



Natural Hazards Research and Applications Information Center  
Campus Box 482  
University of Colorado  
Boulder, Colorado 80309-0482

DROUGHT IMPACT AND PERCEPTION AMONG WISCONSIN DAIRY FARMERS:  
PRELIMINARY SUMMARY OF SURVEY RESULTS

JOHN A. CROSS

1989

QUICK RESPONSE RESEARCH REPORT #30

DROUGHT IMPACT AND PERCEPTION AMONG WISCONSIN DAIRY FARMERS:  
PRELIMINARY SUMMARY OF SURVEY RESULTS

Quick-Response Project Report  
to the  
Natural Hazards Research and Applications Information Center  
University of Colorado, Boulder

John A. Cross  
Department of Geography  
University of Wisconsin-Oshkosh  
Oshkosh, Wisconsin 54901

October 5, 1989

Funding for this survey was provided by the Natural Hazards Research and Applications Information Center of the University of Colorado, Boulder, through their quick-response research program. Any opinions, conclusions, or recommendations expressed in this report are those of the author and do not necessarily reflect the views of the funding agency.

DROUGHT IMPACT AND PERCEPTION AMONG WISCONSIN DAIRY FARMERS:

PRELIMINARY SUMMARY OF SURVEY RESULTS

John A. Cross  
Department of Geography  
University of Wisconsin-Oshkosh

Drought conditions were felt throughout Wisconsin during the summer of 1988, causing the loss of approximately half of the state's hay and corn crops. During Spring 1989 dairy farmers, who comprise nearly half of Wisconsin's farmers, faced not only the consequences of these feed losses, but they also faced the possibility of continuing drought conditions. This preliminary paper summarizes findings from a quick response study, funded by the University of Colorado Hazards Center, which sought information concerning the impacts of the 1988 drought at a time that it was expected that many dairymen would be experiencing hay and feed grain shortages resulting from the substantially diminished 1988 harvest. At the same time data were obtained concerning these farmers' perceptions of the possibility for drought during the summer of 1989 and during the 1990's.

1988 Drought Conditions

Extreme drought conditions occurred within six of Wisconsin's nine agricultural reporting districts during the summer of 1988, while the remaining three districts experienced severe drought conditions (U.S. Dept. of Agric. 1988a). Precipitation

was particularly deficient in May and June, with one of the Milwaukee weather stations reporting a total of 0.99 inches and Green Bay reporting a 0.73 inch total (11.6 percent of normal) for the two months (U.S. Dept. of Commerce 1988). Although portions of eastern Wisconsin received significant rainfall in August and September, over half the state experienced an annual precipitation shortfall of at least six inches, with the southwestern corner of Wisconsin receiving 15 inches below normal precipitation in 1988 (Clark 1989a). Lancaster, Wisconsin finished the year with only 17.58 inches of precipitation (U.S. Dept. of Commerce 1988).

The 1988 drought and other weather hazards resulted in an estimated loss of 50 percent of the state's corn crop, 52 percent of the corn silage, 66 percent of the oat harvest, 50 percent of the alfalfa hay, and 65 percent of the other varieties of hay (U.S. Dept. of Agric. 1988b). The actual 1988 corn harvest was 60 percent below the 1987 harvest, alfalfa hay was down 45 percent, other varieties of hay were off 44 percent, and oats were down 54 percent (Wisc. Dept. of Administration 1989). Furthermore, the 1987 harvests had fallen from even greater 1986 harvests. Nevertheless, because of the shortages, the dollar value of the 1988 hay harvest exceeded that of the 1987 harvest by 18.2 percent. On the other hand, the cash value of the 1988 corn (grain) harvest was down by 48.9 percent and the oat harvest generated 25.5 percent less revenue than in 1987 (Wisc. Agric. Statistics Service 1989).

Press reports during winter and early spring 1989 painted a bleak picture of conditions facing Wisconsin dairy operators.

Large proportions of farmers had either exhausted their feed or were expected to do so before their next harvest. A survey completed by the Wisconsin Agricultural Statistics Service (1988) by early November, 1988 determined that 14 percent of the state's livestock farmers (dairy, cattle, and hog) expected to have exhausted their hay by January, 42 percent by March, and 74 percent would be out of hay by May. Grain or grain concentrate supplies were expected to be expended on 27 percent of the farms by January, by 47 percent by March, and on 64 percent by May. Hay prices had doubled or tripled, with the price of top-grade alfalfa hay exceeding \$200 per ton. Because of the heat during 1988, aflatoxin had contaminated the corn of some farmers. Freezing rains during January had seriously damaged the alfalfa fields. Furthermore, the thawing and freezing of the saturated topsoil in January, together with little snow cover and deep freezing in February, led to an abrupt melting in mid March which resulted in considerable run-off and little infiltration of the winter moisture into the soil (Clark 1989b).

Precipitation during the spring of 1989 was well below normal, with many areas by early May having received less precipitation since the beginning of the year than they had received by the same date during 1988. During April 1989, for example, Green Bay received 0.49 inches of precipitation (18.3 percent of normal and its lowest record for the month) and Milwaukee received 1.33 inches--or 39.7 percent of normal (U.S. Dept. of Commerce 1989). Although western Wisconsin received over half of its normal April precipitation, drought conditions were reported in several parts

of Wisconsin by early May. The May 6, 1989 Palmer Index (U.S.D.A.'s Weekly Weather and Crop Bulletin) indicated that severe drought existed within southwestern Wisconsin, moderate drought existed in central Wisconsin, and mild drought existed in five of the state's remaining seven agricultural districts.

### Methodology

Information concerning the impacts of the 1988 drought and the resulting Spring 1989 hay and feed shortages, as well as the dairy farmers' drought perceptions and mitigation efforts were obtained by the use of two surveys. A short survey was sent to agricultural extension agents throughout Wisconsin requesting data on their observations of farmers within their various counties. Responses were received from 39 extension agents, representing coverage of 56 percent of Wisconsin's counties. The main survey, an eight-page questionnaire (See Appendix) was mailed on May 4, 1989, to a sample of 506 dairy operators throughout the state.

The farmers who received the questionnaire were selected by a systematic one-percent random sampling from an early April 1989 Wisconsin Department of Agriculture listing of 35,611 dairy operators whose herds had passed the Brucellosis Ring Test, required for all commercial milk producers within the state. Within several of the Agricultural Reporting Districts, which because of their small size had few representatives, an additional one percent of the farmers were selected so that district to district comparisons could be made. The initial mailing of the survey with an accompanying cover letter and business reply envelope was

followed by a reminder post card, which was mailed on May 10. This card thanked participants and encouraged persons who had not yet responded to complete and return the survey. Persons who had not responded to the initial survey were mailed a second copy of the questionnaire, a new cover letter, and a second business reply envelope on May 24, 1989. Of the initial mailing, the post office returned two because of bad addresses, two because the addressee was deceased, and three were returned, indicating that the addressee was no longer engaged in dairying. Completed surveys were received from 283 farmers, representing 57 percent of the eligible members of the sample who received the survey.

#### Short-term Drought Perceptions

Seventy percent of the farmers surveyed expected that the summer of 1989 would be drier than normal, with 20 percent anticipating a "much drier than normal" summer (Table 1). When asked "How likely is it that your area of Wisconsin will have a drought during the summer of 1989?" 16 percent responded "very likely" and 51 percent indicated "likely" (Table 2). Although there were some regional variations in perception, there were respondents anticipating that drought was very likely in each of the state's nine agricultural reporting districts. However, farmers within the northeastern, southeastern and southwestern districts most frequently indicated that a 1989 summer drought was very likely. It is interesting to note that Palmer Index figures during the middle of the summer somewhat corroborate the farmers' predictions. The July 1, 1989 Palmer Index (U.S.D.A. Weekly Weather and Crop Bulletin) showed southwestern Wisconsin as having ex-

treme drought conditions, south central Wisconsin as experiencing severe drought, and both southeastern and northwestern Wisconsin as having moderate drought. By August 26, 1989 severe drought was being reported in northeastern and north central Wisconsin, while southwestern Wisconsin remained in the grips of an extreme drought.

Farmers were asked to explain why they expected the summer 1989 weather to be what they predicted. The most common responses were based upon the farmers' weather observations during the spring (51 percent). Winter observations were cited by 6 percent. Eight percent of the farmers cited various weather forecasts. Farmers expecting a dry summer 1989 cited the 1988 drought (5 percent) or that they were expecting a "cycle of bad years" (8 percent). The belief that it was unlikely to experience two consecutive drought years was cited by 4 percent of the farmers, all who expected a normal to wetter summer 1989. Various miscellaneous observations were cited by the remaining farmers.

Soil moisture conditions were reported as "much drier than normal" by 50 percent of the respondents, with an additional 38 percent indicating that their soils were "slightly drier than normal". Within only four of the nine districts did any farmers report that their soils were wetter than normal. Farmers within northwestern Wisconsin were least likely to claim their soils were much drier than normal (30 percent), while dairy operators within northeastern Wisconsin (65 percent) and southwestern Wisconsin (64 percent) were most likely to cite much drier soils.



Heavy rains (up to six inches) which fell throughout west central, central, east central and southeastern Wisconsin during the last five days of May increased the proportion of farmers expecting normal summer precipitation, but had no impact upon the proportion of farmers expecting a "much drier than normal" summer during 1989 (Table 3). Although most portions of Wisconsin had received less than three-quarters of their normal precipitation in the period between April 23-May 27, 1989, the drought likelihood perceptions of the farmers returning their surveys before this precipitation were not statistically different from those who responded after the rains. (It should be noted that the second mailing of the survey was made just before these rains began.) Precipitation totals for June were less than 50 percent of normal for half of Wisconsin, with La Crosse and Madison reporting 32 and 43 percent, respectively, of their normal June precipitation totals. Because dry conditions generally continued throughout the May-June period of this survey, no statistical distinctions are made based upon the date of response.

#### Long-term Drought Perceptions

Another drought--as severe as the 1988 drought--is expected within the next ten years by nearly half of the Wisconsin dairy farmers surveyed (Table 4). Farmers within southwestern and northeastern Wisconsin were most likely to express such expectations. Nineteen percent of the dairy farmers statewide affirmatively answered the question, "Do you expect to experience a drought in Wisconsin within the next ten years which will be more severe than the 1988 drought?" Thirty-six percent of the farmers

indicated that a drought such as occurred in 1988 would be expected at least once every ten years (Table 5), actually a smaller proportion than expected a similar drought in the 1990's, hinting that many farmers may believe that climate is changing. When asked about what they think the weather in the 1990s will be like in comparison with the 1980s, 45 percent felt that conditions would be warmer and drier than the 1980s (Table 6). Another 7 percent thought the weather would be cooler and drier. With 36 percent of the dairymen thinking that the 1990s would be unchanged from the 1980s, only 12 percent expected that the 1990s would be wetter.

Over half the Wisconsin dairy farmers surveyed had no explanation for the 1988 drought. When asked, "What do you think caused Wisconsin's drought in 1988?" 56 percent either gave no reply, indicated they had no idea, or merely stated that the drought was caused because it was dry or because there was no rain. The responses of the remaining 44 percent of the farmers pointed towards a diversity of environmental factors. Sixteen percent mentioned movements of the jet stream or upper air currents. Five percent mentioned by name the "Greenhouse effect," with an additional 4 percent describing air pollution, human activities upsetting the balance of nature, the loss of rain forests, or climatic change. Two percent claimed changes in the ocean temperatures and another two percent explicitly mentioned the el nino. Two percent mentioned volcanic activity or the lack of such activity. Three percent of the farmers blamed the space program for the drought while four percent considered it an Act of God (as punishment for a variety of sins of modern society).

### Drought Perceptions in Perspective

Drought possibilities were considered as a "major problem" facing dairy farmers by 36 percent of the farmers surveyed, with an additional 43 percent indicating that drought was "somewhat a problem" (Table 7). Only one-fifth of those surveyed felt that drought was only a "minor problem" or "not a problem at all." In no agricultural reporting district did less than 25 percent of the dairy farmers view drought possibilities as a major problem, and within the southwestern and south central districts drought was ranked as a major problem by 45 and 46 percent of the respondents, respectively. Drought was considered as being a problem facing dairy farmers far more often than other natural hazards. Indeed, only five percent indicated that hail damages were a major problem, and only 3 percent stated that flood possibilities were a major problem. Insect infestations were considered a major problem by 7 percent of the respondents.

Everyday economic concerns were far more frequently mentioned as major problems than any of the natural hazards, including drought (Table 8). For example, milk support prices were considered a major problem by 53 percent of the farmers and property taxes were cited by 51 percent. Several other economic concerns were drought induced. Shortages of hay and feed were considered major problems by 47 percent of those surveyed and prices of hay and feed were viewed as a major problem by 53 percent of the respondents. Although only 9 percent of the farmers ranked drought possibilities as the single most important problem facing dairy farmers in their Wisconsin county (compared with 45 percent citing either milk support prices or wholesale

milk prices), only five percent of the farmers indicated that the threat of drought was "not a problem at all."

The drought perceptions of the dairy farmers were generally related to the severity of consequences from the 1988 drought which they experienced (Table 9). The more strongly the farmers felt decreases in gross and net farm incomes, increases in farm indebtedness, and shortages in hay and alfalfa, the higher they ranked drought possibilities as a problem. Farmers who were pessimistic about their abilities to remain in business should another drought occur in 1989 were significantly more likely to consider drought possibilities as a major problem.

Previous experience with droughts as severe as the 1988 drought were reported by a quarter of the farmers surveyed. Nevertheless, this previous drought experience was not significantly related to the dairy farmers' perceptions of the drought problem nor their expectations of future drought conditions. Drought perceptions were also not significantly related to various socio-economic characteristics of the farmers.

#### Impacts of 1988 Drought

The 1988 drought had numerous impacts upon Wisconsin's over 36,000 dairy farmers, who represent approximately half of all farmers within the state (Table 10). These farmers experienced substantial crop losses, losses of income, shortages of hay and feed, together with a wide assortment of economic stresses. For some farmers, the drought resulted in the loss of their farms.

Statewide, an estimated 960 farmers had already terminated their dairy operations by early May, 1989, as a direct result of

the 1988 drought, a figure determined by summing the various estimates of the county-level agricultural extension agents. Between March 1988 and March 1989 the total number of commercial herds within Wisconsin, defined by the Brucellosis Ring test, dropped by 1300. Thus, the drought conditions were the leading cause of herd terminations over the past year. However, to keep this loss in perspective, it should be noted that the number of dairy operations in Wisconsin fell by 9.8 percent between 1986 and 1988 (with 4.1 percent of these being participants in the Dairy Termination Program) and fell by 19.2 percent between 1982 and 1988. However, it should be noted that many agricultural extension agents felt that it was still too early to determine the total number of casualties from the 1988 drought, and that for some farmers, 1988 was economically their best year.

#### Crop Losses and Feed Purchases

Crop losses were estimated by the Wisconsin State Agricultural Stabilization and Conservation Service Office in late August 1988 as being 50 percent for both the hay and corn crops. Crop yields for 1988 reported by dairy farmers responding to this survey were very close to these estimates, with the hay/alfalfa harvest averaging 45 percent of normal and the corn crop averaging 50 percent of normal. When surveyed in May-June 1989 only 37 percent of the farmers had "sufficient feed grain supplies to last until the next harvest, although 69 percent had adequate hay/alfalfa supplies. However, 62 percent of the dairy operators had already purchased hay/alfalfa since the beginning of fall and 72 percent had purchased feed grains. The agricultural extension

agents estimated that in a normal year no more than one-quarter of the dairy farmers purchase hay or feed grain supplies. (Responses from the dairy farmers indicate that 41 percent purchase no feeds or hay of any variety in a normal year, but in 1989 over 75 percent had already purchased hay/alfalfa and/or feed grains.)

Purchases of hay and feed grains over the past year (1988-89) averaged \$14,616, with a median purchase cost of \$9,000, among those dairy operators responding to the survey. The average cost of these purchases in a normal year averaged \$6,733 with a median purchase cost of \$2,000. Within a normal year 41 percent of the dairy farmers purchase no hay or feed, but over the past year only 14 percent of the dairy farmers were able to avoid such purchases. Likewise, in a typical year only 5 percent spent as much as \$25,000 on hay and feed. In 1988-89, 20 percent of the farmers spent at least this much. Although obtaining additional hay or feed supplies was the most common means of mitigating the feed shortages, farmers also took a variety of other actions. For example, 38 percent of the respondents reduced the size of their herds, 35 percent had changed the type of feed fed to their animals, and 22 percent had reduced the amount of feed fed to their animals.

#### Drop in Farm Income

Net farm income was down for the majority of the dairy farmers, yet for better than one-in-ten, income was above average. When asked an open-ended question, "Your net farm income (from all sources) for 1988 was about what percent of normal?" 14

percent of the farmers indicated 100 percent and 11 percent indicated over 100 percent (Table 11). Conversely, 11 percent indicated net incomes of 50 percent or less of normal, with the mean net farm income being 84.5 percent of normal (median was 90 percent of normal). A later question in the survey asked farmers to categorize their income, "Your total net farm income, including all drought relief payments during 1988 equaled approximately what percent of your 1987 net farm income?" Fifteen percent indicated their incomes were over 100 percent of their 1987 income and 46 percent indicated their 1988 income was between 76 and 100 percent of their 1987 income. These figures are similar to those of the agricultural extension agents, who estimated that average income was 89 percent of normal. However, one out of seven of the agents estimated that the average farmer within their county obtained a greater than normal income, and several other extension agents who estimated below normal incomes for the average farmer indicated that there were other farmers in their counties who had their best year yet. Obviously, many factors must have influenced the economic vulnerability of Wisconsin's dairy farmers to the drought.

Decreases in net farm income were strongly or moderately felt by 67 percent of the dairy farmers surveyed, an even larger proportion than those farmers reporting decreases in gross farm income (56 percent). (See Table 10.) Decreases in net farm income were only "slightly felt" by 20 percent of the dairy operators, while 13 percent claimed such decreases were "not felt at all." Half of the farmers indicated that shortages in hay or

alfalfa were "strongly felt" with an additional 24 percent claiming these shortages were "moderately felt." Nevertheless, increases in farm indebtedness as a result of the drought were strongly or moderately felt by only 38 percent of the farmers. Drought-induced bank foreclosure threat was strongly or moderately felt by 8 percent of the dairy farmers, and the sales of lands or farm equipment was similarly felt on 10 percent of the farms. Thirty-five percent of the farmers indicated that a "greater need of off-farm income" was strongly or moderately felt.

Drought induced declines in gross and net income, shortages of hay and feed grains, and increased indebtedness were experienced by a broad spectrum of Wisconsin dairy farmers. No differences were noted among the farmers based upon the age of the farmers, the number of years as farm operator, farm acreage, size of dairy herd, the farmer's land tenure status, or whether the farm was a grade A or grade B operation. On the other hand, the response of the farmers to the shortages of hay and feed supplies were related to a number of these characteristics (Table 12). For example, farmers most likely to have already purchased hay or feed grains as a result of the drought were the youngest, those with lower net incomes, those with the largest number of cows, and those with off-farm incomes.

#### Drought Relief

Hay and feed purchases were financed primarily by four sources. Thirty-seven percent of the surveyed farmers indicated that drought relief payments from the government were the most important source of funds to make these purchases. Thirty-five



percent of the farmers primarily relied upon their farm income (milk check) or withdrawal of funds from their savings to purchase hay or feed. Thirteen percent borrowed funds from banks or other financial institutions. It should be noted that the effects of drought-reduced 1988 hay harvest were not evenly distributed. Farmers who had hay surpluses carried over from the 1987 growing season were not faced with substantial purchases, and in some cases were in a position to profit from sales of their surpluses at substantially higher than normal prices.

Wisconsin dairy farmers were asked to evaluate the importance of various factors in helping their farms financially survive the 1988 drought and its aftereffects (Table 13). The two most important factors were government drought relief payments and increased milk support prices, cited as "very important" by 44 and 41 percent of the farmers, respectively. Actually, milk support prices were not increased above pre-drought levels, but a scheduled drop in support prices was omitted. Personal savings were cited as "very important" by 26 percent of the dairy operators, bank credit by 22 percent, and off-farm income by 17 percent. Crop insurance payments were "very important" to only 8 percent of the farmers.

Financial assistance through the Disaster Assistance (Drought Relief) Act was reported by 75 percent of the Wisconsin dairy farmers surveyed, a proportion greater than those who reported this assistance was either "important" or "very important" in helping their farm financially survive the drought. Of those who received this financial assistance, 73 percent indicated that they would have been able to remain in the dairy

business even without the aid. Twenty-one percent doubted their ability to remain in business without the aid, while the remaining 6 percent expressed uncertainty. In contrast, the agricultural extension agents estimated that without the drought relief payments that only 9 percent of the dairy farmers would succumb.

The receipt of drought relief payments was most significant in the survival of Grade B dairy farms, the farmers with off-farm income or employment, those farmers who reported that decreases in net farm income was moderately and strongly felt, and the farmers reporting the greatest hay and corn crop losses in 1988.

#### Vulnerability to Continued Drought Stresses

A third of the dairy farmers surveyed indicated that, if there was a drought during the summer of 1989, they would no longer be in business by Spring 1990. However, an indication that the drought of 1988 still has many victims to claim was the finding that seven percent of the dairy farmers indicated they did not expect to still be in business next year, even if rainfall amounts are normal during the summer of 1989. Another indicator of the vulnerability of many dairy farmers is their desire to sell their farms. Statewide 29 percent of the dairy farmers surveyed affirmatively answered the question, "Would you like to sell your farm?" This was particularly prevalent throughout the northern third of Wisconsin, where 40 percent of the dairy farmers wished to sell. (It should be noted that for northwestern Wisconsin drought conditions began during the summer of 1987. Furthermore the entire northern portion of the state has seen the highest rates of farm abandonment over the past

decade and the greatest participation rates in the Dairy Termination Program (Cross 1989).) On the other hand, although 34 percent of the surveyed farmers within Northwestern and North Central Wisconsin doubted their ability to survive another drought during 1989, the highest levels of vulnerability were reported in Central and East Central Wisconsin (where 44 percent felt vulnerable).

Farmers who expressed the greatest concern about their vulnerability in continued drought were typically those with smaller than average farm acreages, with below average herd sizes, who have Grade B operations (Table 14). Although not statistically significant, a greater vulnerability was expressed by those dairy operators who were in neither the youngest nor oldest groups of operators. Strong statistical relationships were noted between the farmers' expectations that they could survive a 1989 drought and their crop losses (especially corn) in 1988 and the adequacy of their hay and feed grain supplies (Table 15). Those farmers who indicated they did not expect to still be in business--drought or no drought--by 1990 were generally the oldest, with the greatest number of years as farm operators, and with smaller and average herd sizes. Those who expected to quit by 1990 suffered drought-induced crop losses and feed and hay shortages which were no different than the remaining farmers.

#### Drought Mitigation for 1989

Experience with a drought equal to that which occurred in 1988 was cited by only 23 percent of the dairy farmers, although the typical farmer had operated his farm for twenty years. With

virtually all Wisconsin dairy farmers suffering crop losses, with over three-quarters reporting losses in net income, and with 70 percent expecting a drier than normal 1989 growing season, it is surprising that many farmers have made no efforts to mitigate future losses.

Crop insurance to cover drought losses had been obtained by 8 percent of the surveyed Wisconsin dairy farmers in 1988. At the same time 36 percent of these farmers had obtained crop insurance to cover hail losses. For their 1989 crop season, 51 percent of the dairy farmers reported that they either had or would obtain crop insurance to cover drought losses. Such a low figure is surprising because multiperil crop insurance is required of recipients of drought relief payments (Public Law 100-387, Section 207). Furthermore, several respondents indicated that they were only obtaining minimal crop insurance coverage because of its cost.

The 1988 drought prompted 42 percent of the dairy farmers to make changes in their crop planting plans for 1989. Although the farmers planned to continue their reliance upon growing corn and either hay and/or alfalfa, numerous changes in cultivation techniques and crops were undertaken by these farmers. In response to an open ended question, "What are these changes [in your crop planting plans for this year]?", most farmers described changes in crops which would be planted, with only a handful mentioning changes in plowing/planting dates or reduced tillage. Of the farmers reporting changes, most reported plans to grow more or less of specific crops. For example, 20 percent intended to grow

more corn, while 5 percent planned to grow less corn. The need to replant or grow more hay or alfalfa was cited by 24 percent of these farmers. Twelve percent of the farmers citing changes indicated they were planting more sudan grass. On the other hand, only 14 percent of the respondents mentioned changes in their use of fertilizers or herbicides.

Farmers most likely to report that the 1988 drought caused them to make changes in their crop planting plans for 1989 were the farmers with the greatest acreages. Likewise, younger and middle-aged farmers were significantly more likely to report changes than the older farmers (those over 60 years of age). On the other hand, the land tenure status of the farmers, the size of the farmer's dairy herd, and whether the herd was a Grade A or Grade B operation were unrelated to changes in the crop planting.

The prominence of hay/alfalfa, corn, and oat production on Wisconsin dairy farms remains unchanged following the drought. Ninety-five percent of the surveyed farmers reported planting corn in 1988 and 94 percent intended to grow corn in 1989. Similar proportions of the dairy farmers produced hay and/or alfalfa. Oats cultivation was found on 73 percent of the dairy farms in 1988, the same proportion which planned to grow oats in 1989. However, a slightly greater amount of crop diversification was planned for 1989, and the proportion of farms producing many of the lesser grown crops increased. For example, dairy farms planting sudan grass increased from 9.6 percent in 1988 to 13.3 percent in 1989; sorghum from 5.2 percent to 7.3 percent; peas (for silage) from 7.8 percent to 11.4 percent; barley from 7.8 percent to 9.6 percent; wheat from 5.6 to 7.8 percent; and rye

from 1.1 percent to 3.3 percent.

Irrigation is a rarity on Wisconsin dairy farms, notwithstanding various press reports during the 1988 drought about farmers installing systems. Only 3.2 percent of the surveyed farmers had irrigation systems in place before 1988, with an additional 1.4 percent installing systems during 1988. Only two (of the 283 farmers responding to the survey) planned to install an irrigation system during 1989.

Few Wisconsin dairy farmers mentioned any other actions (besides changes in their crop planting plans, crop insurance, and irrigation) which they planned to take to avoid any drought losses in 1989. The most commonly mentioned other action was prayer (by 8.9 percent of the respondents).

### Conclusions

The drought of 1988 has provided us with a unique opportunity to study drought perceptions and drought mitigation among a farm population which rarely has dealt with this hazard. Drought perception and impact research has typically been carried out among farmers of subhumid to semi-arid regions (Warrick 1975 and Rosenberg 1978). If predictions of climatologists about climatic warming because of the Greenhouse Effect are accurate (Schneider 1989), Wisconsin farmers must learn to increasingly deal with an increasingly capricious environment. The ability of dairy farmers to accurately perceive the climatic risks facing them and to appropriately respond to these risks may determine whether or not Wisconsin remains the nation's Dairy State in the Twenty-first Century.

## References Cited

- Clark, Douglas. 1989a. "Precipitation Summary for 1988 and the Outlook for 1989." The Dryline: Drought Management Strategies (University of Wisconsin Cooperative Extension Service), Vol. 2, No. 1 (February 13, 1989), pp. 2-3, enclosures 1-4.
- \_\_\_\_\_. 1989b. "Winter Precipitation Summary." The Dryline: Drought Management Strategies (University of Wisconsin Cooperative Extension Service), Vol. 2, No. 3 (April 27, 1989), pp. 1-3, enclosures 1-3.
- Cross, John A. 1989. "Wisconsin's Changing Dairy Industry and the Dairy Termination Program." Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. In Press.
- Rosenberg, Norman J. (ed.) 1978. North American Droughts. (AAAS Selected Symposium 15). Boulder: Westview Press.
- Schneider, Stephen H. 1989. "The Greenhouse Effect: Science and Policy." Science. Vol. 243 (February 10, 1989), pp. 771-781.
- United States Department of Agriculture. 1988a. Weekly Weather and Crop Bulletin. Various issues May - October, 1988.
- \_\_\_\_\_. 1988b. "Producer Production Losses - Projection Damage Assessment Reports of August 24, 1988." Madison: Wisconsin State Agricultural Stabilization and Conservation Service Office. (xeroxed report).
- \_\_\_\_\_. 1989. Weekly Weather and Crop Bulletin. Various issues May - July, 1989.
- United States Department of Commerce. 1988. Climatological Data: Annual Summary: Wisconsin: 1988. Ashville: National Climatic Data Center, National Oceanic and Atmospheric Administration.
- \_\_\_\_\_. 1989. Weekly Climate Bulletin (Washington: Climate Analysis Center, National Oceanic and Atmospheric Administration). Various issues May-July, 1989, Numbers 89/18-89/27.
- Warrick, Richard A. 1975. Drought Hazard in the United States: A Research Assessment. Boulder: University of Colorado Institute of Behavioral Science (Program on Technology, Environment, and Man Monograph NSF-RA-E-75-004).
- Wisconsin Agricultural Statistics Service. 1989. Wisconsin 1989 Agricultural Statistics. Madison: Wisconsin Department of Agriculture, Trade, and Consumer Protection.
- Wisconsin Department of Administration. 1989. The Drought of 1988. Madison: Wisconsin Department of Administration.

TABLE 1

## DAIRY FARMERS PERDICTIONS OF 1989 SUMMER PRECIPITATION

---

"During this coming summer (Summer 1989), do you expect that precipitation will be wetter or drier than normal?"

Much wetter than normal . . . . .	0.4 %
Slightly wetter than normal . . . . .	4.7 %
Normal . . . . .	29.7 %
Slightly drier than normal . . . . .	50.7 %
Much drier than normal . . . . .	19.6 %

---

TABLE 2

## DAIRY FARMERS EXPECTATIONS OF DROUGHT DURING SUMMER 1989

---

"How likely is it that your area of Wisconsin will have a drought during the summer of 1989?"

Very Likely . . . . .	16.2 %
Likely . . . . .	35.0 %
Neither Likely nor Unlikely . . . . .	30.3 %
Unlikely . . . . .	17.0 %
Very Unlikely . . . . .	1.4 %

---



TABLE 3

DAIRY FARMERS PREDICTIONS OF 1989 SUMMER PRECIPITATION  
AND THE DATE OF RESPONSE TO THE DROUGHT IMPACT SURVEY

Summer 1989 Expected to be:	Questionnaire Returned		
	By May 25	After May 25	Total
Much wetter than normal	.5 %	0	.4 %
Slightly wetter than normal	3.6 %	6.0 %	4.7 %
Normal	21.2 %	33.7 %	29.7 %
Slightly drier than normal	54.9 %	41.0 %	50.7 %
Much drier than normal	19.7 %	19.3 %	19.6 %

TABLE 4

## EXPECTATIONS OF ANOTHER DROUGHT WITHIN 10 YEARS

Agricultural Reporting District	Drought Like 1988	Drought Worse Than 1988
Northwestern Wisconsin	53.6 %	21.4 %
North Central Wisconsin	37.0 %	3.7 %
Northeastern Wisconsin	58.3 %	29.2 %
West Central Wisconsin	49.7 %	22.5 %
Central Wisconsin	51.5 %	25.0 %
East Central Wisconsin	34.2 %	10.8 %
Southwestern Wisconsin	58.1 %	22.6 %
South Central Wisconsin	40.7 %	18.5 %
Southeastern Wisconsin	52.0 %	16.0 %
WISCONSIN TOTAL	47.8 %	18.8 %

TABLE 5  
PERCEIVED FREQUENCY OF DROUGHT LIKE THAT OF 1988

---



---

How frequently would you expect a drought such as occurred during the summer of 1988?

---

Once every 5 years . . . .	5.6 %
Once every 10 years . . . .	31.1 %
Once every 20 years . . . .	19.3 %
Once every 30 years . . . .	15.6 %
Once every 40 years . . . .	5.6 %
Once every 50 years . . . .	21.5 %
Once every 100 years . . . .	1.5 %

---

TABLE 6  
EXPECTATIONS OF WEATHER IN THE 1990'S

---



---

How do you think the weather in the 1990's will be in comparison with the 1980's?

---

Cooler and wetter than the 1980's	5.5 %
Cooler and drier than the 1980's	6.7 %
Warmer and wetter than the 1980's	6.7 %
Warmer and drier than the 1980's	44.9 %
Unchanged from the 1980's	36.2 %

---

TABLE 7

PERCEPTIONS OF DROUGHT, HAIL, FLOODS, AND INSECTS AS PROBLEMS

Indicate the degree to which the following factors may be problems facing dairy farmers in your county.

Hazard	Major Problem	Somewhat a Problem	Minor Problem	NOT a Problem
Drought Possibilities	36.5 %	42.7 %	16.2 %	4.6 %
Flood Possibilities	2.8 %	8.3 %	17.4 %	71.5 %
Hail Damages	5.1 %	23.9 %	43.1 %	27.8 %
Insect Infestations	7.2 %	29.2 %	41.9 %	21.6 %

TABLE 8

PERCEPTIONS OF FARM ECONOMIC CONDITIONS AS PROBLEMS

Indicate the degree to which the following factors may be problems facing dairy farmers in your county.

Factor	Major Problem	Somewhat a Problem	Minor Problem	NOT a Problem
Prices of Hay and Feed	52.9 %	32.7 %	10.6 %	3.8 %
Milk Support Prices	52.6 %	34.8 %	8.1 %	4.4 %
Property Taxes	51.1 %	34.2 %	10.2 %	4.5 %
Government Regulations	30.5 %	40.2 %	21.2 %	8.1 %

TABLE 9

DROUGHT PERCEPTIONS AND 1988 DROUGHT CONSEQUENCES:  
SUMMARY OF CHI-SQUARE SIGNIFICANCE LEVELS

1988 Drought Consequences	1989 Drought	Drought Perceptions			Drought Problem
		1989 Precip	1990's Drought	1990's Precip	
Decline in Gross Farm Income	.0105	.0093	.0047	.0025	.0001
Decline in Net Farm Income	.0011	.0367	NS	.0091	.0003
Increase in Farm Indebtedness	.0232	NS	NS	NS	.0029
Shortages in Hay or Alfalfa	NS	NS	NS	NS	.0025
Reliance on Drought Relief	.0026	.0479	.0006	.0088	.0075
Ability to Survive Drought in 1989	NS	NS	.0604	NS	.0004

NS indicates Not Significant at .10 level.

TABLE 10  
 IMPACTS EXPERIENCED RESULTING FROM 1988 DROUGHT

"Indicate to what degree (if any) you have experienced the following as a result of last summer's drought?"

Condition	Strongly Felt	Moderately Felt	Slightly Felt	NOT Felt
Decrease in gross farm income	27.0 %	29.2 %	23.2 %	20.6 %
Decrease in net farm income	39.1 %	27.8 %	20.3 %	12.8 %
Increase in farm indebtedness	19.6 %	18.1 %	23.1 %	39.2 %
Shortages in hay or alfalfa	49.8 %	24.3 %	13.9 %	12.0 %
Problems with corn toxicity	3.5 %	5.8 %	12.7 %	78.0 %
Bank foreclosure threat	3.5 %	4.3 %	6.7 %	85.5 %
Greater need of off-farm income	14.9 %	19.8 %	20.6 %	44.7 %
Sale of lands or farm equipment	3.5 %	6.9 %	6.9 %	82.7 %

TABLE 11

## CHANGE IN NET FARM INCOME FROM NORMAL DURING 1988

---

---

"Your Net Farm Income (from all sources) for 1988 was about what percent of normal?"

0 to 50 percent of normal . . . .	10.7 %
51 to 75 percent of normal . . . .	19.1 %
76 to 89 percent of normal . . . .	16.8 %
90 to 99 percent of normal . . . .	29.0 %
100 percent of normal . . . . .	13.7 %
101 to 200 percent of normal . . .	10.7 %

---

TABLE 12

SIGNIFICANT RELATIONSHIPS BETWEEN DAIRY FARMER CHARACTERISTICS  
AND RESPONSES TO DROUGHT-INDUCED HAY / FEED SHORTAGES

Farmer Characteristics	Farmer Responses			
	Purchase Hay/Feed	Reduce Herd Size	Change Feed Type	Reduce Feed Amount
Age of Farmer	.00977	NS	.04195	.09128
Years of Farm Operation	.00387	NS	.01902	.01837
Farm Acreage	NS	NS	NS	.03218
Farm Ownership	NS	NS	NS	.06011
Herd Size	.02114	.03078	NS	NS
Drop in Net Farm Income	.06239	.00777	.05057	.07215
Off-farm Income	.02173	.06594	NS	NS

NS indicates Chi-Square not significant at 0.1000 significance level.



TABLE 13

## IMPORTANCE OF VARIOUS FACTORS IN HELPING FARM FINANCIALLY SURVIVE

Factor	Very Impor- tant	Impor- tant	Nei- ther	Unim- portant	Very Unim- portant
Government drought relief payments	44.2 %	25.5 %	12.4 %	6.7 %	11.2 %
Crop insurance payments	7.9 %	8.3 %	27.9 %	31.7 %	34.2 %
Increased milk support price	41.8 %	37.1 %	10.5 %	5.5 %	5.1 %
Credit from bank	22.2 %	24.6 %	19.0 %	15.7 %	18.5 %
Personal savings	26.3 %	30.2 %	22.9 %	11.1 %	9.5 %
Off-farm employment	16.9 %	16.5 %	25.4 %	13.7 %	27.4 %

TABLE 14

SUMMARY OF SIGNIFICANT CHI-SQUARE RELATIONSHIPS  
BETWEEN DROUGHT VULNERABILITY OF FARMERS AND FARMER CHARACTERISTICS

Farmer Characteristics	Could Survive Drought in 1989	Could Survive Without Drought Relief Payment	Wish to Sell Farm
Age of Farmer	NS	NS	.01089
Years of Farm Operation	NS	NS	.08401
Farm Acreage	.06472	NS	NS
Farm Ownership	NS	NS	.039
Herd Size	.00177	NS	NS
Herd Grade (A/B)	.00881	NS	NS
Drop in Net Farm Income	.01891	.00909	.07437
Off-farm Income	.03370	NS	NS

NS indicates Chi-Square not significant at .0.1000 significance level.

TABLE 15

SUMMARY OF SIGNIFICANT CHI-SQUARE RELATIONSHIPS BETWEEN  
1988 DROUGHT IMPACTS AND FUTURE VULNERABILITY OF DAIRY OPERATIONS

Drought Impacts from 1988	Could Survive Drought in 1989	Could Survive Without Drought Relief Payment	Wish to Sell Farm
Hay Crop Losses	.06337	.00001	NS
Corn Crop Losses	.00392	.00424	.00923
Adequacy of Hay Supplies	.00000	.00000	NS
Adequacy of Feed Supplies	.00084	.00164	.05057
Increased Farm Indebtedness	.00004	.00000	.06922
Feed/Hay Purchases	.09500	.00112	NS

NS indicates Chi-Square not significant at 0.1000 significance level.

APPENDIX

Questionnaire sent to Wisconsin dairy farmers, May 4, 1989.