

Net Present Value of Beef Replacements

Regional Analysis Summary

November 2013

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Cow-calf production is dispersed throughout the U.S. with notable variation in production practices typical for operations in different geographical regions. As cattle producer interest in possible beef herd expansion grows, a question that often arises is what regions are most likely to experience herd expansion. The purpose of this factsheet is to highlight historical trends in regional predominance of cow-calf herds and to examine the net present value of possible replacement females available for purchase by representative operations in five different geographic regions.

Historical Trends

The multi-year drought has been the center of attention in overall and regionally varying breeding herd size discussions in recent years. It is also useful to take a look at longer historical trends in where beef cows have resided and at parallel patterns in heifer retention. The information in tables 1 and 2 was derived to present estimates of these closely monitored herd size statistics individually for the 10 states with the largest beef cow herds, as of January 2013, as well as five broader regions defined to be consistent with the pasture conditions reports released by USDA as part of their Crop Progress reporting efforts.

Table 1. Beef Cows that Calved (1,000 hd)

State / Region	1994	2004	2010	2013	1994 (% of US)	2004 (% of US)	2010 (% of US)	2013 (% of US)
TX	5,800	5,383	5,140	4,015	16.8%	16.5%	16.4%	13.7%
NE	1,920	1,848	1,781	1,805	5.5%	5.7%	5.7%	6.2%
MO	2,200	2,085	1,968	1,757	6.4%	6.4%	6.3%	6.0%
OK	1,853	1,920	2,073	1,754	5.4%	5.9%	6.6%	6.0%
SD	1,598	1,711	1,618	1,688	4.6%	5.3%	5.2%	5.8%
MT	1,478	1,432	1,465	1,506	4.3%	4.4%	4.7%	5.1%
KS	1,473	1,550	1,434	1,328	4.3%	4.8%	4.6%	4.5%
KY	1,155	1,128	1,070	1,028	3.3%	3.5%	3.4%	3.5%
IA	1,075	974	885	925	3.1%	3.0%	2.8%	3.2%
ND	941	937	869	922	2.7%	2.9%	2.8%	3.1%
US	34,603	32,531	31,371	29,295				
Great Plains	9,023	8,766	8,575	8,658	26.1%	26.9%	27.3%	29.6%
Southeast	8,597	8,022	7,560	7,204	24.8%	24.7%	24.1%	24.6%
Southern Plains	7,653	7,303	7,213	5,769	22.1%	22.4%	23.0%	19.7%
Cornbelt	5,100	4,705	4,487	4,271	14.7%	14.5%	14.3%	14.6%
West	3,844	3,404	3,193	3,054	11.1%	10.5%	10.2%	10.4%
Northeast	386	331	343	340	1.1%	1.0%	1.1%	1.2%

Source: USDA data, compiled by LMIC, modified for presentation by the authors. Regions defined as: *Great Plains* (CO, KS, MT, NE, ND, SD, WY), *Southeast* (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV), *Southern Plains* (OK, TX), *Cornbelt* (IL, IN, IA, MI, MN, MO, OH, WI), *West* (AK, AZ, CA, HI, ID, NV, NM, OR, UT, WA), and *Northeast* contains remaining states.

Table 2. Heifers for Beef Cow Replacement (1,000 hd)

State / Region	1994	2004	2010	2013	1994 (% of US)	2004 (% of US)	2010 (% of US)	2013 (% of US)
TX	980	740	760	600	15.4%	13.4%	13.9%	11.2%
NE	260	280	320	350	4.1%	5.1%	5.9%	6.5%
MO	370	280	280	270	5.8%	5.1%	5.1%	5.0%
OK	345	370	405	280	5.4%	6.7%	7.4%	5.2%
SD	280	290	285	315	4.4%	5.3%	5.2%	5.9%
MT	355	420	340	435	5.6%	7.6%	6.2%	8.1%
KS	280	230	240	230	4.4%	4.2%	4.4%	4.3%
KY	205	160	150	150	3.2%	2.9%	2.8%	2.8%
IA	160	125	130	150	2.5%	2.3%	2.4%	2.8%
ND	190	156	165	207	3.0%	2.8%	3.0%	3.9%
US	6,364	5,508	5,451	5,361				
Great Plains	1,715	1,631	1,615	1,838	26.9%	29.6%	29.6%	34.3%
Southeast	1,596	1,266	1,223	1,140	25.1%	23.0%	22.4%	21.3%
Southern Plains	1,325	1,110	1,165	880	20.8%	20.2%	21.4%	16.4%
Cornbelt	873	777	752	779	13.7%	14.1%	13.8%	14.5%
West	749	630	599	603	11.8%	11.4%	11.0%	11.3%
Northeast	107	94	97	120	1.7%	1.7%	1.8%	2.2%

Source: USDA data, compiled by LMIC, modified for presentation by the authors. Regions defined as: *Great Plains* (CO, KS, MT, NE, ND, SD, WY), *Southeast* (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV), *Southern Plains* (OK, TX), *Cornbelt* (IL, IN, IA, MI, MN, MO, OH, WI), *West* (AK, AZ, CA, HI, ID, NV, NM, OR, UT, WA), and *Northeast* contains remaining states.

Values in tables 1 and 2 are presented to enable easy comparison to the pre-drought period represented by 2010, 10 years ago (2004), and 20 years ago (1994). This information reveals some important trends that can easily be missed by looking solely at year-over-year adjustments or solely examining changes that have occurred during the recent drought period. Table 1 reveals how stable the geographic dispersion of the beef cow herd was over the 1994-2010 period. The total head in the Great Plains followed the national trend of downsizing over the 1994-2010 period, however, its relative role as home to beef cows and heifers being retained was growing prior to the recent drought. This suggests the Great Plains may be a “growth area” in terms of its role in the national industry. Conversely, while the share of the country’s beef cows has been stable in the Southeast, this region has a longer history of a decreasing role in retaining heifers. This suggests the Southeast may slowly be decreasing its overall relative role in the industry. It is also important to note the Southeast region is the only broad area that has experienced “better pasture conditions than normal” for the last several years. While this could indicate an expansion opportunity, the past pattern of reduced comparative heifer retention casts doubt on the likelihood of expansion in this region. Between the patterns of these two regions is the Southern Plains. Prior to the current drought, the beef cow herd in Texas was contracting while the herd in Oklahoma was expanding leading to limited net change in the region’s collective role in the industry. Since 2010, the portion of both beef cows and retained heifers residing in the Southern Plains has fallen notably due to the significant drought conditions experienced in the region.

Available Forward-Looking Decision Aide and Regional Sensitivities

While this historical context is important for broader understanding of changes that have occurred in the cow-calf industry, producers currently contemplating expansion of their own breeding herd should make decisions in a forward-looking assessment of the expected economic environment of the industry in upcoming years. To guide this assessment process, a user-friendly spreadsheet has been created and posted online to assess the economic situation presented by a given producer purchasing an available replacement female for their breeding

herd.¹ When it comes to projecting the net present value (NPV) offered by purchasing a replacement female, a number of assumptions about the future must be made to provide key inputs into this decision aide. Default values are provided to assist producers but each user is encouraged to adjust inputs (in the spreadsheet “blue” values reflect inputs that can be modified by any user) to best reflect one’s own situation. This decision aide and the impact of varying key assumptions is discussed in a separate factsheet.² In this factsheet the impact of diverse situations for representative producers in five different regions is highlighted.

Information to guide variation of regional inputs for this decision aide were derived from several sources. Cost and return estimates provided by the USDA-ERS were used to obtain production cost and weaning weight information for representative operations in eight different regions.³ While this information is valuable for understanding regional variation, it is slightly problematic to utilize as the USDA-ERS has defined regions not by typical state borders but rather by areas with similar agricultural production practices. These USDA-ERS based weaning weights along with average price-weight scales experienced during the January 2010-October 2013 period in auction markets in key states within each region were used to slightly modify assumed calf prices for representative producers in each region. The second source of information was recognizing how the LMIC traditionally aggregates states into one of five broader regions (as described below tables 1 and 2) defined more cleanly along physical state borders. Many cow-calf producers also receive pasture condition information aggregated in this manner. Combining these multiple pieces of information and making use of the above noted Excel spreadsheet resulted in the information related to net present value of purchase replacement females that is reported in tables 3 and 4.

¹ This spreadsheet (*KSU-Beef Replacement*) is available online at: <http://www.agmanager.info/livestock/budgets/production/default.asp>. Users are encouraged to regularly return to this website and obtain the most current version as updates are periodically made.

² This factsheet (*Net Present Value of Beef Replacements: Sensitivity Analysis Summary*; Publication: AM-GTT-KCD-2013.1) is available online at: <http://www.agmanager.info/livestock/budgets/production/default.asp>.

³ The USDA ERS periodically updates this information which is available online at: <http://www.ers.usda.gov/data-products/commodity-costs-and-returns.aspx#.UngYso7naew>.

Table 3. Net Present Value of Beef Replacements, Analysis Summary Using Operating and Labor Costs*

Year	Number of Calves	Region					
		US	Great Plains	Southeast	Southern Plains	Cornbelt	West
2014	1	\$821	\$890	\$786	\$839	\$597	\$995
2015	2	\$719	\$844	\$654	\$751	\$317	\$1,030
2016	3	\$627	\$798	\$540	\$671	\$85	\$1,047
2017	4	\$519	\$723	\$414	\$572	-\$134	\$1,025
2018	5	\$430	\$660	\$312	\$489	-\$312	\$1,005
2019	6	\$370	\$620	\$241	\$435	-\$442	\$999
2020	7	\$318	\$584	\$180	\$387	-\$549	\$990
2021	8	\$280	\$558	\$135	\$352	-\$632	\$987
2022	9	\$250	\$539	\$100	\$325	-\$696	\$984
2023	10	\$223	\$520	\$69	\$301	-\$751	\$979

Key Inputs Varied Across Scenarios**:

Operating and labor costs, \$/cow/yr	\$903	\$923	\$912	\$898	\$1,114	\$725
Beef cows, head per farm/ranch	100	181	73	108	63	196
Avg Calf Weight, lbs	500	555	484	508	493	497
Avg Calf Price Slide, \$/cwt	\$8.42	\$8.98	\$8.23	\$8.81	\$7.11	\$9.33

* NPV is Net Present Value (\$/head) of a replacement expected to produce the number of saleable calves listed in the "Number of Calves" column before a cow is culled for age-related reasons.

** Annual cost, calf weight, and calf price assumptions were varied with all other inputs set at their default settings as of 11-1-13.

Table 4. Net Present Value of Beef Replacements, Analysis Summary Using Only Operating Costs*

Year	Number of Calves	Region					
		US	Great Plains	Southeast	Southern Plains	Cornbelt	West
2014	1	\$1,204	\$1,174	\$1,259	\$1,210	\$992	\$1,302
2015	2	\$1,406	\$1,353	\$1,504	\$1,415	\$1,025	\$1,580
2016	3	\$1,556	\$1,485	\$1,689	\$1,569	\$1,041	\$1,792
2017	4	\$1,639	\$1,553	\$1,800	\$1,655	\$1,019	\$1,924
2018	5	\$1,702	\$1,602	\$1,885	\$1,720	\$998	\$2,025
2019	6	\$1,763	\$1,651	\$1,964	\$1,782	\$993	\$2,116
2020	7	\$1,807	\$1,686	\$2,022	\$1,827	\$984	\$2,184
2021	8	\$1,845	\$1,717	\$2,071	\$1,865	\$980	\$2,242
2022	9	\$1,876	\$1,743	\$2,111	\$1,897	\$978	\$2,288
2023	10	\$1,897	\$1,759	\$2,139	\$1,919	\$972	\$2,321

Key Inputs Varied Across Scenarios**:

Operating costs, \$/cow/yr	\$520	\$639	\$438	\$527	\$720	\$418
Beef cows, head per farm/ranch	100	181	73	108	63	196
Avg Calf Weight, lbs	500	555	484	508	493	497
Avg Calf Price Slide, \$/cwt	\$8.42	\$8.98	\$8.23	\$8.81	\$7.11	\$9.33

* NPV is Net Present Value (\$/head) of a replacement expected to produce the number of saleable calves listed in the "Number of Calves" column before a cow is culled for age-related reasons.

** Annual cost, calf weight, and calf price assumptions were varied with all other inputs set at their default settings as of 11-1-13.

Table 3 presents the NPV of beef replacements for a representative producer in each of five geographical regions, where a producer is assumed to be examining investments based on annual costs that include all operating and labor costs (\$/cow). Table 4 reports similarly generated information with the only difference being the situation summarized applies to a producer considering investment based upon annual operating costs only. The situation depicted by considering annual total costs is not presented as the representative producer in such a scenario would be better off reducing rather than expanding their herd. In reality, the typical cow-calf operation has a historical pattern of making decisions based upon situations where not all economic costs are considered leading to table 3 and 4 being presented to highlight the relative role of considering labor costs.

Table 3 highlights that the representative U.S. producer who includes operating and labor costs in their assessment of expansion possibilities is unlikely to aggressively bid on replacements given current market prices for cows and heifers. Narrowly, a producer in this situation considering the purchase of a heifer expected to provide one calf for sale in each of the next 10 years could only pay \$223 if they were targeting a 7.5% rate of return. This value is substantially below current market prices suggesting that either the representative producer is currently not the buyer of replacements or purchasing decisions are being made without consideration of both operating and labor costs.

Table 3 indicates the five regions rank as follows from highest to lowest in expected returns in this situation: West, Great Plains, Southern Plains, Southeast, and Cornbelt. This ordering reflects the substantial impact of production costs varying regionally leading to the representative West region seeing significantly more value in replacements than representative producers in other regions. At the other extreme, representative producers in the Cornbelt in this situation would be best served by downsizing as signaled by negative NPV estimates due to their considerably higher operating and labor costs.

Table 4 highlights the notably more favorable economic environment across all regions presented by replacements when labor costs are omitted by producers in their investment assessment. In this situation, the five regions rank as follows from highest to lowest in expected

returns: West, Southeast, Southern Plains, Great Plains, and Cornbelt. This re-ordering highlights the impact of considering (or omitting) labor costs in expansion investment decisions. If labor costs are ignored, the ranking of representative producers in the Southeast in the relative value they see in replacement purchases will increase substantially compared to the case where labor costs are considered.

Summary and Implications

Combined, the information presented here suggests predominance of the U.S. cow-calf herd is likely to shift north and west consistent with historical trends that were in place before the recent multi-year drought. That being said, recognizing the substantial number of cow-calf operators in the Southeast and the fact that managerial decisions may be made with little to no value placed on labor costs tempers this geographical shift conclusion. Narrowly, if producers in regions operating at a comparative disadvantage, when total economic costs are considered but more equal footing when only operating costs are considered, choose to follow past patterns of managing their operations mainly based on operating costs then a more uniform, geographic pattern to national herd expansion may develop.

While these regional differences are of notable interest and hold several implications for the broader U.S. beef-cattle industry, including geographically dispersed infrastructure utilization, it is imperative to also recognize that substantial variation existing within each region. Specifically, it is well documented that production costs (regardless of whether labor costs are included or omitted) vary significantly across producers. Moreover, producer expectations on future cattle prices and the discount rate they likely would charge for candidate investments vary substantially. Recognizing these sources of variation in addition to the regional differences discussed in this factsheet are also important as they can have significant impacts on the amount that can be paid for replacement females.