Ranchers Diverse in Their Drought Management Strategies

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Introduction

Portions of the western U.S. are experiencing the worst drought in 80 years (Piechota et al. 2004). Figure 1 indicates that Wyoming has experienced multiple periods where precipitation was below normal for consecutive years, with the most recent period being between 2000 and 2005. Average annual precipitation has been trending downward since 1895 when official records were kept. Moreover, research suggests that drier summers could become more common as the global climate changes (Hengeveld 2000). The most recent period of drought has reduced range productivity, lowered irrigation water supplies and ultimately forced some ranchers to reduce herd sizes. Many producers culled their herds at a time when cattle prices were below the cyclic peak (between the years of 2000 to 2004), resulting in lower sales revenue. They also incurred higher feed costs to maintain the remaining herd. Together, these factors contribute to reduced profitability. Additionally, breeding livestock purchased now to restock drought liquidated herds would be done so at or near the peak of the most recent cattle price cycle. Current forecasts suggest that cattle prices are likely to start their cyclical decline within the next two years (Livestock Marketing Information Center 2006). Livestock purchased now or in the next several years would likely generate negative returns throughout their productive life, even if a ranch had the available feed resources, causing restocking to be less desirable at this time (O'Neill et al. 1998). The economic consequences of restocking at this point in time coupled with smaller herd sizes from drought liquidation puts ranchers in a weaker financial position to survive the downside of this most recent price cycle. The combined effect of these events has concerned many ranchers, and they are turning to professionals from land grant universities and elsewhere for help or they are selling off their ranches altogether.

Unfortunately, research literature regarding optimal drought management strategies during extended periods of drought is limited. Foran and Smith (1991) indicated that for droughts lasting two years or longer, maintaining a lower-than-average stocking rate was most profitable in the long-run. Hall et al. (2003) found that producers believed that below normal stocking of pastures, storing more hay, and adjusting stocking rates to current grazing capacities were the best drought management strategies available. Lardy and Poland (1997) indicate that providing additional feed supplements, herd liquidation, renting additional pasture and grazing crop residues are all effective strategies for stretching tight forage supplies during periods of drought.

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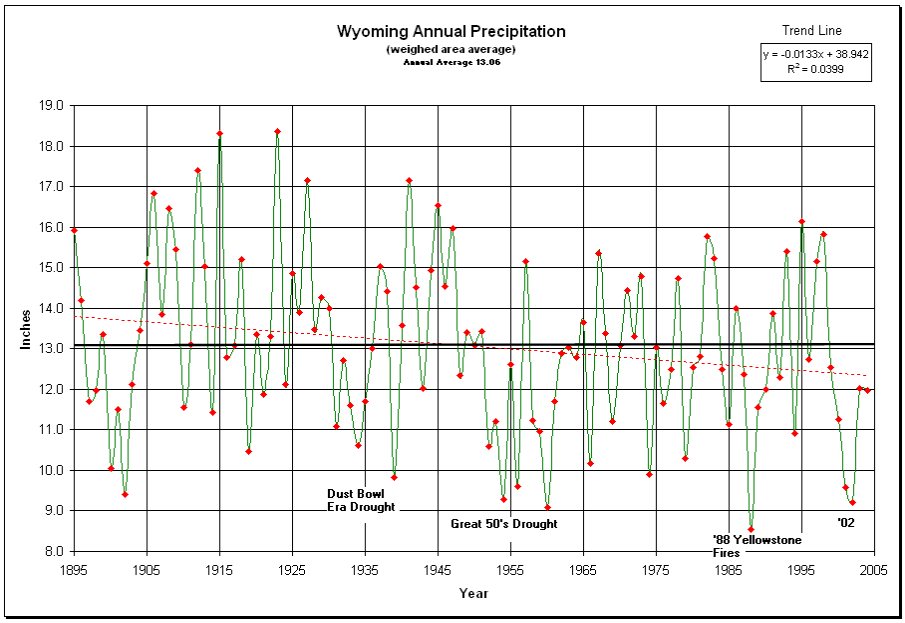
Figure 1. Wyoming annual precipitation from 1895 -2005 compared to average and trendline (http://www.wrds.uwyo.edu/wrds/wsc/climateatlas/drought.html).



Heitschmidt et al. (1999) studied the effects of grazing on range under drought conditions from 1993-1996. The authors concluded that grazing has a smaller impact on the range ecosystem than drought conditions. Hild et al. (2001) conclude that drought limited subsoil root production regardless of grazing treatments. Thurow and Taylor (1999) conclude that management and policy tools must improve the integration of economic and ecological aspects of drought-induced de-stocking decisions.

While the above literature suggests that grazing and stocking decisions are important during periods of drought, and that other strategies exist to extend existing forage resources, the economic consequences of those strategies are not well understood. Moreover, little is reported in the literature regarding how livestock producers respond to extended periods of drought, which could provide useful insights into strategies for coping with this phenomenon. The lack of available research that examines optimal management strategies during extended periods of drought coupled with ranch incomes currently being affected by this phenomenon prompted a multidisciplinary team from Wyoming and Colorado to conduct a pilot study on this issue. The objectives of this project were to gather detailed information from cattle producers regarding their management strategies, resource issues and recent responses to drought. Wyoming cattle producers were chosen for the initial survey under this project. Future research under this project will utilize their responses to construct a variety of economic models that can be used to examine the financial consequences of alternative drought management strategies. This paper presents a detailed picture of the concerns and responses of cattle producers to the recent drought they have experienced.

Data and Methods

A survey of Wyoming cattle producers was conducted during the spring of 2005 by the USDA National Agricultural Statistics Service on behalf of the University of Wyoming. A stratified, random sample of beef cattle producers was drawn from the population of beef cattle producers within Wyoming based on number of breeding-age cows as of the 2000 Agricultural Census.

There were three strata in the sample: small producers (20-299 cows), medium producers (300-999 cows), and large producers (≥ 1,000 cows). A modified Dillman mail survey design was used, including a cover letter and survey, then postcard reminder and a final mailing including final cover letter and survey (Dillman 1978). Moreover, non-respondents were re-sampled and telephone interviews were conducted using the full survey instrument to allow testing for non-response bias in future work. The survey instrument contained questions about the producer's resource base and production practices, marketing practices, drought impacts and management strategies, sagebrush management and demographics. A copy of the complete survey instrument is available at http://agecon.uwyo.edu/WYLivestock/default.htm.

Results

The overall survey response rate was 40% with 1,190 responses received from a sample of 3,000 producers. The total number of responses represented slightly over one-sixth of the total population of cattle producers in Wyoming. A number of respondents had liquidated their breeding-age cows to below 20 head at the time they received the survey. The original survey questions and the strata were designed for producers with 20 or more breeding-age cows, and thus, those respondents with less than 20 head were dropped from the analysis. Dropping respondents from the analysis that had less than 20 breeding-age cows at the time they received the survey reduced usable responses to 814 for a final useable response rate of 27%.

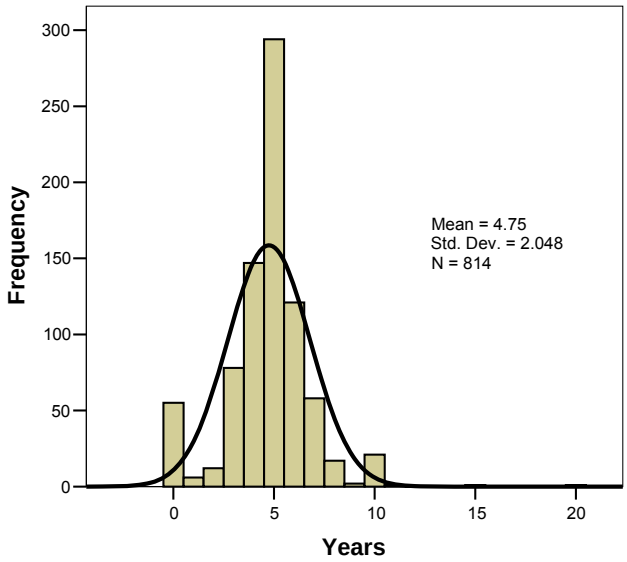
Respondents indicated the length of time that their operations had been negatively impacted by the most recent drought ranged from 0 to 10 years (Figure 2). The overall median and mode was 5 years with a mean of 4.75 years. The vast majority (69%) of responses ranged from 4 years to 6 years. The mean response for small operations was 4.7 years, while the mean response for medium and large operators was 4.9 years. Moreover, in response to a series of Likert scale questions (5- strongly agree; 1-strongly disagree) respondents were strongly in agreement (median score of 5) with the statement "a drought contingency plan is important for beef producers in Wyoming." These results suggest that Wyoming cattle producers needed to consider contingency plans that assume a drought period of nearly five years. If this is the case, future economic analyses of management strategies need to incorporate a longer term view of drought response.

Survey respondents characterized how drought affected grazing, irrigation water supplies, winter feed production, sale weights, weaning and owner equity between the years 2000 and 2004 as a percentage compared to a "normal" year. It should be noted that a standardized definition of drought was not provided to participants. Table 1 reports the mean responses for those producers that indicated their operations had been negatively impacted for at least one year by the most recent drought. Generally, the responses show that the severity of drought impact increased over time. The greatest change is attributed to reduced grazing capacity, irrigation water supplies, and consequently, reductions in winter feed production. Mean changes in grazing capacity ranged from a reduction of 16% in 2000 to 31% in 2004. Mean reduction in irrigation water increased from 12% to 22%, and the resulting winter feed reductions increased from 18% to 35% between the years 2000 and 2004.

Reduced feed availability coupled with other responses to drought also reduced sale weights and weaning percentages. Respondents estimated that, on average, sale weights were reduced between 4% and 7%, while the percentage of calves weaned dropped between 4% and 6%. Not surprisingly, respondents also reported negative impacts to owner equity, with reductions ranging between 4% and 7% over the same time period. These impacts may not be

as large as one might expect given the severity of some of the other impacts, however. This could be the result of policy programs and off-farm income. It is important to note that the standard deviations indicate wide variation in responses which is expected given the temporal and geographic dispersion associated with drought across Wyoming. Overall, these results suggest that future analyses and recommendations regarding drought management strategies need to account for the potential cumulative effects of drought over time.

Figure 2. Consecutive years operation negatively impacted by the most recent drought.



Wyoming cattle producers were asked to identify all of the potential drought management strategies they used each year during the years 2000 through 2004. Table 2 presents the frequency with which each reported a drought management strategy was used across years and operation size. The most frequently cited management strategies across all years and operation sizes were purchasing additional winter feed, partial herd liquidation and participating in some type of government feed assistance program. The next two most frequently used strategies were leasing or purchasing additional forage and early weaning of calves to reduce feed requirements. The least common response was total herd liquidation. No respondents within the large size class ($\geq$ 1000 cows) indicated they had used this strategy. Given the potential for specialization and long term genetic improvement programs for herds, it is not surprising that larger operations were less willing to consider total herd liquidation in response to drought. The responses received for this strategy could understate the frequency with which this strategy was adopted because producers that no longer had cattle when they received the survey may have declined to participate or were eliminated from the analysis. Medium and large size operations were more likely to lease or purchase additional grazing as the length of drought increased. These results support the conclusion that larger operators are less willing to use total herd liquidation as a strategy in dealing with drought.

Not surprisingly, a much higher percentage of respondents in the small and medium operation size categories indicated that they earned more off farm income as a strategy to cope with drought (Table 2). Large operations were much more likely to add alternative crop or livestock enterprises compared to respondents in the small and medium size categories. It is possible that larger producers face fewer resource constraints related to feed and financial resources which may also partially explain the differences observed between the small, medium and large

producers concerning their strategies related to the sale of retained yearlings. Smaller producers with less feed resources may be less likely to add yearlings as an enterprise, and they may be less able to adjust to changing cash flows and/or withstand large variations in income that may come from large fluctuations in the yearling enterprise. Table 2 shows that medium and large size operations are more likely to sell retained yearlings in response to drought than are small operators.

Table 1. Reduction in productivity attributed to drought as a proportion of normal expectations (for all respondents).

	Year				
	2000	**2001**	**2002**	**2003**	**2004**
Changes Experienced			n = 759[1]		
Grazing capacity reduction	16%[2]	20%	28%	28%	31%
	(22.9)[3]	(23.2)	(25.9)	(25.0)	(27.5)
Irrigation water reduction	12%	15%	21%	21%	22%
	(23.6)	(24.6)	(29.6)	(29.1)	(30.9)
Winter feed production reduction	18%	21%	30%	28%	35%
	(26.6)	(27.1)	(31.4)	(30.6)	(36.1)
Average sale weight reduction	4%	5%	7%	7%	6%
	(13.5)	(13.1)	(15.1)	(15.8)	(15.4)
Percent weaned reduction	4%	5%	6%	6%	6%
	(14.9)	(16.3)	(17.1)	(16.6)	(17.0)
Owner equity reduction	4%	5%	7%	7%	7%
	(13.0)	(14.1)	(16.9)	(16.7)	(17.5)
Other	<1%	<1%	1%	1%	1%
	(1.9)	(2.8)	(5.4)	(5.1)	(6.9)

[1] Sample size. Respondents who answered "0" to number of years impacted were deleted, reducing n by 55.
[2] Mean percentages (rounded to the nearest whole percent).
[3] Standard deviation in parentheses.

Figure 3 shows the mean number of strategies used in response to drought by survey respondents by year. As the length of the drought increased, respondents were more likely to use multiple strategies to mitigate its impacts. During the years 2000 and 2001 producers used one to two strategies on average while between the years 2002 and 2004 the mean number of strategies utilized increased to between 2 and 3 strategies in a given year. Overall the results reported in Table 2 and Figure 3 indicate that producers adopted increasingly diverse responses to the most recent drought. This was true both across years and operation size. This presents a significant challenge to agricultural researchers and educators. It is likely that they can better serve clientele if their analyses and recommendations consider a broad number of alternatives and combinations of strategies when addressing extended periods of drought for western livestock production systems.

One common recommendation from agricultural economists in this most recent drought has been to sell breeding livestock and take advantage of income averaging from a tax liability standpoint (Tronstad et al. 2002). Producers experiencing relatively high income in a given year because of breeding stock liquidation could use this as a strategy to reduce tax liability and ultimately maximize after tax income. However, to take advantage of this tax break producers are required to replace breeding livestock to normal levels within 24 months of the liquidation, unless the government decides to grant an exception.

Table 2. Proportion of producers using drought management strategies by operation size (n=759).

		Year				
Management Strategy	***Operation Size***	***2000***	***2001***	***2002***	***2003***	***2004***
Partial Herd Liquidation	*Small*	27%[1]	33%	48%	43%	43%
	Medium	30%	42%	57%	51%	49%
	Large	29%	36%	57%	50%	36%
Total Herd Liquidation	*Small*	1%	2%	2%	2%	2%
	Medium	2%	3%	3%	2%	5%
	Large	-	-	-	-	-
Selling Retained Yearlings	*Small*	5%	7%	9%	10%	10%
	Medium	6%	10%	18%	15%	19%
	Large	14%	14%	21%	21%	21%
Lease/Purchase Addl. Grazing	*Small*	15%	20%	27%	29%	32%
	Medium	19%	24%	32%	37%	36%
	Large	14%	21%	43%	36%	50%
Purchase Addl. Winter Feed	*Small*	34%	41%	56%	54%	57%
	Medium	39%	51%	66%	64%	64%
	Large	50%	64%	79%	71%	64%
Early Weaning to Reduce Feed	*Small*	11%	14%	26%	30%	33%
	Medium	11%	18%	35%	36%	36%
	Large	14%	14%	36%	29%	36%
Gov't. Feed Assistance Program	*Small*	14%	21%	49%	52%	39%
	Medium	20%	30%	63%	64%	52%
	Large	7%	21%	57%	93%	43%
Gov't. Income Assist. Program	*Small*	4%	6%	10%	11%	9%
	Medium	4%	7%	13%	13%	13%
	Large	-	-	7%	14%	7%
Earn Off-Farm Income	*Small*	41%	45%	47%	49%	49%
	Medium	22%	24%	28%	31%	32%
	Large	14%	14%	14%	14%	14%
Added Alt. Livestock Enterprise	*Small*	4%	4%	4%	6%	7%
	Medium	1%	1%	3%	4%	5%
	Large	-	7%	21%	21%	21%
Added Alt. Crop Enterprise	*Small*	1%	1%	2%	2%	3%
	Medium	1%	1%	2%	2%	5%
	Large	-	7%	14%	14%	7%
Other	*Small*	3%	3%	4%	4%	4%
	Medium	2%	3%	3%	5%	4%
	Large	-	7%	7%	7%	7%

[1] Frequency of binary response for category being checked (indicated as a 1), reported as percentage of respondents indicating negatively impacted by drought (n = 759; small 20-299 bred cows n = 569; medium 300-999 bred cows n = 176; large $\geq$1000 bred cows n = 14).

Given the importance of herd liquidation as a strategy and the related potential for reducing tax liability, producers were asked to answer several questions regarding whether they took advantage of this tax break and whether they had repopulated their herd to pre-drought levels. Tables 3 and 4 provide responses to those questions. Table 3 shows that 27% of all respondents who answered this question had used income averaging to reduce their tax liability. Medium size operators responded they had done this more frequently (38%) than large and small operators (20% and 24%, respectively). Interestingly, only 11% of respondents repopulated their herds to pre-drought levels (Table 4). Large operators were most likely to have repopulated their herds (33%) compared to small operations (9%) and medium (13%)

sized operations. These responses suggest that a number of producers may face an additional tax burden at a time when their income potential may be reduced by drought. This result points to a potential policy prescription regarding tax liability forgiveness from drought liquidation sales should extended periods of drought become more frequent in the future.

Figure 3. Mean number of drought management strategies used by respondents.

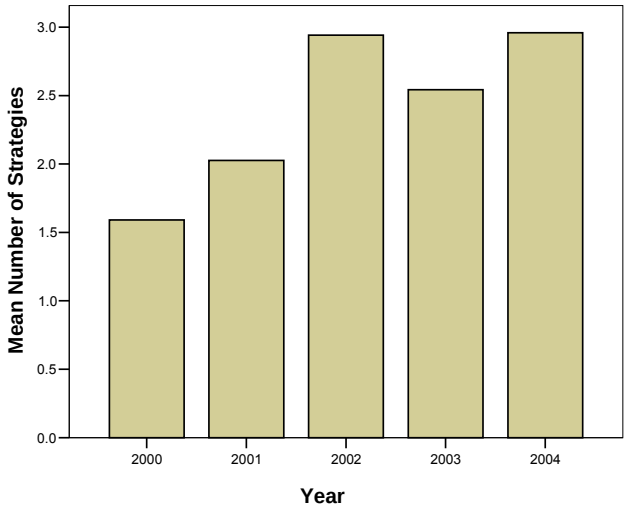


Table 3. Producers using income averaging to reduce tax liability if they liquidated some or all of herd with intention of replacement within 24 months.

All Ranches	By Operation Size		
	20-299 Bred Cows	300-999 Bred Cows	≥ 1000 Bred Cows
n = 598	n = 439	n = 144	n = 15
27%[1]	24%	38%	20%

[1] Percentage of respondents answering question and indicating "yes."

Table 4. Producers replacing liquidated animals with purchased breeding livestock to pre-drought levels.

All Ranches	By Operation Size		
	20-299 Bred Cows	300-999 Bred Cows	≥ 1000 Bred Cows
n = 571	n = 418	n = 144	n = 9
11%[1]	9%	13%	33%

[1] Percentage of respondents answering question and indicating "yes."

At a time of cyclically high prices a number of producers may already have reduced herd sizes compared to pre-drought levels. As Wyoming cattle producers face the downside of the price cycle, a larger number of them may confront increased financial pressures and be less able to liquidate as a strategy to address declining incomes and reduce costs in response to lower prices. This suggests that the point at which drought occurs within the price cycle may matter and producers could face path dependencies related to drought management strategies. These too are issues to consider for future drought analyses and drought management recommendations to livestock producers.

Conclusions

As ranchers turn to professionals for management recommendations in response to drought, they find a paucity of research regarding optimal drought management strategies during

extended periods of drought. As part of a multidisciplinary research project, researchers from Wyoming and Colorado conducted an extensive survey of Wyoming cattle producers to investigate the relevant issues and strategies to be considered in economic analyses. Our results indicate that Wyoming producers were diverse in their responses to this most recent drought. This was true both across years and by operation size. Overall, our results suggest that researchers and educators must consider a number of alternatives and combinations of strategies if they are to be relevant to clientele. This suggests a systems approach is most likely needed. Moreover, our survey results suggest there could be great value in developing research techniques that can account for the potential cumulative effects of drought, potential path dependencies and the importance of cycle dynamics in analyses of drought

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