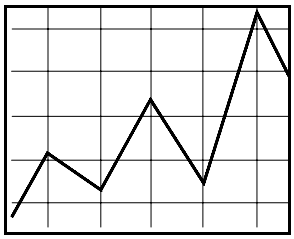
MARKETING AND POLICY BRIEFING PAPER



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Regional Trends in U.S. Milk Production: Analysis and Projections

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Considerable attention has recently focused on the long-term future of dairying in Wisconsin and other Upper Midwestern states. Wisconsin milk production peaked at 25 billion pounds in 1988, and has followed a sideways-to-downward trend since then. Minnesota milk production has shown the same pattern, down about 1.5 billion pounds in 2000 from its peak of 11 billion pounds in 1983. In the meantime, milk production has increased dramatically in several western states, especially California, New Mexico, and Idaho. California removed Wisconsin's crown as the leading milk producing state in 1993, and threatens to become the number one cheese producing state within a few years.

In 2001, several events raised further red flags about the future of dairy farming in the Upper Midwest:

- Alto Dairy Cooperative and Land O' Lakes abandoned plans to jointly construct a large cheese plant in Wisconsin. Land O' Lakes has expanded its operations from the Midwest to California and the Northeast and Alto announced intentions to diversify out of cheese production. Both Cooperatives cited the diminishing milk supply in the Upper Midwest as underlying their decisions.

- Sorrento closed its large Arpin cheese plant, claiming relatively high milk costs and limited milk supply as the principal reasons.

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- The Professional Dairy Producers of Wisconsin (PDPW) issued a report stressing the critical need for Wisconsin dairy farmers to expand milk production in order to maintain the state's processing sector and protect producer profitability.

- Some proposed large-scale Wisconsin dairy farm entrants were stymied by local zoning boards based on negative constituent input.

These events coupled with recent shifts in regional milk production raise serious questions about the competitiveness of Upper Midwest dairying and future levels of milk production in the region. Where is the industry headed? Is dairying in the Upper Midwest on a downhill slope?

To address these questions authoritatively would require advance knowledge of how a host of market, policy, climatic, and environmental factors will influence the future location of milk production. We don't have a crystal ball. But we can shed some light on what might happen if recent trends continue unabated. We do this by projecting long-term trends in regional cow numbers and milk production per cow. We admit up-front that projections based exclusively on historical trends are naïve. Nonetheless, history is a reasonably good guide to the future. And in many cases, trends are strong enough to suggest that aggressive overt actions may be necessary to alter them.

Milk production regions

We assembled annual milk cow and milk production per cow data for the 48 contiguous U.S. states for the period 1950 through 2000. States were aggregated to 13 regions that exhibit similar characteristics with respect to climate, dairy production practices, and milk utilization. The regions conform to the 11 current federal milk order marketing areas with a few exceptions: Unregulated states (except California) are assigned to an adjacent federal order market. The New England states were designated as a separate region in order to separate the Northeast Compact states from the Northeast federal order area. California, not regulated by a federal order, was designated as a separate region. The resulting assignment of states to regions was as follows

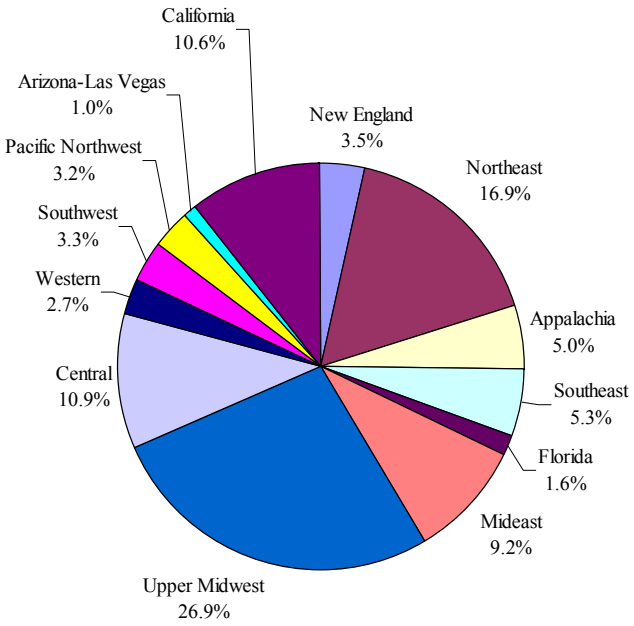
Region	***Included States***			
New England	Maine New Hampshire	Vermont Massachusetts	Connecticut	Rhode Island
Northeast	New York Pennsylvania	Maryland	New Jersey	Delaware
Appalachia	Virginia	Kentucky	North Carolina	South Carolina
Southeast	Tennessee Arkansas	Alabama Mississippi	Georgia	Louisiana
Florida	Florida			

Region	*Included States*			
Mideast	Ohio	West Virginia	Michigan	Indiana
Upper Midwest	Wisconsin	Minnesota	North Dakota	South Dakota
Central	Illinois Iowa	Nebraska Kansas	Missouri Oklahoma	Colorado
Western	Wyoming	Montana	Idaho	Utah
Southwest	New Mexico	Texas		
Pacific Northwest	Oregon	Washington		
Arizona-Las Vegas	Arizona	Nevada		
California	California			

Regional milk production and market shares for 1980 and 2000 are shown below in tabular and graphical forms.

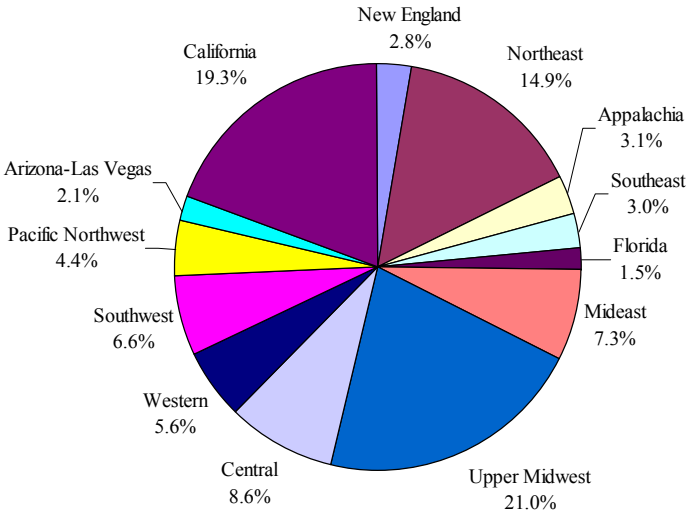
Region	*1980*		*2000*		*% Change, 1980-2000*	
	Production Mil. Lbs	*U.S. Share*	*Production Mil. Lbs*	*U.S. Share*	*Production*	*U.S. Share*
New England	4,530	3.5%	4,668	2.8%	3.0%	-20.8%
Northeast	21,625	16.9%	24,842	14.9%	14.9%	-11.7%
Appalachia	6,365	5.0%	5,149	3.1%	-19.1%	-37.8%
Southeast	6,787	5.3%	4,959	3.0%	-26.9%	-43.9%
Florida	2,028	1.6%	2,461	1.5%	21.3%	-6.8%
Mideast	11,840	9.2%	12,197	7.3%	3.0%	-20.8%
Upper Midwest	34,523	26.9%	35,087	21.0%	1.6%	-21.9%
Central	13,973	10.9%	14,277	8.6%	2.2%	-21.5%
Western	3,421	2.7%	9,275	5.6%	171.1%	108.3%
Southwest	4,227	3.3%	10,971	6.6%	159.5%	99.4%
Pacific Northwest	4,111	3.2%	7,288	4.4%	77.3%	36.2%
Arizona-Las Vegas	1,250	1.0%	3,493	2.1%	179.5%	114.7%
California	13,577	10.6%	32,240	19.3%	137.5%	82.5%
US	128,257	100.0%	166,906	100.0%	30.1%	--

Regional Milk Production Shares, 1980



Total U.S. Milk Production = 128.3 Billion Pounds

Regional Milk Production Shares, 2000



Total U.S. Milk Production = 166.9 Billion Pounds

Changes in milk production were dramatic between 1980 and 2000. In the Eastern part of the U.S., most regions showed a gain in milk production, but all regions lost market share. The Upper Midwest region increased milk production by about a half billion pounds, but saw its market share fall by nearly seven percentage points.

In the West, gains in production between 1980 and 2000 ranged from 77 to 171 percent. Three regions doubled their share of U.S. milk production. Total share for the five West regions increased from 20.7 to 37.9 percent from 1980 to 2000.

Trends in Milk Production per Cow

To project regional milk production, we used trend projections for annual milk production per cow and average number of milk cows for the year. Regional milk per cow and cow numbers are shown graphically in the appendix.

For milk yield, we applied a linear trend with a starting year of either 1950 or 1975. Our criterion for selecting the starting year was minimization of absolute deviations from trend milk per cow for 1996-2000. Coefficients of the linear trend equations are shown below.[2]

Linear Trend Parameters for Regional Milk Yield

Region	*2000 Milk per cow (Lbs)*	*Initial Year*	*Trend Coefficient 1950/75=1 (Lbs./Year)*	*Intercept (Lbs.)*	R^2
New England	17,417	1950	230.42	5,205.2	.99
Northeast	17,581	1975	277.92	10,224.0	.99
Appalachia	14,881	1950	236.03	3,143.3	.99
Southeast	14,457	1950	245.42	1,865.3	.99
Florida	15,675	1950	230.01	3,938.0	.99
Mideast	16,846	1950	230.24	5,076.0	.99
Upper Midwest	17,293	1975	252.59	10,096.0	.98
Central	17,057	1975	282.25	9,173.1	.99
Western	19,860	1975	355.52	10,166.0	.99
Southwest	18,346	1950	310.38	2,093.2	.99
Pacific Northwest	21,626	1975	367.51	11,863.0	.99
Arizona-Las Vegas	21,299	1975	363.88	11,607.0	.97
California	21,169	1950	277.32	6,708.5	.99

[2] See the Appendix for the statistical specifications of the milk yield and cow number trend equations.

Note that both 2000 milk yields and long-run year-to-year increases are higher in the West. Four of the five West regions show a trend increase of more than 300 pounds per year. The comparable increase in the Upper Midwest is about 250 pounds per year.

The R^2 values (percent of year-to-year variation in milk per cow associated with trend) indicate that annual changes in milk yield are very predictable. Improvements in genetics and management have yielded very steady *absolute* gains. But because the base is increasing, the annual *percentage* increase in milk per cow has declined.

Trends in Cow Numbers

Changes in cow numbers do not show the same predictable linear pattern as milk per cow and regions differ considerably in how cow numbers have evolved since 1950 (see appendix). However, inspection of the diverse patterns of change reveals some common tendencies.

Cow numbers in some regions show a clear linear trend, especially in recent years. In some cases, deviations from a linear trend are clearly related to federal dairy policy, especially the milk diversion and dairy termination programs of the 1980s. For other regions, trends appear to be longer-term and nonlinear in nature.

Based on the nature of specific regional patterns, we selected either a linear or log-linear trend specification. We then chose a starting year no later than 1993 that reasonably fit the data and minimized absolute deviations from trend estimates for 1996-2000. The coefficients for the resulting trend equations for cow numbers are shown below.

Note from the trend coefficients that cow numbers exhibit an increasing trend in all five of the West regions. The annual increase in cow numbers in those regions ranged from 3,000 cows (Pacific Northwest) to 36,250 cows (California). Annual percentage increases across the five West regions expressed relative to 2000 cow numbers ranged from 1 to 5 percent.

All other regions show a decreasing trend in cow numbers. For those regions with linear trend specifications, the annual change ranged from (1,600) cows in Florida to (45,700) cows in the Upper Midwest. Expressed as a percent of the 2000 dairy herd, the annual percentage decrease in the Upper Midwest is 2.25 percent.

Trend Parameters for Regional Number of Milk Cows

Region	*2000 Cows (1,000)*	*Trend Specification*	*Initial Year*	*Trend Coefficient*	*Intercept*	R^2
New England	268	Linear	1987	-3.73	317.8	.85
Northeast	1,413	Linear	1971	-16.89	1,944.0	.81
Appalachia	346	Linear	1985	-14.85	569.8	.99
Southeast	343	Log	1954	-667.63	2,936.1	.98
Florida	157	Linear	1976	-1.59	198.7	.80
Mideast	724	Log	1950	-656.54	3,312.4	.94
Upper Midwest	2,029	Linear	1950	-45.71	4,395.0	.94
Central	837	Log	1950	-1,301.70	5,907.7	.94
Western	467	Linear	1993	22.89	276.6	.99
Southwest	598	Linear	1978	12.88	308.9	.94
Pacific Northwest	337	Linear	1970	3.11	263.0	.86
Arizona-Las Vegas	164	Linear	1993	5.46	122.4	.94
California	1,523	Linear	1987	36.25	972.0	.96

Projected 2020 Regional Milk Production

We projected regional milk production through 2020 by extrapolating the estimated regional milk yield and cow number trends. The results are shown in tabular and graphical forms below.

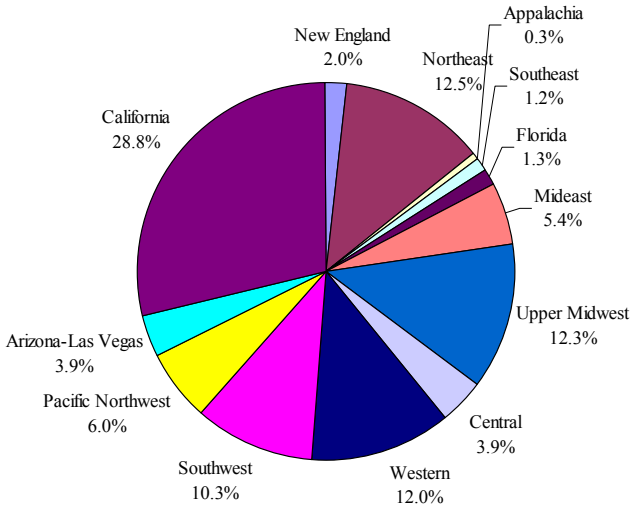
These projections are sobering from the perspective of traditional dairy regions. The Northeast and Florida are the only regions in the East projected to increase milk production between 2000 and 2020 and the increases are small. All regions in the East are projected to lose market share.

Projected Upper Midwest milk production decreases about 10 billion pounds from current levels, to 25 billion pounds in 2020. The projected Upper Midwest market share falls to 12.3 percent, which is below the Northeast share.

Production gains in the West are large, but not as large as actually experienced between 1980 and 2000. Collectively, the five West regions are projected to supply 61 percent of U.S. milk in 2020.

Region	Actual 2000		Projected 2020		% Change, 2000-2020	
	Production Mil. Lbs	U.S. Share	Production Mil. Lbs	U.S. Share	Production	U.S. Share
New England	4,668	2.8%	4,118	2.0%	-11.8%	-27.2%
Northeast	24,842	14.9%	25,298	12.5%	1.8%	-16.0%
Appalachia	5,149	3.1%	701	0.3%	-86.4%	-88.8%
Southeast	4,959	3.0%	2,487	1.2%	-49.8%	-58.6%
Florida	2,461	1.5%	2,577	1.3%	4.7%	-13.6%
Mideast	12,197	7.3%	11,007	5.4%	-9.8%	-25.6%
Upper Midwest	35,087	21.0%	24,964	12.3%	-28.9%	-41.3%
Central	14,277	8.6%	7,954	3.9%	-44.3%	-54.1%
Western	9,275	5.6%	24,333	12.0%	162.4%	116.4%
Southwest	10,971	6.6%	20,818	10.3%	89.8%	56.5%
Pacific Northwest	7,288	4.4%	12,129	6.0%	66.4%	37.2%
Arizona-Las Vegas	3,493	2.1%	7,807	3.9%	123.5%	84.3%
California	32,240	19.3%	58,198	28.8%	80.5%	48.9%
US[3]	166,906	100.0%	202,388	100.0%	21.3%	--

Projected Regional Milk Production Shares, 2020



Projected U.S. Milk Production = 202.4 Billion Pounds

[3] Note that total projected milk production in 2020 is 202 billion pounds, a 21 percent gain from 2000. This implies a slower rate of growth in supply and use of milk (1.0 percent annually) than occurred between 1980 and 2000 (1.5 percent)

Caveats

Repeating our earlier warning, projections based exclusively on historical trends are naïve. Trends provide a foundation for projections, but need to be tempered by subjective reasoning and common sense. More important, trends can be altered by policies at the state and federal levels.

Some of the 2020 milk production projections are clearly unrealistic. For example, milk production in the Appalachian region is shown to nearly dry up between 2000 and 2020. Such a large and rapid decline is implausible. Increasing utilization of milk in higher-valued Class I products would elevate producer milk prices as production fell. That would stimulate local milk supply increases and alter the indicated trend.

The large projected milk production increases in the West are consistent with what has recently occurred. But it is unlikely that such increases are sustainable. Continued rapid growth in the Western region (principally Idaho) and Southwestern region (principally New Mexico) would require a substantial increase in cow numbers. Consequently, growth will eventually encounter natural barriers such as irrigation water availability, higher feed costs, and environmental/manure management restrictions.

California is projected to produce nearly 60 billion pounds of milk in 2020, almost 30 percent of the U.S. supply. Despite occasional water supply problems, high energy costs, increasing competition for land between forage and other crops, urban encroachment, and many other challenges, growth in milk production in the Golden State has been virtually unchecked. But 60 billion pounds is probably not realistic. The brakes on milk production in California will most likely come in the forms of increasing forage costs as competition for land and water intensifies and more stringent nutrient management regulations.

What about the Upper Midwest? A 30 percent drop in milk production by 2020 is possible, but not, in our opinion, likely. The Upper Midwest is characterized by smaller herds than other regions, especially regions in the West. Dairy farm structure is changing rapidly in the Upper Midwest, as the operators of smaller farms retire. As this occurs, the regional dairy herd will increasingly reside in more modern facilities capable of achieving higher milk yields.

We expect that the Upper Midwest will see an upturn in milk production per cow that will alter the downward trend in total milk production and could easily reverse it. The annual gain in milk yield in the region is much smaller than regions in the west. So is the absolute level of production per cow. An increase in milk per cow 25 percent above trend (from 252 pounds per year to 316 pounds) combined with a slowing of the loss in cow numbers from 46,000 cows per year to 40,000 would yield a positive rate of growth in milk production.

A continuation of current milk production trends in the Upper Midwest is more likely if nothing happens to genuinely stimulate investment in dairy production and

manufacturing. Such stimulation could come from the marketplace or from more direct assistance from Upper Midwest states.

Changes in federal milk marketing orders could alter regional milk price patterns and benefit Upper Midwest producers in the long run. But milk prices in Wisconsin and Minnesota are already relatively high compared to most of the West regions. Producers in those regions are expanding despite low milk prices, and any benefits that come from federal order changes will accrue to them as well as Upper Midwest Producers. So relative competitive advantage will not change.

Direct state assistance could take many forms, but generally would involve actions that promote dairy investment on existing and new dairy operations. The region needs to re-assert itself as "dairy friendly" from both an attitudinal and infrastructure support perspective.

Appendix:
Milk production per cow and Cow Numbers by Region, 1950-2000

The following charts plot actual milk yield and cow numbers for the 13 regions identified in this paper. The actual values are shown as bars on the charts. The lines depict trend estimates for applicable time periods.

Regional milk cow numbers are the sum of cow numbers in constituent states. Regional milk per cow is calculated as the sum of milk production for constituent states divided by regional cow numbers.

The milk production per cow trend equations were specified as follows:

$YIELD_t = b_0 + b_1(t-(t_0-1))$

Where t = 1950 though 2000 or 1975 through 2000; b_0 is the intercept term (estimated milk per cow in 1949 or 1974); b_1 is the estimated absolute annual growth in milk per cow, and t_0 is either 1950 or 1975.

The cow number trend equations were specified as either

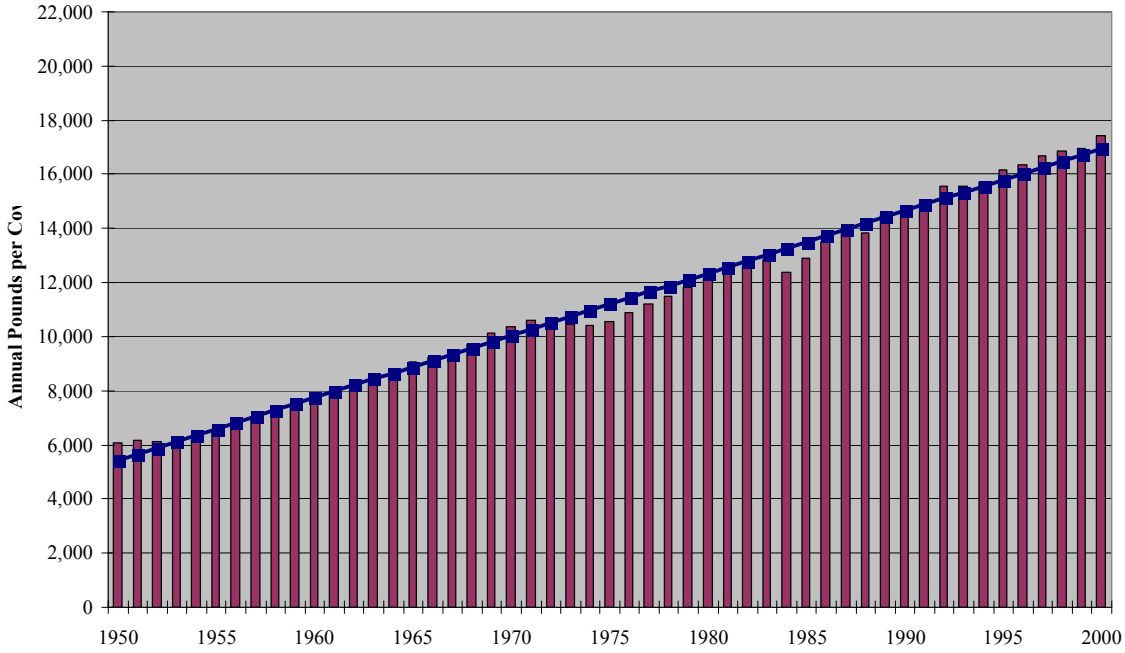
$COWS_t = b_0 + b_1(t-(t_0-1))$ or

$COWS_t = b_0 + b_1 LN(t-(t_0-1))$

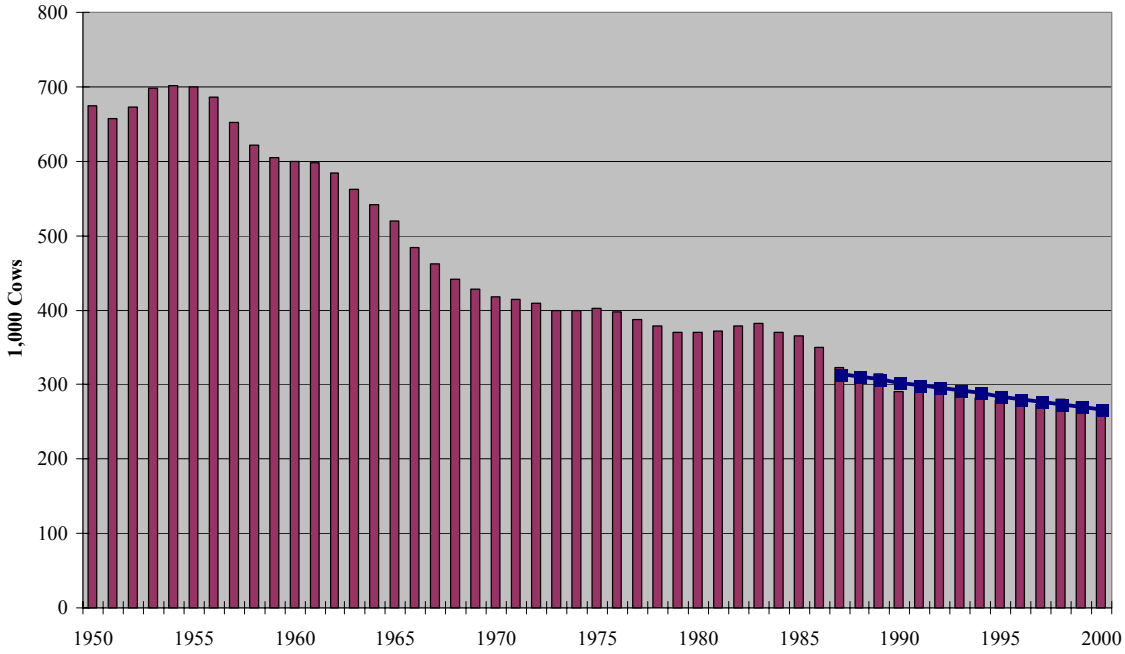
depending on whether a linear or log-linear form was used. The base year (t_0) varied by region. The term, b_0, represents estimated cow numbers in the year preceding the base year. In the linear expressions, b_1 is the estimated annual absolute growth in regional cow numbers.

All data are National Agricultural Statistics Service (NASS), U.S. Department of Agriculture, estimates and were obtained from the annual publication, *Milk Production, Disposition, and Income* or from the NASS web site at:
http://www.nass.usda.gov:81/ipedb/

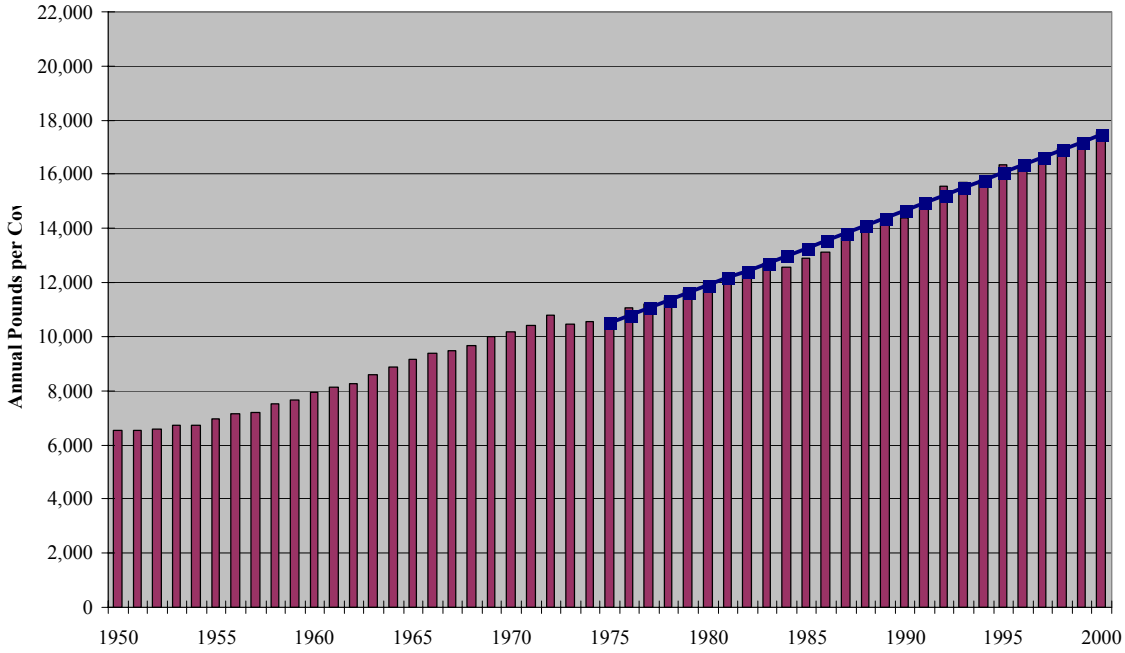
New England - Yield



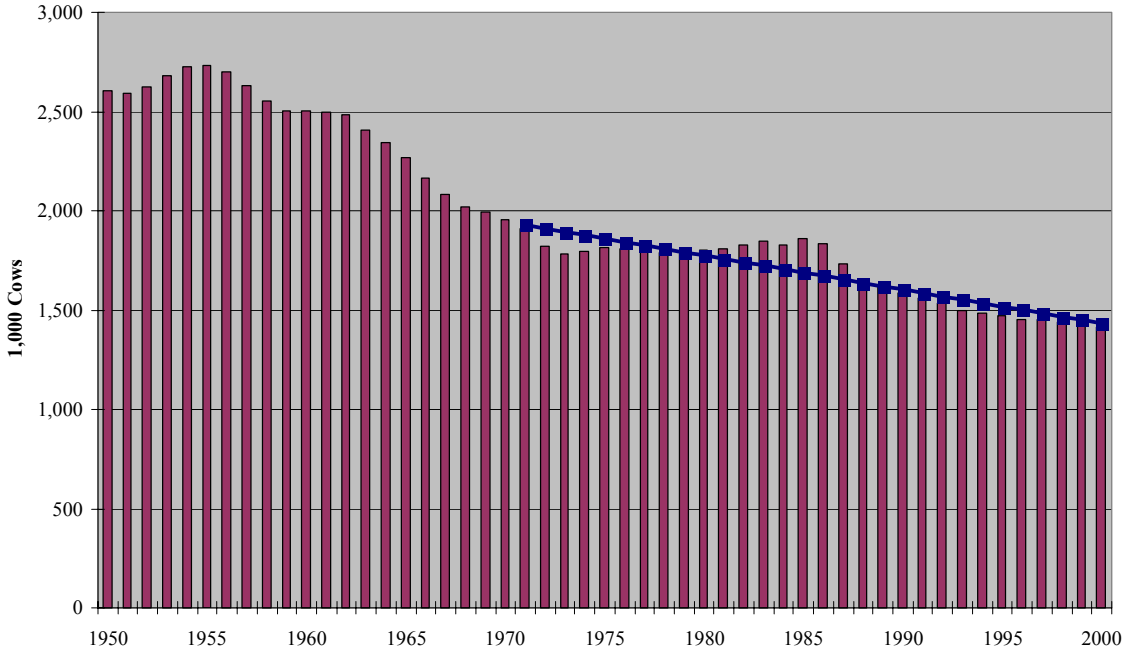
New England - Cows



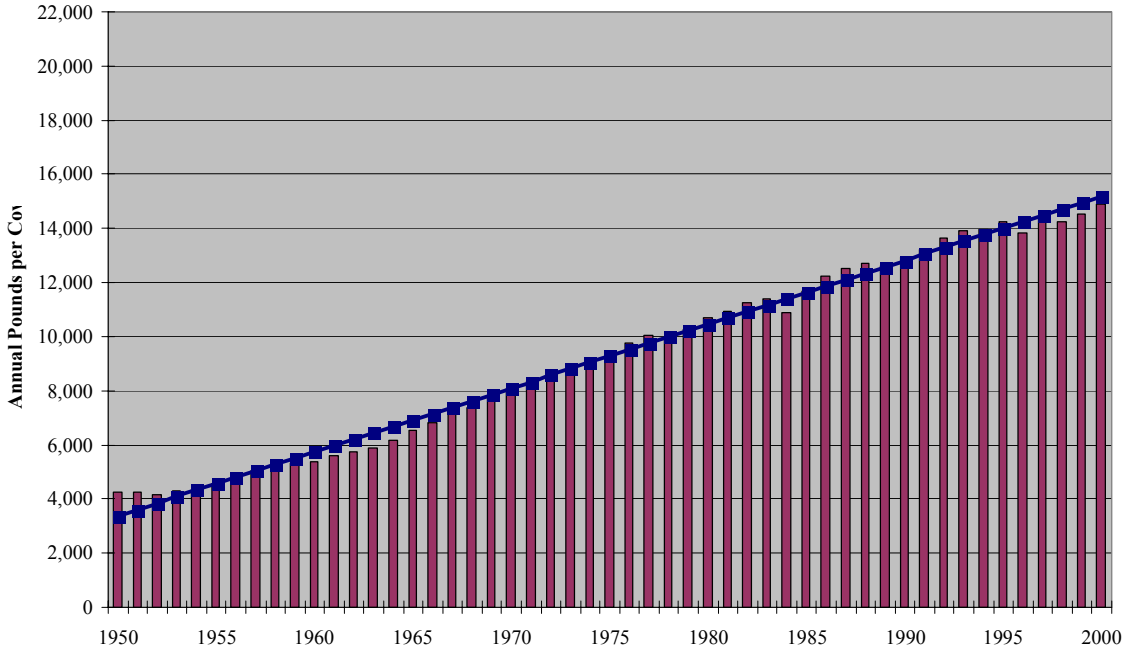
Northeast - Yield



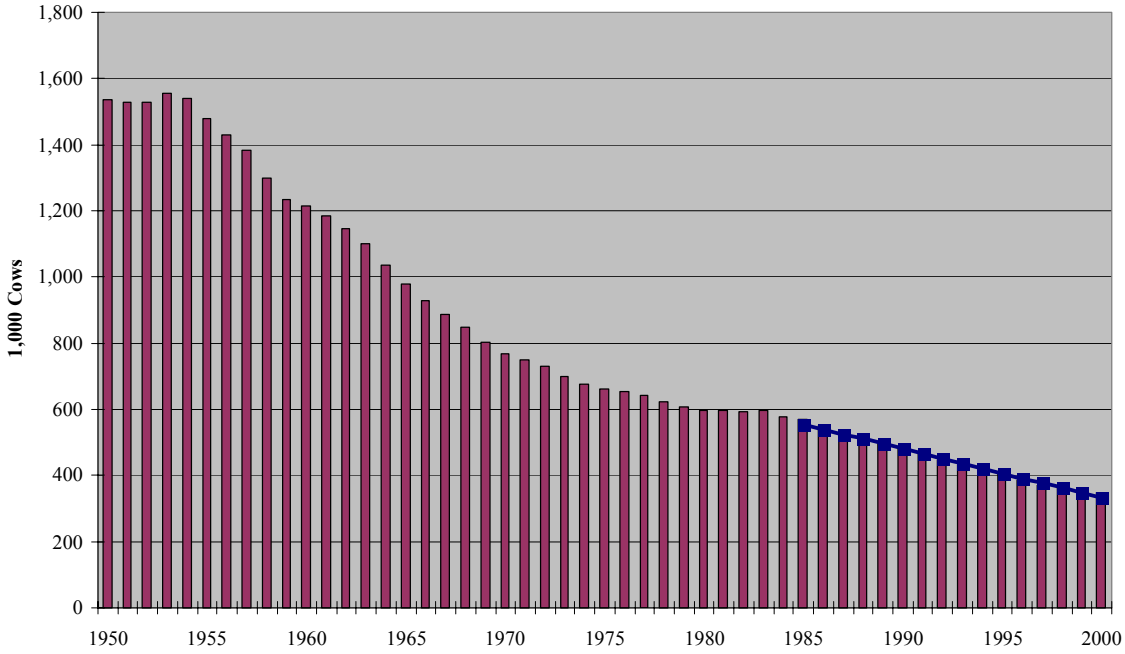
Northeast - Cows



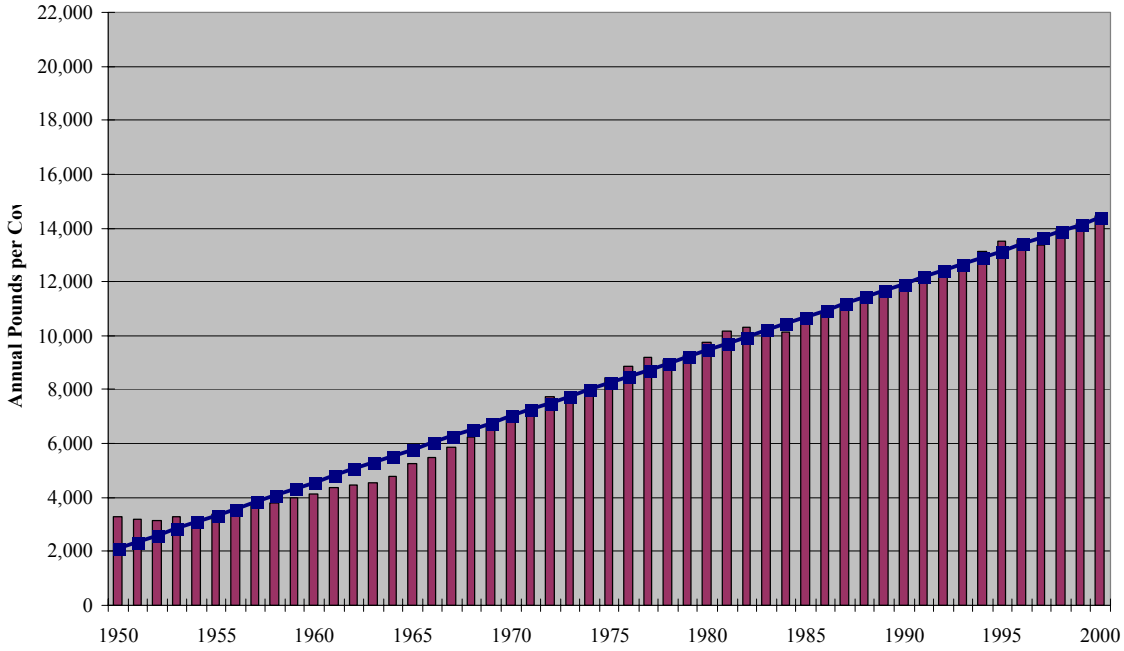
Appalachia - Yield



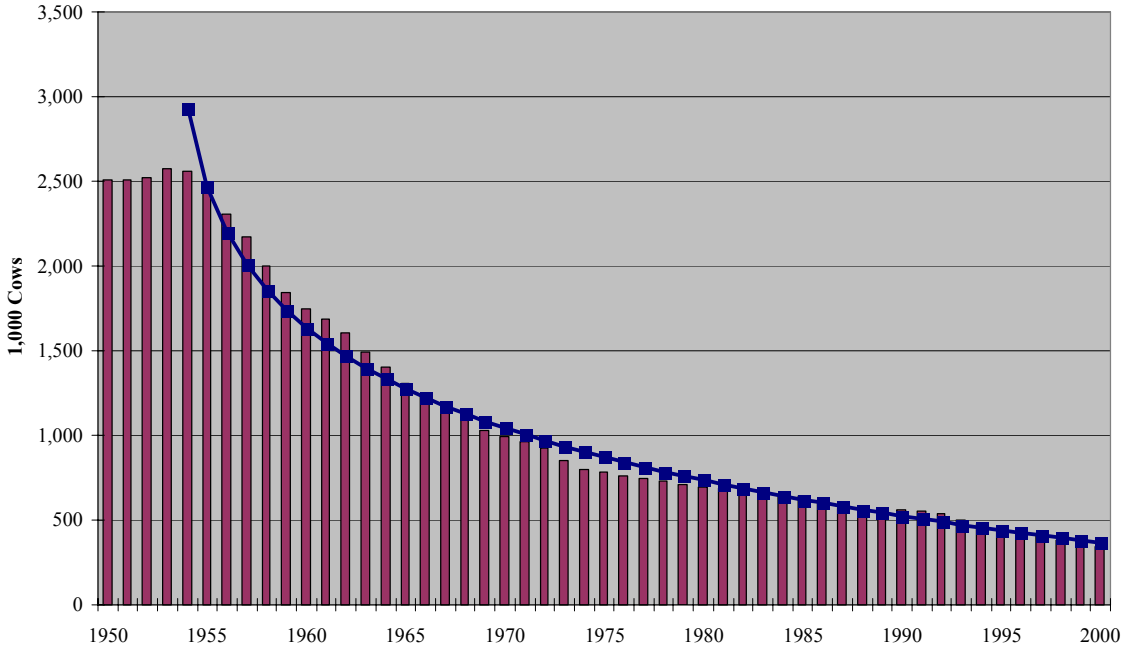
Appalachia - Cows



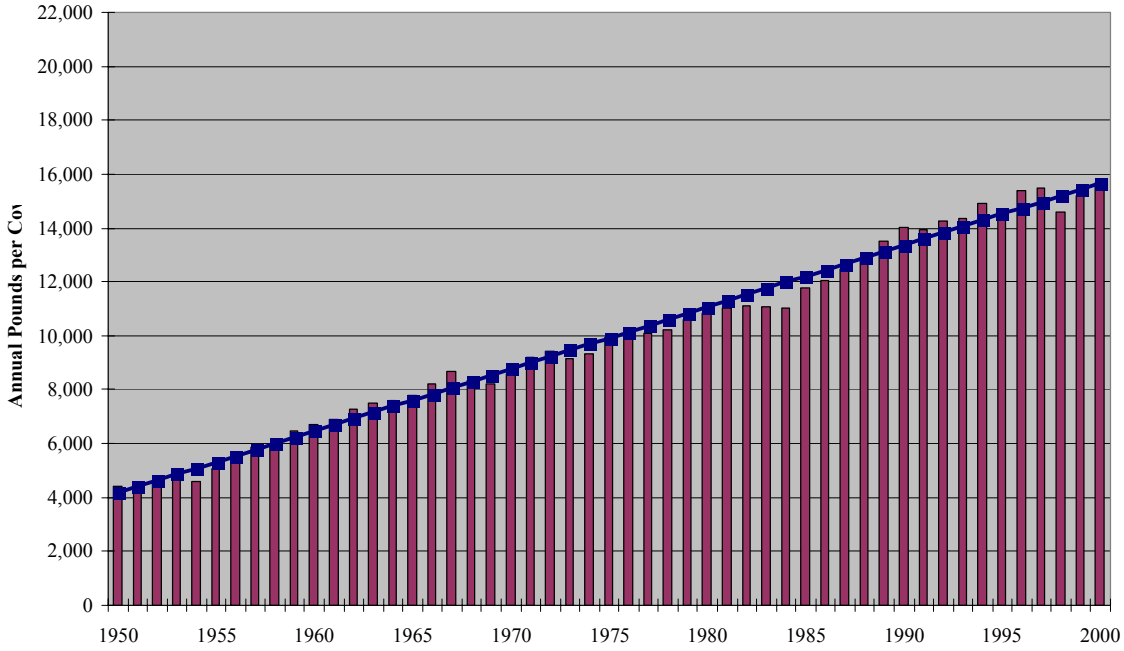
Southeast - Yield



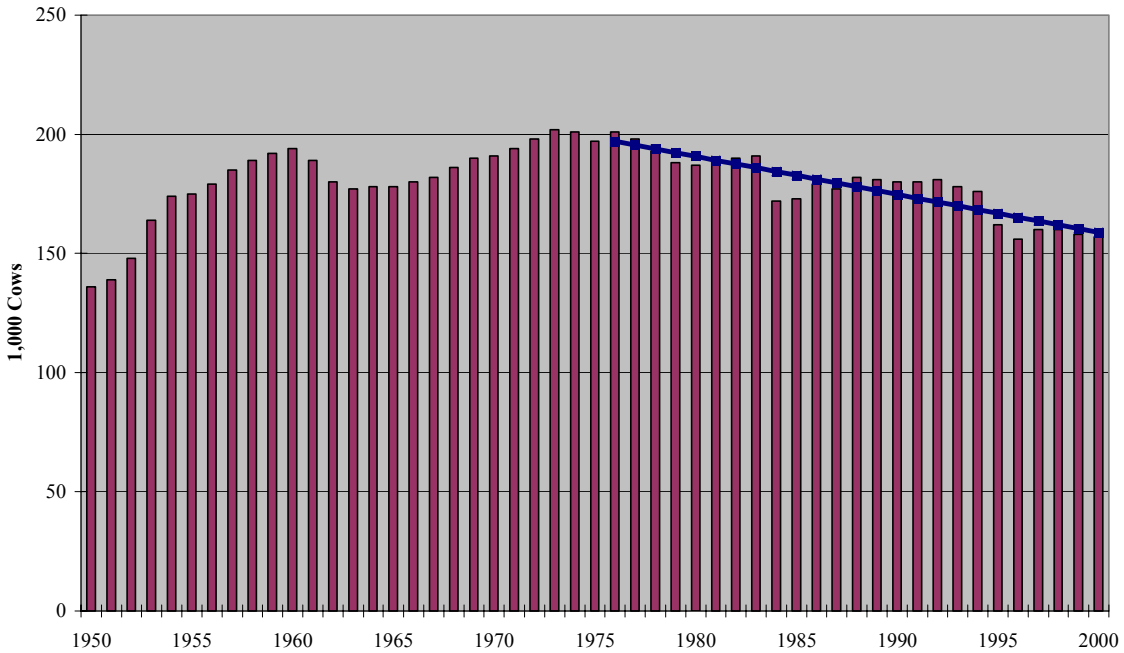
Southeast - Cows



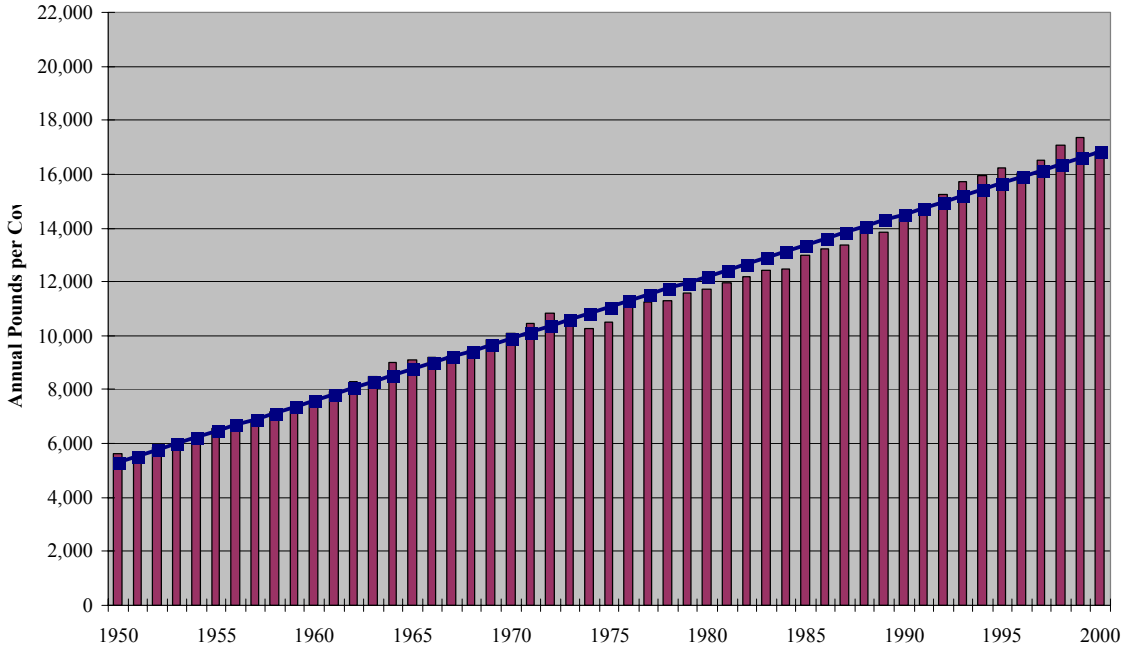
Florida - Yield



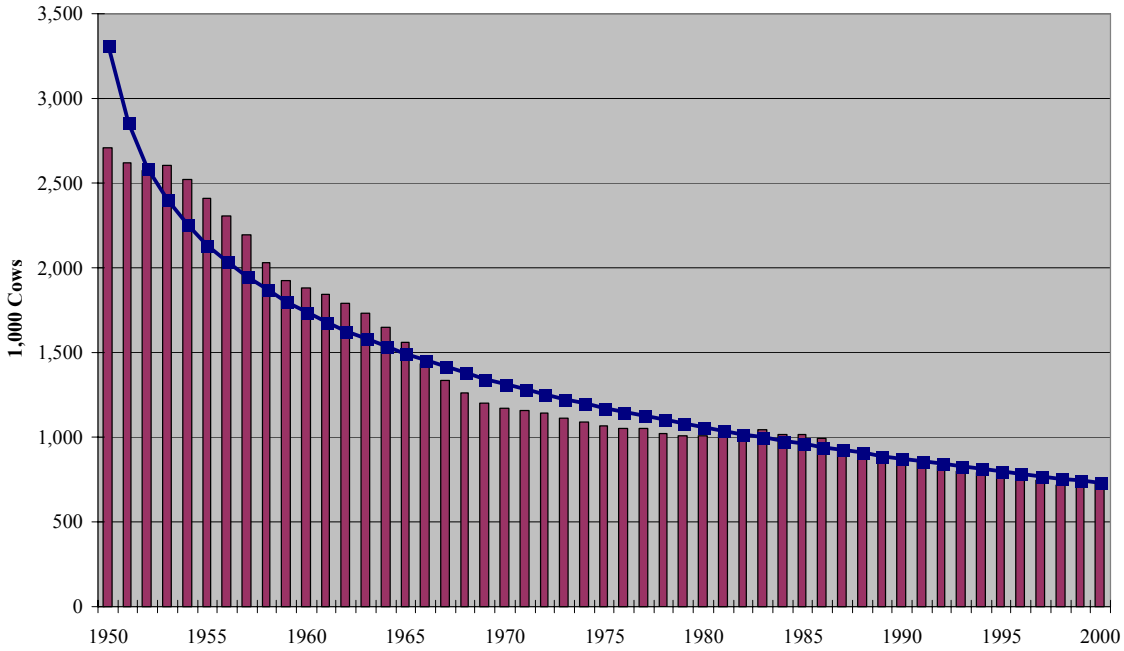
Florida - Cows



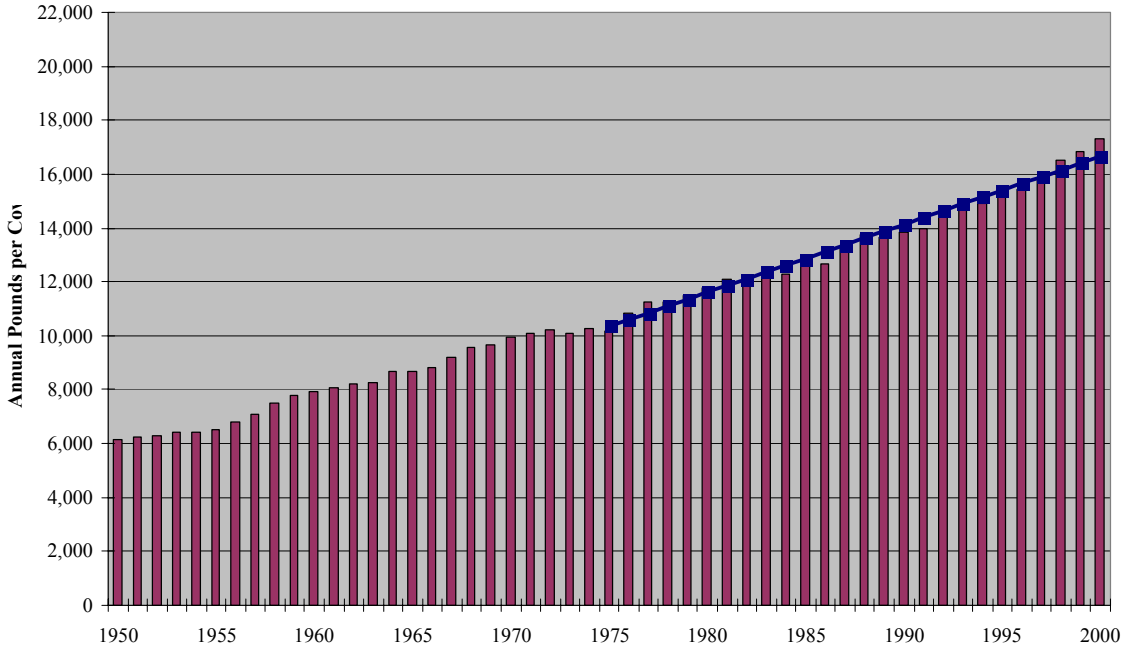
Mideast - Yield



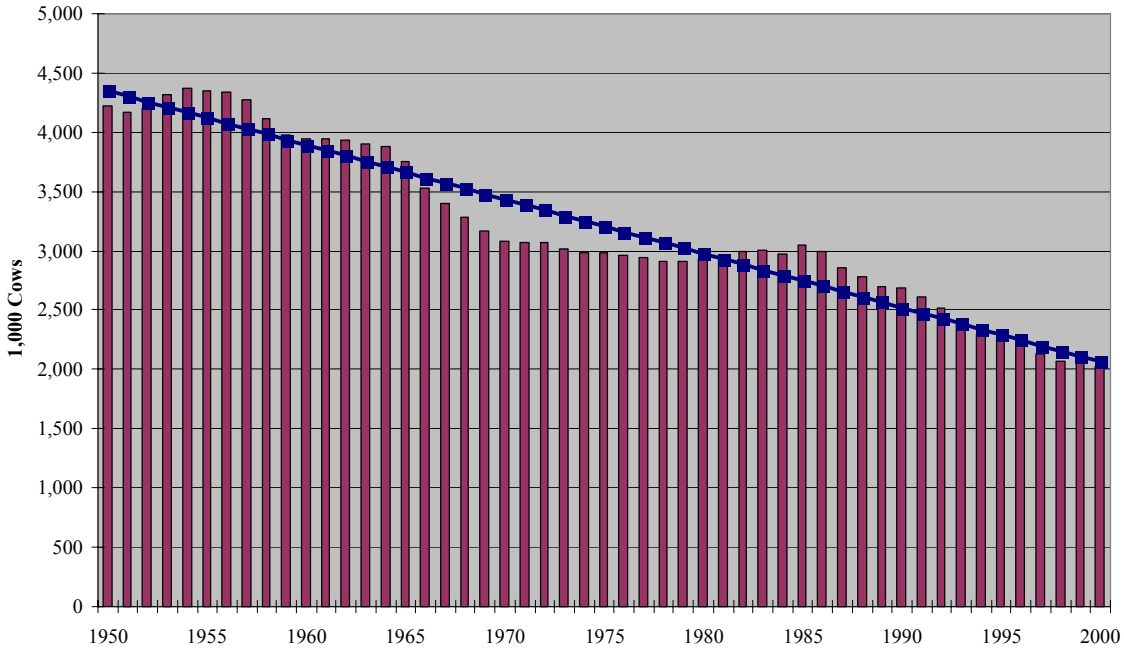
Mideast - Cows



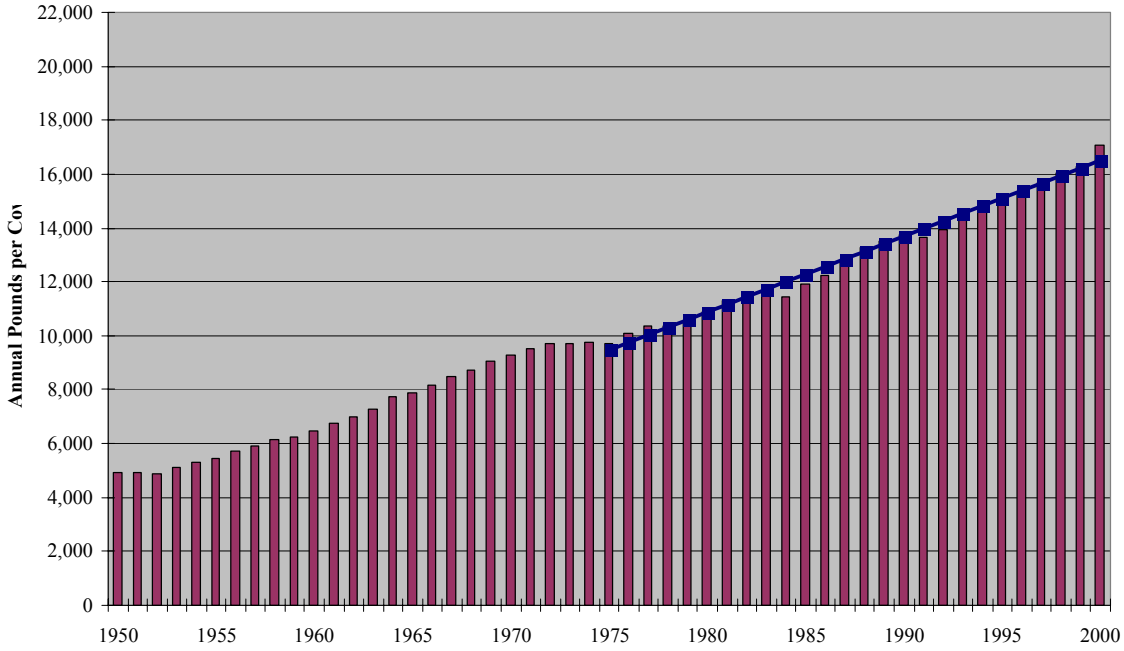
Upper Midwest - Yield



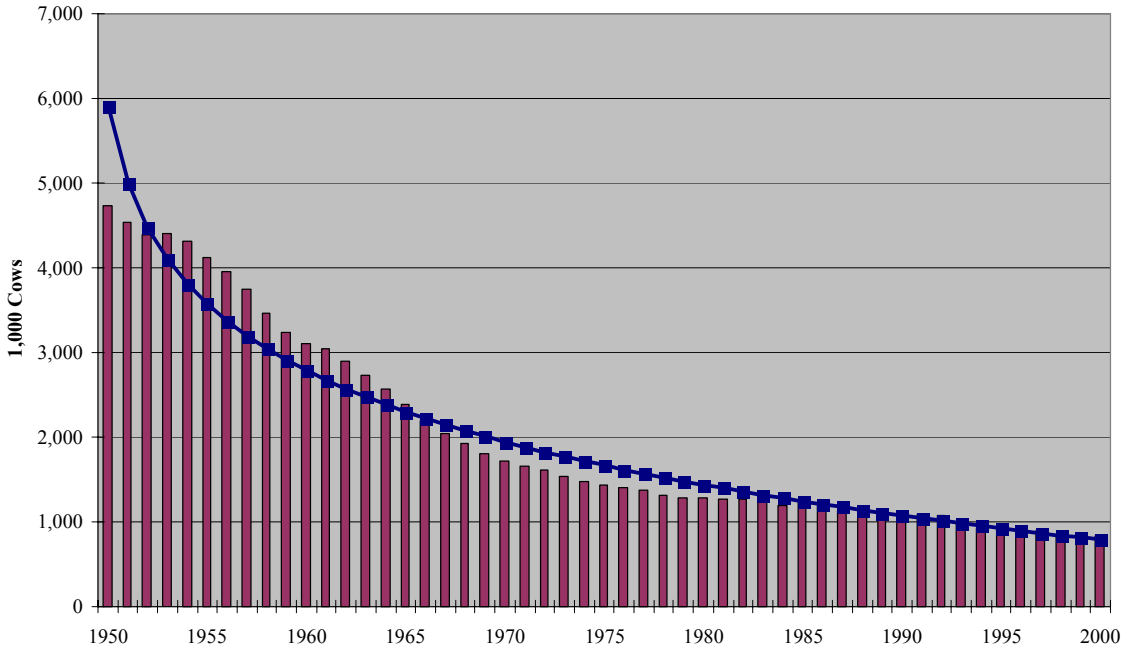
Upper Midwest - Cows



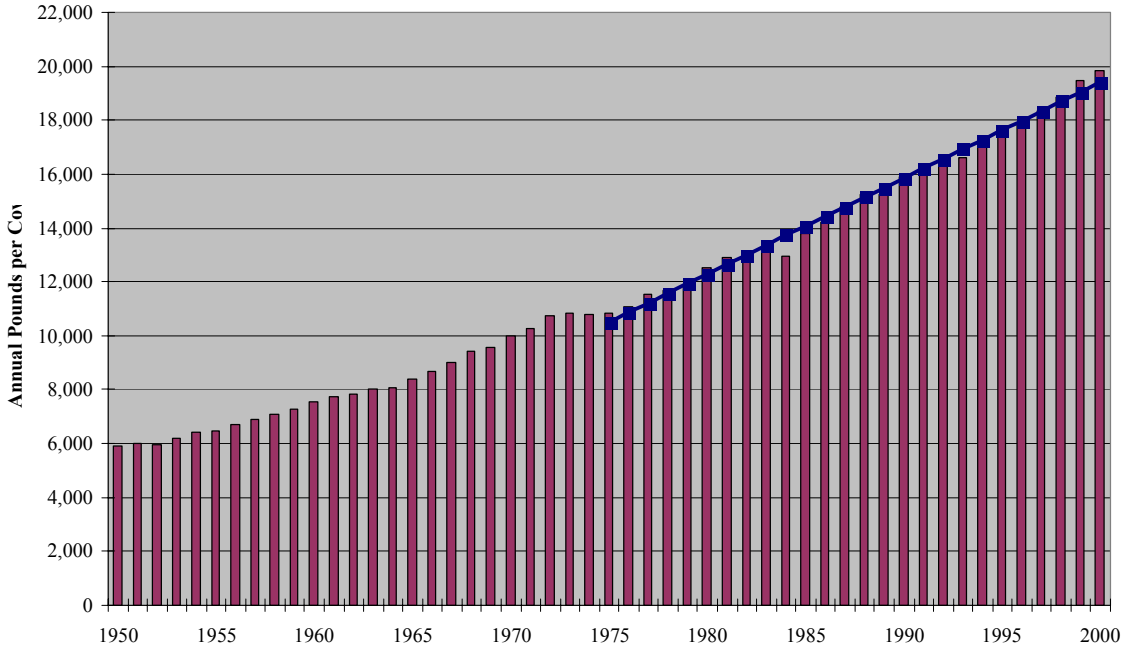
Central - Yield



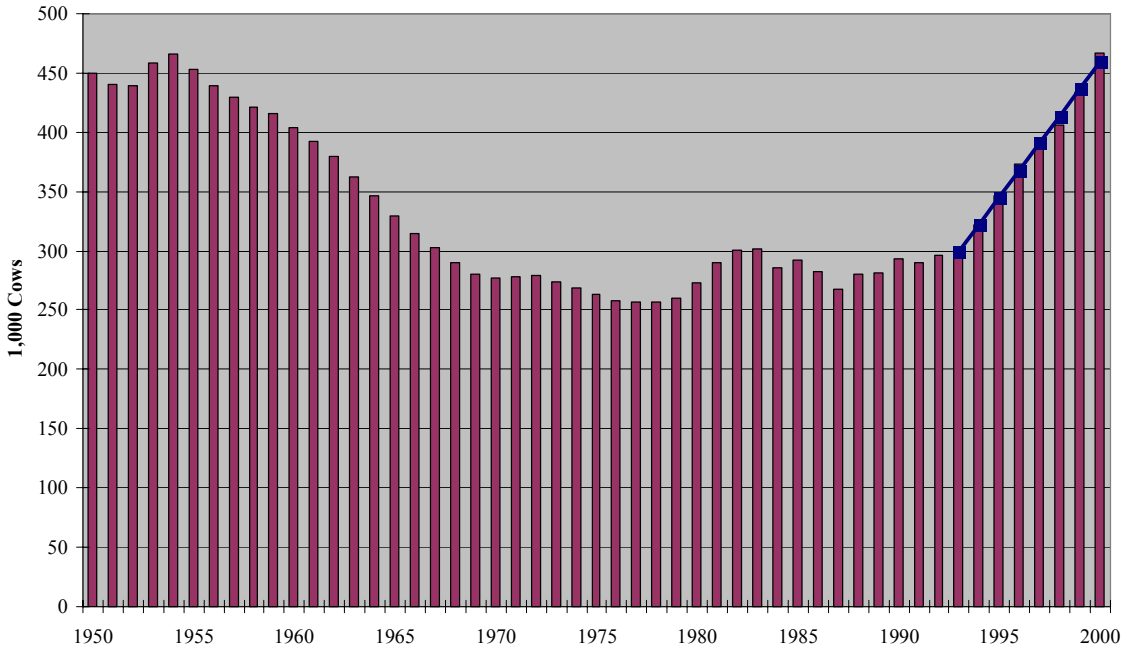
Central - Cows



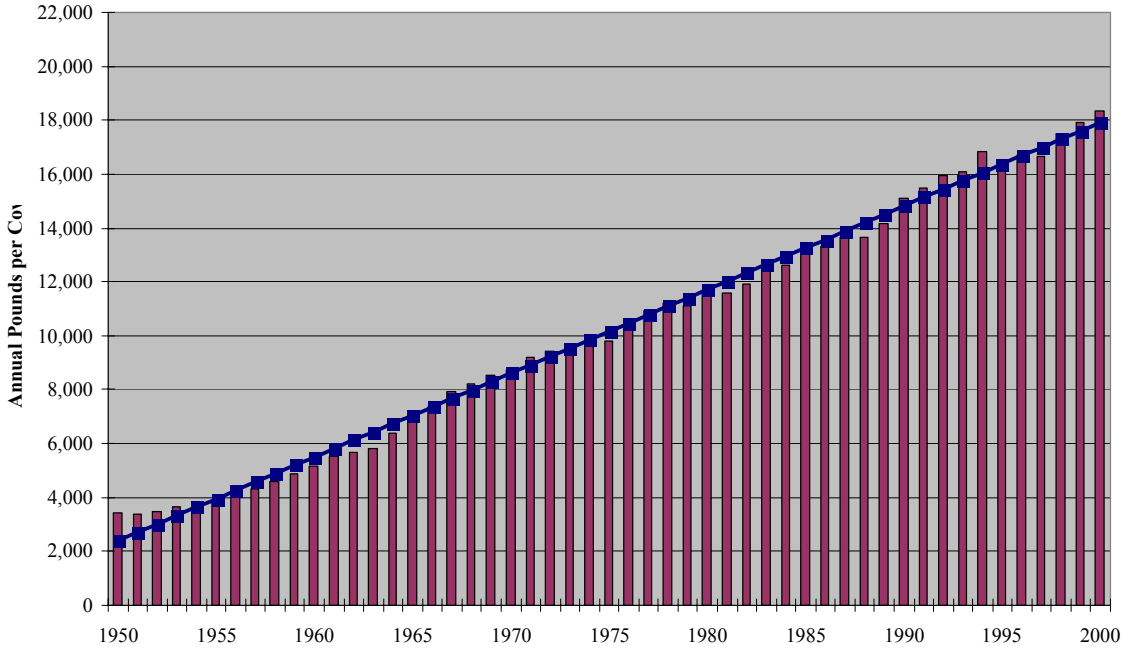
Western - Yield



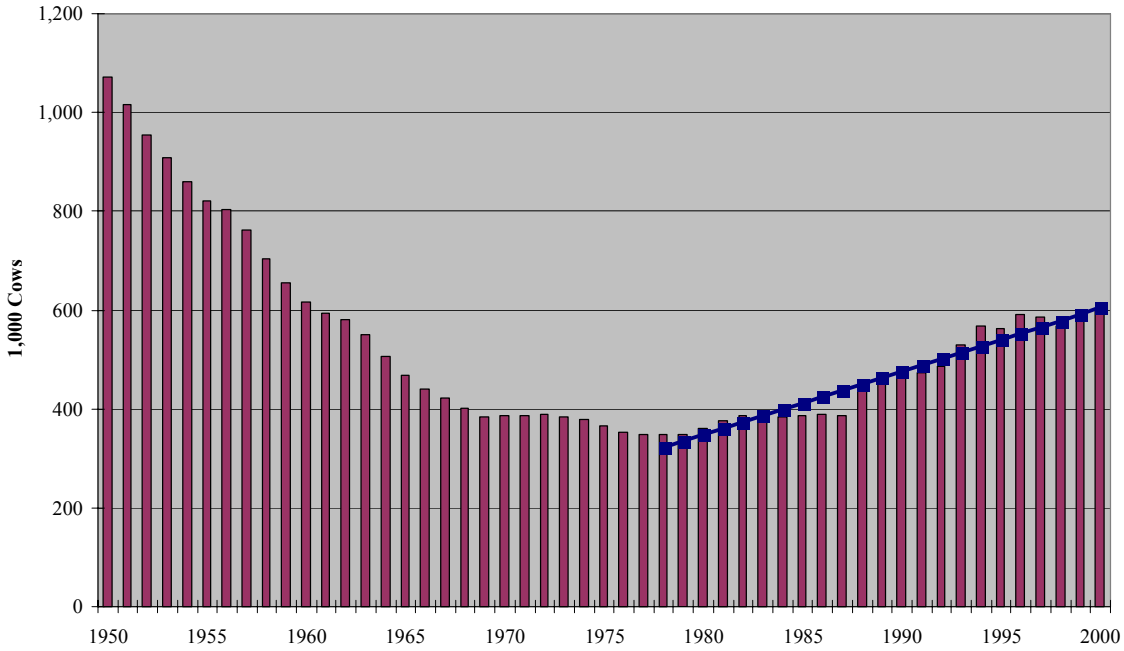
Western - Cows



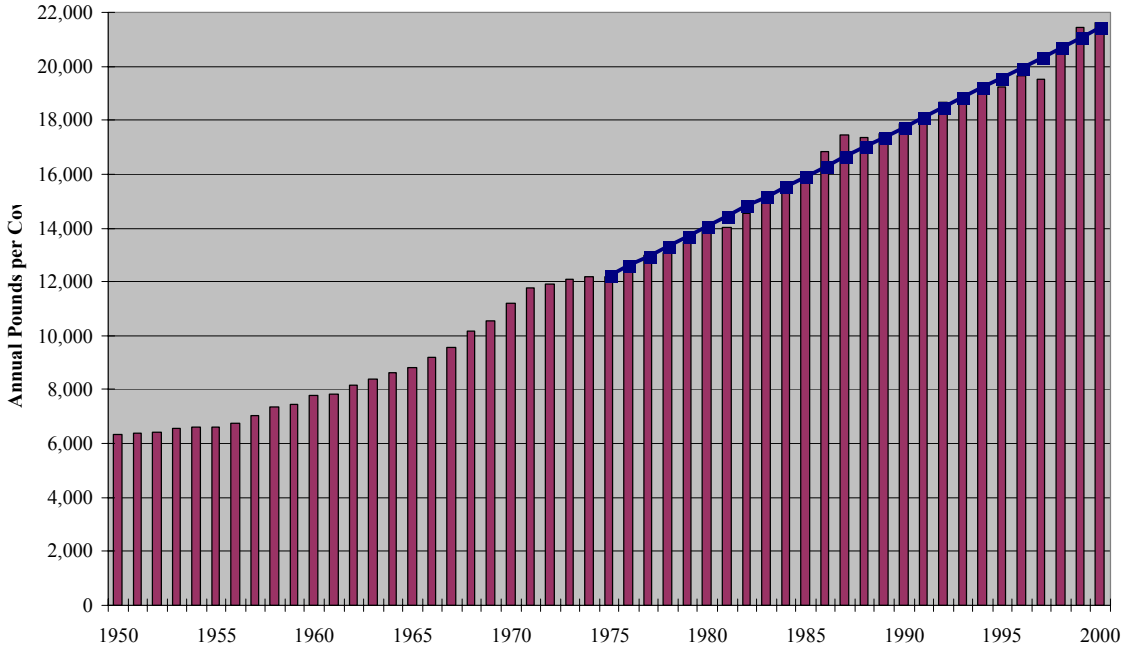
Southwest - Yield



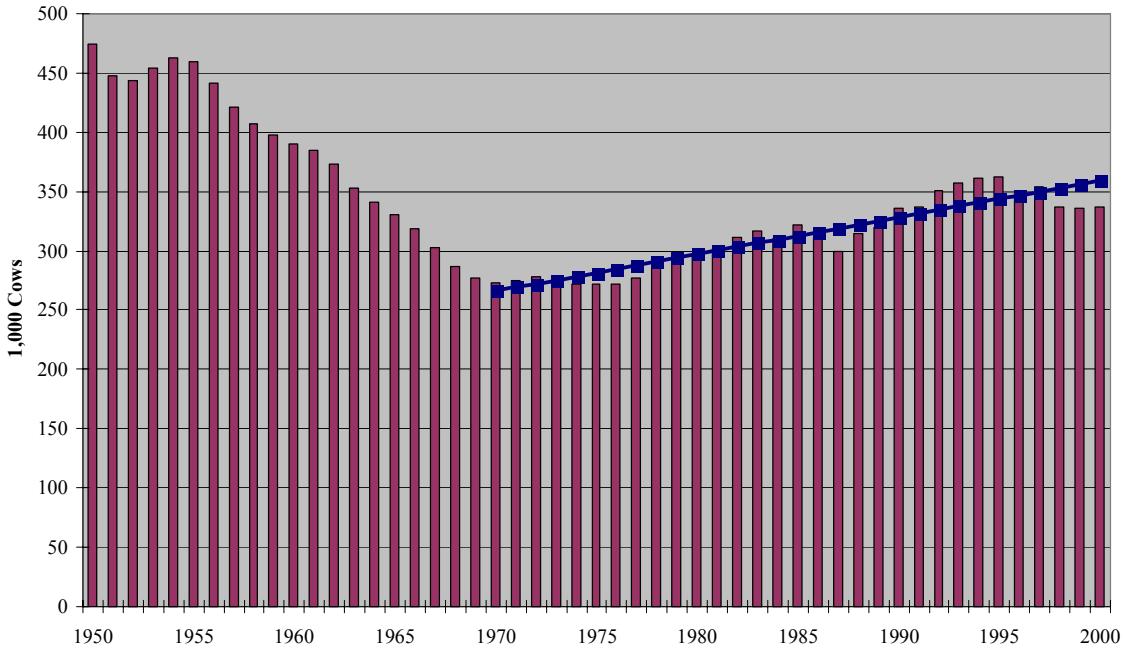
Southwest - Cows



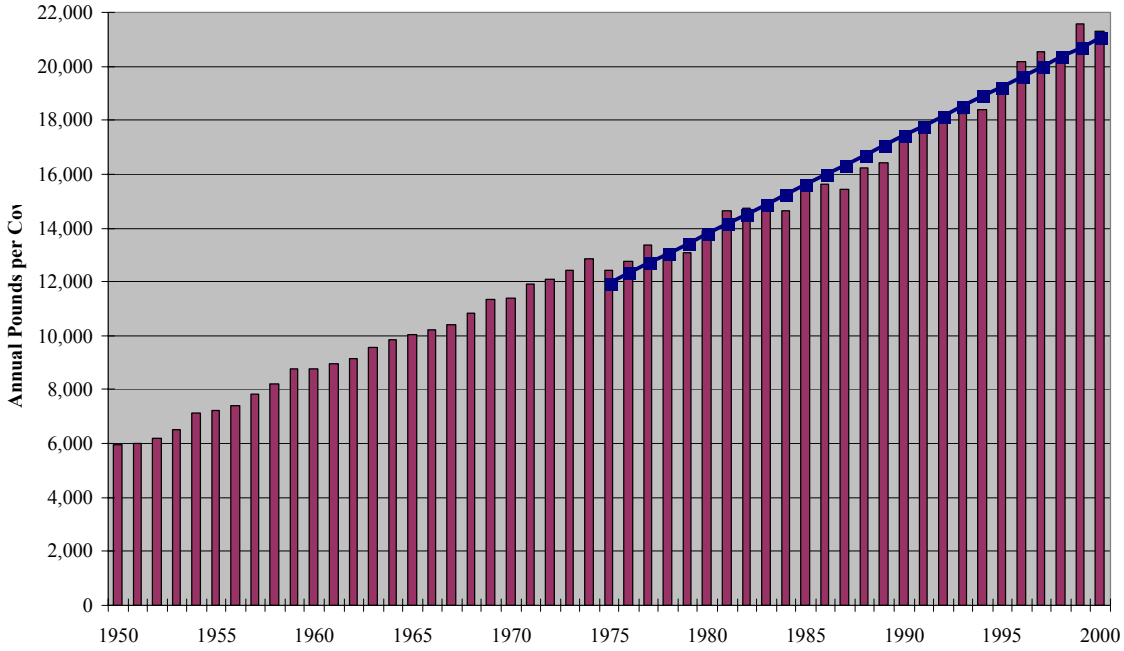
Pacific Northwest - Yield



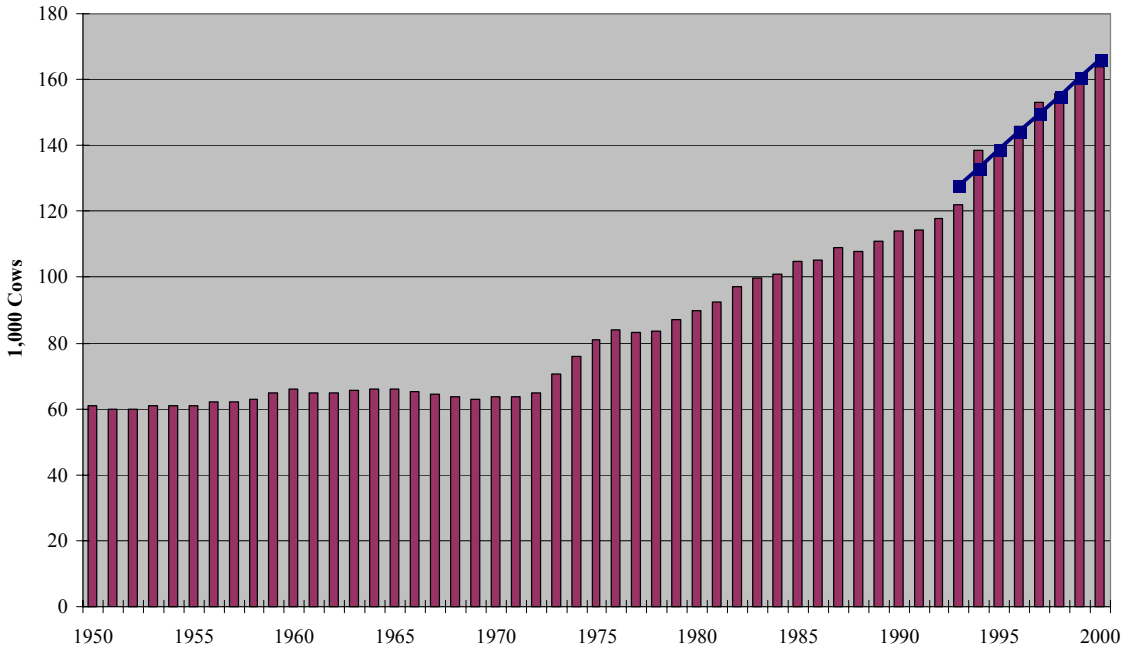
Pacific Northwest - Cows



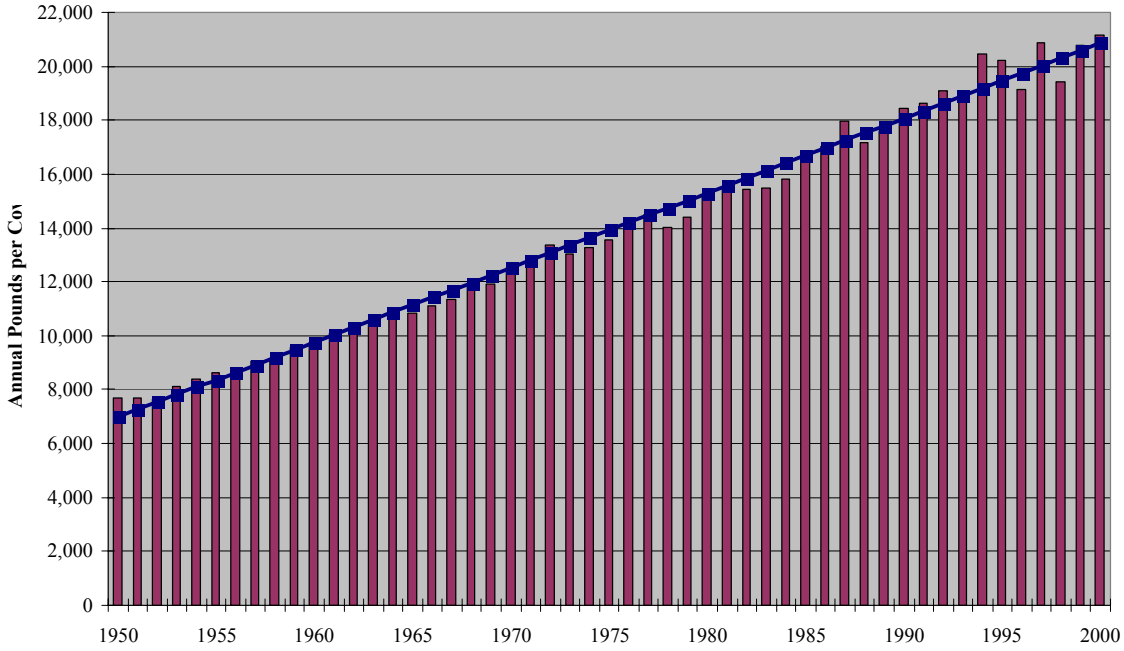
Arizona-Las Vegas - Yield



Arizona-Las Vegas - Cows



California - Yield



California - Cows