Price or Weather – Which Signal Should Livestock Producers Follow?

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Cattle producers are faced with the task of making herd management decisions in a dynamic setting. Profit-driven producers desire to make money but are often constrained in their decisions. Limited resources, physical and financial, as well as fluctuating cattle markets, influence management strategies and resulting outcomes. Producers' grazing decisions are limited by access to land and overall forage production. Grazing season production is largely affected by spring and early summer precipitation leaving producers with limited forage in dry years. Cattle price cycles also impact producers' herd management decisions. Retaining or purchasing breeding animals at high points in the price cycle increases the cost of production while selling large numbers of animals at low points in the cycle results in low per-animal revenues. It would be easier to manage a herd if years of poor forage production were aligned with good selling opportunities in the market or vice versa, but producers seldom face this combination of market and weather impacts.

Price Cycle and Impacts on Revenues

In the past, cattle prices have tended to be cyclical. The price cycle is caused by cyclical expansions and contractions in the nation's stock of breeding animals. Prices rise as producers expand herd sizes initially and retain heifers. As prices rise, the cost of expanding the herd by not selling heifer calves increases. This is compounded as the resulting calf production from these heifers will lag by two or three years. Producers tend to expand herds as long as they have the forage resources and believe it is profitable to do so. Eventually, once enough feeder animals are available, market prices stop rising and at some point start to fall. Once prices drop far enough, producers respond by liquidating breeding livestock, leading to an increase in the downward trend of prices. When the supply of feeder animals is reduced enough, prices begin to increase again, and the expansion of breeding stock begins anew. Figure 1 shows the cattle inventory since 1938.

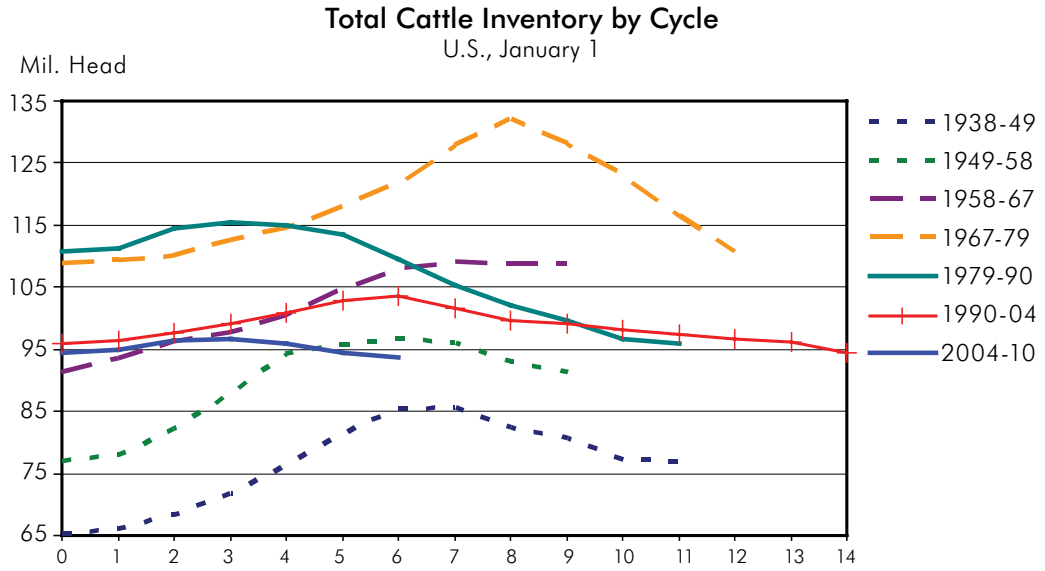
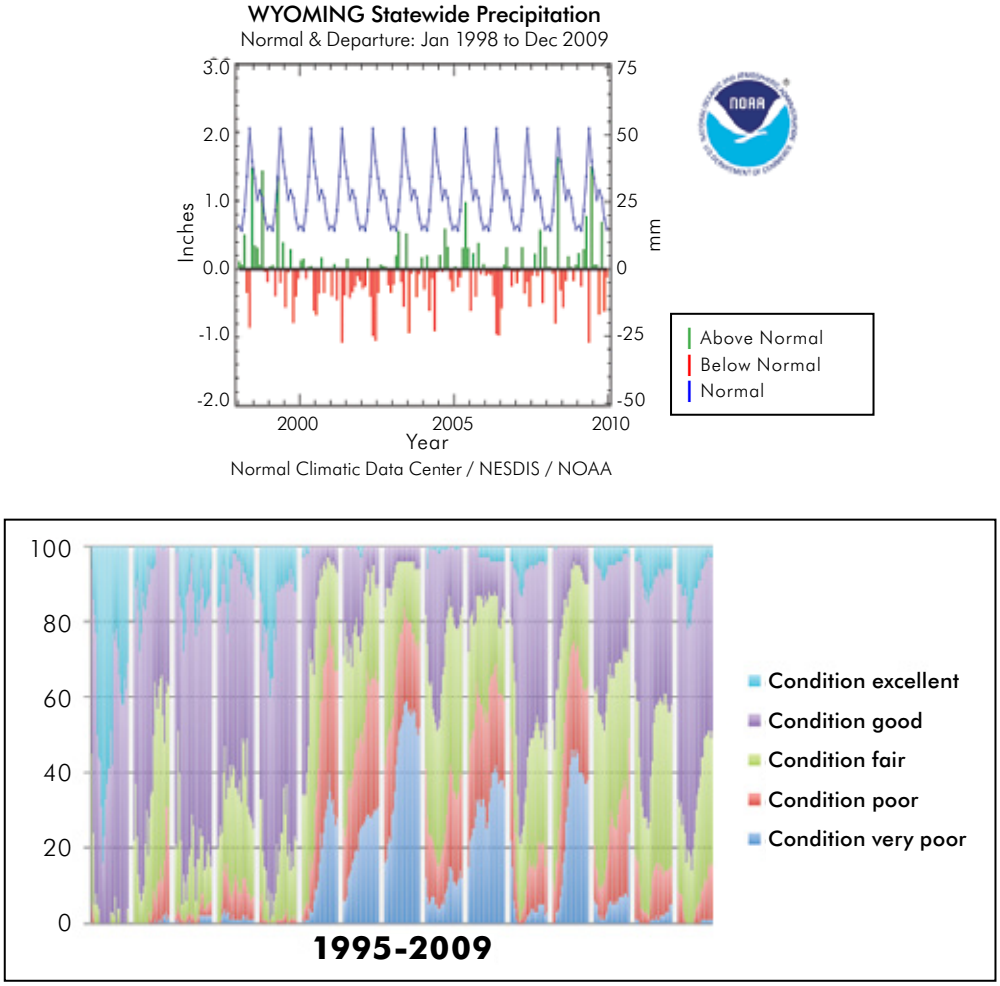


Figure 1. Cattle Inventory Cycles from 1938. The vertical axis represents millions of animals, and the horizontal axis represents years. (Unpublished data from the Livestock Information Marketing Center, using USDA/NASS data)

Although the price cycle is caused by fluctuations in total herd sizes brought about by economic events, individual producers often try to use this phenomenon to their benefit. Maintaining a constant herd size through the cycle can hurt producers' financial outcomes. Many producers aim to take advantage of the "buy low, sell high" strategy. This strategy implies not only buying low, but also retaining animals for breeding stock when prices are low. An animal retained during low prices will be a lower-cost producer than that of an animal retained during times of high prices. However, since any stock retained for breeding requires a lag period before the animal begins to produce calves, the financial impact of retaining animals at the peak of the price cycle is magnified. As calves are produced during a trough in the price cycle, they are sold for increasingly lower prices. Profits may be increased by behaving counter-cyclically, but it is difficult to predict accurately the nature of the cattle cycle, which can make this a difficult, if not risky, strategy.

Weather Patterns

Weather has a major impact on cattle production. Cow-calf producers rely on forage production for grazing, which is in turn dependent upon growing season precipitation. Extended periods of drought can magnify the decrease in forage production from any given tract of land. During these periods, drought negatively affects forage production by reducing soil moisture and quality over time. A tract of land may be able to handle more grazing pressure in the beginning of a drought than compared to a year with similar precipitation at the end of a prolonged drought. Producers need to be aware of the carrying capacity of grazing lands throughout drought events when making grazing decisions. Figure 2 shows actual precipitation and pasture condition for Wyoming pastures since 1995.



Available at: http://www.ncdc.noaa.gov/oa/climate/research/2009/dec/st048dv00pcp200912.html

Figure 2. Actual Precipitation and Pasture Condition for Wyoming

If producers do not respond to dry years by reducing herd sizes or purchasing additional feed, grazing animals will not perform as well. If a producer has a goal of optimal animal performance, dry years require either the acquisition of additional forage or a reduction in animal requirements from the land. Often, a producer is limited by the inability to acquire additional forage, requiring some level of liquidation to maintain herd performance. With the experience of a recent drought and the observed impact on rangeland, some producers may decide to generally carry smaller herds and stock their lands more moderately to reduce the impact of drought on their operations and its rangelands. However, just as the decision to carry a constant herd size throughout the price cycle results in lower incomes, carrying a smaller herd size through varying weather cycles also will result in lower incomes. Fluctuating forage production can offer some opportunities for managers, and producers should respond to poor forage production associated with dry years by reducing herd sizes, but the increased forage production associated with wetter years allows producers the opportunity to carry more animals. A producer must adapt to fluctuating weather and prices to attain the greatest profitability in the long-run.

But, How Do We Decide What to do When Weather and Prices Fluctuate Every Year?

If a producer were able to reliably determine where the price cycle is headed, as well as what weather to expect in the coming years, profitable herd management decisions could be easily made. The problem is that, even with knowledge of prior price and weather movements, producers seldom have perfect knowledge of what will happen to price and weather over the next few months, let alone in coming years. Sometimes, a producer may have an idea or expectation as to trends, but often he or she is uncertain as to what to expect in the future. Therefore, a producer needs to be able to make decisions based on the knowledge of the current state of the market and forage production. Although not intended to be an ever-true decision rule, the following analysis is used to offer producers guidance as to how to respond to fluctuations in both weather and cattle prices.

Current research at the University of Wyoming has focused on distinguishing the effects of fluctuating cattle prices and forage production on cow-calf producer profits, and a few recommendations can be made. The following analysis assumes a risk-neutral producer (i.e., a type of producer who focuses on profitability without concern for the level of risk involved in the decision). Caution must be used when applying the results to any other situation. The analysis does not provide for any minimum yearly cash flows that may be required for debt payment.

Research was conducted evaluating net present value of returns over time when the case ranch was faced with fluctuating weather and prices. The major findings show that, as expected, cattle prices have a large impact on financial returns; however, weather impacts should have a greater impact on management decisions than market indicators. Results from this research are presented in the form of elasticities in Table 1 and graphically in Figure 3. Elasticities are a measure of responsiveness and are reported for variables such as returns, herd size measured in animal unit years (AUY), total cull sales, acres grazed, tons of hay fed, tons of hay fed per AUY, acres grazed per AUY, and cull sales per AUY. In this example, they are used to show how a percentage change in a variable such as precipitation alters either financial outcomes or management decisions described previously, also in percentage terms. For example, the upper left corner of the table says that a 1-percent increase in cattle prices (Market) results in a 4-percent increase in returns to the producer, while a 1-percent increase in growing season precipitation leads to only a 1-percent increase in annual returns.

As seen in both Table 1 and Figure 3, producers should respond to an increase in prices by increasing herd size slightly (as measured by AUY). This is accomplished by retaining more animals and culling at a lower rate. Retaining more animals will allow the producer to increase acreage grazed for the herd if possible, given an increase in market price. An increase in forage production does increase financial returns as well but not as drastically as an equal percentage increase in prices. As with an increase in prices, an increase in forage production should result in larger herd sizes. However, the increase in herd size is more responsive to the increase in forage produced. As forage production increases, this allows stocking rates per acre to be increased reducing the need for additional acres and lowering grazing costs per animal. Although the decisions are responsive to weather and market fluctuations, the decrease in both total and per-animal acreage allowed with an increase in precipitation (as measured by the weather column) is far greater than an increase in prices. Therefore, if a producer sees an increase in both market price and precipitation, producers should stock at a higher density. If producers see prices drop while forage production rises by an equal percentage, herd size should not change much, but a producer can graze the herd on less acreage. If, on the other hand, prices increase by an equal percentage change as a decrease in forage production, more acreage is needed to carry the same size herd, but, again, producers will not alter herd size much. Overall, this suggests when producers make decisions about herd size, stocking rates, and amount of hay fed, generally these should be more responsive to changes in weather and forage production than changes in market prices.

Table 1. Influence of Price and Weather Impacts on Management Decisions Displayed as Elasticities

	Market (1% increase in price)	Weather (1% increase in precipitation)	R Squared	Comparison t Statistic
Yearly returns	4.018 103.113	1.009 36.226	0.632	-51.21*
AUY	0.254 25.707	0.326 46.133	0.286	1.22
Cull	0.202 21.784	0.210 31.648	0.175	0.13
Acres grazed	0.300 31.445	-0.674 -98.684	0.606	-6.36*
Total feed	0.233 22.493	0.326 44.157	0.261	1.60*
Feed/AUY	-0.022 -20.572	-0.002 -2.273	0.058	0.35
Acres/AUY	0.069 16.602	-0.997 -334.394	0.942	-15.80*
Cull/AUY	-0.049 -11.000	-0.102 -32.067	0.142	-0.90

Values represent elasticities estimated using Ordinary Least Squares. Values under coefficients are associated t stats. Also reported are associated R Square Values, as well as comparison t stats against the null hypothesis that the coefficients are equal. Those comparison t statistics with an '*' indicate statistical significance. All reported t statistics reported under coefficients are significant.

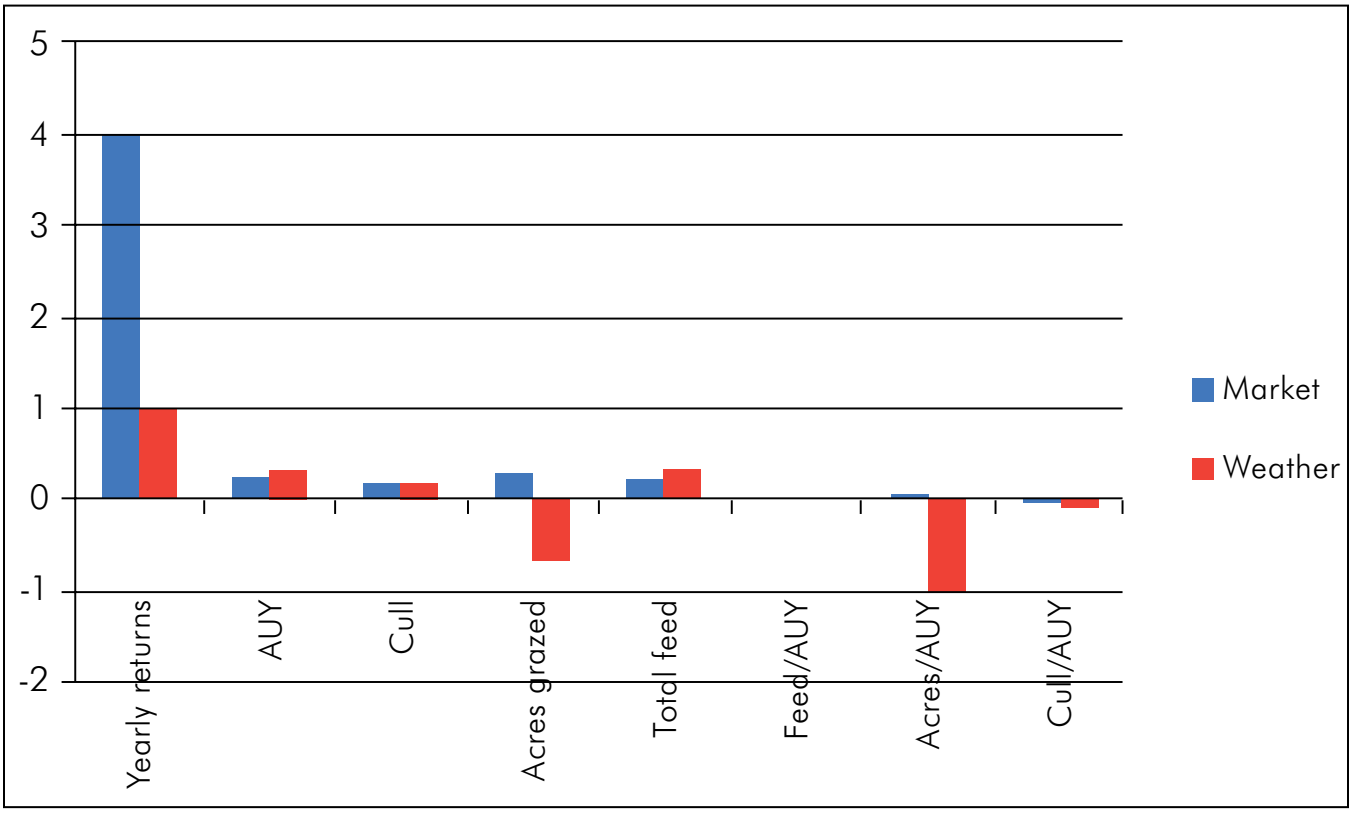


Figure 3. Depiction of Price and Forage Production changes on Management Decisions (Displayed as Elasticities)

Conclusion

Producers can make better herd decisions when aware of the current state and anticipated trends of both the market and weather. However, producers rarely are knowledgeable as to how either of these variables is going to evolve in the near future. While the above analysis indicates cattle prices have a significant impact on financial outcomes for a producer, management decisions related to such factors as amount of feed, stocking rates, and herd size should be more heavily influenced by forage production as impacted by precipitation than prices. With full knowledge of future changes in cattle prices and forage production, a producer would be able to determine his/her most profitable decisions. However, if neither of these two is known with certainty, this analysis suggests a producer is generally better off being more responsive to weather and forage production than market prices. These results should be viewed with caution as the risk-bearing ability of the firm and risk preference of the producer may matter a lot for many producers when making decisions. For example, guaranteeing a minimum cash flow may be more important to some producers than maximizing profits each year.

For more drought-related work, see the other fact sheets in this series:

- *Considerations for Preparing a Drought Management Plan for Livestock Producers*. Bulletin B-1220.
- *Two Common Drought Management Strategies and some Considerations for Wyoming Cattle Producers*. Bulletin B-1218.
- *Comparison of Alternative Cattle Management Strategies Under Long-Term Drought*. Bulletin B-1219.

For a more detailed description of the model used for this analysis and its results, see:

Ritten, J. P., C. T. Bastian, W. M. Frasier, M. A. Smith and S. I. Paisley. *Managing Your Ranch During Drought: Implications from Long and Short Run Analyses*. University of Wyoming Cooperative Extension Service. Bulletin B-1205. May 2010.

For information about how Wyoming producers responded to a recent drought, see:

Nagler, A., C. T. Bastian, J. P. Hewlett, S. Mooney, S. I. Paisley, M. A. Smith, M. Frasier, W. Umberger, and P. Ponnameneni. *Multiple Impacts – Multiple Strategies: How Wyoming Cattle Producers Are Surviving in Prolonged Drought*. University of Wyoming Cooperative Extension Service. Bulletin B-1178. April 2007.

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