# Impact of Seasonal Weather on U.S. Cow-Calf Inventories

*Buddhika Patalee (patalee@ksu.edu) and Glynn Tonsor (gtonsor@ksu.edu)*
*Kansas State University Department of Agricultural Economics – November 2019*

Cow-calf operations often use pasture for two-thirds of their forage requirement. Feed is the largest production cost for cattle (Lawrence et al., 2008) and accounts for 60-70% of the total production cost. According to the Kansas Farm Management Association (KFMA), between 2012 and 2016, average feed cost per cow was $365 (Johnson, 2018). Higher feed cost in the U.S. livestock sector is driven by weather changes (Larson, 2012; Kemper et al., 2012). Changes in weather can result in hotter summers and longer winters. Importantly, weather changes affect both the quantity and quality of pasture. Extended drought reduces the pasture availability forcing farmers to go for alternative feedstuff during summer, which is intended to use in winter. This fact sheet summarizes the impact of seasonal weather on U.S. cow-calf inventories.

To analyze the seasonal weather impact on cow-calf production, annual state-level beef cow inventory data for the period of 1951 to 2017 from the Livestock Marketing Information Center (LMIC) for 25 states[1] was used. Weather variables were constructed using PRISM daily climate data for minimum and maximum temperatures. Weather variables were seasonal[2].

[1] Alabama, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Tennessee, Texas, Virginia, Wyoming
[2] The first season is January through March, the second season is April through June, the third season is July through September, the fourth season is October through December

It is important to notice that all the weather variables considered were past weather variables. Beef cow inventory data used in this analysis are recorded as of January 1st in each year. Hence, lagged weather variables are more appropriate to capture the seasonal weather impacts on beef cow inventories. A regression analysis was used to identify how seasonal weather impacts state-level beef cow inventories.

Results from the regression (Table 1) suggest that increases in season one minimum temperature and season three maximum temperature significantly lower the cowherd size. Higher temperatures during the summer months have a negative impact on both pasture production and cattle performance. Temperatures that exceeded the average temperature during warmer months reduces beef cow inventory numbers. Results also suggest that past beef cow inventory information is an important determinant of the current beef cow inventories. Naturally, past inventories play a significant role in determining the current inventories because of the multi-year nature of cow-calf production. However, findings suggest a negative impact of two years lagged beef cow inventory on the current beef cow inventory. In addition to seasonal weather changes and past inventory numbers, technology changes also have a significant impact on beef cow inventories, which is captured by time trends (i.e. $T_1$ and $T_2$). T1 starts in 1984, and T2 starts in 1989. These time trends are partially controlling for structural changes and low prices that occurred in the mid and late 1980s.

Calf crop percentage and calf weaning weight notably impact the profitability of a cowherd. Temperature and humidity changes during breeding seasons affect breeding performance. Moreover, geographical

diversity, along with climate conditions, affect the feed cost of cow-calf production. Some producers can gain the advantage of grazing throughout the year, whereas some producers have to use alternative feedstuffs, especially during the winter season. Future research can be extended to separate analysis of breeding season weather impacts on cow-calf inventories and geographically separated cow-calf production.

In summary, results suggest that lagged seasonal minimum and maximum temperatures have significant effects on state-level beef cow inventories. Since, reduction in beef cow production can increase domestic beef prices, consumers can experience higher beef prices as a result of a negative supply response.

**Table 1: Effect of the seasonal weather on beef cow inventories**

| Variable | Coefficient | p-value |
|---|---|---|
| Intercept | 0.000 | <0.000 |
| Lagged 3 season 1 min temperature | -0.003 | 0.001 |
| Lagged 1 season 3 max temperature | -0.004 | 0.001 |
| Lagged 2 season 3 max temperature | -0.003 | 0.001 |
| Lagged 3 season 3 max temperature | -0.001 | 0.001 |
| Lagged 3 season 4 min temperature | 0.001 | 0.001 |
| Lagged 1 beef cow inventory(log) | 1.112 | 0.031 |
| Lagged 2 beef cow inventory(log) | -0.146 | 0.043 |
| Lagged 3 beef cow inventory (log) | -0.035 | 0.025 |
| Time trend 1 (starting from 1984) | 0.029 | 0.004 |
| Time trend 2 (starting from 1989) | -0.017 | 0.003 |
| Observations | 1600 | |
| R-square | 0.94 | |

**Figure 1: Dispersion of US beef cow inventories- 1951**

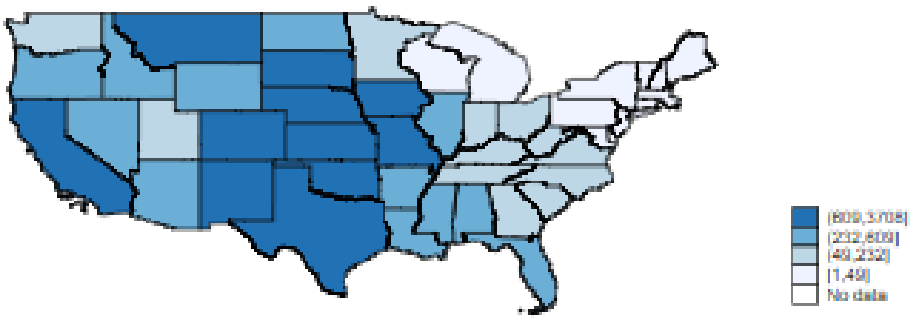
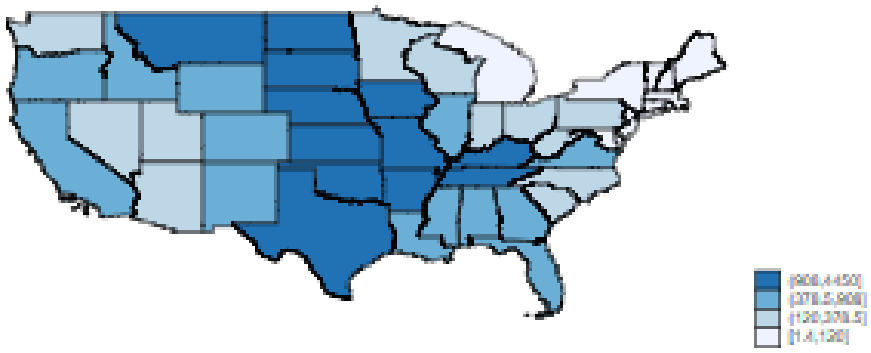



**Figure 2: Dispersion of US beef cow inventories - 2017**




**Note: Dark blue shows the states with the highest beef cow inventories and light blue is the lowest**

**Figure 1: Beef cow inventory changes over time in main cattle producing states (Source: Livestock Marketing Information Center)**

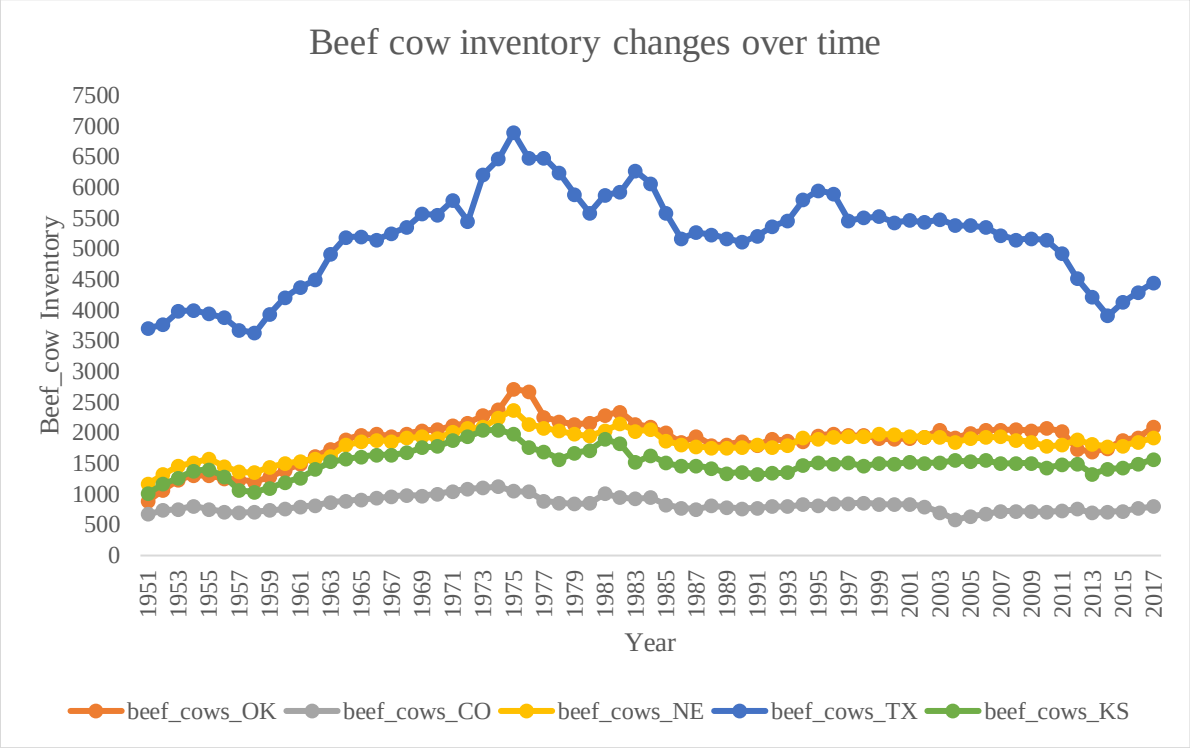
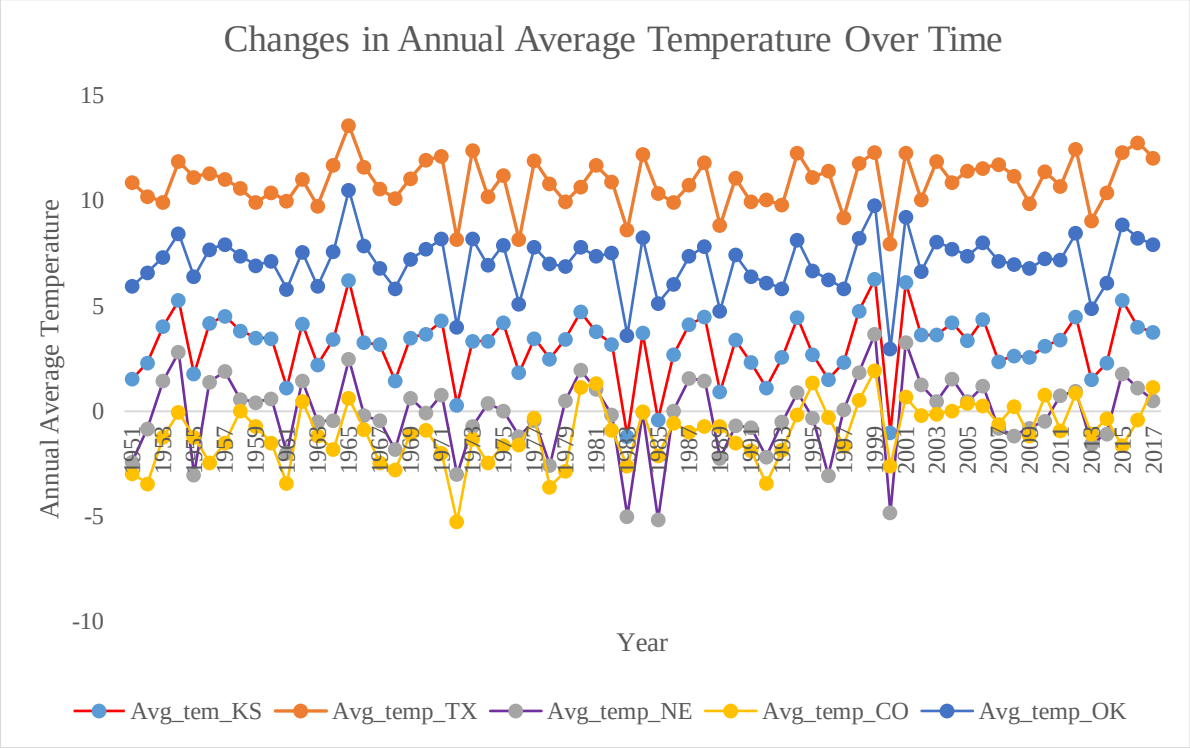


**Figure 2: Annual average temperature changes over time in main cattle producing states (Source: PRISM Climate Data)**



**References:**

Johnson, S. (2018). Cost, profit and production benchmarking. 2018 WRM Series. https://www.asi.kstate.edu/events/Johnson%20WRM%20CostProfit%20and%20Production%20Benchmarking%2002062018.pdf. Accessed 22 October 2019.

Kemper N, Flanders A, Watkins B, Popp M (2012) Impact of the 2012 drought on field crops and cattle production in Arkansas. Preliminary Report, Department of Agriculture, Research and Extension, University of Arkansas System. https://www.uaex.edu/environment-nature/disaster/drought-effects/Ark_Drought_Report_August2012.pdf. Accessed 12 August 2018

Larson DL (2012) Drought impacts on the cattle industry. College NEWS, ACES College of Agricultural, Consumer and Environmental Sciences. https://aces.illinois.edu/news/drought-impacts-cattle-industry. Accessed 22 November 2018

Lawrence, J.D., J. Mintert, J.D. Anderson, and D.P. Anderson (2008). Feed grain and Livestock: impacts on meat supplies and prices. Choices: 11-15

View more information about the authors of this publication and other K-State agricultural economics faculty.
For more information about this publication and others, visit AgManager.info.
K-State Agricultural Economics | 342 Waters Hall, Manhattan, KS 66506-4011 | (785) 532-1504 | Fax: (785) 532-6925