

**PUBLIC AND PRIVATE RESPONSES TO THE DECEMBER 28-31, 2006,
HIGH PLAINS BLIZZARD**

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1. IMPACTS OF BLIZZARDS

On average, the United States annually experiences about 11 blizzards, defined by the National Weather Service (1999) as storms having falling or blowing snow with winds in excess of 35 miles (53 km) per hour and visibility of less than 0.25 mile (0.4 km) for a minimum of three hours. The average blizzard causes property and crop damages of around \$52 million and approximately \$3 million, respectively. Mitchell and Thomas (2001) reported that the average damage caused by blizzards from 1975 to 1998 was \$830 million per year. Blizzards affect an average of 26 million people per winter season, with the major impacts occurring in the populated areas of the U.S. Midwest and Northeast (Schwartz, 2004). Like other weather-related disasters, severe winter storms, including blizzards, cause disruptions to transportation; damage to crops and buildings; closures of schools, businesses, and roads/trails; and breakdown of public utilities such as communication, electricity, and heat (Helburn, 1982; Mitchell and Thomas, 2001; Schwartz, 2004). Blizzards can lead to many other problems such as childbirth complications and heart attacks. In fact, heart attacks suffered while shoveling snow are the number one cause of death during a blizzard. Blizzards make it extremely difficult to obtain necessary medical supplies as well as food and other sources of sustenance (Chapman, 1999; Perry *et al.*, 1996). Blizzards can kill people, cause traffic accidents, and bring life to a halt.

Blizzards can also have severe short and long-term effects on cattle. In a blizzard, cattle try to face away from the wind and move with the storm (Cotton and Ackerman, 2007). They also herd together, creating a windbreak. However, cattle can literally drown by inhaling snow blown by driving winds. Snowstorms also create a number of veterinary problems such as hypothermia, frostbite, and trauma (CEAH, 2002), which may actually eclipse the loss from cattle deaths. Cattle stranded without feed and water for days in bitterly cold open fields can suffer from malnutrition and weight loss. Because of the moisture and cold, the energy and nutrition derived from feed goes to animals' maintaining, rather than gaining, weight. For instance, the estimated loss for a rancher with 4,000 cattle that are "off" by 150 pounds each totals \$550,000 (at \$0.92/lb). Cows that are in advanced stages of their pregnancy during a blizzard often experience spontaneous abortions and still births. Moreover, snowstorms can increase ranchers' costs for additional feed and supplemental nutrition. The wet, cold conditions in the muddy corrals can also lead to frozen feet/foot rot and pneumonia, requiring additional veterinary expenses. Clearing snow necessitates additional fuel and wage payments. Generally, the indirect economic impact of blizzards on cattle is greater than the direct economic impact (CEAH, 2002).

Despite their impacts, compared to all weather-related disasters blizzards have received little attention from hazard researchers. Most available research reports (*e.g.*, Schwartz and Schmidlin, 2002) are concerned either with physical aspects of blizzards or societal impacts of these extreme events (*e.g.*, Schwartz, 2004; Schwartz and Schmidlin, 2002). The objectives of this study were to assess the public and private responses to the December 28-31, 2006, High Plains blizzard.

2. STUDY AREA

Parts of five states (Colorado, Kansas, Nebraska, New Mexico, and Oklahoma) of the U.S. Great Plains region experienced severe winter storms on December 28-31, 2006. These storms brought heavy snow and freezing rain, which led to the loss of electrical power to more than 80,000 homes and businesses, were blamed for at least 13 deaths. Forty-four inches of snow fell in some parts of southeastern Colorado, while as much as 32 inches fell in western Kansas. Strong north winds produced drifts as tall as two-story buildings. In addition, two to three inches of ice accumulated in some parts of southwest Kansas and eastern Colorado, causing significant damage to trees, utility poles, and power lines. In western Kansas, as many as 10,500 utility poles were reported down, and muddy road conditions slowed down replacement activities (FEMA, 2007).

Thousands of cattle were also victims of the storms in the High Plains, as they were trapped for several days by snowdrifts up to 20 feet in some areas. The storm covered more than half of the nation's major cattle-feeding area in the Great Plains. According to the Colorado Division of Emergency Management, approximately 350,000 cattle in the region were at immediate risk due to the storms. In order to save livestock herds, small helicopters and large cargo planes were dispatched to spot cattle and drop hay bales for those that had gone without feed for days. In Kansas, the National Guard dropped hay in Cheyenne and Greeley counties. About 42,000 pounds were dropped in the latter county. Unfortunately, some hay had high nitrate levels which affected animals already under physiological stress (*i.e.*, sick, hungry, and pregnant), thus making them more susceptible to nitrate toxicity. In Colorado's Baca and Bent counties, similar flight missions occurred (Sorensen, 2007). Despite these efforts, about 10,000 cattle died in Colorado alone because of the blizzard (Emery, 2007). President Bush declared 114 blizzard-affected counties in Colorado (13), Kansas (44), and Nebraska (57) as disaster areas, which made federal support available to help the respective states recover (Figure 1). Federal funds were thus available to state and local governments, and some nonprofit organizations, in affected counties for debris removal, road clearance, and other emergency services.

3. RESEARCH OBJECTIVES AND METHOD

The specific objectives of this research were to examine the experiences of people affected by the blizzard of December 28-31, 2006, and to explore the nature and extent of public and private emergency response and relief efforts undertaken to save and rescue cattle in selected rural counties of Colorado and Kansas. Other relevant information, such as blizzard-induced property damage, cattle losses, and residents' sheltering arrangements during the blizzard were also explored, along with residents' level of satisfaction with response efforts extended to them and their cattle.

Although 114 counties across Colorado, Kansas, and Nebraska were declared Federal disaster areas, cattle in Colorado and Kansas were at highest risk from this blizzard. For this reason, those two states were selected as the study area for this research. Considering limited resources and time constraints, only seven of the 57 affected counties of Colorado and Kansas were purposely chosen. Four counties were selected from Kansas. Two of these counties (Sherman and Thomas) are located along Interstate 70 (I-70), while the other two (Greeley and Hamilton) are away from I-70. Three counties were chosen from Colorado – two (Kit Carson and Lincoln) are located along I-70 and one (Kiowa) is distant from the highway (Figure 1).

Such a selection has been made with the assumption that the emergency response and relief efforts would differ between isolated (away from I-70) and non-isolated (along I-70) counties because of differences in physical accessibility.

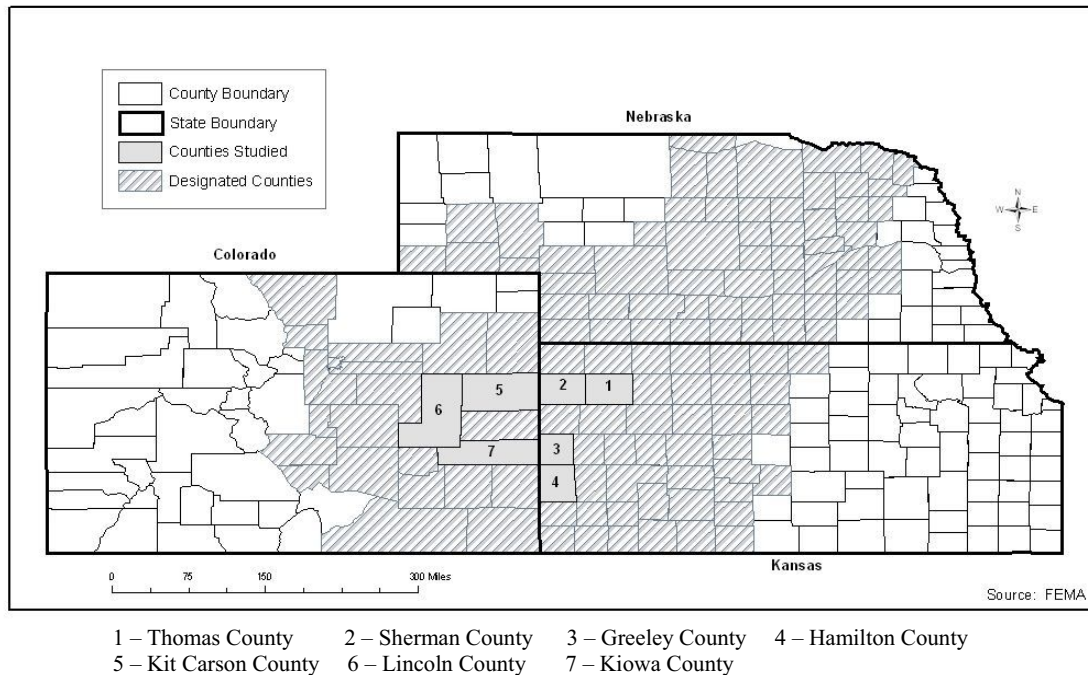


FIGURE 1
 BLIZZARD-AFFECTED DISASTER DESIGNATED COUNTIES AND STUDY AREA

Multiple survey methods (mail, phone, and in-person questionnaire surveys) were used to collect information from blizzard victims. Large-scale corporate feedlot operations, which were few in number, were deliberately excluded from this study as they would have different, more efficient responses to the disaster than the smaller, owner-operator businesses. Given heavy snow accumulations and the advice of several County Agricultural Extension officials, we did not focus solely on in-person surveys. These officials, who had ready access to most blizzard victims, gave us names and phone numbers for some ranchers, which we used to conduct phone surveys. The Extension offices mailed the survey instrument directly to other victims. It was expected that the response rate would increase if the respective County Agricultural Extension officials mailed the questionnaire directly to blizzard victims, given their previous interactions. We collected information from 62 victims: 32 from non-isolated counties and 30 from isolated counties. Relevant information was also collected from secondary sources such as the state and county Emergency Management and County Extension Offices of the blizzard-affected counties of Colorado and Kansas. Three members of the field survey team also attended a livestock auction held in Oakley, Kansas, in mid-February 2007 in order to meet ranchers affected by the blizzards and collect relevant information from them.

A structured questionnaire was used to collect information from the ranchers and farmers on the blizzard that occurred on December 28-31, 2006, and its various impacts, including those on the cattle population. Several questions were included to seek respondents' opinions regarding their level of satisfaction with emergency supplies provided by external sources for their families and cattle. A 1-5 Likert Scale, where 1 signified highly dissatisfied and 5 highly satisfied, was used. A score of 3 meant the respondent was neither particularly dissatisfied nor satisfied. The field data were then analyzed using frequencies, percentages, and relevant descriptive statistics. The Chi-square statistic was used to test for differences between respondent characteristics and their responses, which were dichotomized as counties isolated and non-isolated from I-70.

4. RESULTS

4.1 RESPONDENTS' BLIZZARD EXPERIENCE

According to the questionnaire survey data, few respondents lost electrical power. Two-thirds (41 out of 62) of all respondents did not experience any power loss at their homes during the blizzard. About 69 percent of all respondents of non-isolated counties experienced no loss of power. The corresponding percentage was 63 percent for respondents of isolated counties. This finding was expected because the blizzard was more severe in isolated counties. However, the calculated Chi-square value of 2.576 (d.f.=2; p=0.276) was not statistically significant, indicating that the two types of study sites did not differ statistically with respect to power status. However, the remaining one-third of the survey respondents who lost power had to stay in their homes from a few hours to nine days. On average, these respondents were without power for two days. Although 46 (74 percent) of all respondents owned generators, only 14 had to use them. More than half of the respondents who owned a generator had electricity in their homes. Respondents who lost power and did not own a generator may have taken shelter with or borrowed a generator from friends, neighbors or relatives. Only five respondents indicated that friends, relatives, and/or neighbors took shelter in their homes, and only two reported that several members of their families took shelter outside their homes after the blizzard started.

Respondents did not receive any emergency supplies such as food, drinking water, warm clothing, medicine, or any disaster relief from any external sources. All respondents had enough food at their home during the blizzard, which may be due to the fact that residents of rural areas often buy and stock food for a couple of weeks at a time because it is inconvenient and costly to shop frequently. It might be equally possible that they bought enough food after receiving the “blizzard warning” from six to eighteen hours in advance. Survey data suggested that respondents also stored drinking water in their homes.

The survey data revealed the extent of injuries and property damage from the blizzard. No member of the respondent families experienced any blizzard-related fatalities, but two respondents reported that two family members sustained injuries from falls. Nearly 52 percent of all respondents experienced blizzard-induced damage of their properties. The proportion of respondents experiencing property damage did not differ between the two types of study sites. The blizzard caused the collapse of multiple buildings in the study counties. The blizzard also damaged vehicles, fences, and trees; uprooted poles; and tore away roofs. Respondent damage estimates ranged from \$200 to \$15,000. On average, each respondent experienced property damage totalling under \$1,000.

4.2 EMERGENCY RESPONSE MEASURES UNDERTAKEN FOR STRANDED CATTLE

At the time of the December 28-31, 2006, blizzard, respondents owned cows and/or beef cattle. Beef cattle, cow-calf, and dairy operations were evident in the selected counties. Beef cattle are raised to fatten the animal, while cow-calf operations involve breeding the cattle every year. Once calves are 500-750 pounds, producers sell them off. However, we did not specifically ask a question regarding what type of cattle operation respondents were involved in. In addition to owning cattle, two respondents reported that part of their cattle herd was leased from other ranchers/farmers. The other 60 respondents reported owning a total of 35,495 head of cattle. This means each respondent, on average, owned nearly 592 head of cattle at the time of the blizzard. However, the actual number of cattle owned by respondents ranged from eight to 5,000. The two categories of study sites differed with respect to cattle ownership. Respondents of non-isolated counties reported having on average 919 head of cattle, whereas respondents of isolated counties on average owned only 264 head. The calculated Chi-square value was statistically significant (7.401; d.f.=2; p=0.025). This difference might be explained in terms of differences between soil quality and water availability of the two types of study sites. Because of the presence of an economically viable

aquifer, cultivation of corn and other crops was more prevalent among residents of isolated counties of Kansas compared to residents of non-isolated counties. However, the transportation network is better in non-isolated counties, which probably makes ranching more profitable (all other factors being equal) than in more isolated counties.

During the blizzard, respondents kept their cattle in a variety of locations, such as winter pasture, corn pasture, wheat pasture, field pasture, grass pasture, crop residue pasture, corn stalks, river bottom, home, corrals, and pens. These places are categorized as pasture and corral. The former are located away from the homestead while the latter are generally close to home. Cattle that were in pasture faced more hardship from the blizzard than those kept in pens or corrals. Because of the blizzard, it was difficult for respondents to travel to their pastures and feed cattle. Eight respondents, all from non-isolated counties, reported that after receiving blizzard warnings, they moved most of their animals from pasture areas to closer to their houses, home pens, or corrals. Three respondents mentioned that their cattle were in pastures located outside their own counties during the blizzard. A small number of respondents kept their cattle in both pastures and corrals. Exactly half of the respondents in both isolated and non-isolated counties left their cattle in pastures and half in corrals during the blizzard.

Many respondents indicated they lost cattle. The number of cattle deaths from blizzard impacts ranged from one to 120, but the percentage of respondents reporting cattle losses did not differ by the two types of study sites. Forty out of 62 respondents (65 percent) reported that they lost cattle. In all, 475 cattle owned/attended by respondents died in the study area because of the blizzard (Table 1). This means, on average, each one of the 40 respondents lost about 12 cattle. This can also be expressed in another way: the blizzard caused slightly over 13 deaths per 1,000 head of cattle. The relatively high death toll among cattle in the selected counties of Colorado and Kansas may be due to the severity of the blizzard. The number of deaths included those that occurred after the blizzard in the form of still births and the deaths of both older cattle and underweight and premature calves born to cows stressed by successive blizzards and extremely cold temperatures. A rancher in Kit Carson County, Colorado estimated a 15-20 percent calf loss due to the late December blizzard. While the percentage reporting cattle losses did not differ between types of study sites, the data suggested that the number of cattle deaths did. The respondents of isolated counties owned only 23 percent of all reported cattle, yet they accounted for 59 percent of all cattle deaths. Respondents of isolated counties also experienced a higher death rate per 1,000 cattle (Table 1). The chi-square test compared the number of cattle deaths in isolated and non-isolated counties. The chi-square value suggested that the number of cattle deaths in isolated and non-isolated counties was not statistically significant.

Apart from cattle deaths attributed to the blizzard, major (indirect) losses included higher feed intake to maintain body weight of cattle, a 10-15 percent weight loss of animals, the lower rate of gain of feeder cattle, lighter weaning weights, and higher death losses at calving time born to weakened cows that had lost significant weight. Moreover, ranchers and farmers of blizzard-affected areas had to buy hay at higher prices because of a lack of winter grazing both in terms of stocks and native grass. Feed was expensive due to years of drought. Given the lower rates of weight gain due to the cold, one Kansas rancher estimated that it took \$0.05-0.10 extra in feed to add one pound of weight to cattle. Thus, it cost an extra \$70 to fatten each animal up by 700 pounds. When multiplying the \$70 by the number of head held, the increased production costs were not insignificant. A considerable number of producers had feed bales in the field, but could not get to them to cattle because of the snow depth and/or drifts.

As a result of the blizzard, cattle production has been affected in the short- and long-term. Lost production from stressed cattle and higher prices of feed have already reduced ranchers' profits. Ranchers have lost thousands of dollars in weight gains due to the blizzard and persistent cold weather. The hay feeding primarily kept the animals alive, rather than increasing their weights. Given the snow cover during January and February, some ranchers chose to reduce their herd size rather than spend extra money on feed. The blizzard may also have affected cattle reproduction for years to come. In eastern Colorado, one County Agricultural Extension agent reported that bulls were experiencing reproductive problems due

TABLE 1
NUMBER OF CATTLE DEATHS BY COUNTY TYPE

Number of Cattle Deaths	Number of Respondents		
	Non-isolated Counties Number (%)	Isolated Counties Number (%)	Total Number (%)
1-5	9 (47.4)	14 (66.7)	23 (57.5)
6-20*	8 (42.1)	4 (19.1)	12 (30.0)
>20	2 (10.5)	3 (14.3)	5 (12.5)
Total	19 (100)	21 (100)	40 (100)
Chi-square=1.52 (d.f.=1; p=0.218)			
Total Deaths	194	281	475
Average	10.2	13.4	11.9
Range	8-58	1-120	1-120
Deaths <i>per</i> 1000	7.04	35.46	13.38

*Merged with the next higher category to calculate chi-square.

to frozen testicles. Cows whose embryos die early in the pregnancy due to the cold conditions face an added danger. If the embryo dies and it goes undetected, the mother cow is likely to be infected as a result of absorbing the embryonic tissue. This eventually leads to death. The large number of stillborn or aborted calves leads to a lower number of replacement females. Such reproductive problems resulting from the blizzard may have an economic impact for the next three to five years.

However, the blizzard had some positive impacts. The blizzard produced moisture which has been “unknown” in the last five years in this part of western Kansas. Given the resulting good pasture, there was greater demand for calves in 2007. Similarly, in parts of southeast Colorado that had suffered high cattle losses, the blizzard-produced moisture will lead to greater grass production (important as there was no irrigation and thus a dependency on grass year round) and to the desire to add to one’s herd. However, the diminished calf crop, the reduction in herd size given the cost of providing feed for animals normally on pasture, and the outlook for increased grass production due to the blizzard-related precipitation meant that ranchers faced higher prices for calves. At the livestock auction in Oakley, Kansas, on February 17, 2007, some calves were going for \$400 each, a price far higher than recent averages.

Because the Colorado and Kansas National Guards' air dropping of cattle feed was done selectively, cattle of almost all the survey respondents did not receive such feed. Surprisingly, only one respondent from the isolated counties reported that during this blizzard his cattle received hay dropped by a Colorado National Guard helicopter. Eight Guard helicopters and a C-130 cargo plane were utilized in Colorado’s campaign to save livestock herds trapped by heavy snow and high drifts. The state of Colorado provided helicopter flights to deliver feed, but the cost of feed was either paid for by the cattle owners or by local governments. In Colorado, helicopter flights were primarily restricted to areas suffering the greatest impact, such as Baca and Bent Counties. In addition, volunteer snowmobile search-and-rescue groups joined the effort on the ground. Volunteers also used four-wheel drive vehicles and Humvees to supply feed to stranded cattle. As noted earlier, at least half of all the respondents surveyed reported that during this blizzard, either the entire herd or a portion of their herd stayed in cattle pens and corrals located close to their homes. Cattle on a few other ranches were in pasture areas located near their homes. Additionally, some blizzard victims owned dairy farms, particularly in Hamilton County, Kansas. These farms were generally located close to homes. Helicopters dropped feed only for cattle stranded in open fields. Cattle producers of some affected counties, such as Kiowa County, Colorado, were initially concerned

that they would probably not be able to reach their animals with hay because of road conditions. All roads, however, were cleared much earlier than expected, which facilitated ranchers' ability to reach the livestock (Sorensen, 2007). For this reason, the air dropping of feed for stranded cattle was not necessary. Three respondents of non-isolated, blizzard-affected counties claimed that there was plenty of hay in their fields. Conversations with respondents and local officials revealed that emergency hay lifts were not undertaken in all blizzard-affected counties of Colorado and Kansas. For example, no one reported air drops of cattle feed in Sherman and Thomas Counties in Kansas, nor in Kit Carson and Lincoln Counties in Colorado. As noted previously, cattle of several producers were in counties other than their own during the blizzard. The blizzard status of those counties was not known. Beyond providing hay and snow removal to clear roads to reach cattle, there were no other emergency activities aimed at stranded cattle during this blizzard.

The questionnaire survey results revealed that only eight (13 percent) of the 62 respondents received disaster relief from external sources for their cattle immediately after the blizzard. All such respondents were from isolated counties, and they received cattle feed from several sources. Both private individuals (*e.g.*, Jim May) and corporations (*e.g.*, Coors, Inc.) donated hay bales and pellet supplements in the severely impacted counties of Colorado. Two respondents reported that they picked up Coors-donated supplements from 60 miles away, which cost them \$0.63/bag. Each bag weighed 50 pounds and respondents received up to 19 bags. The state of Kansas and Greeley County, Kansas, also distributed hay among respondents affected by this blizzard. Respondents who received donated cattle feed complained that the hay distribution program was poorly executed and the pellets arrived late. One respondent claimed he received cattle feed three months after the blizzard. As a consequence, none of the eight respondents who received cattle feed were satisfied with the emergency aid provided by external sources.

It is clear from conversations with nearly two dozen affected people in the selected counties of Colorado and Kansas that farmers and ranchers were very dissatisfied over not receiving any (or very little) emergency assistance from public sources for their stranded cattle and losses incurred due to the blizzard. After the federal disaster declaration and approval of federal emergency funding distribution by the President, victims of the blizzard-affected counties expected federal disaster relief and emergency aid, including money for livestock rescue and recovery. At the time of the questionnaire survey, no respondents reported receiving low-interest operating loans from the USDA. In 10 southeastern Colorado counties, the USDA said ranchers and farmers did not qualify for such loans since countywide losses did not equal 30 percent or more of the production of cattle, calves, and winter wheat. By requiring production losses of 30 percent, rather than economic losses, before declaring a disaster, the USDA made it nearly impossible for farmers and ranchers to qualify for the loans (Emery, 2007). Most respondents were thus very disappointed with the lack of federal assistance.

Assistance was provided by private sources. In contrast to federal and state emergency assistance, the cattlemen's associations in the blizzard-impacted counties have been helping fellow ranchers and others to recover from the year-end blizzard. For example, considering the limited external aid, the Bent-Prowers Cattleman's board has been working since early January with the Colorado Cattleman's Association, the Colorado Farm Bureau, and the Colorado Livestock Association to coordinate local relief efforts (Russell, 2007). The Bent-Prowers Cattlemen's board already provided cattle feed in the lower Arkansas Valley for those livestock owners in need due to impacts from the holiday winter storm. In addition, Little Caesar's Pizza and Land O'Lakes/Purina Mills Inc., as well as other business enterprises made cash donations to aid ranchers affected by the blizzard.

5. CONCLUSION

The purpose of this research project was to explore and analyze emergency response and relief efforts undertaken for the December 28-31, 2006, blizzard victims of selected counties of Colorado and Kansas. Besides limited hay lifts and the supplying of hay and pellets

for pick-up, the emergency response to the blizzard was limited. In Colorado, where Coors donated barley pellet supplement for feed, some ranchers felt the distribution could have been timelier in execution. As noted, ranchers and farmers have not received federal disaster relief and emergency aid, such as money for livestock rescue and recovery. To a large extent, in rural communities such as Kanorado, Kansas, farmers provided the disaster relief in dealing with the heavy snowfall and drifts by clearing the roads in town. One rancher interviewed in Kiowa County, Colorado, hoped one outcome of this study would be to raise awareness that there is a need for economic disaster assistance in the form of a supplemental direct payment to help cover farmers' and ranchers' added costs of procuring cattle feed and supplemental nutrition.

Farmers and ranchers (particularly in eastern Colorado) suffered major financial losses prior to the blizzard during seven years of severe drought, for which they also had not received any aid. From their standpoint, the federal government response to the blizzard has been disappointing. They saw very little federal relief forthcoming, and only a very slim possibility for state assistance. Although ranchers are not "holding their breath" for state or federal relief, such relief is greatly desired and to some degree expected, given the disaster declarations. Another factor leading to the limited assistance was that livestock did not fall under USDA crop disaster designations, since livestock are not a crop. One local (Colorado) cattlemen's association tried to get this changed so that livestock would fall under the same designation as a crop. If greater assistance is desired for future blizzards and droughts, state cattlemen's associations must work to get the USDA to change its agricultural disaster designations.

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