



“The native cattle are extinct, but the island is full of artificial breeds. The agriculturalist Bakewell created sheep and cows and horses to order, and breeds in which everything is omitted but what is economical. The cow is sacrificed to her bag; the ox to his sirloin.”

Ralph Waldo Emerson




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Genetic Selection vs. Visual Appraisal: Is it a Conundrum?



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Systematic Sire Selection

- Set Goals
- Assess Cow Herd
- Assess Resources
- Breed Selection
- Bull Selection
 - Reproduction
 - Structure
 - Performance
 - Visual Appraisal

<http://www.nbcec.org/producers/sire.html>



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Developing a Breeding Objective(s)



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Do You Have a Breeding Objective??

Our objective is to breed cattle that **breed as yearlings, calve unassisted** and rear a good calf for **sale at weaning** every year. We aim to breed functional cattle that flesh easily and can forage on the hills over winter but must have the temperament and soundness to be **farmed intensively** during calving and the breeding season.

Missing: How do they replace females in herd?

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Production Level Considerations

Production Environment					Traits		
Feed Availability	Stress	Milk	Mature Size	Ability to store energy	Resistance to stress	Calving ease	Lean yield
High	Low	M-H	M-H	L-M	M	M-H	H
	High	M	L-H	L-H	H	H	M-H
Low	Low	L-M	L-M	H	M	M-H	M
	High	L-M	L-M	H	H	H	L-M

Adapted from Gosey

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Fundamentals of Beef Production Profit

Profit = Revenue – Costs

Revenue – easy to measure
Costs – hard to measure

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Beef Business!

Cattle

↓

Seedstock

Communicate Value??

Cow-calf

Feeder

Packer

Consumer


↑

Information

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The Role of Economically Relevant Traits

- A trait that has a direct cost or return associated with it is an Economically Relevant Trait (ERT).
- Traits that are correlated to ERTs are indicator traits.
- Example: Is Birth Weight or Calving Ease the ERT? Why??
- Weaning Weight or Yearling Weight?



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Relative Economic Weights for Traditional Beef Firm

Reproduction:Growth:End Product

10:5:1





(Melton, 1995)

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Relative Economic Weights for Integrated Beef Firm

Reproduction:Growth:End Product

2:1:1

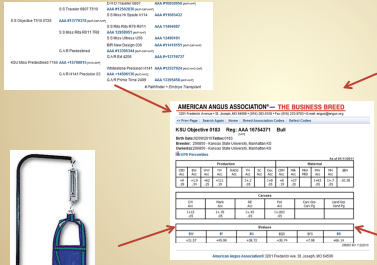





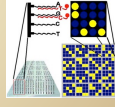
(Melton, 1995)

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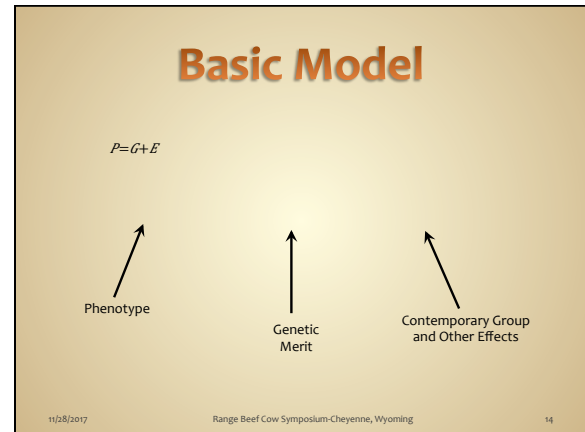
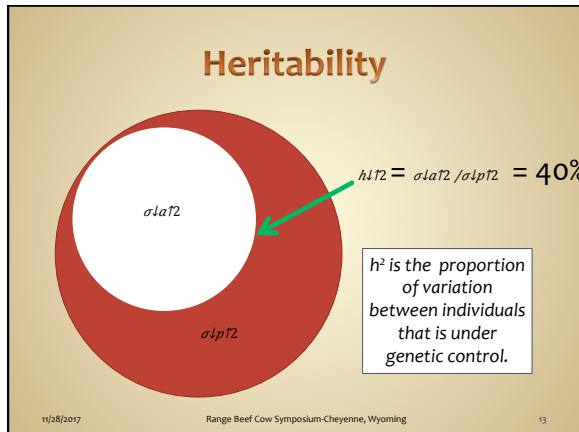
Sources of Information



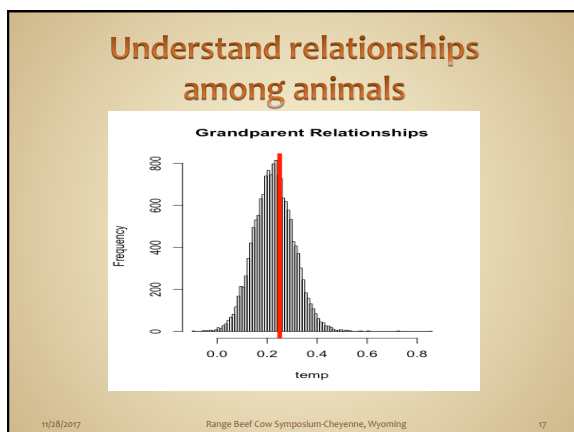
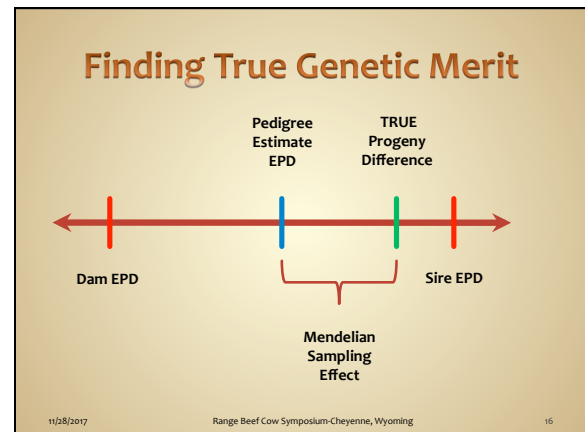
Moser, 2011

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- ### Phenotypic Variation
- Animal to animal variation
 - Genetics
 - Additive (the stuff for which we select)
 - Non-additive (heterosis)
 - Environment
 - Forage resources
 - Dam milk production
 - Effects
 - Sex
 - Age of calf
 - Age of dam
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- ### Sire Selection Tools:
- DNA Markers
 - EPD
 - Ratios
 - Adjusted weights
 - Raw Weights
 - Visual Appraisal
-
- Ability to generate response to selection
- Cost
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Some information is like a...



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EPD-Expected Progeny Difference

- Separates the 'wheat from the chaff'
- What information is included?
 - Pedigree information
 - (Parents, grand-parents, half-sibs, etc.)
 - Individuals' own record (very important)
 - Progeny information
 - Correlated traits (BW, WW, YW)
 - REMOVES ENVIRONMENTAL EFFECTS
 - Can be used across herds but only within a breed

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How EPDs Are Computed: Contemporary Group

- Consists of animals that are:
 - Given **equal** opportunity to perform
 - Of similar age and sex
- Identify fair competition
- Formed from management information
- The basis of all genetic comparisons

$$\text{Phenotype} = \text{CG} + \text{Genetics}$$

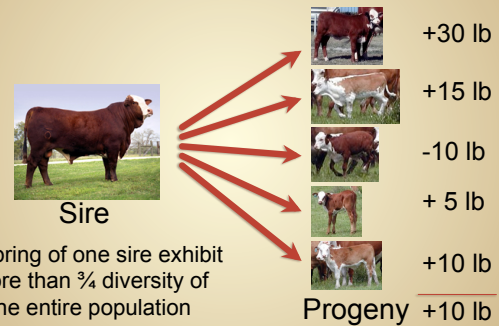
$$\text{Genetics} = \text{Phenotype} - \text{CG}$$

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Performance of the Progeny



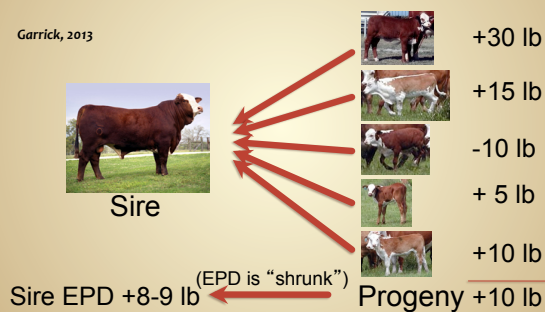
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We learn about parents from progeny

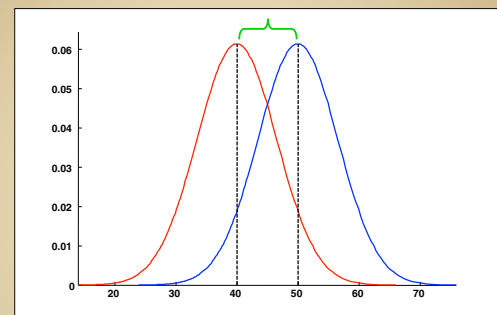
Garrick, 2013



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10 lb. Difference in EPD of Two Bulls

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Do EPDs work??



EPD's Work...

- Much more effective generating response to selection than phenotypic selection
- Can be used to:
 - Increase performance
 - Decrease performance
 - Optimize performance
- Do not select for maximum genetic expression w/o regard to other factors
 - Nutritional conditions

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Table 11. Pooled and within-breed regression coefficients (lb/lb) for weights at birth (BWT), 205 days (WWT), and 365 days (YWT) of F1 progeny and for calf weights (205 d) of F1 dams (MILK) on sire expected progeny difference and by sire breed.

	BWT	WWT	YWT	MILK
Pooled	1.17±0.04	0.80±0.03	0.98±0.04	1.11±0.07
Angus	1.06±0.09	0.83±0.06	1.18±0.07	1.08±0.15
Hereford	1.16±0.07	0.71±0.05	1.00±0.06	1.03±0.15
Charolais	1.14±0.12	0.96±0.11	0.86±0.12	1.06±0.22
Gelbvieh	1.05±0.14	0.81±0.11	1.15±0.12	0.84±0.25
Limousin	1.11±0.11	0.80±0.07	0.86±0.09	1.42±0.21
Red Angus	1.01±0.14	0.74±0.13	0.61±0.15	1.34±0.26
Simmental	1.16±0.14	1.44±0.12	1.33±0.12	0.95±0.30

US-MARC Across Breed EPD Report, BIF Proceedings

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Why Do We Need Selection Indexes?

“There is no easily accessible, objective way for breeders, particularly breeders in the beef and sheep industries where ownership is diverse and production environments vary a great deal, to use these predictions intelligently.”

-- R. M. Bourdon, 1998



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What Is a Selection Index?

- Selection on ‘aggregate merit’ (Hazel, 1943)
- List of traits that influence “satisfaction”
- Relative Economic Value (REV) of each trait
 - Increase in satisfaction with one unit change in a trait, all others held constant
- List of characteristics to be measured on animal
- Relationships between characteristics (phenotypes) and traits (genotypes)

$$H_i = a_1 BV_{i1} + a_2 BV_{i2} + K + a_n BV_{in}$$

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Terminal or Maternal?

Terminal

- \$B, \$F, \$G (Angus)
- TI (Simmental)
- CHB\$ (Hereford)
- MTI (Limousin)
- EPI and FPI (Gelbvieh)
- Charolais
- GridMaster (Red Angus)
- \$T (Beefmaster)

Maternal

- \$W, \$EN (Angus)
- API (Simmental)
- BMI\$, BII\$, CEZ\$ (Hereford)
- HerdBuilder (Red Angus)
- \$Cow (Gelbvieh)
- \$M (Beefmaster)

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EPDs-One Tool in the Tool Box

- Selection is challenging
- Multiple trait selection
- Not all economically important traits have EPD
 - Fertility
 - Disease resistance
 - Fescue fitness
 - Conformation traits
 - Mature weight
- **Use the right tool for job!**



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Phenotypic Selection for Bull Traits

- Pass/Fail approach... Are they good enough?
- Traits
 - Breeding Soundness Exam
 - Docility
 - Feet and Leg Traits



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Phenotypic Selection for Replacement Heifers

- Pass/Fail approach... Are they good enough?
- Breed composition to generate maternal heterosis
- Convenience Traits
 - Feet/Legs
 - Udder/Teat quality
 - Docility
- Genetic Improvement in heifers is driven by sire selection



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What makes a heifer? What makes her SUCCESSFUL?

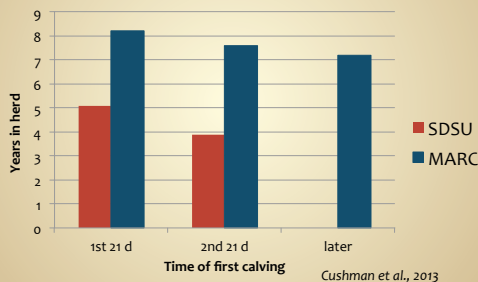
- Environmental Effects?
 - Age at breeding
 - When were they born in calving distribution
 - Body condition score at calving and breeding
- Genetic Effects
 - Heritability of traits important to maternal performance? LOW ~0.1 - 0.2
 - Heterosis (value ~\$150/cow/year)

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Longevity in herd based on calving date as heifer

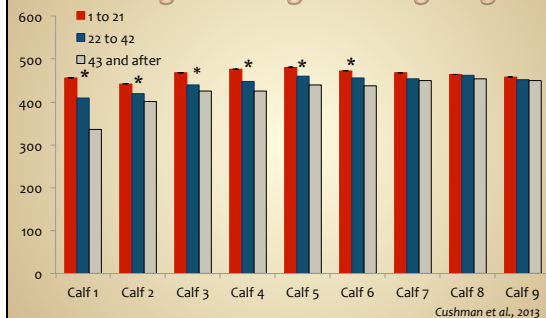


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Effect of time of conception at first breeding on average weaning weight



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