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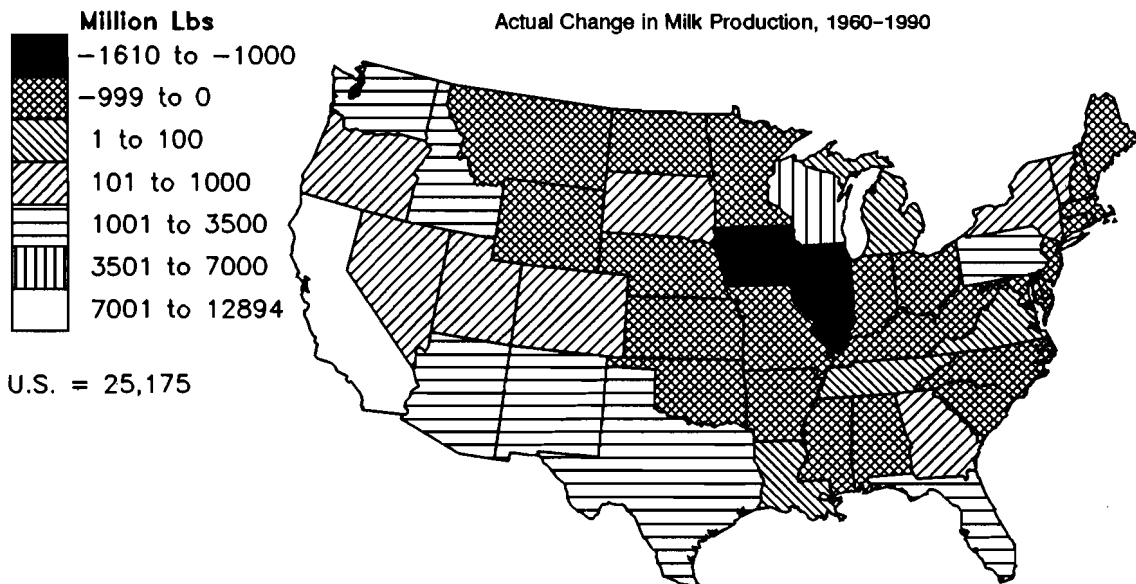
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NATIONAL AND STATE TRENDS IN MILK PRODUCTION, 1991

by

Andrew Novakovic, Kevin Jack, and Maura Keniston



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PREFACE

The authors are members of the Department of Agricultural Economics at Cornell University. Andrew Novakovic is the E.V. Baker Associate Professor of Agricultural Economics. Kevin Jack is an extension associate, and Maura Keniston is a research specialist. This manuscript was prepared for publication by Wendy Barrett, with graphics by Wendy Barrett and Maura Keniston.

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NATIONAL AND STATE TRENDS IN MILK PRODUCTION, 1991

INTRODUCTION

In 1990, Novakovic, Jack, and Keniston reviewed the milk production characteristics of states and regions of the United States.¹ Recent milk production performance nationally was discussed using the USDA revised estimates of milk production, production per cow, and cow numbers by state and for the U.S. over the period 1983 to 1989. The majority of the earlier paper was devoted to a longer term analysis of milk production trends, by state, since 1960. This paper revisits and updates the discussion of national and state trends in milk production.

MILK PRODUCTION IN RECENT YEARS AND MONTHS

U.S. Milk Production

Recently released figures from the U.S. Department of Agriculture² indicate that the decline in milk production in 1989 was slightly greater than their preliminary forecast had indicated.³ These revisions lowered slightly the estimates of U.S. milk production from

¹ Andrew Novakovic, Kevin Jack, and Maura Keniston, National and State Trends in Milk Production, A.E. Ext. 90-12, Dept. of Agr. Econ., Cornell University, May, 1990.

² Milk Production, Disposition, and Income: 1990 Summary, National Agricultural Statistics Service, U.S. Department of Agriculture, May 1991.

³ USDA follows a routine procedure for updating its milk production estimates. About 15 days after the end of a month, USDA issues a preliminary estimate of milk production, cow numbers, and production per cow for each of 21 selected states during that preceding month. At the same time, the first revised estimate is issued for the second preceding month, i.e., revising the preliminary estimate that had been released one month earlier. Milk production, cow numbers, and production per cow are estimated for each of the 50 states on a quarterly basis. In the February issue of Milk Production, the monthly and quarterly estimates for the previous two years are tabulated, and a second revision may occur. An annual summary for the previous two years, titled Milk Production, Disposition, and Income is released in May. This report contains only annual data, but data are reported for each state. Estimates may be revised for a third time in this annual report. Up to this point, revisions are usually fairly modest. Following the release of the quinquennial Census of Agriculture, milk production estimates are revised for the five years since the last Census, up to the year of the current Census. These revisions are referred to as the final estimates. These final revisions may be fairly significant, although they need not be, of course. Additional revisions, either within or beyond this schedule may be made at USDA's discretion; however any other revisions would be rare.

It may also be worth noting that the 21 selected states for which monthly estimates are made are not quite the 21 largest milk producing states, as is often assumed. North Carolina is included in the sample, but four states with larger milk production are not--South Dakota, Arizona, Oregon, and New Mexico. Maryland is also included in the sample; yet the above mentioned states plus Georgia each produce more milk.

144,252 to 144,239 million pounds, maintained estimates of milk production per cow at 14,244 pounds, and lowered milk cow numbers by 1,000 to 10,126 thousand. Of the ten leading dairy states, only California and New York had 1989 milk production totals revised. Both were lowered, by 67 million and 71 million pounds, respectively. The following states had adjustments made to 1989 production per cow estimates: California, up 61 pounds to 17,591; New York, down 91 pounds to 14,267; and Ohio, down 20 pounds to 12,994.

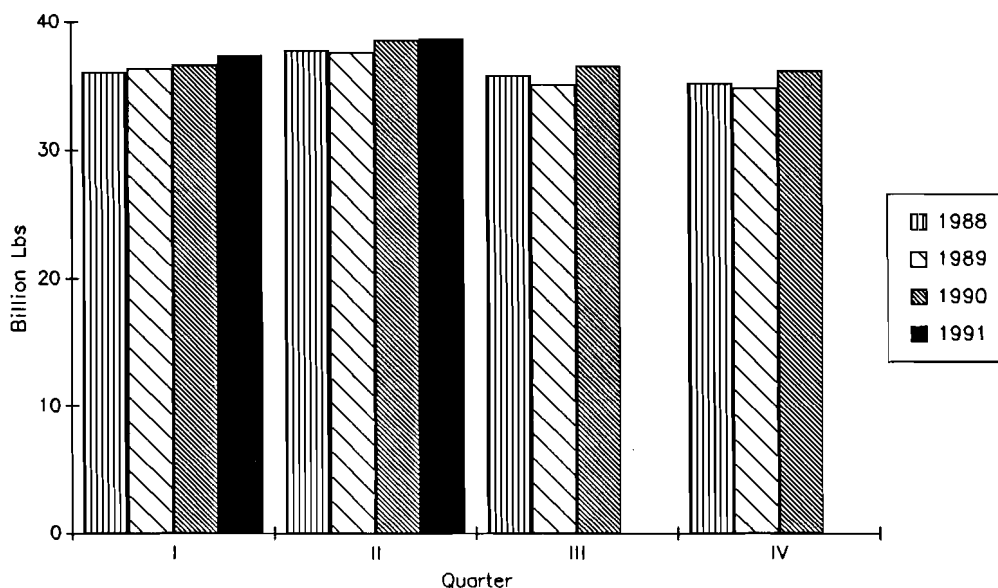
In 1990, U.S. milk production rose to 148.3 billion pounds, an annual increase of over four billion pounds or 2.7 percent. Recognizing that this increase comes on the heels of a 1989 production year hampered by a wet spring and poor quality forage carried over from drought-stricken 1988, the increase represented the largest expansion in output since 1985, whether measured by actual pounds of milk or percentage change. As noted later in the paper, this compares to a compound growth rate in milk production over the last fifteen years of about 1.6 percent.

Although each quarter in 1990 experienced higher milk production than year-earlier levels, the overall change in output is largely attributable to gains made in the third and fourth quarters of the year. Two-thirds of the national increase in milk production in 1990 occurred in the second half of the year.

Quarterly milk production patterns for the U.S. are illustrated in Figure 1. Estimates are shown for 1988 to the most recent quarter available for 1991. By almost any other agricultural or manufacturing standard, U.S. milk production must appear to be very stable; yet the rather insignificant looking ups and downs which occurred primarily in the third and fourth quarters of 1989 and 1990 were associated with enormous changes in farm milk prices. The dips in production in the second half of 1989 helped catapult milk prices to all time record highs. A year later, the second half increases in milk production were a major factor in pushing farm milk prices to a 12 year low. Thus, when looking at and evaluating milk production data, one must be sensitive to the fact that changes which may seem quite modest can have very important market consequences.

During the first six months of 1991, national milk production was up 1.1 percent; however it was up only 0.3 percent in the second quarter, after having increased 2 percent in the first quarter. Given that milk production increased at much higher rates in the second half of 1990; it would seem quite likely that the slowing in milk production occurring in mid-1991 will result in milk production being at best even with or more likely below 1990 levels during the second half of the year. **If so, national milk production in 1991 will be at most 149.1 billion pounds, an annual increase of less than one billion pounds, or about 0.5 percent. If milk production runs below year earlier levels during the last half of 1991, the annual total could be even with 1990's 148.3 billion pounds or somewhat lower. At this point, the latter looks like a good bet.**

Figure 1. U.S. Quarterly Milk Production, 1988-1991



The Top Ten Milk Producing States

Based on the revised figures, aggregate milk production in the top ten states was up over 2.6 billion pounds, or 2.7 percent, in 1990. This expansion in production represents approximately 65 percent of the net increase in the U.S. during 1990. Table 1 below illustrates changes in quarterly milk production figures for 1990 compared to year-earlier figures for the U.S. as a whole and the ten leading dairy states. Inspection of the state data reveals that by no means did all states follow the national pattern of having two-thirds of the increase occur in the third and fourth quarters.

On a percentage change basis, California led the top ten states with an annual increase of 7.9 percent, or 1.5 billion pounds. Close behind were Washington at 7.3 percent (301 million pounds) and Texas at 7.1 percent (369 million pounds).

Among the major milk producing states of the Upper Midwest, Iowa led with an increase of three percent. This follows three years of relatively strong expansion for that state. Wisconsin and Michigan registered gains of 1.7 percent and 1.6 percent, respectively. This represented a healthy rebound from the previous year, when both states were down. Among the major milk producing states of the Northeast, New York showed a very modest increase of 0.3 percent. However, this too followed a down year for New York in 1989. Thus, one might conclude that recovery from the drought effects of 1989 occurred more slowly in the Northeast.

Table 1. Annual Change in Milk Production for the U.S. and the Top Ten Dairy States, by Quarter, 1990

State	I	II	III	IV	Year
(million pounds)					
Wisconsin	-66	86	236	144	400
California	425	462	328	318	1533
New York	-119	-36	100	86	31
Minnesota	-54	7	-20	-35	-102
Pennsylvania	-187	-48	62	108	-65
Texas	111	69	97	92	369
Michigan	-10	7	61	23	81
Ohio	-56	-32	21	27	-40
Washington	73	80	80	68	301
Iowa	44	51	58	-25	128
U.S.	299	924	1475	1345	4043

As is often true, not all states within geographic regions experience similar production patterns. The only top ten dairy states to have lower milk production in 1990 were Ohio, Pennsylvania and Minnesota, down 40, 66, and 102 million pounds, respectively. Milk production in Ohio and Pennsylvania was down in each of the first five months of 1990 compared to year-earlier levels, declining 4.7 and 5.8 percent, respectively, for the period as a whole. Milk production in both states rebounded for the rest of the year. However, these gains were not enough to offset the production losses from earlier in the year. Minnesota milk production declined 2.0 percent for the first quarter of 1990, barely increased from April to August, and subsequently declined 1.8 percent throughout the rest of the year.

USDA estimates for the first half of 1991 indicate a slowing of the pace of growth in milk production among all the top ten states.

California is growing at half the rate it grew in 1990. Perhaps what is most notable is that California growth hasn't been even less. Earlier in the year, dire predictions of record drought led many analysts to speculate that there might be little growth in milk production at all. In fact, some even began discussing the contraction of dairy and other forms of agriculture in California. Heavy spring rains helped ease the drought situation,

although California clearly still labors under serious drought conditions. If nothing else, this year has demonstrated California's capacity to increase milk production even under very adverse conditions.

Two other states that have shown substantial growth in the past are faring less well this year. Washington milk production grew only 1.2 percent, and Texas grew even less at 0.6 percent. This is in sharp contrast to their gains of more than seven percent last year. Many Texas analysts are stating that milk production in that state is unlikely to resume the frenetic growth it experienced during the last two to three years.

After struggling through the last two drought years, Pennsylvania has rebounded this year with a first half gain of two percent, second only to California among the top ten. To some extent this reflects the underlying resilience and strength of Pennsylvania's dairy industry, but it also reflects that fact that milk production was unusually low during the first half of 1990 in Pennsylvania. In the early summer months of 1991, dry weather effects have slowed growth in Pennsylvania as much as elsewhere.

New York, Michigan, and Ohio increased milk production only slightly more than the national average during the first half of 1991.

Minnesota and Iowa are the only states among the top ten to post declines for the first half of 1991. Minnesota is down 2.5 percent, and Iowa is down 4.6 percent. For Minnesota, this is on top of a very lackluster 1990; however the situation in Iowa is different. Iowa milk production had been going through a large growth spurt since 1988 and was one of the major growth states in 1990. Hence, the reduction this year still leaves Iowa with more milk than it had at this time a couple of years ago.

CURRENT STATUS AND LONGER TERM TRENDS IN MILK PRODUCTION

State Size, Rank, and Share in Milk Production

One hundred years ago New York was the leading milk producing state and there were more dairy farms in the Northeast than we now count for the country as a whole. At that time Wisconsin was the sixth largest milk producing state, and California was not even in the top ten.

Fifty years ago, Wisconsin was firmly entrenched as the leading milk producing state; New York had slipped to third (behind Minnesota); and California had climbed to ninth place. While ascending to the position of leading milk producing state during the late 1800s and the early 1900s, Wisconsin increased its milk production relatively more rapidly than California has been doing over the last two decades.

Wisconsin is still the leading milk producing state today, but California has become the number two state. New York drifted back into third place after regaining second

position in the 1950s and 1960s. This historical shifting in ranking and shares of the top ten dairy states is shown in Table 2.

Table 2. Shares of U.S. Milk Production Among the Largest Milk Producing States, 1889 to 1990.

State	1889	1909	1930	1950	1970	1990
(percent)						
Wisconsin	5.8	8.9	11.2	12.7	15.8	16.5
California	<u>a/</u>	3.1	4.0	5.1	8.1	14.1
New York	12.7	10.5	7.1	7.6	8.8	7.5
Minnesota	<u>a/</u>	5.5	7.6	6.9	8.2	6.7
Pennsylvania	7.1	5.5	4.3	4.8	6.1	6.6
Texas	<u>a/</u>	3.2	3.6	3.0 ^{a/}	2.6	3.7
Michigan	4.3	4.7	4.0	4.6	3.9	3.5
Ohio	6.3	4.8	4.1	4.5	3.8	3.0
Washington	<u>a/</u>	<u>a/</u>	1.7 ^{a/}	1.5 ^{a/}	1.8 ^{a/}	3.0
Iowa	9.3	6.6	5.9	5.3	4.0	2.9
Illinois	7.1	5.3	4.6	4.5	2.5 ^{a/}	1.9 ^{a/}
Top 2	22.0	19.4	18.8	20.3	24.6	30.6
Top 5	42.5	37.0	36.4	37.6	47.0	51.5
Second 5	21.5	21.1	20.1	22.0	16.9	16.2
Top 10	64.0	58.1	56.5	59.6	63.9	67.7

^{a/} Not among the top ten at this time.

Several perspectives on the current size and share of milk production by state are illustrated in the next three figures.

Figure 2 illustrates the relative magnitude of milk production by state for 1990. In this figure the 19 states with milk production in excess of two billion pounds are specifically noted. Virginia is a newcomer to these ranks. Within the top 19, there is a large spread, with the bottom of the spectrum having less than one-tenth the production of Wisconsin, the first ranked state. There are notable gaps between first and second, second and third, fifth and sixth, and tenth and eleventh ranked states.

The current size of each state, based on 1990 milk production, is also illustrated on the map in Figure 3.

Figure 2. Milk Production in Top 19 States and All Others, 1990 (Billion Lbs)

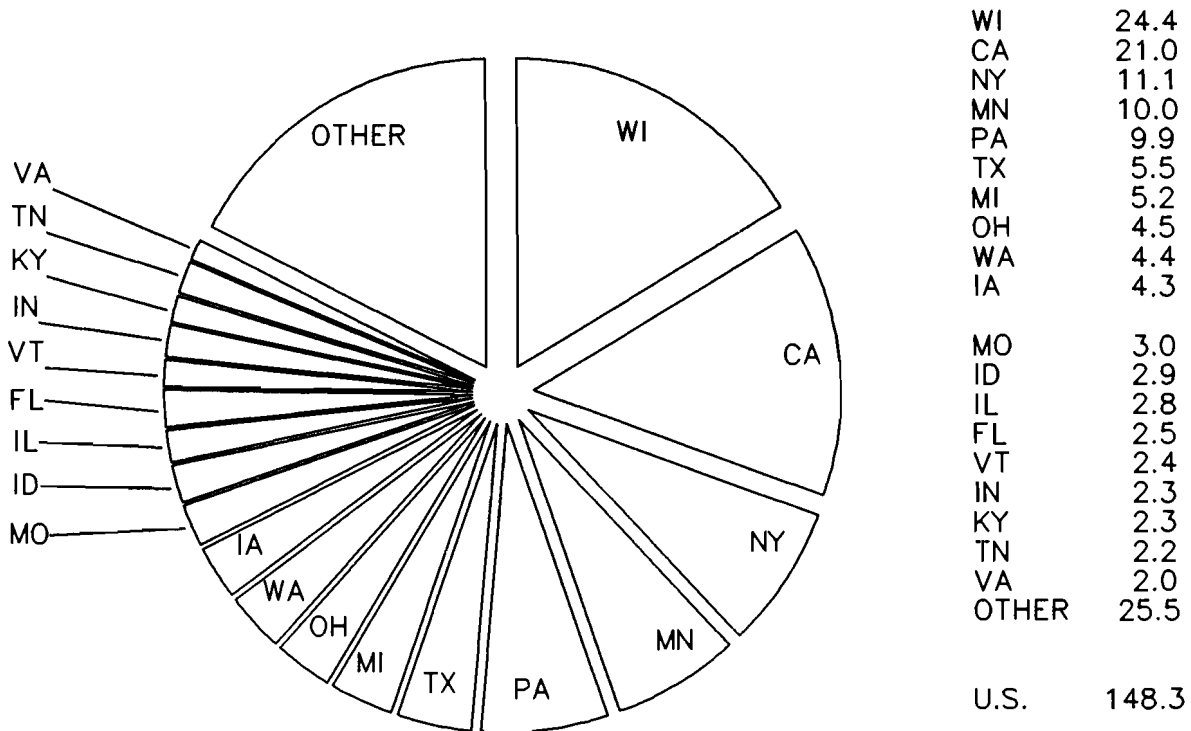
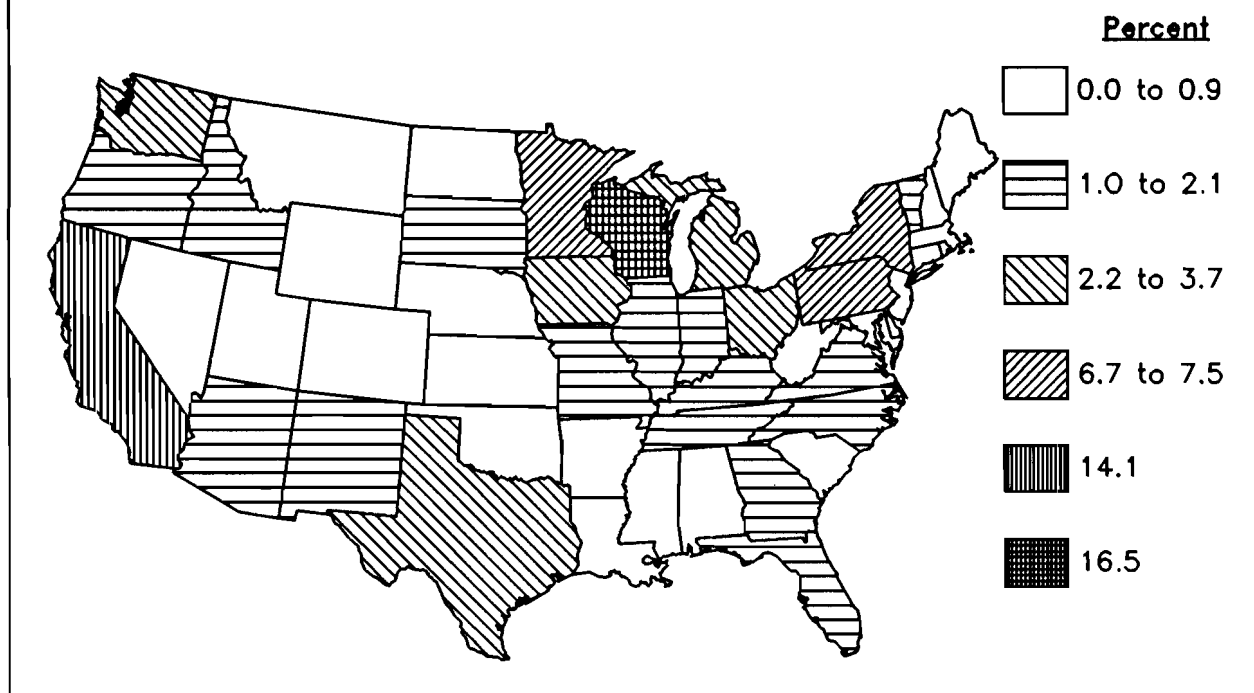


Figure 4 provides a different visual perspective on the scale of milk producing regions. Each region is chosen simply to have contiguous states totaling approximately equal regional production. Wisconsin's milk production represented just under one-sixth of the U.S. total in 1990; hence the U.S. is divided into six regions in Figure 4. Regional groupings can be manipulated to be somewhat larger or smaller, depending on where the somewhat arbitrary borders are drawn. We tried to achieve the most balanced grouping possible.

Even recognizing the arbitrariness of the manner in which these regions were defined, Figure 4 demonstrates that a very large geographic area is required in the Southeast or the Mountain and Plains states to match production in the largest state.

It also highlights the magnitude of milk production in the more compact Northeast. Although it is over twice the area of Wisconsin alone, the Northeast is the second smallest area even though it is the largest of the six regions in terms of milk production. Within the region, three states--#3 New York, #5 Pennsylvania, and #15 Vermont--totaled 23.4 billion pounds. This is 92 percent of the region's total and nearly as much volume as Wisconsin's. The magnitude of milk production in Wisconsin or California is widely recognized, at least in dairy industry circles. Many people, even dairy industry people, outside of the Northeast are unaware of or surprised to hear of the magnitude of dairying remaining in the Northeast.

Figure 3. State Milk Production as a Percent of U.S. Total Production, 1990



The Far West is, of course, dominated by California, which represents 85 percent of production in that region. The growth of California milk production profoundly changes how a map like this looks over time. If a similar map were made using data from 1987, the Far West region would have had to include Oregon and Washington as well.

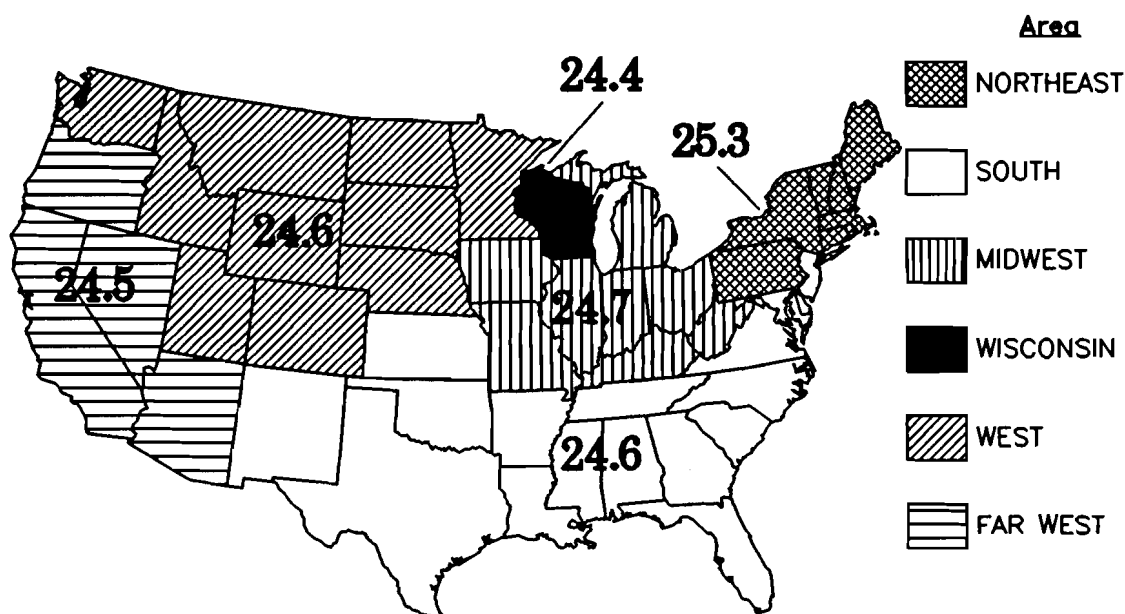
The Midwest region requires eight states to match Wisconsin's production even though three are in the top ten and four are in the second ten. This region produced exactly one sixth of U.S. milk production in 1990.

The West region includes #4 Minnesota, #9 Washington and #12 Idaho but requires seven other states to roughly equal Wisconsin's production.

The South region requires 17 states, including #6 Texas and #14 Florida, to just barely exceed Wisconsin's production by 0.2 billion pounds. Compared to the groupings used in our 1990 publication, New Jersey had to be moved from the Northeast region to the South this year.

The purpose of this figure is not to imply anything qualitative about milk production in any state or area of the country. Rather it is simply to further highlight the commanding position that the largest dairy states hold and to provide a different perspective than the more usual regional groupings (such as the standard USDA regions used by ERS or NASS).

Figure 4. Areas of Equal Volume Production, 1990



One-sixth of 1990 milk production = 24.7 billion pounds

Trends in Milk Production

From 1976 to 1990, U.S. total milk production increased at a simple compound growth rate of about 1.6 percent per year. Growth trends can be analyzed in several other ways. We try to smooth out the ups and downs of annual production figures by statistically estimating a straight-line trend through data from 1976 to 1990.⁴ Based on this simple trend analysis, production has increased at a rate of about 2098 million pounds per year since 1976.

⁴ A simple OLS regression was performed where the dependent variable was annual milk production and the independent variable was the year. Annual production was adjusted to a 365 day basis for leap years. The results are sensitive to the time period selected. Nationally, milk production declined from 1964 to 1969; from 1969 to 1972 it increased; it fell sharply in 1973 and flattened out through 1975; from 1975 to 1983 it increased; after 1983, it fell in 1984, 1987, and 1989, but otherwise increased. Although any national production trend that includes the 1980s will be positive, how much production trends upward will be affected by when the time series is started and when it ends. State level trends are similarly affected. Our use of 1976 to 1990 data is arbitrary. It covers a long enough period that the effects of very short term ups and downs are reduced, and it is a time when national production was basically trending upward at a large rate. With these caveats in mind, any further interpretations or suggestions for future growth patterns must be made with appropriate caution.

Table 3 summarizes the growth trends of individual states using the same method of analysis. Annual increases in pounds per year are based on a straight-line trend from 1976 to 1990. This annual trend is also shown as a percentage of the annual average milk production for the years from 1976 to 1990.

Table 3. Annual Trend in Total Milk Production Among the Top Ten Dairy States, 1976-1990^{a/}

State	Average Annual Increase (million pounds)	Percent of Average Production from 1976 to 1990
California	650.9	4.23
Wisconsin	311.5	1.34
Pennsylvania	205.2	2.24
Texas	139.8	3.48
Washington	133.9	3.99
Minnesota	91.8	0.92
New York	85.1	0.77
Michigan	45.9	0.89
Ohio	31.3	0.68
Iowa	13.5	0.34
U.S.	2098.6	1.56

^{a/} Production trends were calculated from annual production adjusted for leap years.

California has experienced the largest rate of growth, both in actual pounds and as a percentage of average production during this period. Wisconsin ranks second in terms of annual total milk production expansion since 1976, but when measured as a percentage of average production it is slightly below the national average. Pennsylvania, Texas and Washington are the only other top ten dairy states to possess percentage growth rates above the U.S. national average, all three being well above it.

Texas zipped by both Minnesota and Washington for the fourth spot, in terms of percentage growth rates, in 1990, moving up three places in as many years. This rise through the ranks is partly attributable to Texas' fast growth rate during the 1980s, especially the late 1980s. This rapid growth appears to have ground to a halt in 1991, with many Texas analysts suggesting that growth in Texas milk production is likely to remain more sluggish in years to come due to serious environmental restrictions.

At the other end of the spectrum, Iowa has experienced the lowest growth rate among the top ten dairy states since 1976, indicative of the long-standing trends of

dairy industry contraction in the Corn Belt. At one time Iowa was among the very top milk producing states (Table 2), but its share of U.S. production has declined steadily since the 1940s. In the late 1970s and early 1980s it seemed only a matter of time before Washington would overtake Iowa for the ninth rank. The data for 1990 indicate that Washington has at last squeezed ahead of Iowa, despite the latter's surprisingly substantial increases in production in the late 1980s. From 1976 to 1988, Iowa milk production fluctuated in a range from 3.8 to 4.0 billion pounds. In 1989 it broke this pattern and jumped to 4.2 billion pounds, and rose again in 1990 to 4.3 billion pounds. In 1991 it appears that Iowa has headed into another down cycle. This up and down change in milk production seems to be a characteristic of Iowa, but it is not common among other states.

The Next Fifteen Years

Based on the annual growth rates in Table 3, milk production is extrapolated to 2005, as shown in Table 4. This extrapolation illustrates the impact of future growth at these recent rates; however it must be emphasized that it would be naive to blindly extrapolate simple regression trends for the purposes of forecasting. Likewise, any interpretation of this analysis should be tempered by noting that the period since 1976 has been one in which there have been widespread increases in milk production. If the statistical analysis were carried back to a time before milk production began its steady upward climb, the resulting equations would not have as large a positive trend coefficient.

The rapid growth in California is well known and much discussed. It has become fairly common to see projections of when California will surpass Wisconsin as the nation's largest milk producing state. Using linear trend methods to make such a forecast is largely affected by how far back one reaches to collect data. California's meteoric increases in production have become more pronounced in recent years; thus the inclusion of older time series data has the effect of pushing back the date California would be predicted to pass Wisconsin in total milk production. Table 5 shows how this year varies with the choice of starting year. Based on production trends since 1975, California milk production will just pass Wisconsin's in 2010.

Texas has moved up in the rankings considerably in recent years. However, with Pennsylvania production almost twice that of Texas and growth in Texas milk production slowing considerably now, it will be some time before Texas breaks into the top five. The gap in production between sixth place Texas and seventh place Michigan has been steadily widening.

Until 1990, Iowa and Washington had held down the ninth and tenth places, respectively, with production differences of less than 150 million pounds separating them in any one year. In 1990, as previously discussed, Washington edged out Iowa for ninth place by only 68 million pounds. Washington milk producers will widen that

gap in 1991. The projection in Table 4 shows Washington replacing Michigan in seventh place by 2005.

Table 4. Milk Production of Top Ten Dairy States in 1990 and Projected to 2005 Based on Trends from 1976 to 1990.^{a/}

State	1990		2005	
	Rank	Amount	Rank	Amount
		(million pounds)		(million pounds)
Wisconsin	1	24,400	1	30,020
California	2	20,953	2	29,726
New York	3	11,102	4	12,944
Minnesota	4	10,006	5	12,048
Pennsylvania	5	9,993	3	13,665
Texas	6	5,539	6	7,091
Michigan	7	5,233	8	6,143
Ohio	8	4,495	9	5,254
Washington	9	4,398	7	6,300
Iowa	10	4,330	10	4,302
U.S.		148,284		181,125

^{a/} Production trends were calculated from annual production adjusted for leap years.

Table 5. The Effect of Starting Year on Production Projections Based on Historical Trends

If the time-series data begins in:	California is predicted to pass Wisconsin in:
1960	2038
1965	2033
1970	2026
1975	2010
1980	1999
1985	1994

Although it is seldom thought of as a major growth state, Pennsylvania's growth has been substantial among the leading dairy states. In 1990, 73 million pounds (less than one percent) separated Pennsylvania and Minnesota. During the first six months of 1991, milk production in Minnesota was 2.5 percent below year earlier levels, whereas Pennsylvania ran two percent above year earlier levels. In total the two states had nearly equal production for the first six months. Whether it occurs in 1991 or later, it would not be surprising if Pennsylvania overtakes Minnesota as the fourth largest milk producing state in the near future. In fact, our naive trend extrapolation in Table 4 shows Pennsylvania capturing the third spot ahead of New York and Minnesota in the early 21st century.

ANALYSIS OF CHANGES IN MILK PRODUCTION BY STATES

The Big Get Bigger

California and Wisconsin have led all states in volume growth. As they become even larger, it appears that the gap between them and states lower in the rankings will widen, as shown in Table 4. From the late 1800s through the 1960s, the top two dairy states accounted for about 20 percent of the nation's milk (cf. Table 2). In 1990, the top two states had almost 31 percent of the U.S. total. Based on growth patterns of the last fifteen years, Wisconsin and California will command over one-third of U.S. production by 2005.

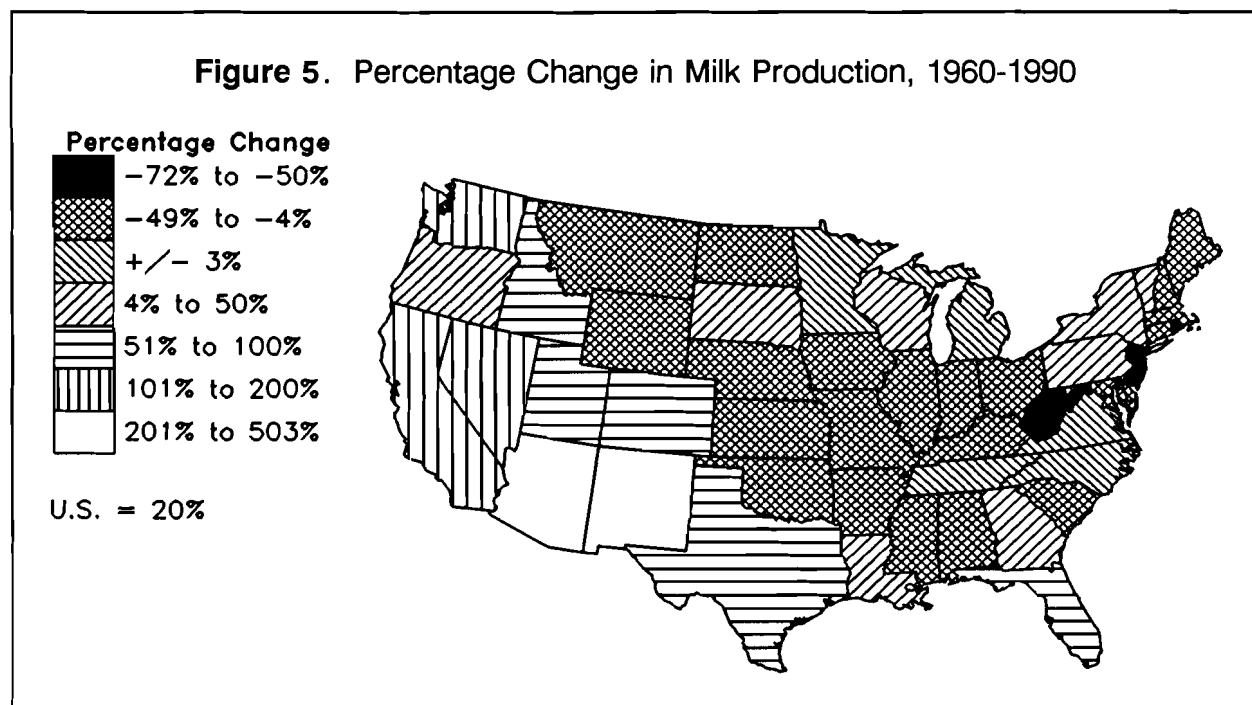
Today over half of U.S. milk production comes from the top five states. Of the next three highest states, Pennsylvania has generally maintained its share, while New York and Minnesota have declined.

Prior to the 1960s the second five had a share of slightly over 20 percent. In 1990 their share is just over 16 percent. The jump from fifth to sixth is large. The production share of the second five totals less than Wisconsin's (16.5 percent), but it has been growing in the last two years, largely as a result of growth in Texas and, to a lesser extent, in Iowa and Washington.

With two-thirds of the U.S. milk supply coming from ten states, one might well question how important it is to look at production in any one of the other states. Missouri and Idaho are the only other states to have more than a two percent share. Outside the top ten, only nine states produced more than 2 billion pounds of milk in 1990; together their total is about 1.5 billion pounds more than California. The average size of the "lower 40" is about 1.3 billion pounds, with an average share of less than one percent.

If nothing else, this should suggest that for some comparisons, percentage changes in milk production in a smaller state or region need to be balanced against actual production levels. The fact that percentage growth in New Mexico is very large is of some interest, but generally it is of small national consequence. Even in a major

dairy state like Texas, comparisons with the largest states must be balanced by actual volume. For example, the amount of milk associated with a 4.4 percent increase in Texas is equivalent to a one percent increase in Wisconsin.



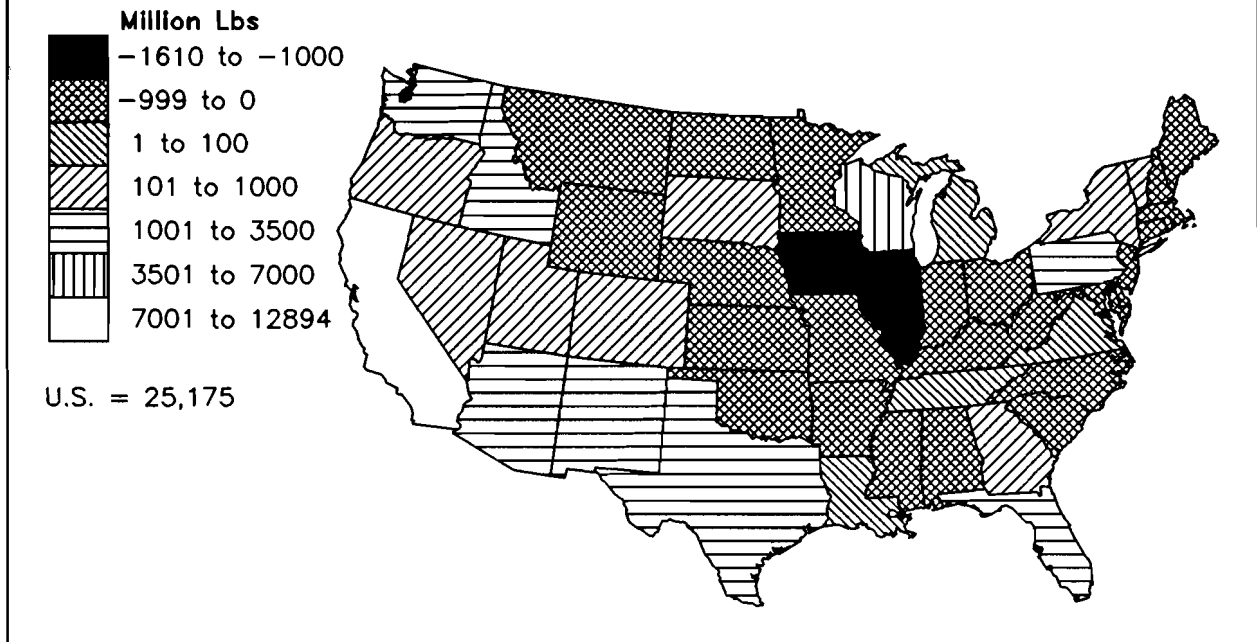
The differences implied by percentage growth versus actual growth are illustrated in Figures 5 and 6, which show changes in state milk production from 1960 to 1990. Figure 6 also illustrates the fact that 27 of the 48 states *actually produced less milk in 1990 than they did 30 years earlier*, despite the fact that U.S. milk production is up more than 25 billion pounds (20 percent) from 1960. Three of those states (Iowa, Ohio, and Minnesota) are in the top ten.

Prospects for Growth and Competitiveness

Growth in milk production, in and of itself, is not necessarily good, and declines are not unequivocally bad. Although changes in milk production probably imply something about the vitality and competitiveness of a state's dairy industry, there are other measures that should be studied. One that we will look at here is production per cow.

Production growth has not occurred in all states; however all states have improved their milk production per cow. Until the 1980s, total production growth in most states and at the national level was achieved by steady increases in production per cow, not increases in cow numbers. Improvements in production per cow are only

Figure 6. Actual Change in Milk Production, 1960-1990



one of many possible measures, but we will use it as an indicator of current and future competitiveness and growth potential.

Table 6 and Figure 7 illustrate the very different rates at which the leading milk producing states improved their production per cow. As with our earlier trend analyses, these are straight-line trends. The time period of analysis is longer, but there are no significant ups and downs to contend with in the earlier years.

In 1990, Washington ranked second behind New Mexico both in annual rate of gain since 1960 and in actual production per cow. California is just behind Washington in actual production per cow. Its annual rate of gain is quite a bit lower than Washington's, although still respectably above the U.S. average. Texas is the only other leading state that ranks above the U.S. average rate of gain, although it ranks well below the U.S. average in actual production per cow.

Michigan and Pennsylvania rank slightly below the U.S. average rate of gain, but they are above or near the U.S. average production per cow. Of the remaining large states, four are among the bottom ten states according to annual rate of gain, and Wisconsin is teetering on that edge. All (including Wisconsin) also rank below the U.S. average production per cow. New York is within 200 pounds of the U.S. average. Ohio is almost 1500 pounds below the U.S. average production per cow.

Table 6. Trends in Milk Production per Cow Among the Top Ten Dairy States, 1960 to 1990.^{a/}

	<u>Annual Trend^{b/}</u>		<u>1990</u>		<u>1960^{c/}</u>	
	Rank	Lbs/yr	Rank	Amount	Rank	Amount
Washington	2	345	2	18557	5	8380
Texas	11	278	23	14350	40	5100
California	13	266	3	18461	1	9780
U.S.	23	243	16	14642	24	7029
Michigan	27	233	13	15212	13	8070
Pennsylvania	31	225	19	14543	14	7780
Wisconsin	38	204	29	13919	7	8270
Iowa	41	193	25	14197	25	7460
New York	42	190	22	14456	9	8150
Ohio	44	188	34	13143	16	6980
Minnesota	48	175	26	14093	11	8120

^{a/} Ranks are relative to the coterminous 48 states and the U.S. national average.

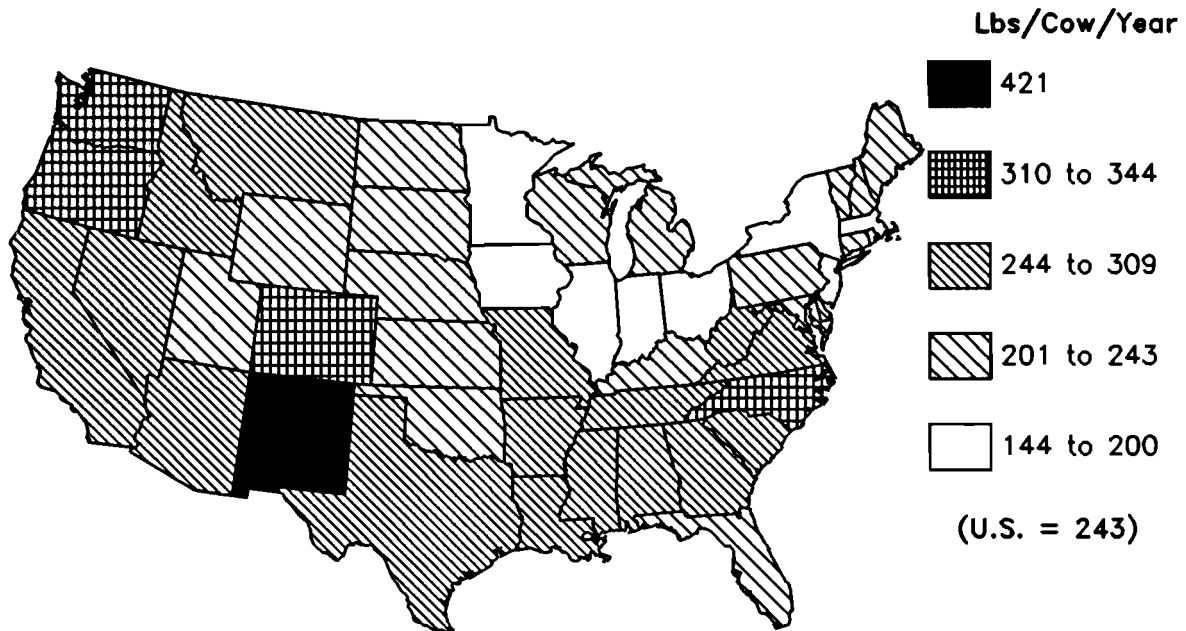
^{b/} Data used to compute trends have been adjusted for leap years.

^{c/} 1960 production data are adjusted for leap year.

The state rankings for actual milk production per cow in 1960 and 1990, shown in Table 6, illustrate the cumulative effects of poor rates of gain. Among the top ten states in 1990, only Texas and Washington showed any improvement in ranking from 1960. California slipped to third, but it obviously occupies a strong position. Between 1960 and 1990, Michigan and Iowa held their ground in the rankings. Pennsylvania, Wisconsin, New York, Ohio, and Minnesota have suffered an appreciable deterioration in their respective ranking. Thirty years ago these states were among the leaders in production per cow as well as total production. Today they are among the bottom third tier of states, based on production per cow gains.

Among the 48 coterminous states, New Jersey shows the lowest rate of improvement in production per cow at 144 pounds per year; New Mexico leads with 416 pounds per year. The median is 236 pounds, slightly less than the average of 243 pounds. As illustrated in Figure 7, the states showing the least improvement are in the Midwest and Northeast. Four of the five leading states are in the West, North Carolina being the exception.

Figure 7. Change in Production per Cow by State, 1960-1990



Past performance in production per cow is not the only indicator of likely future performance or current vitality, but those states showing better than average yield increases are probably more likely to have a growing and/or financially secure dairy farm sector.

CONCLUSIONS

Are there obvious regional patterns here? Yes and no. Growth in the West has obviously been the greatest, but it is not all downhill in the Midwest and Northeast. In fact, the intra-regional differences are more intriguing than those across regions. As noted earlier, in the Midwest Minnesota has been in a weak position and Iowa may not be much better, but neighboring Wisconsin is holding its own. In the Northeast, Pennsylvania has been very healthy, but neighboring New York has a more lackluster record. Comparisons of neighboring farms in any one region would likely reveal as great or greater contrasts.

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