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FARMER RESILIENCY UNDER DROUGHT CONDITIONS

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Coloradoans continue to experience severe drought conditions resulting in significant economic losses. The ongoing drought has led to widespread crop failures, damaged rangelands and reduced livestock productivity. The drought's financial impacts will be felt by agricultural producers for years to come and may threaten the long-term economic viability of some agricultural operations. Nearly all operations are less resilient to future shocks when compared to conditions before the drought. The purpose of this document is to shed light on some aspects of Colorado agricultural operations' lost resiliency.

Agriculture is an important base industry for many rural communities in Colorado. Drought impacts are far reaching, in part because of agriculture's forward and backward linkages with other industries in the supply chain. If Colorado ranchers and farmers face an increased probability of extreme and recurring droughts, it is then important to determine the effect that drought has on the resiliency of farmers and ranchers, and the likelihood that continued assistance will be needed.

Resiliency is the ability of the agricultural operation to return to a similar state of production after enduring a stressor such as a drought. The similar "state" includes biological and physical production characteristics, as well as a level of financial assets and performance. Un-

derstanding resiliency of agricultural producers is useful because it includes:

- Understanding how adaptable agricultural producers are to extreme and changing climatic conditions.
- Indicating how long farmers and ranchers can endure an environmental stressor such as drought until they are ultimately forced to exit the agricultural sector.
- Designing assistance to help agricultural producers adapt to the challenges presented by natural hazards such as drought.
- Quantifying broader impacts to a rural economy. Farmers and ranchers are key components of rural communities, their resiliency is directly correlated with the resiliency of rural communities.
- Assessing impacts to local feed, food and fiber systems. Small and mid-sized farms and ranches have been found to be less resilient than large farms to drought, which many believe decreases the adaptability of the domestic food sector and may lead to food security concerns in the future.

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By investigating resiliency, this document provides insights into the efficacy of current drought relief policies and identifies ways to decrease economic impacts felt by agricultural producers and regional economies.

Other scientists sought to explain farm/ranch resiliency in the face of many stressors, but none have looked at Colorado in particular. These studies found that off-farm income, the size of the operation, experience, and age. Characteristics related to drought induced exits include decreased crop yields, number of acres fallowed, the duration of drought, access to irrigation, and decreased profit.

Most recently, a theoretical model was developed that suggested proxies for a farmers' /ranchers' overall wealth, such as groundwater supplies, since these supplies can be thought of as a saving account during drought. These types of hedges against drought may be an important determinant of resiliency.

Our study explores the determinants of resiliency, but mainly focuses on the roles that wealth and the duration of drought have on farmer and rancher resiliency.

Information is elicited from a statewide, online survey of producers completed in March 2013. Responding agricultural producers completed a questionnaire that considers 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.

As a measure of wealth, we inquired about the respondent's debt-to-asset ratio before and after the 2012 drought. Debt-to-asset ratio is defined as a producer's total liabilities divided by their total assets. And as a measure of resiliency, we asked respondents what the probability was of them leaving farming/ranching if the drought continued for another year.

AGRICULTURAL STATISTICS DISTRICTS

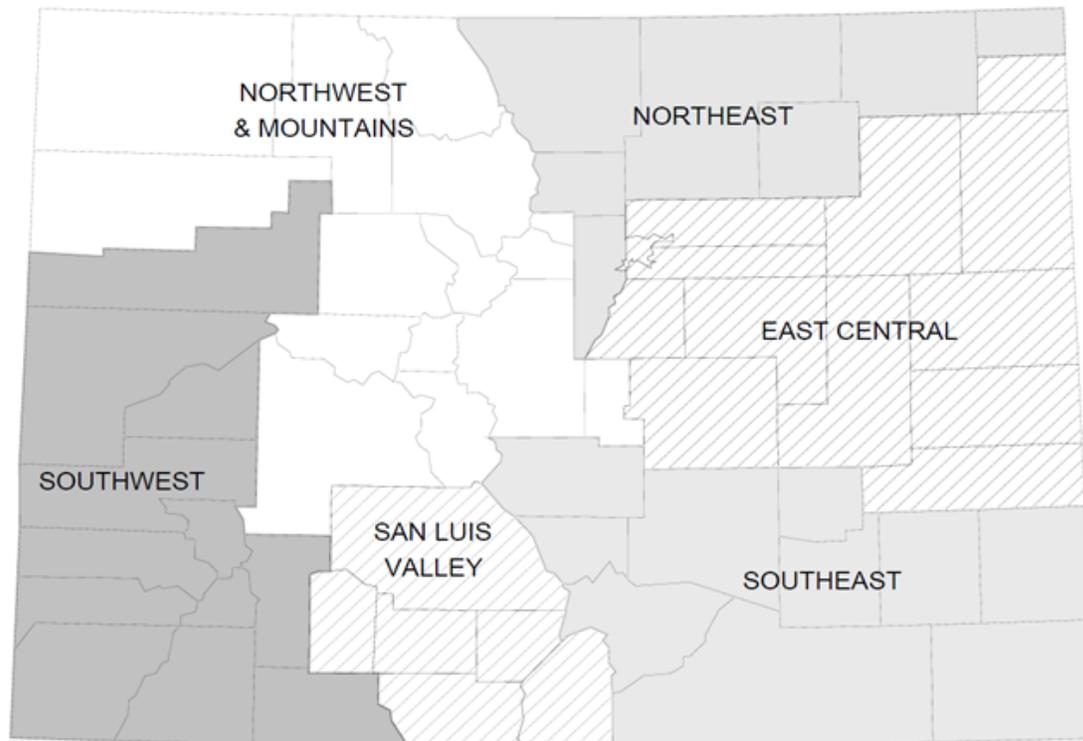


Figure 1: NASS — Colorado Agricultural Statistics Districts

Source: NASS, 2012

Respondents included all major producer types, and the sample was thought to be representative of the larger agricultural enterprises in Colorado. The data gleaned from the survey is the foundation of statistical analysis found below.

Regression methods estimate the determinants of resiliency (see Table 1 for complete results). Several key findings emerge from the analysis. First, location is an important determinant of resiliency. Specifically, we found that the Southeast region of Colorado was more resilient than other regions of Colorado (see Figure 1). This finding is interesting in part because the Southeast region is in its second year of drought while most other regions of Colorado are in their first. The increased resiliency that the Southeast of Colorado possesses during drought may be due to the fact that the Southeast has a long history of drought and therefore operations adapt over time.

This may indicate that the duration of the drought may not be as important as where the drought is occurring and if that area has been repeatedly exposed to similar droughts. A policy implication of this finding is that

drought assistance in form of educational outreach and financial resources may be better utilized by regions less familiar with adapting and planning for drought.

Additionally, our analysis indicates that debt-to-asset ratio is a key determinant of the resiliency of a farmer or rancher. As a proxy for the wealth of the farmer or rancher, this variable reflects, in aggregate, how the farm or ranch has been financially managed over a long period of time. Debt-to-asset ratio's importance reveals that a one year drought may not be a significant factor in motivating an agricultural producer to exit the sector since it likely will not decrease drastically in a single year. Furthermore, profit from the year 2012 was not found to influence resiliency which furthers the claim that a one year drought may not be impacting resiliency. However, multi-year droughts will surely increase the debt-to-asset ratio of most agricultural producers, decreasing resiliency, and possibly increasing agricultural sector exits.

Table 1: Regression Results

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Dependent Variable	Definition		
Resiliency	the respondent's stated probability of leaving farming in the next five years if drought continues in 2013		
Independent Variables	Definition	Marginal Effect	P-Value
ln(acres)	the natural log of the number of acres in an operation	-0.0009	0.955
Debt-to-asset ratio	the debt-to-asset ratio after the 2012 drought	0.0054**	0.036
Profit	profit in 2012	-0.0008	0.723
(Debt-to-asset ratio)* (Profit)	interaction variable	-0.0001	0.44
Southeast	the Southeast district of Colorado as defined by NASS	-0.1709***	0.007
Irrigation	the type of enterprise divided into those with water and those without	0.0525	0.436
Off Farm Income	the percentage of income that comes from off of the farm	-0.0008	0.426
Experience	the number of years the respondent has farmed and/or ranched	0.0011	0.594

**Significant at 5% or under

***Significant at 1% or under

This finding has implication for policy makers, agricultural producers, and industry. First, producers and insurers need to be educated on how increasing debt can lower the resiliency of agricultural producers, and how preparing financially for drought may increase the vitality of a producers enterprise. Second, the form of assistance currently offered, low interest emergency loans, may be decreasing farmer and rancher resiliency by increasing their debt-to-asset ratio. However, low interest emergency loans may be minimizing the negative impact felt by agricultural producers and their communities, and could be the best policy option available for the circumstances. To further determine whether or not low interest emergency loans are the best option for drought assistance, additional research could compare the exit rates of those farmers that choose to take low interest emergency loans versus those that do not.