Beef Genomics 101

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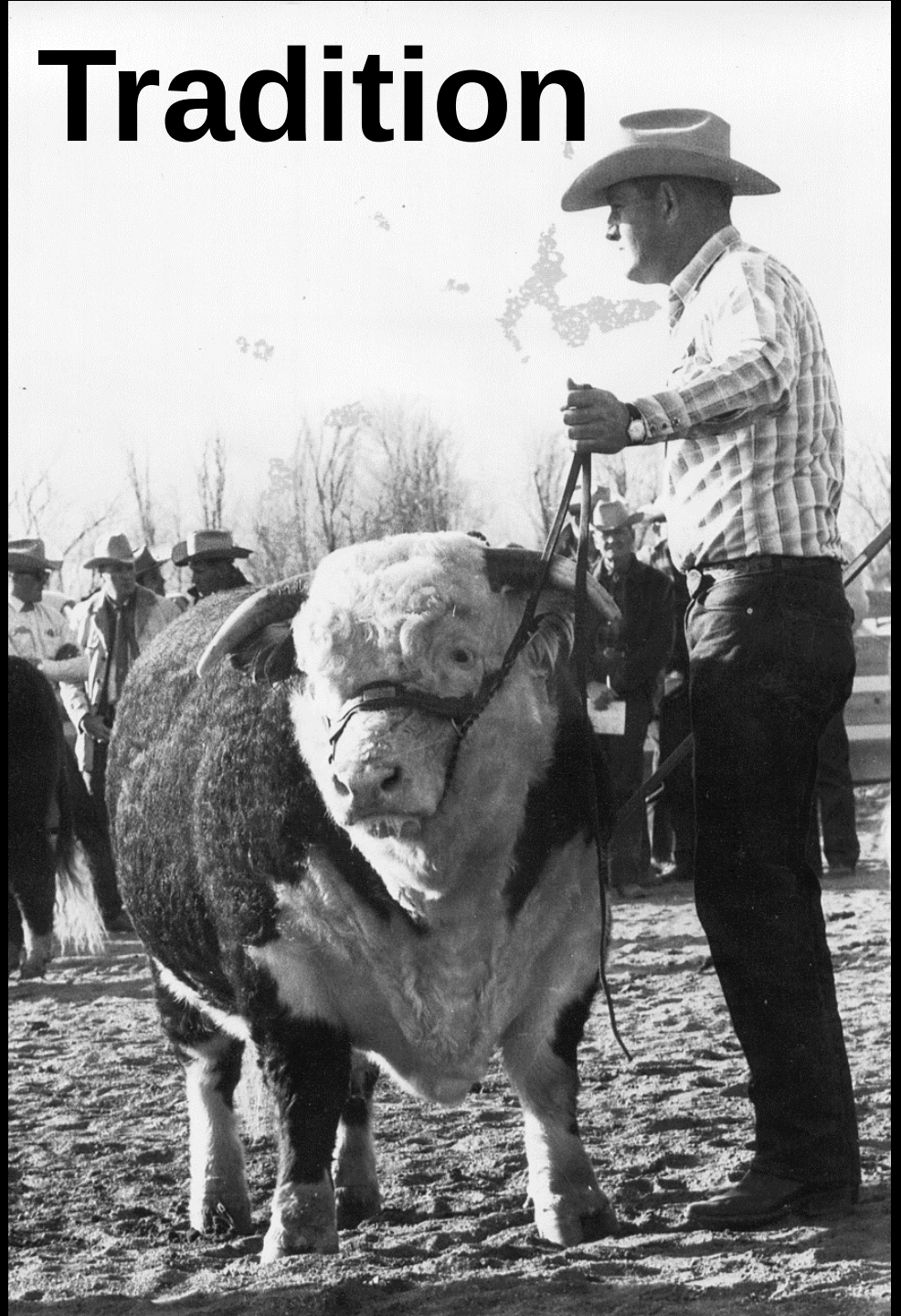
Tradition



Legacy

How?

How?

SUSTAINABILITY:

STEWARDSHIP

RESPONSIBILITY

PROFITABILITY

EPDs Work!

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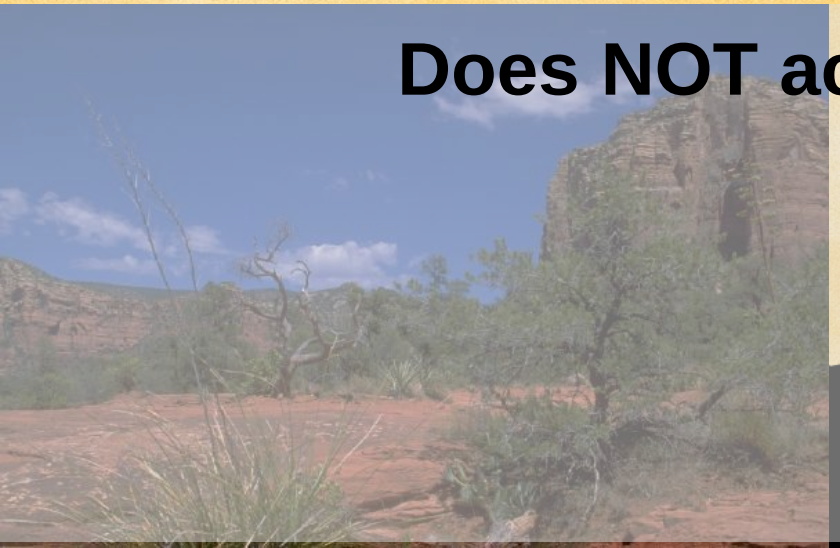
Selection Decisions

Phenotypic Selection

Does NOT account for environmental differences!

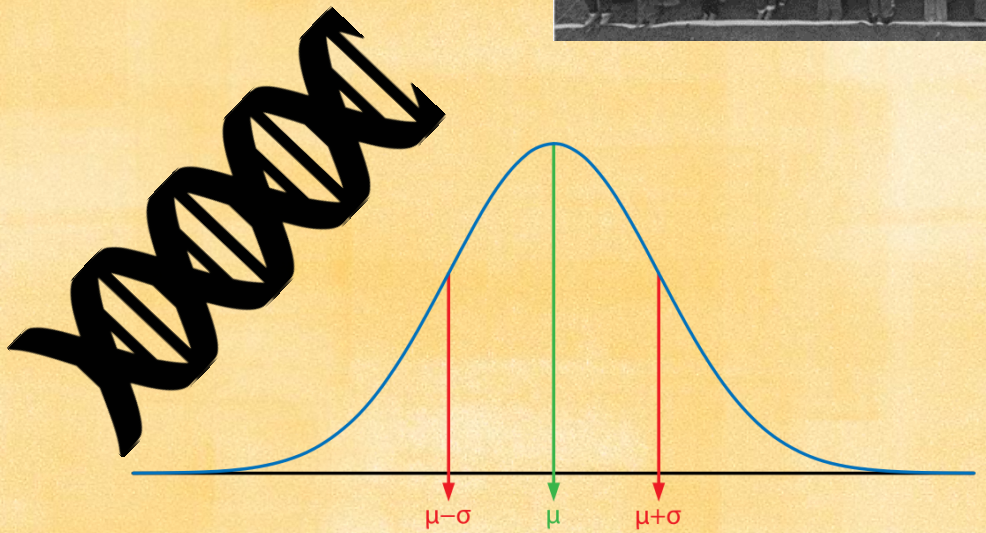


Less accurate

EPDs Defined

- **Expected**
  - Prediction of the Future
  - Average or Mean
- **Progeny**
  - Calves
- **Difference**
  - Compare two animals
  - Compare animal to breed average

Relatedness is KEY



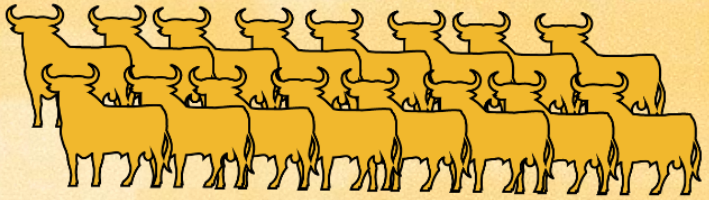
Black Bull

Weaning Weight EPD = 2

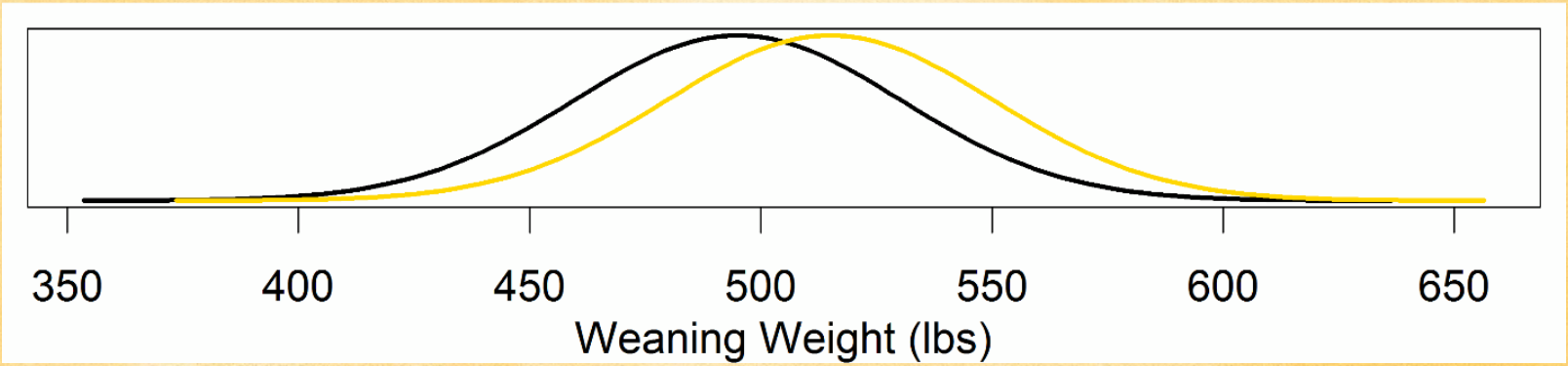
Average Weaning Weight of Calf Crop = 495

Gold Bull

Weaning Weight EPD = 22



Average Weaning Weight of Calf Crop = 515



EPDs in Practice

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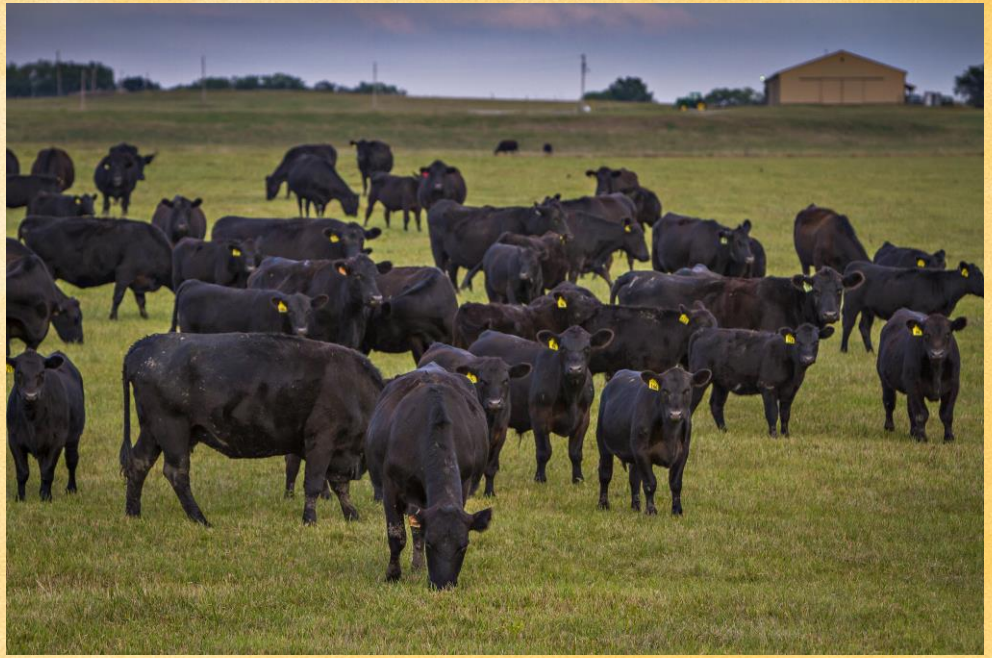
Do EPDs Work?

Thompson Research Center

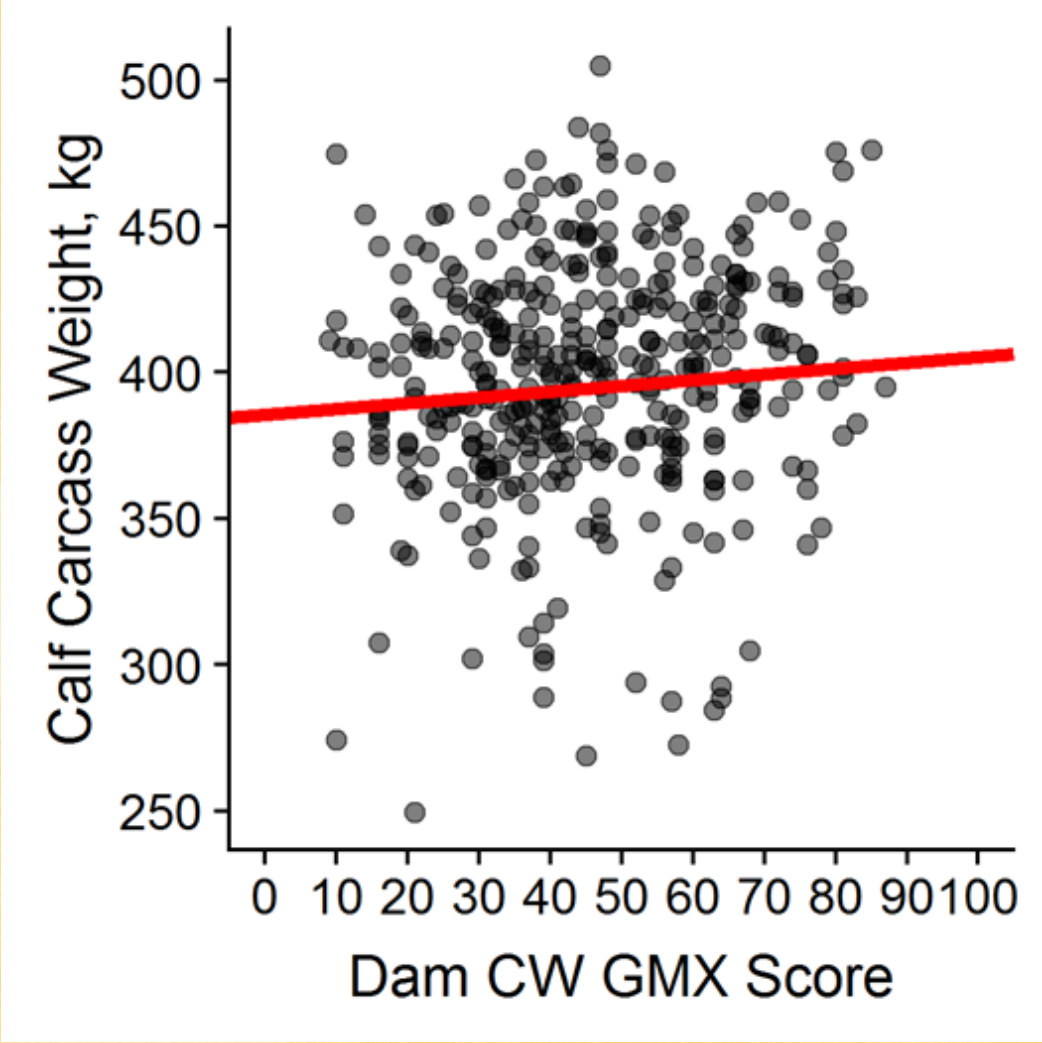
- 781 calves from 231 cows with GeneMax Advantage Scores

Thompson
Research Center
University of Missouri



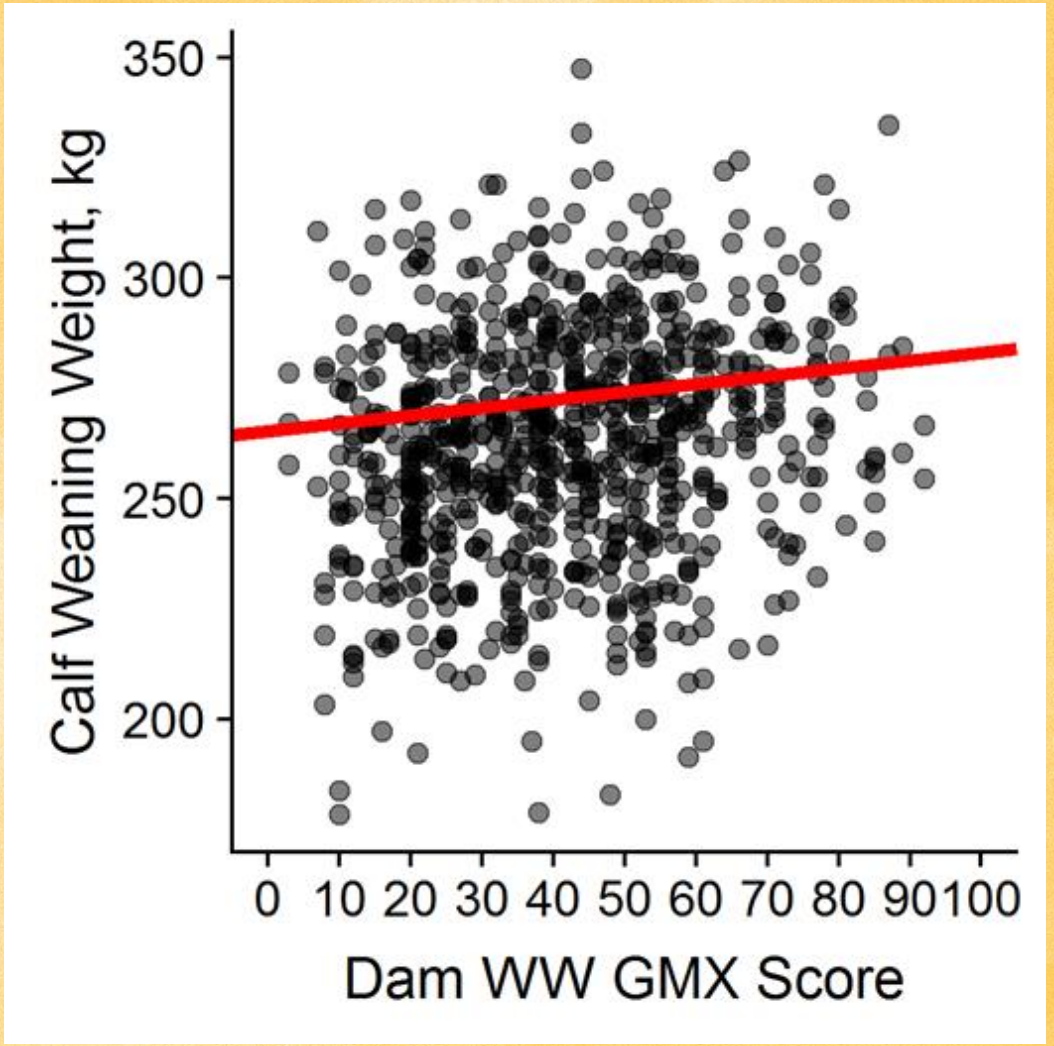
GeneMax

	Estimate	Std. Error	p-value
CW GMX	0.435 lbs	0.204 lbs	0.033



GeneMax

	Estimate	Std. Error	p-values
WW GMX	0.435	0.088	1.0e-06
MM GMX	0.336	0.080	3.0e-05



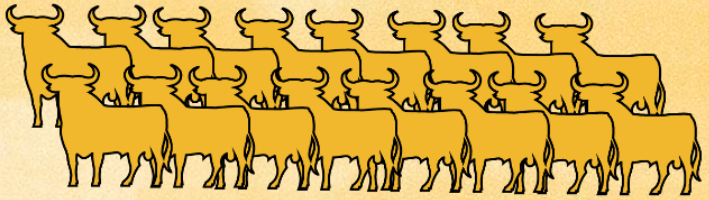
Black Bull

Weaning Weight EPD = 2

Average Weaning Weight of Calf Crop = 495

Gold Bull

Weaning Weight EPD = 22



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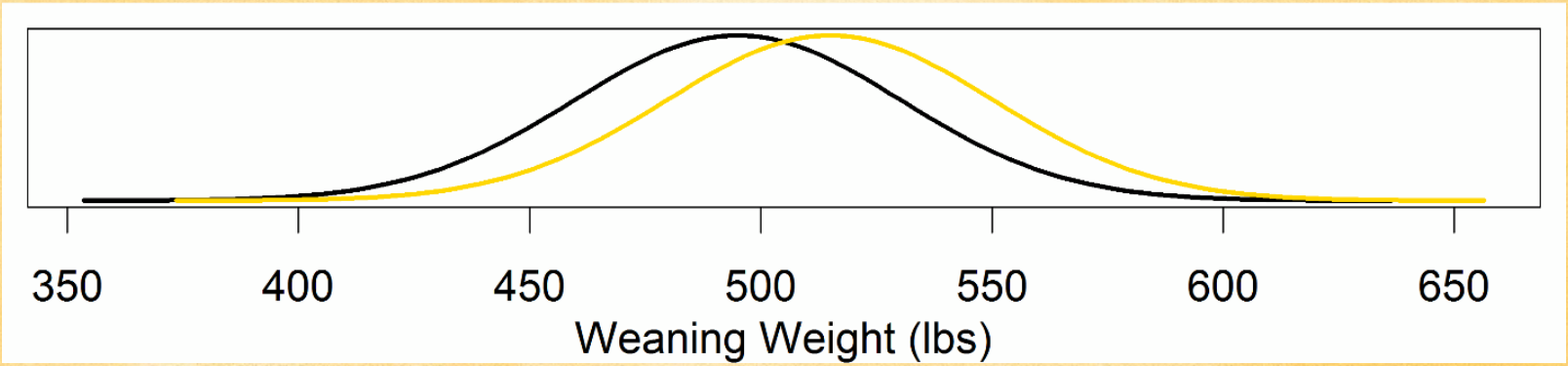
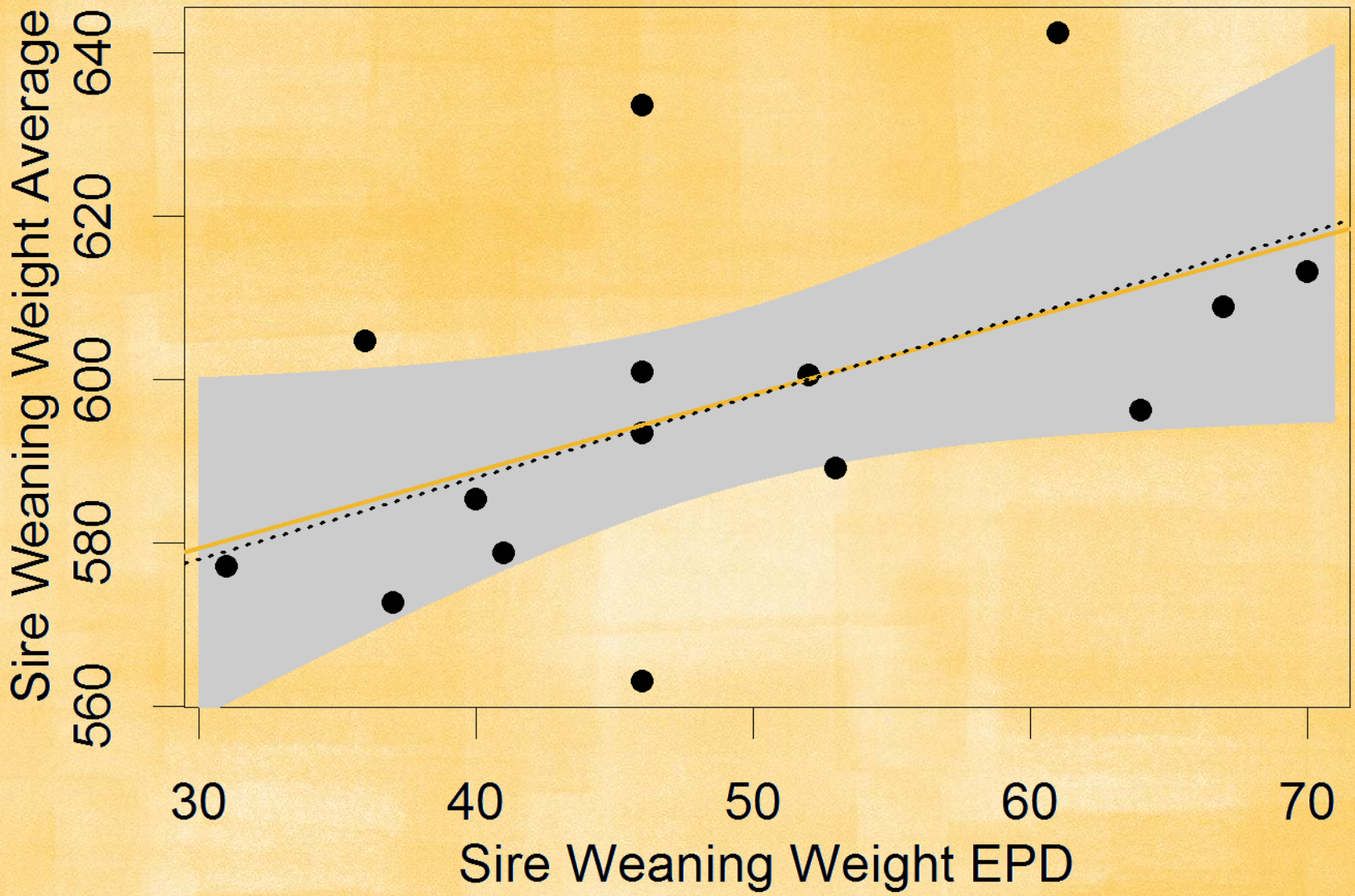


EPDs in Practice

University of Missouri



Calf Performance

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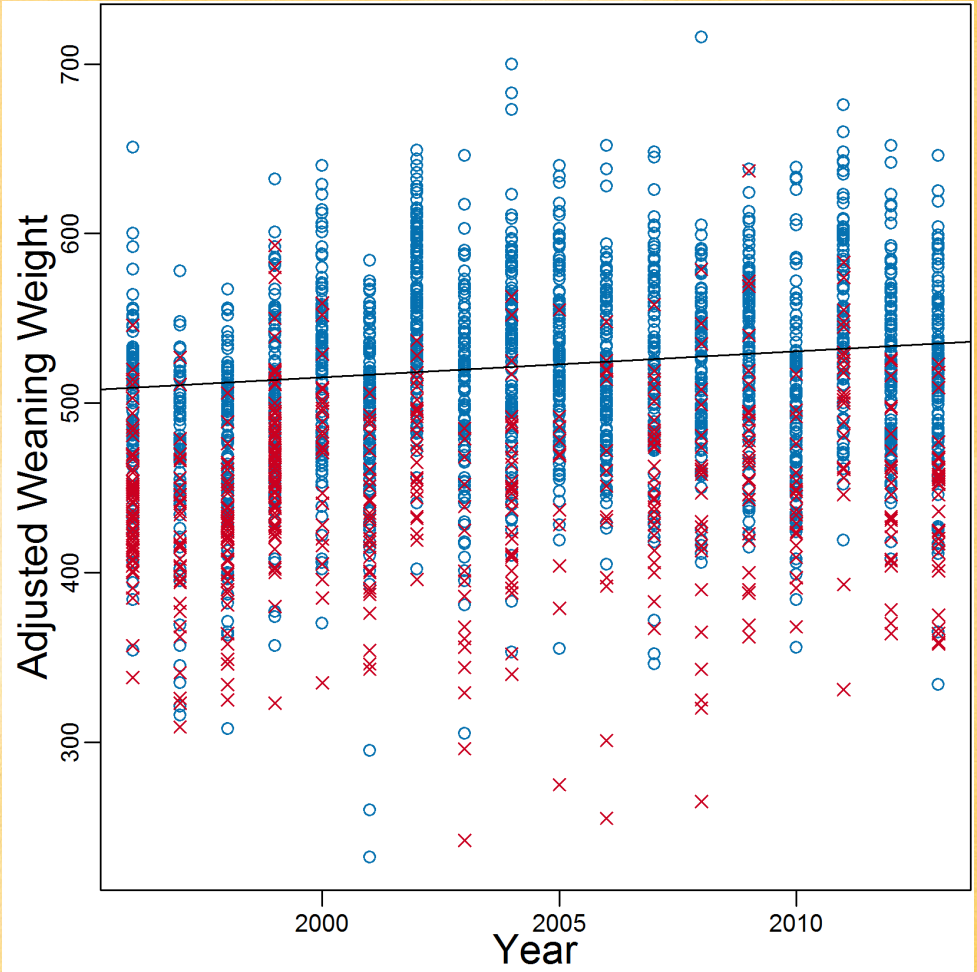
Thompson Research Center
University of Missouri

Weaning Weight is increasing 1.5 pounds per year



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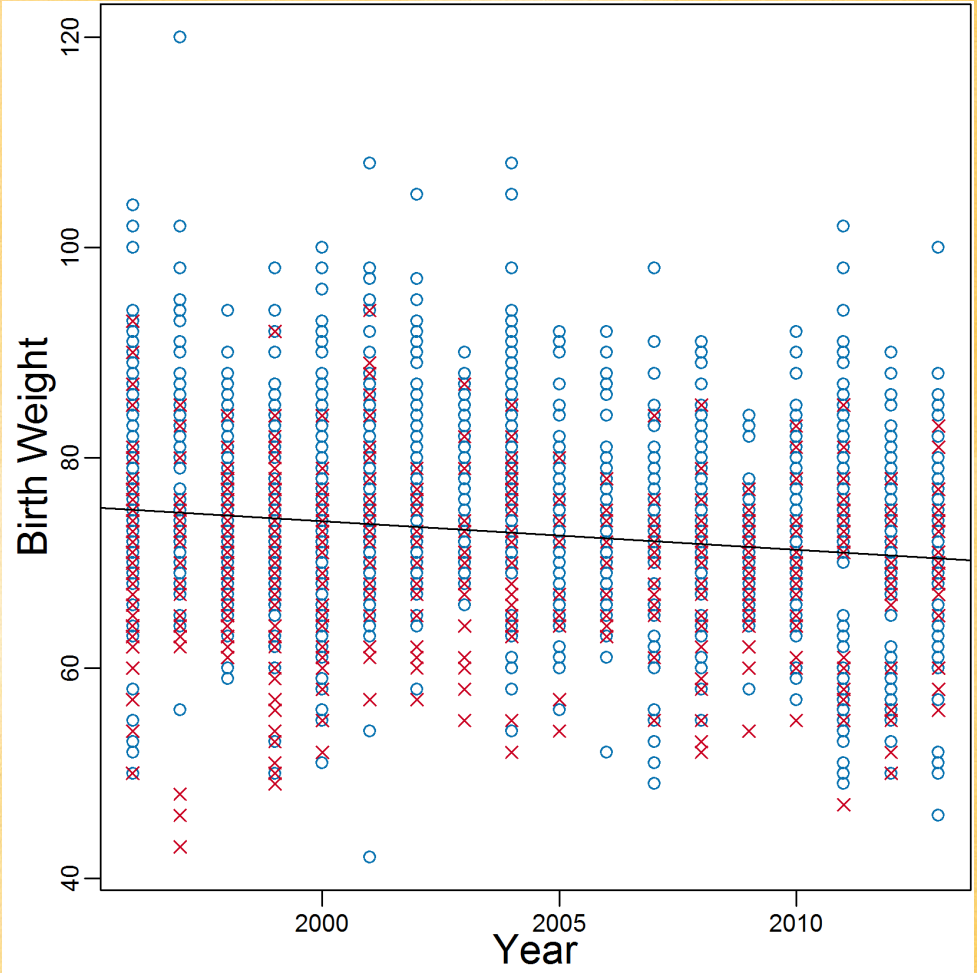
Birth Weight is decreasing 0.27 pounds per year



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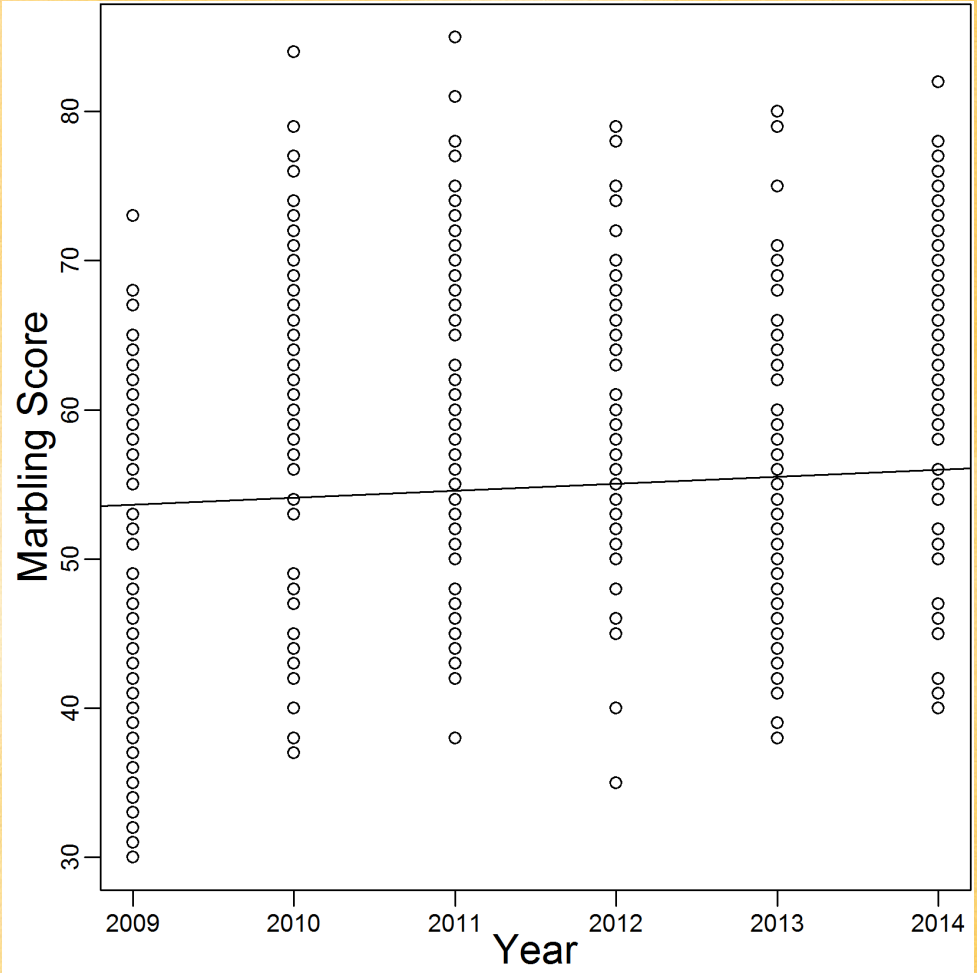
Marbling is increasing 0.47 units per year



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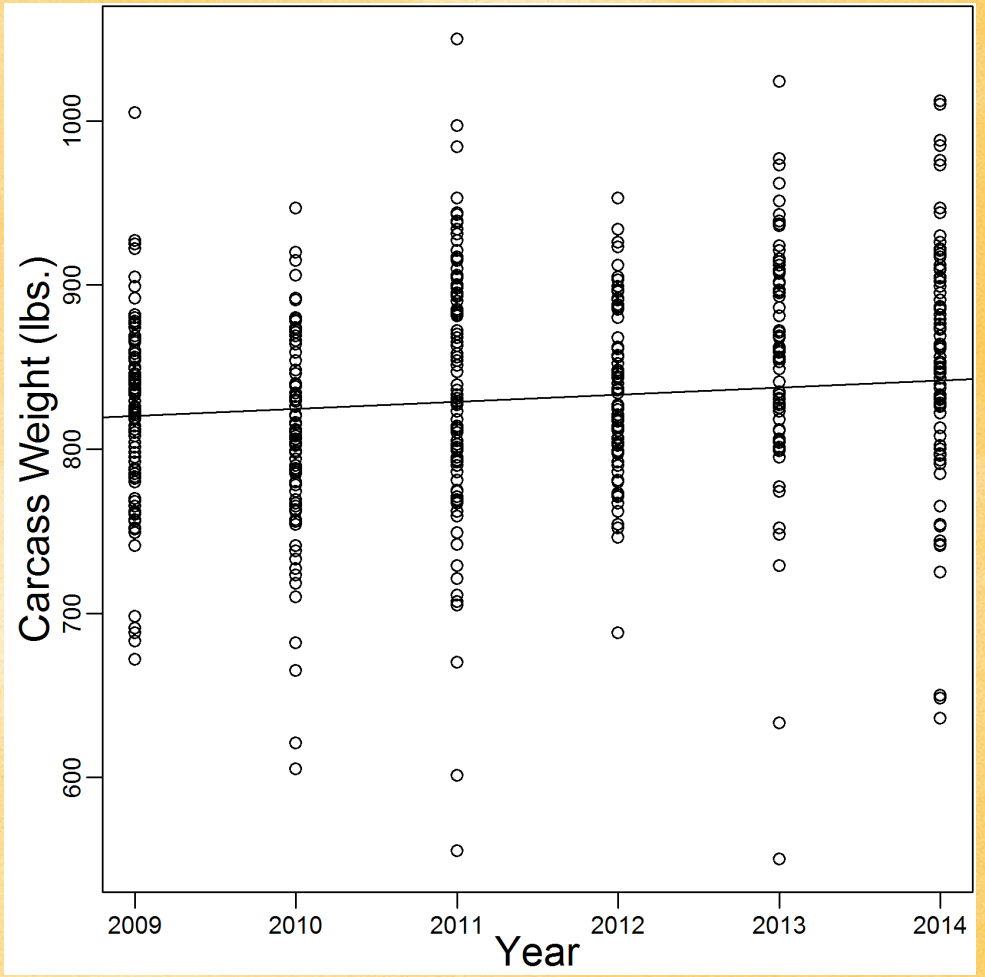
Carcass Weight is increasing 4.3 pounds per year



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EPDs Work!

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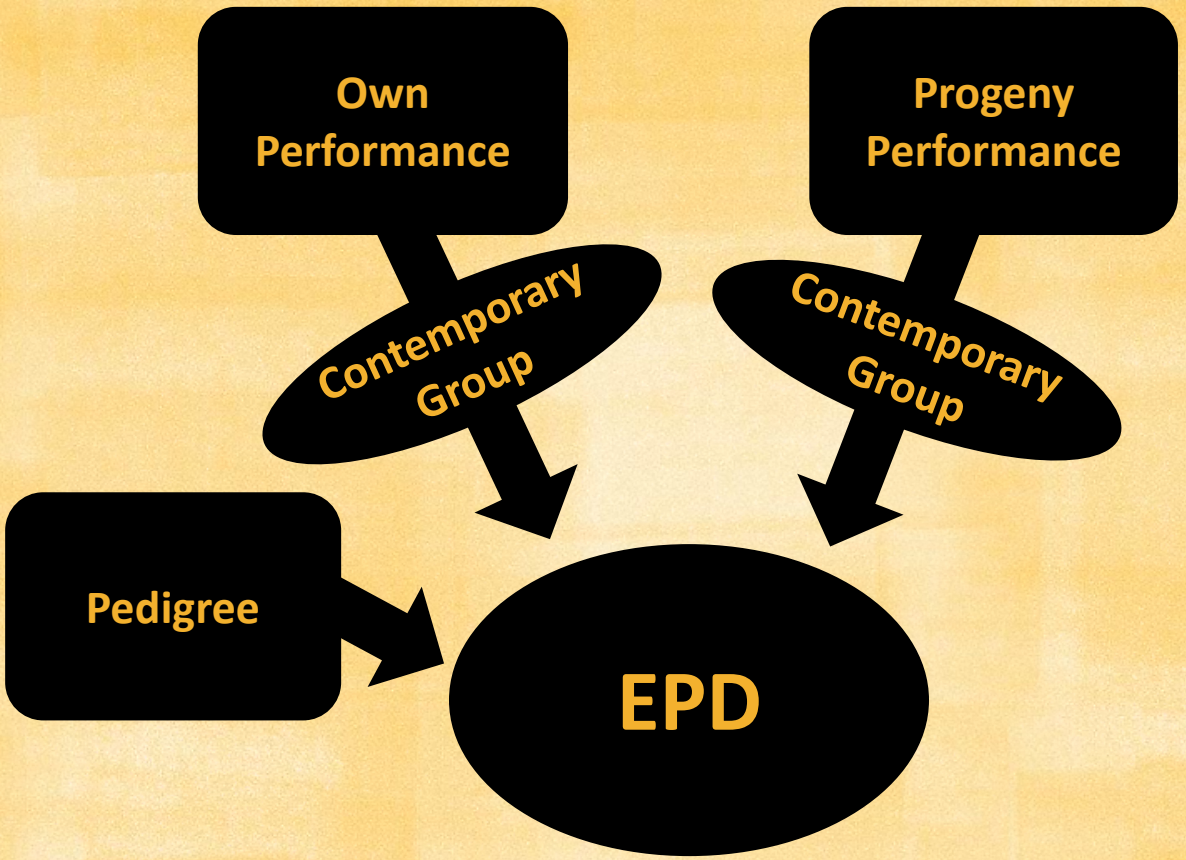
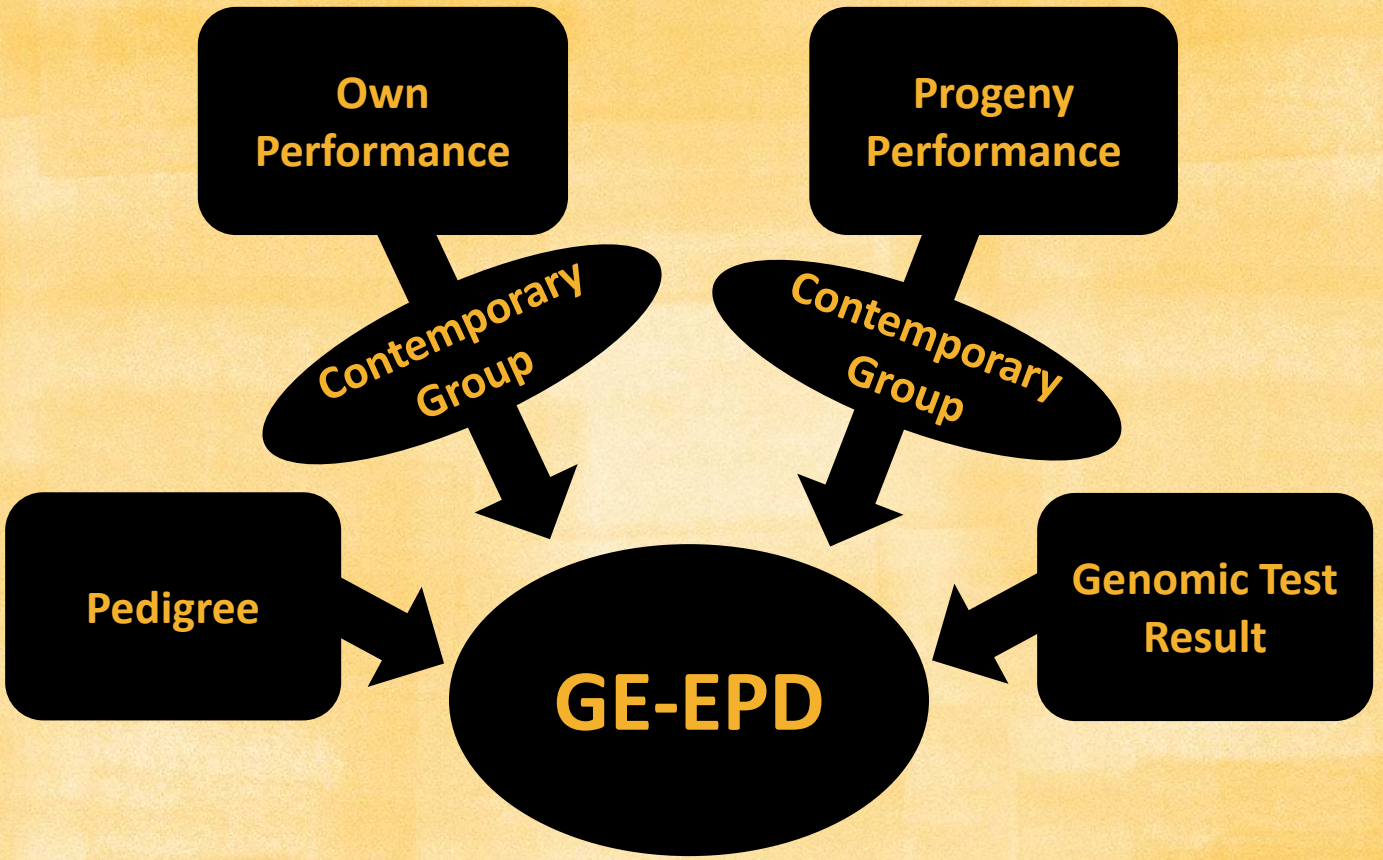
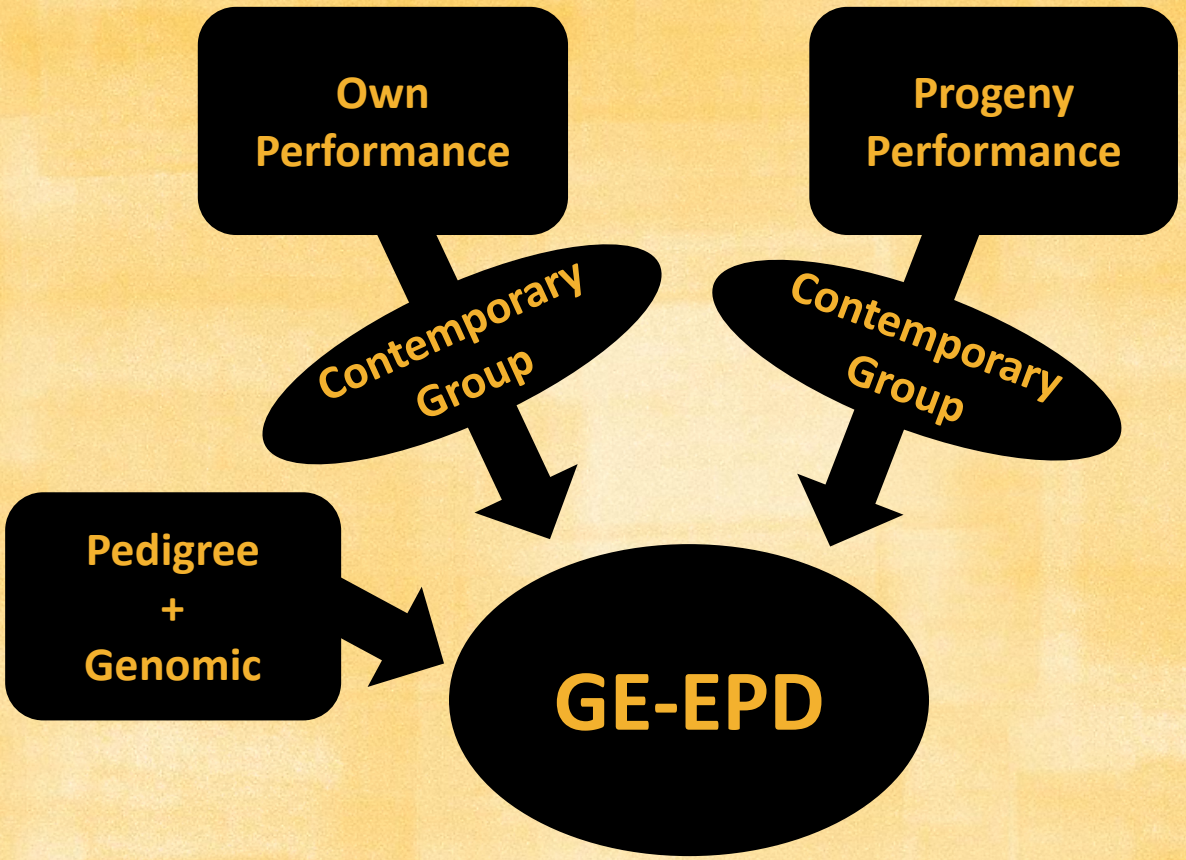
Traditional EPDs

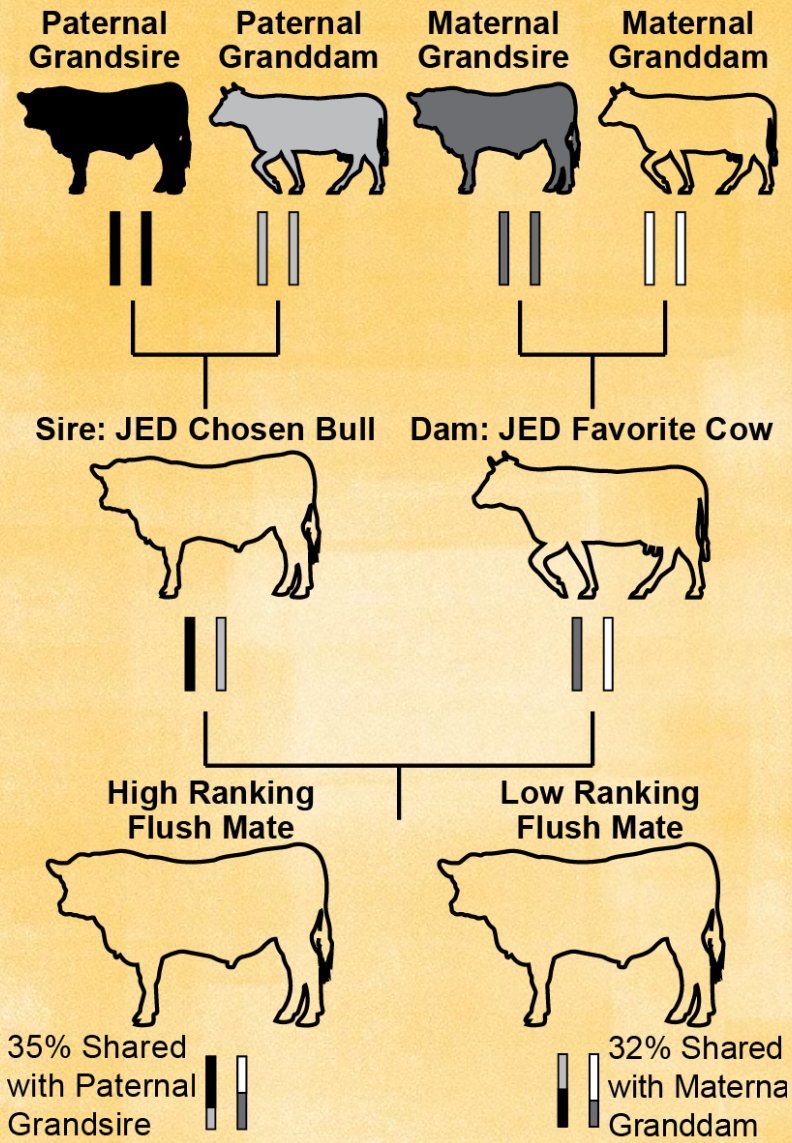


Two-Step Genomic-Enhanced EPDs



Single-Step Genomic-Enhanced EPDs




Paternal Grandsire
Paternal Granddam
Maternal Grandsire
Maternal Granddam
Sire: JED Chosen Bull
Dam: JED Favorite Cow
High Ranking Flush Mate
Low Ranking Flush Mate
35% Shared with Paternal Grandsire
32% Shared with Materna Granddam

	Paternal Grandsire	Paternal Granddam	Maternal Grandsire	Maternal Granddam	Sire	Dam	Animal
Paternal Grandsire	1	0	0	0	0	0	0.25
Paternal Granddam	0	1	0	0	0	0	0.25
Maternal Grandsire	0	0	1	0	0	0	0.25
Maternal Granddam	0	0	0	1	0	0	0.25
Sire	0	0	0	0	1	0	0.5
Dam	0	0	0	0	0	1	0.5
Animal	0.25	0.25	0.25	0.25	0.5	0.5	1

Pedigree Relationship Matrix

	Paternal Grandsire	Paternal Granddam	Maternal Grandsire	Maternal Granddam	Sire	Dam	Animal
Paternal Grandsire	1	0	0.17	0	0	0	0.20
Paternal Granddam	0	1	0	0	0	0	0.30
Maternal Grandsire	0.17	0	1	0	0	0	0.33
Maternal Granddam	0	0	0	1	0	0	0.17
Sire	0	0	0	0	1	0.11	0.5
Dam	0	0	0	0	0.11	1	0.5
Animal	0.20	0.30	0.33	0.17	0.5	0.5	1.07

Genomic Relationship Matrix

Use Genomic Predictions

- **Buy Bulls with GE-EPDs**
  - Increases EPD precision/reliability
  - Identify genetic differences between flush mates
  - Equivalent to 10 to 20 progeny
  - Reduces risk

Heifer Genomic Predictions

- **Have to use the information to see return on investment!**
- **Test many more heifers than you plan to keep**
  - Genomics provides additional information for ranking
  - Increased precision of genomics re-ranks heifers

Pick the right test!

- If testing a registered animal, use the breed association's genomic prediction to produce GE-EPDs!
- If testing commercial straightbred cattle, if a breed specific test is available, USE IT!
- Breed-specific test is going to outperform multiple-breed test

Under appreciated traits

- Stayability/Sustained Cow Fertility
- Heifer Pregnancy
- Mature Cow Weight
- Milk (push towards average or lower)

Multiple Trait Selection

- Which trait is most important?

Multiple Trait Selection

- Which trait is most important?

PROFIT!

- Select for it using an economic selection index

What is an economic index?

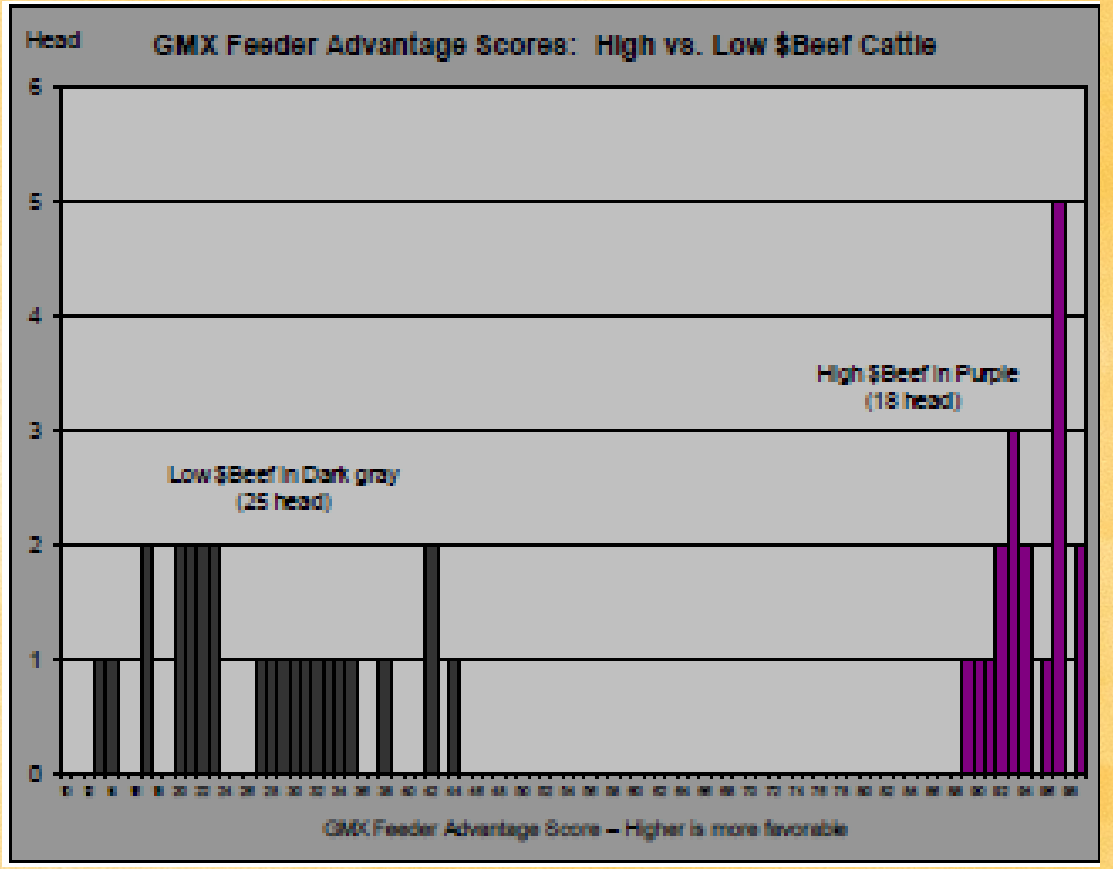
- Combination of EPDs weighted according to their economic importance
- Expressed as a dollar value
- Breeds have different indexes
- Different indexes for different marketing endpoints

Field-Testing $BEEF

- Used embryos from flushes to produce:
- 25 Low $B calves
- (average $*47.40* $B)
- 18 High $B calves
- (average $*141.12* $B)

Field-Testing $BEEF

- Low $B had GeneMax Feeder Advantage index average of *27*
- High $B had GeneMax Feeder Advantage index average of *94*



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Field-Testing $BEEF

- **Breeding values (twice the progeny difference) predicted profit differences of $187.38 between average of the two groups**

Field-Testing $BEEF

- Breeding values (twice the progeny difference) predicted profit differences of $187.38 between average of the two groups
- **Actual difference was $215.47**

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Reaping the Value of Genomics

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Premiums for heifers with various classifications

Predicted premiums for heifers with various classifications, based on mixed model analysis of 2008 to 2017 sale reports.

Variable	Effect	Standard Deviation	p-value
Show-Me-Plus	$153.13	29.59	2.75e-07
Tier II	$66.27	11.07	2.36e-09
Artificial inseminated pregnancy	$106.23	7.12	<2.2e-16
Number of heifers per lot	$17.29	2.35	2.27e-13
Sale Weight	$0.79/pound	0.03	<2.2e-16

ROI ranges from 255%-545% for Show-Me-Plus heifers

Genomic ROI: Early Returns Suggest Premium for Show-Me-Plus Heifers
http://blog.steakgenomics.org/2016/02/genomic-roi-early-returns-suggest.html
See http://agebb.missouri.edu/select/prgmreq.htm for more information.

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Get Paid For What They Are Worth

Average of heifer crop

=

Average of steer crop

Value Added Genetic Based Marketing Programs

ANGUSLINK℠
CATTLE GENETICS VERIFIED

$CHB©

TOP DOLLAR ANGUS®

IGS International Genetic Solutions™
Feeder Profit CALCULATOR™

INTEGRITY BEEF

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Research Highlights

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Reproductive Tract Scores

Applied Reproductive Strategies in Beef Cattle
Ruidoso, NM 2018
http://www.appliedreprostrategies.com/2018/newsroom.html

Pregnancy Rates by Reproductive Tract Score

Subspecies	RTS 2	RTS 3	RTS 4	RTS 5
Bos indicus influenced	35%	39%	52%	55%
Bos taurus	32%	46%	50%	52%

National Center for Applied Reproduction & Genomics

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Training in reproductive and genetic technologies for veterinarians, veterinary students, producers and other industry professionals

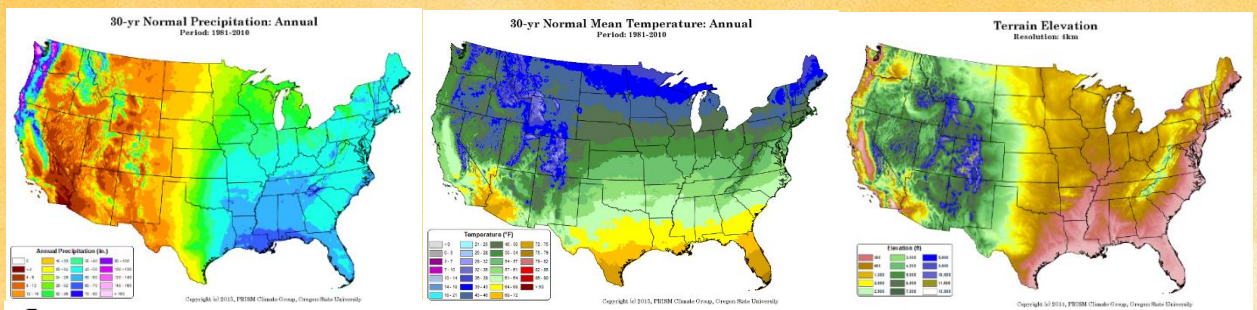
Genomics of Puberty and Fertility

- **~6,000 Angus samples**
- **Proposal under review for ~2,500 Hereford and ~2,500 Red Angus**

- **1,500 *Bos indicus* influenced females available**
  - Seeking funding

Identifying Local Adaptation and Creating Region-Specific Genomic Predictions in Beef Cattle

http://blog.steakgenomics.org/2016/05/local-genetic-adaptation-grant.html



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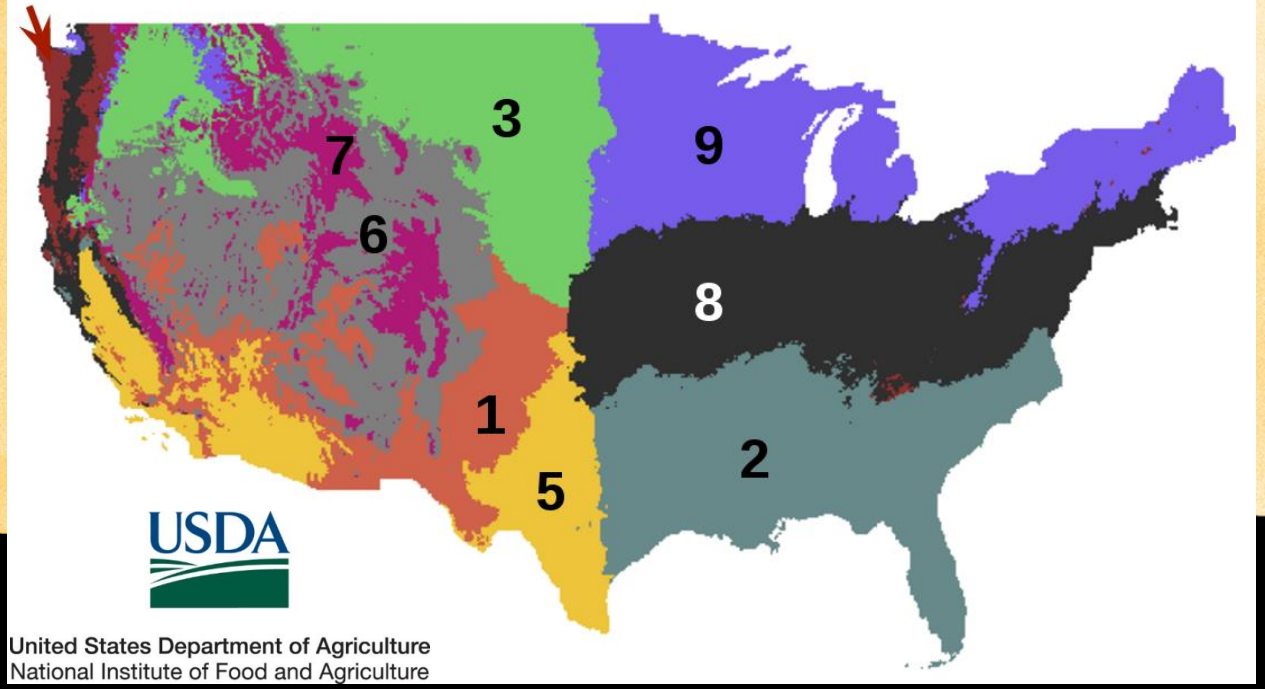

United States Department of Agriculture
National Institute of Food and Agriculture

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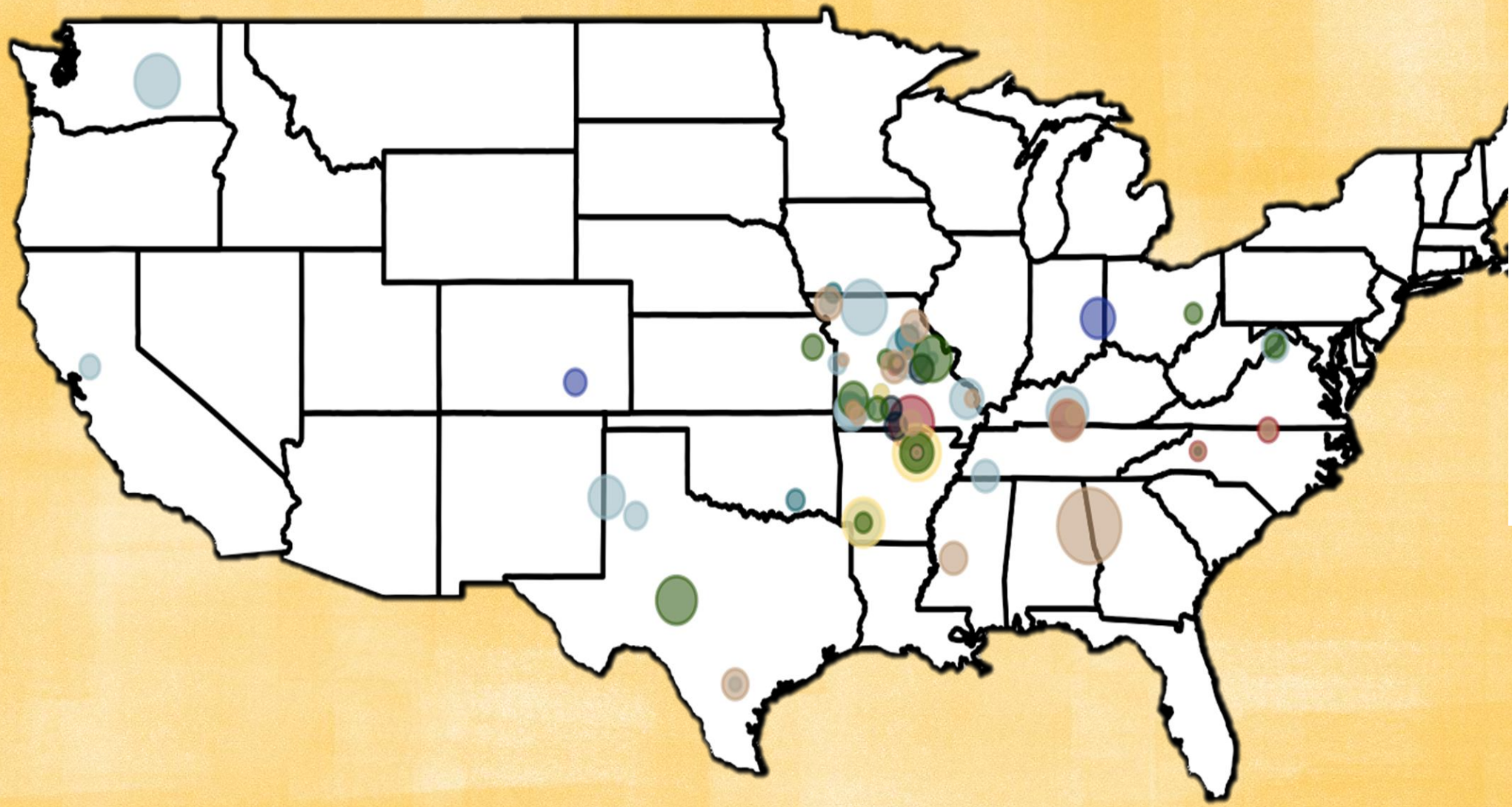
Hair Shedding

- **1 to 5 subjective score**
- **“Hair shedding scores: A tool to select heat tolerant cattle”**

http://articles.extension.org/pages/74069/hair-shedding-scores:-a-tool-to-select-heat-tolerant-cattle



Samples

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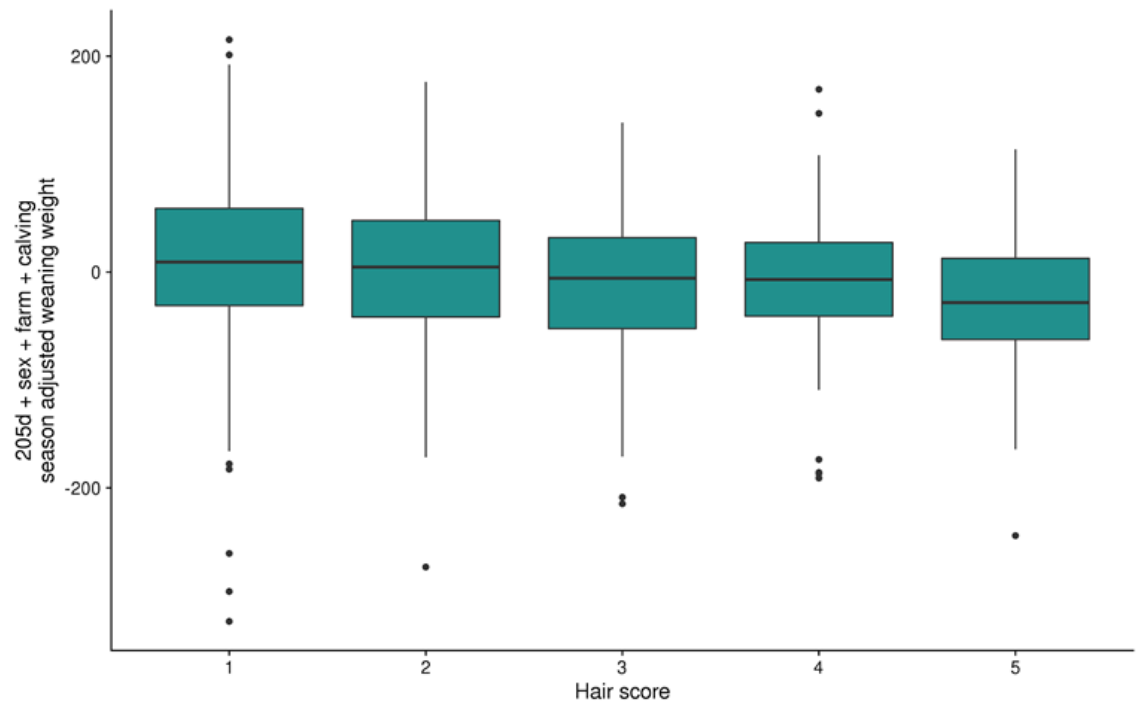
Hair Shedding and Weaning Weight



- Comparing adjusting calf weaning weight with adjusting hair shedding score of the dam,
- Decreasing hair score by 1 unit results in an increased weaning weight of 12.6 pounds (p = 0.056).

EPDs Work!

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