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The Changing Landscape of U.S. Milk Production

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Abstract

The U.S. dairy industry underwent dramatic restructuring during the last 50 or so years. Key structural features of the dairy industry are the quantity of milk produced and the location, number, size, and organization of dairy farms. The questions of where, how much, and by whom milk is produced are important from both a national and a regional perspective. The structure of milk production defines the potential direction of the industry. Dairy farms continue to grow, become more concentrated in certain regions, and become more specialized in producing milk. However, small traditional dairy operations remain scattered around the country.

Keywords: Dairy, farm numbers, farm organization, milk production, structure, structural change.

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Summary

The dairy industry underwent dramatic restructuring in the last 50 or so years. The 1997 U.S. Department of Agriculture report by Manchester and Blayney, *The Structure of Dairy Markets: Past, Present, Future*, described selected dairy product markets, firms in the markets, and changes in the markets and firms for the 1975-99 period. This report provides a similar examination of milk production. Structural changes in milk production are a result of long-term evolutionary processes such as adoption of technological innovations, changes in the production system, and specialization. The key features of milk production examined in this report are the quantity of milk produced, and the location, number, size, and business organization of dairy farms.

Total U.S. milk production in 2000 was about 167.7 billion pounds, about 45 percent more than in 1975. Milk was produced in every State, but long-term milk production growth in California and more recent production growth elsewhere (for instance, southern Idaho, eastern New Mexico, eastern Washington State, and southwestern Kansas) changed the landscape of production. The number of farms with milk cows as well as the number of specialized dairy farms declined dramatically, while the herd size grew. The noticeable changes in the number and size of dairy farms were not matched by any major changes in business organization (ownership). Commercial dairy farms continue to be owned and operated mainly by individuals and families.

Regional milk production shares generally were unchanged over the 1975-2000 period, with the Mountain and Pacific shares growing, while the remaining regional shares were relatively unchanged or at best increasing slowly. Most dairy farms were still located in the traditional regions (Northeast, Lake States, and Corn Belt). In an industry with a great increase in milk output per animal, a more important regional issue is the location of the cows. A general decline in the shares of the milking cow herd (or at best a slow growth) describes all regions except the Southern Plains, Mountain, and Pacific. Marked differences in milk production per cow between western regions and the rest of the country have emerged since the mid-1980s. Individual or family dairy farm ownership dominates in all regions and, if partnerships (many likely involving family members) are included, the share in the two categories jumped to well over 90 percent in every region.

Today's production structure is the foundation for future milk production. As the 20th century ended, concentration and industrialization of agricultural industries became widely debated topics. Dairy farming is more industrialized today than previously, and prospects for the continuation of that process exist but are not totally unconstrained. Environmental concerns are increasing since several key milk-producing areas are in environmentally sensitive locations. Milk production concentrated in particular geographic areas may be disrupted by adverse weather conditions, such as El Niño or the severe cold weather in upstate New York in early 2000. The importance of larger dairy operations and the continued use of many different milk production systems are likely to continue into the foreseeable future—trends suggesting structural change in the dairy industry will remain a topic of interest.

Introduction

The U.S. dairy industry has undergone dramatic restructuring since the end of World War II. Dairy farms, milk processors and manufacturers, milk and dairy product marketing firms (including dairy cooperatives), and retail outlets for food products are very different today from 50, or even 20, years ago. The structure of agricultural product markets has also changed during the same period. A recent USDA report described changes in selected dairy product markets in the United States during the 1975-99 period (Manchester and Blayney, 1997). This report provides a similar overview of milk production, the raw product supply sector of the industry.

Impetus for Changes in the Structure of Milk Production

Structural changes in dairy farming and milk production in the United States derive from long-term evolutionary processes (table 1 and fig. 1). The underlying forces that shape the direction and magnitude of milk production fit one of three broadly defined categories: technological innovations, changes in the milk production system, and specialization.

Technological innovations revolutionized agricultural production. Substituting machinery and equipment (capital inputs) for labor increased the efficiency of milk production. This substitution is one facet of the industrialization of agriculture. Dairy farmers redirected their energies toward milk production when farm machinery eased other tasks such as crop or forage production. Inside the dairy barn, mechanical milking machines, feeding systems, and waste-handling equipment contributed to efficiency gains. Widespread electrification of rural areas allowed milk producers to use refrigeration and bulk tank milk storage, with their associated improvements in health and sanitary conditions. Ongoing design changes in milking parlors and animal housing, development of computerized monitoring tools, and further refinements of technologies continue to change milk production (Weimar and Blayney, 1994).

A more subtle force, but with just as much effect as innovations, was the widespread shift from a pasture-based milk production system to confinement feeding systems. Substitution of purchased or home-grown feed rations for pasture and some forages freed labor

and, in some cases, capital (including human capital) to focus on cow management. Milk production per cow increased as the change was made, lowering production costs. Producers increased milk production with the same number of, or possibly even fewer, cows. Expanding production provided a means to reduce costs and take advantage of economies of scale. Production increases also propelled dairy farmers to produce milk for use beyond just their own farm and local communities.

Finally, forces promoting specialization developed. First, milk production changed from being an activity, perhaps only a sideline, on a farm with milk cows to an activity on an operation where milk production was the sole or most important activity. Second, specialized milk production changed the farmer from a jack-of-all-trades to a more specialized worker—and not necessarily just a milker. The farmer may not be in the barn at all; he or she may be a buyer of inputs (like feed), a manager of inputs (labor and cows, for example), or a financial manager. For some dairy farmers, this has been a difficult transition. Finally, specialization contributed to creation of identifiable dairy regions, a factor with important ramifications for dairy farmers and other members of society.

Dairy farming was a major activity in New England and the Northeast for many years. As westward expansion opened new and less expensive land in the interior, dairy farmers moved there with other pioneers. Dairy farming eventually became a major agricultural activity in the Lake States, particularly Wisconsin, and later in California. Milk production is often associated with what are called “traditional” or “nontraditional areas.” Expansion of milk production into nontraditional areas has fueled debates about the future of the dairy industry.

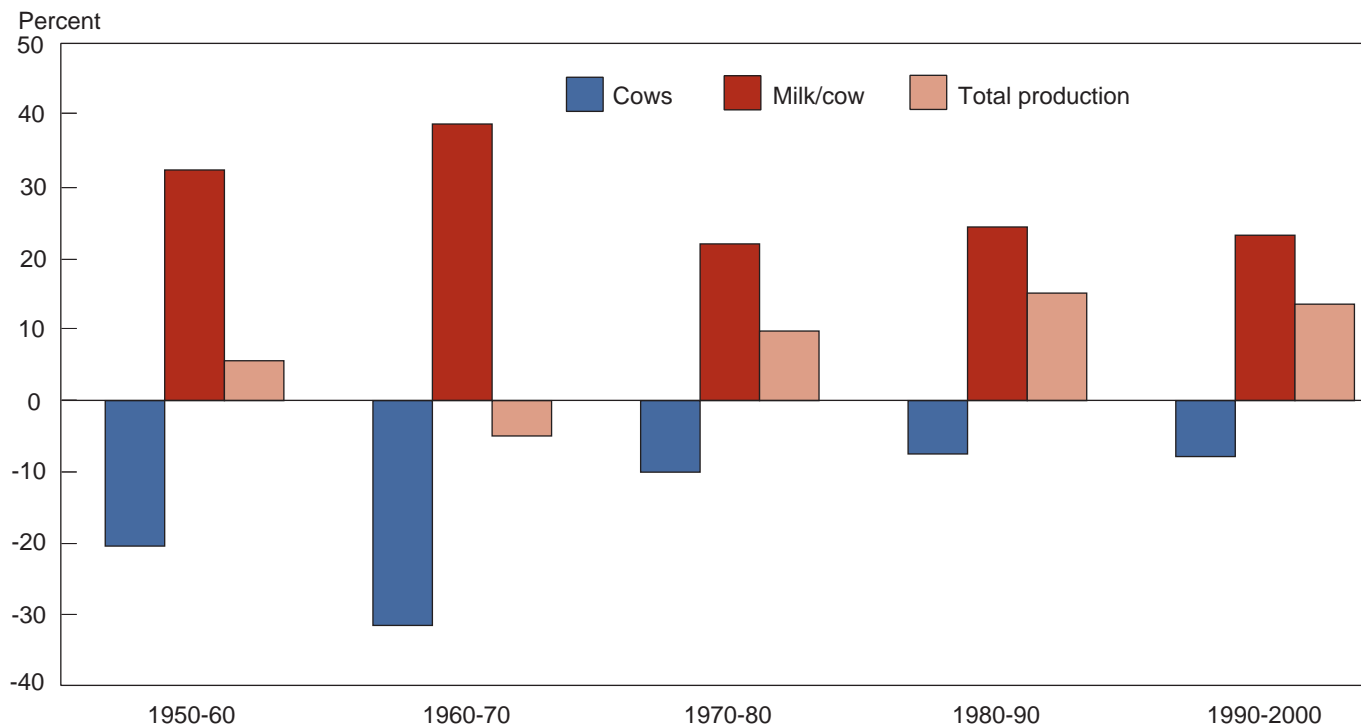
Rapid production growth in nontraditional areas occurred for economic reasons (resource availability and market access, for example) as well as for such considerations as climate and family or social linkages (Fallert, Weimar, and Crawford, 1993). Increases in the size of dairy operations have led to situations where a few operations (or even only one) may greatly affect regional milk production. Dairy farmers cluster in many areas, partly due to social and family links, resulting in a large concentration of production in a small area. Such growth is potentially dangerous to the environment, but the new operations are often state

Table 1—U.S. milk production, selected years

Year	Average cow numbers	Production per cow	Total production	Change in average cow numbers	Change in production per cow	Change in total production
	<i>1,000</i>	<i>Pounds</i>	<i>Millions</i>	<i>..... Date-to-date percent</i>		
1950	21,994	5,314	116,602			
1955	21,044	5,842	122,945	-4.32	9.94	5.44
1960	17,515	7,029	123,109	-16.77	20.32	0.13
1950-60				-20.36	32.27	5.58
1965	14,953	8,305	124,180	-14.63	18.15	0.87
1970	12,000	9,751	117,007	-19.75	17.41	-5.78
1960-70				-31.49	38.73	-4.96
1975	11,139	10,360	115,398	-7.18	6.25	-1.38
1980	10,799	11,891	128,406	-3.05	14.78	11.27
1970-80				-10.01	21.95	9.74
1985	10,981	13,024	143,012	1.69	9.53	11.37
1990	9,993	14,782	147,721	-9.00	13.50	3.29
1980-90				-7.46	24.31	15.04
1995	9,466	16,405	155,292	-5.27	10.98	5.13
1996	9,372	16,433	154,006	-0.99	0.17	-0.83
1997	9,252	16,871	156,091	-1.28	2.67	1.35
1998	9,154	17,189	157,348	-1.06	1.88	0.81
1999	9,156	17,772	162,716	0.02	3.39	3.41
2000	9,210	18,204	167,658	0.59	2.43	3.04
1990-2000				-7.84	23.15	13.50

Sources: U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, various years; *Milk Production, Distribution, and Income, 1999 Summary*, April 2000; and *Milk Production*, February 2001.

Figure 1
10-Year changes in average cow numbers, production per cow, and total production, 1950-2000



of the art and are designed to meet strict environmental constraints. Milk production growth and structural change are not confined to nontraditional areas; there has also been change in traditional areas such as New York and Minnesota (Dickrell, 1993).

Defining “Structure” for Examining Milk Production

A first step in this study is to ask: What is meant by the phrase “structure of milk production”? Several definitions of “structure” (and, by extension, “structural change”) are offered (Scherer, 1971, and USDA, 1979). A common characteristic of each definition is its many elements. Harrington and Manchester (1986) define three structural dimensions of agriculture: production, finance, and policy. Each structural dimension is, in turn, associated with a set of characteristics or elements. The production dimension consists of farm number and size, concentration, specialization, contracting and integration, technology, farm business organization, tenure, and farmland ownership.

Many analyses of the structure of milk production focus only on the number and size of dairy farms, but here the broader view of Harrington and Manchester is, at least partially, taken. This report describes these key features of milk production: (1) the quantity produced, both total and per cow, (2) location of production, (3) number and size of dairy farms, and (4) business organization of dairy farms. After considering changes in each key element, the report provides some thoughts on the future of U.S. milk production.

Quantity of Milk Produced on the Farm

Almost 167.7 billion pounds of milk was produced in the United States in 2000, 45 percent more than in 1975. Production grew in 18 of the 25 years following 1975, averaging 1.8 percent per year. Before 1975, the pattern was very different. The total production in 1975, about 115.4 billion pounds, was almost 1 percent below 1950s production and the number of years of growth and decline were the same. From 1950 to 1975, production declined an average of 0.02 percent per year (app. table 1).

The number of milk cows on farms and milk production per cow also significantly changed over the 1950-2000 period. In only a few years during that span did cow numbers increase and milk per cow decrease. The net effect of the changes was the significant

growth of total milk production, despite a shrinking number of milk cows. Generally, some interesting patterns appear in the two data series, partly due to technological changes. Figure 1 shows 10-year changes in production, cow numbers, and milk per cow. Significant changes in the 1950s set the stage for continuing changes, although smaller in magnitude.

From 1950 to 1975, the average number of milk cows on farms declined by over 49 percent, from almost 22 million in 1950 to just over 11.1 million. The decline from 1975 to 2000, from 11.1 million to 9.2 million, was about 18 percent. Milk per cow nearly doubled from 1950 to 1975 (95 percent greater) and grew an additional 76 percent from 1975 to 2000. These changes occurred as dairy farmers adopted technological innovations and came to a better understanding of the biology of dairy cows.

Onfarm refrigerated bulk milk tanks, improved milking equipment, modern and efficient milking parlors, changes in animal housing, and improved feed-handling and waste-handling systems are examples of technological innovations widely adopted by dairy farmers. Advances in animal nutrition and health, improved artificial breeding techniques, and the recent addition of biotechnology, such as, but not limited to, rbST, helped farmers understand the biological processes of the milk cow. Finally, the management skills of milk producers improved; surveys consistently report that dairy farmers receive more formal education than previously.

Technologies have varying effects. Many technologies that milk producers first adopted had relatively large immediate effects on milk output. As innovations continued to be adopted, their effects generally were less dramatic, because smaller production gains were realized or fewer producers adopted them. Still, a 76-percent increase in milk per cow since 1975 is substantial.

Milk quality changed as dairy farming changed. Widespread adoption of improved milk-handling equipment played a role in the change, but so did milk pricing and regulatory actions. States established milk standards, usually based on sanitary and health conditions, that are embodied in milk grades. Fluid grade milk, which is Grade A in most States, meets the standards that allow its use in fluid (beverage) milk products and, by default, in all other dairy products. Grade B milk, which meets somewhat lower standards, may

be used only for producing manufactured dairy products such as butter, cheese, whole and nonfat dry milks, and canned milk.

Almost all milk produced and sold to plants and dealers in the United States is Grade A. Grade B sales to plants and dealers in 2000 were 2 percent of total production, or about 3.3 billion pounds. In 1975, the 22.1 billion pounds of Grade B milk sold to plants and dealers was just over 19 percent of total production. The largest percentages of Grade B sales to plants and dealers in 2000 were in North Dakota (29 percent) and Wyoming (20 percent). All other States had 8 percent or less Grade B sales (USDA, 2001).

Where Is the Milk?

Where milk is produced and where people think it ought to be produced are two issues at the root of many debates on dairy industry structure in the United States and other countries as well. Milk is produced in all 50 States (table 2). The top five milk-producing States in 2000 were California, Wisconsin, New York, Pennsylvania, and Minnesota. They accounted for about 53 percent of all milk produced. The same five States topped production in 1975, but the order was different. Wisconsin led, followed by California, New York, Minnesota, and Pennsylvania, and they produced almost 49 percent of the Nation's milk. The small percentage increase for these five States between 1975 and 2000 may seem slight, but the underlying total quantity grew substantially.

The total production shares of the top 10 States in 2000 and 1975 were 70 and 65 percent. The second five States in each case highlight one key change in milk production—growth in nontraditional dairy areas. Idaho, New Mexico, and Washington State replaced Iowa, Ohio, and Missouri—States in a traditional dairy area, the Midwest (Corn Belt). Coupled with the long-term milk production growth in California, large quantities of milk production in southern Idaho, eastern New Mexico, eastern Washington State, and southwestern Kansas contributed to the changing national landscape of milk production. The importance of western regions as major sources of milk supplies is a significant feature of the U.S. dairy industry and will remain so.

Number and Size of Dairy Farms

Counting dairy farms and determining their size ought to be a simple task. And, in fact counting is not the problem—it is defining what is, or is not, a dairy farm. The number of all farms in the United States fell about 69 percent from 1940 to 1997, while the number of farms with milk cows decreased even more, over 97 percent (table 3). As a share of all farms, farms with milk cows dropped from over 76 to 6 percent over the same period. In 1964-69, the largest percentage decrease in farms with milk cows (50 percent) occurred. The change in the actual number of farms reporting having milk cows was greatest between 1954 and 1959, a decline of about 1.1 million. The changes from one census of agriculture to the next have all been 20 percent or greater since 1974 except in one case, the 1982 Census.

What was behind the large drop during 1954-69 in farms reporting milk cows? The 1950s and 1960s were periods of increasing farm specialization. One result of specialization was the demise of many side-line dairy enterprises. The ongoing evolution of farm technologies and favorable prices for commodities other than milk helped to spur the change (Miller, 1969). The farms where this took place no longer kept milk cows.

Not all farms with milk cows are in the group that we call “specialized dairy farms.” The number of specialized dairy farms fell from just over 168,000 in 1978 to about 86,000 in 1997, a 49-percent decline. But specialized dairy farms as a percentage of all dairy farms increased from about 53 to 72 percent (table 4).

Structural change in the dairy industry is often couched in terms of large units, whether they are farms, processing plants, or other dairy businesses. “Large” means different things to different people. The average number of cows per dairy operation has more than tripled between 1975 and 2000, from 25 cows to 88. If a large dairy farm is one with 100 or more cows (Perez, 1994), just under 20 percent of dairy operations fit the description in 2000—up from 4.3 percent in 1978, the first year NASS data included the 100-or-more size category (table 5a).

Table 2—Milk production, by State and State shares of U.S. total, 1975 and 2000

State	1975 total	Share of U.S.	State	2000 ¹ total	Share of U.S.
	<i>Million pounds</i>	<i>Percent</i>		<i>Million pounds</i>	<i>Percent</i>
Wisconsin	18,900	16.4	California	32,240	19.2
California	10,853	9.4	Wisconsin	23,259	13.9
New York	9,964	8.6	New York	11,920	7.1
Minnesota	8,946	7.8	Pennsylvania	11,156	6.7
Pennsylvania	7,140	6.2	Minnesota	9,493	5.7
Top 5 total		48.4	Top 5 total		52.5
Michigan	4,411	3.8	Idaho	7,223	4.3
Ohio	4,259	3.7	Texas	5,735	3.4
Iowa	3,893	3.4	Michigan	5,705	3.4
Texas	3,208	2.8	Washington	5,593	3.3
Missouri	2,840	2.5	New Mexico	5,236	3.1
Top 10 total		64.5	Top 10 total		70.1
Illinois	2,446	2.1	Ohio	4,461	2.7
Washington	2,322	2.0	Iowa	3,934	2.3
Kentucky	2,319	2.0	Arizona	3,017	1.8
Indiana	2,210	1.9	Vermont	2,787	1.7
Tennessee	2,031	1.8	Florida	2,461	1.5
Vermont	2,009	1.7	Indiana	2,365	1.4
Florida	1,956	1.7	Missouri	2,258	1.3
Virginia	1,755	1.5	Illinois	2,094	1.2
South Dakota	1,556	1.3	Colorado	1,924	1.1
Idaho	1,555	1.3	Virginia	1,901	1.1
Maryland	1,550	1.3	Oregon	1,695	1.0
North Carolina	1,498	1.3	Kentucky	1,690	1.0
Nebraska	1,431	1.2	Utah	1,687	1.0
Kansas	1,392	1.2	South Dakota	1,634	1.0
Georgia	1,221	1.1	Kansas	1,520	0.9
Oklahoma	1,060	0.9	Georgia	1,433	0.9
Louisiana	1,054	0.9	Tennessee	1,405	0.8
Oregon	990	0.9	Maryland	1,351	0.8
Utah	919	0.8	Oklahoma	1,295	0.8
North Dakota	917	0.8	Nebraska	1,252	0.7
Mississippi	876	0.8	North Carolina	1,189	0.7
Colorado	845	0.7	Louisiana	705	0.4
Arizona	840	0.7	North Dakota	701	0.4
Arkansas	707	0.6	Maine	669	0.4
Alabama	686	0.6	Mississippi	544	0.3
Maine	629	0.5	Arkansas	524	0.3
Connecticut	608	0.5	Connecticut	478	0.3
Massachusetts	601	0.5	Nevada	476	0.3
New Jersey	528	0.5	Massachusetts	392	0.2
South Carolina	512	0.4	South Carolina	369	0.2
New Mexico	366	0.3	Alabama	348	0.2
West Virginia	350	0.3	Montana	315	0.2
New Hampshire	336	0.3	New Hampshire	310	0.2
Montana	278	0.2	New Jersey	266	0.2
Nevada	168	0.1	West Virginia	265	0.2
Hawaii	146	0.1	Delaware	149	0.1
Delaware	127	0.1	Hawaii	116	0.1
Wyoming	110	0.1	Wyoming	76	0.05
Rhode Island	63	0.1	Rhode Island	28	0.02
Alaska	17	0.01	Alaska	13	0.01
United States	115,398	100.0	United States	167,658	100.0

¹Preliminary.

Sources: U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, February 1981, and *Milk Production*, February 2001.

Table 3—Farms and farms with milk cows, selected years¹

Year	Total farms	Farms with milk cows ²	Share of farms with milk cows
	<i>Number</i>		<i>Percent</i>
1940	6,102,417	4,663,413	76.4
1945	5,859,169	4,481,384	76.5
1950	5,388,437	3,681,627	68.3
1954	4,782,416	2,956,900	61.8
1959	3,710,503	1,836,785	49.5
1964	3,157,857	1,133,912	35.9
1969	2,730,250	568,237	20.8
1974	2,310,581	403,754	17.5
1978	2,257,775	312,095	13.8
1982	2,240,976	277,762	12.4
1987	2,087,759	202,068	9.7
1992	1,925,300	155,339	8.1
1997	1,911,859	116,874	6.1

¹The definition of what constitutes a farm has changed through time.

²Farms reporting milk cow inventories at the end of the census year.

Source: *U.S. Census of Agriculture, U.S. Summary and State Data*, Volume 1, part 51, various years.

What is a Dairy Farm?

Once basic definitions are made, then the question shifts to one of describing the farm in some way; say small, large, specialized, or some other descriptor. Many definitions and descriptors exist—the task is to select those relevant for one’s purpose.

Since 1974, the Census of Agriculture has defined a farm as “any place from which \$1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year.” The agricultural census uses coding systems, the Standard Industrial Classification (SIC) and, for the most current and following censuses, the North American Industry Classification System (NAICS), to identify specialization in agricultural products. The term “specialized dairy farm or operation” is based on this agricultural census use.

We also use data supplied by the U.S. Department of Agriculture’s National Agricultural Statistics Service (NASS). NASS data are based on a definition of an operation as “any place having one or more head of milk cows, excluding cows used to nurse calves, on hand at any time during the year.” A place defined in this manner need not be a specialized dairy operation as defined above.

Still another source of dairy farm data is the American Farm Bureau Federation. We do not use that data in this report but acknowledge it as another widely cited set of information. Since 1992, the Farm Bureau has—with the assistance of State Farm Bureau and extension personnel—conducted surveys of regulatory agencies in each State to determine the number of farms actually selling milk, which might serve to describe commercial dairy farming operations.

Table 4—Activities of farms with milk cows, selected years¹

Census year	Home use only	Sideline	Selling milk	Specialized ²
<i>Percent</i>				
1940	45.9	43.1	56.4	10.9
1945	44.8	42.7	55.2	12.5
1950	45.0	38.5	55.0	16.5
1954	50.1	31.3	49.9	18.6
1959	43.2	32.9	56.8	23.9
1964	43.5	24.2	56.5	32.4
1969	36.6	17.4	63.4	45.9
1974	39.5	12.5	60.5	48.0
1978	30.7	16.5	69.3	52.8
1982	28.7	12.5	71.3	58.7
1987	21.2	11.8	78.8	67.1
1992	15.9	11.9	84.1	72.2
1997	17.0	11.1	83.0	71.9

¹Number of farms with milk cows calculated as farms reporting cow inventories as of end of census year, 1940-69. Number of farms with milk cows calculated as farms reporting cow inventories plus farms reporting sales but no cows as of the end of the census year, 1974-97.

²Farms in the SIC (Standard Industrial Classification) or, beginning in 1997, the NAICS (North American Industrial Classification System) dairy farm category which define milk sales as the primary source of farm income.

Sources: *U.S. Census of Agriculture, U.S. Summary and State Data*, Volume 1, part 51, various years, and Manchester, 1983.

Beginning in 1993, NASS began publishing data on the distribution of production by herd size categories. In 2000, about 71.1 percent of production came from operations of 100 or more cows, up from 55.2 percent in 1993. Production from the smallest herds, not a large share to begin with, fell by about half—from 4.1 to 2 percent (table 5b).

Almost 66 percent of the herd inventories were on large operations in 2000, more than twice the percentage in 1975. Recent NASS data, which include a 500-or-more-cows category, make a particularly telling point—slightly over 31 percent of the herd inventory was on these larger operations in 2000 (table 5c).

In 1993, large farms comprised about 14 percent of all operations, housed just over half of the cows, and provided 55.2 percent of the milk produced, or about 83.2 billion pounds. By 2000, large farms were 20 percent of operations, had almost 66 percent of the cows, and produced 119.2 billion pounds of milk (71.1 percent of production). The information about operations with more than 500 milk cows highlights another dimension of the dairy industry. Such operations are about 13 percent of the large operations, house about 48 percent of the cows, and provide just over half of the milk pro-

duced. Clearly, milk production is occurring on a smaller number of larger operations than in the past. The current and future development of large farms poses potentially sensitive questions for the dairy industry—including how it will affect dairy cooperatives.

One final observation is made concerning size. The average herd size of specialized dairy farms has become larger in every agricultural census year since 1978 (table 6). Perhaps more remarkable than the existence of a herd size difference between the specialized and the all dairy farm categories is that the difference itself has remained relatively steady at around 20 cows. Specialized dairy farms increased in size from 54 cows in 1978 to 100 cows in 1997, almost doubling. The growth rate of all dairy farms (which includes the specialized farms) has been larger, over 150 percent. The census data show that the nonspecialized dairy farms, which tend to be smaller in size, have also grown. In fact, the change in herd size on these farms is actually more than double. More dairy farms have been counted as specialized as they have increased herd size—evidence suggesting that larger farms specialize more in producing milk for sale to processors and dairy product manufacturers.

Table 5a—Distribution of dairy operations, by herd size, selected years

Year	Operations	Cows	Average cows per operation	Distribution of operations in each category					
				1-29 head	30-49 head	50-99 head ¹	100-199 head ²	200-499 head ³	500+ head
	<i>Number</i>	<i>1,000</i>	<i>Number</i>	<i>Percent</i>					
1940	4,663,431	21,936	5	99.1	0.7	0.2	*	—	—
1945	4,481,384	22,803	5	—	—	—	—	—	—
1950	3,681,627	21,367	6	98.3	1.3	0.5	—	—	—
1954	2,956,900	20,183	7	96.8	2.4	0.6	0.2	—	—
1959	1,836,785	16,824	9	93.3	4.9	1.5	0.3	0.1	—
1964	1,133,912	14,623	13	87.0	8.9	3.3	0.6	0.2	—
1969	568,237	11,174	20	76.7	14.8	6.8	1.7	—	—
1970	647,860	12,000	19	—	—	—	—	—	—
1971	591,870	11,839	20	—	—	—	—	—	—
1972	539,350	11,700	22	—	—	—	—	—	—
1973	497,040	11,413	23	—	—	—	—	—	—
1974	470,240	11,230	24	—	—	—	—	—	—
1975	443,610	11,139	25	—	—	—	—	—	—
1976	416,160	11,032	27	—	—	—	—	—	—
1977	393,510	10,945	28	66.9	17.4	15.7	—	—	—
1978	369,210	10,083	27	64.8	18.3	12.6	4.3	—	—
1979	349,470	10,734	31	63.1	18.3	13.8	4.8	—	—
1980	334,180	10,799	32	60.8	18.9	14.9	5.4	—	—
1981	320,160	10,898	34	58.5	19.6	16.2	5.7	—	—
1982	307,920	11,011	36	56.5	20.2	17.2	6.1	—	—
1983	297,740	11,059	37	54.2	20.9	18.4	6.5	—	—
1984	282,430	10,793	38	52.2	21.6	19.3	6.9	—	—
1985	269,050	10,981	41	50.5	21.5	20.5	7.5	—	—
1986	249,190	10,773	43	48.6	21.5	22.0	7.9	—	—
1987	227,880	10,327	45	46.0	22.4	22.8	8.8	—	—
1988	216,130	10,224	47	44.2	23.0	23.4	9.4	—	—
1989	202,890	10,046	50	42.2	23.1	24.4	10.3	—	—
1990	192,660	9,993	52	40.9	23.3	24.8	11.0	—	—
1991	180,640	9,826	54	39.8	22.8	25.9	11.5	—	—
1992	170,500	9,688	57	38.9	22.1	26.0	13.0	—	—
1993	157,150	9,581	61	37.3	22.2	26.8	9.3	4.4	—
1994	148,140	9,500	64	36.1	22.0	27.4	9.8	4.7	—
1995	139,670	9,466	69	34.5	22.2	28.1	10.2	5.0	—
1996	130,980	9,372	72	32.9	22.3	28.7	10.8	5.4	—
1997	123,700	9,252	75	31.6	22.1	29.0	11.4	4.1	2.0
1998	117,180	9,154	78	30.9	21.7	29.0	11.9	4.4	2.1
1999	111,000	9,156	82	29.7	21.6	29.7	11.9	4.8	2.3
2000	105,250	9,210	88	29.6	20.8	29.8	12.2	5.1	2.5

*indicates less than 0.05 percent.

—indicates no data were collected or reported for the year and size category.

¹Includes 100+ for 1977.

²Includes 200+ for 1974-92.

³Includes 200+ for 1974-96.

Sources: Compiled from Perez, 1994; U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates, 1988-92; Milk Cows and Production Final Estimates, 1993-97*; and *Milk Production*, February 2000. Data prior to 1970 is from the Census of Agriculture, various volumes.

Table 5b—Distribution of milk production, by herd size, selected years

Year	Operations	Cows	Average cows per operation	Distribution of cow inventory in each category					
				1-29 head	30-49 head	50-99 head ¹	100-199 head ²	200-499 head ³	500+ head
	<i>Number</i>	<i>1,000</i>	<i>Number</i>	<i>Percent</i>					
1940	4,663,431	21,936	5	—	—	—	—	—	—
1945	4,481,384	22,803	5	—	—	—	—	—	—
1950	3,681,627	21,367	6	—	—	—	—	—	—
1954	2,956,900	20,183	7	—	—	—	—	—	—
1959	1,836,785	16,824	9	—	—	—	—	—	—
1964	1,133,912	14,623	13	—	—	—	—	—	—
1969	568,237	11,174	20	—	—	—	—	—	—
1970	647,860	12,000	19	—	—	—	—	—	—
1971	591,870	11,839	20	—	—	—	—	—	—
1972	539,350	11,700	22	—	—	—	—	—	—
1973	497,040	11,413	23	—	—	—	—	—	—
1974	470,240	11,230	24	—	—	—	—	—	—
1975	443,610	11,139	25	—	—	—	—	—	—
1976	416,160	11,032	27	—	—	—	—	—	—
1977	393,510	10,945	28	—	—	—	—	—	—
1978	369,210	10,083	27	—	—	—	—	—	—
1979	349,470	10,734	31	—	—	—	—	—	—
1980	334,180	10,799	32	—	—	—	—	—	—
1981	320,160	10,898	34	—	—	—	—	—	—
1982	307,920	11,011	36	—	—	—	—	—	—
1983	297,740	11,059	37	—	—	—	—	—	—
1984	282,430	10,793	38	—	—	—	—	—	—
1985	269,050	10,981	41	—	—	—	—	—	—
1986	249,190	10,773	43	—	—	—	—	—	—
1987	227,880	10,327	45	—	—	—	—	—	—
1988	216,130	10,224	47	—	—	—	—	—	—
1989	202,890	10,046	50	—	—	—	—	—	—
1990	192,660	9,993	52	—	—	—	—	—	—
1991	180,640	9,826	54	—	—	—	—	—	—
1992	170,500	9,688	57	—	—	—	—	—	—
1993	157,150	9,581	61	4.1	13.1	27.6	18.9	36.3	—
1994	148,140	9,500	64	3.4	12.0	26.0	19.2	39.4	—
1995	139,670	9,466	69	3.1	11.3	26.1	19.8	39.7	—
1996	130,980	9,372	72	2.7	10.2	24.8	20.0	42.3	—
1997	123,700	9,252	75	2.4	9.5	23.4	20.0	44.7	—
1998	117,180	9,154	78	2.3	8.9	22.4	19.2	16.8	30.4
1999	111,000	9,156	82	2.0	8.5	20.9	17.9	16.9	33.8
2000	105,250	9,210	88	1.8	7.7	19.4	17.3	18.0	35.8

— indicates no data were collected or reported for the year and size category.

¹Includes 100+ for 1977.

²Includes 200+ for 1974-92.

³Includes 200+ for 1974-96.

Sources: Compiled from Perez, 1994; U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates, 1988-92; Milk Cows and Production Final Estimates, 1993-97*; and *Milk Production*, February 2000. Data prior to 1970 is from the Census of Agriculture, various volumes.

Table 5c—Distribution of cow inventory, by herd size, selected years

Year	Operations	Cows	Average cows per operation	Distribution of production in each category					
				1-29 head	30-49 head	50-99 head ¹	100-199 head ²	200-499 head ³	500+ head
	<i>Number</i>	<i>1,000</i>	<i>Number</i>	<i>Percent</i>					
1940	4,663,431	21,936	5	91.3	4.9	2.3	0.9	0.6	—
1945	4,481,384	22,803	5	—	—	—	—	—	—
1950	3,681,627	21,367	6	85.3	7.9	6.8	—	—	—
1954	2,956,900	20,183	7	—	—	—	—	—	—
1959	1,836,785	16,824	9	62.9	19.3	10.6	7.2	—	—
1964	1,133,912	14,623	13	47.2	25.3	16.3	5.9	5.3	—
1969	568,237	11,174	20	—	—	—	—	—	—
1970	647,860	12,000	19	—	—	—	—	—	—
1971	591,870	11,839	20	—	—	—	—	—	—
1972	539,350	11,700	22	—	—	—	—	—	—
1973	497,040	11,413	23	—	—	—	—	—	—
1974	470,240	11,230	24	—	—	—	—	—	—
1975	443,610	11,139	25	—	—	—	—	—	—
1976	416,160	11,032	27	—	—	—	—	—	—
1977	393,510	10,945	28	18.2	24.2	57.6	—	—	—
1978	369,210	10,083	27	15.9	24.3	29.6	30.2	—	—
1979	349,470	10,734	31	14.8	23.3	30.2	31.7	—	—
1980	334,180	10,799	32	13.5	22.9	30.4	33.2	—	—
1981	320,160	10,898	34	12.5	22.6	31.3	33.6	—	—
1982	307,920	11,011	36	11.6	22.2	31.9	34.3	—	—
1983	297,740	11,059	37	10.6	21.7	32.8	34.9	—	—
1984	282,430	10,793	38	10.5	21.7	32.7	35.1	—	—
1985	269,050	10,981	41	10.1	20.5	33.1	36.3	—	—
1986	249,190	10,773	43	9.1	19.4	33.9	37.6	—	—
1987	227,880	10,327	45	8.3	19.2	33.0	39.5	—	—
1988	216,130	10,224	47	7.8	18.6	32.4	41.2	—	—
1989	202,890	10,046	50	7.2	17.9	32.1	42.8	—	—
1990	192,660	9,993	52	6.9	17.3	31.5	44.3	—	—
1991	180,640	9,826	54	6.3	16.6	31.7	45.4	—	—
1992	170,500	9,688	57	5.5	15.2	30.0	49.3	—	—
1993	157,150	9,581	61	5.0	14.8	29.2	19.2	31.8	—
1994	148,140	9,500	64	4.6	14.0	28.7	19.3	33.4	—
1995	139,670	9,466	69	4.0	13.0	28.0	20.0	35.0	—
1996	130,980	9,372	72	4.0	12.0	27.0	20.0	37.0	—
1997	123,700	9,252	75	3.5	11.5	26.0	20.0	14.6	24.4
1998	117,180	9,154	78	3.5	10.5	24.2	19.3	15.5	27.0
1999	111,000	9,156	82	3.1	10.1	23.2	18.4	16.3	28.9
2000	105,250	9,210	88	2.9	9.1	22.0	18.0	16.3	31.4

—indicates no data were collected or reported for the year and size category.

¹Includes 100+ for 1977.

²Includes 200+ for 1974-92.

³Includes 200+ for 1974-96.

Sources: Compiled from Perez, 1994; U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates, 1988-92*; *Milk Cows and Production Final Estimates, 1993-97*; and *Milk Production*, February 2000. Data prior to 1970 is from the Census of Agriculture, various volumes.

Table 6—Number and size of all farms with milk cows and specialized dairy farms, selected census years¹

Herd size	1978		1982		1987		1992		1997	
	Number	SIC ¹	Number	SIC ¹	Number	SIC ¹	Number	SIC ¹	Number	NAICS ¹
1-4	121,252	1,923	81,538	1,634	42,394	968	26,946	515	17,974	391
5-9	15,799	3,576	11,121	3,077	7,468	1,936	5,857	2,949	4,850	630
10-49	131,946	101,945	112,009	91,441	83,530	69,987	60,315	51,319	40,833	34,556
50-99	48,023	44,098	53,253	49,213	48,317	44,856	41,813	38,756	33,477	30,858
100-199	12,052	11,448	14,535	13,707	14,838	14,081	14,062	13,267	12,602	11,776
200-499	3,295	3,191	3,974	3,852	4,253	4,106	4,652	4,492	4,881	4,705
500+	843	833	1,052	1,039	1,268	1,250	1,694	1,676	2,257	2,221
Total farms	333,210	167,014	277,482	163,963	202,068	137,184	155,339	112,974	116,874	85,137
Total cows	10,316,914	9,008,837	10,820,393	9,751,585	10,084,697	9,281,565	9,491,818	8,845,791	9,095,439	8,524,690
Cows per farm	31	54	39	59	50	68	61	78	78	100

¹Standard Industrial Classification (SIC) or North American Industrial Classification System (NAICS) definition.

Source: U.S. Census of Agriculture, U.S. Summary and State Data, Volume 1, part 51, various years.

Business Organization of Dairy Farms

The notable changes in the number and size of dairy farms have not been matched by major changes in business organization (ownership). The Census of Agriculture identifies four business organizations: individual or family (sole proprietorship); partnership; corporation (family and nonfamily); and others (cooperative farms, estates and trusts, and institutional farms).

In 1997, sole proprietorships and family corporations accounted for 84 percent of specialized dairy farms. Another 15 percent were partnerships, many of which probably involved family members. Nonfamily corporations, the image of corporate farms that is likely held by many, represented less than 1 percent of the specialized dairy farms, a share that has changed little over the years.

The mix of business organizations has changed over time—the shares of partnerships and family corporations are greater today than previously. Reasons for such moves are usually based on the desire to mitigate the confining nature of dairy farms and on financial considerations such as tax status, asset transfer, and capital access (borrowing). Large shares of cows and dairy product sales are associated with farms in the sole proprietorship and family corporation groupings (table 7).

Regional Milk Production

USDA has delineated 10 production regions within the Nation (fig. 2). The basic questions in the regional context are: (1) How much milk is produced? (2) How many dairy farms are there, and how big are they? and (3) What is the business organization of the dairy farms?

Regional Milk Supplies

Milk production shares of seven regions fell between 1975 and 2000 (fig. 3). The Northeast, Lake States, and Corn Belt are generally known as the traditional dairy regions. Before 1995, production shares consistently moved downward in all except the Southern Plains, Mountain, and Pacific regions. Since 1995, production shares have tended to stabilize or decline more slowly in the seven regions where shares had been falling. The production share of the Southern Plains peaked in 1995 and has declined since. In the Pacific region, the share was stable in 1997 and 1998, followed by increases in 1999 and 2000. Only the Mountain region has exhibited a continual upward pro-

duction share—not surprising since some of the fastest growing milk-producing States (Idaho and New Mexico) are in this region.

Where Are the Farms and the Cows?

Most dairy operations are located in the traditional dairy areas. Slightly more than 71 percent of all operations with milk cows were located in these three regions in 2000. These same regions had significant shares of the operations in 1975, but the Appalachian region was also important then. In fact, it took the Northeast, Lake States, Corn Belt, and Appalachian regions combined to account for 70 percent of the farms in 1975. The Northeast is the only region that has shown a consistent upward trend in the share of operations since 1975. Patterns in the other regions have varied (fig. 4). The largest shares of specialized dairy farms also are in the three traditional regions (fig. 5).

In an industry where large increases in output per animal have been the norm, a second important issue is the number of cows in each region. Increasing output per cow can help to increase or stabilize regional production even if farm and cow numbers decline. Between 1975 and 2000, increases in the share of the milk cow herd appear in the Southern Plains, Mountain, and Pacific regions (fig. 6). Prior to 1985, most milk cows were in the regions with most of the farms. The Northeast, Lake States, and Corn Belt combined had 62 percent of the milk cows in 1975 and 1980. Cow numbers in the Pacific region matched those in the Corn Belt in 1985, then surpassed the Northeast in 1997. Only the Mountain and Pacific regions have shown relatively large growth in cow numbers (the Southern Plains has indeed grown but has leveled off in recent years).

Recognizing the regional patterns of milk production, dairy operations, and cow numbers, one would expect herd sizes and milk output per cow to vary across regions as well. The average herd size in all regions has grown, but more rapidly in the Southeast, Southern Plains, Mountain, and Pacific regions than elsewhere (fig. 7). Herds have been larger in the Pacific region for many years, while the increases in the Southeast and Mountain regions date only to the mid-1980s.

Figure 8 shows the regional differences in milk output per cow and their changes over the 1975-2000 period. While the quantities are different, the percentage increase in each region is about the same. Milk output

Table 7—Organization of U.S. dairy farms, selected years¹

Year	Sole proprietorship	Partnership	Corporation		Other ²
			Family	Nonfamily	
<i>Percent of farms³</i>					
1978	84.2	13.6	1.9	0.2	0.2
1982	81.7	15.4	2.5	0.2	0.2
1987	80.8	15.8	2.9	0.1	0.4
1992	80.4	15.5	3.5	0.1	0.4
1997	79.4	15.4	4.5	0.2	0.5
<i>Percent of sales⁴</i>					
1978	72.3	19.7	6.8	0.0	0.3
1982	68.7	21.8	8.3	0.0	0.4
1987	66.4	23.1	9.3	0.0	0.7
1992	63.7	24.4	10.4	0.0	0.8
1997	59.0	26.0	13.3	0.0	0.9
<i>Percent of cows⁵</i>					
1978	74.6	18.6	5.8	0.7	0.3
1982	71.1	20.8	7.1	0.7	0.3
1987	68.8	22.1	8.1	0.4	0.6
1992	66.0	23.6	9.2	0.6	0.6
1997	61.9	24.9	11.7	0.7	0.8

¹The definition of what constitutes a farm has changed over time.

²Includes cooperative farms, estates or trusts, institutional, etc.

³Farms are those identified as SIC (Standard Industrial Classification) or NAICS (North American Industrial Classification System) dairy farms.

⁴Nonfamily corporations included in the reported percentage for family corporations.

⁵Percentages calculated on numbers of all farms reporting dairy product sales and cow inventories as of the end of the census year.

Source: Compiled from the U.S. Department of Commerce, Bureau of the Census, Census of Agriculture, various years.

Figure 2
USDA farm production regions

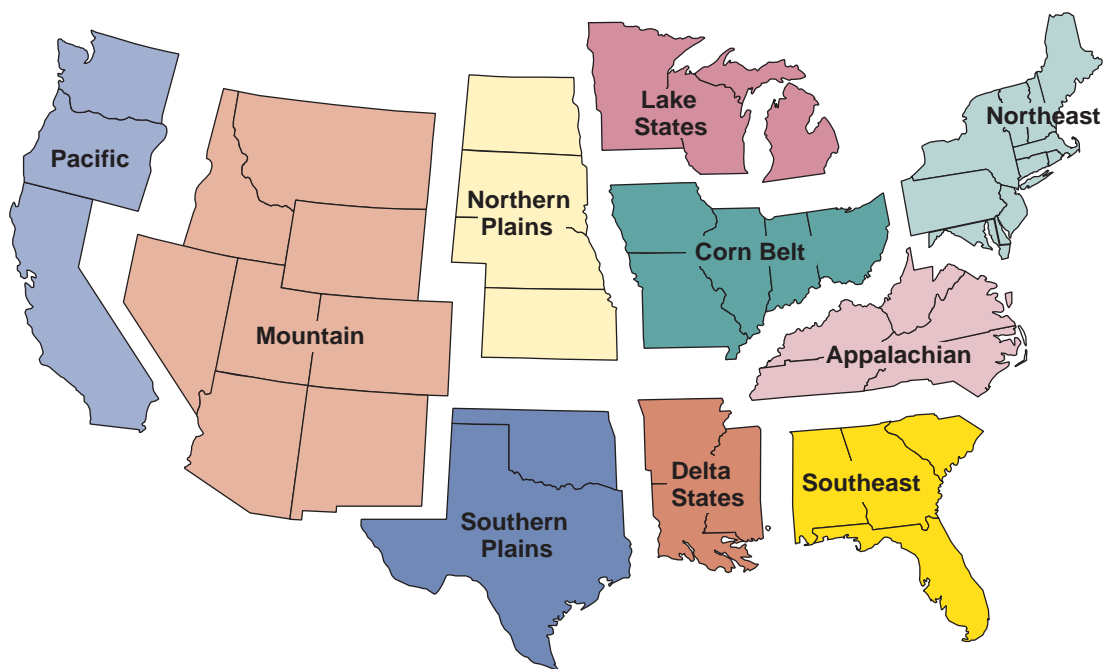


Figure 3
Regional share of U.S. milk production, 1975 and 2000

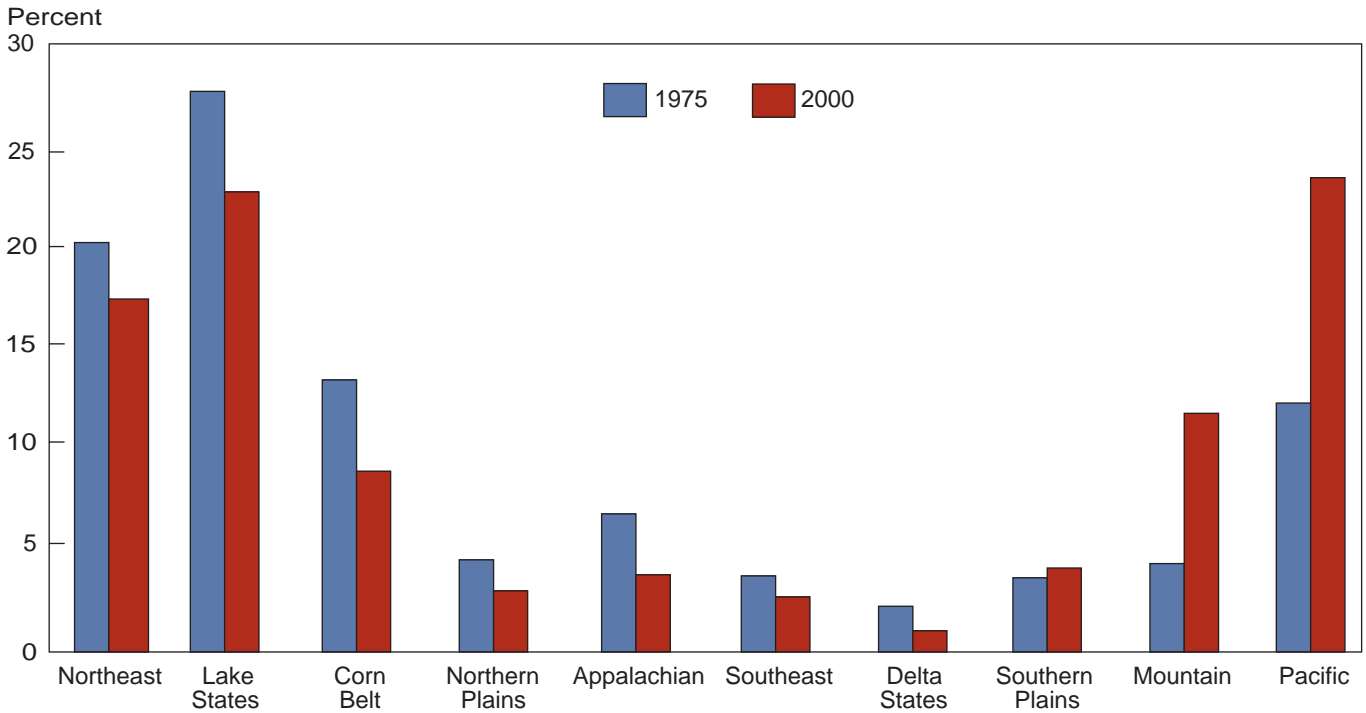


Figure 4
Shares of operations with milk cows, by region, 1975 and 2000

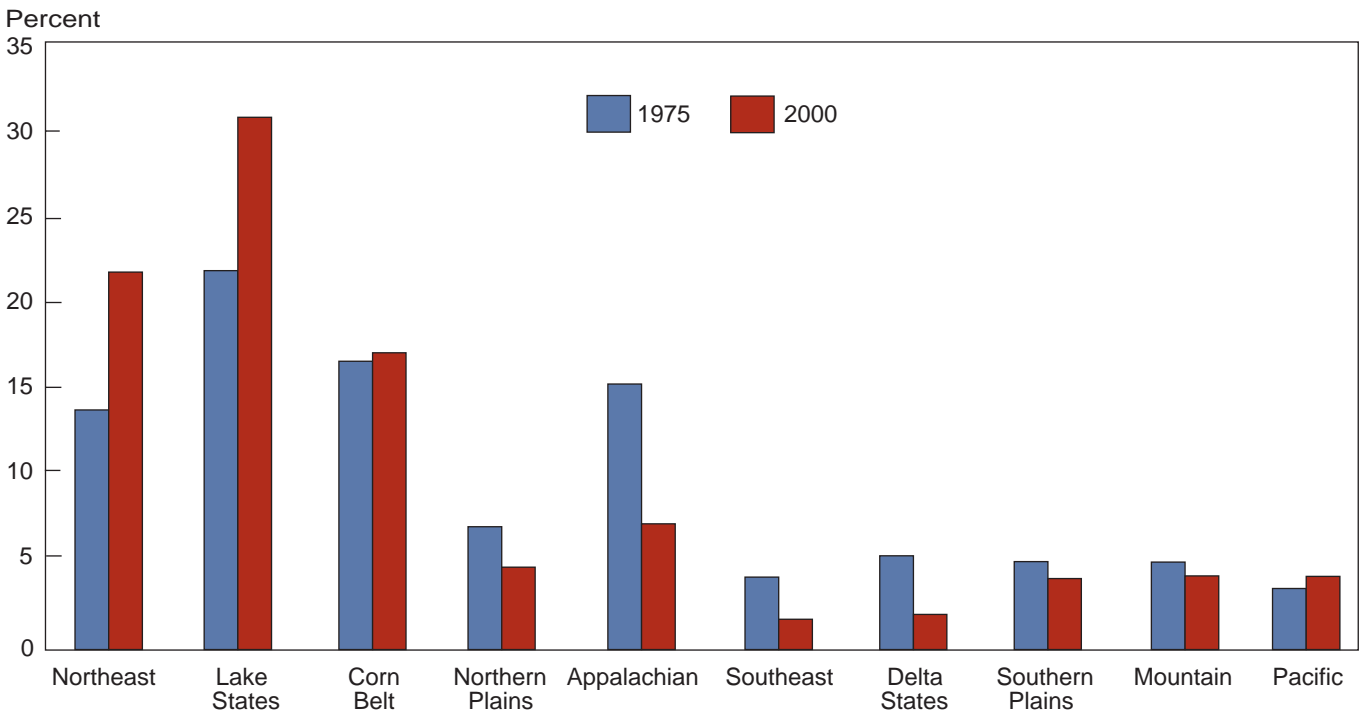


Figure 5
Shares of specialized dairy farms, by region, 1978 and 1997

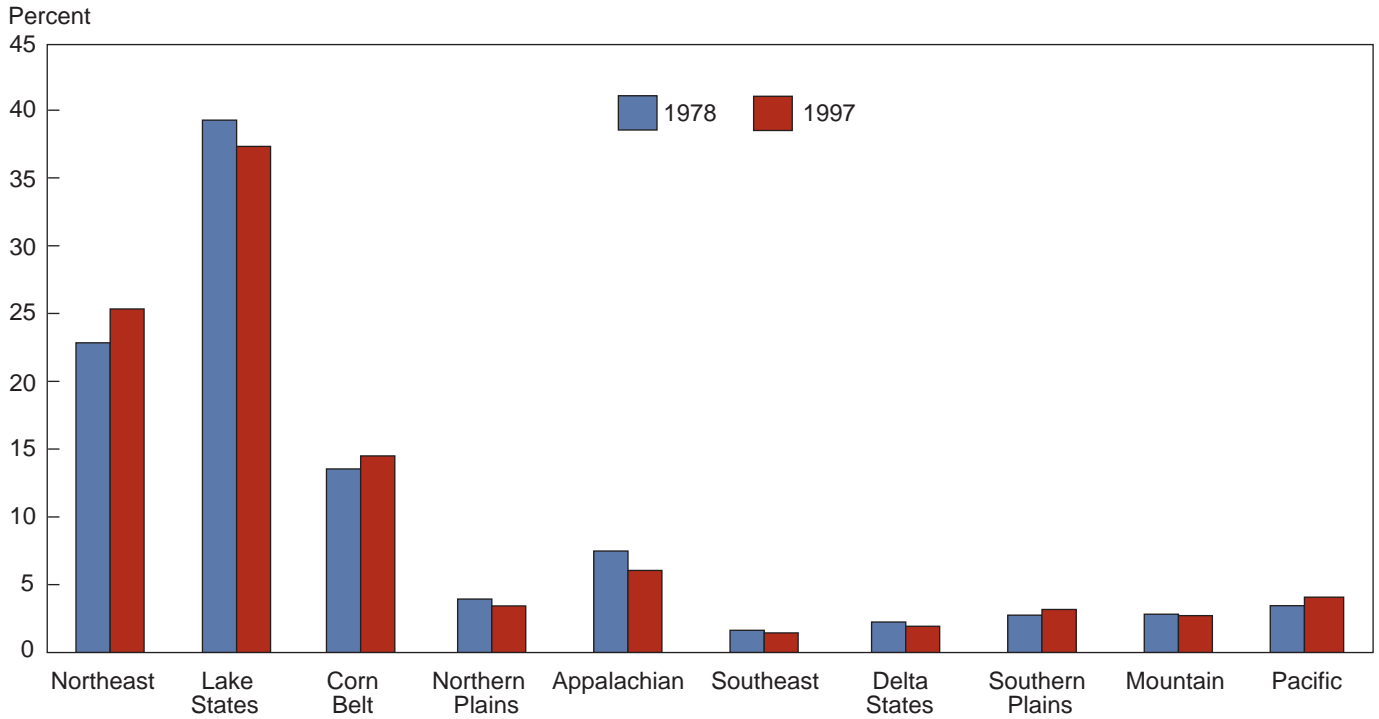


Figure 6
Shares of cows, by region, 1975 and 2000

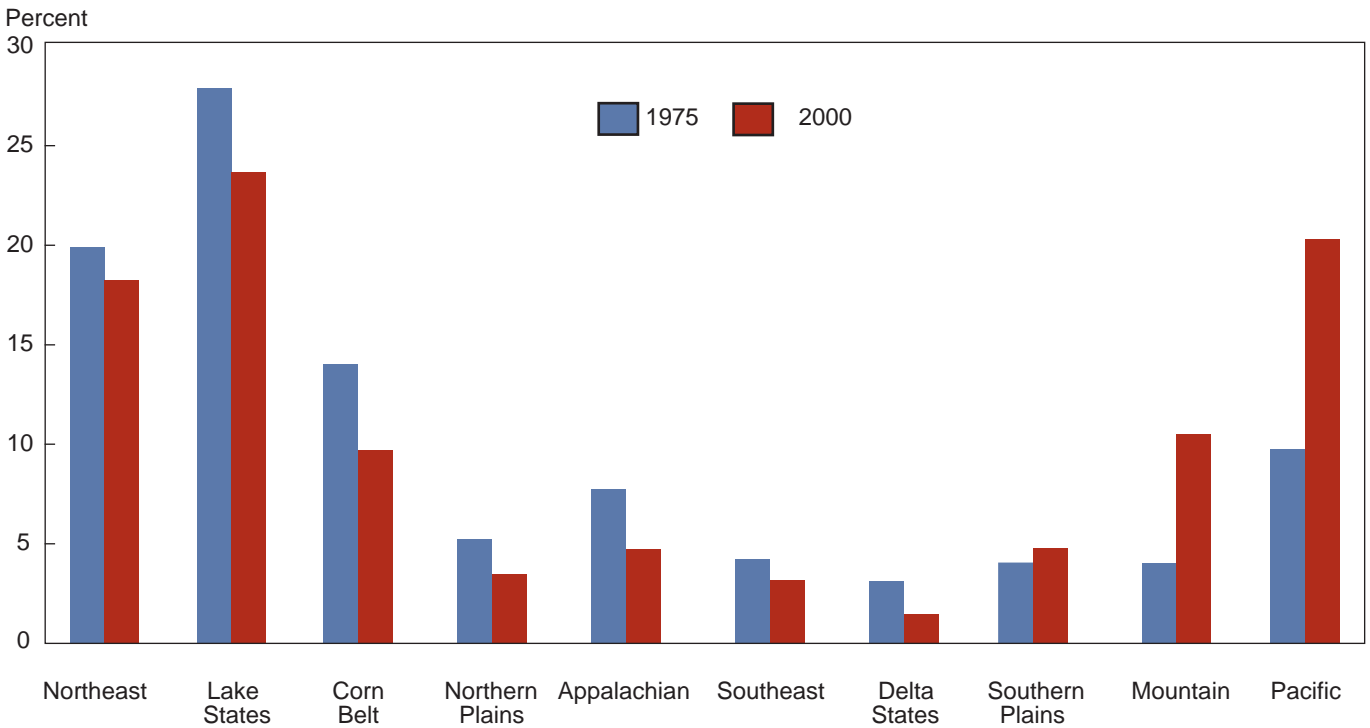


Figure 7
Cows per operation, by region and United States, 1975 and 2000

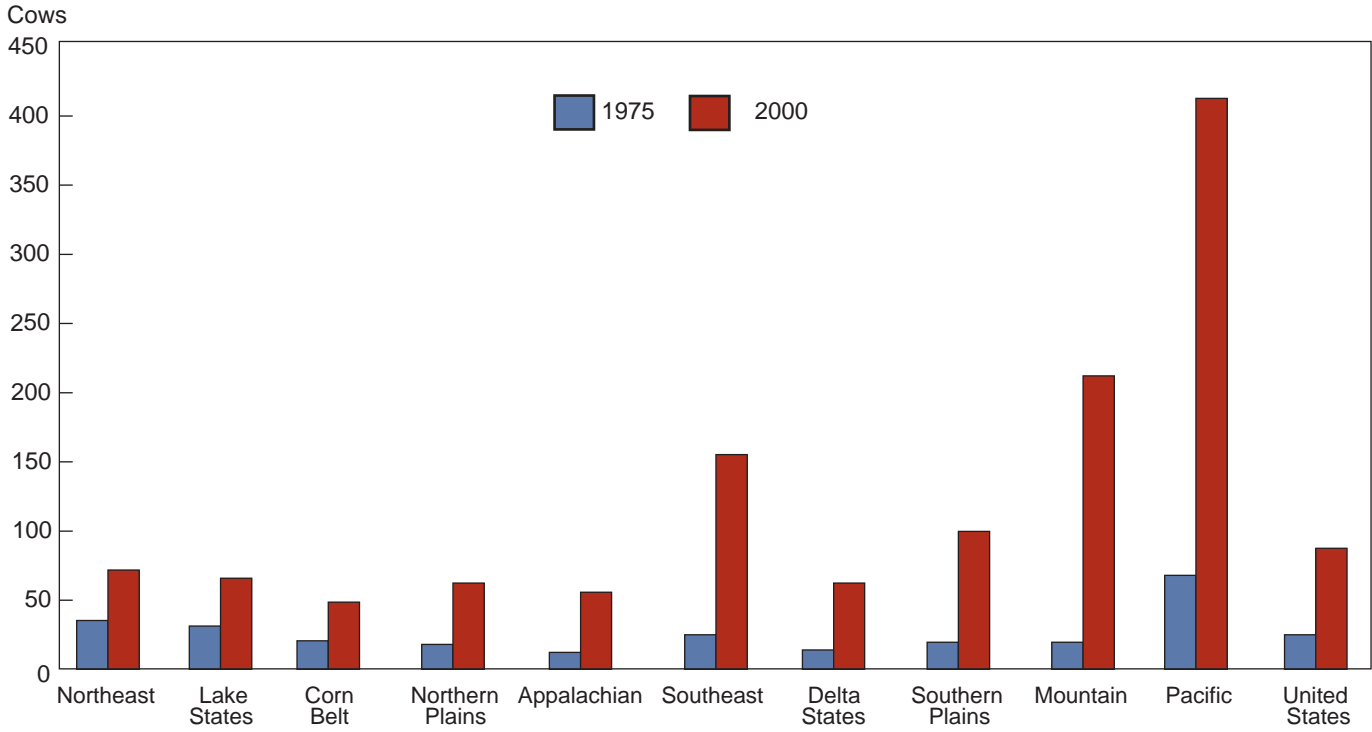
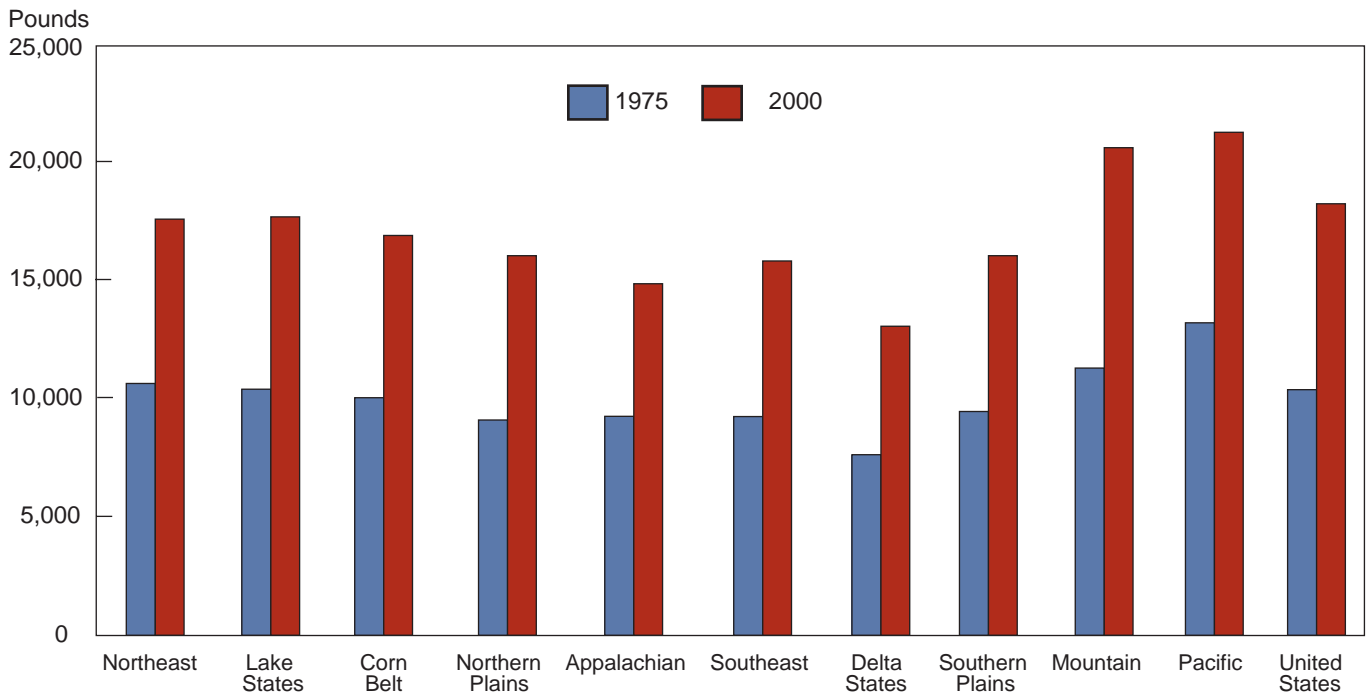


Figure 8
Milk production per cow, by region and United States, 1975 and 2000



per cow tended to be higher in the Pacific region from the beginning of the period. Beginning in 1985, milk output per cow increased in the Mountain region and began to resemble that of the Pacific region.

Do Dairy Farm Business Organizations Differ Across Regions?

In 1997, the percentages of individual or family ownership of specialized dairy farms across regions ranged from 63 to 82 percent. Adding family corporations, the share of the two categories in all regions was greater than 70 percent (73 and 87 percent, respectively). If partnerships are included, the percentage jumps to well over 95 percent in every region. The share of individual or family ownership is somewhat lower in the Southeast, Mountain, and Pacific regions—where average herd sizes are larger. The family corporation is most widely used in those same regions. Partnerships are most prevalent in the Pacific and Appalachian regions (table 8).

Is the current mix of business organizations in regions much different than in the past? In 1978, individual or family ownership accounted for more than 70 percent of specialized dairy farms in all regions. Family corporations accounted for a smaller share, 1.1 to 4.7 percent, and the share of partnerships was 12 to 20 percent (table 9). The drop in individual or family ownership to the 1997 level has been compensated for by the rise in family corporations and partnerships. There is little evidence that nonfamily corporate farms are numerous in milk production. The actual number of farms in the “Other” category grew from 1978 to 1997, bucking the farm number trends of all other ownership categories.

Whether one should make much of the business organization information is an open question. State laws covering partnerships and corporations likely influence the decisions to organize in those ways. Those laws have economic consequences for the farm firm, for instance, in its tax treatment and borrowing capacity.

Table 8—Regional shares of specialized (NAICS) dairy farms, by type of organization, 1997¹

Region	Individual or family	Partnership	Family corporation	Other than family corporation	Other	Total
	<i>Percent</i>					<i>Number</i>
Northeast	80.4	16.1	2.9	0.1	0.5	21,789
Lake States	82.4	13.2	4.0	0.1	0.3	32,107
Corn Belt	79.6	16.1	3.8	0.2	0.4	12,473
Northern Plains	81.3	12.4	5.8	0.2	0.2	2,961
Appalachian	73.9	19.8	5.5	0.3	0.5	5,206
Southeast	68.6	15.8	13.4	1.3	0.9	1,240
Delta States	81.3	12.6	4.5	0.1	1.5	1,663
Southern Plains	80.8	13.3	5.2	0.1	0.6	2,726
Mountain	65.8	19.2	12.5	1.0	1.4	2,347
Pacific	63.3	25.6	9.7	0.5	1.0	3,510
	<i>Number</i>					
United States	68,336	13,282	3,854	150	400	86,022

¹NAICS means North American Industrial Classification System.

Source: 1997 Census of Agriculture, State, Volume 1.

Table 9—Regional shares of specialized (SIC) dairy farms, by type of organization, 1978¹

Region	Individual or family	Partnership	Family corporation	Other than family corporation	Other	Total
Percent						Number
Northeast	84.7	13.0	1.9	0.2	0.2	38,475
Lake States	86.6	12.1	1.1	0.1	0.1	66,190
Corn Belt	82.6	15.4	1.5	0.1	0.4	22,811
Northern Plains	87.0	10.9	1.9	0.1	0.1	6,654
Appalachian	77.3	19.9	2.5	0.2	0.1	12,613
Southeast	74.0	18.0	7.1	0.7	0.2	2,758
Delta States	85.3	12.1	2.4	0.2	0.1	3,771
Southern Plains	85.6	11.8	1.9	0.4	0.3	4,655
Mountain	80.3	14.0	4.8	0.5	0.4	4,745
Pacific	76.5	17.9	4.7	0.6	0.3	5,801
Number						
United States	141,780	22,946	3,155	284	308	168,473

¹SIC means Standard Industrial Classification.

Source: 1978 Census of Agriculture, State, Volume 1.

The regional shares may reflect the ease or difficulty of organizing in a particular way. Regardless of the regional differences, the general conclusion is clear. Individuals or families make the production and operational decisions on most specialized dairy farms.

Dairy Farming Today and Tomorrow

The structure of milk production today is the basis for the dairy industry as a new century begins, although we can learn much by examining changes. It is clear that individuals or families are important for the industry. There is some evidence that today's dairy farms are more likely to specialize in producing and selling and that there is regionalization of production and cows, although not of farms. Nothing in the near term suggests dramatic changes in these trends—dairy farms will continue to become larger, more concentrat-

ed in certain regions, and more specialized in producing milk.

The agricultural sector is under pressure to address old arguments related to concentration and its effects on agricultural industries (MacDonald, 1999). Concentration is sometimes linked to the industrialization of agriculture, a topic about which much has been written. At a 1995 farm policy seminar, two “camps” were identified with somewhat differing definitions of “industrialization”: the familiar one emphasized the resources and technology used in farming, while the second was vague and potentially more politically sensitive in that it emphasized organizational structure and decisionmakers (Breimeyer, 1996). A working definition is likely somewhere in the middle.

By either definition, dairy farming is much more industrialized today than in the past. Technological innovations have increased opportunities for expansion

and specialization; processes that tend to separate roles attributed to the farmer. Even on smaller operations, dairy farm managers are doing more than just making the production decisions directly related to the animals, they are managing labor and other inputs, and possibly making farm output marketing decisions.

Technology has clearly changed the way milk is produced. The switch to a more technologically oriented production process has coincided with expansion to take advantage of economies of scale. However, not all technologies are capital intensive—rotational grazing is a production system that does not necessarily require large capital investments, but it does require a relatively large investment in human capital. In fact, capital-intensive, confinement dairies also need high-quality human capital (labor) for efficient operation.

The average size of U.S. dairy operations in 2000 was 88 cows. While examining the structure of dairy farms and milk production, it is easy to discern why the average herd size is relatively small—there is a wide range of herd sizes on dairy operations today, associated with several different production systems. Much attention is paid to the large dairy farms. In November 1998, the top 20 U.S. dairies, based on the number of cows in producing herds, were ranked by the *Successful Farming* magazine (Looker, 1998).

The smallest of these farms had 6,500 cows and the largest, 18,500. Several of these dairy farms are multiple-herd operations spread over wide geographical areas, even different States. These types of farms closely follow the industrial model, with separation of production roles being a prominent feature. Capital technology and high levels of human capital in the manager and in consultants, such as nutritionists, are also commonly observed on such farms.

Large dairy farms pose potentially difficult issues for dairy cooperatives. The question revolves about the one-member, one-vote concept, long the foundation of cooperative business structures. This concept clashes with the fact that one member may contribute a very large share of the milk to a particular cooperative. If large producer-members become dissatisfied, their leaving the cooperative could have severe repercussions for remaining members. The widely diverse

structure of milk production and the growing importance of larger producers could make maintaining member satisfaction a more difficult task.

Prospects for continued industrialization of milk production clearly exist, but they are not limitless. Environmental concerns about large numbers of animals on potentially small acreages are increasing, as are the waste management issues associated with those animals. Several key milk-producing areas are in environmentally sensitive areas, particularly with respect to water quality. Environmental issues are not only large farm issues; small farms can have the same types of problems. An example is the smaller farms of western Washington State and their runoff into local streams. Studies in the area traced high loads of factors decreasing water quality to agriculture. These concerns led to efforts to develop a permit system for dairy waste management in the State.

Concentration of milk production in particular geographic areas may increase the possibility that weather conditions might disrupt dairy operations regardless of their size. El Niño in California and the severe cold weather in upstate New York are two recent examples. In California, increased mud from rains led to lower production on many farms as cases of mastitis increased. In New York, milk collection problems and power outages disrupted milking schedules. Dairy farms in the Southeast and some areas of other regions are faced with heat-stress problems during the summer months. Potentially large quantities of milk could be affected if an area with even a few larger farms has bad weather.

Individuals or families are in control of much of the decisionmaking on dairy farms, even most of the large ones. The data also suggest that current farms are more likely to be specialized in producing and selling milk than to have other large enterprises, such as crops or replacement heifer raising, as part of the operation. It also appears that production and cows are becoming more regionalized, even if farms are not. Nothing in the near term suggests past trends are going to change—dairy farms will continue to become larger, more concentrated in certain regions, and more specialized in producing milk.

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Appendix table 1—U. S. milk production, 1950-2000

Year	Average cow numbers	Production per cow	Total production	Change in average cow numbers	Change in production per cow	Change in total production
	<i>1,000</i>	<i>Pounds</i>	<i>Millions</i>	<i>Year-to-year percent</i>		
1950	21,994	5,314	116,602			
1951	21,505	5,333	114,681	-2.22	0.36	-1.65
1952	21,338	5,374	114,671	-0.78	0.77	-0.01
1953	21,691	5,542	120,221	1.65	3.13	4.84
1954	21,581	5,657	122,094	-0.51	2.08	1.56
1955	21,044	5,842	122,945	-2.49	3.27	0.70
1956	20,501	6,090	124,860	-2.58	4.25	1.56
1957	19,774	6,303	124,628	-3.55	3.50	-0.19
1958	18,771	6,585	123,220	-5.07	4.47	-1.13
1959	17,901	6,815	121,989	-4.63	3.49	-1.00
1960	17,515	7,029	123,109	-2.16	3.14	0.92
1961	17,243	7,290	125,707	-1.55	3.71	2.11
1962	16,842	7,496	126,251	-2.33	2.83	0.43
1963	16,260	7,700	125,202	-3.46	2.72	-0.83
1964	15,677	8,099	126,967	-3.59	5.18	1.41
1965	14,953	8,305	124,180	-4.62	2.54	-2.20
1966	14,071	8,522	119,912	-5.90	2.61	-3.44
1967	13,415	8,851	118,732	-4.66	3.86	-0.98
1968	12,832	9,135	117,225	-4.35	3.21	-1.27
1969	12,307	9,434	116,108	-4.09	3.27	-0.95
1970	12,000	9,751	117,007	-2.49	3.36	0.77
1971	11,839	10,015	118,566	-1.34	2.71	1.33
1972	11,700	10,259	120,025	-1.17	2.44	1.23
1973	11,413	10,119	115,491	-2.45	-1.36	-3.78
1974	11,230	10,293	115,586	-1.60	1.72	0.08
1975	11,139	10,360	115,398	-0.81	0.65	-0.16
1976	11,032	10,894	120,180	-0.96	5.15	4.14
1977	10,945	11,206	122,654	-0.79	2.86	2.06
1978	10,803	11,243	121,461	-1.30	0.33	-0.97
1979	10,734	11,492	123,350	-0.64	2.21	1.56
1980	10,799	11,891	128,406	0.61	3.47	4.10
1981	10,898	12,183	132,770	0.92	2.46	3.40
1982	11,011	12,306	135,505	1.04	1.01	2.06
1983	11,059	12,622	139,588	0.44	2.57	3.01
1984	10,793	12,541	135,351	-2.41	-0.64	-3.04
1985	10,981	13,024	143,012	1.74	3.85	5.66
1986	10,773	13,285	143,124	-1.89	2.00	0.08
1987	10,327	13,819	142,709	-4.14	4.02	-0.29
1988	10,224	14,185	145,034	-1.00	2.65	1.63
1989	10,046	14,323	143,893	-1.74	0.97	-0.79
1990	9,993	14,782	147,721	-0.53	3.20	2.66
1991	9,826	15,031	147,697	-1.67	1.68	-0.02
1992	9,688	15,570	150,847	-1.40	3.59	2.13
1993	9,581	15,722	150,636	-1.10	0.98	-0.14
1994	9,494	16,179	153,602	-0.91	2.91	1.97
1995	9,466	16,405	155,292	-0.29	1.40	1.10
1996	9,372	16,433	154,006	-0.99	0.17	-0.83
1997	9,252	16,871	156,091	-1.28	2.67	1.35
1998	9,154	17,189	157,348	-1.06	1.88	0.81
1999	9,156	17,772	162,716	0.02	3.39	3.41
2000	9,210	18,204	167,658	0.59	2.43	3.04

Sources: U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, various years; *Milk Production, Distribution, and Income, 1999 Summary*, April 2000; and *Milk Production*, February 2001.

Appendix table 3—Regional shares of milk production, selected years

Region	1975	1980	1985	1990	1995	1997	1998	1999	2000 ¹
	<i>Percent</i>								
Northeast	20.4	20.4	20.1	18.4	18.3	18.3	18.5	18.1	17.6
Lake States	28.0	28.7	28.7	26.7	24.4	23.7	23.8	23.4	22.9
Corn Belt	13.6	12.4	11.8	11.4	10.3	9.5	9.5	9.0	9.0
Northern Plains	4.6	4.1	3.8	3.6	3.0	2.8	2.9	2.9	3.0
Appalachian	6.9	6.6	6.1	5.5	4.8	4.4	4.2	4.0	3.8
Southeast	3.8	3.5	3.1	3.3	3.1	3.1	2.9	2.8	2.8
Delta States	2.3	2.0	1.8	1.7	1.5	1.3	1.2	1.1	1.1
Southern Plains	3.7	3.7	3.6	4.6	4.8	4.5	4.3	4.2	4.2
Mountain	4.4	4.8	5.5	6.4	9.0	10.2	10.7	11.2	11.9
Pacific	12.4	13.9	15.5	18.4	20.9	22.2	22.1	23.2	23.7
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

¹Preliminary data.

Source: Compiled by Economic Research Service from U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, various years, except for 1998, 1999, and 2000. Data for 1998, 1999, and 2000 are from *Milk Production*, February 1999, 2000, and 2001.

Appendix table 4—Regional shares of operations with milk cows, selected years¹

Region	1975	1980	1985	1990	1995	1997	1998	1999	2000
	<i>Percent</i>								
Northeast	14.1	16.3	18.0	18.9	19.8	20.8	21.5	21.9	22.2
Lake States	22.3	24.4	26.9	29.1	32.0	32.1	31.3	31.4	31.4
Corn Belt	17.0	16.6	17.2	16.7	16.8	16.8	17.2	17.3	17.5
Northern Plains	7.2	6.9	6.4	5.9	5.2	5.1	4.9	5.0	4.8
Appalachian	15.6	12.8	10.7	9.1	7.9	7.7	7.8	7.6	7.4
Southeast	4.3	3.9	2.6	2.6	2.0	2.0	1.9	1.8	1.8
Delta States	5.5	4.0	2.9	2.9	2.6	2.3	2.2	2.1	2.1
Southern Plains	5.2	5.3	4.8	4.7	4.6	4.6	4.5	4.3	4.2
Mountain	5.2	5.7	5.7	5.1	4.4	4.3	4.3	4.3	4.3
Pacific	3.6	4.2	4.7	5.0	4.6	4.3	4.3	4.3	4.3
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

¹Operations with one or more milk cows, excluding cows used to nurse calves, on hand any time during the year.

Source: Compiled by Economic Research Service from U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, various years, except for 1998, 1999, and 2000. Data for 1998, 1999, and 2000 are from *Milk Production*, February 2000 and 2001.

Appendix table 5—Regional shares of specialized dairy farms, selected years¹

State	1978	1982	1987	1992	1997
	<i>Percent</i>				
Northeast	22.8	22.2	22.7	22.9	25.3
Lake States	39.3	39.7	39.3	38.6	37.3
Corn Belt	13.5	14.3	14.7	14.4	14.5
Northern Plains	3.9	4.4	4.3	3.9	3.4
Appalachian	7.5	7.2	7.2	6.7	6.1
Southeast	1.6	1.4	1.3	1.6	1.4
Delta States	2.2	2.1	1.9	2.1	1.9
Southern Plains	2.8	2.5	2.5	3.4	3.2
Mountain	2.8	2.8	2.5	2.5	2.7
Pacific	3.5	3.3	3.5	3.8	4.1
United States	100.0	100.0	100.0	100.0	100.0

¹“Specialized” means farms identified by SIC (Standard Industrial Classification) or NAICS (North American Industrial Classification System).
Source: *Census of Agriculture, U.S. Summary and State Data*, Volume 51, part 51, various years.

Appendix table 6—Regional shares of milk cows, selected years

Region	1975	1980	1985	1990	1995	1997	1998	1999	2000 ¹
	<i>Percent</i>								
Northeast	19.9	20.1	19.9	18.6	18.4	18.6	18.8	18.6	18.3
Lake States	27.9	28.4	29.0	27.8	25.4	24.5	24.2	24.1	23.6
Corn Belt	14.0	13.3	12.5	11.7	10.8	10.2	10.1	9.8	9.7
Northern Plains	5.2	4.6	4.4	4.2	3.6	3.4	3.3	3.4	3.5
Appalachian	7.7	7.4	7.0	6.4	5.5	5.2	5.0	4.8	4.7
Southeast	4.3	4.0	3.5	3.7	3.4	3.4	3.3	3.3	3.2
Delta States	3.1	2.6	2.4	2.1	2.0	1.8	1.6	1.5	1.5
Southern Plains	4.1	4.0	3.9	4.9	5.2	5.1	4.9	4.8	4.8
Mountain	4.0	4.4	4.9	5.7	8.0	8.9	9.4	9.9	10.5
Pacific	9.8	11.2	12.5	14.8	17.6	18.8	19.3	19.8	20.3
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

¹Preliminary data.

Source: Compiled by Economic Research Service from U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, various years, except for 1998, 1999, and 2000. Data for 1998, 1999, and 2000 are from *Milk Production*, February 2000 and 2001.

Appendix table 7—Regional cow numbers per operation, selected years

Region	1975	1980	1985	1990	1995	1997	1998	1999	2000 ¹
					<i>Number</i>				
Northeast	35	40	45	51	63	67	68	70	72
Lake States	31	38	44	50	54	57	60	63	66
Corn Belt	21	26	30	36	45	46	47	47	49
Northern Plains	18	22	28	37	47	49	53	57	63
Appalachian	12	19	27	37	51	51	51	53	56
Southeast	25	33	55	72	140	128	134	149	155
Delta States	14	21	33	38	56	58	58	60	62
Southern Plains	20	24	33	54	81	82	84	91	100
Mountain	20	25	35	58	121	156	173	189	212
Pacific	68	85	110	153	257	324	348	379	413
United States	25	32	41	52	69	75	78	82	88

¹Preliminary data.

Source: Compiled by Economic Research Service from U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, various years, except for 1998, 1999, and 2000. Data for 1998, 1999, and 2000 are from *Milk Production*, February 2000 and 2001.

Appendix table 8—Regional milk per cow, selected years

State	1975	1980	1985	1990	1995	1997	1998	1999	2000 ¹
					<i>Pounds</i>				
Northeast	10,621	12,048	13,093	14,613	16,309	16,549	16,891	17,304	17,553
Lake States	10,382	12,007	12,913	14,186	15,746	16,309	16,891	17,204	17,657
Corn Belt	10,024	11,074	12,283	14,313	15,561	15,694	16,195	16,417	16,866
Northern Plains	9,084	10,591	11,412	12,777	13,888	14,219	14,774	15,241	16,009
Appalachian	9,237	10,545	11,343	12,575	14,065	14,186	14,245	14,552	14,828
Southeast	9,230	10,572	11,557	13,386	14,889	15,220	14,817	15,409	15,791
Delta States	7,621	8,983	10,174	11,821	12,272	12,428	12,467	12,645	13,037
Southern Plains	9,442	11,063	12,120	13,930	14,931	14,930	15,408	15,714	16,014
Mountain	11,271	12,800	14,403	16,789	18,343	19,264	19,553	20,146	20,571
Pacific	13,185	14,802	16,064	18,286	19,489	19,861	19,643	20,857	21,218
United States	10,360	11,891	13,021	14,781	16,433	16,871	17,189	17,772	18,204

¹Preliminary data.

Source: Compiled by Economic Research Service from U.S. Department of Agriculture, National Agricultural Statistics Service, *Milk Final Estimates*, various years, except for 1998, 1999, and 2000. Data for 1998, 1999, and 2000 are from *Milk Production*, February 2000 and 2001.