Implications of Adjustments in the Beef Industry for Related Industries, 1970-1980*

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The economic history of the American beef industry is in a very real sense the economic history of all America in microcosm. The patterns of specialization and division of labor, geographic adjustment to technological change, and differential time lags in economic adjustments among the various sequentially related levels of the industry can be found throughout most phases of the American economy.

The real beginning of the American beef industry was observed during the mid-1800's—basically in Texas. Following the War Between the States, the industry was expanded via the cattle drives into the Great Plains and the Intermountain West. In the beginning, the industry was simply that—an industry. So far as cattle were concerned, it was a family affair—mammas, papas, babies, and adolescents all lived together in the same operation and on the same ranges. Cattle were moved by cattle drive and later by rail directly from grass to slaughter—typically at ages in excess of three years. The large slaughter complexes that grew up around rail centers such as Omaha and Chicago were the outcome of this sort of industry organization.

With the introduction of hybrid corn in the 1930's, and with the development of mechanization in crop farming, a breeze of change began to waft through the beef industry. Hybrid corn for the first time gave the American farmer a surplus of grain. The continuing mechanization of crop production released large acreages from the oat and hay production that was essential in an animal powered agriculture, thus increasing that surplus. For the first time, a "generation gap" of sorts developed in the beef industry as two-year-old steers began to be separated from the parent herds in the Great Plains and the Intermountain West and "sent to college" in farm feedlots in the Corn Belt.

The breeze of change that was observed in the 1930's became a wind following World War II, a gale during the 1960's, and it has every possibility of becoming a veritable hurricane during the 1970's. Cow herds are today specialized operations that typically market calves at the time of weaning. Weaned calves are grown in specialized operations to feeding weights, and are then fed in specialized operations to slaughter weights. Cattle are no longer slaughtered in the mammoth multi-specie plants in rail centers—rather, they are slaughtered in small, highly efficient beef abattoirs located geographically in the heartlands of fat cattle supplies.

Since the 1930's, the beef production industry has really become three industries specializing in basic calf production, stocker growing, and cattle feeding. Concurrent with this increasing specialization in production has been the development of a cadre of specialized service industries such as feed supplements, equipment manufacturing, nutritional consultation and the like. The development of the Association of Bovine Practitioners is in itself a side result of the increasing specialization in the beef production sector. It is entirely appropriate that this society should examine the questions of what further changes are likely to occur in the beef production sector in order that the members of this society can be prepared to serve the needs of the beef producer.

It is my intent today to examine the changes that have occurred in the beef sector and to postulate what sorts of future change are likely. First, I'd like to set the stage by briefly examining the general demand and supply conditions for the entire industry in order to gain some indication of the probable magnitude of the industry in 1980. Second, I intend to examine the probable changes in the geographic distribution of the various sectors of the industry and the forces that are likely to cause these changes. Finally, during the panel discussion that follows this presentation, I would hope that we could jointly draw inferences concerning the types, volume, and geographic concentrations of bovine veterinary services required.

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The Conditions of Demand for Beef

Per capita consumption of beef has more than doubled since 1951 (Figure 1). By way of comparison, pork consumption has remained

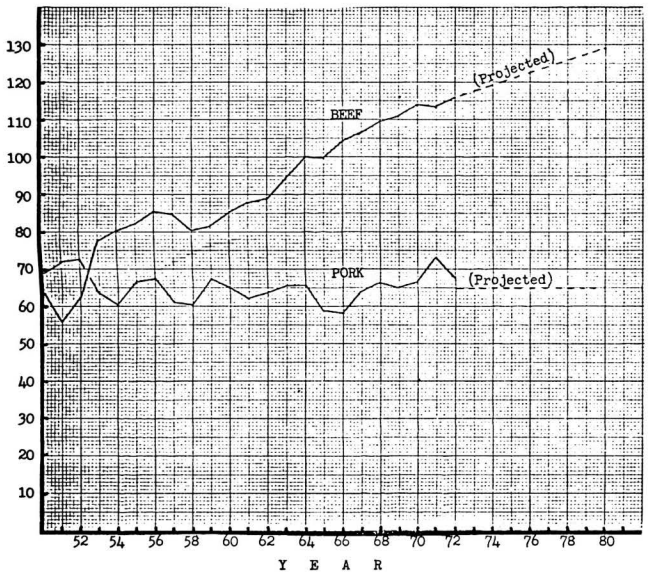

Figure 1: Per capita consumption of beef and pork, U.S., 1950-1972, with projections to 1980. Source: Livestock and Meat Statistics, AMS, SRS, ERS, USDA. 1962 issue and subsequent supplements. Projections are linear trends from the data shown, but are quite compatible with the OBERS projections made by the USDA.

relatively stable. This increasing per capita consumption, coupled with increasing population, increased total needs for carcass beef from 9.6 billion pounds in 1952 to 23.8 billion pounds in 1972—an increase of 148%.

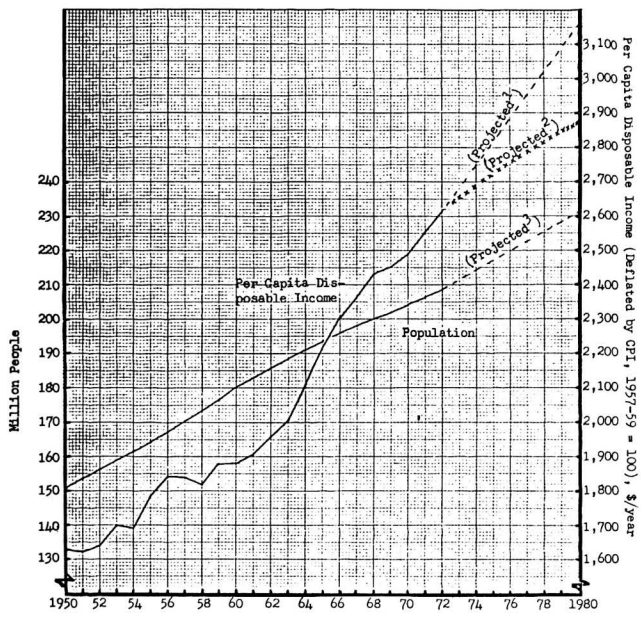

Figure 2: Total population and per capita disposable income (deflated) U.S., 1950-1972, with projections through 1980. [1]National Planning Assn. of Commerce, State Economic and Geographic Projections, Regional Economics Projections Series, Report 70-R-1, Washington, D.C., 1970. [2]Goodwin's estimate. [3]U.S. Bureau of the Census, Series "X" projection (old Series "E").

The two major determinants of demand for all red meats—including beef— are total population and the income that the individual within that population has to spend. Population has grown steadily since the founding of the United States. The so-called "population explosion"—which began not after World War II, but rather in the early 1900's about the time that general availability of contraceptives allowed man to consciously limit the size of his family—is still with us (Figure 2). But rather than increasing at an increasing rate, there is some evidence that the rate of population increase will be somewhat less during the 1970's than during the previous two decades. The Bureau of the Census has abandoned its top two series of population projections and is now using Series "C" as the most rapid probable growth rate. Projected 1980 U. S. population under the conditions of Series "C" would be something above 240 million. The projection used for population in Figure 2 is Bureau of the Census Series "X" (old Series "E") which suggests a 1980 population of about 231 million Americans.

It really isn't too important which population growth projection is used. Under *any* conditions, the beef-consuming population of the United States will be *at least* 10% larger in 1980 than it was in 1972 and perhaps as much as 17% larger. In any case, the need for beef will expand substantially over the next few years on the basis of population alone.

It will be noted in Figure 2 that per capita income has been "deflated" with the Consumer Price Index (1957-59 base period) in order to eliminate the distorting effects of inflation. Since one American in five was between the ages of 10 and 19 in 1970, the inflationary pressures during the 1970's will be enormous. The work force will be enlarged by 35% during the decade of the 1970's—i.e., by 3-5% annually, depending upon which year is examined. Thus, the economy must grow by about 4% annually to absorb the new workers. Add to this the 4-5% of the work force displaced by automation each year and it becomes painfully apparent that the annual rate of economic growth during the 1970's must be in the neighborhood of 8%—*above and beyond inflation*—in order to maintain current living standards. This kind of growth cannot be achieved in the absence of steady and substantial inflation—4-5% annually.

Disposable real income per capita is very likely to increase during the 1970's, but not at the rate

observed during the past two decades. For the first time in 30 years, the employment market is a buyer's market. This is likely to persist into the 1980's. For this reason, it is the opinion of this analyst that the National Planning Association estimate of $3,150 per capita income in 1980 (20% above 1972) is a bit optimistic. A per capita income increase of perhaps half this level is probably more realistic.

One of the effects of increasing real income and the resulting higher living standards is the increased intake of red meat. Since 1950, the per capita consumption of red meats in the United States has increased by 45 lbs. or by 30% (Figure 3).

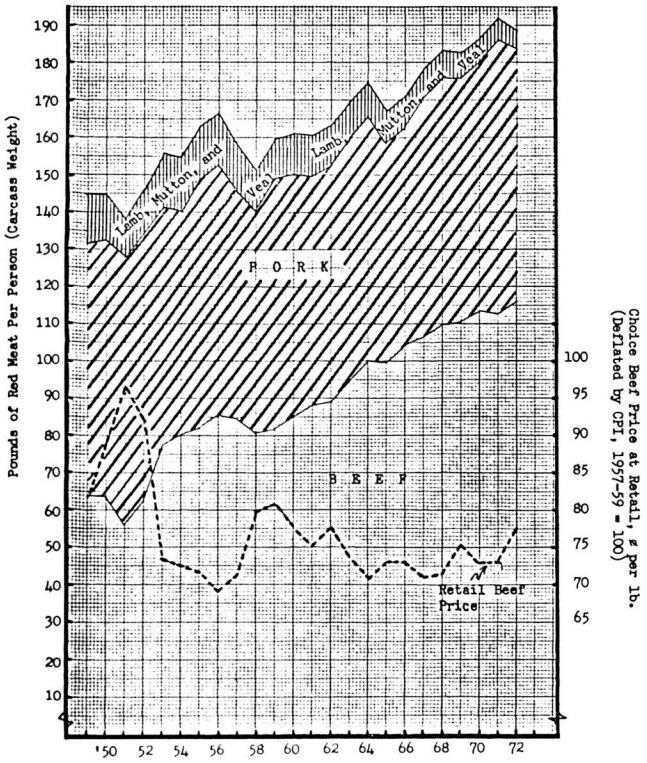

Figure 3: Per capita consumption of red meats compared with retail prices for beef, U.S., 1949-1972.

However, beef has made up an increasing proportion of total red meat consumption. As a matter of fact, increased beef consumption accounts for the entire increase in red meat consumption since 1950, *plus* an additional seven pounds due to reductions in the per capita consumption of pork, veal, lamb and mutton. Thus, the American consumer is not only willing to substitute beef for other red meats, he is eager to do so.

The pattern of retail beef prices during the 1949-72 period shown in Figure 3 is revealing. During the period immediately prior to and during the Korean Conflict, retail beef prices were at an all-time high in response to very limited quantities available for civilian consumption. But during 1953, with increased per capita beef availability, retail prices dropped about 20%. From that time forward, retail beef prices declined when per capita beef consumption increased and increased when per capita beef consumption declined. The only exceptions to this were 1962, 1968 and 1972. In 1962 and in 1968, income increases were sharp enough to pull retail beef prices up slightly in spite of greater per capita availability of beef. In 1972, even though per capita beef availability was somewhat larger than in the previous year, sharp reductions in the per capita availability of pork reduced the availability of total red meats. This, combined with fairly substantial increases in per capita income, caused *all* meat prices to increase substantially. Even so, once the impact of inflation is removed, it is apparent that 1972 retail beef prices were quite comparable to those observed in the early 1960's and were much *below* those observed in the early 1950's.

The Irreversible Nature of the Demand for Beef

The price and quantity combinations discussed above do not fully explain the nature of the demand for beef. Goodwin and Andorn (1) discovered the "irreversible" nature of the demand for beef in 1968, and Crow and Goodwin refined this analysis in 1971 (2). Beef consumers tend to exhibit one pattern of response when the per capita availability of beef is increasing and quite another when per capita availability is decreasing. This non-reversible phenomenon is closely related to the cycles in beef production and price.

The beef production sector appears to be an industry that can't abide prosperity. Each time the profit margins for beef producers reach levels that would be of minimal acceptability in the non-farm sector, these producers expand production until profits not only disappear—actually, substantial losses are incurred because the earlier profits have been bid into the fixed cost structure of the firm (3). Even though the industry tends to produce itself into poverty, it does receive an unexpected dividend as a result of this expanded production.

Each time beef production is expanded and prices begin to fall, consumers react by expanding beef consumption exuberantly. Complete consumer adjustment to declining beef prices is made within a period of three to six months. When production—i.e., the per capita availability—of beef is reduced, however, the consumer's response is much less exuberant. A period of six and a half *years* is required for him to return to his original position.

This apparent phenomenon of irreversible response to changes in the availability of beef works strongly in the beef producer's favor (see Figures 4 and 5). Once consumers have achieved

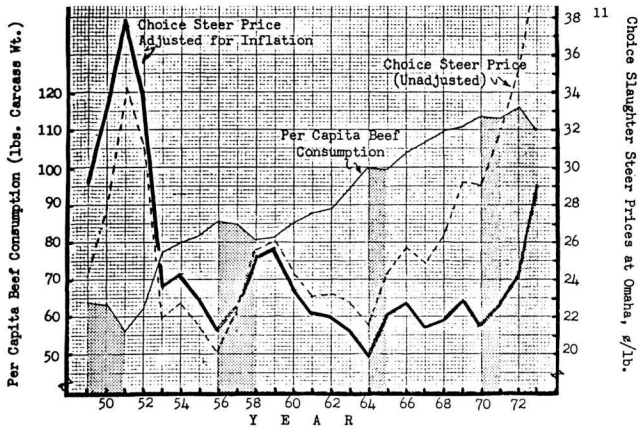

Figure 4: Per capita beef consumption (U.S.), and Omaha choice steer prices, 1949-1972.

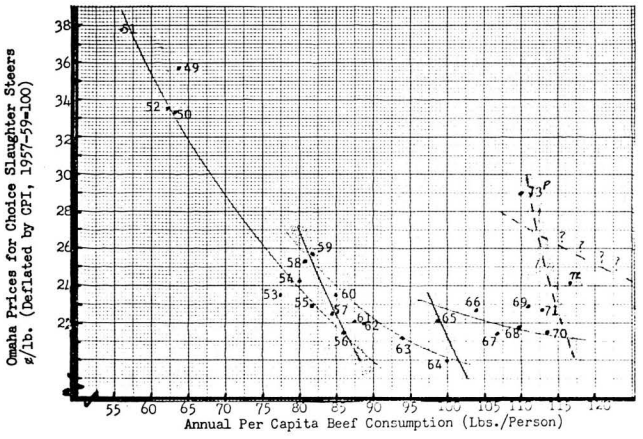

Figure 5: Estimated demand for live beef cattle, U.S., 1949-1972, showing irreversibility of the demand function.

the luxury of an elevated level of beef consumption, they stubbornly resist any reduction in what they have come to view as a God-given right to this elevated standard of living. If the per capita availability of beef is on the wane, consumers will typically increase their cash outlay for beef by about 10% in an effort to avoid a reduction in their level of beef consumption. (This translates to about 3-4 cents per pound for choice slaughter steers at Omaha in 1957-59 dollars.)

The shaded portions of Figure 4 showing the "down" phases of the beef production cycle correspond to the shaded portions of the demand curve(s) in Figure 5. (The statistical properties of this function, incidentally, are R^2 = .977, MSE = .42 lbs. of beef per quarter, or about 2% of current quarterly consumption.)

It is apparent in Figure 4 that per capita beef availability turned down during 1949-1951, 1956-1958, 1964-1965, and in 1973 after a false start in 1970-1971. It is probable that the 1970-1971 downturn would have been the full impact had there been no governmental meddling with the price mechanism in 1973. During each downward movement in per capita consumption, the prices that consumers were willing to pay to maintain their level of beef consumption increased very rapidly.

Several conclusions can be drawn from Figures 4 and 5:

1. The demand for beef is irreversible, with increases in demand occurring at those times when per capita availability is reduced.
2. The increases in demand for beef (i.e., the bidding up of prices in order to maintain a given level of consumption) have historically occurred at intervals of six to seven years following the upturn in consumption.
3. Per capita beef consumption has increased about 15 pounds per person during each of these six to seven-year periods.
4. The new "price image" for beef in any of the transitional phases has typically been established at about 3-4 cents liveweight above the old level. (It must be pointed out that this elevation in "price image" is measured in 1957-1959 dollars. Any forecast based on this analysis must be adjusted for inflation.)
5. The most recent transition from one level of demand to another occurred in the 1970-1973 period.

Based on these conclusions, the next real increase in the demand for beef can probably be expected during the 1977-1979 period. Beef production is increasing rapidly (January 1 beef brood cow numbers in 1973 were 6% above the numbers in 1972, and the indications are that a similar increase will occur in early 1974). Since it normally takes about four years for the decisions made by beef producers to appear in the meat counter, the 1977-1979 date is quite reasonable. The level of per capita consumption at that time should be in the neighborhood of 130 lbs. annually. If a 4% annual rate of inflation is assumed, choice steer prices in the 1979-1980 period (following the 1977-1979 transition) can be expected to be in the neighborhood of 46 cents per pound—approximately the "abnormal" levels of 1973 when beef prices were driven up by extremely short pork supplies and by federal tampering with the price mechanism.

Goodwin and Crow econometrically estimated per capita beef consumption on the basis of

projected changes in income (4). Their estimate was for an annual consumption of 129 lbs. of beef per capita by 1980. This estimate is totally compatible with the levels predicted by Figure 5. If the 130 lbs. per capita beef consumption estimate is combined with the 1980 projected population of 231 million people, total beef needs in 1980 will be about 30 billion lbs., carcass weight, or about 25-26% more than the 23.8 billion lbs. consumed in 1972. If slaughter cattle weights in 1979-1980 are similar to those currently observed, fed cattle numbers can be expected to increase by about eight million head—i.e., by a million head annually —between now and 1980.

The Conditions of Beef Supply

Enormous structural changes in both the production and processing phases of the American beef industry have altered the conditions of beef supply. In the early 1900's, cattle were grass fattened and sold for slaughter at 3-4 years of age. This method of production still exists in Latin America and Australia. The problem with this approach is that it involves a basic waste of land and grazing capacity. The United States beef production capacity would be perhaps 40% of current production if this method were still employed.

The means by which U.S. beef production has achieved its present volume has been to "break up" this integrated beef production industry into sectors, and then to operate the separate sectors in highly specialized individual units. The first evidence of this procedure was the emergence of the grain finishing of cattle. Grain feeding is basically an accelerated aging process which reduced the original 3-4 year production period by about a year.

Calf Production

The most obvious and dramatic shift toward enlarged and intensified specialized beef production is of course the commercial feedlot. However, commercial feedlots could not have developed without some subtle, but perhaps even more dramatic, changes in the size and composition of the nation's cowherd (Figure 6). The cowherd has continued to expand—between 195[illegible] and 1973, cow numbers increased by 30%. But [illegible] composition of the herd changed even mor[illegible] dramatically. Milk cow numbers have declined by half since the early 1950's, even though milk production has been relatively stable. This reflects both genetic improvement and technical improvement in dairy nutrition. As a result, the pasture that formerly was used to support about 12 million

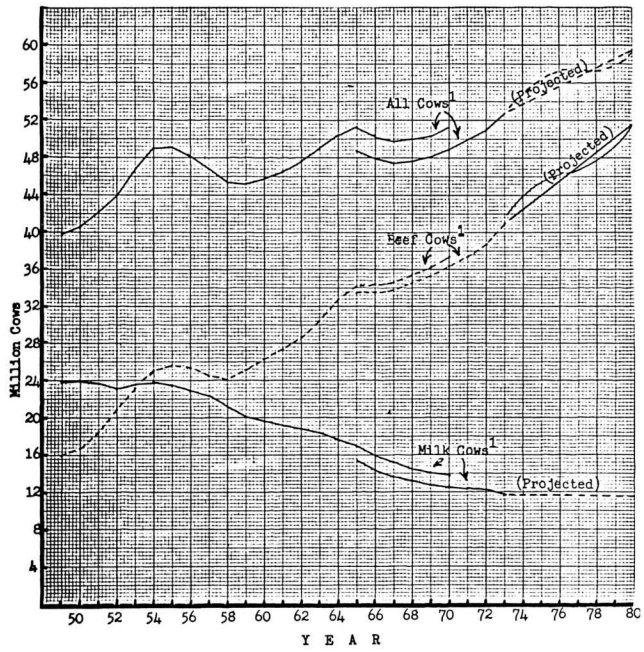

Figure 6: January 1 inventory of beef cows, dairy cows, and all cows, U.S., 1949-1973, with projections through 1980. [1]Reporting system change accounts for double figures. Prior to 1965, the number reported was cows two years old and older. After 1970, the number reported is the number of cows and heifers that have calved. Source: Livestock Inventory, Jan. 1, CRB, SRS, USDA. Projections are from Economic Activity in the U.S., OBERS Projections, RED, BEA, SESA, USDC and NRED, ERS, USDA, Sept. 1972.

milk cows is now being used to partially support a beef broodcow herd that has almost tripled in size since 1950.

The reduction in the numbers of milk cows could not begin to provide the grazing for 26 million additional beef cows. The continuing increase in the demand for beef, combined with changes in land usage, and with intensification in the manner in which existing range was utilized made up the difference. Between 1950 and 1969, the cropland used for grazing purposes was increased from 69 million acres to 88 million acres—an increase of 28% (5). In addition to this, some 45 million acres were converted from cropland to permanent pasture (6). If pasture establishment practices in Oklahoma are any indication for the total beef industry, one acre of established tame pasture is approximately four times as productive as an acre of native range. Thus, the 45 million acres of newly established pastures are comparable with 180 million additional acres of native range—an increase in privately owned grazing capacity of *at least* 43%.

The major part of the cropland conversion opportunity was—and is—in the area between central areas in Oklahoma and Texas, east to the Atlantic coast. This region has replaced the Intermountain West as the largest secondary source

of feeder cattle. The primary feeder cattle source area has been and remains the Great Plains area from Texas to Montana.

Milk cow numbers appear to have descended to levels that are about as small as can feasibly occur. Thus, further declines in the dairy industry are not likely to provide much additional beef cow capacity. Yet, substantial growth *must* occur if 1980 beef consumption needs are to be met. Further, the projected levels of cow inventories are such that these 1980 consumption levels can be met. As will be shown in subsequent sections of this study, the location of the necessary increase in cow numbers is most likely to be in the region east of the Mississippi River and in the states of Missouri, Arkansas, Louisiana, Oklahoma and Texas.

The cyclical nature of beef production is readily apparent in the cow inventory shown in Figure 6. The major influence in the cycle is obviously in the variation in beef cow numbers. While the very rapid growth in the beef cow herd obscures the cycle in beef cow numbers, the declining numbers of milk cows have stripped enough of the trend out of the figures to make the cycle apparent in the numbers of total cows.

The cycle in cow numbers has historically been 8-10 years in length, with the "up" phase of the cycle being longer than the "down" phase. Beef cow numbers are expected to "peak" cyclically, probably in 1975. This suggests that the numbers of calves available for feeding in the fall of 1974 is likely to be sufficiently large that prices at all levels in the beef industry will be substantially below those observed in 1973. This declining price situation is likely to prevail at least into 1976 and possibly into 1978.

Stocker Growing

Over the past ten years, a second specialized beef production sector has begun to develop. This sector is involved with taking light cattle at 350-450 lbs.—basically at weaning weight—and then growing them out to 600-700 lbs. prior to placement on full feed. This specialized stocker growing activity has further reduced the length of the time period between birth and slaughter such that cattle today are commonly slaughtered at 15-20 months of age.

While the stocker growing activity is still new enough that no published figures are available, the practice is especially common in the small grain areas and in the areas adjacent to commercial feeding areas. Many producers in central Oklahoma and central Texas are buying light calves out of the Southeast (Mississippi, Alabama, and Florida primarily) and out of the dairy areas of New York state and the Upper Great Lakes. These cattle are grown on small grain pastures from November to March, on permanent pasture during April and May, on forage crops during June through August, and back to permanent pasture during September and October. In this fashion, they are able to more than double their beef production per acre.

Cyclically, as cattle prices move higher, the bidding for light cattle typically gets so competitive that stocker growers will adjust toward brood cows or toward bred heifers that will be calved out and sold as brood cows. As stocker cattle become more plentiful and calf prices decline, they will again increase the stocker growing activity.

Since published figures on the stocker growing activity are unavailable, the best source of information concerning the probable future development of this sector is the information simulated from cost figures. Goodwin and Crow showed that economic pressures would tend to center the stocker growing activity in the Plains and in the South Central region, with a limited industry salvaging corn stubble in the western reaches of the Corn Belt (7). As the total beef industry expanded, these areas would be expected to expand the stocker activity, and the northeastern portions of the country could be expected to become a factor in providing feeding-weight cattle (8).

Cattle Feeding

Once feeder cattle are available, the major limitation to the absolute size of the volume of fed beef produced is the availability of grain. The total U.S. production of feed grains has almost doubled since 1950 (Figure 7). As would be expected, the most important single feed grain has been and is likely to continue to be corn. However, grain sorghum has become of increasing importance as a feed grain and is likely to become of even greater importance.

The utilization of feed grain has actually changed very little since the middle 1950's, except for the total volume of feed grain use (Figure 8). The primary changes have been that exports and cattle feeding have taken up a relatively larger and larger proportion of the total grain available. Production has increased more rapidly than has domestic utilization.

It is fairly obvious that the grain for producing the projected levels of animal proteins are likely to be available in some abundance. It is likely, however, that grain prices will show some general increase, not only because of inflation, but also

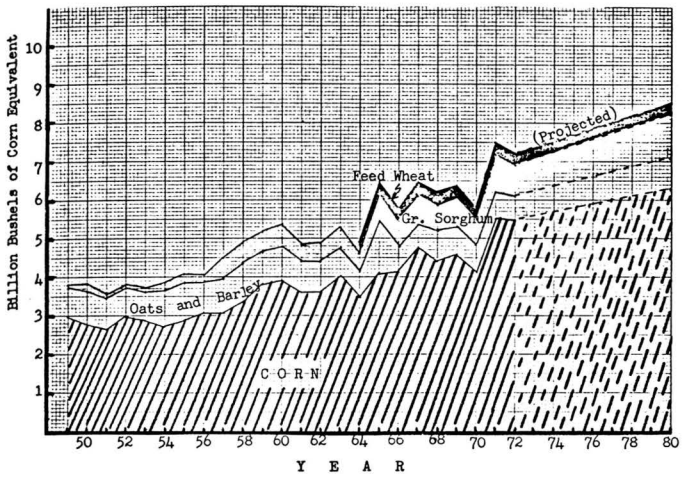

Figure 7: Production of feed grains, U.S., 1949-1970, with projections through 1980, in bushels of corn equivalent. (A bushel of corn equivalent is simply the quantity of any grain that will replace a bushel of corn in a livestock ration as defined in Morrison Feeds and Feeding. One bushel of the following grains will replace corn at the following rates: barley–.72 bu. of corn; grain sorghum–.97 bu. of corn; oats–.47 bu. of corn; wheat–1.07 bu. of corn. Only 20% of the wheat crop is considered available for feeding [see John W. Goodwin and J. Richard Crow, Optimum Locations of Beef Production and Processing Enterprises, Okla. Agric. Expt. Sta., Bulletin in Process]). Source: Crop Production, SRS, CRB, USDA. Projections from OBERS Projections, Economic Activity in the U.S., RED, BEA, SESA, USDC and NRED, ERS, USDA, Sept. 1972.

due to the increased demand and the increased per unit cost of meeting that demand.

In 1955, only 37% of U.S. commercial cattle slaughter was made up of fed cattle. By 1960, this had increased to 52%. By 1965, 58% of all slaughter cattle were fed cattle. In 1970, 70% of all slaughter cattle came from feedlots, and in 1972, 74% of all slaughter cattle were grain fed.

This increased proportion of feeding of cattle has been one of the major ways in which the American beef industry has met the increased needs for beef. However, the potential for increasing the proportion of cattle fed is just about exhausted. An absolute maximum of 77-80% of all slaughter cattle can come from feedlots. The remainder will of necessity be made up of cull cows, bulls, and cattle that for one reason or another are not suitable for feeding. Thus, the relationships between slaughter cattle and fed cattle shown in Figure 9 must change. Historically, there has been so much growth in the fed cattle sector that the cattle cycle is completely obscured from the figures. This can no longer occur. Fed cattle slaughter in the future is most likely to reflect a very close proportional relationship with total commercial cattle slaughter, since virtually all feedable cattle will be fed.

The emergence of large-scale commercial feedlots, first in California-Arizona and later in the High Plains area from western Nebraska through

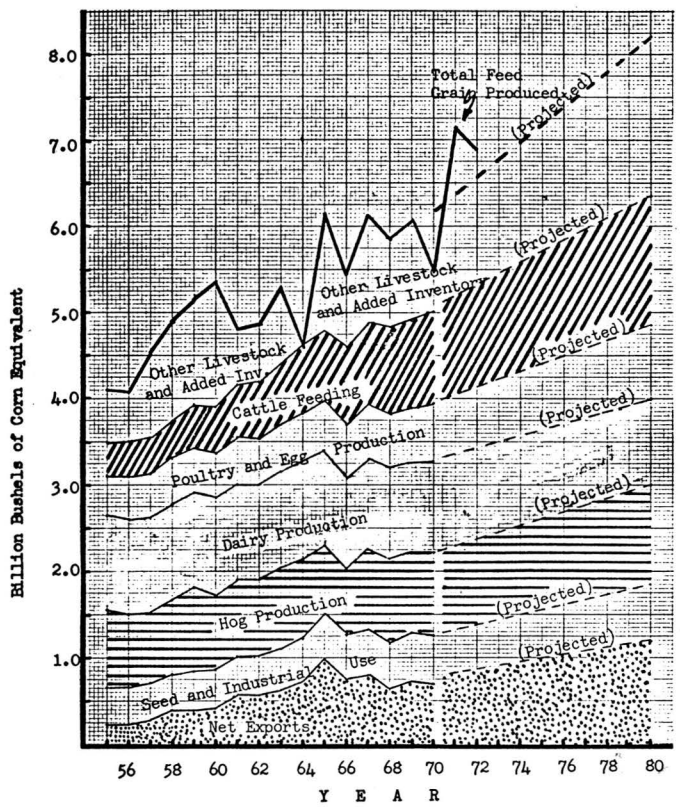

Figure 8: Disposition of feed grains (excluding wheat), U.S., 1955-1970, with projections to 1980*, in bushels of corn equivalent. *Assumes .5 lbs. of corn equivalent per pound of milk produced; 2.52 lbs. per lb. of live hog; 6.0 lbs. per lb. of gain on beef cattle; 56 lbs. per laying hen per year; 3.0 lbs. per lb. of live turkey prior to 1959, and 2.8 lbs. per lb. of live turkey after 1960; and for each lb. of live broiler, 1.5 lbs. of corn equivalent prior to 1959, 1.44 in 1959, 1.38 in 1960, 1.32 in 1961 and 1.26 in 1962 and subsequent years. Source: Agricultural Statistics, 1972. Projections of production and domestic usage from OBERS. Exports have been projected on the basis of the historical trends.

the Texas and Oklahoma Panhandles, has given a new dimension to the cost-competitive structure among feeders. These large scale commercial lots operate differently from the farmer-feeder enterprises of the Corn Belt. Commercial lots will typically "turn" their volume 2-2.5 times annually rather than on a seasonal basis, and they utilize purchased rather than farm-produced grain.

The managerial objectives of the feeding enterprise differs significantly between the commercial and farmer-feeder operation in that the commercial lot must be profitable in and of itself. The investment in capital equipment is very large, and as a result, the lot must operate month-in and month-out, year-in and year-out if the investment is to be amortized. The farmer-feeder, on the other hand, has only very limited investment in feeding facilities, so if a better technique for marketing corn becomes available, altering his volume of cattle feeding presents no major problem to the overall farm business.

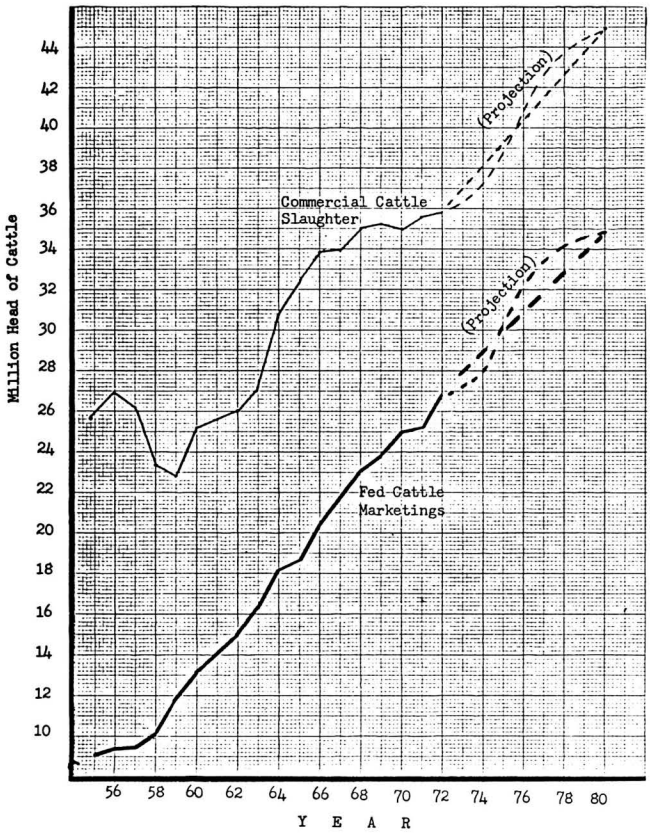

Figure 9: Commercial cattle slaughter and numbers of cattle marketed from feedlots, U.S., 1955-1972, with projections through 1980.

The Future Geographic Distribution of the Beef Industry

The conditions of beef demand suggest that the magnitude of the beef industry must increase by about a million head of fed cattle each year if that demand is to be met. We have seen from the conditions of supply that the increased numbers of cattle for the future must come from somewhat different sources than have the increases of the past, since the decline of dairy cow numbers, land released from feed production for horses and mules, and the proportions of cattle grain fattened are all approaching their limits. The questions that must now be examined include:

1. *Where* will we produce 8 million additional feeder calves?
2. *How* will we get the forage to grow those calves from weaning to feeding weights?
3. *Who* will feed these cattle to slaughter weights? and
4. *How much* will it cost to provide this beef to the American consumer?

The production activity that is most directly aimed at satisfying the ultimate consumer demand is the feedlot. Since the feedlot is the activity that generates the greatest concentration of cattle populations, and since cattle population concentration is the factor that allows the veterinary practitioner to specialize in the bovine species, let's consider these questions within the framework of the beef feedlot.

Even though the markets for feeder cattle, slaughter cattle and carcass beef are national markets, the production of fat cattle tends to be highly concentrated in four basic areas, with a fifth minor area along the Snake River in the Pacific Northwest, and another potential area in eastern Montana and western North Dakota (Figure 10). Since cattle feeding data are reported only on the basis of state lines, it is necessary that regions be defined along state lines for purposes of analyzing the regional competitive strength. It should be recognized that western Nebraska feeding really fits with the Southern Plains, and that northeastern Kansas and northwestern Missouri feeding really belongs with that in the Missouri River feeding and slaughter complex. But because of data imperfections, it is impossible to completely separate these areas from the rest of the state figures.

The major determinants of the regional location of cattle feeding include feed grain availability and costs, feeder cattle availability and costs, availability of slaughter markets, and the scale-density impact on service costs. Other factors include feeding technology, labor costs, and climate. Each of these factors will be treated in turn, and the regional advantage or disadvantage examined. On the basis of these factors, expected regional changes in slaughter cattle production by 1980 will be specified and the region with major advantage for increased production specified.

Cost and Availability of Feed Grains

If there is any factor that does *not* limit the production of fed cattle, that factor is the availability of feed grains. During the 1969, 1970, and 1971 crop years, the nation as a whole produced an average of 141 billion lbs. of corn equivalent above and beyond that required for the feeding of livestock and poultry. This suggests an annual national surplus of about 2.5 billion bushels of corn equivalent (9). The Missouri River Complex, the Eastern Corn Belt and the Southern Plains all have the grain for massive increases in fed cattle production.

The availability of feed grains is most probably grossly understated in the case of the Southern Plains and in the Northwest since no allowance has been made for the feeding of wheat. Goodwin and Crow found that the Southern Plains could be expected to feed about 20-25% of local wheat

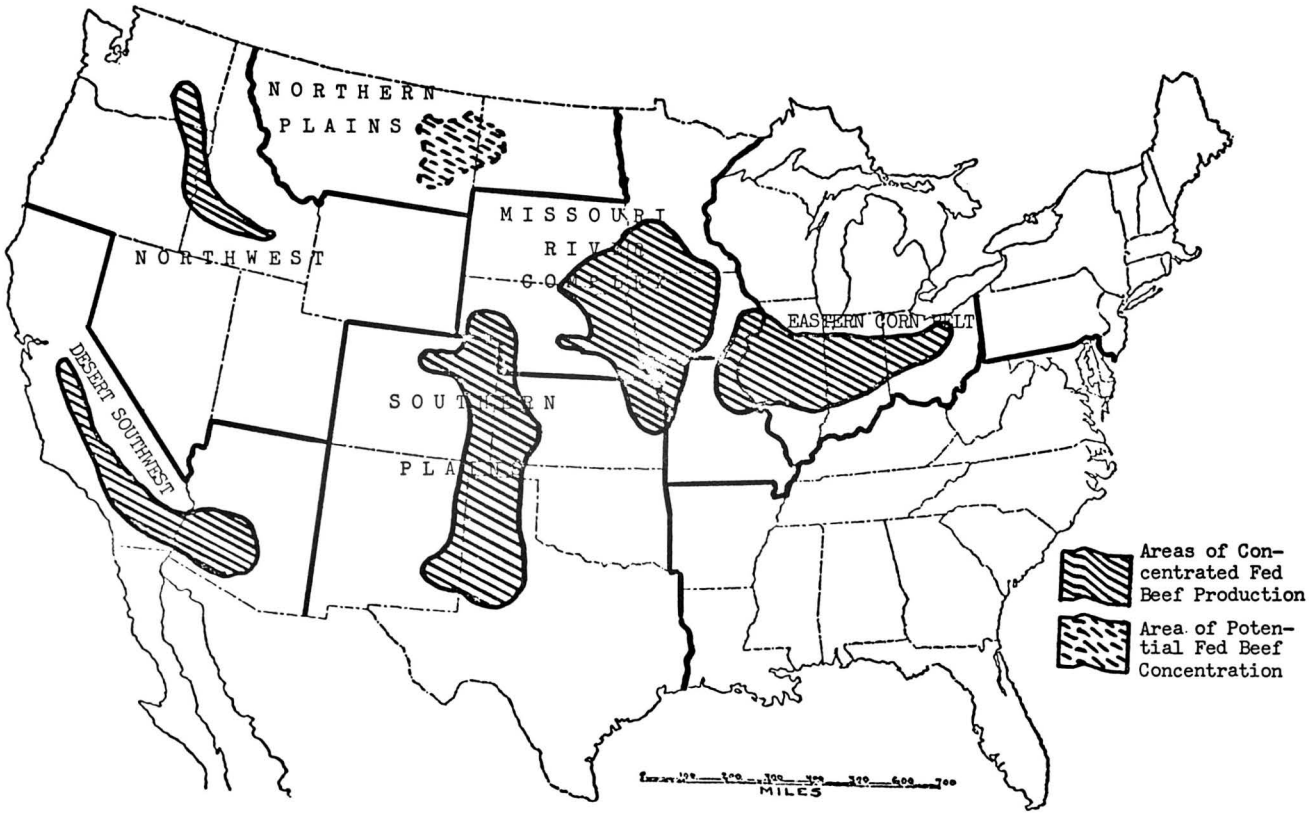

Figure 10: Cattle feeding regions and areas of concentrated fed cattle production, U.S., 1973.

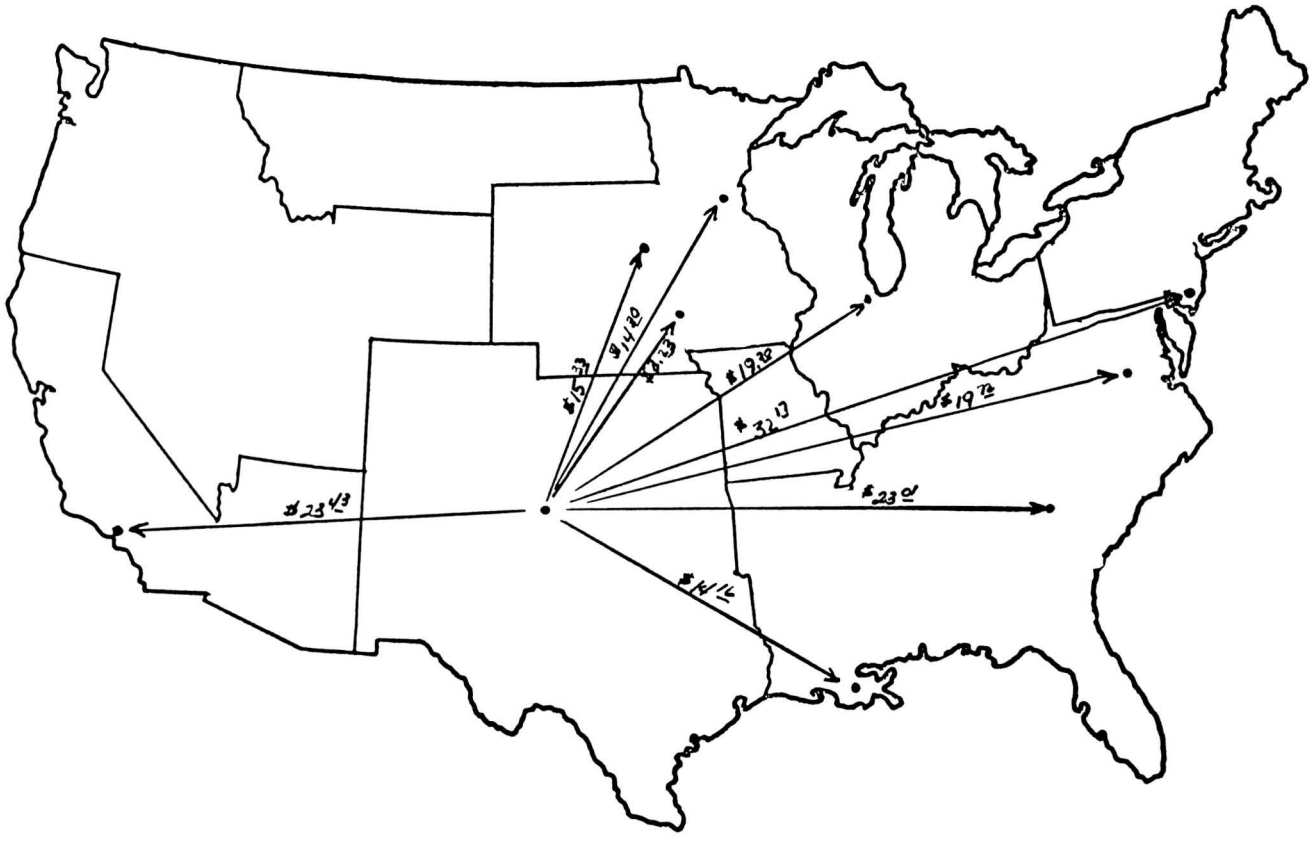

Figure 11: Minimum cost for transporting 1100 lb. slaughter cattle from Guymon, Okla., to selected points. Source: Goodwin and Crow, Optimum Regional Location of Beef Production and Processing Enterprises.

production at prices prevailing prior to the fall of 1972 (10). Most analysts are agreed that the very high wheat prices of late 1972 and 1973 are purely temporary and that wheat prices will descend to more normal levels by mid-1974. If this adjustment does in fact occur, then the feed grain surplus in the Southern Plains could be expected to be in the neighborhood of 23.5 billion pounds of corn equivalent—or enough to feed out an additional 9.75 million cattle annually. In any case, feed grain availability should be no problem in any of the major feeding areas other than the Desert Southwest.

The cost of feed grains is quite another matter. During the 1968-1970 crop year period, the average cost for feed grains favored increased feeding in the Southern Plains, in western Nebraska, and in the eastern Montana-western North Dakota area. As suggested earlier, the nation's cheapest feed grains are located in the North Plains area of Montana and North Dakota. These prices are low primarily because of the distance to markets for either feed grains or the products of those feed grains, and because the very low population density in the region dictates that local markets are totally inadequate for utilizing the local production capability. The next most advantageous feed grain price situation is shared by the Red River area in Minnesota and the Dakotas and the High Plains area between the South Canadian and Platte Rivers.

Feeder Cattle Availability and Costs

Historically, feeder cattle have come from the 17 western states, with a preponderance of these cattle originating in the Great Plains. Since World War II, however, rapid increases in the nation's beef cow herd coupled with crop adjustments have forced other areas into production. The most rapid growth has occurred in the Southeast and in the states of Iowa and Missouri. Bowser and Goodwin found that the lowest cost cattle were found in the Southeast and in Texas and Oklahoma (11). Movement north and west from these areas was associated with price increases that were almost perfectly related to the cost of transporting cattle from these surplus areas. Goodwin and Crow estimated the cash costs of cow-calf production and of growing stocker cattle to feeding weights (12). Interestingly, the areas enjoying the lowest cost feed grains also tended to have the lowest costs for calf production and stocker growing.* Thus, the Southern Plains and the eastern Montana area currently enjoy the major advantage for feeder cattle procurement and cost.

Expanded production of the calves that will eventually become feeder cattle can come in basically four areas—the northeast part of the U.S.—basically in the area north of and including Pennsylvania, in the Great Lakes area, in the South Atlantic area, and to a limited extent, in the lower Mississippi Valley (13). These are the areas that either currently have surplus forage production or that have undeveloped forage production potential. While the Southern Plains and the South Central areas will continue to be the major source of feedlot cattle, and as a result the Plains area will continue to enjoy an advantage in feeder cattle procurement, expanded calf production in the marginal areas of the north and east will erode this advantage to some degree. The beneficiary of such developments will most likely be the Eastern Corn Belt (14).

The South St. Paul and St. Louis markets are the lowest so far as *all* feeder steers in the specified weight ranges are concerned, but the presence of large concentrations of lower grade dairy breeds and dairy-cross cattle in these two markets distort the price picture. Of the bona-fide feeder cattle markets, Oklahoma City is the lowest for both light and heavy feeder cattle.

Availability of Slaughter Markets

The numbers of plants operating under Federal Inspection Grants increased by 29% during the 1972 calendar year. Much of this increase was the result of the inspection activity in four states (Kentucky, Oregon, Pennsylvania, and Missouri) being assumed entirely by the U.S. Department of Agriculture. Nevertheless, there was still a net gain of 96 federally inspected red meat plants under federal regulation.

Not all federally inspected slaughter plants are engaged in beef slaughter; many of the plants cleared for interstate shipment of beef are of minor consequence. For example, numerous locker plants that slaughter cattle on a custom basis do carry federal inspection. Why is a mystery since federal inspection involves considerable cost, but the situation does exist. As a result, the sheer numbers of plants under federal inspection can be very misleading. Therefore, some indication of slaughter capacity is essential if any sense is to be made of the federally inspected plant numbers.

**This deals with "non-land" costs of production. Total land costs reflect mineral values, speculative values, and site value for industrial and residential development as well as the productivity value in the beef enterprise. The non-agricultural factors vary from region to region and cannot fairly be charged to agricultural enterprises. That is, these values will in no way affect the agricultural use to which land is put, even though they will affect land prices. Therefore, only non-land costs have been included.*

Estimated Slaughter Capacity

Even though total numbers of cattle slaughtered are reported monthly by states, the slaughter capacity for individual states, regions, or the nation as a whole is not reported as such. Goodwin and Crow estimated total cattle slaughter capacity by using the largest total monthly commercial cattle slaughter reported (both federally inspected and non-federally inspected) for the years of 1968, 1969, and 1970 and multiplied that figure by twelve (15). Although this method most probably underestimates the total U.S. potential slaughter capacity since numerous plants that were closed during this period might potentially be reopened and since many plants in areas with excess capacity rarely operate at full capacity, the procedure does yield an estimate of the capacity effectively available in any given locale.

When actual commercial cattle slaughter is compared with the estimate of slaughter capacity, some indication of the location of surplus slaughter capacity can be gleaned. All regions have substantial slaughter capacity excesses except for the Northwest—which is essentially at a break-even—and the Southern Plains and Northern Plains. While the Northern Plains deficit is minor, any significant increase in feeding will cause the capacity deficit to become a very real limitation since the distance to alternative slaughter markets is substantial.

The really major slaughter capacity deficit is in the Southern Plains. An estimated 2.1 million slaughter cattle were exported into other slaughter markets from the Southern Plains in 1971. Many of these cattle went into the Missouri River area and into the Southeast. At least two additional plants are currently under construction in the Southern Plains, so the slaughter capacity deficit will be reduced—though not eliminated—in the very near future.

The regional structure of the beef slaughter industry is of necessity largely predetermined by the interregionally competitive structure in cattle feeding since feedlots provide the major portion of the raw materials that are essential to the packing sector. As cattle feeding goes, so must the beef slaughter industry go *eventually*. There is, however, a lag of several years between regional shifts in feeding and the eventual shifts in slaughter capacity. Typically, the shifts in slaughter capacity occur such that new capacity is constructed prior to the salvaging of old capacity. As a result, the beef slaughter sector finds itself in a state of chronic over-capacity. This is true in a national sense, but it is doubly true in the regional sense for those regions that are not sharing in the benefits of regional shifts in cattle feeding.

This situation would suggest that the areas with substantial surplus slaughter capacity would provide an ideal bargaining position for producers outside those areas. Such is not the case. Through the early and mid-1960's, there was a pell-mell rush of slaughter facilities from the metropolitan areas around rail centers such as Chicago toward the concentration of production units. Much of the early movement of slaughter facilities was into the Missouri River Complex—this area expanded its share of beef slaughter from 31% in 1962 to 35% in 1967. Since that time, the Missouri River area has lost market share. The entire movement of the beef slaughter industry the past five years has been into the Southwest.

About two million head of slaughter cattle were exported from the Southern Plains for slaughter in other regions. The major recipients of these cattle were probably the Missouri River Complex and the Southeast, with large numbers of cattle from eastern Iowa moving in to fill the 1.3 million head needs that were imported into the Eastern Corn Belt.

This kind of movement of fed cattle cannot persist. Tippets, et al., found that fat cattle tended to show substantial weight losses when in transit for extended periods of time (Table 1) (16). The nearest point in the slaughter cattle surplus Southern Plains area to the deficit Missouri River slaughter concentrations is a minimum of 10 hours in driving time. Even granting a 4% "pencil shrink,"* the buyer of these cattle could expect an additional 2.2% above the "pencil" figure. This means that a 1,100 lb. animal moved from Garden City, Ks., to Omaha or Sioux City could be expected to lose 25 lbs. above and beyond the level of the shrink discount that the cattle feeder would tolerate. This means that the net cost of cattle imported from the Southern Plains to the Missouri River Complex would be $10 per head at early 1973 market prices, plus the cost of transportation. This cost must be added to the price paid at the feedlot since this is also the price that the Southern Plains packer is paying for comparable animals. A sample of fat cattle transportation costs from Guymon, Okla., in the heart of the Southern Plains to alternative slaughter surplus capacity points is shown in Figure 11.

"Pencil shrink" is the term used to describe the weight loss that the buyer and seller agree is to be expected when cattle are moved. Four percent is the common figure in the Southern Plains.

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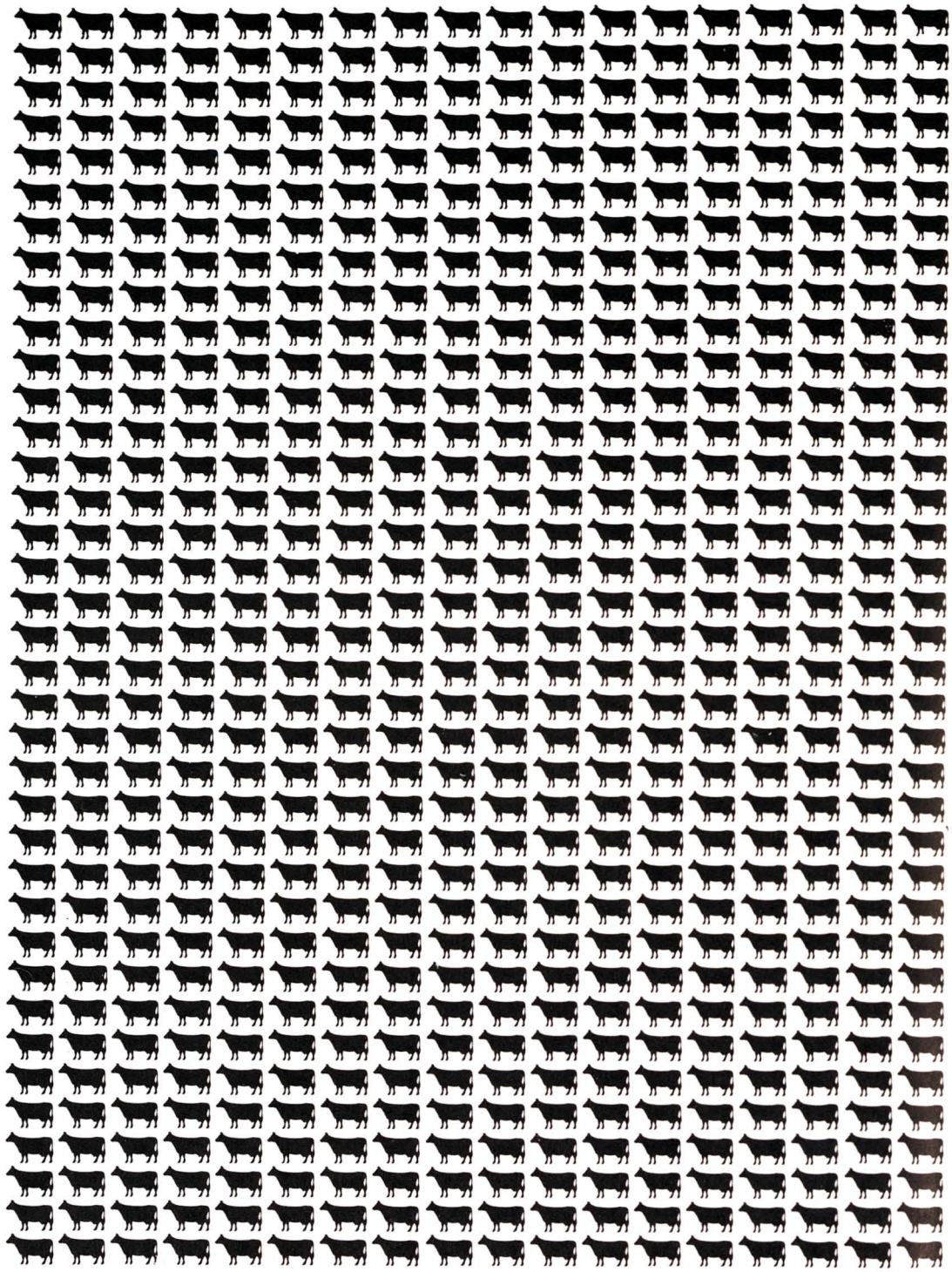

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	447	81%

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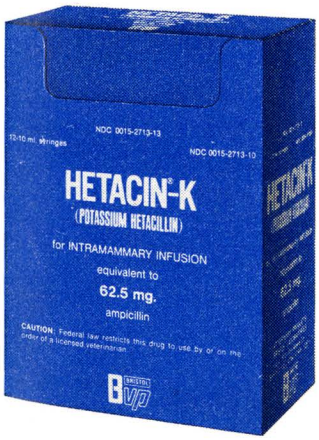

There can be no outcome of the current situation in the surplus slaughter capacity regions other than extensive closings of plants. These closings are already underway. The loss of slaughter capacity is not likely to be terribly serious in the Eastern Corn Belt, the Northeast or Southeast, since the facilities in these areas tend to be of an age that allows salvaging of these facilities at no great loss. But the Missouri River Complex was the recipient of the new slaughter construction during the early 1960's. This means that much of this construction has not yet been amortized. Some major losses are going to occur in the Missouri River Complex unless the growth in cattle feeding meets the available slaughter capacity.

A major reduction in slaughter capacity is already underway in the Missouri River area. As would be expected, the majority of the plants closed to date are of the older types that are already amortized. There are at least 16 plants that have been shut down completely. One plant has been remodeled into a pork processing facility and one has gone from two shifts to a single shift operation.

Feeding Technology

The technology for cattle feeding is highly mobile and can be transferred quite readily from one region to another. In the case of the Southern Plains, the technology was transferred largely from the commercial feeding areas of California and Arizona. Whether or not the technology *will* be adopted in an area is another matter.

Technological adaptation is not only cost reducing—it is also typically output increasing. That is, in order to realize the cost reductions available, the manager must expand the scale of his output. The presence of large numbers of small units that are too small to efficiently utilize new technology and a tradition of dependence of grain produced within the unit will likely prevent immediate adaptation of new technology in the farmer-feeder areas. Further, the provisions of the Agricultural and Consumer Protection Act of 1973 discourage feeding in the Corn Belt. Thus, the areas that can and are likely to continue to adopt commercial feeding technology are the Southern Plains and the Desert Southwest.

Scale-Density Considerations

Many of the cost reductions available in commercial feeding arise from the specialization of function that is possible in the very large operation. For example, nutritional consultation that electronically calculates the least-cost combination of ingredients for a ration that will generate a given level of performance would be nonsensical for a farmer-feeder. His volume of production is so small that the cost per animal would be prohibitive. Other examples include specialized consultation in animal health, record keeping or tax management. Within the lot, a large operation can employ specialized personnel to purchase feeder cattle, to sell fat cattle, or to procure feedstuffs. A grain buyer in a lot that keeps 20,000 head of cattle on feed the year round can increase the profitability of that lot by $21,000 for each cent that he reduces the per bushel cost of grain. Savings of 3-5 cents per bushel can be achieved with only minor skill on the part of the buyer.

While services described above cannot be feasibly utilized unless the lot is large scale, unless the density of lots of a scale large enough to utilize these services is such that the purveyors of such services can afford to serve an area, the services may not be available at all. Specialized veterinary or nutritional services are of this type.

Presently, only the Desert Southwest and the Southern Plains enjoy a scale-density advantage. Large scale lots are too scattered in other regions to allow full realization of the cost reductions available.

Labor Costs

In general, the Southeast has the lowest labor cost. As one moves north or west from these points, labor costs increase. Of all the present feeding areas, the Southern Plains has by far the most advantageous labor situation.

Cost Impact of Climate

Until very recently, the only basis for selecting one feedlot location over another because of climate was folk wisdom. The common folk wisdom was that high rainfall regions were undesirable because cattle weren't that much different from man. That is, man would be likely to reduce the frequency of his visits to the dinner table if he had to wade through mud and manure belly-deep to get there. And obviously, cattle aren't going to gain weight unless they eat more than is necessary to simply maintain present body weight.

California researchers have quantified some of the effects of climate factors that have discouraged the development of commercial lots in the traditional farmer-feeder areas (17).

1. Muddy lots reduce feed efficiency by 20-30%. This means that feeders in the Missouri River Complex, the Eastern Corn Belt and the Southeast would be forced to pave commercial lots in order to realize the cost advantages

accruing from size and year-round feeding. This would force investment costs to exhorbitantly high levels.

2. Rainfall reduces feed efficiency by up to 20%. The incidence of relatively high levels of rainfall during the spring, summer and fall in the Southeast and Midwest increases feeding costs substantially.
3. Wind does not appear to affect the performance of feedlot cattle to any significant degree. If there *is* any effect, the advantage is in favor of those areas having substantial winds. On the basis of the California research, the climatic advantage appears to be with the Southern Plains (low rainfall, rarely muddy lots, and substantial wind) and with the desert areas of California and Arizona.

The California research has been verified by

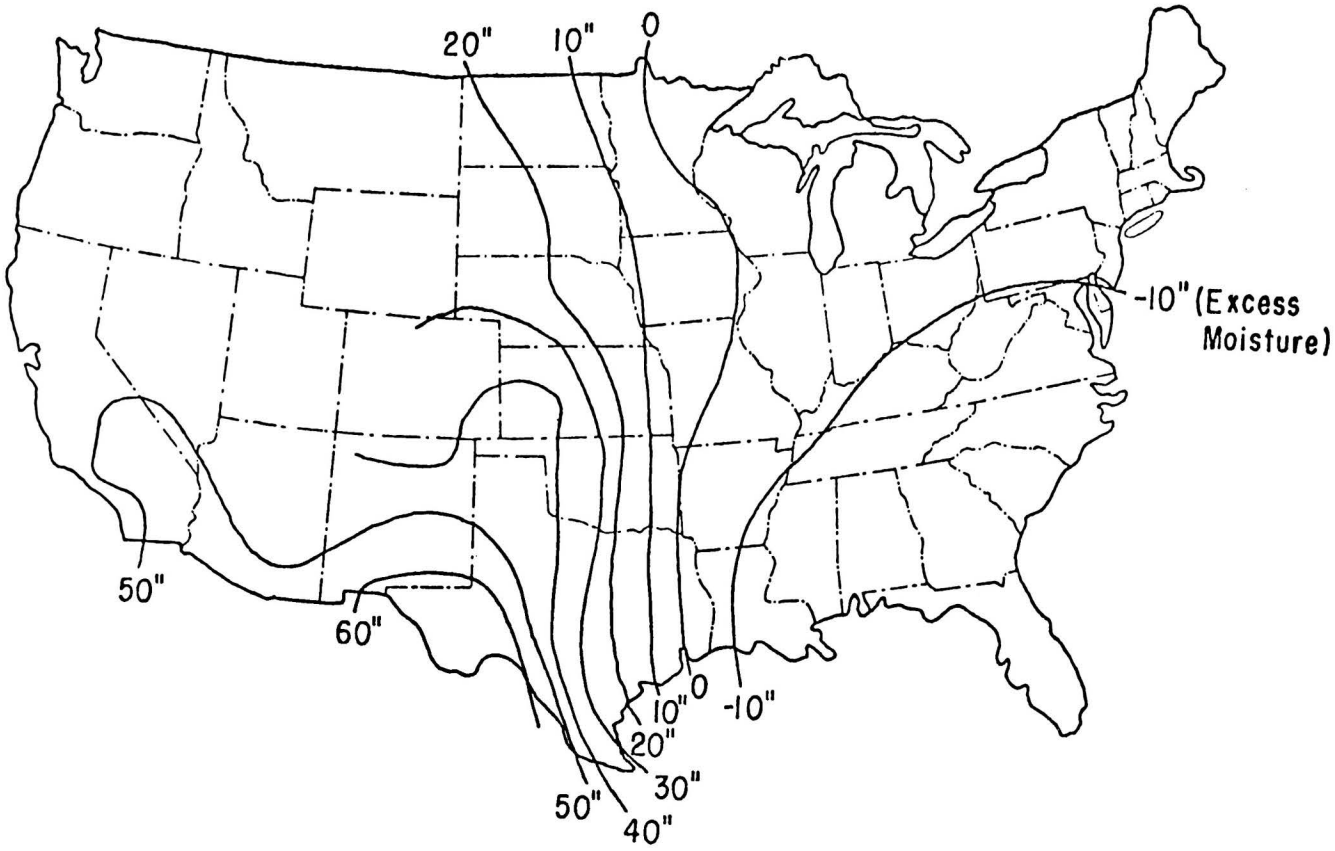

Figure 12: Lines of moisture deficit for the 48 contiguous states. Souce: A. F. Butchbaker, et al., Evaluation of Beef Cattle Feedlot Waste Management Alternatives, Okla. Agric. Expt. Sta. for the Office of Research and Monitoring, Environmental Protec. Agency, Grant No. 13040, Nov., 1971.

Table 1

Shrinkage of Feeder and Fat Cattle as Related to Hours in Transit

Hours in Transit	Fat Cattle			Feeder Cattle			Average All Cattle		
	No. of Shipments	No. of Head	% Shrink	No. of Shipments	No. of Head	% Shrink	No. of Shipments	No. of Head	% Shrink
1 Hour	7	615	1.70	11	563	1.85	18	1,178	1.77
2 Hours	24	1,138	4.24	23	2,261	3.74	47	3,399	3.95
3 Hours	42	1,415	4.98	16	1,733	3.57	58	3,148	4.33
4-6 Hours	24	1,001	5.42	23	1,495	3.77	47	2,497	4.66
7-9 Hours	50	2,132	5.81	12	1,735	5.98	62	3,867	5.90
10-17 Hours	852	29,769	6.20	27	1,983	8.20	879	31,752	6.27
18-35 Hours**	97	5,531	9.63	80	12,702	7.18	177	18,233	8.08
36-59 Hours**	85	3,610	7.53	95	9,180	10.14	178	12,790	9.18
60-83 Hours	39	2,470	8.60	66	8,540	10.44	105	11,010	9.91
84 Hours & Over	22	1,078	10.81	82	12,970	12.44	104	14,048	11.99

**Feed, water, and rest period during journey.

Source: Neff Tippets, Ira M. Stevens, C. B. Brotherton, and Harold Abel, In-Transit Shrinkages of Cattle, Mimeo. Circular No. 78, Agric. Expt. Sta., Univ. of Wyoming, Feb. 1957.

research at Oklahoma State University examining the impact of climate upon waste management in the feeding industry (18). These researchers concluded that cattle were comfortable within an average daily temperature range of 20°F to 80°F, but that temperatures below freezing created problems in the management of solid waste. Waste management problems were also compounded in high humidity areas since evaporation could not provide a major means for handling feedlot wastes under excessively humid conditions, and since mud problems tend to be compounded in humid areas. Their measure of the degree of humidity was to compare average annual precipitation with the average annual lake evaporation (Figure 12). If there was a "moisture deficit"—that is, if average

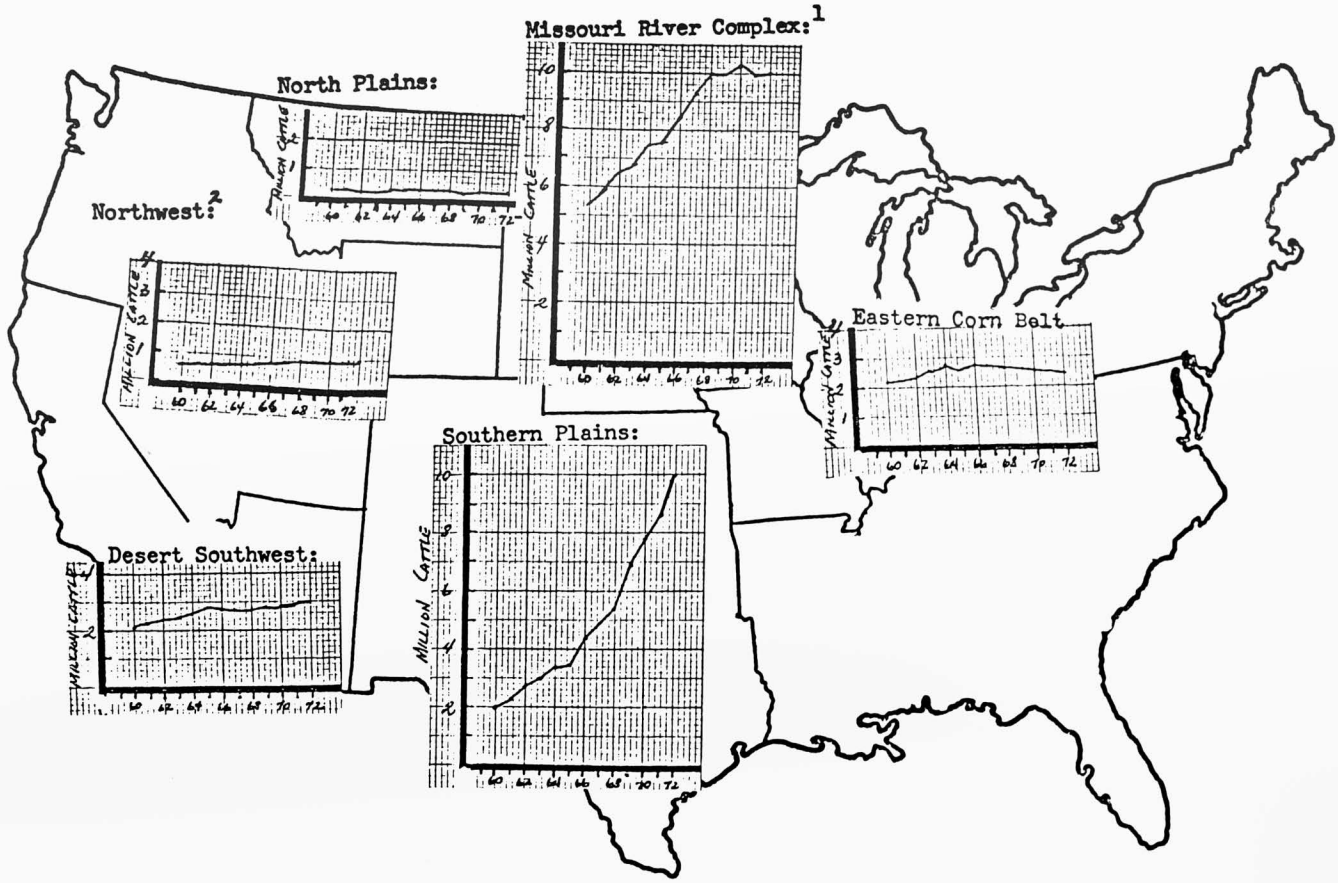

Figure 13: Regional marketings of fed cattle by major feeding regions in million head, 1960-1972. [1]Includes Missouri. [2]Includes Washington, Oregon and Idaho only.

Table 2

Summary of Regional Potential for Increased Cattle Feeding, 1972

Competitive Factor	Region							
	North-west	North Plains	Desert Southwest	Southern Plains	Missouri River	Eastern Corn Belt	North-east	South-east
Availability of feed grains	−−	+	−−	++	++	++	−−	−−
Cost of feed grains	−	++	−−	++	+	+	−−	−−
Local availability of feeder cattle	+	+	−−	++	−−	−−	−−	++
Cost of feeder cattle	0	+	−−	++	−	−−	−−	+
Availability of slaughter markets	0	−	++	−	++	++	++	++
Feeding Technology	0	0	0	0	−	−	−	−
Scale-Density	−	−	++	++	−−	−−	−−	−−
Labor Costs	0	+	−−	++	0	−	−	++
Climate	+	+	++	++	−	−	−	−−
Overall Potential	−	+	−−	++	0 to −	−	−−	−

Code may be interpreted as follows: −− Major Disadvantage; − Minor Disadvantage; 0 Neither Advantage nor Disadvantage; + Minor Advantage; ++ Major Advantage.

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annual lake evaporation exceeded average annual precipitation—of as much as 30 inches of water annually, the management of solid feedlot wastes was greatly simplified because of the evaporation of liquids from lagoons, feedlot surfaces, or evaporation ponds. Also, waste management costs were reduced, and environmental pollution problems were simplified.

When the moisture deficit information is combined with the temperature information, the optimum cattle feeding climate is shown to extend from central Oklahoma and south central Kansas through the Texas panhandle and most of New Mexico to western Arizona. Two near optimum areas include the remainder of the Southern Plains and Desert Southwest feeding regions.

Summary and Conclusions

What have we discussed and what have we discovered this afternoon? First, we examined the overall conditions of the demand for beef and discovered that there likely would be a need for about eight million more fed cattle annually by 1980. That is, the beef industry can expect continued expanded demand for its product in the magnitude of about a million head increase each year. When we examined the potential for producing the feeder cattle to meet this demand, we discovered that while the traditional production areas could increase production modestly, the major portion of the increase would likely come from the non-traditional areas east of the Mississippi and north of the Ohio River, and from the area along the south Atlantic coast.

When we considered the feeding of those cattle, the area that had the major advantage for increase was the Southern Plains area, with some secondary advantage in the North Plains area of Montana and North Dakota (Table 2). Of all the factors examined, the Southern Plains enjoyed a primary advantage in all save the availability of slaughter markets. And the shortage of Southern Plains slaughter capacity is being corrected very rapidly. Two large plants are currently under construction, and I would predict that at least three additional plants will be constructed in the next five years.

We suggested earlier that total fed cattle marketings in 1980 would be 34-35 million head of fed cattle. About 44-45% of this is likely to be in the Southern Plains (about 15 million head—half again as many as in 1972). Another 27% is likely to be in the Missouri River area of Iowa, Nebraska, Minnesota, and South Dakota (about nine million head or 10% less than in 1972). The remaining 28-29% will be scattered in other production areas, with some substantial local development in Montana and North Dakota and just possibly in Tennessee-Kentucky-Virginia.

The changes visualized are already underway (Figure 13). The downturn in the upper Midwest started in 1970 and in the Eastern Corn Belt area in 1966. The growth in the Southern Plains has accelerated from the beginning. Feeding in other areas has been relatively stable, but there can be little question but that the downturn in California and Arizona is imminent. Within this area, California is already on the decline, but growth in Arizona has offset the California decline.

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