Short communication: Farm and socioeconomic characteristics of the top 100 dairy farm counties in the United States

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ABSTRACT

The objectives of this study are to describe dairy farm demographic and socioeconomic conditions in the top 100 counties in the United States for dairy sales in 2007, and to describe the association of dairy farm demographics with socioeconomic conditions. The top 100 counties were responsible for 56% of all US dairy sales in 2007 with a median growth rate of 78% compared with 1997. Counties varied widely for farm demographics with as few as 5 very large dairy farms that averaged \$17,924,000 in dairy sales per farm to as many as 1,730 dairy farms with less than \$250,000 in dairy sales per farm. Most of the top 100 dairy counties had higher illiteracy rates, a higher proportion of residents without a high school degree, and lower median incomes than state averages, but unemployment rates were similar to the state average. The socioeconomic measures were from public records and not collected specifically for this research. Nevertheless, the top dairy counties in the western states tended to have poorer socioeconomic conditions than the top dairy counties in other regions, and significant associations were observed between dairy farm demographics and socioeconomic conditions. Having many dairy farms was associated more favorably with county socioeconomic conditions than having high dairy sales.

Key words: farm demographic, socioeconomic, dairy counties

Short Communication

Dairy farms are an important contributor to rural economies. For example, an analysis of the New Mexico dairy industry with an input-output model indicated that every \$1 million in dairy sales resulted in \$1.92 million of output to the state economy (Cabrera et al., 2008). Additionally, socioeconomic conditions in rural communities that continue to rely on agricultural production are reported to be favorable compared with

rural counties whose economies have migrated toward other industries (Albrecht, 1998). This favorable relationship between the dairy industry and rural economies is an important consideration in public policy decisions that affect the dairy industry (CDE, 2010).

Although evidence exists that the dairy industry has a positive economic impact, relationships between the structure of the agricultural production systems and rural socioeconomic conditions are also important considerations (Durrenberger and Thu, 1996; Lobao and Stofferahn, 2008). County-level socioeconomic and farm demographic data are readily available to allow investigation into such relationships, but have not been frequently reported for the top dairy counties. The objectives of this study are to describe dairy farm demographics in the top 100 counties for dairy sales in 2007, describe socioeconomic conditions in the those counties, and describe the association of dairy farm demographics with socioeconomic conditions.

Farm demographic information was retrieved for 2007, which was the year of the latest agricultural census in the United States, from the National Agricultural Statistic Service at USDA (USDA-NASS, 2007). Data from the top 100 counties for dairy sales are included in the accompanying Excel (Microsoft, Seattle, WA) workbook (Supplementary file, available online at <http://www.journalofdairyscience.org/>). County-specific farm demographics that were available for all counties included the value of dairy sales, value of all agricultural sales (animal plus crop sales), number of dairy farms, the number of all types of farms, and the average age of all types of farmers. The value of dairy sales in 1997 was also available and used to calculate 10-yr percentage change in dairy sales. The number of dairy farms was the number of county operations with a North American Industry Classification System code of 11212 (US Census Bureau, 2010a). The value of dairy sales and number of dairy farms were subtracted from the value of all agricultural sales and the number of all farms, respectively, to derive the value of other farm sales and the number of other farms.

Total county land area as of 2000 (US Census Bureau, 2000), the 2007 county population estimate (US Census Bureau, 2007a), 2007 county and state pov-

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erty rate estimates (US Census Bureau, 2007b), 2007 county and state median household income estimates (US Census Bureau, 2007b), and proportion of county and state residents age 25 and greater without a high school degree in 2000 (US Census Bureau, 2010b) were all retrieved from the US Census Bureau. County and statewide illiteracy rates in 2003 were available from the National Center for Education Statistics (NCES, 2003), and 2007 county and state unemployment rates were available from the United States Department of Labor (USDOL, 2007). These additional county demographic statistics were merged with farm demographic data and are included in the accompanying Microsoft Excel workbook (Supplementary file, available online at <http://www.journalofdairyscience.org/>).

The following farm demographics were calculated for each county: dairy sales, dairy sales per farm, dairy sales per county resident, dairy sales per km², percentage change in dairy sales from 1997 to 2007, number of dairy farms, dairy farms per county resident, dairy farms per km², other agricultural sales per county resident, other farms per county resident, and average age of the county's farmers. Other agricultural sales (and farms) were determined by subtracting dairy sales (or farms) from all agricultural sales (or farms). Other agricultural sales would include the nondairy sales from dairy farms (e.g., cull cows, bull calves).

County poverty rate, median household income, proportion of residents without a high school degree, and illiteracy rates were all highly correlated (absolute values of correlations range from 0.47 to 0.93). Therefore, the first principal component of those statistics was derived using the PRINCOMP procedure of SAS (version 9.1.2, SAS Institute Inc., Cary, NC) to reduce the number of factors that needed to be associated with the described previously farm demographics. The principal component explained 78% of the variation for those factors and is referred to as the socioeconomic principal component. All factors received similar absolute weighting in the socioeconomic principal component, with eigenvectors of -0.44 for median income, 0.51 for illiteracy rate, 0.51 for poverty rate, and 0.52 for proportion of residents without a high school degree. Thus, a high value for the socioeconomic principal component is associated with a low median income, high illiteracy rate, high poverty rate, and high proportion of residents without a high school degree. Unemployment rate was not strongly correlated with the other socioeconomic factors (range of absolute values = 0.01 to 0.29) and was evaluated separately.

Counties were stratified into classes of the highest 25, middle 50, and lowest 25 counties for each farm demographic. Associations of farm demographics with the socioeconomic principal component and unemploy-

ment rate were evaluated with the GLM procedure of SAS (version 9.1.2, SAS Institute Inc., Cary, NC). The socioeconomic principal component and unemployment rate were treated as dependent variables. For analysis of the socioeconomic principal component, state poverty rate and state illiteracy rate were included in the model as covariates. State median income and the statewide proportion of residents without a high school degree were not significant effects ($P > 0.05$) for the socioeconomic principal component when state poverty rate and state illiteracy rate were included. Farm demographic variables were included in the model one at a time, and least squares means were estimated for each demographic. The analysis of unemployment rate was the same, except that state unemployment rate was included as a covariate in place of state poverty rate and state illiteracy rate.

The top 100 dairy counties produced \$17.99 billion of dairy sales in 2007, which was 56% of total US output. Wisconsin had the most counties in the top 100 with 27, followed by California (13), New York (12), Idaho (7), Texas (6), Minnesota and Pennsylvania (5 each), Michigan (4), Vermont (3), and 10 states with 1 or 2.

The median, minimum, and maximum of each farm demographic and socioeconomic condition is reported in Table 1. The median county dairy sales were \$104 million, and the median increase in sales was 78% when compared with 1997 for the same counties. On average, 48% of county agricultural sales were dairy sales and 13% of farms were dairy farms. The total proportion of sales from the county dairy farms are >48% because revenue from the sale of cows to slaughter and from the sale of bull calves are not included in the dairy sale estimates. The top dairy county in 2007 (Tulare, CA) was also the top dairy county in 1997. A wide range was observed in the types of counties represented in the top 100, with the number of recorded dairy farms ranging from 5 (Hamilton, KS; Morrow, OR) to 1,730 (Lancaster, PA). Variation was also observed in the contribution of dairy sales to the county's total agricultural sales, ranging from 7% (Sioux, IA) to 88% (Tillamook, OR).

The number of counties that had favorable socioeconomic conditions when compared with their state is reported in Table 2. Because of variation across geographical regions, results were stratified into East (22 counties), Upper Midwest (UMW; 40 counties), and West (38 counties) regions. Forty-seven counties had higher poverty rates than their state average, but this varied by region, with a high proportion of counties (76%) in the West with relatively higher poverty rates and lower proportions in the East (32%) and UMW (28%). The West counties were also slightly more likely to have unemployment rates higher than their state

Table 1. Median, minimum, and maximum counties for farm and socioeconomic demographics

Item	Median	Minimum		Maximum	
		County, state	Value	County, state	Value
Farm demographics					
Dairy sales 2007 (\$ thousands)	\$104,357	Wood, WI	\$67,268	Tulare, CA	\$1,685,257
Dairy sales 1997 (\$ thousands)	\$59,025	Morrow, OR	\$183	Tulare, CA	\$611,789
Change in sales 1997–2007 (%)	78	Riverside, CA	−30	Morrow, OR	48,873
Dairy sales per resident	\$1,746	Sacramento, CA	\$54	Gooding, ID	\$33,311
Dairy sales per sq km	\$43,832	Owyhee, ID	\$4,328	Gooding, ID	\$252,168
Dairy sales per farm (\$ thousands)	\$733	Vernon, WI	\$183	Morrow, OR	\$17,924
Number of dairy farms	159	Two counties ¹	5	Lancaster, PA	1,730
Dairy farms per 100,000 residents	206	Maricopa, AZ	1	Clark, WI	2,882
Dairy farms per 1,000 sq km	65	Morrow, OR	1	Lancaster, PA	704
Nondairy agricultural sales (\$ millions)	\$124	Orleans, VT	\$12	Fresno, CA	\$3,294
Number of nondairy farms	1,169	Tillamook, OR	181	Fresno, CA	5,997
Farmer age	55.4	Lancaster, PA	47.7	Bailey, TX	62.1
Socioeconomic conditions					
Population	61,194	Hamilton, KN	2,591	Maricopa, AZ	3,872,962
Poverty rate (%)	12.2	Two counties ²	5.3	Roosevelt, NM	24.4
Illiteracy rate (%)	11.1	St. Croix, WI	4.5	Tulare, CA	31.5
Median income	\$46,849	Roosevelt, NM	\$29,857	Chester, PA	\$82,979
No high school degree (%)	19.5	Dane, WI	7.8	Parmer, TX	39.3
First principal component	0.0	Chester, PA	−4.0	Tulare, CA	4.4
Unemployment rate (%)	4.6	Owyhee, ID	1.9	Merced, CA	10.0

¹Hamilton, KS, and Morrow, OR.²Calumet, WI, and St. Croix, WI.

and most counties in both the West and UMW had illiteracy rates and proportions of residents with no high school degree that were greater than their state level. Of the 27 counties that had a median income greater than their state median income, 19 were from the UMW and only 2 were from the West. Counties with higher median incomes tended to be less rural, with a higher average population density (77 versus 40 residents per km²) and fewer farms per resident (2,059 vs. 3,052 farms per 100,000 residents) than counties with median household incomes below the state average.

Least squares means of the socioeconomic principal component and unemployment rate are presented in

Table 3. The highest 25 counties for total dairy sales, dairy sales per resident, dairy sales per farm, and the percentage change in dairy sales from 1997 all had a significantly higher socioeconomic indicator than the remaining counties. Dairy sales per farm had a relatively strong relationship with the socioeconomic principal component, and raw means for each of the individual factors that contributed to the principal component were more unfavorable for the highest 25 counties. The highest 25 counties averaged \$2.7 million of dairy sales per farm, compared with \$1.7 million for the middle 50 counties and \$296,570 for the bottom 25 counties. Raw means for illiteracy rate, proportion of residents with no high school degree, and poverty rate were 10.8%,

Table 2. The number of top 100 dairy counties in the East, Upper Midwest (UMW), West, and all regions with rates of poverty, illiteracy, no high school degree, and unemployment that were less than or equal to their state and county level median incomes that are higher than their state median incomes

Item	Region ¹			
	East	UMW	West	All
Total counties (n)	22	40	38	100
Poverty rate (n)	15	29	9	53
Illiteracy rate (n)	13	12	14	39
No high school degree (n)	13	12	5	30
Unemployment (n)	12	24	17	53
Median income (n)	6	19	2	27

¹East = Florida, New York, Pennsylvania, Vermont, Virginia; UMW = Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin; West = Arizona, California, Colorado, Idaho, Kansas, New Mexico, Oregon, Texas, Washington.

Table 3. Least squares means for the socioeconomic principal component and unemployment rate of the top 25, middle 50, and bottom 25 counties for various farm demographics

Farm demographic	County rank		
	Top 25	26–74	Bottom 25
Socioeconomic principal component ¹			
Total dairy sales	0.71 ^a	−0.25 ^b	−0.25 ^b
Dairy sales/resident	0.97 ^a	−0.07 ^b	−0.88 ^c
Dairy sales/sq km	−0.03	−0.22	0.46
Percent change in dairy sales from 1997	1.05 ^a	−0.41 ^b	−0.29 ^b
Dairy sales/farm	1.54 ^a	−0.60 ^b	−0.42 ^b
Total number of dairy farms	−0.20 ^a	−0.41 ^a	1.01 ^b
Dairy farms/resident	0.27	−0.29	0.28
Dairy farms/sq km	−0.57 ^a	−0.37 ^a	1.32 ^b
Other agricultural sales/resident	1.07 ^a	−0.13 ^b	−0.86 ^c
Other farms/resident	0.70 ^a	0.02 ^b	−0.78 ^c
Average farmer age	0.85 ^a	−0.24 ^b	−0.44 ^b
Unemployment rate			
Total dairy sales	5.61 ^a	4.48 ^b	4.74 ^b
Dairy sales/resident	4.95	4.82	4.77
Dairy sales/sq km	5.15 ^a	4.43 ^b	5.31 ^b
Percentage change in dairy sales from 1997	5.03	4.85	4.62
Dairy sales/farm	5.44 ^a	4.70 ^b	4.48 ^b
Total number of dairy farms	4.72	4.86	4.92
Dairy farms/resident	4.81 ^{ab}	4.57 ^b	5.40 ^a
Dairy farms/sq km	4.34 ^a	4.99 ^b	5.06 ^b
Other agricultural sales/resident	5.10	4.77	4.71
Other farms/resident	4.86	5.02	4.50
Average farmer age	4.77	4.53	5.28

^{a-c}Values within a row that do not share a common superscript are significantly different ($P < 0.05$).

¹Higher values are associated with higher poverty rates, higher illiteracy rates, a higher proportion of residents age 25 or greater with no high school degree, and lower median household income.

10.6%, and 5.7% higher, respectively, whereas median income was \$6,688 lower for the highest 25 counties for dairy sales per farm compared with the remaining 75 counties.

Differences among farm demographic levels were generally less strongly related to unemployment rate than to the socioeconomic principal component. Nevertheless, the top 25 counties for total dairy sales and dairy sales per farm had significantly higher unemployment rates than the remaining counties. Least squares means for unemployment rate in the highest 25 counties for dairy sales per farm were 0.74 and 0.96% higher than in the middle 50 and bottom 25 counties, respectively. Counties with high sales of other agricultural products were also significantly associated with poorer socioeconomic conditions. This may indicate that large agricultural operations choose to locate in regions with poor socioeconomic conditions due to potentially lower operating costs and land availability. Additionally, counties with older farmers had poorer socioeconomic conditions.

In contrast to relationships with dairy sales, the top 25 counties for the number of dairy farms and number of dairy farms per km² had a significantly more favorable value for the socioeconomic principal component than the bottom 25 counties. The top 25 counties for dairy

farms per km² also had significantly lower unemployment rates than the bottom 25 counties. Favorable socioeconomic conditions may result in higher land prices and more competition for labor in counties with many dairy farms, which could limit opportunities for farm consolidation. Alternatively, dairy industry structure may play a more direct role in county socioeconomic conditions. Durrenberger and Thu (1996) concluded that increasing the number of hog operations would have a more favorable impact on local socioeconomic conditions than increasing hog production from a few operations. Lobao and Stofferahn (2008) reviewed 51 studies and concluded that a shift toward farm models with a division of labor among ownership, day-to-day management, and farm work was associated with largely detrimental effects on community welfare compared with models where ownership was also responsible for farm management and labor.

The top 100 counties for dairy sales in the United States generated most dairy sales in 2007 and experienced a high rate of growth compared with 1997. Those counties varied widely in dairy farm demographics, from a large number of relatively small farms to as few as 5 very large farms. Sales per farm in 2007 ranged from less than \$250,000 to greater than \$17 million. Most of

the top 100 dairy counties had higher illiteracy rates, a higher proportion of residents without a high school degree, and lower median incomes than state averages, but unemployment rates were similar to the state average. Socioeconomic conditions in counties from the West generally compared unfavorably to counties in other regions. Having many dairy farms was associated more favorably with county socioeconomic conditions than having more dairy sales; however, whether this is because poorer regions attract large-scale farms, large-scale farms have a less favorable impact on community welfare, or both, is not clear, partly because the socioeconomic measures were from public records and not designed specifically for this research.

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