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# Drought Consequences for Cow-Calf Production in Wyoming: 2011–2014

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## On the Ground

- Drought reduces forage quantity and carrying capacity, but reductions in cow-calf performance measured by calf average daily gain (ADG) and weaning weight (WW) are less understood.
- From 2011 to 2014, a period with very dry and very wet years, we assessed an adjusted 210 day WW and ADG for a total of 869 calves on two University of Wyoming ranches.
- We found WW was up to 99 pounds (lb) lower, and ADG was up to 0.47 lb lower between the driest and wettest years.
- For each one inch reduction in precipitation, WW are predicted to be 7 lb to 14 lb lower, ADG is expected to be 0.03 lb to 0.07 lb lower, and dollar per head values $12 to $27 lower, depending on calf sex and ranch location.
- If drought occurs, or continues to escalate in frequency and severity, WW reductions, ADG reductions, and value per head reductions should be expected and documented for strategic planning and/or compensation programs.

**Keywords:** beef, climate, precipitation, weaning weights, weather.

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Drought is a constant challenge to livestock production on western rangelands. The early twenty-first century resembled the extreme droughts of the 1930s "dust bowl" and the 1950s drought in the southwestern United States[1] and caused many ranches to reduce herds or go out of business completely. Drought has been defined as a period when precipitation is consistently less than what is climatically expected. The magnitude or severity of drought can be characterized three ways, including (1) persistence, (2) intensity or deficit severity, and (3) the interval between events.[2] The most common way that drought impacts livestock production is the reduction of forage quantity and carrying capacity relative to animal demand; an effect that typically leads to herd reduction or complete liquidation. Although the problematic reduction of forage quantity leading to reduced animal numbers is well understood, what may be less understood is its negative effect on forage quality and subsequent livestock performance. Even when ranches are stocked to absorb the variation in precipitation and reduction in forage quantity, ranchers may not fully recognize and quantify the potential negative effects of the low-quality forage as it influences cow nutrient requirements and optimal calf growth.

## The Situation

The drought of 2011 and 2012 was noted as one of the worst droughts in North America in recorded history.[3] Droughts such as these often result in losses from the liquidation of cows from the herd due to reduced forage quantity.[4] However, severe drought also reduces the nutritive value of grasses, causing deleterious effects on forage quality through reduced crude protein and higher acid detergent fiber.[5] Thus, the reduced nutritive value of drought-stricken forage on rangelands is reflected in lower protein and energy and, consequently, lower cow and calf performance.

## Cattle and Rangeland Management Description

This study was conducted on two University of Wyoming Agricultural Experiment Station (AES) ranches in the northern mixed prairie of southeastern Wyoming, an area with a semi-arid climate. The Sustainable Agriculture Research and Extension Center (SAREC) ranch is located

northwest of Lingle, Wyoming, in Goshen County. The SAREC ranch comprises 1,880 acres of native rangeland dominated by sagebrush (*Artemisia* spp.); native cool-season grasses, such as western wheatgrass (*Pascopyrum smithii*) and needle-and-thread (*Hesperostipa comata*), with a minor component of warm-season grasses, such as blue grama (Bouteloua gracilis), buffalograss (Bouteloua dactyloides), little bluestem (*Schizachyrium scoparium*), sand bluestem (*Andropogon hallii*), and sand dropseed (*Sporobolus cryptandrus*); and improved forages, such as crested wheatgrass (*Agropyron cristatum*). Soils comprise sand, loam, and shallow loam. Average elevation at SAREC is 4,104 feet, with approximately 300 feet in elevation change due to steep bluffs. During the study period, mean ± standard error (SE) stocking rate for SAREC was 0.31 ± 0.06 animal unit months (AUMs) per acre, and stocking rate was reduced after the 2012 drought from 0.43 to 0.21 AUMs per acre. SAREC uses extensive (as opposed to intensive) rotational grazing, basing cattle movements across six pastures, depending on available forage and cattle are on the ranch for the entire year. SAREC uses natural service for two to three heat cycles at a bull/cow ratio of 1:20–25. On average, 44 calf weights per year were collected for our study from the SAREC ranch. The average birth weight (BW) was 85 lb, the average weaning weight (WW) was 534 lb, the average birth date was March 16, and the average weaning date was September 30. SAREC calves were sorted and weighed the day of weaning. Weights were collected at SAREC by using an LBS scale system that is part of the squeeze chute, so weights were collected as calves were processed.

The McGuire ranch is part of the Laramie AES Beef Unit located north of Laramie, Wyoming, in Albany County. The McGuire ranch comprises 5,550 acres of native rangeland dominated by sagebrush; native cool-season grasses, such as bluebunch wheatgrass (*Pseudoroegneria spicata*), streambank wheatgrass (*Elymus lanceolatus*), green needlegrass (*Nassella viridula*), western wheatgrass, and needle-and-thread; and a minor component of improved forages, such as crested wheatgrass and Russian wildrye (*Psathyrostachys juncea*). Soils are highly variable and include shallow loam, coarse upland, saline, and impervious clay. Average elevation at McGuire is 7,165 feet, with greater than 450 feet in elevation change due to rocky outcropping complexes. During the study period, mean ± SE stocking rate for McGuire was 0.14 ± 0.01 AUMs per acre, and stocking rate was reduced after the 2012 drought from 0.14 to 0.12 AUMs per acre. McGuire uses seasonal continuous grazing during the growing season, with all cattle having access to the entire ranch, with the exception of small holding paddocks near the shipping corrals. McGuire uses synchronized heat for artificial insemination (AI) for all cows, followed by 45-day exposure to cleanup bulls (i.e., three heat cycles) at a bull/cow ratio of 1:20. On average, 174 calf weights per year were collected for our study from McGuire. Cows calve at the Beef Unit at Laramie, Wyoming, and then are moved to McGuire in June for summer grazing. The average BW was 85 lb, the average WW was 555 lb, the average birth date was March 17, and the average weaning date was October 8. McGuire calves were sorted, loaded, and trucked to the Beef Unit headquarters to be weighed the same day or the day immediately after weaning. Weights were collected by using an independent aluminum platform with a Tru-Test XR3000 unit placed in the alley before the calves proceeded through the squeeze chute for additional processing.

The McGuire Ranch serves as the genetic foundation herd for SAREC, and cows at both ranches were Angus or Angus x Gelbvieh (*Bos taurus*). Average cow age for both ranches was estimated to be 7 years through the study period. McGuire used semen from nine bulls for AI during the study period, with average breed expected progeny differences (EPD) for WW (mean ± SE of 49 ± 3) and yearling weight (YW; 82 ± 5). SAREC used breed representative bulls for natural service. Given the control of sires, any variation in growth potential of calves is not attributed to variability of heritable growth traits from bulls.

## Objectives and Outcomes

Our objective for this study was to understand how WW and ADG could be predicted by annual variation in precipitation in Wyoming. We anticipate that this information will provide three applied outcomes: (1) provision of data for ranchers to forecast calf performance consequences caused by drought, (2) quantification and prediction of the potential economic consequences of escalating drought prevalence in the western Great Plains, and (3) documentation of these negative consequences in a peer-reviewed format to provide a reference for ranchers seeking compensation.

## How We Analyzed the Data

We used the calf WW and ADG from both ranches as the metric of cow production. Because of variability in birth dates and weaning dates, we adjusted WW to a 210-day value by calculating "total gain" (WW − BW), "days gaining weight" (weaning date − birth date), "ADG" (total gain ÷ days of gaining weight), and then multiplied ADG by 210 days to calculate the final 210-day adjusted WW. We then calculated the mean and standard error of the adjusted WW separately by calf sex (steer and heifer calves) for each ranch location and each year. Because our data are limited to two weights per calf (BW and WW), the adjusted WW assumes that ADG is linearly related to time, so we also calculated and analyzed the mean and standard error of ADG (i.e., pounds of gain per head per day) in a similar fashion.

We graphed the mean and standard error of the adjusted WW and ADG by calf sex relative to the cumulative precipitation from January 1 to October 1 to assess the relationships in cow production along the drought gradient. We then used linear least squares regression to fit a trendline to the graphed points. We calculated the coefficient of determination ($r^2$) to understand how well the fit trendline explained the variation and assessed a *P* value for significance. We assessed the slope of the linear equation for each scenario to predict how many pounds of adjusted WW and ADG may be lost per one-inch reduction in cumulative precipitation. We also used analysis of variance (ANOVA) at the 95% confidence level (CI)