale
  - Genomics?

# Genetic evaluation

- Genetic evaluation is about parsing

$$P = G + E$$



Genotype (EBV):

- WWT: 5.37 kg
- PWWT: 9.01 kg
- PFAT: -2.92 mm
- PEMD 1.25 mm

# Breeding value

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- Breeding value (BV)
  - The value of the genes that a parent transfers to its offspring for a given trait
- Seldom known and therefore must be estimated (EBV)
- Estimate becomes more accurate when a trait is
  - More heritable
  - More persistently measured
    - Particularly if on closer relatives

# Selection index

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- Breeders seldom wish to select for one trait in isolation
  - Profit usually depends on several traits
  - Optimising profit therefore depends on placing the right emphasis on each trait to be improved
- A selection index predicts genetic merit for a combination of several traits
  - Key to their design is deciding which traits to improve

# What's key?

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## ■ Growth

- Pre-weaning
- Post-weaning

## ■ Carcass

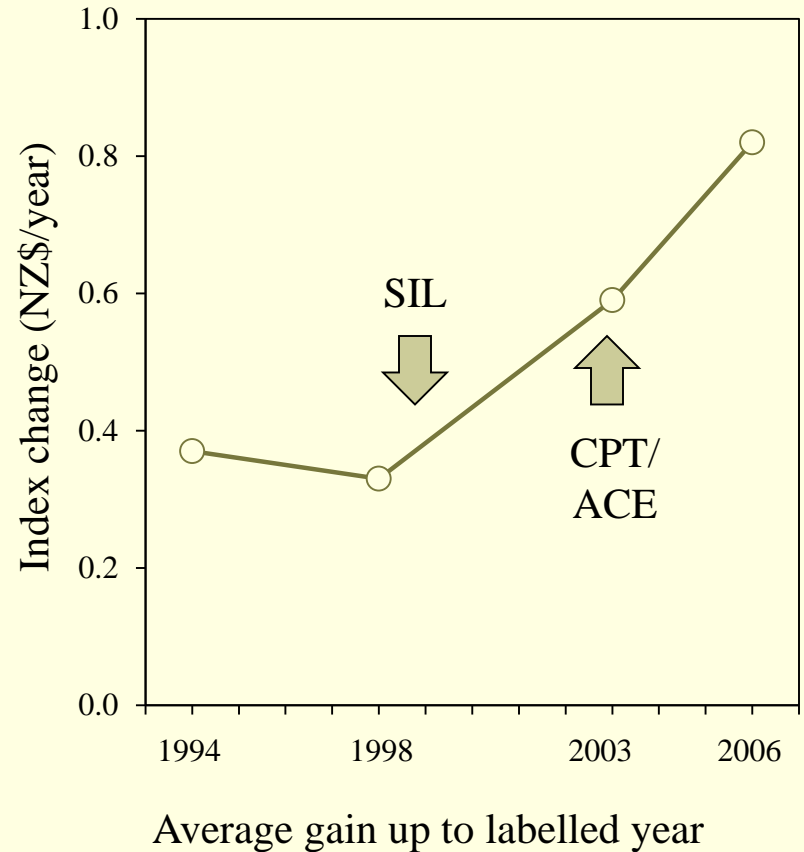
- Carcass weight
- Lean & fat contents
- Quality & yield grades

## ■ Longevity & fitness

- Ram survivability
- Ewe productive lifespan

# New Zealand example

- Sheep Improvement LTD (SIL)
  - Began in 1999
- Central Performance Test (CPT), Advanced Central Evaluation (ACE)
  - Began in 2004



# United Kingdom example

## ■ United Kingdom

- Lean growth index
- Developed by Scottish Agricultural College
  - Began 1989



In 9 years, 1 kg increase in lean weight in 20 kg carcass (+ 5%)

## ■ Selection goal

- Increase lean carcass weight (+3)
- Little change in carcass fat weight (-1)

## ■ Selection criteria

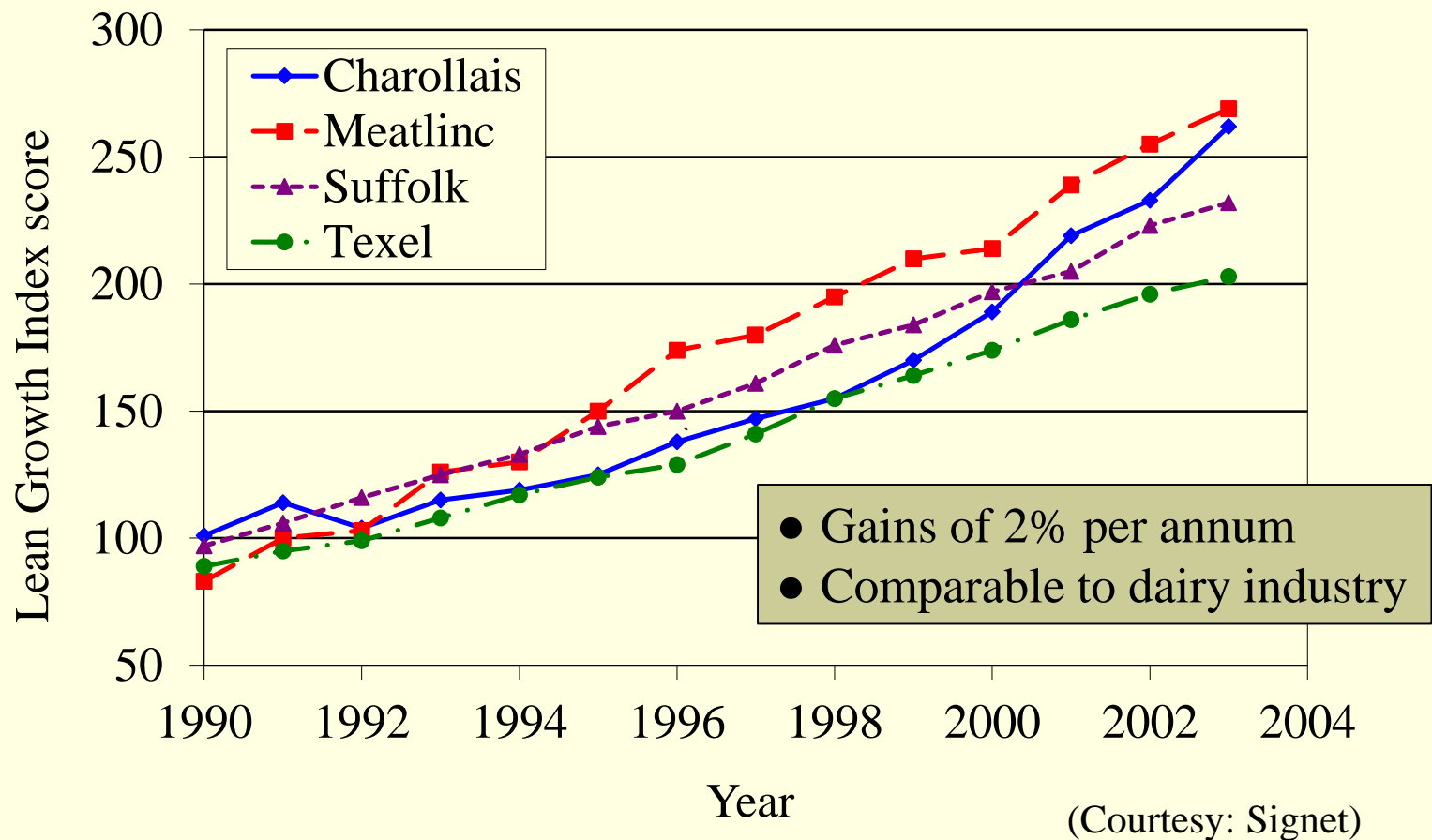
- Live weight (+)
- Muscle depth (+)
- Fat depth (-)

(Simm and Dingwall, 1989; Lewis et al., 2002; Simm et al., 2002)



# United Kingdom example

## ■ Gains in industry schemes



# United Kingdom example

- Effects on marketable output
  - Comparison of crossbred lambs sired by high index sires versus low index terminal sires
    - 6,400 lambs sired by 90 high index sires
    - Rams differed by 10% in carcass weight
  - Benefits of high index sires
    - 10% more saleable meat yield (1000 carcasses)
    - £353 extra retail value per high index ram over its lifetime

**£15 million annually for UK sheep industry  
(US\$ 20 million annually)**

(Lewis et al., 2006., Márquez et al., 2012;  
Márquez et al., 2013a,b; Márquez et al., 2015)

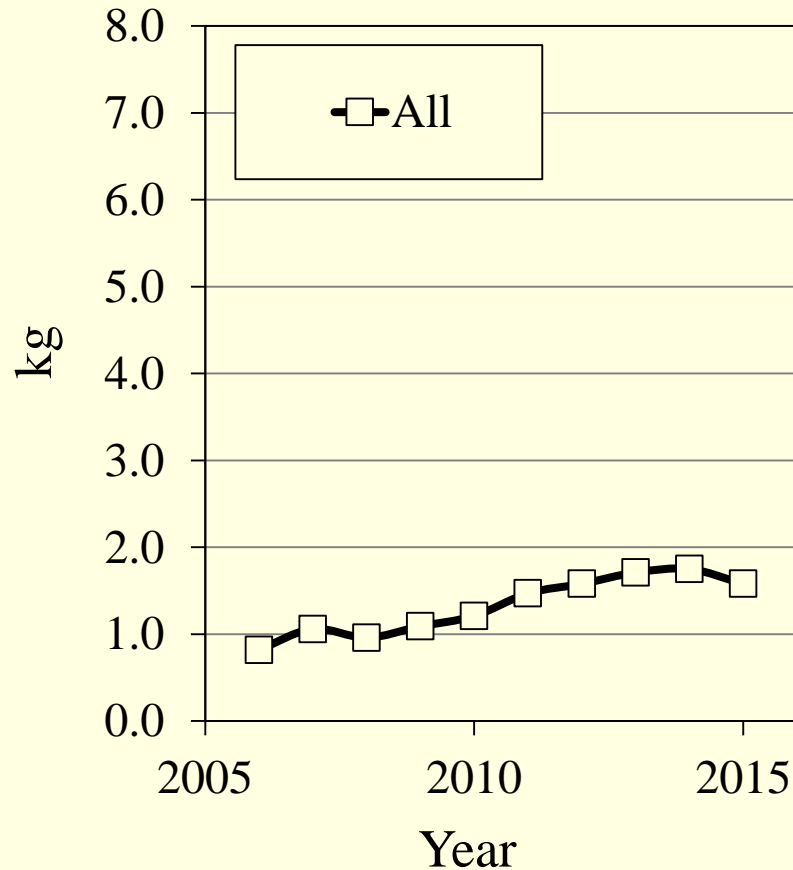
# Where we are

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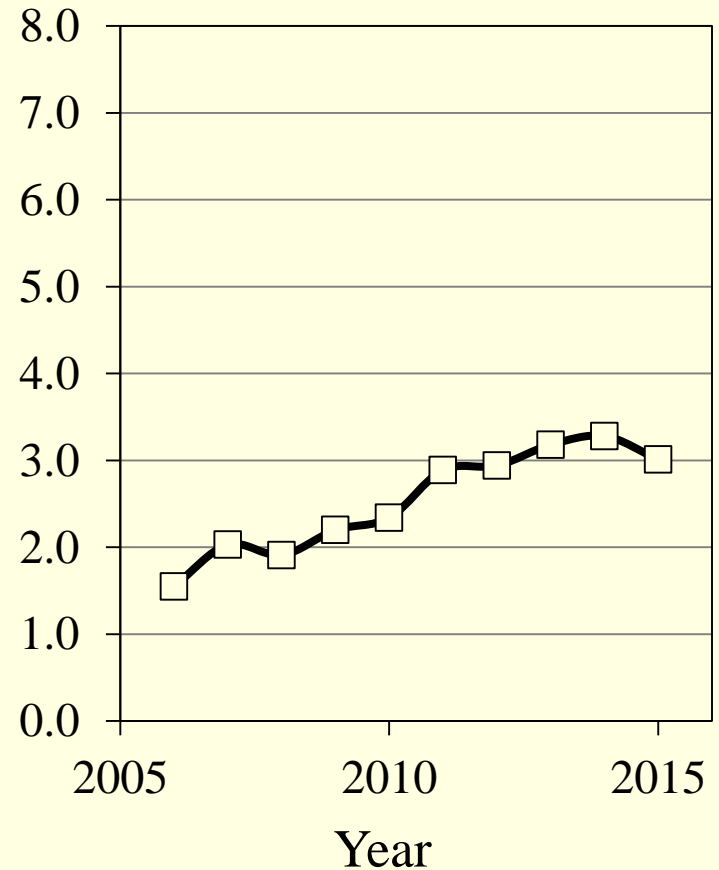


# Trends in Suffolk EBV

## Weaning wt. EBV

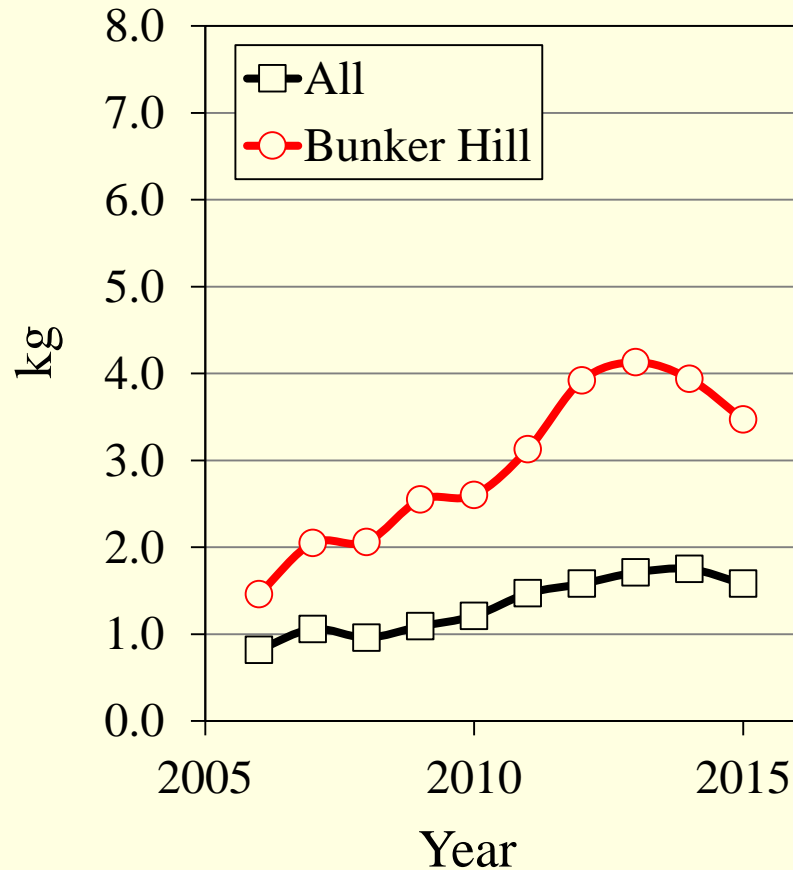


## Post-weaning wt. EBV

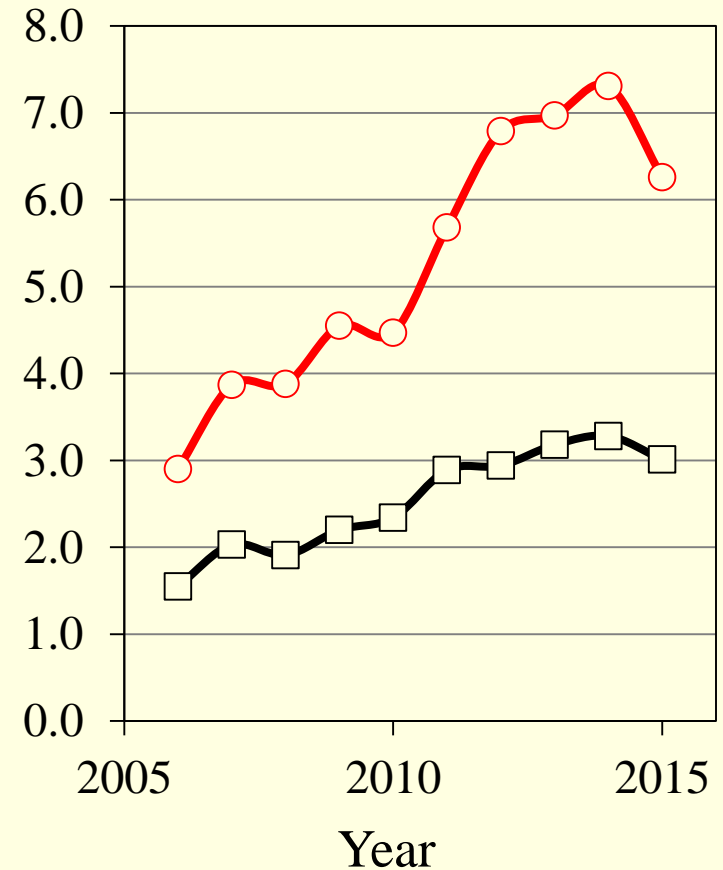


# Trends in Suffolk EBV

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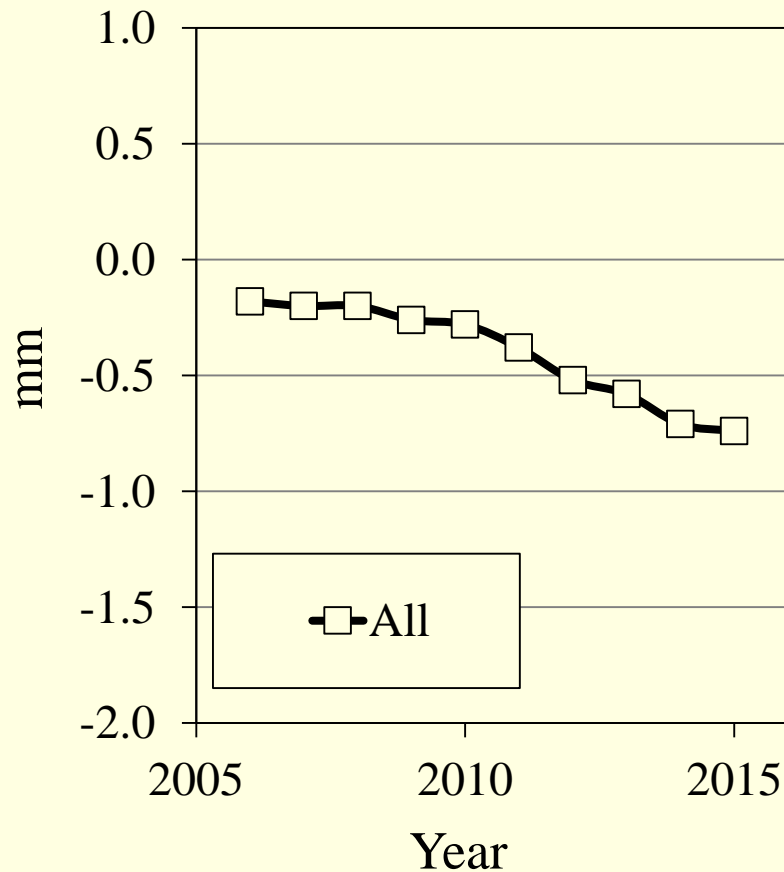


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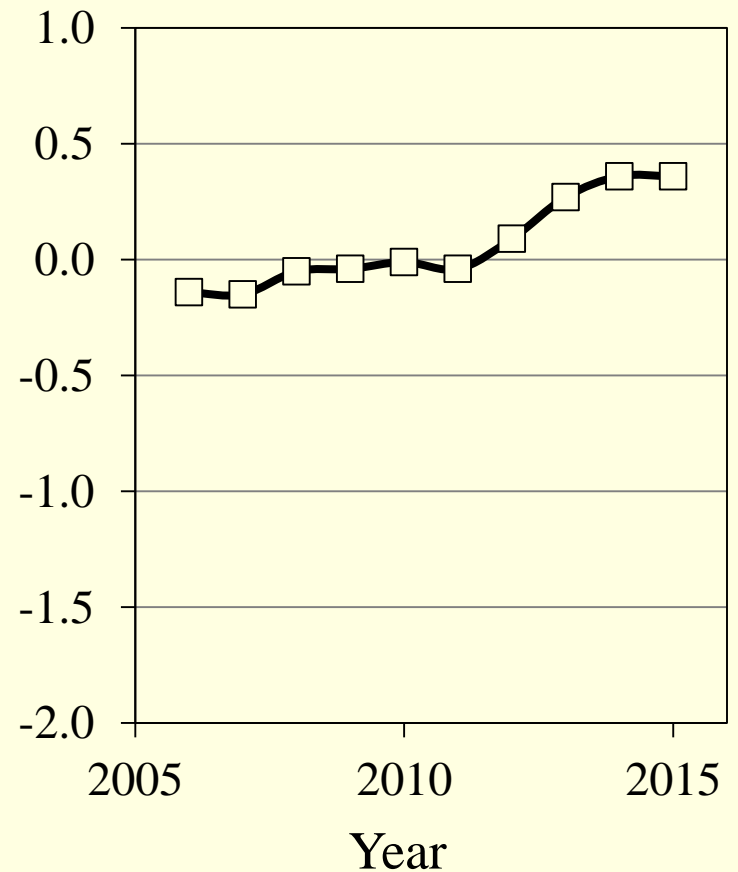


# Trends in Suffolk EBV

## Fat depth EBV

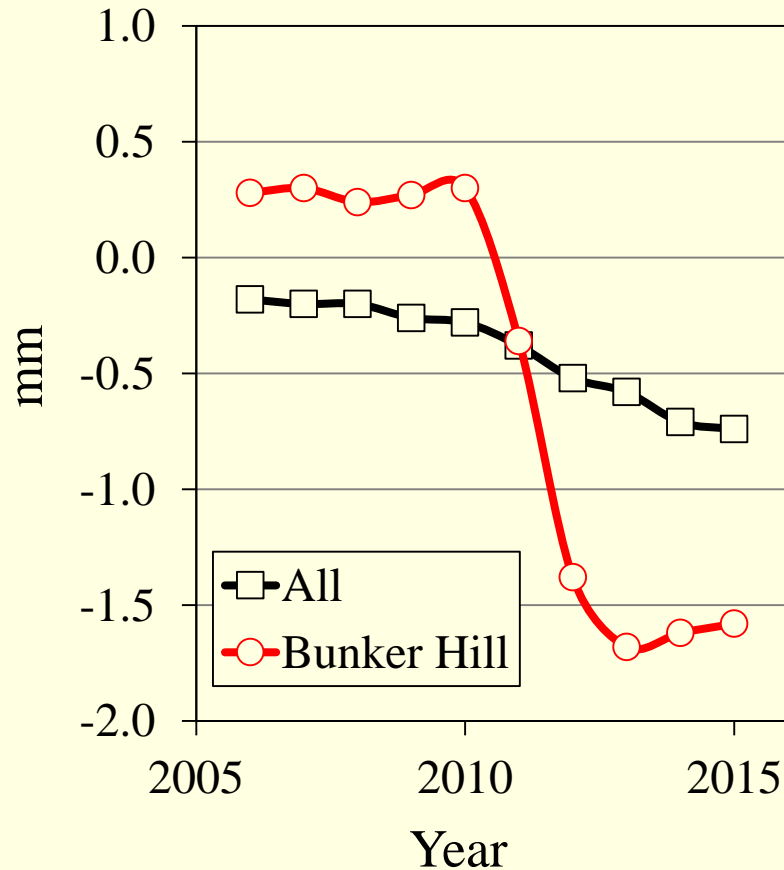


## Muscle depth EBV

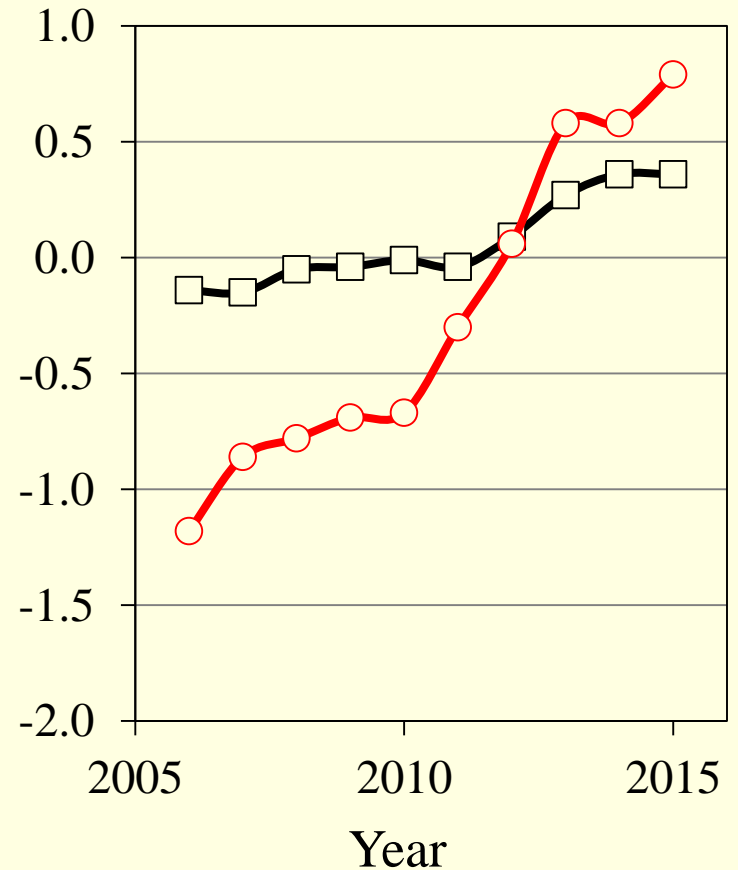


# Trends in Suffolk EBV

## Fat depth EBV



## Muscle depth EBV



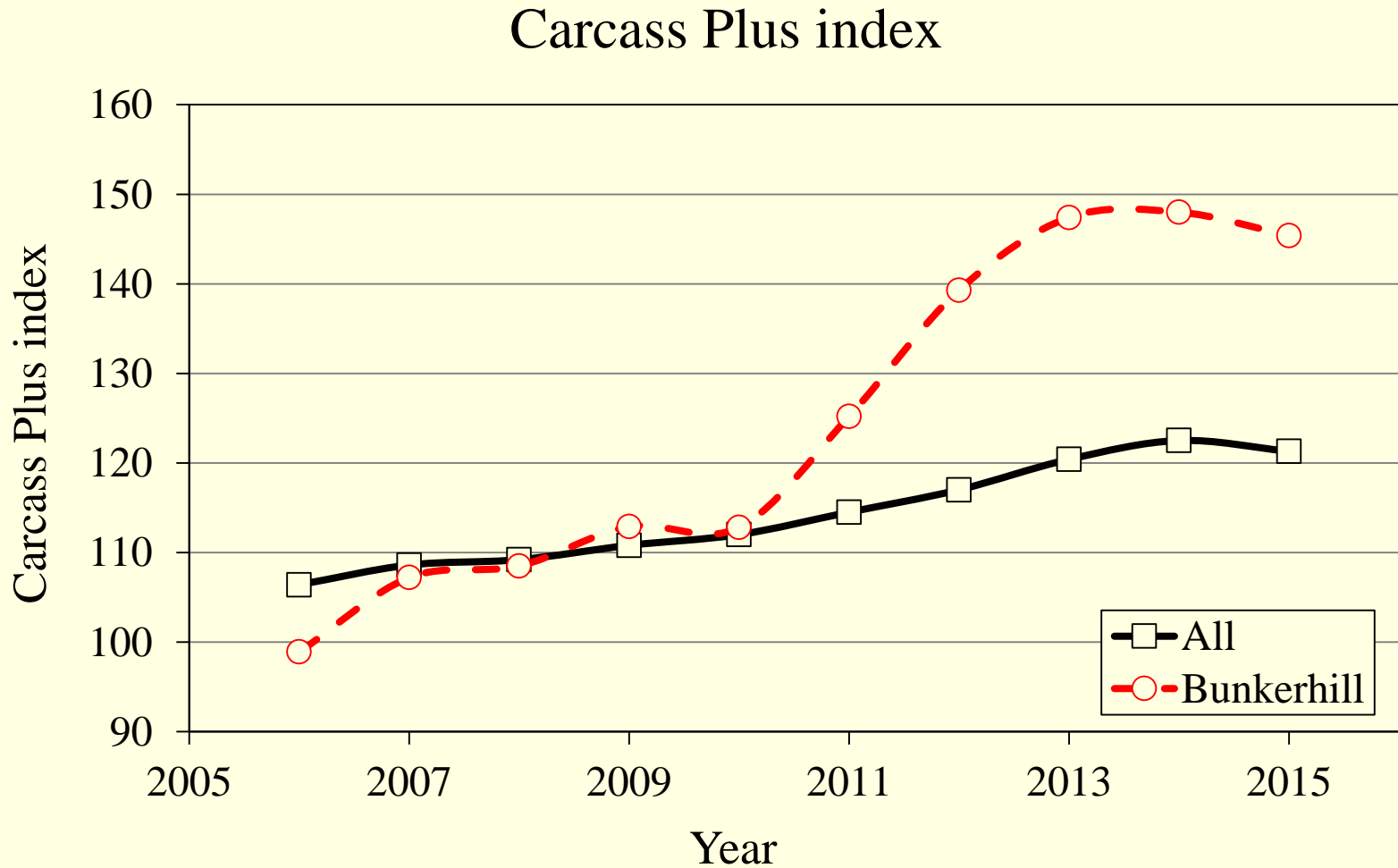
# Carcass Plus Index

- Developed to improve carcass value in Australian sheep industry
- Provides a good assessment of carcass value in U.S. terminal sires

Criteria (EBV)	Index Weight	Relative emphasis
Weaning weight (kg)	2.33	30%
Post-weaning weight (kg)	3.50	35%
Fat depth (mm)	-4.07	5%
Muscle depth (mm)	11.40	45%




# Trends in Suffolk Carcass Plus index



# Elite sires report

- Top Suffolk sires ranked on Carcass Plus Index score

 <b>Elite Report - Suffolk</b>		<b>- Sires with 2015 - 2016 Offspring</b>										<b>May 2016</b>	
		<b>Carcass+</b>											
ID Flock	Prg:Flks Inbrd.Coef	BWt kg	WWt kg	MWWt kg	PWWt kg	PFat mm	PEMD mm	NLW %	NLB %	PSC cm	SRC\$	Carc.+	Sire Dam
690035-2015-005352 <i>Mint Gold Ranch-Suffolk</i>	12 : 1 14%	1.18 75%	8.35 72%	0.76 40.0	13.03 73%	-4.37 71%	0.04 75%	-2.4 34%	-0.3 29%	0.0 0%	121.7 48%	183.3 70%	6900352014004111 6900352014004139
690035-2014-004111 <i>Mint Gold Ranch-Suffolk</i>	30 : 1 4%	0.74 81%	5.78 79%	0.77 51.0	7.81 80%	-3.29 78%	1.61 82%	-3.8 43%	-1.2 38%	0.0 0%	115.7 56%	172.5 78%	6900242009009170 6900352011001062
690007-2014-002896 <i>Bunker Hill Farms</i>	15 : 1 8%	0.29 81%	4.81 80%	0.32 53.0	9.01 82%	-2.92 81%	1.25 85%	-5.7 42%	-1.0 36%	0.0 0%	110.6 56%	168.9 81%	6900242010000152 6900072012002667
690007-2011-002553 <i>Bunker Hill Farms</i>	154 : 2 3%	0.39 93%	5.37 91%	-0.33 74.0	8.92 93%	-2.56 93%	1.11 94%	-0.2 60%	7.1 52%	0.0 0%	116.7 70%	166.8 93%	6900242009009170 6900072009BH2360
690007-2013-002868 <i>Bunker Hill Farms</i>	23 : 1 1%	0.36 79%	4.45 79%	-0.43 40.0	6.91 82%	-2.60 80%	1.60 84%	1.1 33%	1.4 28%	0.0 0%	115.3 53%	163.4 80%	6900352012002005 6900072012002660
690007-2014-002870 <i>Bunker Hill Farms</i>	30 : 1 2%	0.29 84%	4.43 84%	0.12 51.0	7.02 86%	-2.30 85%	1.62 88%	2.8 39%	7.0 33%	0.0 0%	118.0 57%	162.7 85%	6900072011002553 6900072008BH2271
690007-2014-002889 <i>Bunker Hill Farms</i>	28 : 1 8%	0.29 81%	3.59 80%	0.44 47.0	5.15 82%	-2.55 81%	2.11 85%	-4.1 37%	0.5 32%	0.0 0%	111.1 54%	160.8 81%	6900072011002553 6900072011002565
690007-2014-002895 <i>Bunker Hill Farms</i>	28 : 1 17%	0.26 84%	4.66 82%	0.24 48.0	9.18 84%	-2.53 82%	0.59 85%	-6.1 40%	-4.2 34%	0.0 0%	111.4 56%	159.9 82%	6900242010000152 6900072012002716

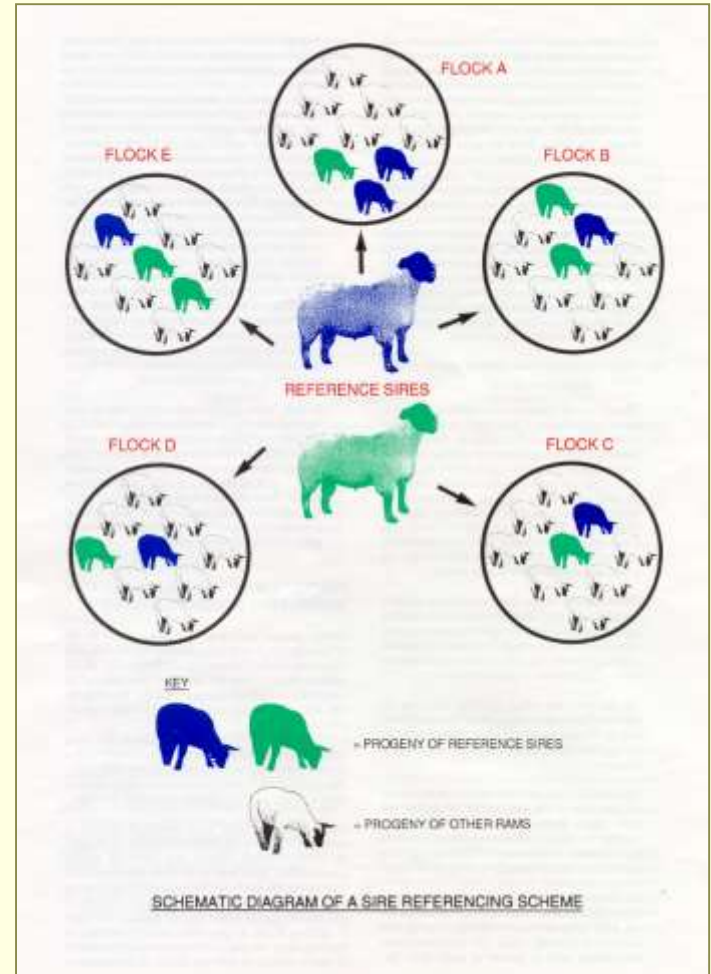
# Connectedness

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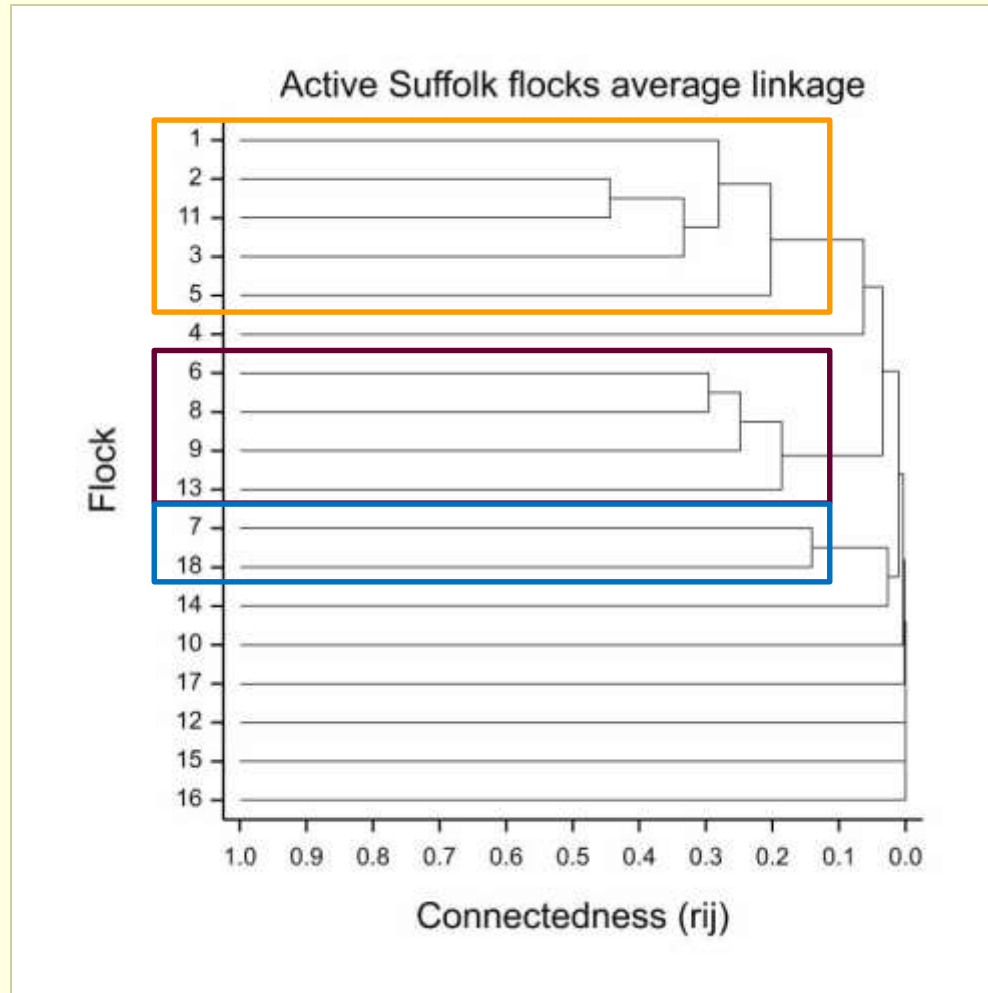
- Seedstock flock sizes generally small
  - Few animals to choose among within flock, which slows genetic progress
- Fair comparisons of genetic merit of animals across flocks not always possible
  - Husbandry differences between flocks can mask genetic differences

# Connectedness

- Solution?
  - Form genetic linkages, or **connectedness**, among flocks
  - Most easily achieved by systematic sharing of rams



# Connectedness



# Potential scale

≈ 65,000 ewes bred  
(≈ 43,000 to terminal sires)

↑ ⇔ 3 rams / 100 ewes / year

Annual breeding ram inventory ≈ 1,290 rams

↑ ⇔ Average ram life of 1.8 year

Cull 50% ⇒ 720 new breeding rams  
Produce ≈ 1,440 ram lambs per year

↑ ⇔ 130% lamb crop

≈ 2,215 recorded lambings of terminal sire ewes

# Genomics?

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- Genomic selection
  - Limited opportunities currently given industry dynamic
  - Still, need to begin to establish a reserve of DNA samples on well-chosen NSIP sheep

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  - Limited opportunities currently given industry dynamic
  - Still, need to begin to establish a reserve of DNA samples on well-chosen NSIP sheep
- Genetic tests for some major genes
  - OPP virus susceptibility
  - Scrapie susceptibility
  - Muscling (myostatin)
- Parentage determination





# Thank you

Questions?

