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Examining Economic Impact and Recovery in South Dakota from the 2002 Drought

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Examining Economic Impact and Recovery in South Dakota from the 2002 Drought

Matthew A. Diersen and Gary Taylor

Abstract

During the 2002 drought, farm sector economic factors were monitored to assess the likely statewide economic impacts. Timely moisture during the spring of 2003 resulted in a sizeable wheat harvest relative to recent years. Prices in the fall of 2003 have also been significantly higher for cattle and soybeans compared to prices in recent years. As a result, there have been inquiries as to the extent of economic recovery in the farm sector of South Dakota. The purpose of this paper is to outline the estimation procedure used to assess the drought in 2002, validate the extent of the impact, and discuss potential mitigating effects observed during 2003. The results suggest the direct costs to the farm sector in 2002 can best be described using a range of \$650-800 million. The improved market conditions in 2003 would offset a portion of those losses at the state level. While the offset estimate is \$477 million, a range of \$375-550 million would better encompass the scope of the impact. Finally, while the aggregate farm sector will benefit in 2003, winter wheat and cow-calf producers most adversely affected by the drought will likely need additional time to recover.

Key words: drought impacts, farm sector, multiplier effects, model validation

Examining Economic Impact and Recovery in South Dakota from the 2002 Drought

Members of the Department of Economics at South Dakota State University monitored and assessed the likely statewide economic impacts of the 2002 drought. Timely moisture during the spring of 2003 resulted in a sizeable wheat harvest relative to recent years. Prices in the fall of 2003 have also been significantly higher for cattle and soybeans compared to prices in recent years. As a result, there have been inquiries into the extent of economic recovery attributable to the farm sector of South Dakota following the negative impacts during 2002.

The purpose of this paper is to outline the estimation procedure used to assess the economic impact of drought in 2002, validate the extent of the impact, and discuss potential mitigating effects of improved market conditions observed during 2003. The disparity of the mitigating effects across different segments of the farm sector is also covered. The drought was not specific to South Dakota and its impact occurred during a time when the rural economy was already depressed (Henderson and Novak). Further, we have received numerous requests from policy analysts in other states for details about our method for estimating the impact.

Estimating Economic Effects of the 2002 Drought

In February of 2003 an estimate of the drought-related impacts on the farm sector and overall economy in South Dakota was released. Details of the direct, indirect, and induced effects on the farm sector and overall economy are provided in this section. The estimated overall impact was revised from \$1.8 billion to \$1.4 billion, which included \$642 million in direct effects on farm income (Table 1). A key factor in the revision was

direct federal aid of \$100 million for drought losses. Smit reported that aid to South Dakota exceeded \$94 million in late 2002.

Table 1. Summary of South Dakota Drought Effects as of February 2003.

Factor	(\$ mil.)	Impact (\$ mil.)	(\$ mil.)
Livestock			
Pasture Losses	138		
Increased Feed Costs	100		
Culling Losses	43		
Crop Effects			
Grains/Oilseeds Losses	255		
Hay Losses	146		
Other Effects	60		
Federal Aid Offset	<u>(100)</u>		
Total Direct Effects	642		
Indirect Effects		494	
Induced Effects		<u>263</u>	
Total Impact			1,399

The details of the direct effects estimation changed throughout the production year. The early estimates were based on projected yield losses on crops and projected feed and culling costs on livestock. The crop costs were later refined using production estimates and insurance indemnity payments. Any revisions to the initial direct effects estimated are noted in this section, and detailed later in the paper if warranted. No adjustments or allowances were made in the direct estimates for market impacts of corn, wheat, or cattle prices on farm revenue. Corn and wheat prices were higher than expected at the time of the 2002 harvest. However, cattle prices were generally lower than expected at the time of calf marketing in 2002.

Pasture Losses

Pasture losses, which would account for lower sales weight of animals, totaled \$138 million. Range and pasture conditions declined steadily throughout 2002 as the drought continued to worsen and spread east across South Dakota. The percent of pasture rated “very poor” or “poor” was 17 percent in May and was 78 percent in August. Crop and livestock data are from South Dakota Agricultural Statistics Service or related Internet sources. In August, based on the pasture conditions and anecdotal evidence, it was assumed that one-third of the cow-calf pairs in S.D. had been affected for 4 months, and another one-third for 2 months. Given the lack of forage growth it was further assumed that all pasture (and all pairs) would suffer an additional 2 months of losses. Aggregating the lost pasture amounts was equivalent to all the cow-calf pairs needing 4 months of pasture.

Using a value for pasture of \$18.30 per cow-calf pair per month, the loss accumulated over 4 months across 1.9 million pairs, yielding \$138 million. The number of pairs is actually higher than the 1.8 million head of beef cows reported as of July 1, but no allowance was made for replacements, yearlings, bulls, etc. in the pasture loss estimation. The pasture losses could have been estimated by determining the extent of any early marketing of calves or yearlings at lower per-head prices.

Increased Feed Costs

Additional purchased feed expense likely amounted to \$100 million. The expected loss of pasture forced many cows into feeding situations. Assuming that two-thirds of the beef cows needed purchased summer feed of 30 lbs. of hay a day for 3

months, and with hay priced at \$60 per ton, the expense amounts to \$100 million. The presence of old stocks of hay, cheaper alternative feeds, and culling practices could alter that figure. There was some concern that feed costs were double counting pasture losses. The pasture losses amounted to fewer pounds of animals to sell. The feed costs were additional maintenance costs for the cowherds. The feed costs may be looked at as taking down feed inventories.

Culling Losses

The expected loss from drought-related culling of beef cows totaled \$43 million. Producers were estimated to cull 30 percent of their beef cows in 2002 compared to 15 percent in a normal year, giving an early cull total of 285,000 head. Animals culled early would normally have value as breeding stock, but producers were receiving slaughter animal prices because so many were moving through local markets. Using the price difference between old and young breeding stock, the loss amounted to \$150 per animal (Gerke). The actual, state-level, culling rate was smaller as discussed later in this paper.

Grains/Oilseeds Losses

Losses from crops other than hay were estimated to total \$255 million. This loss total is after accounting for insurance payments. During the growing season, crop conditions for the major crops in South Dakota (corn, soybeans, wheat, sunflowers, and oats) were used to estimate losses. Over 60 percent of the small grain crops were rated “very poor” or “poor” before harvest. In addition, as of August 4, 2002 47 percent of the corn crop was rated “very poor” or “poor”. Soybeans remained in relatively good

condition. Assuming that conditions of “very poor” or “poor” would be bad enough to trigger insurance indemnity payments, the percent of the crop in those condition categories was used as the percent of the uninsured value that would contribute to the loss. This resulted in an early estimate of \$323 million in losses. Once production estimates and actual indemnity payments became available the losses were adjusted. The statewide loss was calculated as the crop value (assumed to be trend production times the loan rate) minus the indemnity payments. The adjustment resulted in the losses being concentrated in corn and wheat.

Hay Losses

Losses to the hay (alfalfa and other hay) crop were expected to total \$146 million. South Dakota had expected to harvest 4.5 million acres of hay in 2002, and the crop production reports estimated the all-hay yield at 1.1 tons per acre compared to 1.8 tons per acre in a normal season. An expected 9 million ton crop worth \$60 per ton was reduced to a 5 million ton crop worth \$75 per ton. The difference between the expected value and the reduced value amounted to \$165 million. Such losses exceed the 1988 disaster payments for hay that totaled over \$43 million in South Dakota (Dismukes, Zepp, and Smith). Only about 20 percent of the hay acres in South Dakota were covered by insurance, and the level of coverage was typically not high. The indemnity payments on hay totaled \$19 million in February, reducing losses to \$146 million. Updated data shows the indemnity payments totaling \$21 million for 2002.

Other Effects

Producers incurred an estimated \$60 million in other costs from the drought. Water hauling, additional transportation of cattle, additional interest, and building fences to graze Conservation Reserve Program lands are examples of such costs. An ERS study of drought impacts estimated that drought-related activities increase costs 2-5 percent above normal (Morehart et al.)

Indirect and Induced Effects

The total effect of the drought on the South Dakota economy was divided into three separate multiplier facets. The state multiplier was derived using IMPLAN Pro, a social accounting and impact analysis software package. The three parts of the multiplier are as follows: the direct effect is 1.00, the indirect effect is 0.77, and the induced effect is 0.41. This results in a total multiplier for the state of 2.18. The magnitude of these three effects depends on a number of different factors, including the population of the state, the number of industries in the state, and how much economic activity stays in the state and how much “leaks” out due to the buying or selling of goods into or out of the state and the in- or out-migration of labor.

IMPLAN Pro is a commonly accepted software package used to create a predictive model of a local economy that may be used to analyze shocks to the economic system. The name of the program is derived from its function, IMPact analysis for PLANning. The program uses data from 528 different industrial sectors to create a model of the economy, including employment, value added activities, and business-to-business transactions, to create a baseline economy. Impacts to the system, either

increases or decreases in economic activity or investment, may then be compared to the baseline scenario. The multipliers developed by the program represent actual linkages between businesses, government, and households in the study area. They do not model the number of times a dollar is turned over in the economy, but the actual increases or decreases in spending that occur due to the economic shock being analyzed.

The direct effect, with a multiplier of 1.00, was the \$642 million shock to farm sector income. The indirect effect, which affected businesses related to agriculture, was \$642 million times the indirect multiplier of 0.77 or \$494 million. The induced effect, which affected local consumers and businesses, was \$642 million times 0.41 or \$263 million. These three total the \$1.4 billion impact to the South Dakota economy. To put this loss in perspective, the U.S. Bureau of Economic Analysis projected the gross state product for South Dakota was \$24.3 billion in 2001. The gross state product is the value of all the goods and services produced during a one-year period.

Various media contacts were helpful in further elucidating the importance of farm sector income. We were often asked “So what?” in reference to how the farm economy would impact the rest of South Dakota. The multiplier quantified this effect, but for practical implications it was discussed in terms of lower retail sales, potential effects on employment, and consumption or savings behavior. A related issue was where the shortfall would come from. That is, did all of the direct effects on producers have to be covered by cash? The answer is no. Some of the direct effects came in the form of reduced pasture, hay, and grain inventories. Part of the effects were covered or smoothed by retained earnings or savings by farm operations or households. The multipliers accounted for such interactions.

Validation of Economic Effects

During the 1976 drought, South Dakota cow numbers dropped dramatically. The number of beef cows dropped from 1.9 million to 1.4 million head. Producers said the 2002 drought was worse, and a fair number of culls had been marketed when we estimated the culling level. Further, producers not directly affected by extensive and early pasture losses anticipated reduced feed supplies would force additional liquidation to occur across South Dakota. The culling level was not expected to be as extensive as the culling that occurred in 1976 because of a smaller beginning inventory in 2002. In 1988 the inventory was hardly reduced at all, but the base number was relatively small at 1.5 million head.

County level cattle inventory statistics validate the culling and feed cost estimates. The South Dakota beef cow inventory declined from 1.8 to 1.7 million head by January 1, 2003. Beef cow inventories were sharply lower in the Northwest, North Central, West Central, and Central agricultural statistics districts (figure 1). The culling was not as extensive as estimated, being down 106,000 head instead of 250,000 head. While this may warrant reducing the culling losses estimate, we hesitate because of the likely costs involved with maintaining the herds. Many cattle were relocated in South Dakota with and without ownership changing hands. Tronstad and Feuz outline the costs associated with destocking and restocking cowherds. Further, in many western states they report that cows were relocated to non-drought areas. Without knowing the extent herds changed ownership, we assume the cost to the sector remained \$43 million.

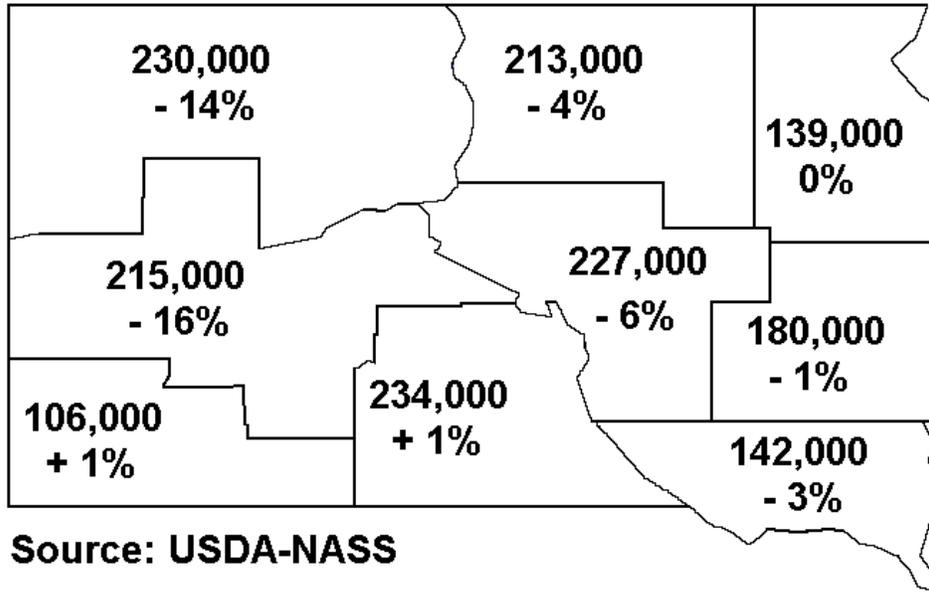


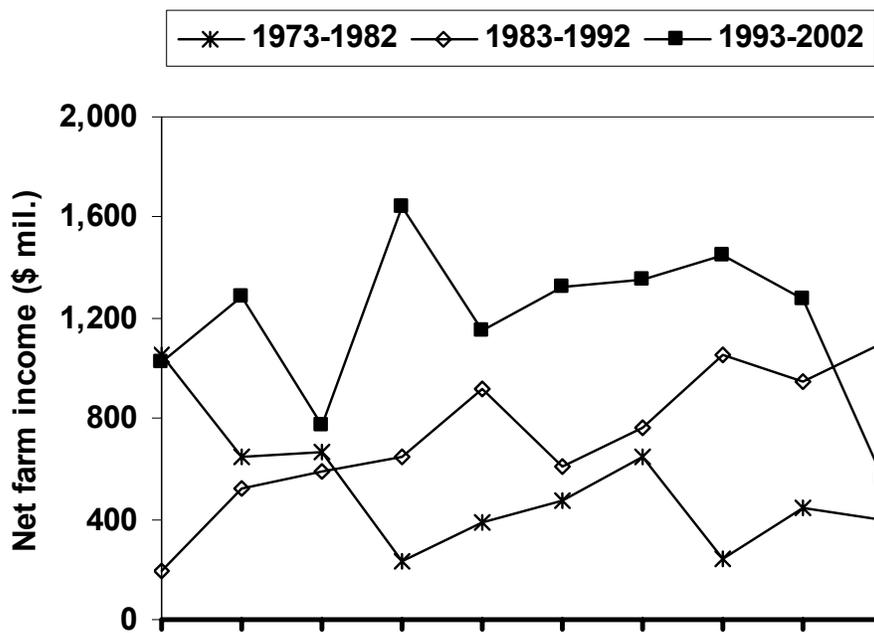
Figure 1. Beef cow inventory by Agricultural Statistics District on January 1, 2003 with the percent change from 2002.

Accounting for higher corn prices following the 2002 harvest would fully offset drought losses related to corn. However, we are hesitant to do so for several reasons. First, any forward contracted or hedged sales would not likely have been made at prices observed at harvest, and the extent of hedging is unknown. Second, a substantial percentage of last year's crop would have been utilized as feed in South Dakota. Those with corn would have sold it to those needing feed and the higher price received by the seller (a gain at the state level) would be offset by higher feed costs paid by the buyer (an equivalent loss at the state level). Third, the marketings pattern (percent sold by month) is unknown at this time.

The farm level impact, a component of the direct effects, was documented by Keen. Participants in the Farm/Ranch Business Management Program had average net profit of \$25,700 in 2002 compared to \$47,500 the year before. Similarly, in a Federal

Reserve Bank of Minneapolis survey, 82 percent of agriculture lenders in South Dakota said farm income was lower in late 2002 compared to year earlier (Madden). As for multiplier-style effects, 50 percent of the lenders said household spending was lower and 81 percent said capital spending was lower.

Economic Research Service estimates that 2002 net farm income in South Dakota was only \$560 million compared to the average from 1999-2001 of \$1.36 billion (figure 2). The calculation accounts for drought effects on lower production and reduced inventories and also includes market price impacts on revenue flows, e.g., higher corn and wheat prices and lower cattle prices. The estimate is on a calendar year basis so the category totals are not always consistent with other sources. McElroy et al. provide details of the value-added method.



Source: Economic Research Service

Figure 2. South Dakota Annual Aggregate Net Farm Income.

Net farm income can fluctuate substantially from year to year. However, the change from 2001 to 2002 was the largest absolute decline on record. The data are in nominal terms. 2002 was the first volatile year since the mid-1990s. However, the \$800 million income reduction is in line with our \$642 million direct impact.

Mitigating Crop Situation in 2003

The principal cash crops in South Dakota are corn, soybeans, and wheat. After two years of poor winter wheat harvests and a general turnaround in crop prices, 2003 will show sizable returns from crops in South Dakota. From 2000-2002 the combined value of crop production and crop insurance indemnity payments for corn, soybeans, and wheat averaged \$1.789 billion (table 2). During 2002 indemnity payments actually led to higher aggregate crop returns than realized in 2001.

Adequate moisture during the early part of the growing season led to favorable wheat and corn crops in 2003. The wheat yield in South Dakota was above the 10-year average and the August price of \$3.24 per bushel in 2003 was above the average price received in recent years. Similarly, the corn yield was above the 10-year average, while the October price of \$1.86 per bushel is similar to the price received in recent years. The resulting crop values were higher than 2000-2002.

The lack of moisture during the latter part of the growing season reduced soybean yields. The South Dakota yield is below the 10-year average while the October price of \$6.68 per bushel is the highest price received in recent years. The high price makes up for the lower production, leading to the highest value for the crop in a number of years.

However, anecdotal evidence suggests a number of producers forward priced soybeans ahead of harvest at prices below the October average.

Table 2. Revenue and Production Value of Primary South Dakota Cash Crops.

	Price ^a (\$/bu.)	Production ^b (mil. bu.)	Value (\$ mil.)	Indemnity ^c (\$ mil.)	Total (\$ mil.)
Corn	1.75	426	746	32	
Soybeans	4.90	153	750	24	
Wheat	2.68	114	306	12	
2000 Total					1,870
Corn	1.75	371	649	71	
Soybeans	4.90	143	701	45	
Wheat	2.78	77	214	60	
2001 Total					1,740
Corn	2.20	304	669	150	
Soybeans	5.15	127	654	50	
Wheat	4.05	42	170	90	
2002 Total					1,783
Corn	1.86	431	802	20	
Soybeans	6.68	122	815	10	
Wheat	3.24	116	380	10	
2003 Total					2,037

Notes: ^aPrices from 2000 and 2001 are the statewide loan rate by crop. Prices in 2002 are the preliminary marketing year average prices from SDASS. Prices for corn and soybeans in 2003 are the October price paid to farmers from NASS and the price for wheat is from August. ^bProduction data are from NASS. ^cIndemnity data are from the Risk Management Agency and for 2003 do not include the entire crop year.

Combining the returns from corn, soybeans, and wheat for 2003 shows a total of \$2.037 billion. The returns are **\$239 million** above the previous three-year average. The additional return could be looked at as a way to offset the 2002 drought losses from the State's perspective. Any hedging activity would likely reduce the offset and any change in prices for the remainder of 2003 would affect inventory values for any unsold part of the crop. Relatively speaking, winter wheat producers are less likely to have recouped

losses incurred after two years of poor crops and lower insurance coverage levels preceding the 2003 harvest.

Mitigating Livestock Situation in 2003

Conditions at the end of 2003 show range and pastures in South Dakota at 22 percent “very poor” and 35 percent “poor”. This is almost as bad as conditions at the end of 2002 where 30 percent was rated as “very poor” and 27 percent as “poor”. Hay yields were below the 10-year average and the relatively tight ending stocks position from 2002 results in another relatively tight supply situation for the 2003 feeding period. Anecdotal reports are that there was a good first-cutting of hay across most of the state. Hay prices are also much lower than a year ago, which should help those short on feed. However, given the latest production estimate, hay prices are likely to increase by the end of 2003.

NASS projections for South Dakota’s calf crop indicate a reduction of 80,000 head from 2002. However, prices in 2003 are higher than during 2002. The calf crop can be valued at fall prices to determine a two-pronged impact on the farm sector. Calves that are or will be sold by the end of 2003 would add directly to farm sector revenue. Calves retained for further feeding would have greater inventory values compared to last year.

The weighted average price for stocker cattle, steer calves weighing between 500 and 600 pounds, was \$113 per cwt. in South Dakota during October of 2003. The price for the same time in 2002 was only \$88 per cwt. This data comes from USDA Agricultural Marketing Service reports. The 2002 price allows one to value the calf crop by multiplying the \$484 value per head by 1,840,000 head, giving \$890,560,000. The

2003 price means the \$622 value per head makes the 1,760,000 head calf crop worth \$1,094,720,000. The difference of **\$204 million** is sizeable, and could also offset the statewide effect of 2002 drought losses.

The estimate is quite susceptible to any reduction in price by the end of 2003. A \$10 per cwt. drop in calf prices would reduce the value of the calf crop by \$97 million. In addition, any forward pricing with out of state buyers would reduce the sales value of the calf crop. The smaller calf crop is showing up in the smaller sales volume of stocker cattle. Sales of stockers in 2003 comprising the weighted price totaled 29,894 head from July through October. The volume is down 82 percent from 2002 and down 86 percent from the five-year average. Similarly, the volume of yearlings sold during the same time totaled 14,417 head, which is down 70 percent from 2002 and down 67 percent from the five-year average.

Slaughter cattle prices have been higher than expected since the BSE case in Canada in late May of 2003. The midpoint of price projections for the third and fourth quarters of 2003 were \$74 per cwt. and \$76 per cwt. before taking into account the ban on cattle imports from Canada (Southard). Feedlots with animals to sell from July on, that stayed in the cash market, have benefited from the higher prices received since that time. Large feedlots are surveyed by NASS as to their monthly marketings. Small feedlot survey data is not available monthly, but their annual total averages out to 20,000 head marketed per month. To estimate the unexpected increase in revenue from the price spike, cattle feeding returns in excess of the projected price are calculated for marketings.

For example, during September large feedlots in South Dakota marketed 37,000 head of slaughter cattle (table 3). In addition, small feedlots marketed an additional

20,000 head. The price premium for September is estimated at \$15 per cwt., the difference between the Sioux Falls slaughter cattle price (\$89 per cwt.) and the third quarter price projection (\$74 per cwt.). The 57,000 head of slaughter cattle weighing 1,300 pounds each would generate \$11.1 million for the feedlot sector.

Using marketings from July through October, the feedlot sector may generate an additional **\$34 million** in farm sector revenue in 2003. At some point in the feeding period, returns would no longer continue to accrue in this manner. The relative size of the calf crop and feeding values is also evident. Similar to the other enterprises, any forward pricing would likely reduce the returns from this estimated level.

Table 3. Additional South Dakota Feedlot Revenue During 2003.

Month	Price Premium (\$/cwt.)	Price Premium (\$/head)	Feedlot Marketings (head)	Additional Revenue (\$ mil.)
July	2	26	58,000	1.5
August	6	78	63,000	4.9
September	15	195	57,000	11.1
October	24	312	54,000	16.8

Another piece of evidence supports disparity in the mitigating livestock situation. The South Dakota Animal Industry Board's *Auction Agency Report* covering July through September of 2003 shows the number of cattle sold at South Dakota livestock sale facilities totaled 416,527 head. During 2002 volume during the same time period was much higher at 526,793 head. The drought stressed pastures enough in 2002 that producers pulled yearlings off grass early, weaned and sold calves early, and culled and sold cows early.

The 2003 numbers, however, are much higher than the 2001 volume of 326,430 head and the 2000 volume of 249,054 head. Part of the disparity is explained by the sale locations with large changes in sales volume. In 2003, auctions located where cowherds were reduced (figure 1) show smaller sales compared to earlier years. Auctions located in more predominate cattle feeding areas, especially those that sell a relatively large portion of slaughter animals, are seeing an increase in sales volume in 2003 compared to earlier years.

Finally, an additional \$30 million in revenue is expected from hogs and dairy products in South Dakota for 2003 compared to 2002. However, costs perhaps have been pressured by increased corn, soybean (meal), and alfalfa prices.

Policy Considerations and Conclusions

The direct costs to the farm sector in 2002 can best be described using a range of \$650-800 million. The improved market conditions in 2003 would offset a portion of those losses at the state level. While the offset estimate is \$477 million, a range of \$375-550 million would better encompass the scope of the impact. Thus, about two-thirds of the drought and market impacts from 2002 have been restored to the farm sector by positive market impacts in 2003.

Climatologic evidence supports the disparity among those receiving the benefits of rebounding market conditions and raises concerns for the future. According to Dennis Today, State Climatologist, large portions of western South Dakota have received below-normal precipitation during the past 21 months. In addition, the drought monitor shows most of South Dakota in some stage of drought at the present time. The outlook for

moisture is difficult to predict because of the absence of a defined El Nino or La Nina situation.

The ad hoc disaster aid has both proponents and opponents. Certainly, the negative impact of the drought affected the farm sector financially. The evidence also supports the disparity among those affected. Ad hoc aid has a spotty track record (Le Roy and Klein). Furthermore, the presence of such aid may work against other policy responses. Van Asseldonk, Meuwissen, and Huirne find survey evidence that shows producers may be less likely to purchase an insurance product, or reduce the level they would pay for an insurance product to guard against disasters if they believe in the presence of ad hoc payments. Ad hoc and established assistance programs in the U.S. do not address the needs of agribusinesses affected by disasters (Johnson and Smith).

Eventually more detailed information will become available. We expect a U.S. Bureau of Economic Analysis sector breakdown for 2002 will be published in April of 2004, which will complement the net farm income data of the Economic Research Service. The Census of Agriculture was also conducted as of the end of 2002, and will thus give insight into how inventories, expenditures, etc. were affected by the drought.

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