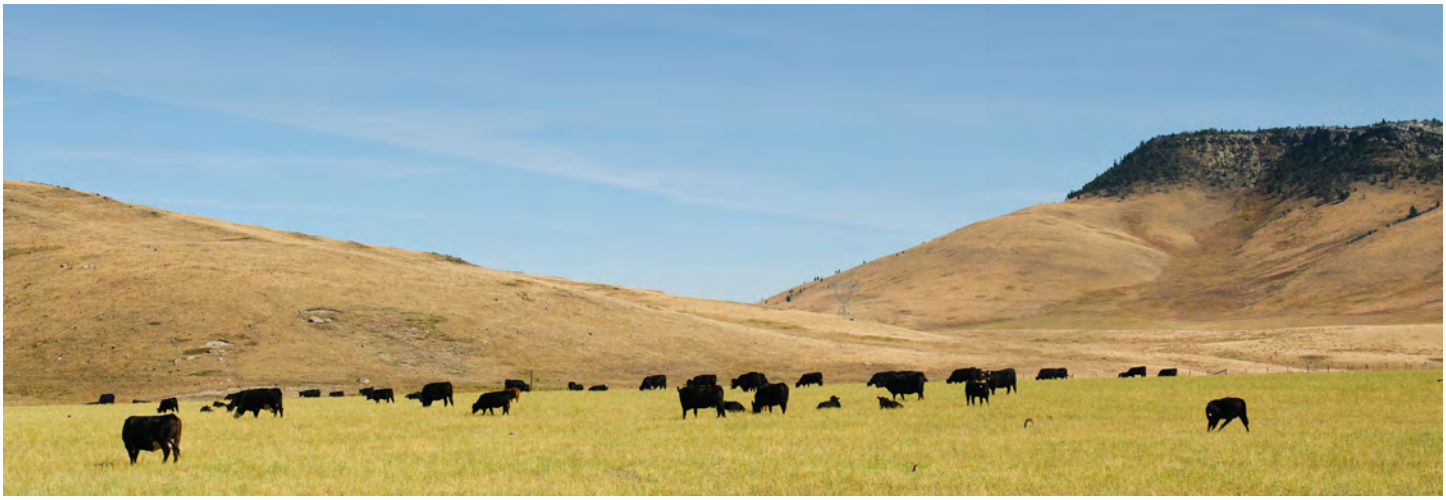

Beef Cow Size: Industry Trends, Economics, and Implications for Grazing Wyoming Rangelands

John Derek Scasta, Dallas Mount, Blake Hauptman and Tamarah Jorns
Ecosystem Science and Management
University of Wyoming Extension

INDUSTRY TRENDS

Beef cows have been getting bigger over the last several decades according to data from the United States Beef Improvement Federation and the National Cattle Slaughter Summary (Figure 1). In 1975, the average US beef cow weighed 1,047 pounds but in 2009 weighed 1,350 pounds – an increase of 303 pounds on average across almost four decades! American Cattleman also estimate that 16 percent of the U.S. beef cow herd consisted of cows weighing over 1,500 pounds in 2010 or more than 5 million cows. The drivers of this trend towards larger cattle can be attributed to the advancement of genetic information to assist ranchers in selecting productive animals. The use of growth-based genetics through Expected Progeny Difference (EPD) data has helped ranchers select bulls that produce growthy calves that have higher weaning weights. This is not necessarily a bad thing for a terminal bull that is only producing calves going into a terminal feeding scenario, however, it is common for many heifers to be retained back and put out on the range. Unfortunately, there is also a relationship between the selection for muscle growth (i.e., production traits) and increasing maternal traits such as maternal weight, maternal height and maternal milk. These maternal traits indicate what you might expect out of a bull's daughters. Not only will a growthy bull's daughters be larger, but they likely will produce more milk as reported by Kuehn and Thallman (2016) where they found that several beef breeds demonstrated an increase in maternal milk EPDs from 1990 to 2014. In contrast to the increase in cow size and selection for growth, evidence suggests that calf weaning weights may no longer be increasing in the northern U.S. states (Colorado, Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Wisconsin and Wyoming) based on an analysis of forecasted delivery weight of calves offered for sale through Superior Livestock Auction's video sales from 1995 to 2016 (Lalman et al. 2019). This study demonstrates a plateau around 2006-2007 and a stable trend of 550.7 pounds for non-implanted calves and 592.3 pounds for implanted calves (Lalman et al. 2019).

UW College of Agriculture and Natural Resources Extension

B-1343 | May 2019

(a) 1957 Champion Hereford Bull at the Wyoming State Fair in Douglas, WY.

(b) 2012 Grand Champion Polled Hereford Bull at the National Western Stock Show in Denver, CO.

Figure 1. Examples of selection for growth and size in beef cattle sires through time.

IMPACTS ON THE BEEF INDUSTRY

Larger cattle can have an impact at all segments of the beef industry – from transport, to processing, to retail. Cattle can bump and bruise their backs as they go into the lower deck during transportation. This can cause bruising in the strip loin and require a carcass cutout. Today, it is estimated $35 million is lost annually due to an estimate of 68 percent of carcasses having bumps and bruises according to Dr. Dan Thomson with Kansas State University (Henderson 2016). Carcasses that are too large at the processing stage may also be problematic because the rail-to-floor height may not be able to accommodate cattle over 58 inches tall. Carcasses of this size run the risk of dragging on the floor at plants. This has been an issue at Tyson Foods, who reportedly banned steers over 58 inches tall in 2013. The larger carcasses are harder for workers to handle, slows the processing plant and reduces plant productivity (Dairy Herd Management 2017). Finally, at the retail stage of the beef industry, larger carcasses result in larger primal cuts which may have negative consequences for consumers. Recent reports suggest that primal cuts are too big and retailers are forced to cut steaks smaller to meet packaging and cost restrictions according to Dr. Russell Cross, a meat scientist formerly with Texas A&M University (Cross 2018).

UNIT COST OF PRODUCTION ESTIMATES

We ran model scenarios assuming a limited (constrained) forage base for cow herds uniformly consisting of big cows (~1,400 lbs.), moderate cows (~1,200 lbs.) or small cows (~1,000 lbs.). To populate the necessary weaning weight data, we used data based on actual calf weights and cow size classes from 2011-2014 derived from University of Wyoming cattle grazed at the McGuire Ranch north of Laramie, Wyo. (Figure 2). This study suggested that there was no significant difference in calf weaning weights relative to cow size across wet and dry years in this Wyoming rangeland grazing environment.

*Calf weaning weights were not significantly different (p = 0.99) relative to the 5 cow size classes across the 4 year study (2011-2014) located in Albany County, Wyoming.

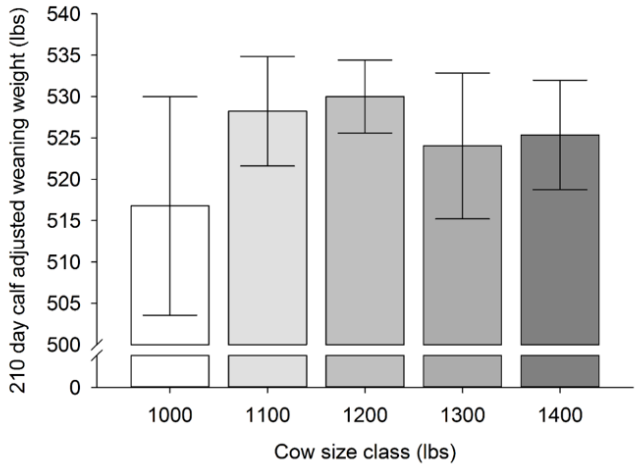

Figure 2. Calf weaning weights relative to five cow size classes ranging from 1,000 lbs. to 1,400 lbs. Data from 2011-2014 and from a study published in the Journal of Animal Science (Scasta, J. D., Henderson, L., & Smith, T. (2015). Drought effect on weaning weight and efficiency relative to cow size in semiarid rangeland. *Journal of Animal Science*, 93(12), 5829-5839.).

Table 1. Production profile of different cow herds relative to cow size and a limited forage base.

Production parameter	Big Cows (1,400 lbs)	Moderate Cows (1,200 lbs)	Small Cows (1,000 lbs)
Cow-calf numbers based on uniform cow size herd composition and forage available			
Number of cows (Jan 1)	78 hd	88 hd	100 hd
Adjusted females exposed	85 hd	98 hd	111 hd
Number of females bred	78 hd	88 hd	100 hd
Live calves born	74 hd	83 hd	95 hd
Live calves weaned	72 hd	81 hd	93 hd
Weaning weights and total pounds produced (derived from UW McGuire Ranch data)			
Average weaning weight[1]	525 lbs	530 lbs	519 lbs
Total lbs weaned	37,800 lbs	42,930 lbs	48,267 lbs
Lbs weaned/female exposed	485 lbs	488 lbs	483 lbs
Assumptions for culling, replacement, reproductive success, and weaning success			
# cows culled	9 hd	10 hd	11 hd
# cows died	1 hd	2 hd	2 hd
# calves died	5 hd	7 hd	7 hd
Pregnancy percentage	91.8%	89.8%	90.1%
Live calves born as % of bred cows	94.9%	94.3%	95.0%
Culling percentage	11.5%	11.4%	11.0%
Calving percentage	94.9%	94.3%	95.0%
Weaning percentage	92.3%	92.0%	93.0%
Replacement rate	11.5%	11.4%	11.0%
Cow death loss	1.3%	2.3%	2.0%
Calf death loss	2.7%	2.4%	2.1%

[1]Weaning weights based on actual calf weights and cow size classes from 2011-2014 using University of Wyoming cattle grazed at the McGuire Ranch north of Laramie, WY.

We also assumed that we had a limited amount of grass available that would provide adequate feed for 100 head of small cows, 88 moderate cows or 78 big cows based on their energy requirements and forage consumption that increases as cows get bigger (Table 1). Consequently, once we account for culling, replacement, reproductive success and weaning success, we estimate that the total pounds weaned would be 48,627 lbs. for the small cows, 42,930 lbs. for the moderate cows and 37,800 lbs. for the large cows (Table 1). The data from the University of Wyoming 2011-2014 suggests that calf weaning weights were not different, we assigned a price of $170.00 per cwt based on current market trends and then estimate a total gross value of weaned calves of $81,737.70 for the small cow herd, $72,981.00 for the moderate cow herd and $64,260.00 for the big cow herd (Table 2). Cull sales and replacements are accounted for as shown in Table 2. We then accounted for feed costs based on the number of cows and their intake using constant feed prices (Table 2). We also estimate that the total feed cost, including the value of grazed feed, per cow would be $361.52 per small cow, $441.56 per moderate cow and $523.79 per big cow.

Finally, when we summarize profit/loss, as returns to labor and equipment, and unit cost of production, we estimate that total herd profit would be $6,289.14 for the small cow herd, ($1,637.68) for the moderate cow herd and ($7,918.29) for the big cow herd (Table 3). On a per cow basis, estimated profit would be $62.89 per small cow, ($18.61) per moderate cow and ($101.52) per big cow. On a per pound of calf basis, we estimate profit would be $0.13 for small cows, ($0.04) for moderate cows and ($0.21) for big cows (Table 3). Lastly, the estimated unit cost of production was $1.57 per small cow, $1.74 per moderate cow and $1.91 per big cow (Table 3).

Table 2. Calf value and costs assumptions.

	Big Cows (1,400 lbs)	Moderate Cows (1,200 lbs)	Small Cows (1,000 lbs)
Calf Value			
$ per cwt	$170.00	$170.00	$170.00
$ per hd	$892.50	$901.00	$878.90
Total gross calf value	$64,260.00	$72,981.00	$81,737.70
Cull Value			
Number of Cows	9	10	11
$ per cwt	$65.00	$65.00	$65.00
Total cull income (plus 1 bull)	$9,975.00	$9,585.00	$8,935.00
Number of replacement females	10	12	13
Value of replacements ($1,300/hd females + 1 bull)	$18,000.00	$20,600	$21,900.00
Net costs for replacements	$8,025.00	$11,015.00	$12,965.00
Value produced (calf value-replacement costs)	$56,235.00	$61,966.00	$68,772.70
Value produced per cow	$660.94	$704.16	$687.73
Feed Costs[1]			
Pasture lease cost total	$20,000	$20,000	$20,000
Hay amount (tons) @ $130/ton	145.7 tons	124.9 tons	104.1 tons
Salt and mineral amount (tons) @ $778/ton	1.5 tons	2 tons	2 tons
Protein (tons) @ $355/ton	2.1 tons	3 tons	3 tons
Total feed cost	$40,855.29	$38,857.68	$36,151.56
Total feed cost per cow	$523.79	$441.56	$361.52
Total feed cost per pound of calf	$1.08	$0.91	$0.75
Other Costs			
Medicine	$1,170.00	$1,325.00	$1,500.00
Fuel	$780.00	$880.00	$1,000.00
Livestock supplies	$390.00	$440.00	$500.00
Trucking	$780.00	$880.00	$1,000.00
Marketing	$1,170.00	$1,325.00	$1,500.00
Opportunity interest on capital	$106,800.00	$121,600.00	$137,200.00
Opportunity interest based on 6% rate cost per cow	$82.15	$82.91	$82.32
Total other cost per cow	$137.15	$138.02	$137.32
Total other cost per pound of calf produced	$0.28	$0.28	$0.29
Overhead Costs[2]	$12,600.00	$12,600.00	$12,600.00

[1] Feed costs based on cow weight and consumption at 2.5% of body weight for a 3 month period

[2] Overhead costs assume 1/3 labor unit or $10,000, and $2,600 contribution toward depreciation and repairs on machinery for the herd

Table 3. Summary of profit/loss and unit cost of production

	Big Cows (1,400 lbs)	Moderate Cows (1,200 lbs)	Small Cows (1,000 lbs)
Calf sales (total)	$64,260.00	$72,981.00	$81,737.70
Calf sales (per cow)	$823.85	$829.33	$817.38
Herd replacement cost (total)	$8,025.00	$11,015.00	$12,965.00
Value produced (total)	$56,235.00	$61,966.00	$68,772.70
Value produced (per cow)	$720.96	$704.16	$687.73
Feed costs (total)	$40,855.29	$38,857.68	$36,151.56
Other costs (total)	$10,698.00	$12,146.00	$13,732.00
Overhead costs	$12,600.00	$12,600.00	$12,600.00
Total Costs	$64,153.29	$63,603.68	$62,483.56
Profit or Loss (total)[1]	($7,918.29)	($1,637.68)	$6,289.14
Profit or Loss (per cow)[1]	($101.52)	($18.61)	$62.89
Profit or Loss (per pound of calf)[1]	($0.21)	($0.04)	$0.13
Unit cost of production	$1.91	$1.74	$1.57

[1]Model scenarios do not consider overheads such as labor and machines, so numbers are a more accurate reflection of returns to labor and equipment. Additional assumptions of the labor and machine costs, which are highly variable by operation, would be needed to further understand and calculate estimated profit/loss.

IMPLICATIONS FOR GRAZING WYOMING RANGELANDS

Although beef genetics have rapidly advanced, forage production on rangelands has not appreciably increased during that same time frame. Predictions for increasing frequency and magnitudes of drought could reduce rangeland forage in some areas. Ultimately, larger cows that produce more milk require more forage for maintenance. As cow size increases, forage intake requirements also increase proportionally because larger cows have a larger rumen, larger proportion of body mass comprised of visceral organs and greater nutritional maintenance requirements. Smaller cows have been shown to be more efficient because they have lower maintenance requirements. Smaller cows also have the potential to be more efficient calf producers because their calves gain more weight in relation to dam weight when compared to larger cows (Vaz et al., 2016). Larger sized cattle translates into eating more to maintain adequate body condition. However, it is important to note that selecting for increased fertility may be more important than selection purely based on cow size.

Potential Problem #1

When a ranch has been passed down through generations and the younger generation may perceive the ranch's carrying capacity to be a set number of animals. This perception may not be true for most ranches because the cows of today are much larger than the cows of yesterday.

Potential Problem #2

Larger cows may have reduced longevity as researchers in Oklahoma found that 1,400 pound cows produce one fewer calves in their lifetime than 1,100 pound cows and larger cows may have a reduced calving rate of up to seven percent lower.

Potential Problem #3

In high-production environments, such as improved pastures, larger cows may wean heavier calves, however in low-production environments, such as Wyoming's rangelands, this may not be the case. Data from New Mexico, Texas and Oklahoma's Standardized Performance Analysis (SPA) indicates that weaning weights have not been increasing over time – even though cow size has. Our study in Wyoming reported that across years there was no weaning weight advantage associated with larger cows, as 1,000 pound cows weaned similar weight calves as 1,400 pound cows. Furthermore, the smallest cows always had higher relative efficiency measured as calf weight to cow weight and only the 1,000 pound cows achieved an efficiency of 0.5, indicating they weaned a calf that weighed 50% of their body weight.

Potential Problem #4

If the slow trend of bigger cows has gone unnoticed, and stocking rates are not adjusted accordingly, areas grazed by the same number of cows long-term may be over-grazed and the contemporary cows may have difficulty in maintaining body condition and breeding back. This further justifies the need to know how much forage your land can produce and then balancing animal demand with that forage production. A general rule of thumb is that a beef cow will consume 2.5 percent of her body weight in air dry forage daily. A 1,000 pound cow needs 25 pounds of grass per day, a 1,200 pound cow needs 30 pounds of grass per day and a 1,400 pound cow needs 35 pounds of grass per day. It is important to note that forage intake does not scale exactly 1 to 1 because metabolic rate, according to Kleiber's law, is actually calculated at a 0.75 power. For beef cows to optimize efficiency there could be some advantage to having a rumen that is optimal in size in terms of capacity. It also suggests that more research is needed on the variation in rumen capacity, forage intake and digestive efficiency for cows on rangeland – an area that has been explored in the feedlot but not on rangelands.

CONCLUSIONS

Many herds would be well served to purchase replacement females with desirable maternal characteristics and focus breeding decisions on terminal progeny. Trying to balance selection for maternal and terminal traits has contributed to this situation. If a producer chooses to retain their own heifers rather than purchasing replacement heifers, it is critical to not only consider the production trait EPD's of sires like birth weight, calving ease, weaning weight and yearling weight, but to also look at maternal trait EPD's such as maternal milk, maternal height and maternal weight when considering purchasing bulls that will sire your replacement heifers. These maternal traits are all indications of what that bull's daughters will be like. The beef industry is aware of this cow size, milk and nutrient requirement trend and is making additional selection indices available. For example, breed associations are recognizing that cattle with greater dry matter and nutrient requirements due to greater body size and maternal milk is prevalent and that additional EPDs are needed. Thus, the American Angus Association (http://bit.ly/Angus-EPD) and the American Hereford Association (http://bit.ly/Hereford-EPD) now offer a dry matter intake (DMI) EPD.

More small to moderate size cows can be economically advantageous because overhead costs can be spread over more animals and more cows equal more calves that could potentially result in greater total pounds weaned. Because rangeland forage grazed by roaming cattle is often the most economical nutrient source, matching cow size to forage resources to optimize forage utilization should be integrated into the ranch management and stocking rate decisions.

The information presented here is intended to develop awareness about the cow size trend and potential consequences of this trend. There are a number of related questions and issues for which very little information is available. First, calf value through the rest of the chain as it relates to the dam's size has been lacking. The potential feedlot performance of different calves as perceived by order buyers, performance of retained calves on grass as stockers, time to finish weight, carcass quality, etc. are additional performance metrics that a producer needs to consider. Second, cow size and the information we have presented may be more applicable to private lands grazing because grazing fees are typically charged on a per cow basis rather than an animal unit (AU) basis and adjusting permitted cattle numbers on public grazing allotments is quite difficult. If you are interested in the application for public lands grazing and associated costs related to how grazing fees are charged, check out the factsheet by Utah State University "The Optimal Cow Size for Intermountain Cow-Calf Operations"; http://bit.ly/Utah-State-Optimal-Cow-Size. It is important to note that in this factsheet the authors set up their model with the assumption that a 1,400 pound cow would wean a 630 pound calf versus a 1,000 pound cow that would wean a 500 pound calf – assumptions that affect economic outcomes. Related to cow size, the AU concept can readily account for different cow sizes through the application of animal unit equivalents (AUE) (SRM Rangeland Assessment and Monitoring Committee 2017). Third, the cow size and information we have presented are based on real data from an extensive Wyoming range cattle operation that is minimizing input costs. It is possible that some operations have the capability to more intensively

manage the nutritional resources available to realize the genetic growth potential that larger cows convey to their calves. For example, Beck et al. (2016) reported an increase in calf weight relative to cow size in a study from Arkansas where 200 pounds of nitrogen was applied via ammonium nitrate annually on pastures composed of exotic forage species – a production environment that is very different from Wyoming rangelands. When considering the information in this factsheet, it is important to consider an entire ranch inventory of feed sources, forages, genetics and marketing strategies.

REFERENCES

Henderson. (2016). Cattle's $35 Million Bruise. *AgWeb*. https://www.agweb.com/article/cattles-35-million-bruise-naa-greg-henderson/

Beck et al. (2016). Effect of mature body weight and stocking rate on cow and calf performance, cow herd efficiency, and economics in the southeastern United States. *Journal of Animal Science* 94(4):1689-1702. https://academic.oup.com/jas/article/94/4/1689/4704165

Bir et al. (2018). Optimal beef cow weights in the US Southern Plains. *Journal of Agricultural and Resource Economics* 43(1):103-117. https://ageconsearch.umn.edu/record/267612/files/JARE%2CJanuary2018%2C%237%2CBir%2C103-117.pdf

Cross. (2018). What are the big carcasses doing to the future of the beef industry. Beef Magazine. https://www.beefmagazine.com/ranching/what-are-big-carcasses-doing-future-beef-industry

Dairy Herd Management. (2016). Holstein steers need to get heavier, and shorter. https://www.dairyherd.com/article/holstein-steers-need-get-heavier-and-shorter

Doye and Lalman (2011). Moderate versus big cows: Do big cows carry their weight on the ranch?. *Proceedings of the Southern Agricultural Economics Association*, Corpus Christi, TX, February 5-8, 2011. https://ageconsearch.umn.edu/record/98748/files/SAEA%202010%20Moderate%20versus%20Big%20Cow%20Results.pdf

Kuehn and Thallman (2016). Across-breed EPD tables for the year 2016 adjusted to breed differences for birth year of 2014. Beef Improvement Federation Annual Meeting and Symposium. June 14-17, 2016, Manhattan, Kansas, USA. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1379&context=hruskareports

Lalman et al. (2019). Weaning weight trends in the US beef cattle industry. Applied Animal Science 35(1):57-65. https://www.appliedanimalscience.org/article/S2590-2865(19)30001-1/abstract

Olson et al. (1982). Effects of cow size on cow productivity and on calf growth, postweaning growth efficiency and carcass traits. *Journal of Animal Science* 54(4):704-712. https://academic.oup.com/jas/article/54/4/704/4661895

Scasta et al. (2015). Drought effect on weaning weight and efficiency relative to cow size in semiarid rangeland. *Journal of Animal Science* 93(12):5829-5839. https://www.researchgate.net/profile/John_Scasta/publication/283829597_Drought_effect_on_weaning_weight_and_efficiency_relative_to_cow_size_in_semiarid_rangeland/links/56bb874a08ae47fa3956a5d6/Drought-effect-on-weaning-weight-and-efficiency-relative-to-cow-size-in-semiarid-rangeland.pdf

SRM (Society for Range Management) Rangeland Assessment and Monitoring Committee. (2017). Does size matter? Animal units and animal unit months. *Rangelands* 39:17-19. http://rangelands.org/wp-content/uploads/2016/08/Rangelands-1-s2.0-S0190052816301031-main.pdf

PHOTOS

Wyoming State Archives Photo Collection (http://spcrphotocollection.wyo.gov/luna/servlet/detail/SPCRACV~3~3~2382506~135350:WY-AGRICULTURE-DEPARTMENT---STATE-F?qvq=w4s:/when%2F1957&mi=18&trs=44)

Tri-State Livestock News (https://www.tsln.com/news/hereford-breeders-earn-top-honors-at-2012-national-western-stock-show/)

College of Agriculture and Natural Resources Extension

B-1343 • May 2019

Editor: Katie Shockley. Graphic design: Tanya Engel.

Issued in furtherance of extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. University of Wyoming Extension, University of Wyoming, Laramie, Wyoming 82071.