Ewe Nutrition and Reproductive Potential

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MONTANA STATE UNIVERSITY

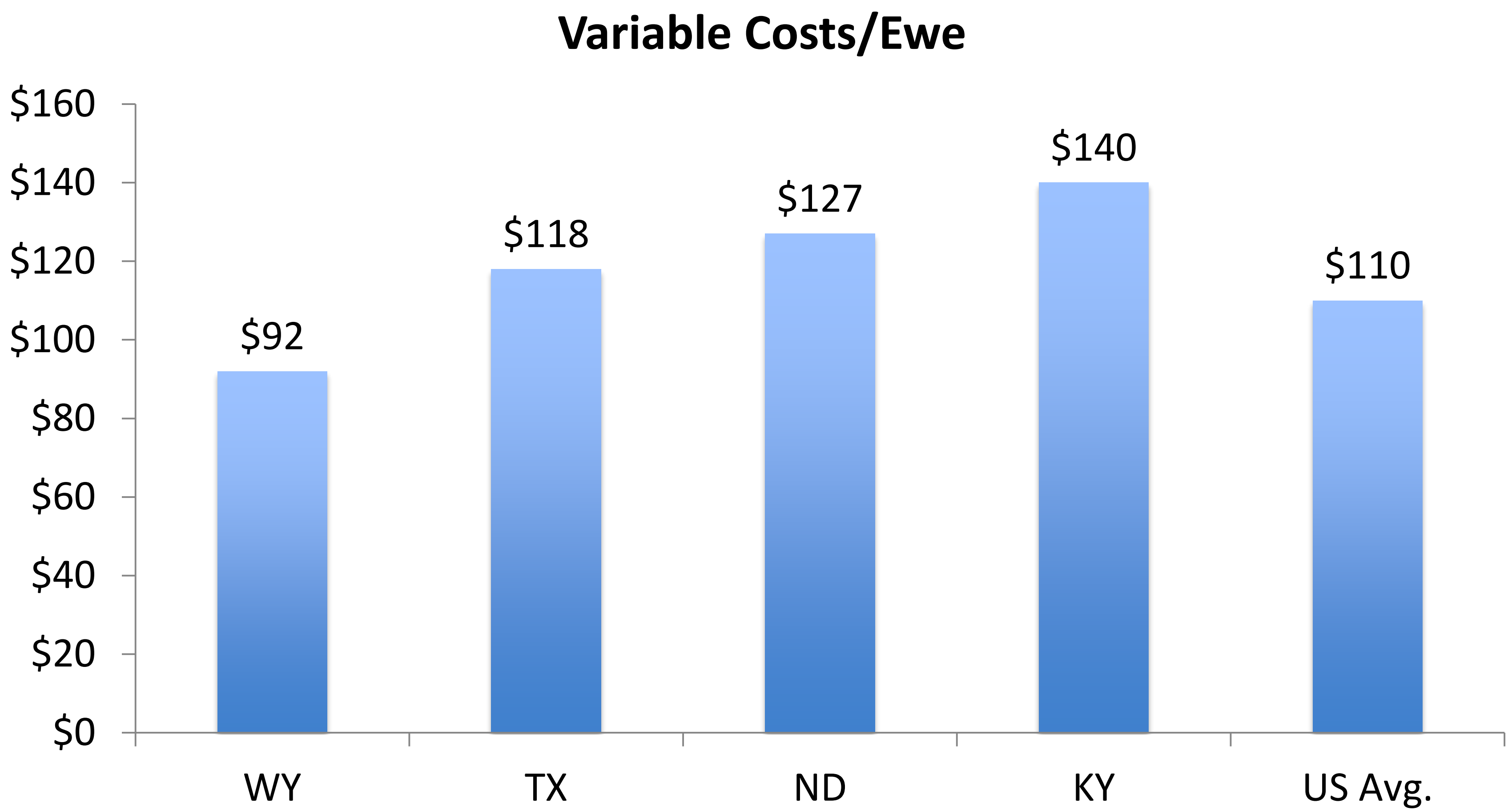
EXTENSION

Sheep Program

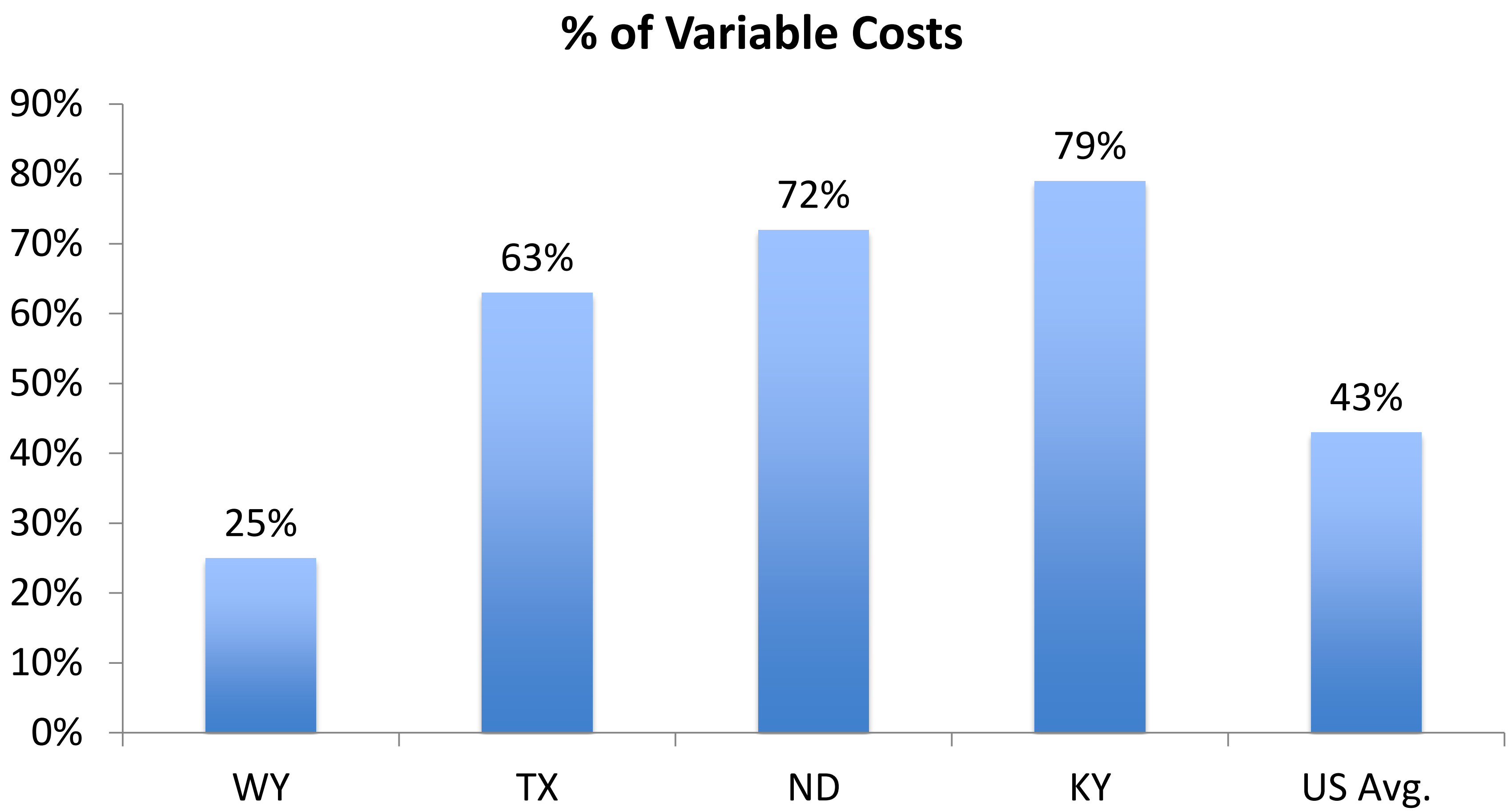
Objectives/Disclaimer

- "Sheep production is an art and science"
  Leroy Johnson, Retired UW Sheep Specialist
- Is nutritional management annually evaluated?
- Re-evaluation of nutritional strategies can:
  - Reduce feed related input costs
  - Improved "bang for buck" with supplemental feed inputs

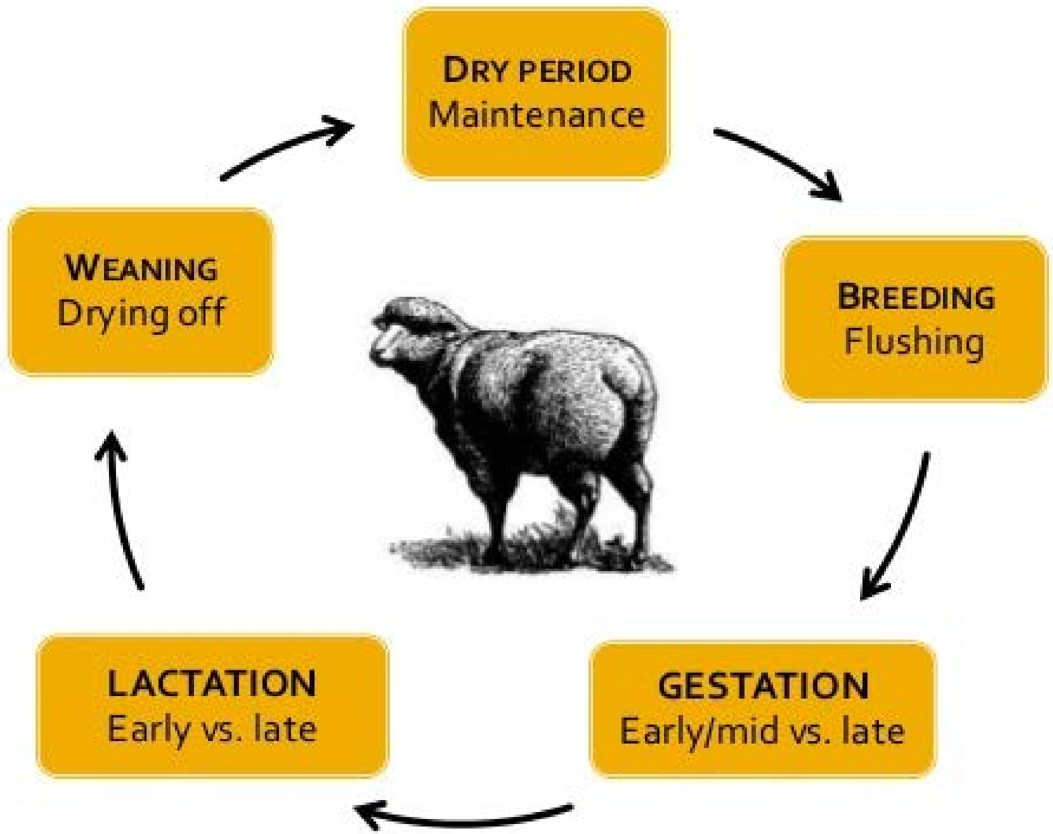
Annual Variable Costs/Ewe



Feed Costs as % of Variable Costs

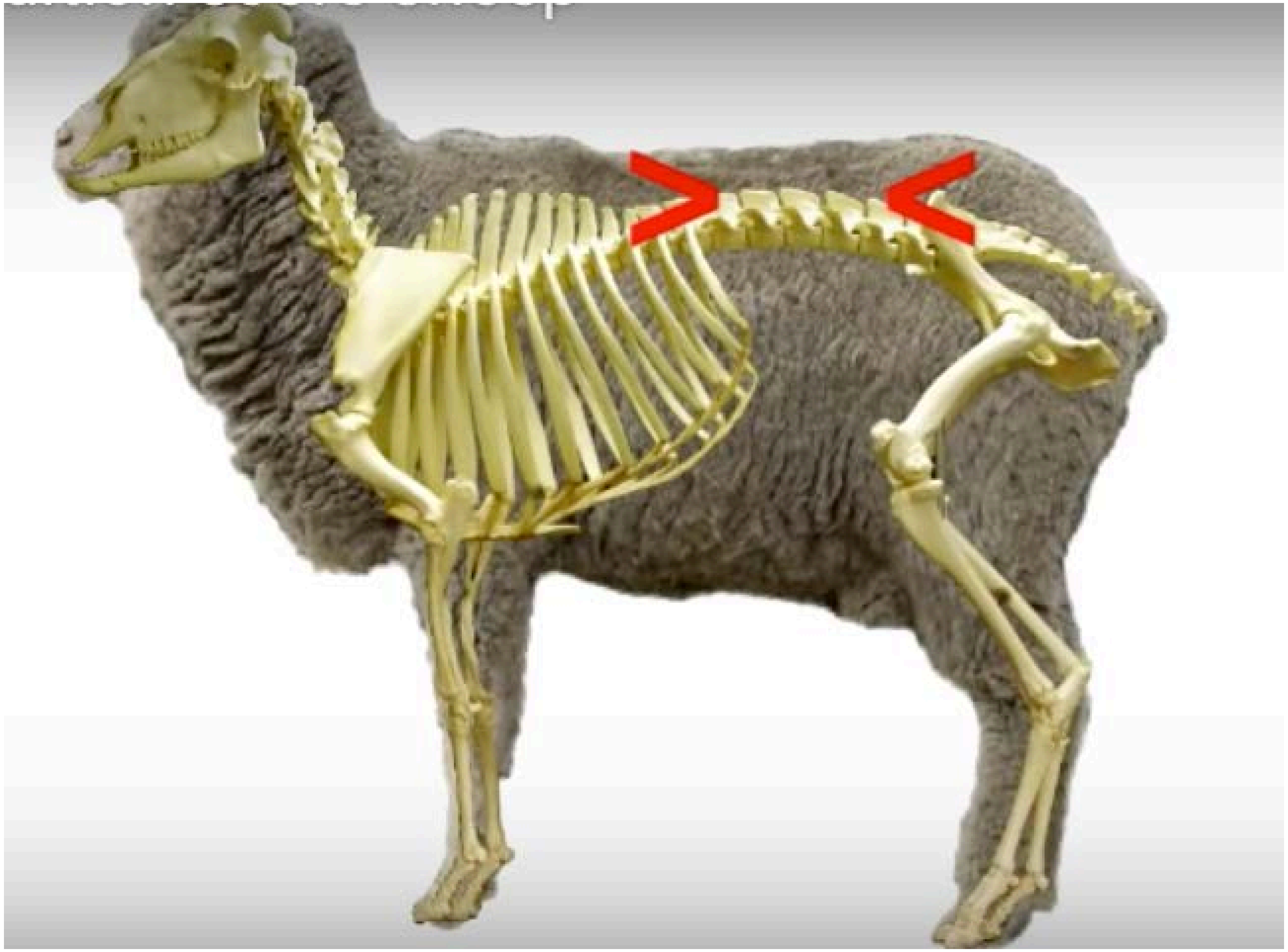


Ewe Flock Nutritional Requirements

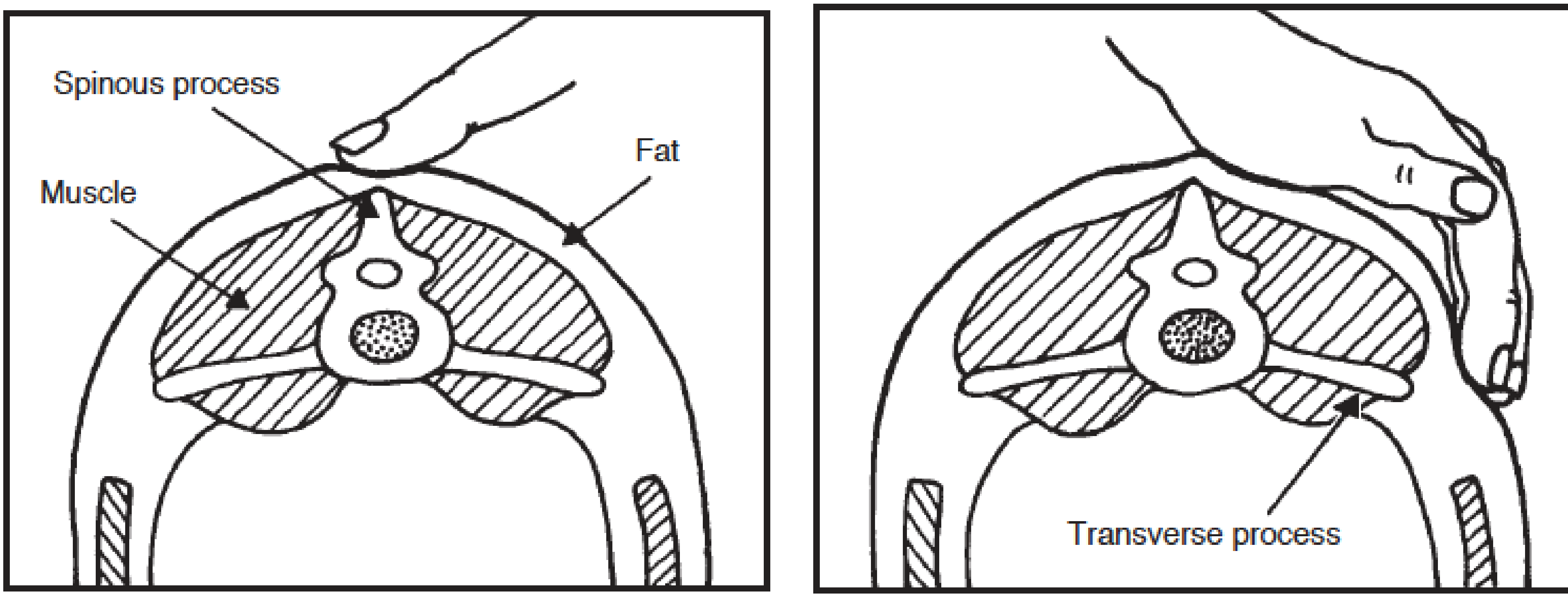


Difficult without hands on

How to body condition score



How to Body Condition Score

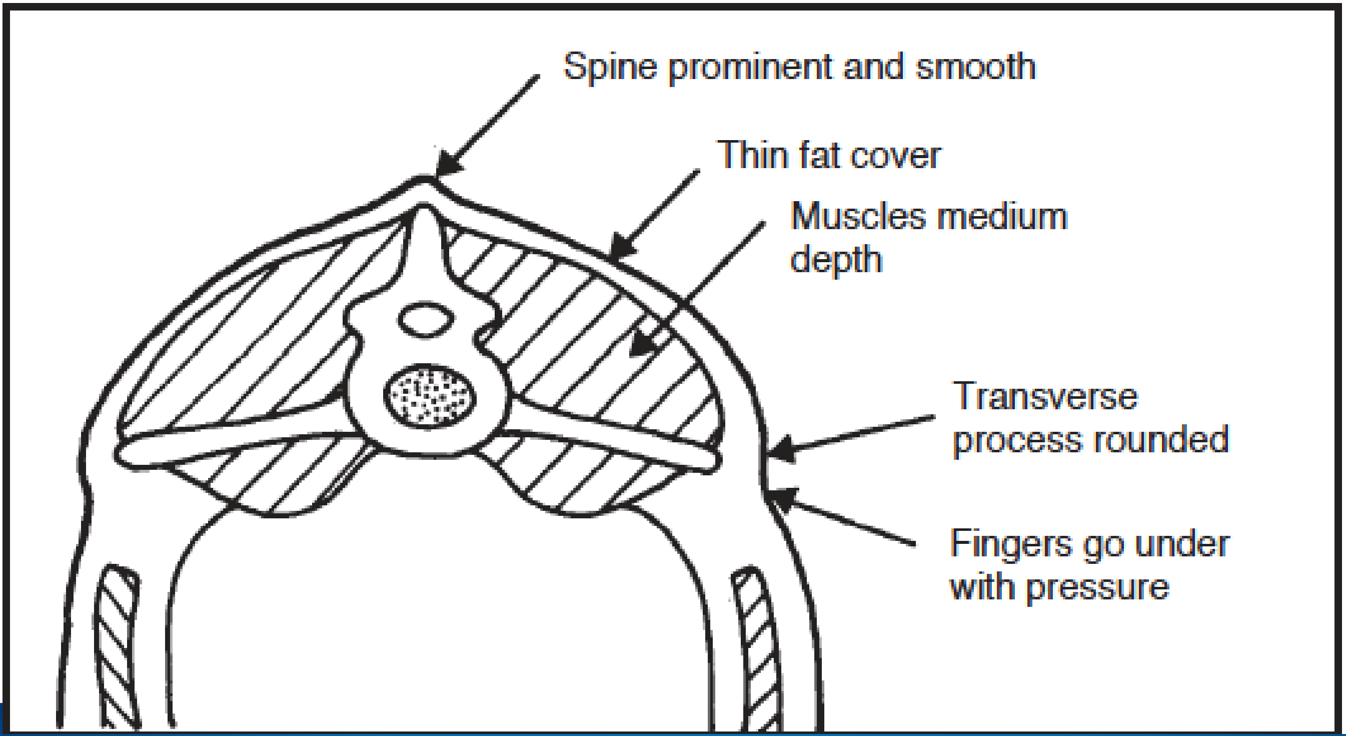


Thompson and Meyer, 1994

1.0		The ends of the short ribs feel like the ends of your fingertips. When you push your fingers under the short ribs, there is no muscle underneath, just skin. Spine is prominent. There is virtually no muscle on the back and it feels concave.
2.0		Muscle depth under short ribs equivalent to distance from first knuckle to finger tip. Can feel spine. Back muscle is slightly concave and not rounded.
2.5		Muscle depth under short ribs about equivalent to distance from second knuckle, to first knuckle when fingers are flexed. Need some pressure to feel short ribs. Some cover on spine, back muscle flat.
3.0		Muscle depth under short ribs about equivalent to distance from 3rd knuckle to 2nd knuckle, when fingers are flexed. Need moderate to strong pressure to feel short ribs. Back muscle rounded.
4.0		'Prime'. Can only feel short ribs with really strong pressure. Back is rounded with plenty of fat cover. Muscle under short ribs deep - nearly the distance from first knuckles to the beginning of your wrist joint.
5.0		Obese. Fat rolls either side of spine. Spine is in a dimple. Impossible to feel short ribs - fat either side of tail head. Almost never see in a commercial flock.

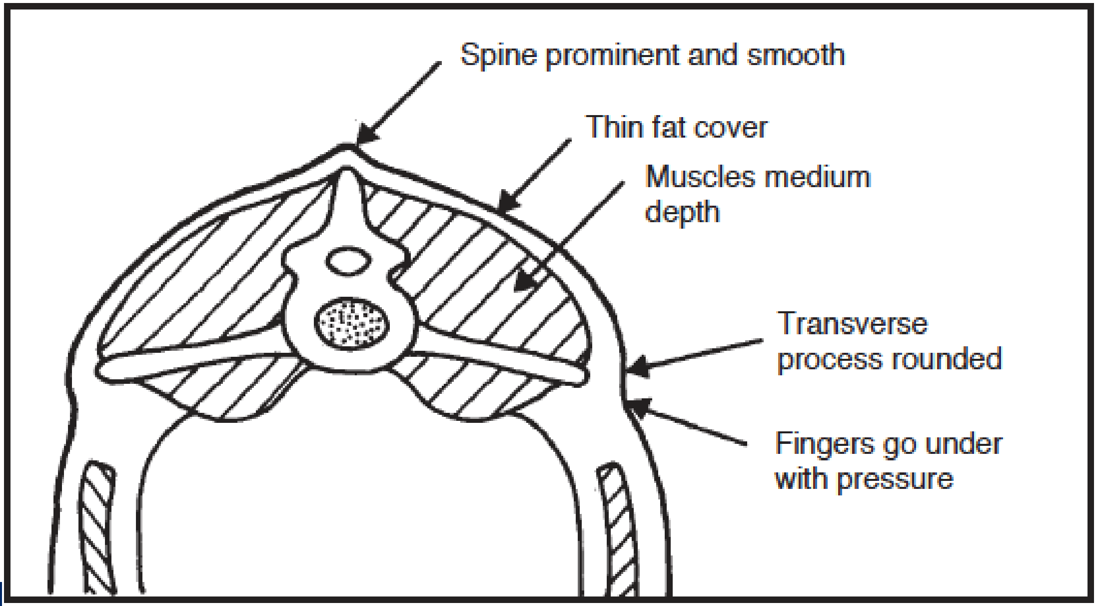
Body Condition Score 1

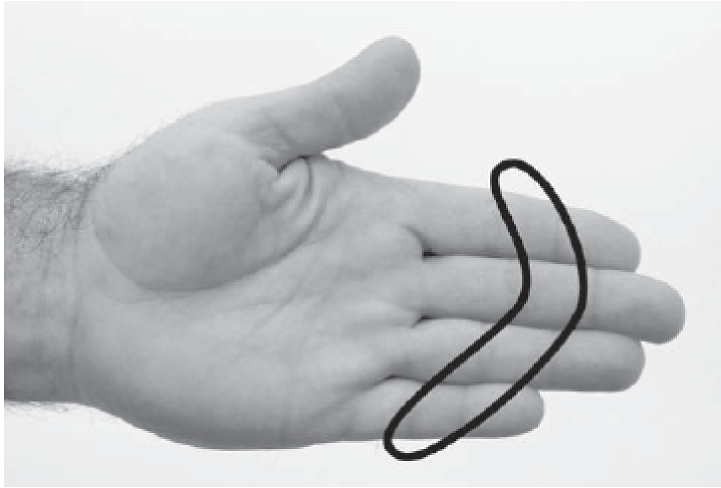
- **Spinal processes are prominent**
- **Fingers easily pass under transverse process**
- **Can feel between each transverse process**



Body Condition Score 2

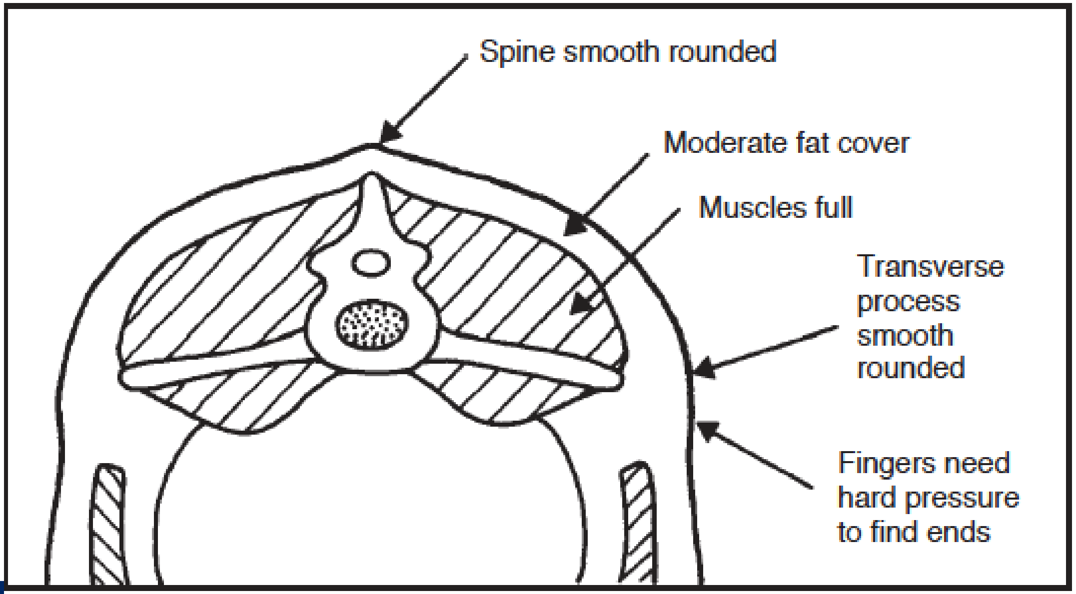
Spinal processes are still noticeable with minimal pressure
Fingers easily pass under transverse process with minimal pressure
Can feel between each transverse process similar to second joint fingers
Loin muscle moderate with little fat cover

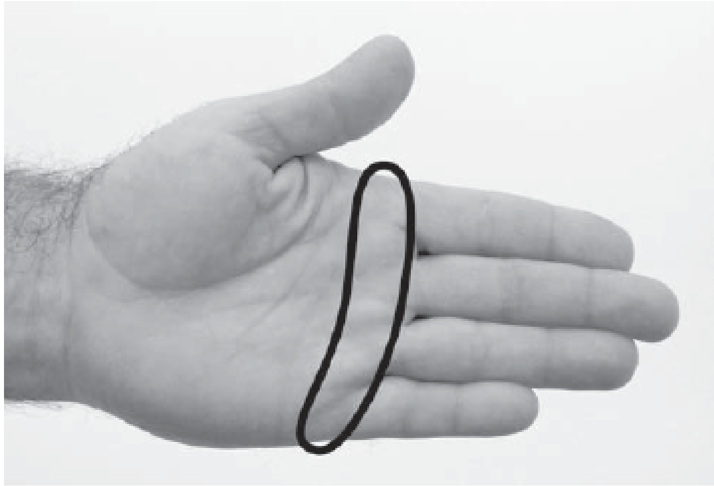




Body Condition Score 3

- **Spinal processes are smooth and rounded**
- **Spinal and transverse processes can only be felt with moderate pressure**
- **Can feel between each transverse process similar to palm below fingers**
- **Loin muscle full with some fat cover**

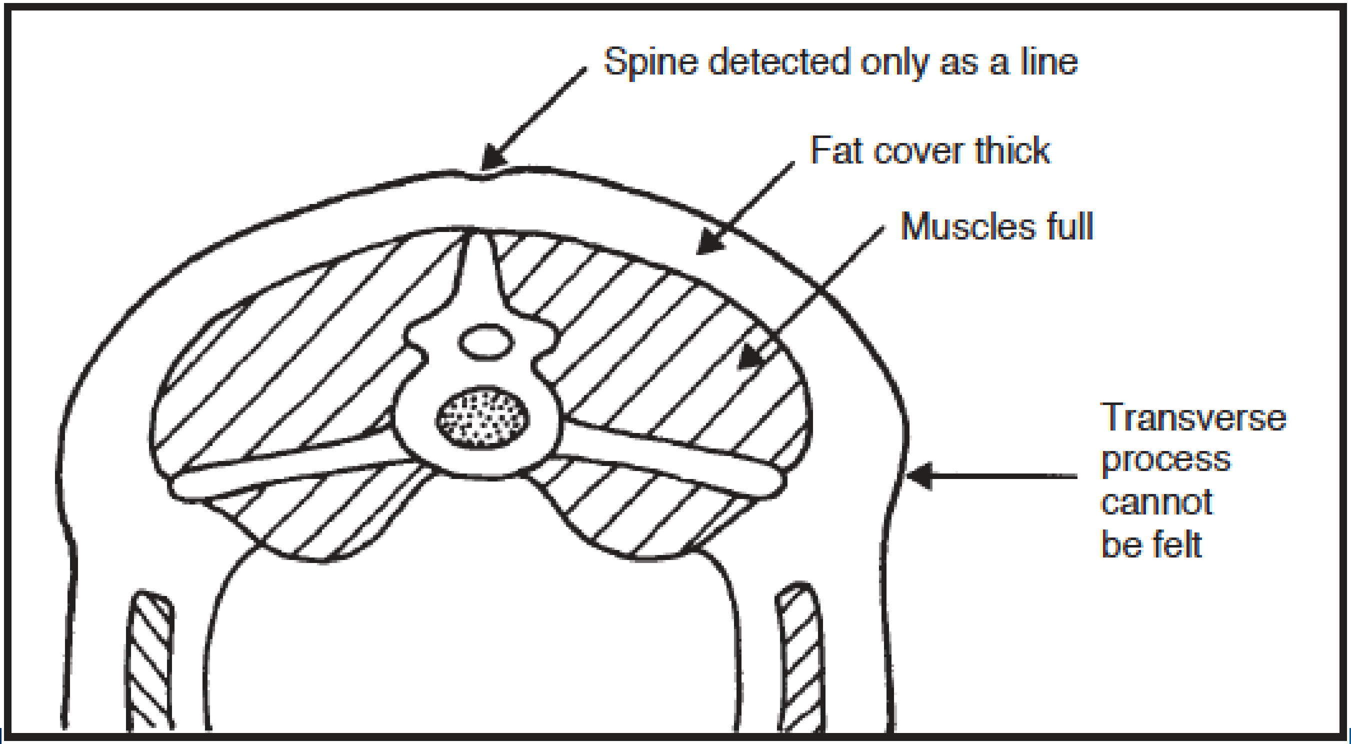




Thompson and Meyer, 1994; Fernandez, 2013

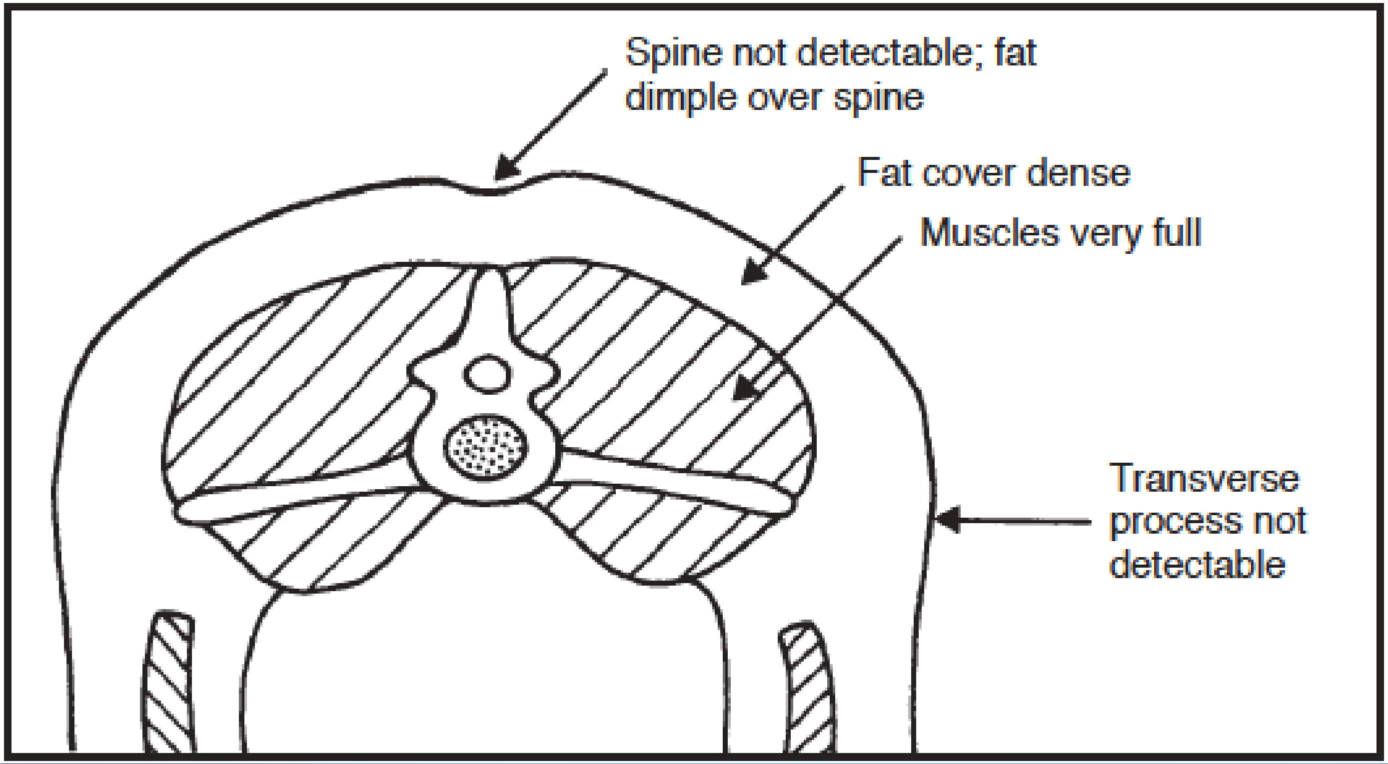
Body Condition Score 4

- **Spinal processes are smooth**
- **Spinal processes can only be felt with significant pressure**
- **Transverse processes cannot be felt**
- **Loin muscle full with thick fat cover**



Body Condition Score 5

- **Spinal processes cannot be detected, fat dimple over spine**
- **Spinal processes can only be felt with significant pressure**
- **Transverse processes not detectable**
- **Loin muscle full with thick fat cover**



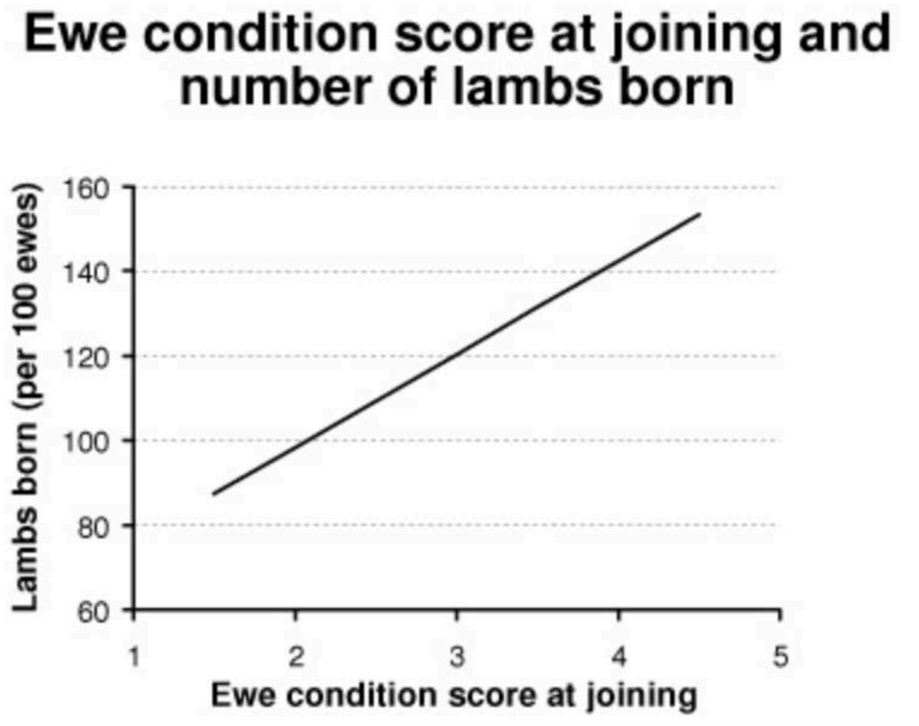
Thompson and Meyer, 1994

Reproduction is a luxury event

- On/Off switch largely controlled by nutritional status
- Circuitry of hormone production and neuroendocrine signaling requires the power of <u>**nutrition**</u>.
- Number of Lambs Born = # of ovulations × fertilization % × embryonic survival × fetal survival × survival of the birth process

Why does Body Condition Score Matter?

- An additional 20 lambs per 100 ewes for an increase of 1 Body Condition Score



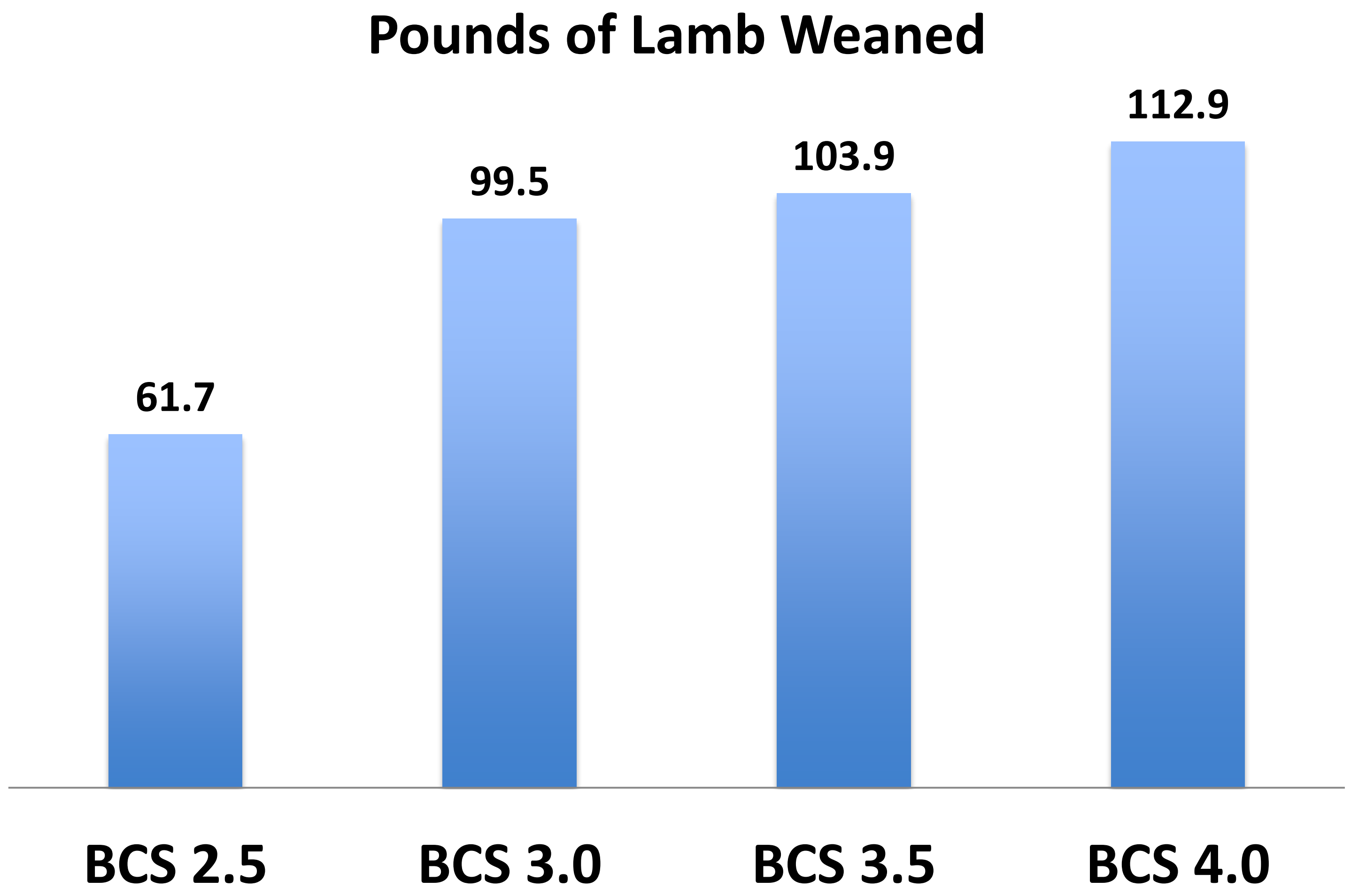
Why does Body Condition Score Matter?

- 70% lamb mortality birth to weaning occurs first 48 hours
  - Better condition at lambing = heavier lambs
  - Heavier lambs at birth = greater lamb survival
- 15 to 20% greater lamb survival when born BCS 3 vs. 2.3

Case Study: Ewe BCS and Lamb Survival

	BCS at lambing	Survival of singles (%)	Survival of twins (%)
Western Australia (4 locations)	**2.2** **3.1**	**74** **86**	**38** **56**
Throughout Australia (16 sites)	**2.2** **3.0**	**83** **90**	**57** **67**

BCS at Breeding on Weaning Weights



Khan et al., 1992

Optimum Body Condition Scores

Production Stage	**Optimum Score**
Breeding	3–4
Early- Mid Gestation	2.5–4
Lambing (singles)	3.0–3.5
(twins)	3.5–4
Weaning	2 or higher

***Danger Zone:**

Twin bearing ewes less than 2.5 BCS @ lambing

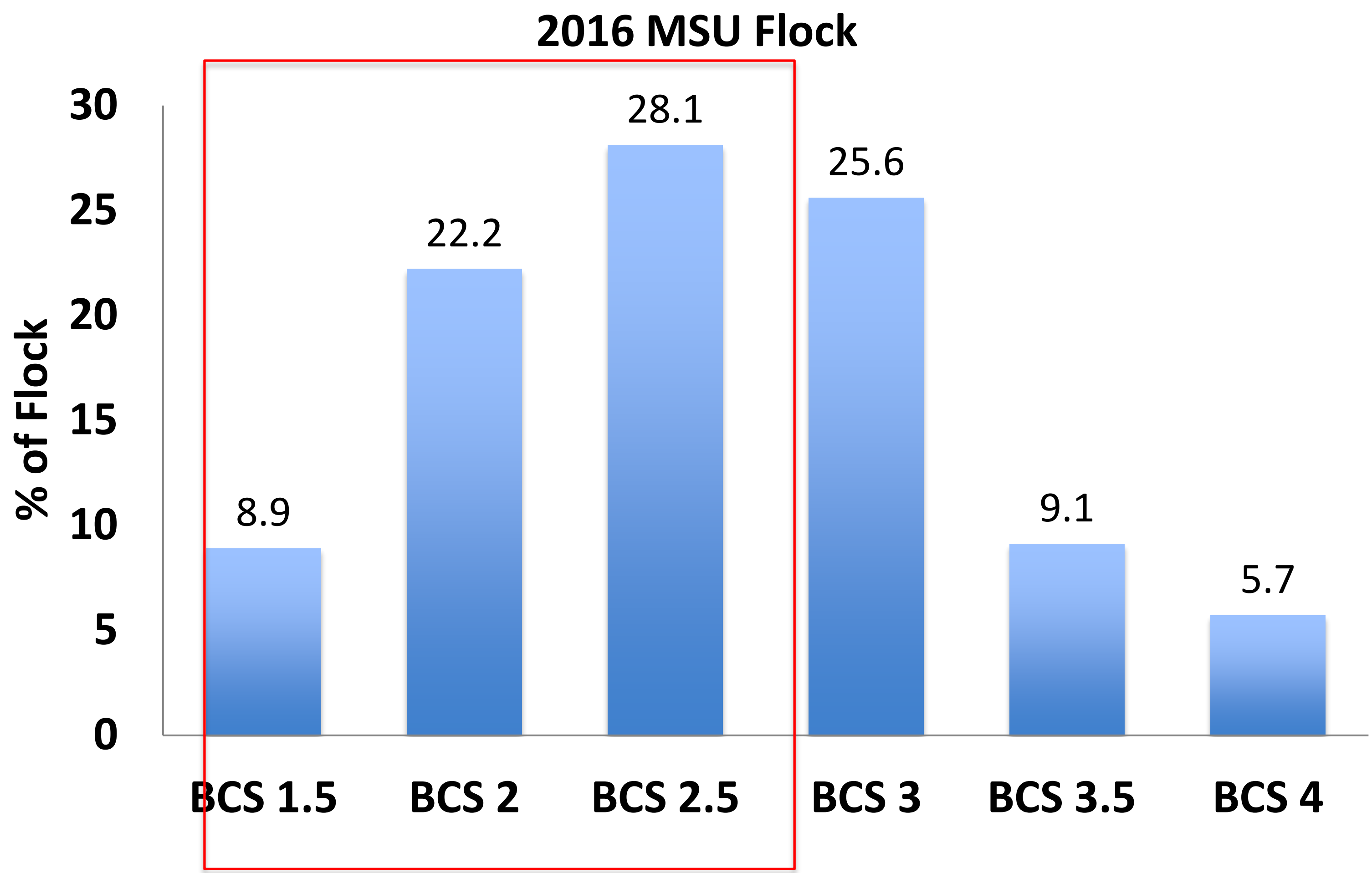
Single bearing ewes less than 2 BCS or greater 4 @lambing

Managing by Condition Score

- **Randomly score 25 ewes and place mark in corresponding body condition score box**

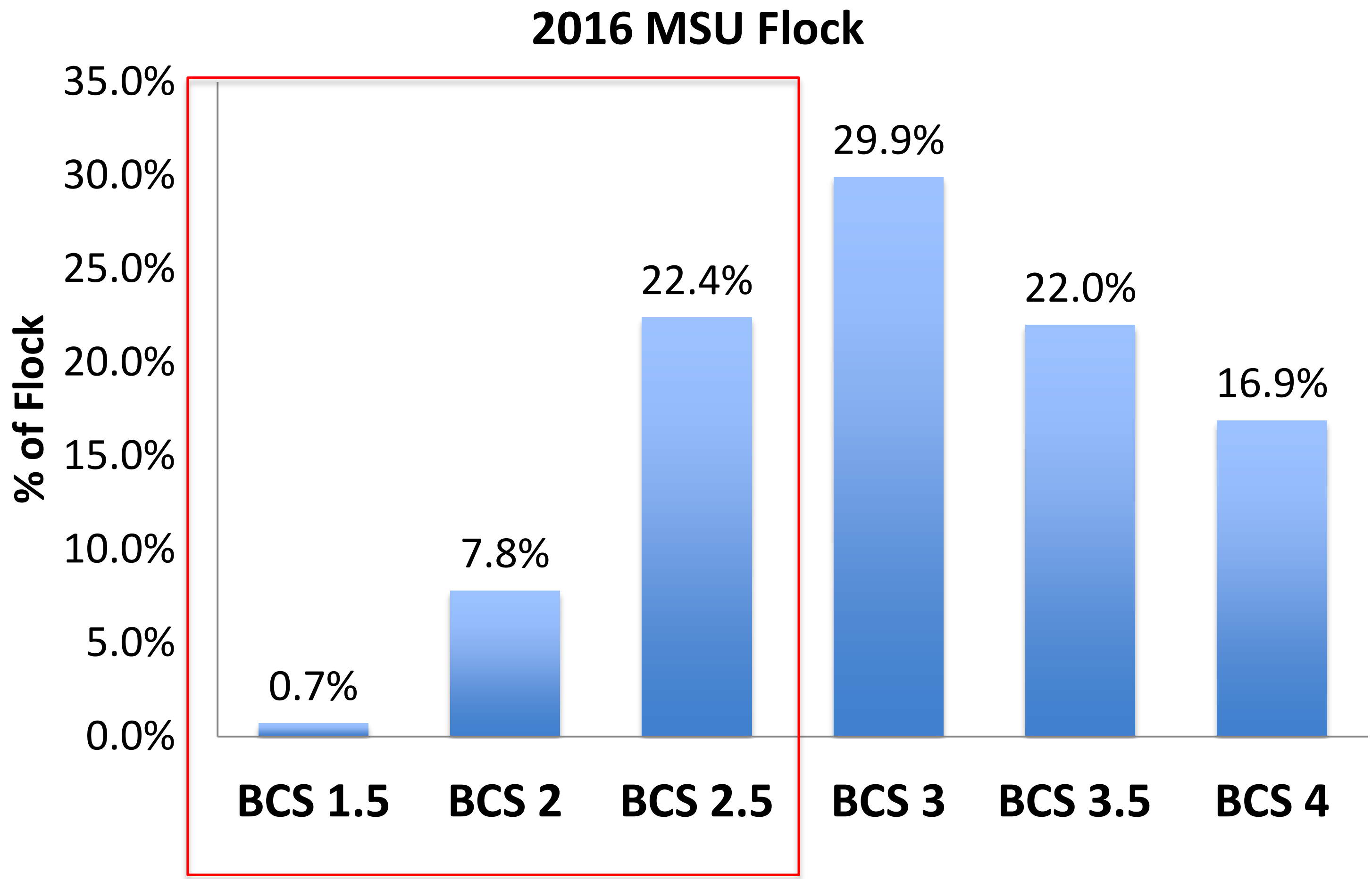
				X				
				X				
			X	X				
			X	X	X			
			X	X	X			
		X	X	X	X			
	X	X	X	X	X			
	X	X	X	X	X	X		
1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Ewe BCS Scores 50 Days Post-Lambing



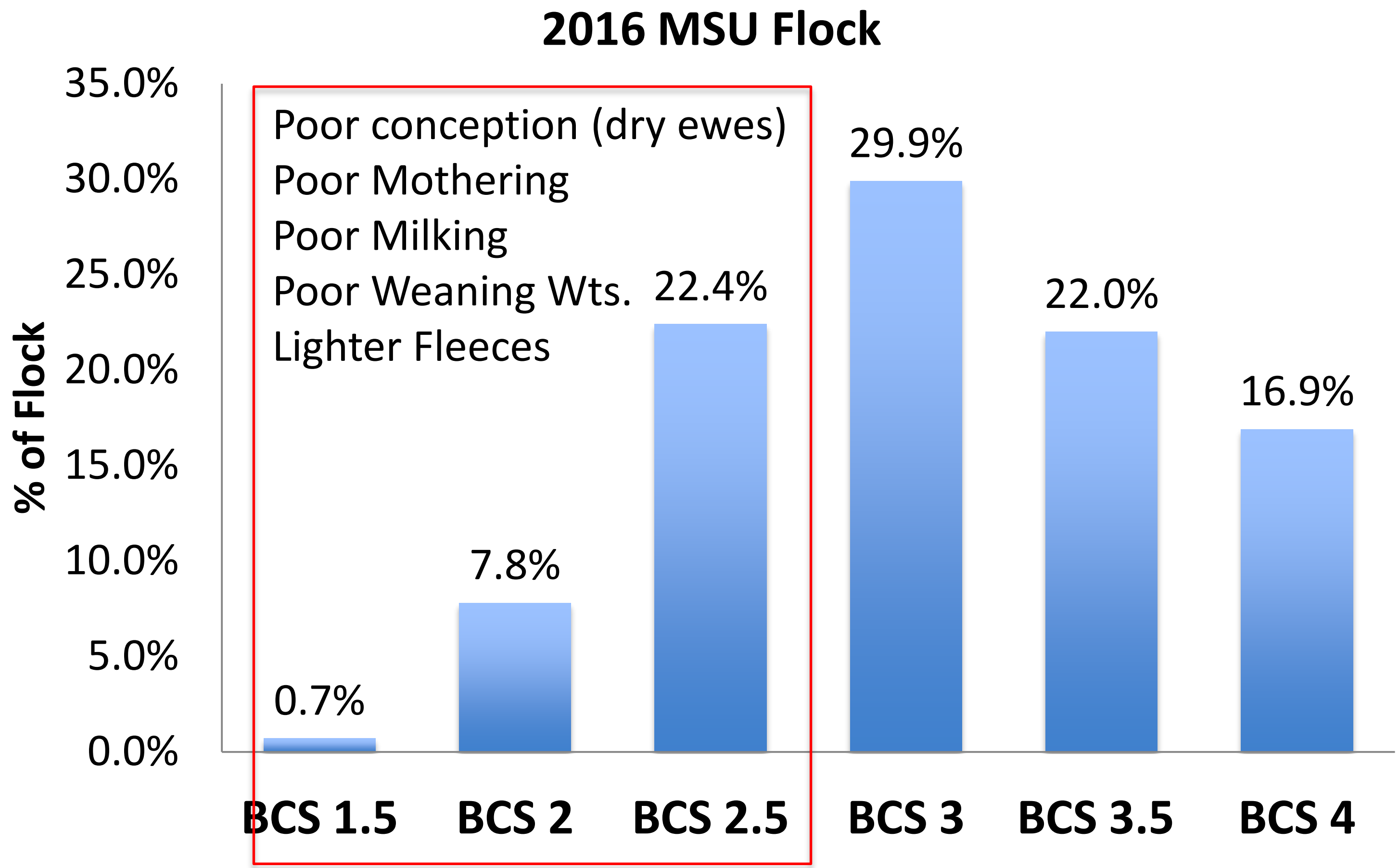
*Ideal BCS Score Lambing: 3 to 4

Ewe BCS Scores @ Weaning



*Ideal BCS Score Lambing: 2 or greater; Breeding: 3 or greater

Ewe BCS @ Weaning



0.5 BCS = 9 to 11 lb.

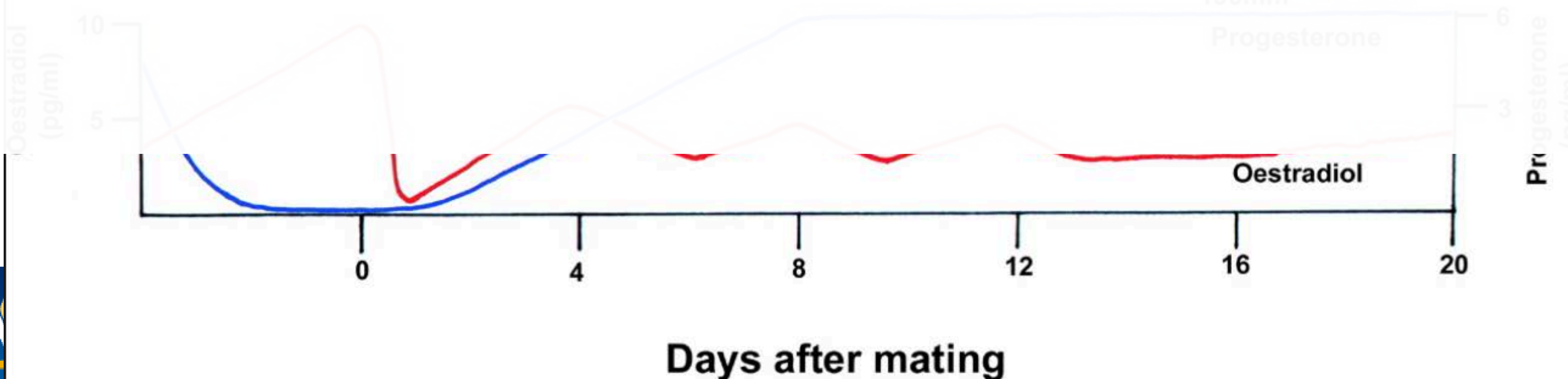
Thoughts on Flushing

- Energy response (Energy dense feeds)
  - Corn 88% TDN vs. Alfalfa, 61% TDN
  - Short term effects on ovulation rate (1 wk. to 3 wk.)
  - Don’t start too late or stop early (2 wk. prior, 2 wk. post)
- Only thin ewes responsive (< 2.5–3.0 BCS)
  - 20% of the flock
  - Uniform consumption when fed in group
- Number of Lambs Born = # of ovulations × fertilization % × embryonic survival × fetal survival × survival of the birth process

Early Pregnancy

- Early embryonic mortality in 5 to 30% of all pregnancies

- 50 to 70% of embryonic loss occurs in first 30 days of pregnancy



Feeding Scenarios

	Flushing Entire Flock (400 ewes)	Flushing 20% of Flock (80 ewes , 2.5 BCS)
Pounds of Corn Required (1 lb × 21 days)	8,400 lb	1,680 lb
Cost Whole Corn @ $3.50/bu = $0.06/lb	$504 to flush flock for 21 days	$100 to flush flock for 21 days

Supplement Cost Comparisons

Feedstuff	% Total Digestible Nutrients	% Crude Protein	Cost per Ton	Cost per Pound TDN	Cost per Pound Crude Protein
Corn	90	9.5	$124	$0.07	$0.65
Barley	85	13.2	$187	$0.11	$0.71
Peas	90	24.5	$133	$0.07	$0.27
Wheat Midds	81	17.8	$110	$0.07	$0.31
Alfalfa 18% Dehy Pellets	65	18	$205	$0.16	$0.57

Additional Feed Help

Home | Feeds | Requirements | Balance | Calculator | Documents | Help | My Account | About | Login

Montana Sheep Institute

Animals Rangelands People

Animal & Range Sciences
Montana State University

Montana State University Sheep Ration Program

Welcome to Montana State University's Sheep Ration Program, designed to help producers meet the nutritional needs of their sheep with available forages and feeds.

Use this FREE online program to:

- View sheep nutritional requirements
- View the standard nutrient content of more than 300 feeds
- Enter and save custom feed values based on laboratory results
- Balance and save rations for sheep at various lifecycles stages
- Find answers to frequently asked nutritional questions
- Balance feedlot rations
- Determine quantities of feed for a flock
- Determine supplement needs for ewes grazing winter range

NOTE: this site works best with Internet Explorer 10 or higher, Chrome or Firefox. IE 10 and Chrome are recommended.

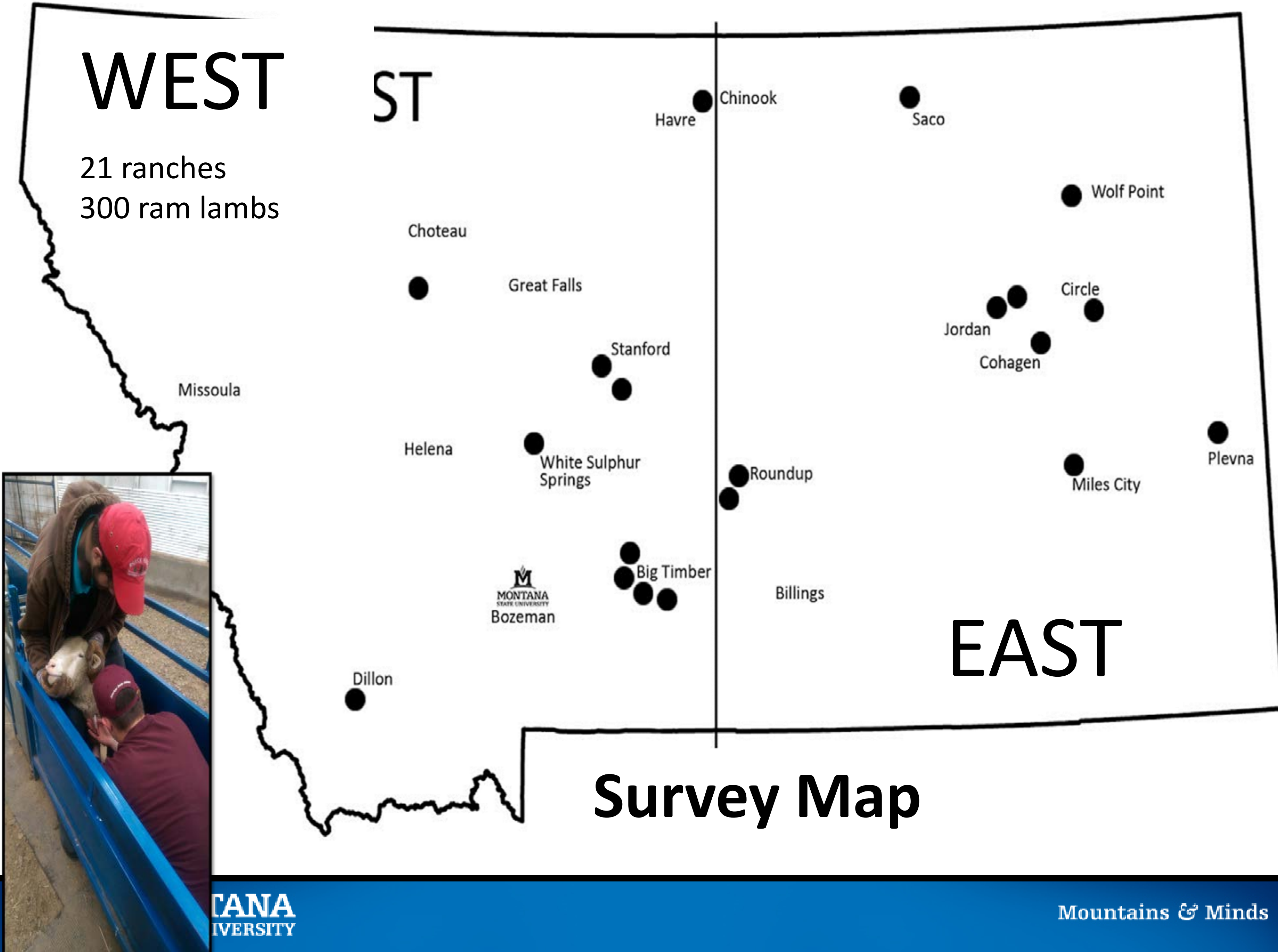
Create New Account or Login

Survey of serum trace mineral concentrations in weaned Montana ram lambs

C. M. Page†, M. L. Van Emon†, S. L. Spear†, T. W. Murphy‡, J.G.P. Bowman†, and W. C. Stewart†*
†Department of Animal and Range Sciences, Montana State University, Bozeman MT
‡Department of Animal Science, University of Wisconsin–Madison, Madison WI

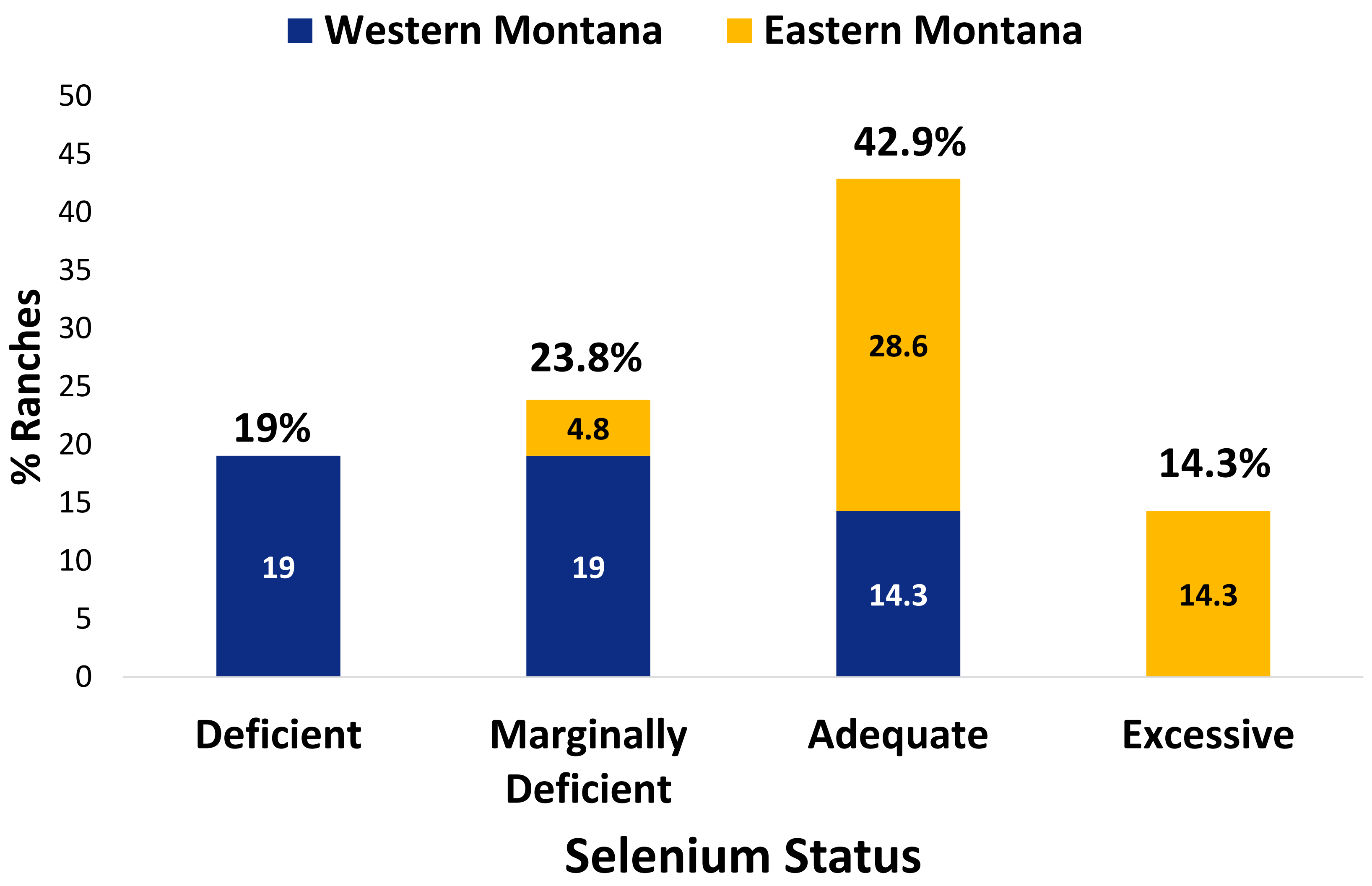
WEST

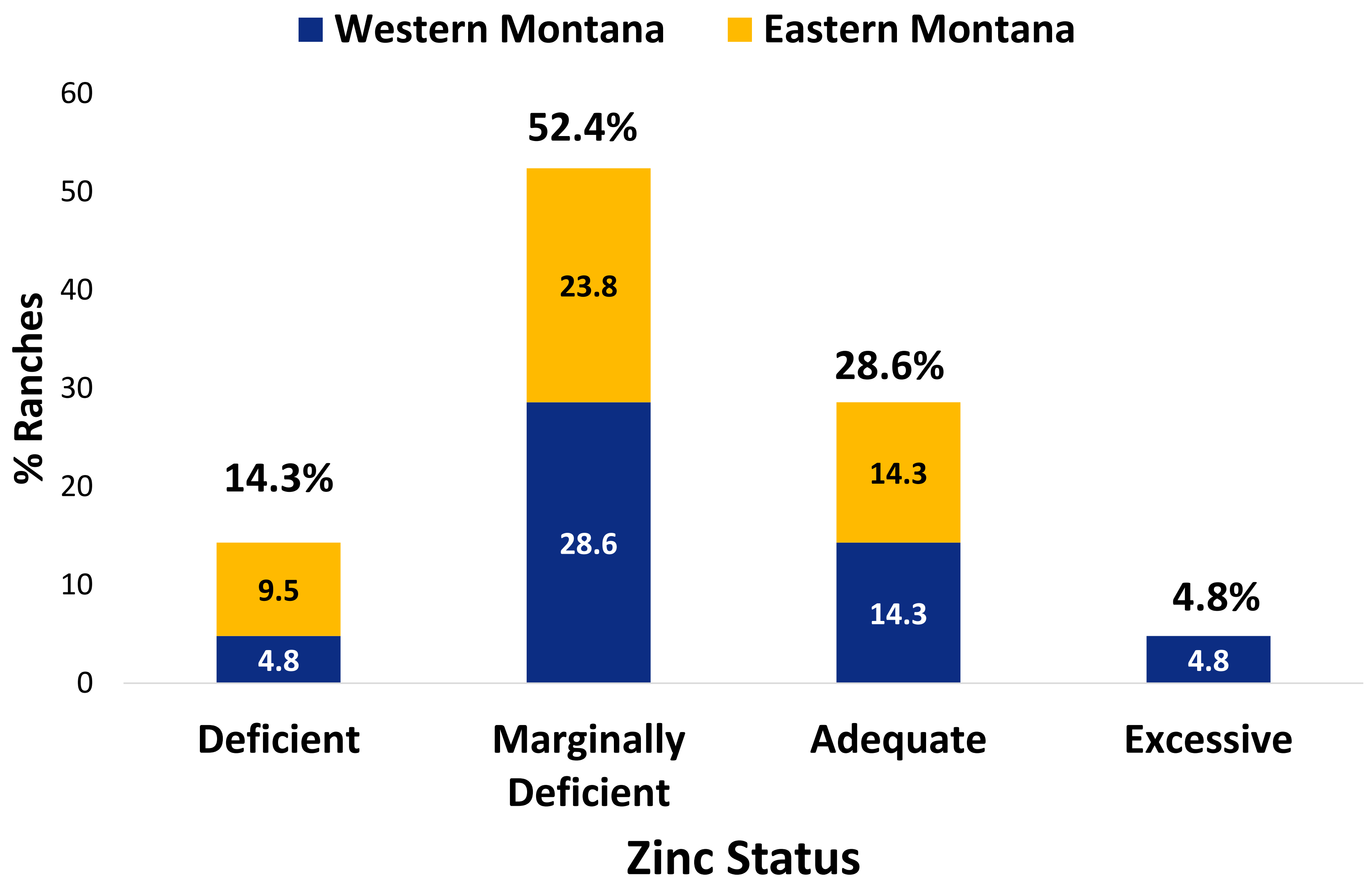
21 ranches
300 ram lambs



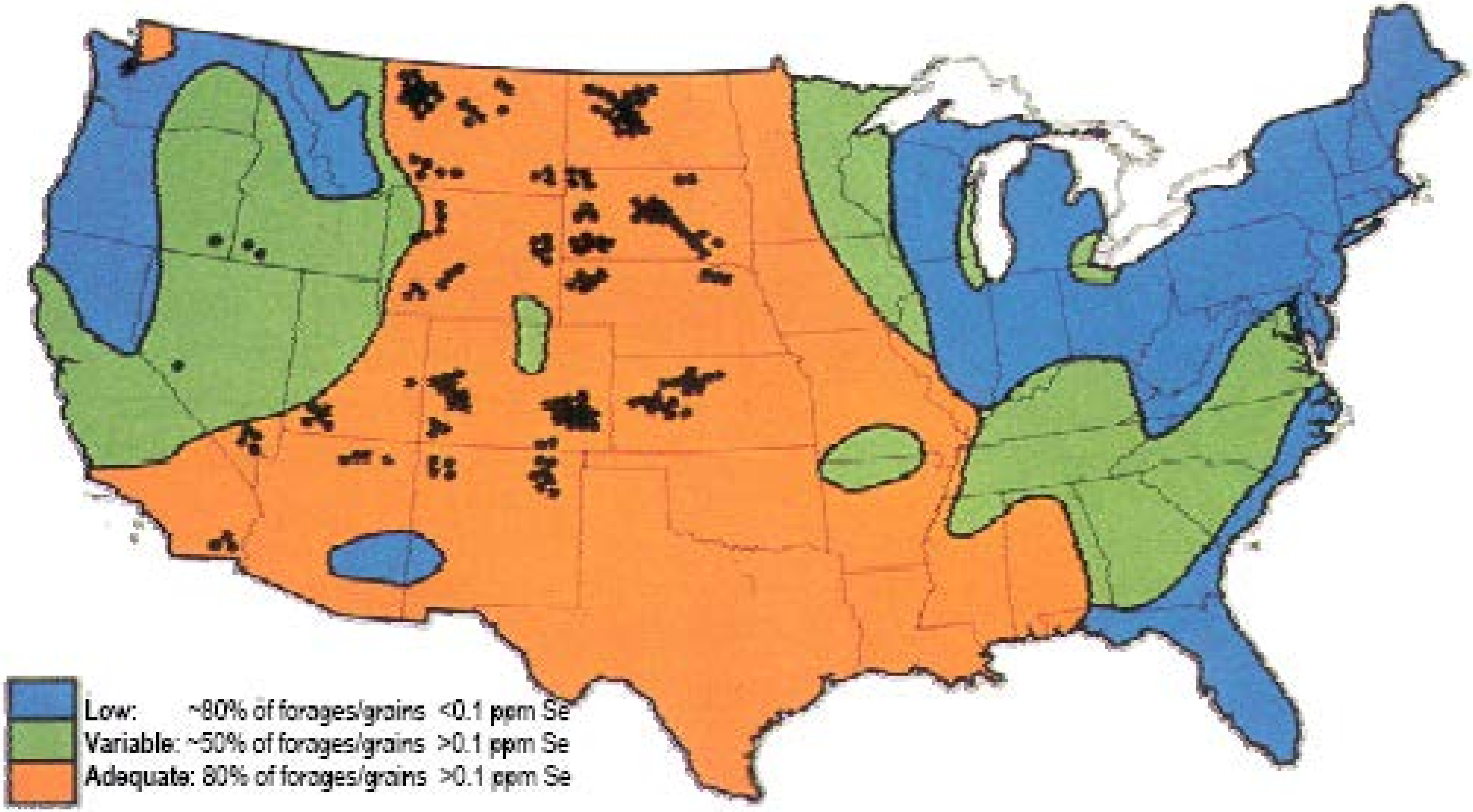
EAST

Survey Map

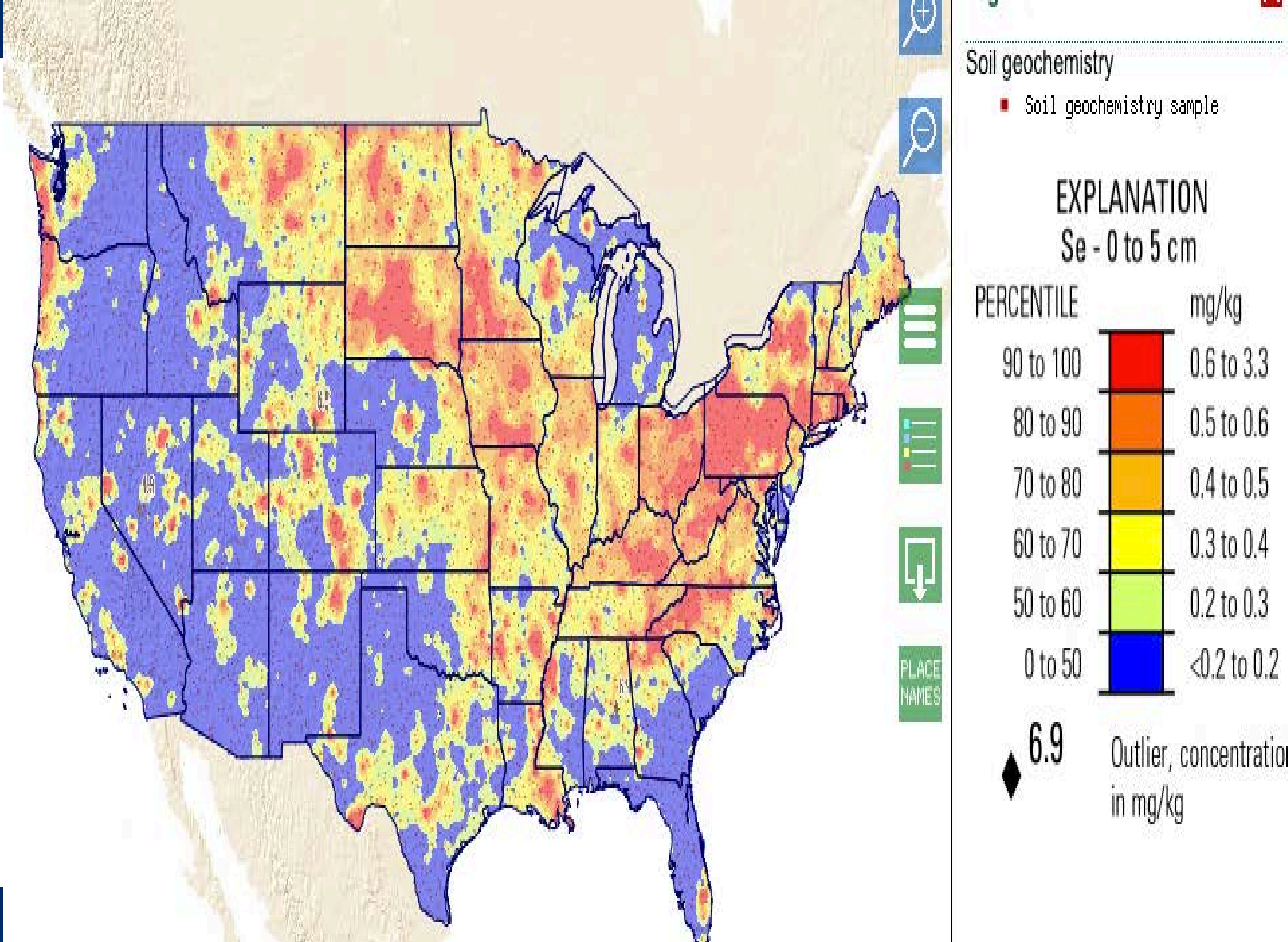

Western Montana
Eastern Montana
50
45
40
35
30
25
20
15
10
5
0
% Ranches
19%
19
23.8%
4.8
19
42.9%
28.6
14.3
14.3%
14.3
Deficient
Marginally Deficient
Adequate
Excessive
Selenium Status


Western Montana
Eastern Montana
60
50
40
30
20
10
0
% Ranches
52.4%
23.8
28.6
14.3%
9.5
4.8
28.6%
14.3
14.3
4.8%
4.8
Deficient
Marginally Deficient
Adequate
Excessive
Zinc Status

Map of Se Deficiency



Gabryszuk & Klewiec, 2002; Koyuncu & Yerlikaya, 2007; McDonald et al., 1975; Munoz et al., 2008; Rooke et al., 2004


Soil geochemistry
Soil geochemistry sample
EXPLANATION
Se - 0 to 5 cm
PERCENTILE
mg/kg
90 to 100
0.6 to 3.3
80 to 90
0.5 to 0.6
70 to 80
0.4 to 0.5
60 to 70
0.3 to 0.4
50 to 60
0.2 to 0.3
0 to 50
<0.2 to 0.2
6.9
Outlier, concentration in mg/kg
PLACE NAMES

Common Sense Selection Strategies

Whit Stewart, Ph.D.
Assistant Professor of Sheep and Wool Production
Extension Sheep Specialist

What is common sense selection?

- Identifying your objectives (Needs vs. Wants)
  - Lbs. lamb weaned per ewe
  - Lean muscle growth
  - Fiber characteristics (micron, fleece weight)
- Emphasizing Economic Traits
- Projecting the impact of a ram on the future productivity of a flock

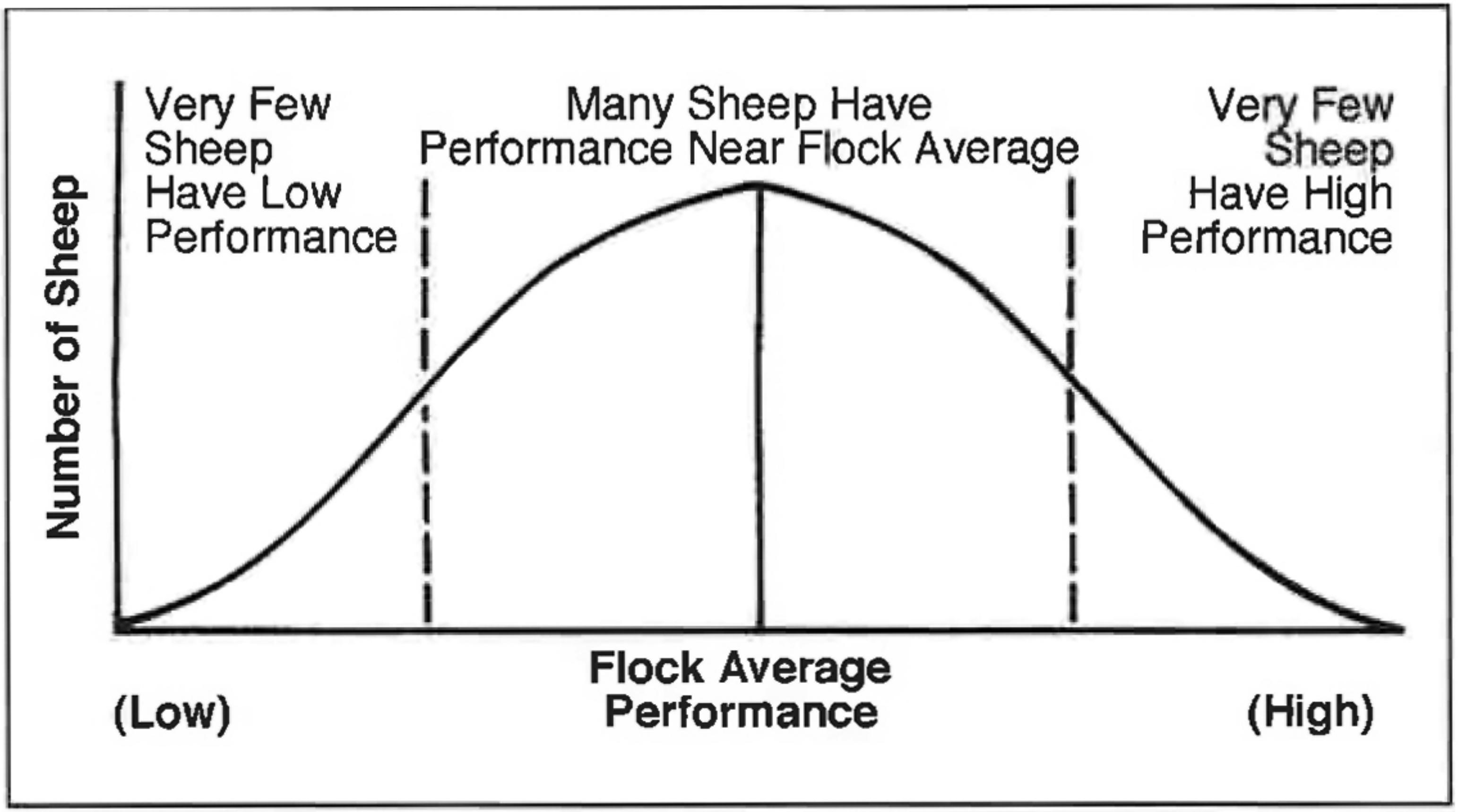
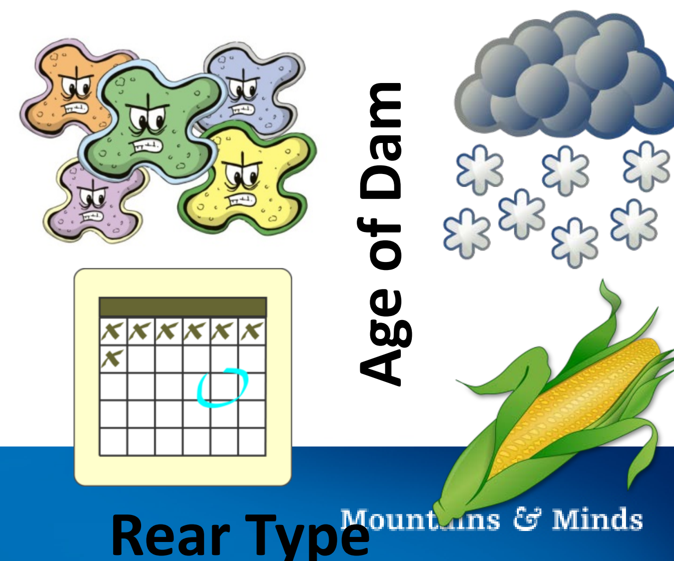


Figure 6. *Normal Distribution Curve for A Quantitative Trait. Most sheep have performance levels close to the average of the flock with few sheep having very low or very high performance.*

Phenotypic Composition

- An animal's phenotype (P) for a trait is a combination of their genetic makeup (G) and the effect of the environment (E).

$$P = G + E$$



Heritability

- A measure of the strength of the relationship between phenotypes and true breeding values.
- The degree to which the performance of offspring resembles the performance of parents.
- The proportion of variation in performance that is due to variation in genetic factors.
  - Heritability can take values from 0 to 1

Heritability's of Various Traits

Table 18. Heritabilities of Various Traits

Traits	Percentage
Reproductive:	
Ewe fertility	5[a]
Prolificacy[b]	10
Scrotal circumference	35
Age at puberty	25
Lamb survival[c]	5
Ewe productivity[d]	20
Growth:	
Birth weight	15
60-day weight	10
90-day weight	15
120-day weight	20
240-day weight	40
Preweaning gain: birth-60 days	15
Postweaning gain: 60-120 days	25
Carcass:	
Carcass weight	35
Weight of trimmed retail cuts	45
Percent trimmed retail cuts	40
Loin eye area	35
12th rib fat thickness	30
Dressing percent	10
Fleece:	
Grease fleece weight	35
Clean fleece weight	25
Yield (%)	40
Staple length	55
Fiber diameter	40
Crimp	45
Color	45
Dairy:	
Milk yield	30
Fat percentage	30
Protein percentage	30
Fat yield	35
Protein yield	45

[a] May increase to 10% in ewe lambs, in ewes lambed in the fall, and in ewes lambed in the spring in flocks with low fertility.

[b] Lambs born per ewe lambing.

[c] May increase to 10% in flocks with low lamb survival.

[d] Pounds of lamb weaned per ewe exposed.

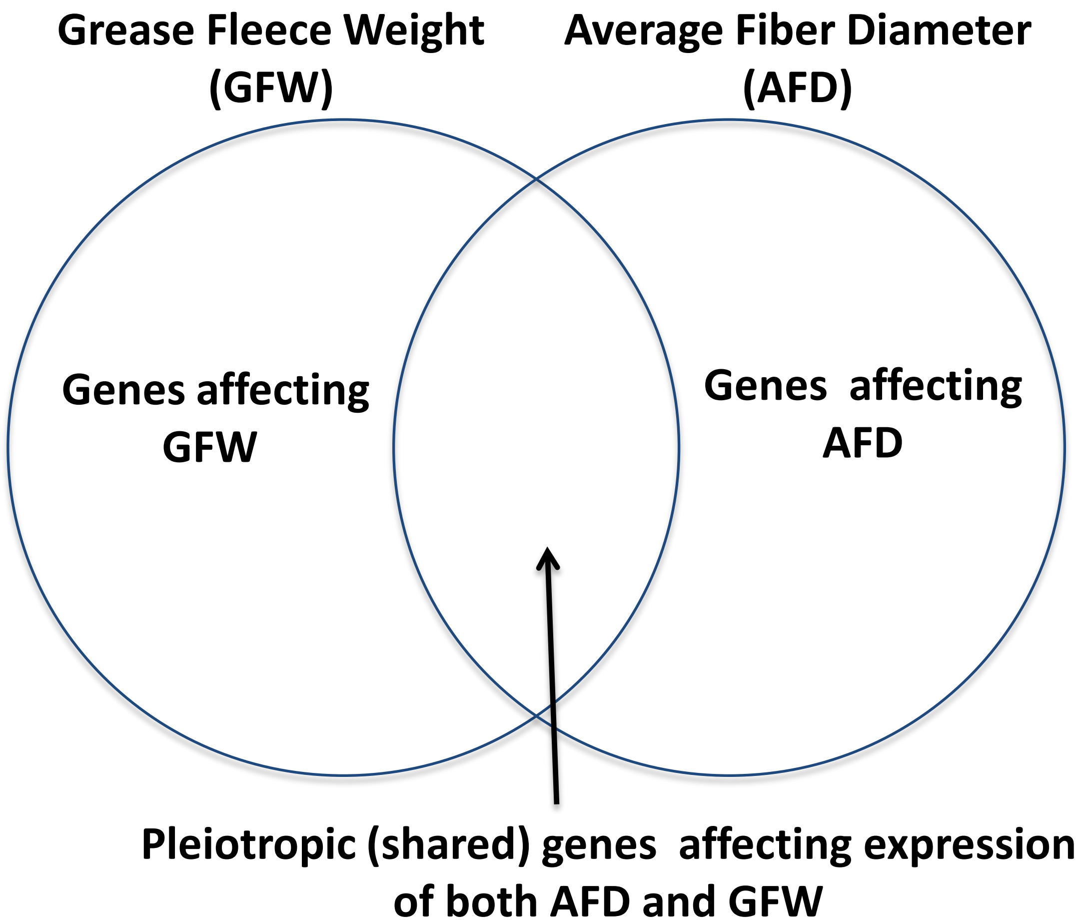
Heritability intuition

- The **higher** the heritability, the **better** an animal's own performance predicts their breeding value.
- The **lower** the heritability, the **greater** the influence of the environment on performance.

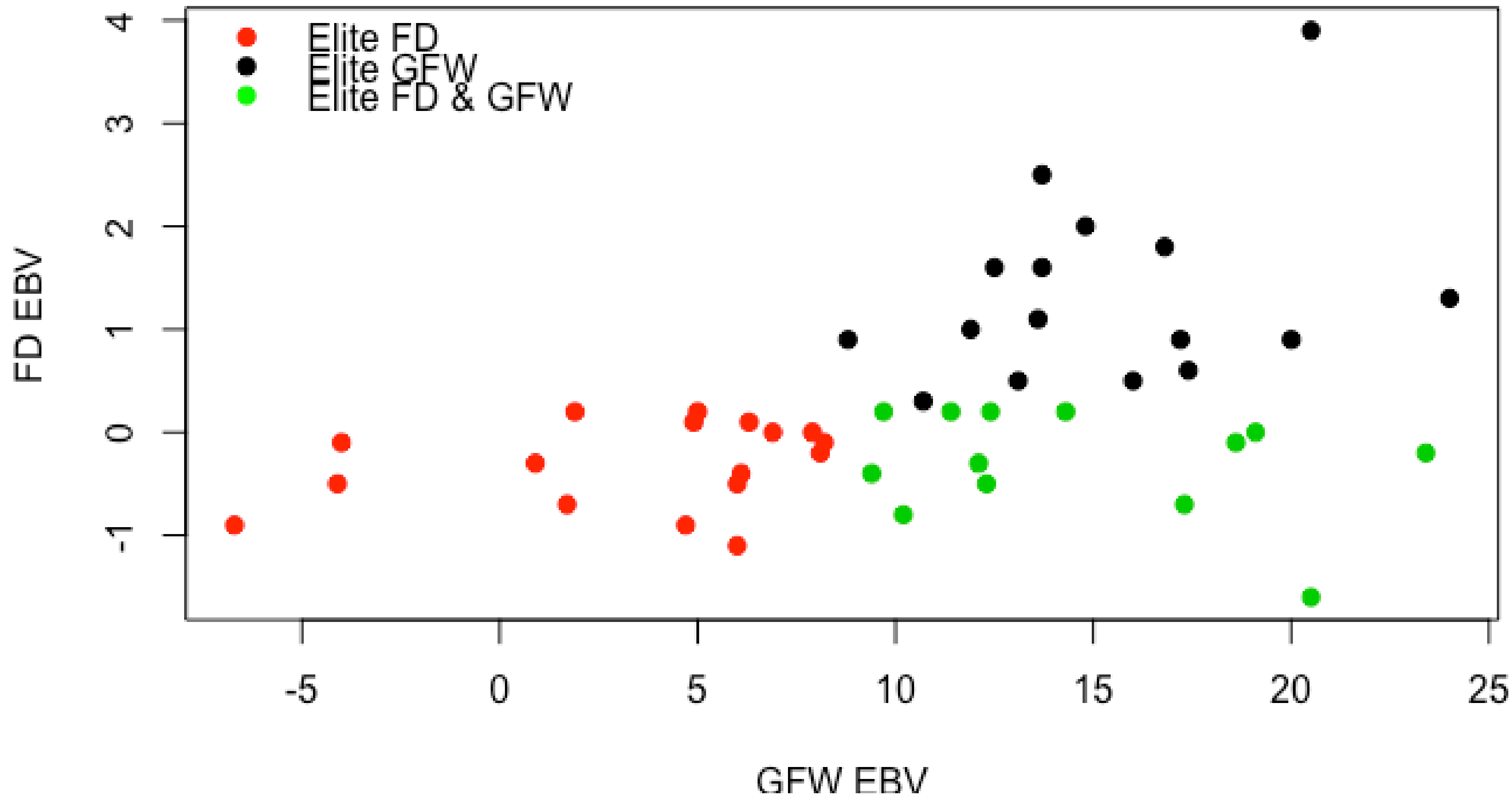
Trait	Heritability estimate
NLB	0.10
120 d Wt	0.20
LEA	0.35
Fleece Wt	0.35
Frame size	0.60

Genetic Correlations

Fleece Wt. and Fiber Diameter +0.51 (.01 to 1 Scale)



Tandem Selection for Fiber Diameter and Grease Fleece Weight



What Is NSIP?

The U.S. National Sheep Improvement Program

- **Our Mission:**

  To provide predictable, economically important genetic evaluation information to the American sheep industry by converting performance records into relevant decision-making tools.

What Is NSIP?

National Sheep Improvement PROGRAM

- The U.S. National Sheep Improvement Program represents:
  - Groups of like-minded breeders who focus on the collection and processing of objective performance data to facilitate genetic improvement in their flocks and in those of their customers.
- The resulting EBVs are the metrics and the currency of genetic improvement.

Large scale genetic evaluation

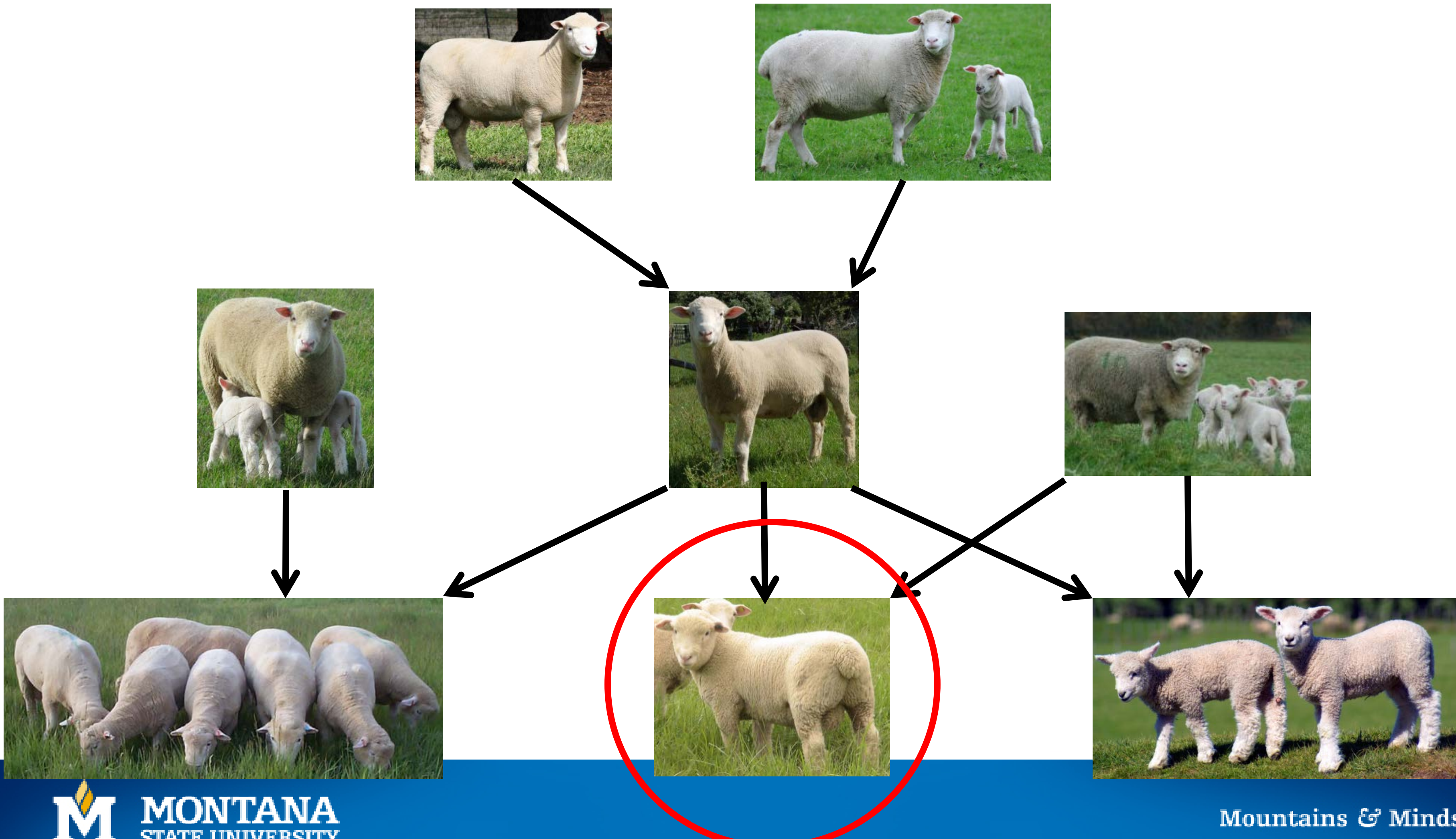
- EBVs are calculated by adjusting performance records for non-genetic effects (sex, farm, season, age of dam, etc.) and by optimally combining records on **all** genetic relatives.
  - More emphasis on close relatives (offspring, parents, full-sibs, grandparents, half-sibs).
  - Less emphasis on more distant relatives (great-grandparents, cousins, aunts, uncles, etc.).
- Because of genetic connectedness, the EBVs of animals born in different flocks can be reliably compared.

NSIP EBV Traits

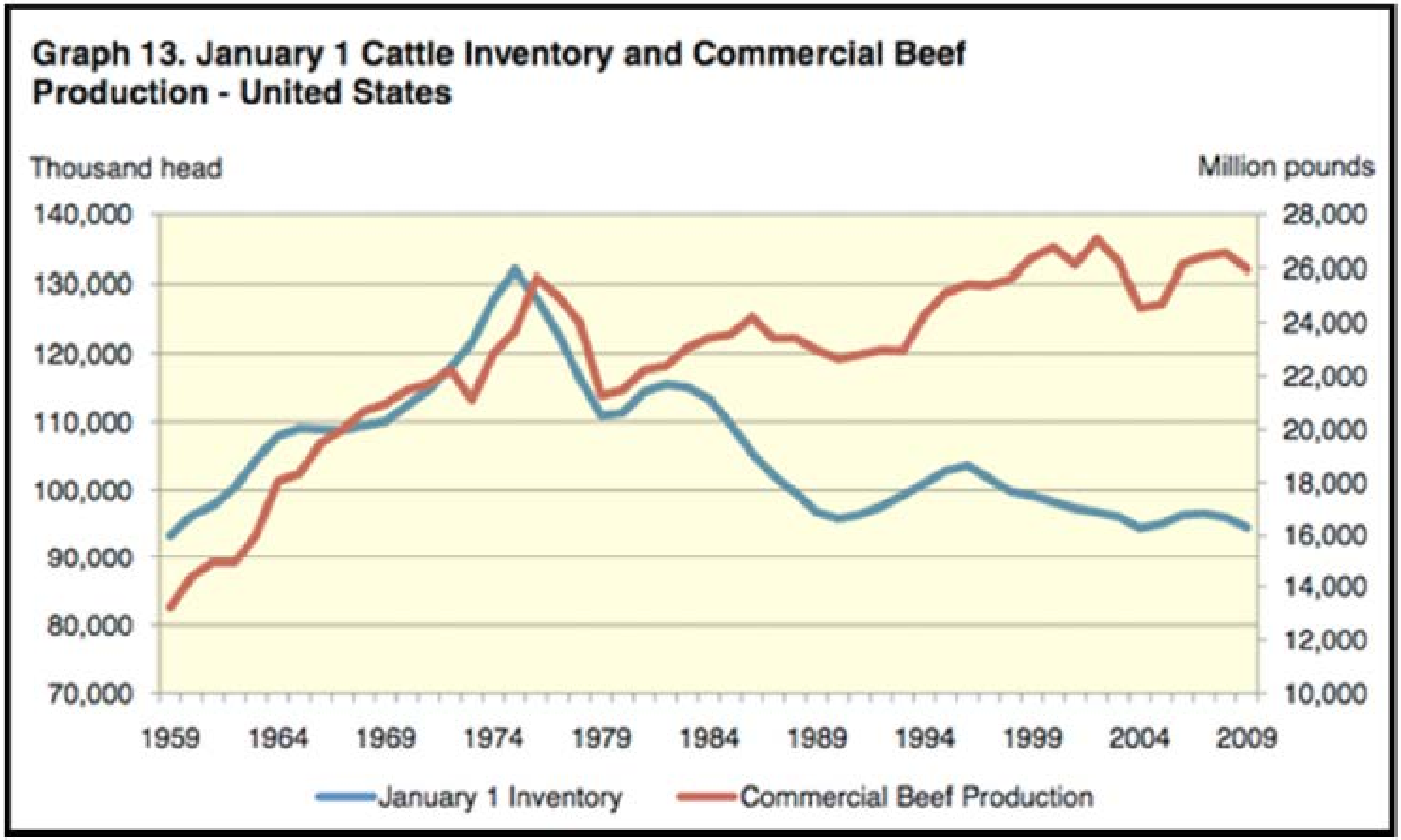
Trait
Birth weight (direct and maternal)
Weaning weight (direct and maternal)
Postweaning weight
Yearling weight
Hoggets (breeding) weight
Ultrasound fat and muscle depth

Trait
No. lambs born/weaned (litter size/lamb survival)
Fecal egg counts
Scrotal circumference
Greasy fleece weight
Fiber diameter (OFDA fiber profile)
Staple length

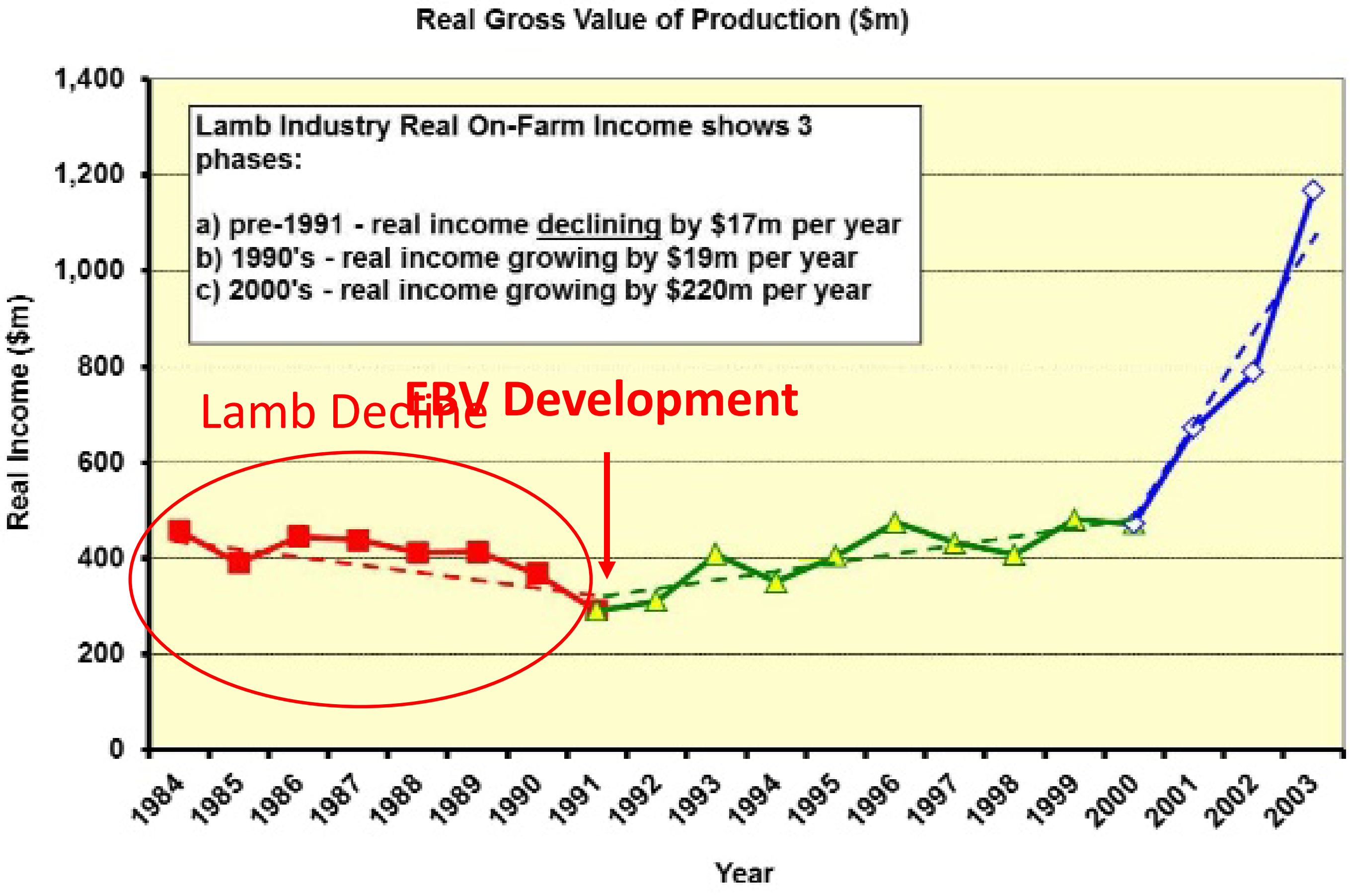
What is this ram lamb's EBV?



Quantitative Genetic Selection

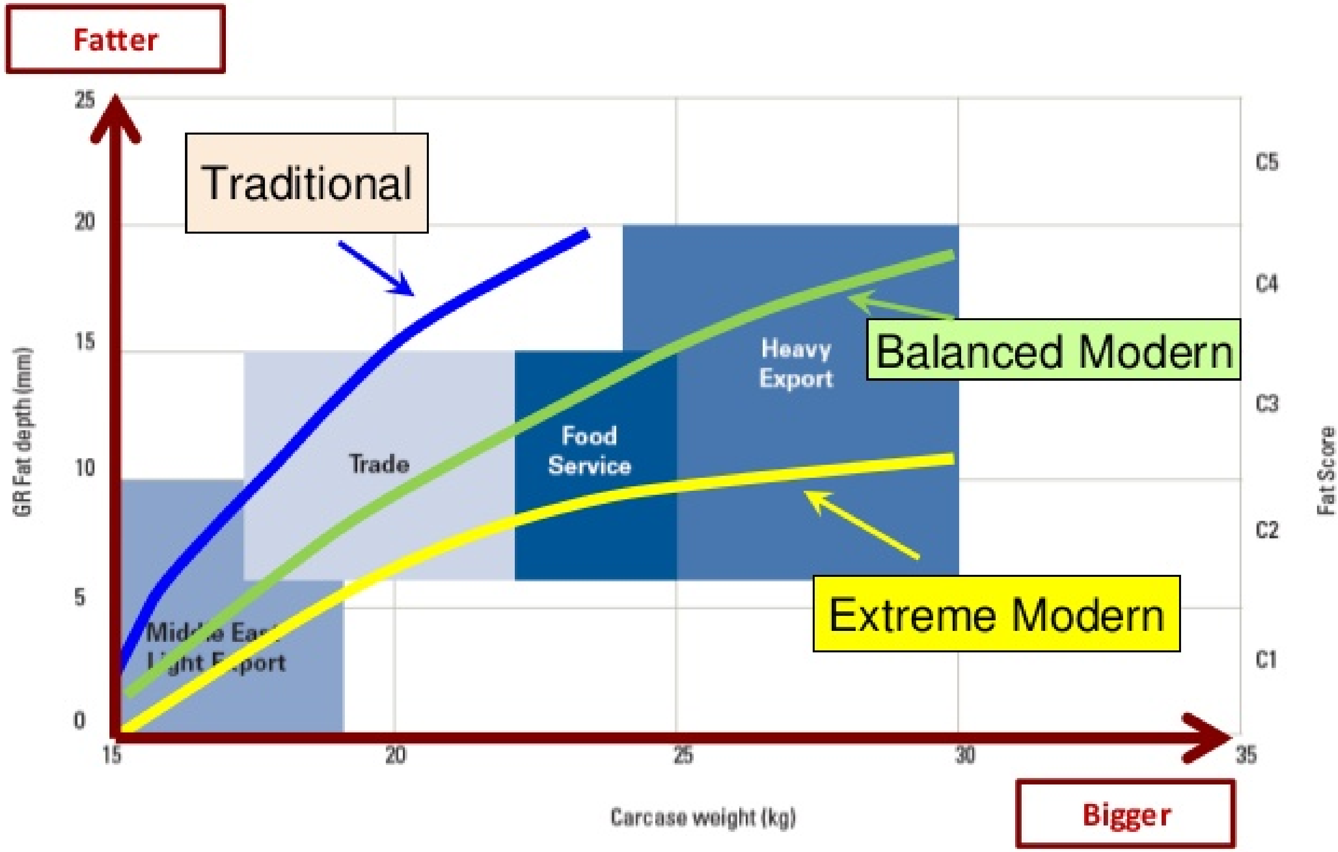


Quantitative Genetic Selection Australian Success Story

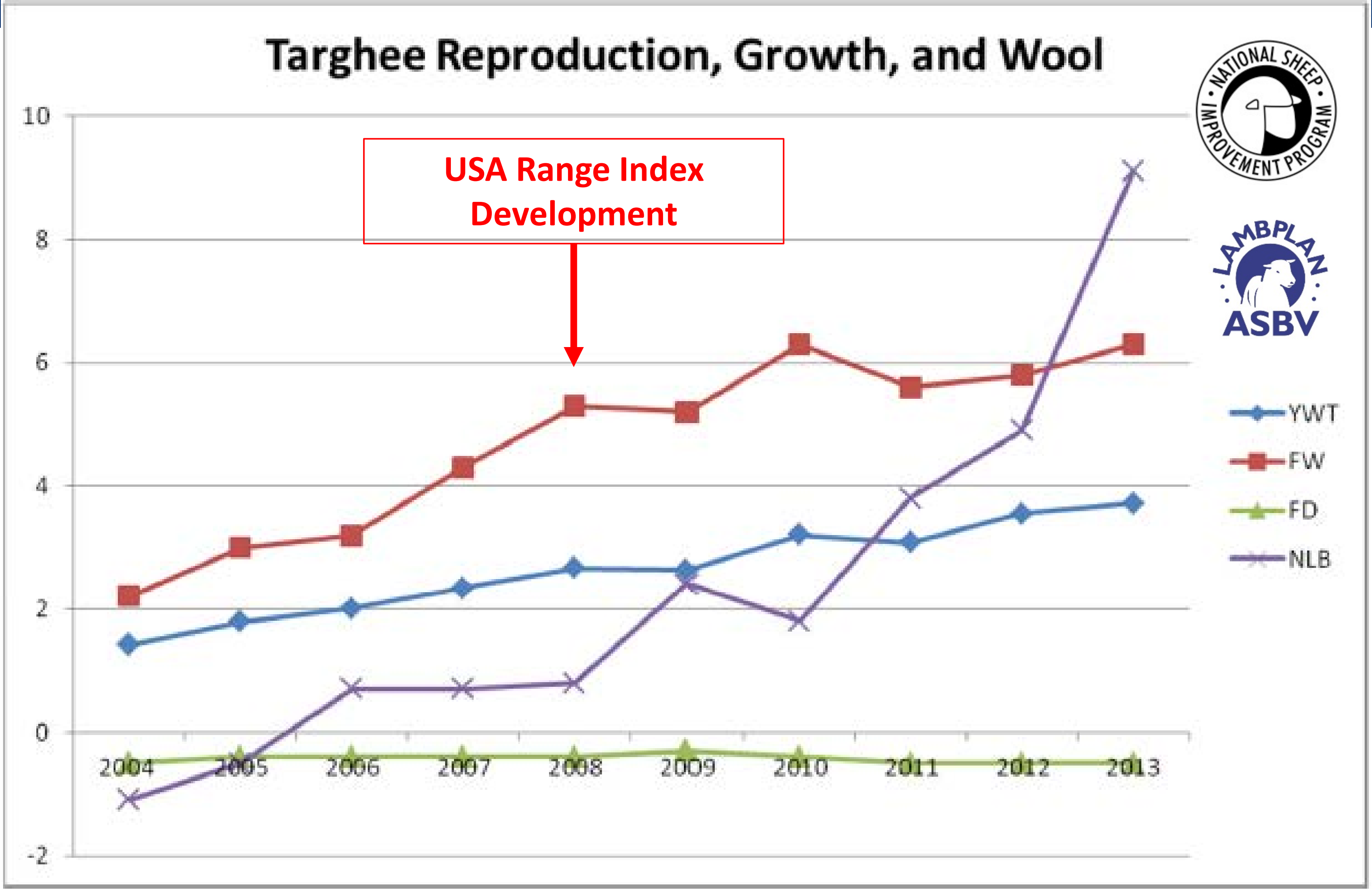


R. Banks. 2014. How the U.S. sheep industry can benefit from NSIP.

Matching genetics to markets



R. Banks. 2014. How the U.S. sheep industry can benefit from NSIP.



R. Redden. 2013. Profitable genetic selection: How NSIP can help U.S. sheep and goat industries.

NSIP

National Sheep Improvement PROGRAM

America's GENETIC FOUNDATION FOR A PROFITABLE Sheep INDUSTRY

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NSIP's Estimated Breeding Values Lead the Way to Genetic Improvement

Our Mission:

To provide predictable, economically important genetic evaluation information to the American sheep industry by converting performance records into relevant decision-making tools.

By using breeding stock with genetic predictability, all types of flocks have a foundation of genetic information upon which to build a superior and more consistent product to their customers, whether this be a feeder, packer or consumer. This genetic predictability is achievable through NSIP's Estimated Breeding Values (EBVs).

EBVs are science-based, industry-tested measurements of heritable traits that can be tracked and measured. For those familiar with Expected Progeny Differences (EPDs) used in cattle, EBVs are very similar. EPDs denotes the breeding value of an individual animal's progeny whereas EBVs denote the value of the individual animal. More simply, EBVs equal EPDs times two.

Index Utilization

NSIP- Western Range Index

- PWWT +0.26 MWWT-0.26 YWT + **1.92 YFW** – **0.47 YFD** + 0.36 NLB

WY Ram Test Certified Rambouillet Index=

- 60 (ADG) + 4.0 (365 adj staple length) + 4.0 (364 Clean Wool) + (Fiber Diameter Points)
  - (22- actual micron) x 3; (max of +9 points)
  - (actual micron-22) x 3; (max of -6 points)
  - (22.0 – actual CV) x 1.25; (max of ±5)

Central Performance Testing

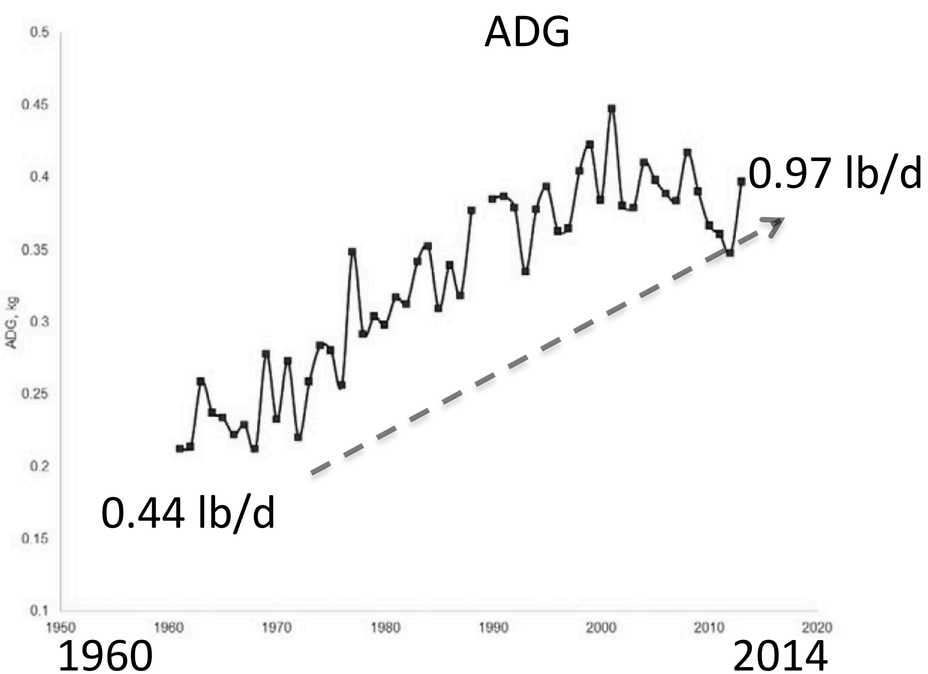

Figure 3. Average daily gain (in kg). Average daily gain increased linearly ($P < 0.001$) by year, but the cubic effect of year accounted for more variation (0.45 vs. 0.51 adjusted r^2).

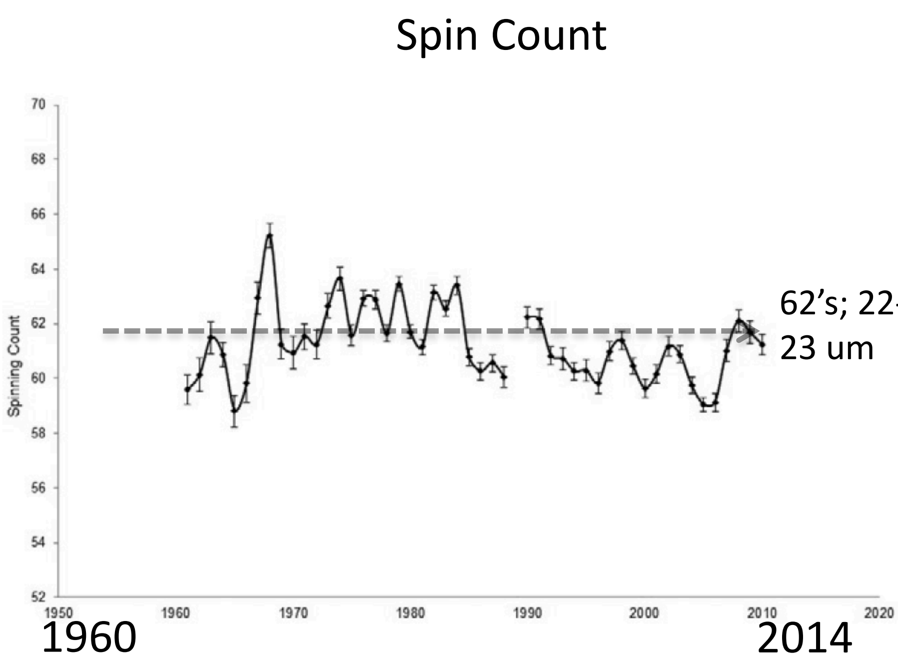

Figure 4. Spinning count. Spinning count is a measure of wool fineness and reflects the number of "hanks" (560 yards) of wool that can be spun from a pound of wool. As wool becomes finer, more hanks (or yards) of wool can be spun from a pound of wool. Wool with a spinning count of 62 would produce 62 hanks of wool (Kott, 1993).

On-Farm Performance Testing

- Data Collection-
  - Yearling Fleece Wt., Fiber Diameter, Staple Length
- Within Flock Ratio-
  - Example:
  - (Individual Performance ÷ Group Average) × 100 = Ratio

ID	Fleece Wt.	Staple Length	Wt Ratio	Staple Ratio	
1	**8.1**	**3.2**	**108.97**	**114.29**	
2	7.2	2.7	96.86	96.423	
3	7	2.5	94.17	89.29	
Average	**7.43**	**2.8**			

Influence of Ewe's Type of Birth on Lambing Rate

Ewe's type of Birth	N	Average # of Lambs born/ewe/year
Single	920	1.36
Twin	1275	1.52

WHY Crossbreed?

- To Optimize Gene Frequencies
  - Mix strengths of different breeds to create something that is needed but may not currently exit
  - Allows focus on Maternal Traits in the ewe flock and Growth and Carcass Value in the sires.
- To Utilize Heterosis
  - Important, positive effects on performance in both the crossbred lamb and the crossbred ewe.

Average Heterosis in Crossbred **Lambs**

Trait	Level of heterosis (%)
Birth weight	3.2
Weaning weight	5.0
Postweaning daily gain	6.6
Yearling weight	5.2
Conception rate	2.6
Prolificacy (litter size) of the dam	2.8
Survival, birth to weaning	9.8
Carcass traits	~ 0
Lambs born per ewe exposed	5.3
Lambs weaned per ewe exposed	15.2
Weight of lamb weaned per ewe exposed	17.8

Average Heterosis the Crossbred **Ewes**

Trait	Level of heterosis (%)
Fertility	8.7
Prolificacy (litter size)	3.2
Postweaning daily gain	6.6
Ewe body weight	5.0
Fleece weight	5.0
Lamb birth weight	5.1
Lamb weaning weight	6.3
Lamb survival, birth to weaning	2.7
Lambs born per ewe exposed	11.5
Lambs weaned per ewe exposed	14.7
Weight of lamb weaned per ewe exposed	18.0

Cumulative Heterosis from Crossbred Lamb and Crossbred Ewe	
Weight of lamb weaned per ewe exposed	39.0%

Average Heterosis in Crossbred Lambs

Trait	Level of heterosis (%)
Birth weight	3.2
Weaning weight	5.0
Postweaning daily gain	6.6
Yearling weight	5.2
Conception rate	2.6
Prolificacy (litter size) of the dam	2.8
Survival, birth to weaning	Up to 9.8
Carcass traits	~ 0
Lambs born per ewe exposed	5.3
Lambs weaned per ewe exposed	15.2
Weight of lamb weaned per ewe exposed	≥ 15.3

Average Heterosis the Crossbred Ewes

Trait	Level of heterosis (%)
Fertility	≥ 3.0
Prolificacy (litter size)	3.2
Postweaning daily gain	6.6
Ewe body weight	5.0
Fleece weight	5.0
Lamb birth weight	5.1
Lamb weaning weight	≥ 5.0
Lamb survival, birth to weaning	≥ 2.7
Lambs born per ewe exposed	11.5
Lambs weaned per ewe exposed	14.7
Weight of lamb weaned per ewe exposed	≥ 11.0

Cumulative Heterosis from Crossbred Lamb and Crossbred Ewe

Weight of lamb weaned per ewe exposed	≥ 28.0%

Production of Pure- and Cross- bred lambs at MSU[a]

Breed	N	Survival rate at weaning (16 wks or age) %	Avg weaning wt of lambs	Lb. of lamb weaned/ewe lambing
Pure bred	998	80	73	58
Cross bred	285	92	75	69

[a] Data collected from 1977 to 1981 Rambouillet, Targhee, and Columbia ewes.

Crossbred = Suffolk sire

Final Thoughts

- Prescriptive “Non-Dogmatic” Thinking
  - Heritability Estimates
  - Breed Complementarity
  - Heterosis
- What are <u>your</u> goals
- Genetic progress can be accomplished multiple ways