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ADAPTATIONS TO DROUGHT: EVIDENCE FROM AG PRODUCER SURVEY¹

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Colorado's ongoing drought is in its significant geographic reach and economic impacts. For Ncondition, reduces cow condition and leads to difficulty in locating critical feed inputs. These production losses generally reduce revenues although declining receipts may be partially offset by higher prices.

Yet, the drought's impacts to the farm or ranch business are not contained within a single season. Much like reservoir levels that are drawn down and may take years to replenish, the impact of a drought can reduce a farm or ranch's equity position making it difficult to service debt or take advantage of future investment opportunities. Equity erosion may take years to rebuild.

In this article, recent drought survey responses are described in order to characterize the potential longer term impacts of drought. Emphasis is placed on production losses and producers' mitigating actions. While it is difficult to forecast the length of the recovery period for Colorado farmers and ranchers, their adaptations and changing production activities in 2012 do indicate the severity and persistence of financial stress.

An Economic Drought Morphology for Colorado

The economic severity of a drought depends importantly on several factors such as:

- The initial soil moisture, snowpack and reservoir storage conditions. Generally speaking, if a drought follows a wet or normal year, the economic impacts to the entire state's agricultural economy are less severe than if the beginning conditions are characterized by water shortage.
- The timing of the drought's onset. If a drought begins in late fall and extends into the winter, farmers may choose to adjust planting decisions and ranchers may evaluate forage alternatives and replacement decisions. However, if drought becomes severe later in the calendar year, agriculture producers lose flexibility in mitigation strategies. For spring grain crop producers, many inputs such as fertilizer, seed and chemical are purchased early in the season. These costs are sunk should a drought occur sometime after planting, and below average revenues are often insufficient to recover these costs. Likewise, a ranch's forage alternatives are reduced as the grazing season progresses, so a late drought may

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induce the purchase of more expensive hay stocks from greater distances.

- A widespread drought is costly for purchasers of feedstuffs and farm products, but sellers of farm commodities may actually receive some offsetting benefits. Simply put, the greater the geographic reach of the drought, the more that national markets are influenced, and the subsequent reduced supply of farm commodities drives higher prices. Higher prices can partially offset production losses for the seller of farm commodities. Yet, the price increases represent cost shocks to purchasers of farm commodities (such as feedlots and millers) who have fewer alternatives for ag products and may have to ship inputs greater distances.
- The duration and severity of the drought also influences the resiliency of farm and ranch businesses. When droughts that extend over multiple seasons, economic impacts are likely to be more severe not only because of aggregate impacts, but also because of an inability to service debt or obtain access to credit.

Localized drought is a consistent climate feature in Colorado, but the last few years are notable. Drought began in southeastern Colorado in Fall 2010 and resulted in more than \$100 million of lost revenues and related shortfalls to allied industries (Goemans et al, 2012). As indicated by Figure 1, the drought was particularly intense in the southern part of the state in Fall 2010 through Winter 2011, and then the drought extended to the entire state during the Summer of 2012. State-wide water storage and snowpack were better than average during the winter of 2011/2012 meaning that irrigated crop producers suffered less severe disruption of operations compared to dryland producers and ranch owners who had **no** such stores of available moisture.

The drought's national reach was (and to a lesser extent still is) extensive -- more than 2/3 of cropping acres in the United States were affected by drought in Summer 2012. The resulting high prices partially offset revenue losses for producers of certain commodities, but also dramatically increased the costs of purchasing feed and forage supplies. The national drought was largely unexpected (Hoerling et al, 2013) leaving few mitigation opportunities for producers. An

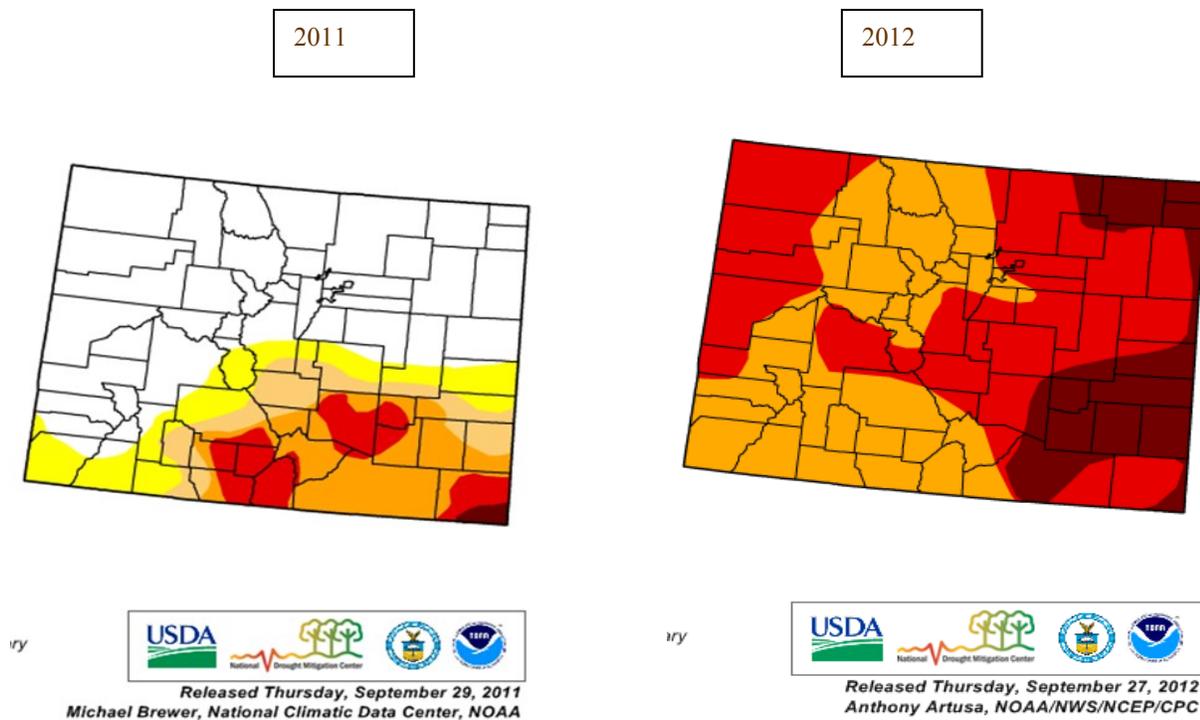


Figure 1. National Climate Data Center Depiction of the 2011 and 2012 Drought Severity in Colorado. Available at: <http://www.droughtmonitor.unl.edu/monitor.html>

exception is the southern Great Plains that had experienced drought in the immediate previous years, but adaption in this region largely pre-dated 2012.

Colorado Farm and Ranch Responses to Drought

For individual operations, how significant are the short and long term impacts of the 2012 drought? Some evidence can be taken from a statewide, online survey of producers completed in March 2013. Responding agriculture producers completed a questionnaire that examines production losses, drought mitigation strategies, future plans and demographic/financial information. In sum, 550 Colorado producers completed a portion, if not all, of the survey with 75% reporting their operations were impacted by drought. The following describes some of those responses with particular emphasis on production losses and mitigation actions.

Production Impacts

As indicated in Figure 2, production losses were pervasive among survey respondents whether enterprises included irrigated or dryland cropping. Interesting was the relatively small portion of dryland wheat abandoned acres (6%), largely because fewer acres were planted in Fall 2011 due to little soil moisture in south-eastern Colorado.

Production losses were partially offset by higher prices, crop insurance and stored irrigation water, so that some producers received near normal or above average revenues (Figure 3). Irrigated cropping fared better than dryland cropping, and the most severe revenue decreases appear to be from the east-central part of Colorado.

Irrigated Crop Yields and Harvested Acres

	<i>Corn Grain</i>	<i>Corn Silage</i>	<i>Wheat</i>	<i>Dry Beans</i>
<i>Actual vs. Expected Yield</i>	-28%	-34%	-29%	-21%
<i>Harvested vs Planted Ac. For Respondents</i>	-19%	-17%	-6%	0%

Dryland Crop Yields and Harvested Acres

	<i>Wheat</i>	<i>Milo</i>	<i>Millet</i>	<i>Sunflower</i>	<i>Corn</i>
<i>Actual vs. Expected Yield</i>	-30%	-69%	-75%	-55%	-87%
<i>Harvested vs Planted Ac. For Respondents</i>	-6%	-63%	-45%	-44%	-68%

Figure 2. Survey Respondents Reported Production Losses for Selected Irrigated and Dryland Crops

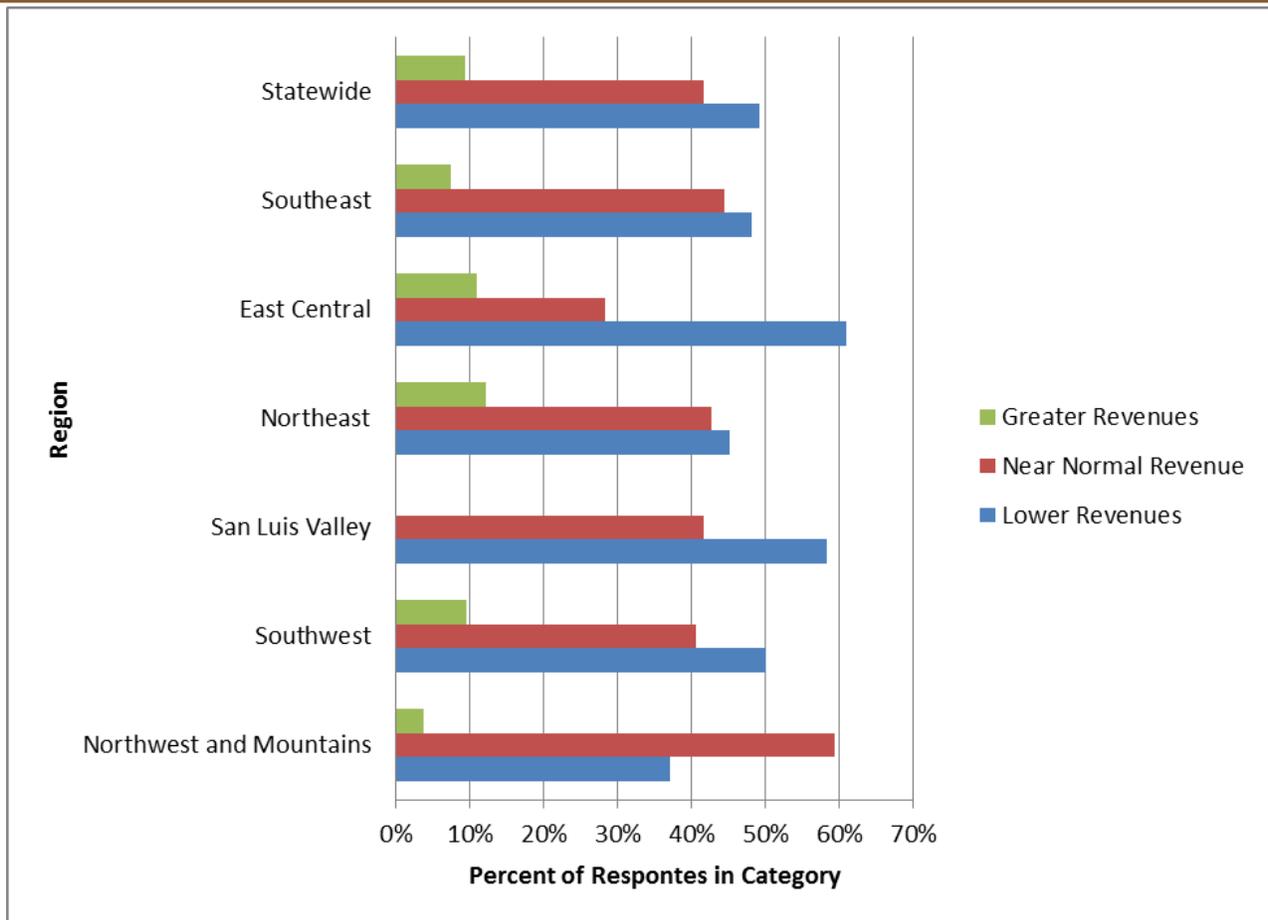


Figure 3. Respondents' Revenues Compared to a Normal Year by Colorado Region

Cow-calf producers also suffered losses (Figure 4), especially due to increased costs of feeding. Respondents indicate increased culling rates and a decreased herd size as they respond to drought.

Mitigation Strategies for Drought

More aggressive culling is an example of a disruptive drought mitigation strategy. The selling of assets, such as breeding livestock, can be very disruptive to the agricultural operation because it reduces revenue generated in subsequent years, and asset replacement significant capital investment in the future. For these reasons, asset sales can signal significant financial stress for the farm or ranch operation.

More generally, a hierarchy of mitigation strategies exists ranging from the least to most disruptive for the operation:

- **Managing Cash Flow:** Agriculture producers will seek to increase household income by generating

more revenue from the existing asset base and reducing expenses. From a business perspective, farm and ranch managers critically evaluate whether a production input will “pay its way” by matching revenues and expenses. The exceptions are longer term assets whose revenues may extend beyond the current accounting cycle. Examples of managing cash flow include performing soil tests so that nutrient application is more precisely matched to crop needs, custom farming for others and reduced household expenses.

- **Managing Debt:** A drought can reduce cash flow to the operation, and for the leveraged producer, reduced cash flows may result in inability to service debt. If debt service is a problem, debt management strategies include refinancing existing loans for longer terms, paying only interest on term notes, pledging more collateral as security, cross-collateralization and amortizing an operating note from a single year to multiple year payback. These strategies are less desirable than adjusting

Production Metric	Change from Typical Conditions
Number of Cows	- 48%
Culling Rate	21%
Cow Condition at Present	- 18%
Weaning Percentage	- 1%
Average Weaning Weight	- 16%
Average Cost Per Cow	+ 40%

Figure 4. Respondents' Production Metrics for Cow-Calf Production

managing cash flow because they influence the farm/ranch's ability to service and acquire future investment capital. In addition, the strategies may improve cash flow in the short term, but increase the overall cost of financing assets in the long term via increased total interest expense.

- **Managing Assets:** Assets are converted to cash for the operation by sale or may be used more intensively to increase revenues. Initially, farm and ranch managers sell short term assets (e.g., grain inventories) or place calves in a feedlot early in order reduce expenses and increase revenues to the operation. These actions may be poorly timed, but

are less disruptive than leasing assets or more intensive use of assets (e.g., custom farming with own equipment) that hastens the depreciation of assets. The most disruptive asset strategy is to sell noncurrent assets such as breeding livestock and land.

Survey results indicate that Colorado producers are using a mix of these mitigation strategies in response to drought, but are generally focused on managing cash flow and managing debt. As indicated in Figure 5, respondents sought to reduce family expenses first (59% of respondents) while relatively few took advantage of federal drought assistance (18% of

	<i>In response to drought our operation ...</i>	<i>If the drought continues our operation will ...</i>
Custom Farm(ed)	12%	14%
Sought/ Seek Off-Farm Employment	25%	26%
Reduce(d) Family Expense	59%	40%
Sought/ Seek Federal Assistance	18%	25%

Figure 5. Respondents' Approaches and Participation Rates for Managing Cash Flow

respondents), even though more than 4 out of 5 were aware that assistance was available. Perhaps the participation can be explained by a lack of eligibility, a shortfall of federal funds, or an unwillingness to complete the sign up process. Respondents were also asked to indicate if they would adopt a practice if the drought continues. A smaller proportion selected reducing family living expenses (41%) as strategy, likely because it is difficult to cut expenses that have already been reduced. An increasing percentage will adopt custom farming, seek off farm employment and obtain federal assistance.

Respondents are managing debt to mitigate drought impacts. The most popular debt management is rolling an operating note into the next year (17%) followed by paying the interest only for a scheduled debt payment (15%) or putting up more collateral (9%). If the drought persists, more operations will seek all debt management strategies.

It is clear that survey respondents are depopulating their cow herd with more aggressive culling in order to cope with drought. Among survey respondents, 41 % indicate they have sold breeding livestock and 29% indicate they will do so if the drought continues.

	<i>In response to drought our operation ...</i>	<i>If the drought continues our operation will ...</i>
<i>Paid / Will Pay Interest only</i>	15%	16%
<i>Put Up More Collateral</i>	9%	11%
<i>Roll Operating Note Into Next Year</i>	17%	18%

Figure 6. Respondents' Approaches and Participation Rates for Managing Debt

	<i>In response to drought our operation ...</i>	<i>If the drought continues our operation will ...</i>
<i>Sold / Will Sell Breeding Live-stock</i>	41%	29%
<i>Sold / Will Sell Equipment</i>	13%	19%
<i>Sold / Will Sell Land</i>	2%	9%

Figure 7. Respondents' Approaches and Participation Rates for Managing Assets

Relatively few have sold land in response to drought (2%) but more will consider doing so if the drought continues (9%).

Based on survey responses, farm and ranch operations are experiencing financial stress due to the drought, but the hierarchy of strategies represented in Figures 5 through 7 suggests that the most intense stress is borne by those who are culling breeding livestock. If the drought persists, financial stress will likely increase, but respondents do not anticipate drastic changes to current efforts.

One caveat applies to the previous statement. Survey respondents are predicting slight changes if drought continues, but these same respondents are adding debt to the operation. As illustrated in the “Before Drought” and “After Drought” debt to asset percentages in Figure 8, the proportion of operations with very little debt has decreased substantially, and those in the highest debt category – 50% or more of assets financed with debt – has increased significantly. If the drought continues through 2013, more drastic management practices may be adopted than those suggested by survey respondents.



Figure 8. Respondents’ Percentage of Assets Financed by Debt Before and After the Drought