

# The Interregional Structure of the American Beef Industry in 1975 and 1980

Bulletin B-708  
July 1973



Agricultural Experiment Station  
OKLAHOMA STATE UNIVERSITY

# Contents

Introduction	5
Problem and Justification	8
Method of Analysis	9
The Results	15
1975 Projections	15
The West	16
The Plains	17
The Corn Belt	19
The Northeast	20
The South	20
Beef Industry Sectoral Analysis for 1975	22
Calf Production	24
Stocker Operation	24
Utilization of Feeding Capacity	25
Cattle Slaughter and the Flow of Beef	26
Level of Resource Utilization	27
Increased Cost Due to Expansion	28
1980 Projections	28
The West	28
The Plains	30
The Corn Belt	31
The Northeast	32
The South	33
Beef Industry Sectoral Analysis for 1980	34
Calf and Stocker Operations	34
Feeding Activity Changes	34
Meat Distribution	34
Feed Grains and Wheat	38
Summary and Implications	39
Calf Production and Stocker Growing Operations	40
Cattle Feeding	43
Cattle Slaughter	43
Overall Regional Potential	44
Literature Cited	45
Appendix Tables	47

# The Interregional Structure of the American Beef Industry in 1975 and 1980

John W. Goodwin and J. Richard Crow  
Department of Agricultural Economics

In the early 1900's cattle were grazed in the West, shipped East for slaughter and there consumed. Because of the geographic locations of population and of slaughter and transportation facilities, the interregional flows of livestock and livestock products were fairly simple. Shifts in the mode and geographic distribution of beef production, regional specialization of production, and shifts in the geographic redistribution of population in the United States since World War II have created a complex pattern of interregional flows of beef and beef products. Between basic calf production and ultimate beef consumption, the activities of growing, fattening, slaughtering, breaking and distribution are involved.

The structure of the beef industry changed significantly during the 1960's. Rapidly increasing disposable per capita income allowed the average consumer to improve his standard of living by increasing average levels of red meat consumption. Per capita consumption of beef increased from 85 pounds per person in 1960 to 113.7 pounds per person in 1970 [1]. The increased demand has been met through increased cow numbers, increased feeding of beef cattle, and increased feed grain production. The slaughter industry has been decentralized from the Northern urban centers to locations of concentrated fed cattle production, with beef being moved in carcass rather than live form.

The climatic conditions of the continental United States and rapidly increasing technological developments have resulted in increasing geographic specialization of agriculture. Wheat in the Southern High Plains, feed grain in the Mid-West, and truck farms along the seaboard are specialized enterprises which have developed. Historically, cattle have

---

Research reported herein was conducted under Oklahoma Station Project No. 1449.

been grown in the native ranges of the West and Southwest, and then moved to the Mid-West for fattening. Live animals were shipped into the metropolitan areas along the Missouri River, in the Great Lakes area, and in the Northeast for slaughter and consumption.

Following World War II, the development of irrigation areas in the West and in the Plains states dramatically increased the crop production potential. Capital was readily available for farmers and investors to utilize the new irrigation technology. Large cattle feeding operations sprang up in the California-Arizona area. The flows of feeder cattle changed dramatically, as the Desert areas of the Southwest began to build a feedlot empire.

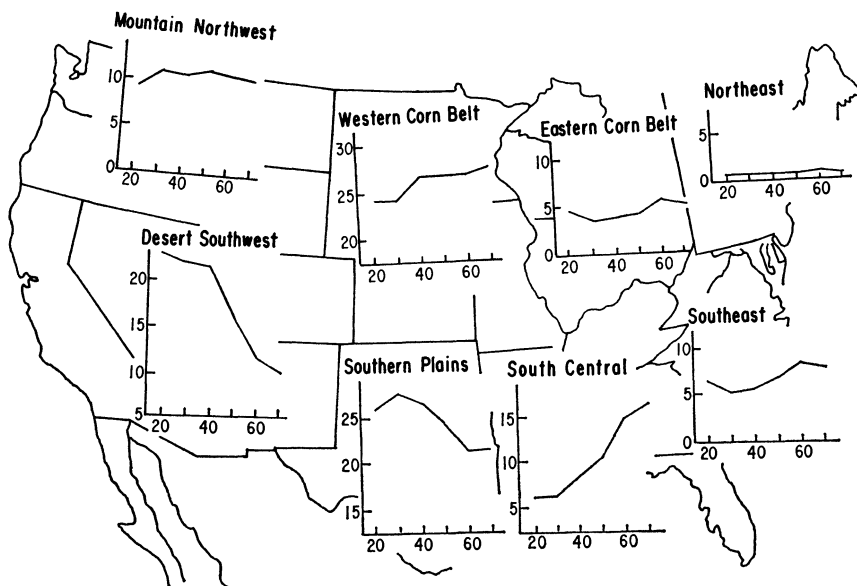
Gradually, irrigation technology and capital flowed into the High Plains area of the United States. The traditional crops of cotton and wheat were limited by the acreage allotment restrictions introduced by the agricultural programs of the early 1950's. Producers discovered that wheat did not respond well enough to irrigation to justify the investment. Thus, large acreages in the Plains were converted to the irrigated production of feed grains and forage. Vast amounts of grain became available for livestock feeding operations. Large volumes of this grain were shipped into the desert feeding areas.

By the late 1950's, the presence of large grain supplies in the Plains encouraged the development of Plains feedlots. From the beginning, Plains feeding was concentrated in large operations that fed beef to the high Good and Choice grades. The relative proximity of expanding population centers in the Southeast and Gulf Coast areas provided markets for the beef. The continued growth in Plains feeding further changed the flows of feeder cattle movement.

Traditionally, beef cow operations have been concentrated in the seventeen Western states. However, the changing structure of Southern agriculture coupled with Federal agriculture programs generated sweeping changes in the patterns of Southern land usage. Large acreages were transferred from cotton to forage production. In addition, large acreages of abandoned cropland were converted to improved pasture. As a result, the Southern states have replaced the Intermountain West as the nation's secondary producer of feeder cattle (Figure 1).

The cattle business is important to the Western states, but if we consider the pattern of changes in the beef brood cow herd over the past fifty years, the South Central and Southeastern regions plus the states of Iowa and Missouri have emerged as the dominant growth areas in beef brood cow herds. The Plains states and the Desert Southwest have consistently lost ground to these areas.

To illustrate the impact of pasture improvement, Eastern Oklahoma is annually converting about a quarter of a million acres to the tame,



**Figure 1. Percent of National Beef Brood Cow Herd, by Region, Decennial Years, 1920-70**

Source: John W. Goodwin, "Quo Vadis for the Beef Industry," *Agricultural Economics*, Paper 7027, Oklahoma State University, Stillwater, Oklahoma.

fertilized grasses. This represents an annual growth potential of about 87,000 brood cows in Eastern Oklahoma alone. This same pattern is being repeated across the South but most especially in Mississippi, Alabama, Kentucky and Tennessee.

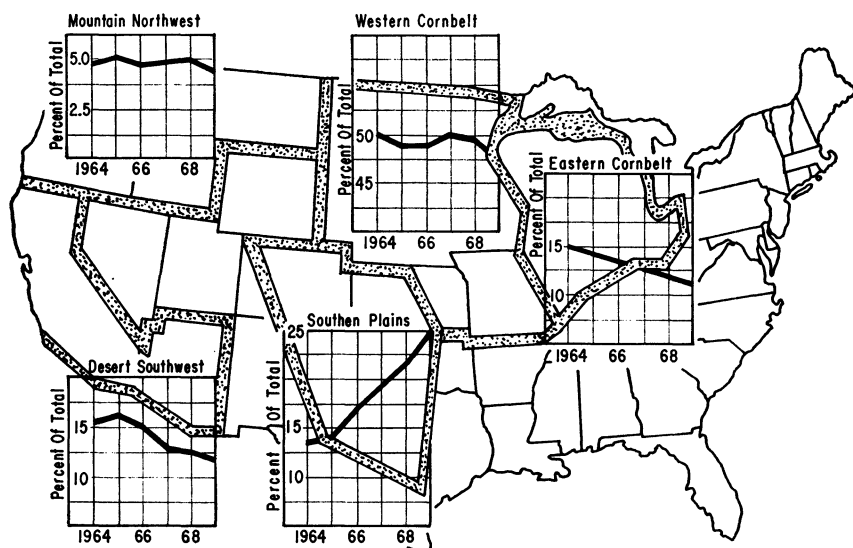
A second factor which has become extremely important to the growth in the beef industry is feed grain supplies. Fed beef has been of increasing importance as a proportion of American food expenditures. Of the 113.7 pound per capita beef consumption in 1970, 74 percent was from animals sold through feedlots. The location of feed grain supplies is of critical importance in the location of fed beef production. Since it has been generally cheaper to move cattle to feed grain than to move feed grains to cattle, cattle have typically been fed where the grains have been available. As late as 1955, the Corn Belt states fed almost all of the nation's cattle. During the 1950's, California and Arizona began to feed large numbers of cattle with imported feed grain, but feeding in these states has since declined. During the 1960's, there was a tremendous surge of cattle feeding in the Southern Plains.

Through the latter 1960's the Southern Plains became the dominant growth area in fed beef production (Figure 2). In 1960, the Southern Plains fed eight percent of the nation's cattle. By 1965, this had increased to 14 percent. In 1969, the Plains fed 24 percent of the 24 million head of cattle marketed from United States feedlots. The location of future growth in the beef industry will depend on the interaction among the beef production, slaughter, consumption, and transportation activities.

### Problem and Justification

A rapidly changing economic environment has resulted in significant changes in the beef industry. Factors such as population, growth, changes in regional distributions of population, increased per capita income, increased preference for beef, technology, and government agricultural policy have altered regional patterns of beef production, finishing, and marketing. Technological changes at all levels have altered cost structures and volume potentials for all regions of the United States.

It is apparent that the forces which created the sweeping changes throughout the beef industry during the 1960's have not yet run their course. These and other forces will continue to generate changes and necessitate adjustments through the 1970's and into the 1980's. Since



**Figure 2. Regional Shares of Cattle Feeding, Percentage of 23 States Total, 1964-69**

Source: John W. Goodwin, "Quo Vadis for the Beef Industry," Agricultural Economics, Paper 7027, Oklahoma State University, Stillwater, Oklahoma.

beef accounted for 26.5 percent of the total income to farmers in 1969, and is the single largest contributor to farm income, [2] information concerning long term probable competitive positions in the production, finishing, and marketing of beef is of utmost importance. The growth of the feeding industry has brought a high degree of economic growth and development to some areas. Information concerning this growth is needed for defining the potential for future growth in all sections.

Knowledge concerning the optimal locations of beef production and processing activities, and the competitive positions for different regions is of prime importance to decision makers in the beef industry. These decision makers may be cow-calf producers, small grain producers, feed-lot owners, meat packers, transportation companies, or others involved in the marketing of beef products. Such knowledge could be useful in determining the locations for the various installations that would minimize costs of production and/or distribution. Such information could also be useful to marketing firms in suggesting which markets should be investigated or where facilities should be located.

Although an optimum organization<sup>1</sup> (one which minimizes the cost of providing beef to the consumer) may never be attained in a dynamic economic environment, a partial equilibrium analysis can suggest the direction and magnitude of probable adjustments.

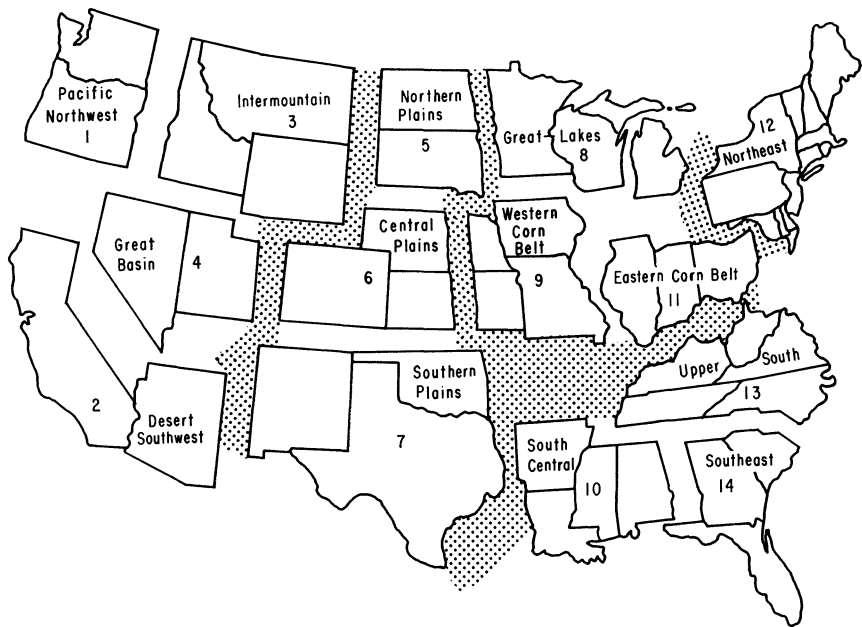
A companion study [3] to this analysis examines the optimum organization and the interregional structure of the beef industry under conditions approximating those present in 1970, and suggests the adjustments which are likely, given those conditions. It is the purpose of this analysis to examine whether the U. S. can in fact domestically meet the increased need for beef and to suggest the adjustments and postulate the changes in the various beef industry sectors that will result not only from the conditions present in 1970, but also from the increased beef demand generated by the expected further growth in population and per capita disposable income by 1980. An intermediate analysis for the target year of 1975 is also reported in this study for purposes of suggesting the chronological order in which the probable adjustments might be expected to emerge.

## **Method of Analysis**

Fourteen broad competitive geographic regions were defined on the basis of similarity of resource base, and production and marketing patterns (Figure 3). Representative points within these regions were specified as origins of production, and points of concentrated population

---

<sup>1</sup> For this study an 'optimum' organizations defined to be that organization which minimizes the cost of providing beef to the consumer.



**Figure 3. Regional Demarcation of the United States**

were designated as destinations for consumption. These origin and destination points in the various regions are specified in Table 1.

Each region was credited with facilities for activities such as calf production<sup>1</sup>, stocker growing, cattle feeding and slaughter at the average levels of these facilities which existed in 1968-1970. Regional consumption estimates for 1975 and 1980 were synthesized from work completed at Oklahoma State University, [5] along with secondary information from the *Household Food Consumption Survey*, [6] and projected estimates of population [7] and income [8] in 1975 and 1980.

Regional constraints on grass availability, cow herds, feedlot capacity, slaughter capacity, feed grain availability, and wheat availability were collected from secondary sources and are presented in Appendix A. The production within a region depends on availability of these resources. To expand the beef production capability not only of an individual region, but also of the industry as a whole, mobility of resources is extremely important.

In this analysis, all cattle and feed concentrates were free to move among regions, provided the importing region could pay the transporta-

<sup>2</sup> Cow numbers credited to any region include all beef cows and half the milk cows two years old and older.



**Table 1. Regional Basing Points for Beef Production and Consumption**

Region	States Included	Origin	Consumption
1 Pacific Northwest	Washington, Oregon	Portland	Portland
2 Desert Southwest	California, Arizona	Brawley	Los Angeles
3 Intermountains	Montana, Wyoming, Idaho	Helena, Montana	Helena, Montana
4 Great Basin	Utah, Nevada	Wells, Nevada	Salt Lake City
5 Northern Plains	N. Dakota, S. Dakota	Aberdeen, S. Dakota	Sioux Falls, S. D.
6 Central Plains	Colorado, W. Nebraska, W. Kansas	Holyoke, Colorado	Denver
7 Southern Plains	Oklahoma, Texas, New Mexico	Guymon, Oklahoma	Dallas
8 Lake States	Wisconsin, Michigan, Minnesota	St. Paul	St. Paul
9 Western Corn Belt	Iowa, Missouri, East Nebraska, East Kansas	Omaha	Omaha
10 Southern Central	Arkansas, Louisiana, Mississippi, Alabama	Jackson, Mississippi	New Orleans
11 Eastern Corn Belt	Illinois, Indiana, Ohio	Fort Wayne, Indiana	Chicago
12 Northeast	New England, New York, Pennsylvania, Maryland, New Jersey, Delaware	Albany	New York City
13 Upper South	West Virginia, Virginia, Kentucky, Tennessee, North Carolina	Knoxville	Richmond, Virginia
14 Southeast	South Carolina, Georgia, Florida	Thomasville, Georgia	Atlanta

tion cost. Present feeding, slaughtering, and grass facilities were not movable to other regions, but if a region required additional facilities, those facilities could be purchased and then used in production operations. Costs of activities associated with each of the constraints in the model were determined from secondary sources listed in the bibliography.

Transportation costs for stockers, feeders, fat cattle, dressed beef, feed grain, and wheat were provided by rate information from common carriers. So far as grain rail rates were concerned, rates for moving domestically consumed grain were used. Rail rates for carcass beef were rail carload freight rates on domestic shipment of fresh meat. Similar rates for truck transportation were also obtained for least cost transportation comparisons.

Truck rates for the movement of live cattle were based on a rate of 70 cents per load mile which was the common rate at the time of the programming of this study. A 44,000 pound load limit, which is the highest legal weight a truck can carry, was used. Therefore, for this study, 110 400-pound stocker calves may be hauled in one truck load. Seventy-three feeder cattle weighing six hundred pounds each may be trucked in a

single load. For fat cattle, the truck could legally haul only 44 animals at one time.<sup>3</sup>

The basic data were integrated in a transshipment model. The expected locations of calf production, stocker operations, feeding and slaughtering facilities and the expected interregional flow patterns for stocker cattle, feeder cattle, fed cattle, processed beef and concentrates were defined, based upon the levels of population and income projected for 1975 and 1980.

Cost differences among regions may be explained to some degree by differences in the normal regional scales of plant, by differing cost structures for inputs, and by differing structures of the entire agricultural sector in the various regions. Factors such as larger consumer markets, more rapid rates of technical adaptation, climate, lower factor costs or greater specialization of labor are all reflected in varying regional cost estimates.

The primary bases for the expected growth in the beef industry are projected increases in the population of the United States and an expected continued increase in per capita disposable income. To adjust the projected national fed beef consumption, income elasticities were used to increase per capita regional consumption estimates based on the projected income increases.<sup>4</sup> These were multiplied by the expected increase in population for the regions based on the population projections calculated by the Bureau of the Census. These regional per capita estimates of beef demand for 1975 and 1980 are shown in Table 2 along with the aggregate demand for beef for each region.

Additional grazing capacity was made available to each region through a pasture improving activity. Future regional pasture improvements were projected, based on the average numbers of acres improved through the 1967-1969 period. [9] The grazing production from the improved acreage was converted to AUM's<sup>5</sup> on the basis of state experiment station bulletins from the various regions. [10] For different operations, a cow-calf unit was defined to require 13 AUM's of grazing per cow unit per year, while a stocker animal required six AUM's per year.

The increased grazing capability was allocated between cow herds and stocker growing as dictated by the needs of the analytical model.

---

<sup>3</sup> Detailed discussion of the data needs and a mathematical definition of the analytical model can be found in John W. Goodwin and J. Richard Crow, *Optimal Regional Locations of Beef Production and Processing Enterprises*, Bulletin B-707 Oklahoma Agricultural Experiment Station, Stillwater, 1973.

<sup>4</sup> The procedure for estimating the projected fed beef consumption for various regions is reported in J. Richard Crow and John W. Goodwin.

<sup>5</sup> An AUM (animal unit month) is defined to be roughly equivalent to 450 pounds of total digestible nutrients, i.e., the grazing necessary to maintain a 1,000 pound cow and her calf for a period of one month.

**Table 2. Estimated Per Capita Fed Beef Consumption by Regions and the Associated Estimated Total Fed Beef Consumption for Each Region**

Region	Population			Per Capita Disposable Income			Per Capita Fed Beef Consumption			Number of Carcass Animals Demanded		
	1970 <sup>1</sup>	1975 <sup>2</sup>	1980 <sup>2</sup>	1970 <sup>3</sup>	1975 <sup>4</sup>	1980 <sup>1</sup>	1970	1975	1980	1970	1975	1980
	(ooo people)											
1 Pacific Northwest	5,500	5,545	6,001	3,170	3,863	4,380	81.66	84.7	92.4	653,766	688,409	813,039
2 Desert Southwest	21,466	25,904	29,480	3,550	4,147	4,622	88.55	92.5	100.9	2,875,304	3,512,993	4,363,515
3 Intermountains	2,312	1,892	2,043	2,640	3,192	3,714	74.62	79.1	86.6	250,936	219,411	259,297
4 Great Basin	1,548	1,829	2,042	2,920	3,065	3,519	71.62	75.9	83.1	163,564	203,596	248,750
5 Northern Plains	1,283	1,401	1,475	2,690	3,358	3,924	75.0	79.5	87.0	141,122	163,313	188,160
6 Central Plains	3,478	3,196	3,465	2,904	3,590	4,106	76.62	81.2	88.9	390,829	380,568	451,562
7 Southern Plains	14,771	16,378	17,857	2,750	3,285	3,791	68.67	72.8	79.7	1,487,378	1,748,027	2,085,682
8 Lake States	16,883	16,818	19,220	3,170	3,526	4,070	73.4	77.8	86.3	1,817,127	1,918,534	2,432,091
9 Western Corn Belt	9,793	10,826	11,827	2,878	3,573	4,159	80.17	83.7	91.4	1,148,781	1,329,280	1,584,853
10 South Central	11,198	12,883	13,973	2,230	2,895	3,346	64.82	68.7	75.2	1,064,344	1,297,915	1,540,513
11 Eastern Corn Belt	26,842	28,800	31,139	3,380	4,239	4,823	82.08	85.7	93.6	3,230,539	3,620,692	4,272,253
12 Northeast	52,291	56,169	63,664	3,420	4,144	4,695	88.12	92.05	100.5	6,859,537	7,980,080	9,377,557
13 Upper South	18,517	19,886	21,873	2,490	3,280	3,796	64.92	68.8	75.3	1,762,662	2,006,532	2,415,235
14 Southeast	13,437	15,588	17,358	2,660	2,957	3,436	64.92	68.8	75.3	1,279,034	1,572,742	1,916,506
	199,319	217,115	241,417				79.1	84.0	90.2	23,124,923	26,748,092	31,949,013

<sup>1</sup> U.S. Department of Commerce, 1970 Census of Population (Washington, D. C., 1971). Issues for each state were consulted.

<sup>2</sup> U.S. Department of Commerce, *Population Estimates*, Series P-25, No. 375 (Washington, D. C., October, 1967), p. 34.

<sup>3</sup> "Per Capita Income by County and State," *Sales Management* (June 10, 1970), p. B-3.

<sup>4</sup> National Planning Association of Commerce, *State Economics and Geographic Projection*, Regional Economics Projection Series, Report 70-R-1 (Washington, D. C., 1970), pp. S-6. For 1975 and 1980, the income for the state for which the consumption point is located was used.

That is, calf production had first claim upon grazing, since the calf had to be produced before it could be grown to feeding weight. These two types of production were allocated among regions such that the total cost of all beef produced, slaughtered, and delivered to the carcass market was minimum.

Feed grain production was assumed to be at the levels observed during the 1968-70 period in all regions except for the Southern Plains. While all regions have experienced increases in feed grain production due to improved technology, technological growth has had about the same impact in all areas. However, the continuing development of irrigation in the Southern Plains has rapidly expanded and is continuing to expand feed grain production through increased irrigation in an area bounded on the north by the Arkansas River and the south by the South Canadian River. These acreages will be subject to any increases in yield that result from technological development other than irrigation. But the irrigation itself enormously enhances feed grain production potential. Future estimates of feed grain supplies for the Southern Plains were drawn from the production estimates made by Bekure in a study of the Central Ogallala Formation. [11] The production in this small area was the only expansion of feed grain production allowed in this study, since other technical growth would be expected to have approximately proportional impact in all regions.

When the future beef production resulting from expanded facilities for the Southern Plains is analyzed, the Southern Plains designation commonly includes those parts of Southwest Kansas and Southeast Colorado which lie south of the Arkansas River. Even though Colorado and Western Kansas have been defined as a part of the Central Plains in this study, the increase expected in feed grain production in the Southeast Colorado-Southwest Kansas area as a result of expanded irrigation was included with Southern Plains production because of the inability to specify the quantities of grain produced in each of the sub-state areas within the area. Also, many analysts (such as Bekure) group Southwest Kansas and Southeast Colorado with the Oklahoma-Texas High Plains area because of similarities in production and marketing practices.

Transportation costs on a point-to-point basis were assembled for all relevant commodities for all modes of transportation except for truck movement of grain. A functional relationship was utilized in the case of truck movement. [12] Transportation costs considered included

- (1) transportation costs for shipment of feed grains
- (2) transportation costs for shipment of wheat
- (3) transportation costs for shipment of stocker calves
- (4) transportation costs for shipment of feeder cattle
- (5) transportation costs for shipment of fat cattle

(6) transportation costs for shipment of carcass beef.

In all cases, both rail and truck rates were considered. Where applicable, barge rates were also considered in moving grain. [13] In each case, the least-cost mode of shipment was used as the cost for transferring a product from one region to another.

## The Results

The results of this study will be discussed for two different analyses — the interregional adjustments probable in the beef industry as it strives to meet the demand for beef based on projected regional levels of population and income expected in 1975 and 1980. The numbers of brood cows and the forage available, feed lot capacity, and slaughter capacity were assumed to be available at the levels observed during the 1968-70 period. Additional capacity could be purchased as needed in any given region.<sup>6</sup>

For each analysis optimal locations of calf production, stocker cattle growing, cattle feeding and slaughtering activities will be discussed, and optimal patterns of movement examined. The regional volumes of production and the patterns of product flows should be interpreted as the manner in which the marketing system would be expected to function given the expected demand for beef, the levels of resources available and the costs of additional resources in order to minimize the total cost for supplying the regional requirements of beef. Given the basic data, no other patterns of production would result in a lower total cost for the system as a whole.

## 1975 Projections

American consumers are expected to demand 2.385 billion more pounds of beef by 1975. The main force behind this 15 percent increase in demand is population growth with some secondary impact from an expected increase in average per capita disposable income. The increased beef demand can be met either by increased domestic production or through increased beef imports. For the purpose of this study, it was assumed that the additional increase would come from domestic production. The objective of this analysis was to define the probable resource adjustments and the regional growth patterns that would be expected to emerge from an increase in domestic production through 1975.

---

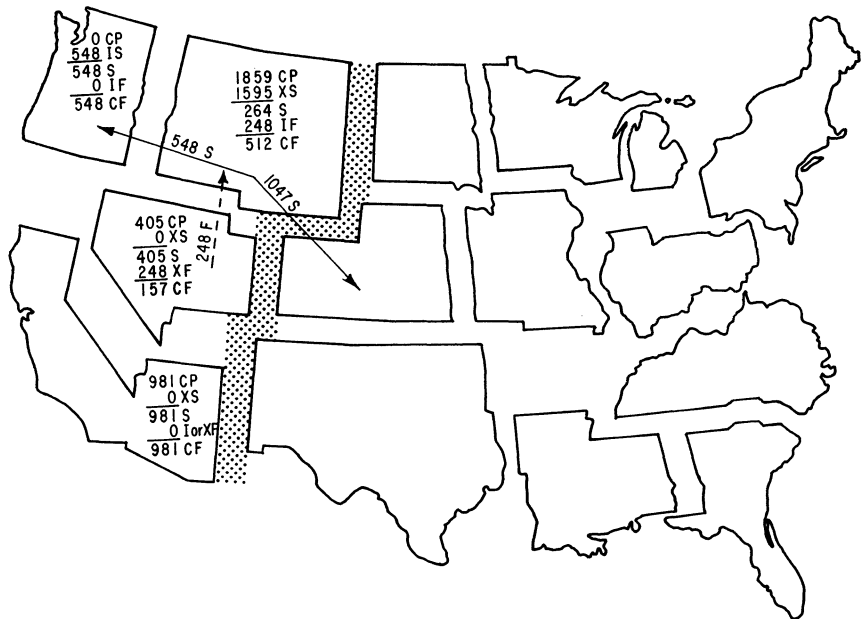
<sup>6</sup> Costs of additional capacity for feeding, slaughter, and improved pasture are defined in Goodwin and Crow, *Optimal Regional Locations of Beef Production and Processing Enterprises*.

## The West

In the aggregate, calf production in the four Western regions was optimally expected to decline by some 20 percent below 1968-1970 levels. This decline was almost totally the result of the absence of calf production in the Pacific Northwest. There was a calving increase in the Desert Southwest with a substantial decrease in the Intermountain area. The decrease in Intermountain calf production was replaced by an increase in the stocker growing activity. The overall beef production pattern in the West, shown in Figure 4,<sup>7</sup> suggests that the four Western regions are likely to produce beef primarily for their local markets. The key production region for the West was the Intermountain area. The Intermountain beef industry was geared to supplying stockers for both the Pacific Northwest and the Central Plains. Also, the grain production of the Intermountain area supported the feeding industry of all the Western regions.

Stocker calves were exported from the Intermountain area because of the comparative advantage the Intermountain region enjoyed in pro-

<sup>7</sup> For all maps, solid lines indicate movements of stocker calves, while dashed lines represent movements of feeder cattle.



**Figure 4. Calf, Stocker and Feeding Operations in the Western Regions, Projected Conditions for 1975**

cluding calves as compared with other regions. The Intermountain region was the only feasible import source for the calves grown out to feeding weights in the Central Plains. Many of the stocker calves shipped to the Central Plains eventually found their way to the Desert Southwest as carcass beef. This flow pattern occurred since the Central Plains could import stocker calves from the Intermountain region, grow the animals to feeder weight, feed them, and ship the beef cheaper than the combination of operations could be accomplished in any of the Western regions. A small portion of the Desert Southwest market was served through local beef production, but only because resources in the Intermountain and Central Plains areas were exhausted in meeting more favorable beef demands elsewhere.

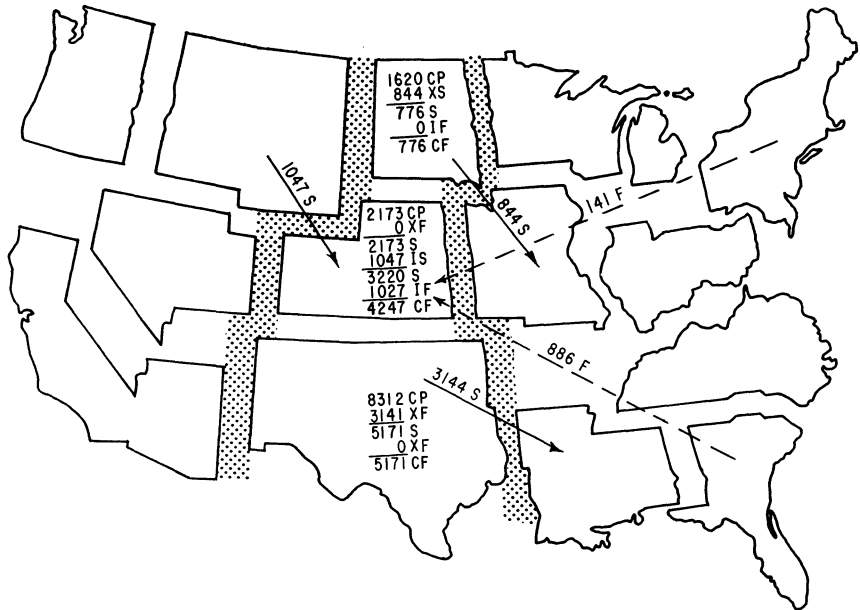
Even though excess feeding capacity existed in the Intermountain area, a more efficient beef industry resulted from this area being a supplier of basic resources rather than final products.

## **The Plains**

The three Plains regions accounted for 45 percent of all stocker calf production under conditions projected for 1975, with the Southern Plains alone producing 31 percent. This suggests that the cow-calf enterprise can be expected to show substantial growth in the Southern and Central Plains up to 1975, but not in the Northern Plains. Northern Plains cattlemen replaced some of the cows with stocker calves. Stocker calf operations became extremely important in the Northern and Southern Plains as these two regions began to grow out all calves eventually fed in the regions. The Central Plains grew out substantial numbers of stocker calves, but still imported about a fourth of the feeder cattle used in the region. The balance sheet for beef production in the Plains is shown in Figure 5.

Each of the Plains regions completely utilized all available grass. The South Plains was the only region to purchase additional grass, purchasing 12.5 million AUM's. This growth suggests that four million acres of present pasture will be converted to improved pasture between 1970 and 1975, that 1.6 million acres of cropland will be planted to the high yielding tame pasture grasses, or some combination of these two will occur in order to meet the projected grazing needs. This is completely feasible considering the rate of pasture improvement in the Southern Plains region since 1960.

Both the Northern and Southern Plains reserved enough grass to produce the stocker cattle which eventually were fed in these regions. The balance of the grass was utilized in the production of calves. Stocker calves which were in excess supply in the Northern Plains were shipped



**Figure 5. Calf, Stocker and Feeding Operations in the Plains Regions, Projected Conditions for 1975**

CP Calf Production  
 IS Import Stockers  
 XS Export Stockers  
 IF Import Feeders

XF Export Feeders  
 CF Cattle Fed  
 S Stockers Raised  
 (figures in 000's)

to grass to be grown to feeding weights in the Western Corn Belt, while the excess stockers in the Southern Plains were shipped to the South Central region.

Grass capacity in the Central Plains was not sufficient for both producing calves and carrying them through to feeding weights. To make the best use of resources, supplemental calves were imported from the Intermountain region to the Central Plains, keeping calf production in the Central Plains to a minimum.

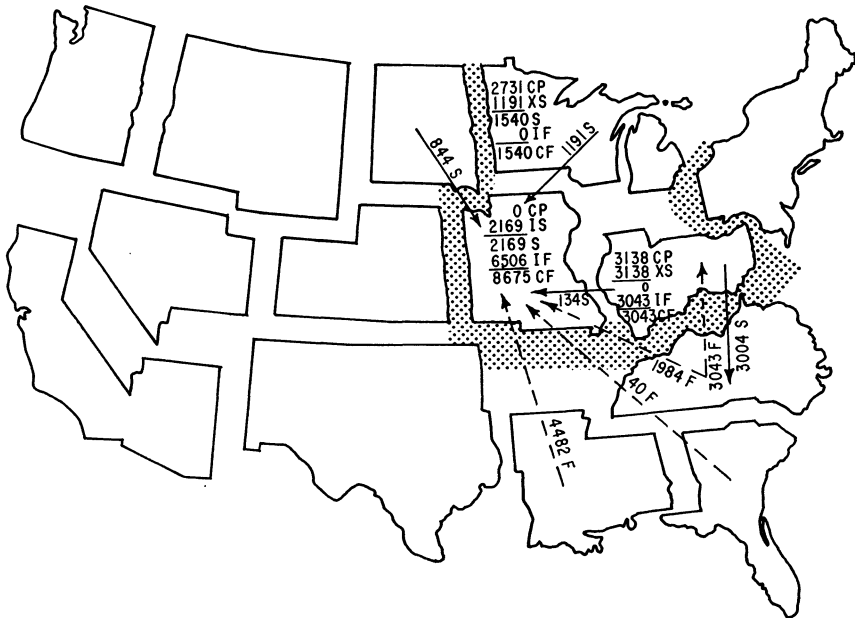
While feeding in the Southern and Central Plains was limited because of feed grain supplies, the Northern Plains had a large surplus of feed grains. Feeding in the Northern Plains was limited by the Northern Plains inability to compete with either the Central or Southern Plains or the Corn Belt region for the Northeastern beef market. Only after the feed grains in the Central and Southern Plains areas and after the feeding facilities of the Corn Belt had been exhausted was the Northern Plains able to expand its feeding operations.



## The Corn Belt

A major revision in resource use was suggested for the three Corn Belt regions. These regions did not invest in major pasture improvement—they merely utilized forage that has heretofore been unused. In the Lake States, resources would be expected to move toward increased calf production with the region retaining only those stocker calves that would ultimately be fed in local feedlots. Surplus stocker calves from the Lake States would be moved into the Western Corn Belt for growing and eventual feeding (Figure 6).

The Western Corn Belt would not be expected to produce large numbers of calves under the conditions projected for 1975. Rather, Western Corn Belt grazing capacity would be utilized to grow calves to feeding weights, thus reducing the feeder cattle expense for a substantially expanded feeding industry. Optimally, all available grazing would be utilized for growing imported stocker calves to feeding weights. The Lake States, the Northern Plains, and the Eastern Corn Belt would be



**Figure 6. Calf, Stocker and Feeding Operations in the Corn-Belt Regions, Under Conditions Projected for 1975**

CP Calf Production	XF Export Feeders
IS Import Stockers	CF Cattle Fed
XS Export Stockers	S Stockers Raised
IF Import Feeders	(figures in 000's)

expected to emerge as the suppliers of these stocker calves, rather than the Intermountain and Southern Plains regions—the traditional source of stocker and feeder cattle for the Corn Belt. In addition to the stocker calves grown locally, the Western would be required to import massive numbers of feeder cattle from the three southern regions, primarily from the South Central area.

The Eastern Corn Belt—historically not a beef cow region—would be expected to expand calf production substantially under the conditions projected for 1975. Even though the Eastern Corn Belt had the second highest cash costs of production of any region, the increased calf requirements for 1975 forced the region into production. Interestingly, the Eastern Corn Belt retained none of its calves beyond weaning, but rather preferred to move stocker calves to the Western Corn Belt and Upper South for growing. Those calves grown out at lower cost in the Upper South then returned to the Eastern Corn Belt for feeding.

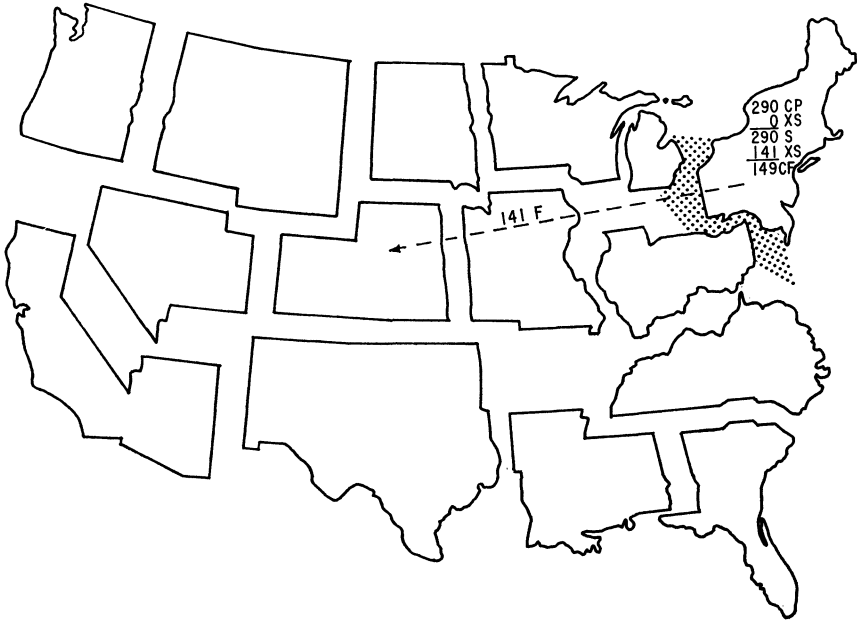
### **The Northeast**

Optimal production patterns for the conditions expected by 1975, shown in Figure 7, suggested that the Northeast might be expected to emerge as another marginal beef producing region forced into operation by the expected increase in the total demand for beef. Of the calves produced within this region, all would be carried through to feeding weight. Feeder calves in excess of those used for local feeding were transported to the Central Plains.

### **The South**

The Southern beef industry would be expected to remain a strong cow-calf and stocker production region at least through 1975, with the South Central area remaining the dominant Southern beef region. The optimal number of calves for 1975, however, was smaller in the three Southern regions than was actually observed in the 1968-70 base period. This is a result of the Southern cow man's practice of selling light calves to be grown to feeding weights in other regions. The optimal situation for 1975 suggests that not only should Southern calves be retained for growing, but also, that the South Central and Upper South regions should be importing large numbers of stocker cattle for growing out to feeder weights. The large inshipments of stocker cattle limited the numbers of cows to those numbers that could be carried on the grass available after needs for stocker growing had been met. Other than the feeder cattle kept for feeding locally with grain barged in from the Corn Belt, feeder cattle from the South Central area were ultimately fed in the Western Corn Belt (Figure 8).

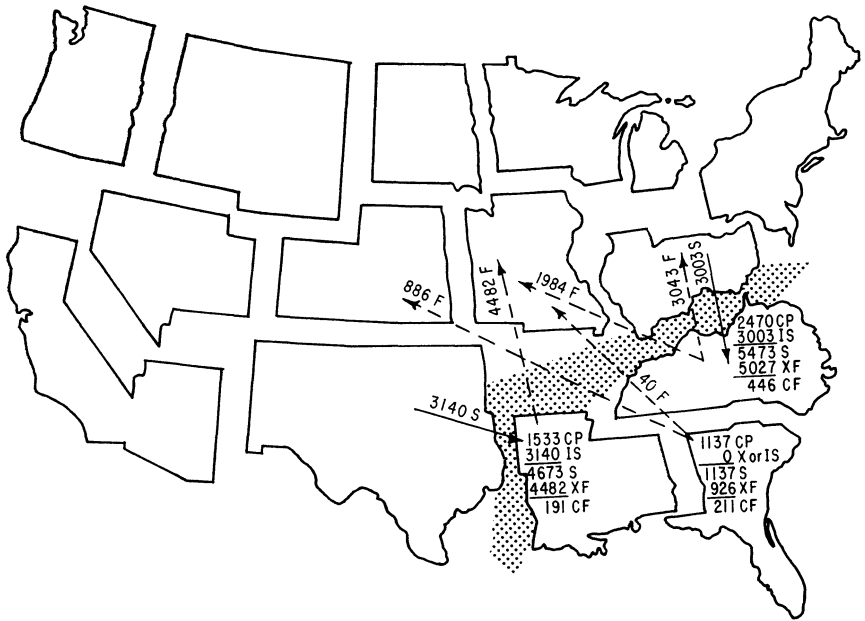
As the result of increased calf production in the Eastern Corn Belt,



**Figure 7. Calf, Stocker and Feeding Operations in the Northeast Regions, Under Conditions Projected for 1975**  
 CP Calf Production  
 IS Import Stockers  
 XS Export Stockers  
 IF Import Feeders  
 XF Export Feeders  
 CF Cattle Fed  
 S Stockers Raised  
 (figures in 000's)

grass in the Upper South was shifted toward stocker operations. In an effort to offset high calf production costs in the Eastern Corn Belt total costs of beef production were reduced by using pasture in the Upper South for stocker growing rather than greatly increased calf production. Consequently, calf production in the Upper South was limited to the levels permitted by the expanded stocker growing enterprise. Feeder cattle grown out in the Upper South were fed in both the Eastern and Western Corn Belts. Feeding in the Upper South increased to the limit of the locally available wheat supply. Feed grains were barged into the region from the Corn Belt to blend with the local wheat.

A substantial reduction in calf production in the South Central region was replaced by enormous numbers of stocker cattle imported from the Southern Plains for growing to feeder weights. These cattle, along with the bulk of South Central calf production ultimately found their way to feed lots in the Western Corn Belt.



**Figure 8. Calf, Stocker and Feeding Operations in the Southern Regions, Under Conditions Projected for 1975**

CP Calf Production	XF Export Feeders
IS Import Stockers	CF Cattle Fed
XS Export Stockers	S Stokers Raised
IF Import Feeders	(figures in 000's)

## Beef Industry Sectoral Analysis for 1975

The interregional distributions of calf production and fed cattle marketings during the 1968-70 period are shown in the balance sheet of Table 3. It will be noted in Table 3 that only 62 percent of the potential feeder calf production was actually available for feeding, once allowance for beef cow replacements, calf slaughter, death loss, and farm slaughter had been made.

No data are available to indicate the regional incidence of stocker growing during the base period. Thus, the estimates of regional exports and imports of cattle are net figures that may or may not reflect the actual patterns of live cattle movement. That is, a stocker calf that was imported into a region for purposes of growing to feeding weight and was then exported to another region for feeding would not be included in the estimates of Table 3, since the inshipment of the calf and the outshipment of the feeder animal would cancel each other.

**Table 3. Balance Sheet of Calf Production and Disposition, by Region Forty-Eight Contiguous States, 1968-70 Average**

Region	Potential	Less				=	No. of Calves Avail. for Feeding ±	Regional Imports (+) or Exports (-) =	Actual No. of Fed Cattle Mkt'd.
	Feeder Calf Prod. <sup>1</sup>	Beef Replmt. Heifer Needs <sup>2</sup>	Comm. Calf Sltr.	Death Loss <sup>3</sup>	Farm Sltr. <sup>4</sup>				
	(1000 hd)								
Pacific Northwest	1,107	110	26	111	38	822	- 306	516	
Desert Southwest	1,387	144	196	205	19	823	+2,029	2,852	
Intermountain	2,820	424	2	232	27	2,135	-1,534	601	
Great Basin	576	114	6	62	8	386	- 386	τ	
North Plains	2,693	374	---	226	29	2,064	-1,354	710	
Central Plains	3,546	564	4	366	21	2,591	+2,431	5,022	
Southern Plains	7,841	1,326	330	550	46	5,589	-2,141	3,448	
Lake States	2,463	146	681	514	76	1,046	+ 270	1,316	
Western Corn Belt	5,302	746	301	506	50	3,699	+3,279	6,978	
South Central	3,726	792	364	339	34	2,197	-2,197	τ	
Eastern Corn Belt	1,873	190	310	300	48	1,025	+1,137	2,162	
North East	1,374	40	1,876	270	46	- 858	+ 991	133 <sup>8</sup>	
Upper South	3,296	527	308	361	41	2,059	-2,059	τ	
Southeast	1,819	299	354	149	15	1,002	-1,002	τ	
<b>48-State Total</b>	<b>39,823</b>	<b>5,796</b>	<b>4,758</b>	<b>4,191</b>	<b>498</b>	<b>24,580</b>	<b>- 842<sup>a</sup></b>	<b>23,738</b>	

<sup>1</sup> Total Beef Calf production plus half of Dairy Calf production.

<sup>2</sup> Includes 12.5 percent of average Beef Cowherd plus average of increase in Beef Cowherd.

<sup>3</sup> Death loss of cattle and calves.

<sup>4</sup> Farm Slaughter of cattle and calves.

<sup>5</sup> Less than 500 head.

<sup>6</sup> Should be interpreted as total of non-fed Steer and Heifer slaughter plus fed cattle marketings in non-reported states.

<sup>7</sup> Not available.

<sup>8</sup> Pennsylvania is the only state included in this figure. Other states not reported.

SOURCE: All data reported in *Livestock and Meat Statistics*, Statistical Bulletin No. 333 and Supplements, ERS, USDA, Washington, D. C., and in *Livestock Slaughter*, 1968, 1969, and 1970, CRB, SRS, USDA, Washington, D. C.

## Calf Production

Total costs of beef production were minimized by organizing the industry such that the movement of heavier cattle was also minimized. Calves tended to be produced in the peripheral areas, with grass in the feeding areas tending to be used for growing stocker cattle to feeding weights. The Eastern Corn Belt and the Northeast became calf production areas under the demand conditions postulated for 1975. Other regions which had substantially increased calf production included the Lake States, the Southern Plains and the Desert Southwest (Table 4).

## Stocker Operations

Stocker operations became very significant portions of the beef industries in the Upper South, the Southern Plains and the Desert Southwest (Table 5). The Upper South's feeder cattle were used for expanded feeding operations in the Western Corn Belt. Feeders produced in the Desert Southwest were used locally as the beef industry in that region became entirely internal to the region. Stocker operations generally occurred in areas where the calves were eventually fed, or in areas immediately adjacent to the ultimate feeding destination.

**Table 4. Regional Calf Availability under 1975 Optimum Conditions Compared with 1968-70 Actual Numbers**

Region	Actual 1968-70 <sup>1</sup> No. Available For Feeding	Projected 1975 Optimum	Change	Percentage Change
	(000 head)			
1 Pacific Northwest	822	0	- 822	-100.0
2 Desert Southwest	823	981	+ 158	+ 19.1
3 Intermountains	2,135	1,859	- 276	- 12.9
4 Great Basin	386	405	+ 19	+ 4.9
5 Northern Plains	2,064	1,620	- 444	- 21.5
6 Central Plains	2,591	2,173	- 418	- 16.1
7 Southern Plains	5,589	8,312	+2,723	+ 48.7
8 Lake States	1,046	2,731	+1,685	+161.1
9 Western Corn Belt	3,699	0	-3,699	-100.0
10 South Central	2,197	1,533	- 664	- 30.2
11 Eastern Corn Belt	1,025	3,138	+2,113	+206.0
12 Northeast	- 858 <sup>2</sup>	290	+1,148	+
13 Upper South	2,059	2,470	+ 411	+ 20.0
14 Southeast	1,002	1,137	+ 135	+ 13.5
<b>Total</b>	<b>24,580</b>	<b>26,649</b>	<b>+2,069</b>	

<sup>1</sup> Actual Calf Production figures are calculated on the basis of  
(BC + .5 DC) = CALF PRODUCTION

where BC is Beef Cow numbers

DC is Dairy Cow Numbers

CP is Calving Percentage (i.e., calves born as a percent of January 1 inventory of cows and heifers 2 years old and older)

<sup>2</sup> Negative number results from large numbers of calves imported for slaughter.

**Table 5. Optimum Interregional Distribution of Stocker Growing, 1975 Projected Conditions**

Region	1975
1 Pacific Northwest	548
2 Desert Southwest	981
3 Intermountain	264
4 Great Basin	405
5 Northern Plains	776
6 Central Plains	3,220
7 Southern Plains	5,171
8 Lake States	1,540
9 Western Corn Belt	2,169
10 South Central	4,673
11 Eastern Corn Belt	0
12 Northeast	290
13 Upper South	5,473
14 Southeast	1,137
<b>Total</b>	<b>26,647<sup>1</sup></b>

<sup>1</sup> Totals may vary slightly because of rounding.

### Utilization of Feeding Capacity

Feeding the additional 3 million cattle required to meet the demands postulated for 1975 completely utilized all feeding facilities available during the 1968-70 period except for 2.3 million head of capacity in the Western regions. The Desert Southwest, the Intermountain area, and the Central Plains would all optimally feed fewer cattle in 1975 than they actually fed during the base period (Table 6). The Northern Plains and the Pacific Northwest fed at essentially the same levels under the conditions projected for 1975 as existed in fact during the base period.

Cattle fed in the Southern Plains increased due to the expansion of facilities. The Southern Plains purchased capacity for 1,207,000 additional head of cattle. Feed for these cattle was produced locally with a mixture of wheat and feed grains used as the ration base.

The expected decline in Central Plains feeding by 1975 is probably more imaginary than real. What has actually happened is that the growth in feeding in North Central Colorado (the Greeley area) has probably outstripped the levels justified by the prevailing economic conditions. However, as will be seen in the results for 1980, the Central Plains region will optimally have substantial growth potential — especially in Western Kansas and Eastern Colorado.

Expansion of facilities in the Eastern Corn Belt by 711,000 head was the major portion of the increased numbers of cattle fed in the Corn Belt. The Lake States and the Western Corn Belt expanded feeding to the limits of the feedlot capacity available during the 1968-70 period, but did not purchase additional facilities.

**Table 6. Optimum Regional Distribution of Feeding Activity Under 1975 Projected Conditions Compared with Actual 1968-70 Levels**

Region	Average No. Fed Cattle Marketed 1968-70	Optimum No. Fed Cattle 1975	Change	Percentage Change
			(000 hd)	
1 Pacific Northwest	516	548	+ 32	+ 6.2
2 Desert Southwest	2,852	981	-1,871	-65.6
3 Intermountain	601	512	- 89	-14.8
4 Great Basin	<sup>1</sup>	157	<sup>3</sup>	<sup>3</sup>
5 Northern Plains	710	776	+ 66	+ 9.3
6 Central Plains	5,022	4,247	- 775	-15.3
7 Southern Plains	3,448	5,171	+1,723	+49.4
8 Lake States	1,316	1,540	+ 224	+14.5
9 Western Corn Belt	6,978	8,675	+1,697	+24.3
10 South Central	<sup>1</sup>	191	<sup>3</sup>	<sup>3</sup>
11 Eastern Corn Belt	2,162	3,043	+ 881	+40.7
12 Northeast	133 <sup>2</sup>	149	<sup>3</sup>	<sup>3</sup>
13 Upper South	<sup>1</sup>	447	<sup>3</sup>	<sup>3</sup>
14 Southeast	<sup>1</sup>	212	<sup>3</sup>	<sup>3</sup>
<b>Total</b>	<b>23,738</b>	<b>26,649</b>	<b>+2,911</b>	<b>+12.3</b>

<sup>1</sup> Not available.

<sup>2</sup> Pennsylvania only. Other States not available.

<sup>3</sup> Undetermined.

One hundred and forty-nine thousand head of cattle were fed in the Northeast. To meet the beef demand in the area, utilization of their facilities became necessary.

Except for limited feeding in the Upper South, the three Southern regions were not really involved in the distribution of cattle feeding that would be optimum under 1975 projected conditions. The Upper South purchased 252,000 head of additional feeding capacity. The barge transportation system played an extremely important role in this region. Feed grains were transported via barge from St. Paul down the Mississippi and Tennessee River water ways. Enough excess slaughter capacity existed in the Upper South prior to the increased feeding that no new slaughter capacity was necessary. All beef produced in the Upper South was consumed internally.

### **Cattle Slaughter and the Flow of Beef**

Slaughtering of fat cattle occurred at the point of feeding except for the shipment of 227,000 fat animals from the Northern Plains to the Lake States. Additional slaughter facilities were built in the Intermountain, Central Plains, Southern Plains, and Western Corn Belt. Slaughter capacity was completely utilized in those regions that purchased additional capacity, as well as in the Northern Plains and the Eastern Corn Belt. Excess slaughter capacity was available in all other regions.

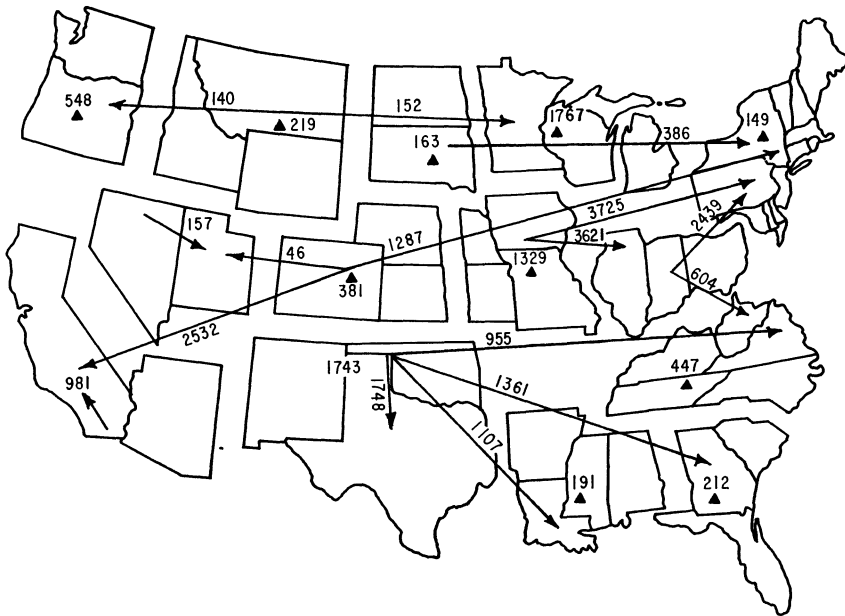


Movements of beef under the conditions projected for 1975 were in the same general pattern as have been reported in numerous beef marketing studies. The Southern Plains dominated the market in all Southern regions. The Central Plains were the dominant supplier for the California Market, and were a major supplier to the Northeast. The increased demand in the Lake States was partially supplied by beef from the Intermountain area, while the Northeast internally provided 149,000 carcasses (Figure 9).

**Level of Resource Utilization**

As a result of the increased production necessary for optimally meeting the total demands for beef under conditions expected in 1975, the Desert Southwest and Intermountain areas were the only regions with unused existing feeding capacity. All other regions were operating at the limits of the constraints in the model with three regions—the Southern Plains, the Eastern Corn Belt and the Upper South—purchasing new feeding capacity.

The major feeding regions (the three Plains regions, the Eastern and Western Corn Belts, and the Intermountain area) utilized all exist-



**Figure 9. Optimal Meat Flows, Under Conditions Projected for 1975**  
 Figures are in 000 carcasses

ing slaughtering capacity. All other regions had surplus slaughter capacity, even with increased total United States production.

Grassland for producing calves was completely utilized in all regions except in the Pacific Northwest and in the Northeast. Only in the Southern Plains was additional grazing capacity purchased. After the increased feeding requirements had been met, surplus feed grains still existed in the Northern Plains and the three Corn Belt regions. Surplus wheat was still present in the Pacific Northwest, in all Plains regions, and in the Lake States.

### **Increased Cost Due to Expansion**

The increased demand for beef required that production be expanded to the maximum possible levels of currently available resources in the major regions. Further, production was expanded into the marginal regions such as the Northeast. Assuming that there were no additional per unit cost increases resulting from increased production, the average cost for supplying meat to all regions increased by \$9 per animal. This cost increase would be attributed largely to the increased cost of producing calves and feeder cattle in marginal regions. Feeding, for the most part, was accomplished without increasing average costs, and shipment to the markets occurred at the same average costs per animal.

## **1980 Projections**

By 1980, the population of the United States is expected to reach 242,000,000. Per capita income is expected to continue to increase. Beef consumption should continue to grow but probably not at the rate observed during the 1960's. When population increases and moderate increases in per capita income are considered, 8.8 million additional head of fed cattle will be necessary to feed our population by 1980. The 1975 analysis suggested that about three million additional fed cattle will be needed by 1975. From 1975 to 1980, five to five and a half million head in addition to the 1970-75 increase will be required. Resource use was expanded almost to the limit in the 1975 analysis. Thus, the 1980 analysis was designed to define the additional adjustments that would be required to move 5.3 million additional fed beef animals through the system between 1975 and 1980.

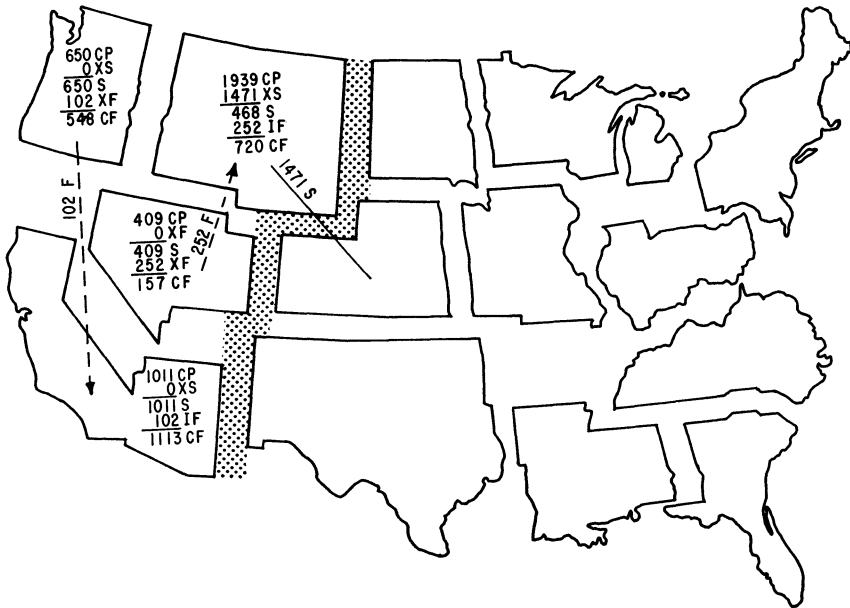
### **The West**

The Western beef industry would be expected to carry a larger burden in internally supplying the needs of its own region. In the analysis for 1975, the Pacific Northwest utilized its grazing only for stocker calves. The increased demand for beef expected by 1980 forced this region into producing calves which were locally carried to feeding weights. Only

those feeders required for fully utilizing the locally available feeding capacity were retained in the region, with the balance of the feeders being shipped to the Desert Southwest (Figure 10).

The interrelationships between the Intermountain and the Desert Southwest areas are still quite important. Calves produced in the Intermountain area moved to the Central Plains where they were fed and eventually shipped as carcass beef to the Desert Southwest. The Desert Southwest increased all phases of their beef industry by importing feed grain from the Central Plains to carry out the feeding expansion. This movement occurred because feeder cattle were not available at cost levels permitting the Central Plains to further expand feeding operations. Consequently, the Desert Southwest was able to compete to a limited extent for its own beef market.

Overall production in the other two Western regions remained relatively constant over 1975-80 period. Feeding did increase nominally in



**Figure 10. Calf, Stocker and Feeding Operations in the Western Regions, Under Conditions Projected for 1980**

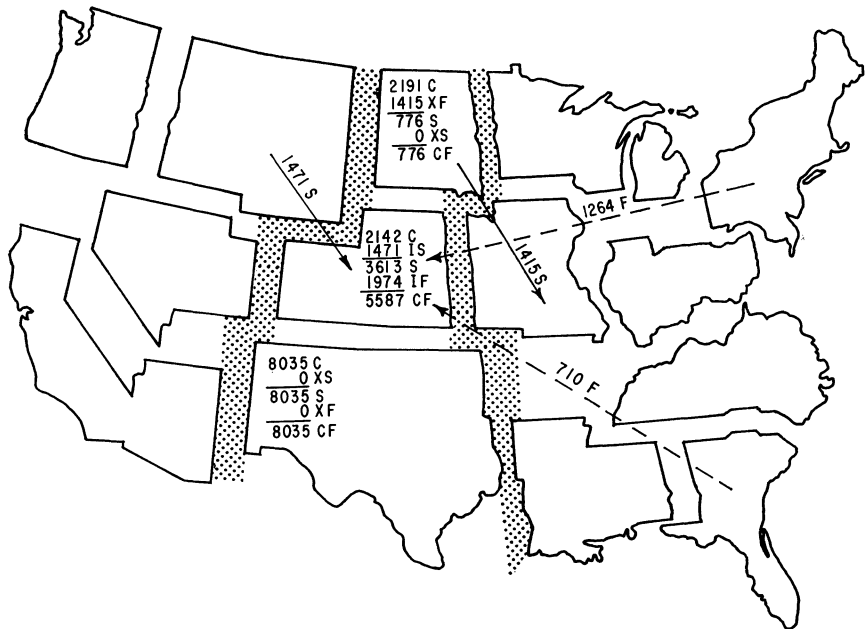
- |                    |                    |
|--------------------|--------------------|
| CP Calf Production | XF Export Feeders  |
| IS Import Stockers | CF Cattle Fed      |
| XS Export Stockers | S Stockers Raised  |
| IF Import Feeders  | (figures in 000's) |

the Intermountain area because of its relatively cheap feed grain and low cost feeder cattle.

### The Plains

Beef production in the Plains follows the same general patterns as observed in the analysis for 1975. Each of the regions utilized all available grass to produce as many feeders as possible in the vicinity of their feeding industry (Figure 11). The Central Plains is the only Plains region which does not have sufficient grass for growing the necessary numbers of feeder cattle. To balance their feeding program, the Central Plains imported large numbers of stocker cattle from the Intermountain area, large numbers of feeder cattle from the Northeast and Southeast, and shipped excess feed grains to the Desert Southwest.

Within the Plains, the Southern Plains is and is likely to continue to be the largest single calf producing region. This region might be expected to produce 8.03 million calves—about three percent less than the



**Figure 11. Calf, Stocker and Feeding Operations in the Plains Regions, Under Conditions Projected for 1980**

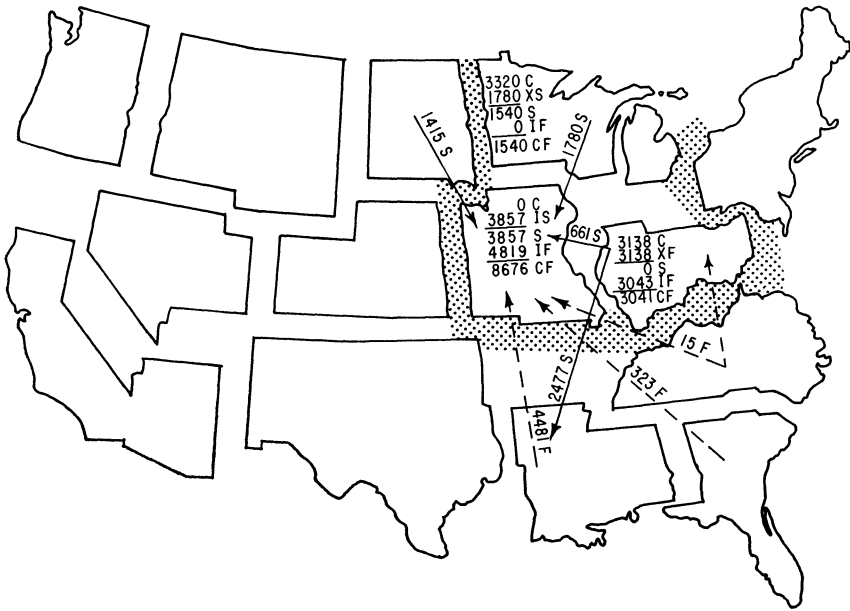
CP Calf Production  
 IS Import Stockers  
 XS Export Stockers  
 IF Import Feeders  
 XF Export Feeders  
 CF Cattle Fed  
 S Stockers Raised  
 (figures in 000's)

1975 results suggest and 44 percent more than during the 1968-70 period. Stockers became an increasingly important enterprise. Southern Plains stocker growing enterprises increased by 55 percent over the levels that would be optimum in 1975. All stocker calves grown to feeding weights were retained in the region for feeding, utilizing a wheat-feed grain ration.

**The Corn Belt**

Most of the changes in calf production in the Corn Belt regions occurred under conditions expected to prevail by 1975. The Lake States and the Western Corn Belt each expanded their pasture to the maximum levels permitted by the analytical model. The Lake States fed cattle at the same level as in the 1975 analysis, shipping all additional cattle to the Western Corn Belt (Figure 12).

The Western Corn Belt still did not engage in calf production. All of their grazing was utilized for growing stocker calves imported from



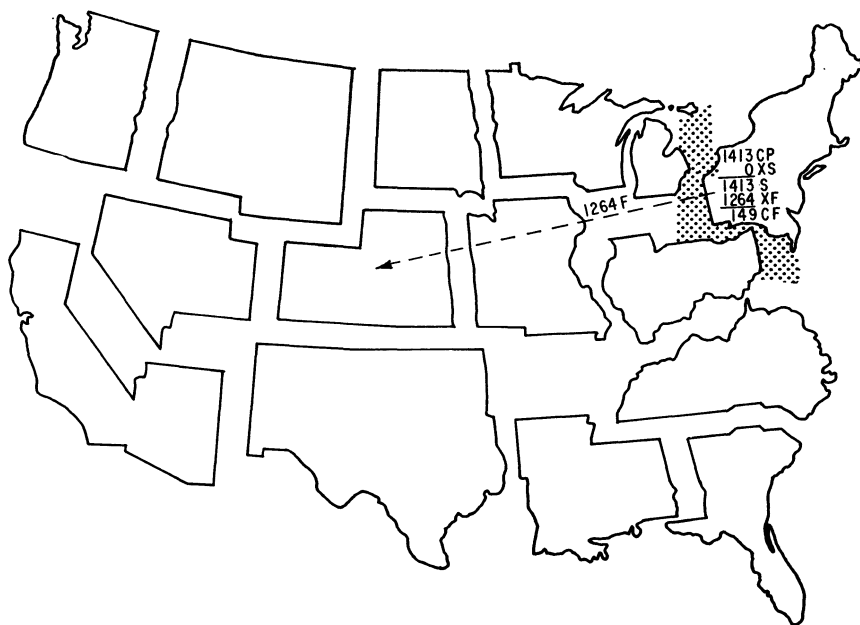
**Figure 12. Calf, Stocker and Feeding Operations in the Corn-Belt Regions, Under Conditions Projected for 1980**

- CP Calf Production
- IS Import Stockers
- XS Export Stockers
- IF Import Feeders
- XF Export Feeders
- CF Cattle Fed
- S Stokers Raised (figures in 000's)

the Northern Plains and the other two Corn Belt regions. Again, additional feeder cattle were obtained from the Southern regions to meet Western Corn Belt feeding needs. The Eastern Corn Belt followed the same production patterns as observed in the 1975 analysis except they now exported their stocker calves to the South Central region rather than the Upper South because of the South Central area's greater potential for increasing grazing capacity. Feeder cattle for Eastern Corn Belt feeding continued to be supplied by the Upper South.

### The Northeast

Through 1980, the Northeast expanded their beef operations to help meet the increased total demand for beef. The region retained all calves produced to feeding weights (Figure 13). Since the Northeastern region's feeding program did not grow, the Northeast now became a substantial supplier of cattle for Central Plains feedlots.



**Figure 13. Calf, Stocker and Feeding Operations in the Northeast Regions, Under Conditions Projected for 1980**

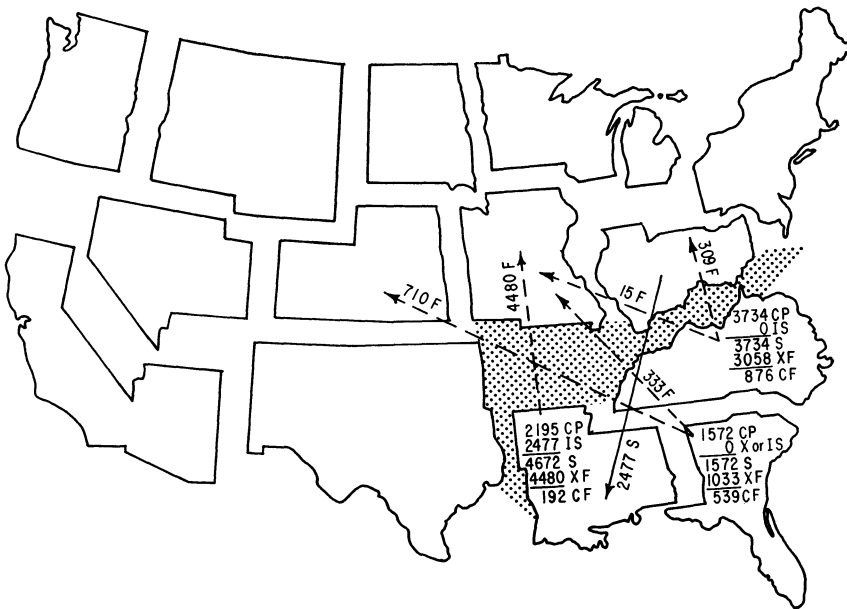
CP Calf Production  
 IS Import Stockers  
 XS Export Stockers  
 IF Import Feeders

XF Export Feeders  
 CF Cattle Fed  
 S Stockers Raised  
 (figures in 000's)

## The South

Optimally, the three Southern regions would produce 24 percent of all calves under the conditions postulated for 1980—a three percent increase in their total share. Production in the Upper South shifted emphasis to include a substantial increase in calf production. Exports of feeder cattle to the Western and Eastern Corn Belts accounted for the majority of beef production in the Upper South, with the remaining cattle retained for an expanded cattle feeding program within the region (Figure 14).

Basic calf production in the South Central region for 1980 was essentially unchanged from the 1968-70 observed levels, even though it was substantially larger than the 1975 optimum. This was due largely to the reduction in stocker cattle imports from the Southern Plains between the 1975 and 1980 optima. A continued pasture improvement program had been utilized in stocker growing in the Southern Plains. Thus, the South Central area imported a reduced number of stockers (from the Eastern Corn Belt rather than the Southern Plains) and utilized the re-



**Figure 14. Calf, Stocker and Feeding Operations in the Southern Regions, Under Conditions Projected for 1980**

- CP Calf Production
  - IS Import Stockers
  - XS Export Stockers
  - IF Import Feeders
  - XF Export Feeders
  - CF Cattle Fed
  - S Stockers Raised
- (figures in 000's)

mainder of the region's grazing capability in basic calf production and in growing out the increased numbers of locally produced calves.

The Southeast beef industry was similar to that of the South Central area. The Southeast expanded cow-calf operations by more than half with the major part of the expansion coming after 1975. All calves produced were held over for the stocker growing activity. Inshipments of stockers did not occur. After the stocker calves reach feeding weights, feeders were shipped to the Central Plains and the Western Corn Belt.

## **Beef Industry Sectoral Analysis for 1980**

### **Calf and Stocker Operations**

Under the conditions projected for 1980, the optimum calf production would be expected to continue to center in the three Southern regions and the Southern Plains. Stocker growing was of increasing importance in all the Southern regions, but most especially in the Upper South and South Central areas. More calves were produced throughout the South, with inshipments of calves for the intermediate growing period being less numerous than under conditions expected in 1975.

Calf production was maintained in the Eastern Corn Belt at the level observed in the 1975 projections, but the cow-calf enterprise still did not compete favorably in the Western Corn Belt, even with the 3.5 million increase in total calf needs. Western Corn Belt grass was utilized solely for stocker growing operations in both analyses. Stocker calves utilized grass more efficiently than cows, and the Western Corn Belt's need for feeder cattle gave the Western Corn Belt a comparative advantage for inshipment of light cattle. The increased needs for calves forced the Pacific Northwest into production. The Desert Southwest was forced to more fully utilize its grass in cow-calf operations, while retaining its calves for growing to feeding weights. The Central and Northern Plains states increased both calf production and stocker operations. These regions handled cattle which would be fed primarily within the region. The optimal calf and stocker production patterns for the different projections are shown in Tables 7 and 8.

### **Feeding Activity Changes**

Through 1975, the increased needs for cattle feeding were met primarily by the Plains states and the Corn Belt regions. However, from 1975 to 1980, the Central and South Plains emerged as the really significant growth regions (Table 9).

Growth in the four Western regions occurred only in the Intermountain area. Feeding that would have been optimal under conditions postulated for 1980 was 61 percent below the levels actually observed



**Table 7. Regional Calf Availability per Annum, 1975 and 1980 Projected Optimum Conditions, Compared with 1968-70 Actual Numbers**

Region	1968-70 Actual No. of Calves Available for Feeding	1975 Projections	1980 Projections	Change 1968-70 to 1980	Percentage Change
1 Pacific Northwest	822	0	650	— 172	— 21
2 Desert Southwest	823	981	1,011	+ 188	+ 23
3 Intermountain	2,135	1,859	1,939	— 196	— 9
4 Great Basin	386	405	409	+ 23	+ 6
5 Northern Plains	2,064	1,620	2,191	+ 127	+ 6
6 Central Plains	2,591	2,173	2,142	— 449	— 17
7 Southern Plains	5,589	8,312	8,035	+2,446	+ 44
8 Lake States	1,046	2,731	3,321	+2,275	+217
9 Western Corn Belt	3,699	0	0	—3,699	—100
10 South Central	2,197	1,533	2,195	— 2	— 0
11 Eastern Corn Belt	1,025	3,138	3,138	+2,113	+206
12 Northeast	— 858 <sup>1</sup>	290	1,413	+2,271	+
13 Upper South	2,059	2,470	3,934	+1,875	+ 91
14 Southeast	1,002	1,137	1,572	+ 570	+ 57
<b>Total</b>	<b>24,580</b>	<b>26,649</b>	<b>31,950</b>	<b>+7,370</b>	<b>+ 30</b>

<sup>1</sup> Negative value results from large inshipments of slaughter calves.

**Table 8. Regional Distribution of Stocker Growing Activities Per Annum, 1975 and 1980 Optima**

Region	1968-1970 Actual <sup>1</sup>	1975 Optimum	1980 Optimum
1 Pacific Northwest	<sup>1</sup>	548	650
2 Desert Southwest	<sup>1</sup>	981	1,011
3 Intermountain	<sup>1</sup>	264	468
4 Great Basin	<sup>1</sup>	405	409
5 Northern Plains	<sup>1</sup>	776	776
6 Central Plains	<sup>1</sup>	3,220	3,613
7 Southern Plains	<sup>1</sup>	5,171	8,035
8 Lake States	<sup>1</sup>	1,540	1,540
9 Western Corn Belt	<sup>1</sup>	2,169	3,857
10 South Central	<sup>1</sup>	4,673	4,672
11 Eastern Corn Belt	<sup>1</sup>	0	0
12 Northeast	<sup>1</sup>	290	1,413
13 Upper South	<sup>1</sup>	5,473	3,934
14 Southeast	<sup>1</sup>	1,137	1,572
<b>Total</b>	<b>24,580</b>	<b>26,647<sup>2</sup></b>	<b>31,950</b>

<sup>1</sup> No Data Available.

<sup>2</sup> Totals may differ slightly from previous totals because of rounding.

**Table 9. Regional Distribution of Fed Cattle Marketings Per Annum, 1968-70 Actual Compared with Optimal Levels for 1975 and 1980**

Region	1968-70 Actual	1975 Optimum	1980 Optimum	Change 1968-70 to 1980	Percentage Change
(000 head)					
1 Pacific Northwest	516	548	548	+ 32	+ 6
2 Desert Southwest	2,852	981	1,113	-1,739	- 61
3 Intermountain	601	512	720	+ 119	+ 20
4 Great Basin	<sup>1</sup>	157	157	<sup>3</sup>	<sup>3</sup>
5 Northern Plains	710	776	776	+ 66	+ 9
6 Central Plains	5,022	4,247	5,587	+ 565	+ 11
7 Southern Plains	3,448	5,171	8,035	+4,587	+133
8 Lake States	1,316	1,540	1,540	+ 224	+ 17
9 Western Corn Belt	6,978	8,675	8,675	+1,697	+ 24
10 South Central	<sup>1</sup>	191	191	<sup>3</sup>	<sup>3</sup>
11 Eastern Corn Belt	2,162	3,043	3,043	+ 881	+ 41
12 Northeast	133 <sup>2</sup>	149	149	+ 16	+ 12
13 Upper South	<sup>1</sup>	447	877	<sup>3</sup>	<sup>3</sup>
14 Southeast	<sup>1</sup>	212	539	<sup>3</sup>	<sup>3</sup>
<b>Total</b>	<b>23,738</b>	<b>26,649</b>	<b>31,950</b>		

<sup>1</sup> Fed Cattle Marketings not reported for these regions.

<sup>2</sup> Pennsylvania only. Other States in region do not report Fed Cattle Marketings.

<sup>3</sup> Not available.

in the Desert Southwest during the 1968-70 base period. The other two Western regions—the Pacific Northwest and the Great Basin—were essentially unchanged from base period actuals.

The majority of the feeding expansion occurred in the Central and the Southern Plains regions. The Central Plains expanded by 11 percent, with all growth occurring during the 1975-1980 period. Feeding in the Southern Plains expanded by 4.5 million animals over the ten-year period with 2.8 million of this expansion occurring during the 1975-1980 period. Feeding in the Northern Plains was at essentially 1968-70 levels. Locally available resources for feeding in the three Plains regions gave these areas an advantage for supplying beef to consumer markets. The disadvantages these regions face in distance from the markets for carcass beef were more than made up in lower feeding costs (both feed and non-feed) and in lower costs of acquiring feeder cattle.

The Eastern Corn Belt was the only Corn Belt region to expand operations beyond currently available feeding facilities. To feed 3,043,000 cattle under the conditions postulated for 1980, the Eastern Corn Belt expanded feeding capacity by an additional 711,000 head. The Western Corn Belt remained the largest single region in the feeding of beef cattle, feeding about 8.7 million head under 1980 conditions. The region had the feed grain resources to feed more cattle, but elevated levels of non-feed cost put the region in a position of disadvantage so far as expanded feeding facilities were concerned. Feeding in the Lake



## Feed Grains and Wheat

After beef production needs for 1980 were met, surplus feed grains remained in the Northern Plains and the Corn Belt while surplus wheat remained in the Pacific Northwest, in the Intermountain area, in all Plains regions, and in the Lake States.

For cattle fed under the conditions projected for 1980, the four Western regions used a ration in which the concentrates were composed of equal amounts of wheat and feed grains. The Pacific Northwest received feed grain from the Intermountain area while the Desert Southwest purchased feed grain from the Central Plains. The Intermountain area exhausted its supply of feed concentrates through local feeding and export. Additional feed grain was imported by rail from the Northern Plains. Feed grain for Great Basin feeding came from the Central Plains. Without the local supplies of wheat or feed grains, feeding in the Western regions was of necessity very, very limited.

Feed grains were the major concentrate used in the three Corn Belt regions. The Lake States utilized only feed grain while the other two regions did use limited amounts of wheat.

The Southern regions were deficit regions with regard to both wheat and feed grain. Barge transportation permitted the South Central area and the Upper South to procure grains for feeding at relatively low cost. Each of the Southern regions utilized equal quantities of wheat and feed grain in their rations. Optimal wheat and feed grain movements are shown in Tables 10 and 11.

**Table 10. Optimal Shipment of Wheat Under 1980 Projected Conditions**

Origin	Destination	Quantity Shipped
		(000,000 therms)
1 Washington, Oregon	1 Washington, Oregon	546
	2 California, Arizona	1,077
2 California, Arizona	2 California, Arizona	35
3 Montana, Wyoming, Idaho	3 Montana, Wyoming, Idaho	711
	4 Nevada, Utah	80
6 Colorado, West Kansas, West Nebraska	6 Colorado, West Kansas, West Nebraska	5,647
7 Oklahoma, Texas, New Mexico	7 Oklahoma, Texas, New Mexico	8,007
9 Iowa, East Kansas, East Nebraska, Missouri	9 Iowa, East Kansas, East Nebraska, Missouri	867
	10 Louisiana, Alabama, Mississippi, Arkansas	143
10 Louisiana, Alabama, Mississippi, Arkansas	10 Louisiana, Alabama, Mississippi, Arkansas	48
11 Ohio, Indiana, Illinois	11 Ohio, Indiana, Illinois	2,748
	12 New England	148
13 Tennessee, Kentucky, West Virginia, Virginia, North Carolina	13 Tennessee, Kentucky, West Virginia, Virginia, North Carolina	445

**Table 11. Optimal Shipments of Feed Grains Under 1980 Projected Conditions**

Origin	Destination	Quantity Shipped
		(000,000 therms)
3 Montana, Wyoming, Idaho	1 Washington, Oregon	546
	3 Montana, Wyoming, Idaho	687
4 Utah, Nevada	4 Utah, Nevada	12
5 North Dakota, South Dakota	3 Montana, Wyoming, Idaho	24
	5 North Dakota, South Dakota	1,547
6 Colorado, West Nebraska, West Kansas	2 California, Arizona	821
7 Oklahoma, Texas, New Mexico	7 Oklahoma, Texas, New Mexico	1,984
	7 Oklahoma, Texas, New Mexico	6,023
8 Wisconsin, Minnesota, Michigan	12 New England	148
	2 California, Arizona	293
	8 Wisconsin, Minnesota, Michigan	3,069
	13 Kentucky, Tennessee, West Virginia, Virginia, North Carolina	1,301
	14 Florida, Georgia, South Carolina	1,074
9 Iowa, Missouri, East Kansas, East Nebraska	9 Iowa, Missouri, East Kansas, East Nebraska	16,732
	10 Mississippi, Alabama, Louisiana, Arkansas	190
11 Illinois, Indiana, Ohio	11 Illinois, Indiana, Ohio	3,509

## Summary and Implications

The purpose of this study was to examine the probable changes in regional beef production and marketing patterns under conditions expected to prevail in 1975 and 1980. A secondary objective was to suggest the degree of strength each of fourteen beef production and marketing regions might enjoy in competing with other regions in the various sectors of the beef industry. A transshipment model was selected for simulating optimal regional patterns of production and slaughter in the beef industry, with U. S. Census Bureau information regarding expected regional patterns of population and income change used to define probable levels of demand for fed beef.

Per capita demand for beef for 1975 and 1980 was estimated on the basis of income and price elasticities. The resulting estimate of per capita beef demand was 120 pounds in 1975 and 129 pounds in 1980. The percentage of nonfed beef (i.e., cow and bull beef) generated in the process of meeting the resulting estimate of total demand for beef was deducted from the total demand, to define an estimate of the per capita demand for fed beef. Regional per capita demand was calculated in a similar manner, using expected regional per capita income. The expected regional distributions of population at these points in time were then used to estimate total demand for fed beef in the various regions.

Each of the regions was credited with the productive resources and with the levels of feeding and slaughter facilities that were present in the region during the 1968-70 period. Additional facilities could be constructed at 1970 levels, and livestock and feed grains were free to move between regions for the cost of production in the region of origin plus the cost of transportation via the least costly mode available. Additional grazing resources could be acquired through pasture improvement.

The principal conclusions to be drawn from this analysis relate to the applicability of the findings in indicating probable directions of change in the location of beef production and in product flows. Interpretation of the magnitudes of regional production and of geographic flows of products must be conditioned by the nature of the available data. The various series of published livestock data are often inconsistent, not only between series but also occasionally within series. Because of this data limitation, the magnitudes of the estimates in this study should be interpreted as relative rather than absolute figures in anticipating the regional adjustments.

A summary of the results of the analysis is presented in Table 12. It is apparent from this summary that the expected increase in the need for beef can be met domestically within reasonable limits of current costs, provided that irrigation continues to develop at its current rate in the Plains area or provided that technological development continues to increase grain yields. Major increases in basic calf production can be expected in most areas east of the Mississippi River and in the Southern Plains. The intermediate calf growing period — the period between weaning and feedlot placement — can be expected to assume greater importance adjacent to feeding regions. Feeding can be expected to continue to center in the Corn Belt and the Plains. Slaughter will continue its trend to move toward production areas.

The general regional tendencies shown by Table 12 suggest that the trends observed since World War II can be expected to continue through the decade of the 1970's. However, it should be pointed out that detailed sector analysis of the beef industry suggests some emerging changes in the interregionally competitive structure.

### **Calf Production and Stocker Growing Operations**

Under the conditions projected for 1980, calf production would be expected to center in the three Southern regions (24 percent of total) and in the Southern Plains (25 percent of total). These regions were, of course, major calf production areas during the 1968-70 base period; however, the share of total calf production increased in these regions even as the total need for calves was increased by about a third. Interestingly, the optimal secondary source of the greatly enlarged number of calves

**Table 12. Regional Location of Beef Production Enterprises: Actual 1968-1970 Location Compared with Optimum Locations for Expected Demand Conditions in 1975 and 1980**

Region	1968-1970 Actual			1975 Optimum				1980 Optimum			
	Calves Available for Feeding <sup>1</sup>	Impts (+) or Expts (-) of Cattle	Fed Cattle Mktgs.	Calves Prod. for Feeding	Impts (+) or Expts (-) of Stocker Calves	Impts (+) or Expts (-) of Feeder Cattle	Fed Cattle Mktgs.	Calves Prod. for Feeding	Impts (+) or Expts (-) of Stocker Calves	Impts (+) or Expts (-) of Feeder Cattle	Fed Cattle Mktgs.
	(Thousand Head)										
Pacific Northwest	822	— 306	516	0	+ 548	0	543	650	0	— 102	548
Desert Southwest	823	+2,029	2,852	981	0	0	981	1,011	0	+ 102	1,113
Intermountain	2,135	—1,534	601	1,859	—1,595	+ 248	512	1,939	—1,471	+ 252	720
Great Basin	386	— 386	2	405	0	— 248	157	409	0	— 252	157
North Plains	2,064	—1,354	710	1,620	— 844	0	776	2,191	—1,415	0	776
Central Plains	2,591	+2,431	5,022	2,173	+1,047	+1,027	4,247	2,142	+1,471	+1,974	5,587
South Plains	5,589	—2,141	3,448	8,312	—3,141	0	5,171	8,035	0	0	8,035
Lake States	1,046	+ 270	1,316	2,731	—1,191	0	1,540	3,321	—1,780	0	1,541
Western Corn Belt	3,699	+3,279	6,978	0	+2,169	+6,506	8,675	0	+3,857	+4,819	8,676
South Central	2,197	—2,197	2	1,533	+3,140	—4,492	191	2,195	+2,477	—4,480	192
Eastern Corn Belt	1,025	+1,137	2,162	3,138	—3,138	+3,043	3,043	3,138	—3,138	+3,043	3,043
Northeast	— 858 <sup>4</sup>	+ 991	133 <sup>5</sup>	290	0	— 141	149	1,413	0	—1,264	149
Upper South	2,059	—2,059	2	2,470	+3,004	—5,027	447	3,934	0	—3,058	876
Southeast	1,002	—1,002	2	1,137	0	— 925	212	1,572	0	—1,033	539
48-State Total	24,580	— 842 <sup>3</sup>	23,738	26,649	— 1 <sup>7</sup>	+ 1 <sup>7</sup>	26,649	31,950	+ 1 <sup>7</sup>	+ 1 <sup>7</sup>	31,952 <sup>8</sup>

<sup>1</sup> "Calves Available" includes beef calf crop plus half of dairy calf crop, less beef replacement heifer needs, commercial slaughter of calves, and death loss and farm slaughter of cattle and calves.

<sup>2</sup> Fed Cattle Marketings not reported for these regions.

<sup>3</sup> This 842,000 head "export" for the 48 states should be interpreted as the total of non-fed steer and heifer slaughter plus the fed cattle marketed in non-reporting states.

<sup>4</sup> Negative value results from large numbers of imported slaughter calves.

<sup>5</sup> Pennsylvania only. Other states do not report fed cattle marketings.

<sup>6</sup> Regional Imports exceed Regional Exports slightly due to rounding errors.

<sup>7</sup> Does not add to zero because of rounding errors.

<sup>8</sup> Exceeds calves available because of rounding errors.

required to satisfy the much larger demand for beef expected in 1980 moved into the Lake States, the Eastern Corn Belt, and the Northeast (Table 13). These three regions produced 25 percent of all potential feeder calves under the 1980 conditions as opposed to the 5 percent observed during the 1968-1970 base period.

The major interregionally competitive strength for increased calf production—assuming that the projected 1980 demand will in fact develop—appears to be in the regions east of the Mississippi River and North of the Ohio. Within this area the initial growth would likely occur in the Eastern Corn Belt, later moving north and east into the Lake States and the Northeast.

So far as stocker cattle growing operations are concerned, there are no data to suggest the regional magnitudes of this activity during the 1968-70 base period. However, the optimum situations for the conditions expected in 1975 and 1980 suggest that the stocker growing activity will tend to be located such that the costs of moving heavier feeder cattle will be minimized. Thus, the major feeding areas (the Western Corn Belt and the Southern and Central Plains) and those portions of the Southern states that abut on feeding areas will have the greatest potential for stocker growing (Table 14).

**Table 13. Regional Distribution and Regional Share of Annual Basic Beef Calf Production Actual 1968-1970, Compared with Optimal Levels for 1975 and 1980**

Region	Actual 1968-1970 Calves Available for Feeding		1975 Optimum		1980 Optimum	
	1,000 Head	% Share	1,000 Head	% Share	1,000 Head	% Share
	1 Pacific Northwest	822	3.3	0	0	650
2 Desert Southwest	823	3.3	981	3.7	1,011	3.2
3 Intermountain	2,135	8.7	1,859	7.0	1,939	6.1
4 Great Basin	386	1.6	405	1.5	409	1.3
5 Northern Plains	2,064	8.4	1,620	6.1	2,191	6.9
6 Central Plains	2,591	10.5	2,173	8.2	2,142	6.7
7 Southern Plains	5,589	22.7	8,312	31.2	8,035	25.1
8 Lake States	1,046	4.3	2,731	10.2	3,321	10.4
9 Western Corn Belt	3,699	15.1	0	0	0	0
10 South Central	2,197	8.9	1,533	5.7	2,195	6.9
11 Eastern Corn Belt	1,025	4.2	3,138	11.8	3,138	9.8
12 North East	— 858 <sup>1</sup>	—3.5 <sup>1</sup>	290	1.1	1,413	4.4
13 Upper South	2,059	8.4	2,470	9.3	3,934	12.3
14 Southeast	1,002	4.1	1,137	4.3	1,572	4.9
<b>Total</b>	<b>24,580</b>	<b>100.0</b>	<b>26,649</b>	<b>100.0</b>	<b>31,950</b>	<b>100.0</b>

<sup>1</sup> Negative value results from inshipments of slaughter calves.



**Table 14. Regional Distribution and Regional Share of Annual Stocker Calf Growing Actual 1968-1970, Compared with Optimal Levels for 1975 and 1980**

Region	Actual 1968-1970		1975 Optimum		1980 Optimum	
	1,000 Head	% Share	1,000 Head	% Share	1,000 Head	% Share
1 Pacific Northwest	<sup>1</sup>	--	548	2.1	650	2.0
2 Desert Southwest	<sup>1</sup>	--	981	3.7	1,011	3.2
3 Intermountain	<sup>1</sup>	--	264	1.0	468	1.5
4 Great Basin	<sup>1</sup>	--	405	1.5	409	1.3
5 Northern Plains	<sup>1</sup>	--	776	2.9	776	2.4
6 Central Plains	<sup>1</sup>	--	3,220	12.1	3,613	11.3
7 Southern Plains	<sup>1</sup>	--	5,171	19.4	8,035	25.1
8 Lake States	<sup>1</sup>	--	1,540	5.8	1,540	4.8
9 Western Corn Belt	<sup>1</sup>	--	2,169	8.1	3,857	12.1
10 South Central	<sup>1</sup>	--	4,673	17.5	4,672	14.6
11 Eastern Corn Belt	<sup>1</sup>	--	0	0	0	0
12 North East	<sup>1</sup>	--	290	1.1	1,413	4.4
13 Upper South	<sup>1</sup>	--	5,473	20.5	3,934	12.3
14 Southeast	<sup>1</sup>	--	1,137	4.3	1,572	4.9
Total	--	--	26,647	100.0	31,950	100.0

<sup>1</sup> Not Available.

## Cattle Feeding

Probably the most dramatic adjustments in the beef industry will continue to be in the feeding sector (Table 15). The three Corn Belt regions—by far the dominant feeding center during the 1968-1970 base period—will continue to be a major force in cattle feeding. However, the Southern Central Plains regions will continue to increase their share of total feeding to the point that these two regions become even more important than the three Corn Belt regions as a source of fed beef. Indeed, the Southern Plains and the Western Corn Belt should feed approximately equal shares of more than half the cattle by 1980.

## Cattle Slaughter

The "production orientation" of cattle slaughter observed during the 1960's is likely to accelerate during the 1970's. Even assuming that current slaughter facilities are maintained at no cost in the various regions, all interregional movements of fat cattle had disappeared in the 1980 analysis, and only a limited movement (227,000 head) from the Northern Plains into the Lake States occurred in the 1975 optimum. The regional shares of steer and heifer slaughter (Table 16) in 1980 were identical with the regional shares of cattle feeding. This suggests a mammoth increase in cattle slaughter capacity is probable in both the Southern and Central Plains.

**Table 15. Regional Distribution and Regional Share of Annual Fed Cattle Marketings, Actual 1968-1970 Compared with Optimal Levels for 1975 and 1980**

Region	Actual Marketings 1968-1970		1975 Optimum Marketings		1980 Optimum Marketings	
	1,000 Head	% Share	1,000 Head	% Share	1,000 Head	% Share
1 Pacific Northwest	516	2.2	548	2.1	548	1.7
2 Desert Southwest	2,852	12.0	981	3.7	1,113	3.5
3 Intermountain	601	2.5	512	1.9	720	2.3
4 Great Basin	<sup>1</sup>	--	157	.6	157	.5
5 Northern Plains	710	3.0	776	2.9	776	2.4
6 Central Plains	5,022	21.2	4,247	15.9	5,587	17.5
7 Southern Plains	3,448	14.5	5,171	19.4	8,035	25.1
8 Lake States	1,316	5.5	1,540	5.8	1,540	4.8
9 Western Corn Belt	6,978	29.4	8,675	32.6	8,675	27.1
10 South Central	<sup>1</sup>	--	191	.7	191	.6
11 Eastern Corn Belt	2,162	9.1	3,043	11.4	3,043	9.5
12 North East	133 <sup>2</sup>	.6	149	.6	149	.5
13 Upper South	<sup>1</sup>	--	447	1.7	877	2.7
14 Southeast	<sup>1</sup>	--	212	.8	539	1.7
<b>Total</b>	<b>23,738</b>	<b>100.0</b>	<b>26,649</b>	<b>100.0</b>	<b>31,950</b>	<b>100.0</b>

<sup>1</sup> Not reported.

<sup>2</sup> Pennsylvania only. Other states not reported.

## Overall Regional Potential

The regional shares in all sectors of the beef industry are shown in Table 17. The interregional distributions of beef production and marketing activities under the conditions expected in 1975 and 1980 suggest that the Southern Plains is the only region that can expect to enlarge its share of the total in *all* phases of beef production and marketing. While there may be increases in the absolute magnitudes of the various sectors of industry in other regions, the Southern Plains is the only region that can expect relative increases across the board.

A second implication that may be drawn from Table 17 is that the beef industry will tend to strive toward regional self-sufficiency through the slaughter stage. Interregional movements of beef prior to the carcass stage will be minimal and concentrated where possible in the movement of lightweight stocker cattle. Feeding will be limited to a large extent to locally available feed concentrate supplies and slaughter will occur at the point of production.

**Table 16. Regional Distribution and Regional Share of Annual Steer and Heifer Slaughter, Actual 1968-1970, Compared with Optimal Levels for 1975 and 1980**

Region	Actual 1968-1970 Steer & Heifer Slaughter <sup>1</sup>		1975 Optimum		1980 Optimum	
	1,000 Head	% Share	1,000 Head	% Share	1,000 Head	% Share
1 Pacific Northwest	780	2.9	548	2.1	548	1.7
2 Desert Southwest	2,567	9.6	981	3.7	1,113	3.5
3 Intermountain	519	1.9	512	1.9	720	2.3
4 Great Basin	253	.9	157	.6	157	.5
5 Northern Plains	765	2.8	549	2.1	776	2.4
6 Central Plains	3,210	11.9	4,247	15.9	5,587	17.5
7 Southern Plains	2,270	8.4	5,171	19.4	8,035	25.1
8 Lake States	2,899	10.8	1,767	6.6	1,540	4.8
9 Western Corn Belt	8,493	31.6	8,675	32.6	8,675	27.1
10 South Central	592	2.2	191	.7	191	.6
11 Eastern Corn Belt	2,249	8.4	3,043	11.4	3,043	9.5
12 Northeast	1,026	3.8	149	.6	149	.5
13 Upper South	782	2.9	447	1.7	877	2.7
14 South East	466	1.7	212	.8	539	.7
<b>Total</b>	<b>23,738</b>	<b>100.0</b>	<b>26,649</b>	<b>100.0</b>	<b>31,950</b>	<b>100.0</b>

<sup>1</sup> Regional Estimates derived from information provided by the Western Livestock Information Project, Cooperative Extension services in the Western States and U.S.D.A., Cooperating, Denver, Colorado. Includes non-fed slaughter, thus exceeding total of fed cattle marketings. Also, total exceeds the "potential number of calves available for feeding" estimated in Tables 3, 12 and 13. Total steer and heifer slaughter includes feeder cattle imported from Canada and Mexico as well as culled dairy replacement heifers, neither of which were considered in the potential feeder cattle estimate.

### Literature Cited

1. U.S. Department of Agriculture, *Livestock and Meat Statistics*, Economic Research Service, Statistical Bulletin 333, Supplement for 1970 (Washington, D. C., 1971), p. 138.
2. U.S. Department of Agriculture, *Agriculture Statistics 1969*, Economic Research Service (Washington, D. C., 1969), pp. 449-451.
3. See John W. Goodwin and J. Richard Crow, *Optimal Regional Locations of Beef Production and Processing Enterprises*, Bulletin B-707, Oklahoma Agricultural Experiment Station, Stillwater, 1973.
5. John W. Goodwin and Reuven Andorn, *The Irreversible Demand Function for Beef*, Technical Bulletin T-127, Oklahoma State University, Agricultural Research Experiment Station (June, 1968).
6. U.S. Department of Agriculture, *Household Food Consumption Survey, 1965-66*, Reports Nos. 1-5 (1968).

**Table 17. Regional Shares of Beef Production and Processing Activity, Actual 1968-70 Compared with Optima for Conditions Expected in 1975 and 1980**

Region	Actual 1968-1970						1975 Optimum					1980 Optimum				
	Calf Prod.	Stocker Growing	Cattle Feeding	Steer & Heifer Slaughter	Fed Beef Consump.		Calf Prod.	Stocker Growing	Cattle Feeding	Steer & Heifer Slaughter	Fed Beef Consump.	Calf Prod.	Stocker Growing	Cattle Feeding	Steer & Heifer Slaughter	Fed Beef Consump.
	(Percent of 48-State Total)															
1 Pacific Northwest	3.3	<sup>3</sup>	2.2	2.9	2.7	0	2.1	2.1	2.1	2.1	2.6	2.0	2.0	1.7	1.7	2.5
2 Desert Southwest	3.3	<sup>3</sup>	12.0	9.6	12.4	3.7	3.7	3.7	3.7	13.1		3.2	3.2	3.5	3.5	13.7
3 Intermountain	8.7	<sup>3</sup>	2.5	1.9	1.1	7.0	1.0	1.9	1.9	.8		6.1	1.5	2.3	2.3	.8
4 Great Basin	1.6	<sup>3</sup>	<sup>3</sup>	.9	.7	1.5	1.5	.6	.6	.8		1.3	1.3	.5	.5	.8
5 Northern Plains	8.4	<sup>3</sup>	3.0	2.8	.6	6.1	2.9	2.9	2.1	.6		6.9	2.4	2.4	2.4	.6
6 Central Plains	10.5	<sup>3</sup>	21.2	11.9	1.7	8.2	12.1	15.9	15.9	1.4		6.7	11.3	17.5	17.5	1.4
7 Southern Plains	22.7	<sup>3</sup>	14.5	8.4	6.4	31.2	19.4	19.4	19.4	6.5		25.1	25.1	25.1	25.1	6.5
8 Lake States	4.3	<sup>3</sup>	5.5	10.8	7.9	10.2	5.8	5.8	6.6	7.2		10.4	4.8	4.8	4.8	7.6
9 Western Corn Belt	15.1	<sup>3</sup>	29.4	31.6	5.0	0	8.1	32.6	32.6	5.0		0	12.1	27.1	27.1	5.0
10 South Central	8.9	<sup>3</sup>	<sup>3</sup>	2.2	4.6	5.7	17.5	.7	.7	4.9		6.9	14.6	.6	.6	4.8
11 Eastern Corn Belt	4.2	<sup>3</sup>	9.1	8.4	14.0	11.8	0	11.4	11.4	13.5		9.8	0	9.5	9.5	13.4
12 Northeast	— 3.5 <sup>1</sup>	<sup>3</sup>	.6	3.8	29.7	1.1	1.1	.6	.6	29.8		4.4	4.4	.5	.5	29.4
13 Upper South	8.4	<sup>3</sup>	<sup>3</sup>	2.9	7.6	9.3	20.5	1.7	1.7	7.5		12.3	12.3	2.7	2.7	7.6
14 South East	4.1	<sup>3</sup>	<sup>3</sup>	1.7	5.5	4.3	4.3	.8	.8	5.9		4.9	4.9	1.7	1.7	6.0
Total <sup>2</sup>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0

<sup>1</sup> Negative value results from inshipments of slaughter calves

<sup>2</sup> May not add exactly to 100.0 because of rounding.

<sup>3</sup> Not Available.

7. U.S. Department of Commerce, *Population Estimates*, Series P-25, No. 375 (Washington, D. C., October, 1967), p. 34.
8. National Planning Association, *State Economics and Demographic Projection*, Regional Projection Series, Report 70-R-1 (Washington, D. C., 1970), p. S-6.
9. U.S. Department of Agriculture, *Agriculture Conservation Programs Accomplishments*, Agriculture Stabilization and Conservation Service (1956-1970).
10. See John W. Goodwin and J. Richard Crow, *Optimum Regional Locations of Beef Production and Processing Enterprises*, Bulletin B-Oklahoma Agricultural Experiment Station, Stillwater, 1972.
11. Solomon Bekure, "An Economic Analysis of the Intertemporal Allocation of Ground Water in the Central Ogallala Formation" (Unpub. Ph.D. thesis, Oklahoma State University, 1971), p. 57.
12. Hoy A. Richards and Jack T. Lamkin, "An Empirical Analysis of Motor and Inland Carrier Grain Rate Structures for the North Central Region of the United States" (Unpub. research report, Texas Transportation Institute in cooperation with the U.S. Dept. Agriculture Economic Research Service, Texas A&M University, April, 1967).
13. Waterways Freight Bureau, *Local, Joint, Proportional, Import and Export All-Water Commodity Rates on Grain and Products, and Related Articles in Bulk*, Freight Tariff No. 7 (Washington, D. C., 1968).

**Appendix Table 1. The Estimated Supply of Cows, Estimated Feedlot Capacity and Estimated Slaughter Capacity for Steers and Heifers by Regions**

Region	Number of Cows	Level of Feedlot Capacity	Estimated Slaughter Capacity
	(000 head)	(000 head)	(000 head)
1 Pacific Northwest	1,217	548	952
2 Desert Southwest	1,613	3,064	3,774
3 Intermountains	3,032	720	277
4 Great Basin	647	157	226
5 Northern Plains	2,865	776	549
6 Central Plains	3,772	4,247	4,224
7 Southern Plains	8,910	3,964	3,289
8 Lake States	2,737	1,540	3,766
9 Western Corn Belt	5,640	8,675	8,402
10 South Central	4,383	191	441
11 Eastern Corn Belt	2,104	2,332	3,043
12 Northeast	1,616	149	1,608
13 Upper South	3,745	195	876
14 Southeast	2,218	212	539
<b>Total</b>	<b>44,449</b>	<b>26,770</b>	

**Appendix Table 2. Estimated Therms of Feed Grains and Therms of Wheat Available for Livestock Feed in Each Region**

Region	Therms Available Before Other Livestock Feed Is Removed	Therms Available After Other Livestock Feed Is Removed	Therms of Wheat Available for Livestock Feed
	(000 therms)	(000 therms)	(000 therms)
1 Pacific Northwest	1,041,719	—0—	5,674,656
2 Desert Southwest	3,799,917	—0—	35,472
3 Intermountains	3,366,052	1,233,282	6,459,696
4 Great Basin	280,236	11,820	80,400
5 Northern Plains	11,940,612	5,583,110	10,900,896
6 Central Plains	13,483,698	8,595,874	15,556,224
7 Southern Plains	13,030,881	5,399,631	8,241,072
8 Lake States	31,119,417	7,756,365	1,009,392
9 Western Corn Belt	53,823,424	25,012,296	47,760
10 South Central	1,694,512	—0—	2,896,176
11 Eastern Corn Belt	47,767,437	22,052,828	—0—
12 Northeast	6,467,121	—0—	445,056
13 Upper South	6,136,578	—0—	—0—
14 Southeast	2,571,087	—0—	—0—

**Appendix Table 3. Estimated Non-Land Costs of Cow-Calf Operations, Partial Costs of Growing Stockers and Non-Fed Costs for Feeding Activity**

Region	Cost/Cow	Cost/Head	Costs (\$ for 500 lb. gain)
1 Pacific Northwest	\$28.13	\$30.00	\$26.75
2 Desert Southwest	21.36	30.00	21.94
3 Intermountains	11.58	23.20	26.75
4 Great Basin	18.45	23.20	26.75
5 Northern Plains	14.34	17.80	27.29
6 Central Plains	16.17	22.00	21.40
7 Southern Plains	13.41	16.20	21.40
8 Lake States	20.12	26.00	48.15
9 Western Corn Belt	22.54	25.60	32.10
10 South Central	21.28	16.80	27.29
11 Eastern Corn Belt	25.08	36.00	37.45
12 Northeast	25.08	26.00	37.45*
13 Upper South	22.65	21.80	26.76
14 Southeast	21.28	16.32	26.75*

\* Values of nearest region of same general characteristic were used because no actual costs were located.

**Appendix Table 4. Costs of Feed Grains and Wheat, Free of Transportation Costs by Region in Cents Per Therm**

Region	Cost per Therm of Feed Grain	Cost per Therm of Wheat
1 Pacific Northwest	.029	.0282
2 Desert Southwest	.0325	.0294
3 Intermountains	.0243	.0257
4 Great Basin	.0315	.0275
5 Northern Plains	.024	.0294
6 Central Plains	.0245	.0253
7 Southern Plains	.0249	.0263
8 Lake States	.0257	.0279
9 Western Corn Belt	.0256	.0253
10 South Central	.0316	.0247
11 Eastern Corn Belt	.0267	.0256
12 Northeast	.031	.0259
13 Upper South	.029	.0264
14 Southeast	.03	.0262

**Appendix Table 5. Costs of Slaughtering An 1100 Pound Animal**

Region	Cost/Head
1 Pacific Northwest	\$11.66
2 Desert Southwest	12.43
3 Intermountains	10.89
4 Great Plains	11.99
5 Northern Plains	11.77
6 Central Plains	12.21
7 Southern Plains	10.67
8 Lake States	13.20
9 Western Corn Belt	12.76
10 South Central	10.34
11 Eastern Corn Belt	11.77
12 Northeast	9.46
13 Upper South	9.68
14 Southeast	10.34

Source: Irving Dubov, University of Tennessee, Knoxville, Tennessee, Southern Cooperative Publication in process.

**Appendix Table 6. 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	Percent Shrink	No. of Shipments	No. of Head	Percent Shrink	No. of Shipments	No. of Head	Percent 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	1,496	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	93	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 and 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*, Mimeograph Circular No. 78, Agricultural Experiment Station, University of Wyoming, February, 1957.

**Appendix Table 7. Minimum Cost in Shipping 400 Pound Stocker Calves in Dollars Per Head by Mode of Transportation**

FROM REGION	TO REGION													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	-	7.62	5.86	3.98	8.52 <sup>1</sup>	8.68 <sup>1</sup>	10.24	9.12 <sup>1</sup>	9.76 <sup>1</sup>	13.92 <sup>1</sup>	14.00 <sup>1</sup>	18.64 <sup>1</sup>	16.00 <sup>1</sup>	16.16 <sup>1</sup>
2	7.62	-	10.43	4.65	9.80	8.28	5.91	10.16	8.84	0	0	0	0	0
3	5.86	10.43	-	4.01	4.27	4.08	7.08	5.04	5.33	0	0	0	0	0
4	3.98	4.65	4.01	-	7.59	5.65	7.60	8.24 <sup>1</sup>	7.40 <sup>1</sup>	0	11.06	0	0	0
5	8.52 <sup>1</sup>	9.80	4.27	7.59	-	3.12	5.68	1.44	2.19	0	4.91	9.10	0	0
6	8.68 <sup>1</sup>	8.28	4.09	5.65	3.12	-	5.04 <sup>1</sup>	4.12	2.16	0	6.05	10.28	0	0
7	10.63	7.69	7.48 <sup>1</sup>	8.52 <sup>1</sup>	5.57	5.04 <sup>1</sup>	1.54	5.20	3.63	3.04	5.51	10.27	5.70	6.76
8	9.12 <sup>1</sup>	10.16 <sup>1</sup>	5.04	8.24 <sup>1</sup>	1.44	4.12	4.54	-	2.28	6.69	3.69	7.88	5.39	8.24
9	9.76 <sup>1</sup>	8.84 <sup>1</sup>	5.33	7.40 <sup>1</sup>	2.19	2.16	2.70	2.28	-	5.52	3.86	8.34	6.02	7.82
10	14.00 <sup>1</sup>	9.11	11.00 <sup>1</sup>	11.74	7.80	7.60	4.14	6.69	5.52	-	4.86	8.20	3.81	2.68
11	14.00 <sup>1</sup>	13.40 <sup>1</sup>	11.00 <sup>1</sup>	11.06	4.91	6.05	6.87	3.69	3.86	4.86	-	4.49	1.30	5.22
12	18.64 <sup>1</sup>	18.00 <sup>1</sup>	12.99	15.55	9.10	10.28	11.66	7.88	8.34	8.20 <sup>1</sup>	4.49	-	4.76 <sup>1</sup>	6.97
13	16.00 <sup>1</sup>	12.75	11.59	12.98	8.38	8.62	7.00	5.39	6.02	3.81	1.30	4.76 <sup>1</sup>	-	3.00
14	16.16 <sup>1</sup>	13.32 <sup>1</sup>	12.68 <sup>1</sup>	13.92 <sup>1</sup>	10.16	9.96 <sup>1</sup>	6.74	8.24	7.82	2.68	5.22	6.97	3.00	-

<sup>1</sup> Denotes rail rates; others are truck rates.

<sup>2</sup> None designates that these shipments were assumed not to exist.



**Appendix Table 8. Minimum Cost for Transporting 600 Pound Feeder Cattle in Dollars Per Head by Mode of Transportation**

TO REGION		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FROM REGION	1														
1		11.48	8.83	6.00	12.78 <sup>1</sup>	13.02 <sup>1</sup>	15.36 <sup>1</sup>	13.68 <sup>1</sup>	14.64 <sup>1</sup>	20.88 <sup>1</sup>	21.00 <sup>1</sup>	27.96 <sup>1</sup>	24.00 <sup>1</sup>	24.24 <sup>1</sup>	
2			15.72	7.01	16.70 <sup>1</sup>	12.42 <sup>1</sup>	16.80 <sup>1</sup>	15.24 <sup>1</sup>	13.26 <sup>1</sup>	15.60 <sup>1</sup>	20.10 <sup>1</sup>	27.00 <sup>1</sup>	19.22 <sup>1</sup>	19.98 <sup>1</sup>	
3				6.04	6.43	6.16	8.94	7.59	8.03	15.36 <sup>1</sup>	12.25	19.57	17.47	19.02 <sup>1</sup>	
4					11.44	8.51	10.14	12.36 <sup>1</sup>	11.10	17.04 <sup>1</sup>	16.67	23.43	19.55	20.88 <sup>1</sup>	
5						7.14 <sup>1</sup>	8.40	2.17	3.30	12.06	7.39	13.71	12.62	15.30	
6					4.70		3.69	6.20	3.26	11.34	9.11	15.49	13.0	14.94	
7		8.90				7.56	0	6.85	4.07	6.23	13.0	17.57	10.65	10.15	
8							7.83		3.44	10.08	5.56	11.88	8.12	12.42	
9							4.51			8.32	5.81	12.57	9.07	11.78	
10		13.72	14.94 <sup>1</sup>	16.74 <sup>1</sup>			7.76				7.32	12.30	5.73	4.04	
11	19.86 <sup>1</sup>	19.20 <sup>1</sup>						10.52				6.76	1.97	7.86	
12	25.32 <sup>1</sup>	23.88 <sup>1</sup>	19.38 <sup>1</sup>	22.44 <sup>1</sup>				17.66					7.96	10.51	
13	23.58 <sup>1</sup>			19.44 <sup>1</sup>				10.81						4.57	
14			18.66 <sup>1</sup>	20.52 <sup>1</sup>				12.61							

<sup>1</sup> Denotes rail rates; others are truck rates.

<sup>2</sup> Costs from region 7 were from Vernon, Texas, while costs "in" were to Guymon, Oklahoma.

<sup>3</sup> Blank spots mean that the costs are the same as the above diagonal.

<sup>4</sup> Some costs differ to and from regions because of rail rate structures.

**Appendix Table 9. Minimum Cost for Transporting 1100 Pound Slaughter Cattle in Dollars Per Head By Mode of Transportation**

TO REGION		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FROM REGION															
1	-	20.95	16.12	10.96	26.92	25.97	29.23	29.37 <sup>1</sup>	29.75	43.19	40.30	0	0	0	0
2	20.95	-	28.68	12.79	30.15	23.73	22.44 <sup>1</sup>	32.78 <sup>1</sup>	28.49 <sup>1</sup>	0	0	0	0	0	0
3	16.12	28.68	-	11.03	11.74	11.24	16.31	13.86	14.65	0	24.19	0	0	0	0
4	10.96	12.79	11.03	-	20.88	15.52	18.50	24.71	23.76 <sup>1</sup>	0	30.42	0	0	0	0
5	26.93	30.15	11.74	20.88	-	8.58	15.33	3.96	6.02	0	13.49	25.03	0	0	0
6	25.97	23.73	11.24	15.52	8.58	-	6.74	11.32	5.95	20.91	16.63	28.26	0	0	0
7	29.33	23.43	16.31	18.50	15.33	6.74	-	14.30	8.23	14.16	19.20	32.17	19.72	23.01	23.01
8	29.75	32.78 <sup>1</sup>	13.86	24.71	3.96	11.32	14.30	-	6.28	18.39	10.15	21.68	14.82	22.66	22.66
9	29.75	29.21	14.65	26.39	6.02	5.95	8.23	6.28	-	15.19	10.61	22.94	16.56	21.51	21.51
10	43.19	19.47 <sup>1</sup>	30.40	32.29	22.02	20.91	14.16	18.39	15.19	-	13.35	24.65	10.47	7.37	7.37
11	40.30	0	24.19	30.42	13.49	16.63	19.20	10.15	10.61	13.35	-	12.34	3.59	14.35	14.35
12	51.81 <sup>1</sup>	48.07 <sup>1</sup>	35.72	42.75	25.03	28.26	32.17	21.68	22.94	22.55 <sup>1</sup>	12.34	-	14.53	19.18	19.18
13	45.64	35.07	31.89	35.68	23.03	23.71	19.72	14.82	16.56	10.47	3.59	14.53	0	8.26	8.26
14	50.70	38.36	36.07	40.62	27.93	28.46	23.01	22.66	21.51	7.37	14.35	19.18	8.26	-	-

<sup>1</sup> Denotes rail movement; others are truck rates.<sup>2</sup> None designates that these shipments were assumed not to exist.

**Appendix Table 10. Minimum Costs of Shipping Feed Grain in Cents Per Therm By Mode of Transportation**

TO REGION		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FROM REGION	1														
	2														
	3	.0103	.0136		.0082	.0081	.0082	.0105	.0094	.0097					
	4	.0090	.0112	.0090		.0196 <sup>1</sup>	.0129 <sup>1</sup>	.0145 <sup>1</sup>	.0219 <sup>1</sup>	.0129 <sup>1</sup>					
	5	.0717	.10202	.0098	.0337		.0069	.0138	.0044	.0054	.0124	.0390	.0570	.0143 <sup>1</sup>	.0161 <sup>1</sup>
	6	.0215 <sup>1</sup>	.0215 <sup>1</sup>	.0091	.0160	.0068		.0057	.0091	.0051	.0139	.0341	.0827	.0153 <sup>1</sup>	.0165 <sup>1</sup>
	7	.0216 <sup>1</sup>	.0216 <sup>1</sup>	.0162	.0214	.0143 <sup>1</sup>	.0057		.0129	.0065	.0135	.0127	.0298	.0236 <sup>1</sup>	.0165 <sup>1</sup>
	8	.0213 <sup>1</sup>	.0213 <sup>1</sup>	.0138	.0213 <sup>1</sup>	.0041	.0091	.0134		.0053	.0042†	.0237	.0371	.0050†	.0064†
	9	.0215 <sup>1</sup>	.0215 <sup>1</sup>	.0141	.0214 <sup>1</sup>	.0053	.0051	.0066	.0054		.0037†	.0151	.0438	.0057†	.0077†
	10														
	11					.0388	.0335	.0133	.0237	.0151	.0032†		.0543	.0042†	.0055†
	12														
	13														
	14														

<sup>1</sup> Denotes rail movement; † denotes barge movement; others are truck movement.

<sup>2</sup> Costs above and below the diagonal may differ because of handling costs difference between the regions.

<sup>3</sup> No transportation costs were charged for intraregional movements. The other blanks indicate that the activities were assumed not to exist prior to programming.

Appendix Table 11. Minimum Cost for Shipping Wheat in Cents Per Therm By Mode of Transportation

TO REGION		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FROM REGION															
1			.0088	.006	.0077	.0714	.0233 <sup>1</sup>	.0249 <sup>1</sup>	.0255 <sup>1</sup>	.0233 <sup>1</sup>					
2	.088			.0137	.0079	.1017	.0233 <sup>1</sup>	.0249 <sup>1</sup>	.0268 <sup>1</sup>	.0233 <sup>1</sup>					
3	.9967	.0135			.0076	.0075	.0075	.0071	.0077	.0075					
4	.0075	.0078	.0076			.0196	.0233 <sup>1</sup>	.0249 <sup>1</sup>	.0268 <sup>1</sup>	.0233 <sup>1</sup>					
5	.0716	.1019	.0077	.0335			.0068	.0248 <sup>1</sup>	.0268 <sup>1</sup>	.023 <sup>1</sup>	.0140	.0388	.057	.0143	.0162 <sup>1</sup>
6	.0215 <sup>1</sup>	.0205 <sup>1</sup>	.0075	.0215 <sup>1</sup>	.0067			.0057	.0053	.0051	.0139	.0341	.0827	.0154	.0165
7	.0216 <sup>1</sup>	.0216 <sup>1</sup>	.0216 <sup>1</sup>	.0216 <sup>1</sup>	.0185	.0059			.0128	.0066	.0135	.0127	.029	.0236	.0165
8	.021 <sup>1</sup>	.021 <sup>1</sup>	.021 <sup>1</sup>	.021 <sup>1</sup>	.0059 <sup>1</sup>	.0053	.0133			.0053	.0041†	.0236	.037	.0049†	.0049†
9	.0215	.0215	.0215	.0215	.0054	.0053	.0056		.0055		.0037†	.0151	.0437	.0056†	.0076†
10									.0071	.0072			.0076†	.0074†	.0039
11					.0387	.0335	.0132		.0236	.015	.0031	.0074		.0054	.0044
12											.0039				.0065
13															
14															

<sup>1</sup> Denotes rail movement; † denotes barge movement; others are truck movement.

<sup>2</sup> Costs above and below the diagonal may differ because of handling costs difference between the regions.

<sup>3</sup> No transportation costs were charged for intraregional movements. The other blanks indicate that the activities were assumed not to exist prior to programming.

**Appendix Table 12. Minimum Cost for Transporting Carcass Beef in Cents Per Pound by Mode of Transportation**

TO REGION		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FROM REGION	1		1.82		2.06	3.32	2.23	3.32 <sup>1</sup>	3.32	3.32	3.32 <sup>1</sup>	3.62	5.55	5.51	5.06
	2	1.98	.79	2.25	1.45	3.32 <sup>1</sup>	1.81	3.15	3.32 <sup>1</sup>	3.17	3.32 <sup>1</sup>	3.29	5.14	3.39	3.16
	3		1.88		1.84	1.79	1.87	3.46	1.50	2.28	3.68	2.08	4.73	3.97	3.52
	4	1.24	2.02	1.35		3.32 <sup>1</sup>	1.65	3.24	3.32	2.58	2.39	3.46	4.35	5.08	3.85
	5	2.71	2.53	2.53	2.67		1.375 <sup>1</sup>	2.96 <sup>1</sup>	.935 <sup>1</sup>	1.10 <sup>1</sup>	1.92	1.12	2.338 <sup>1</sup>	2.48 <sup>1</sup>	1.93
	6	1.38 <sup>1</sup>	1.35 <sup>1</sup>	1.34 <sup>1</sup>	1.38 <sup>1</sup>	1.42	.35	1.60	1.99	.90	1.82	1.39	2.61 <sup>1</sup>	2.96	2.31
	7	1.76 <sup>1</sup>	1.54 <sup>1</sup>	1.76 <sup>1</sup>	1.54 <sup>1</sup>	1.35	.94	1.03	1.54	.98	1.55	1.65	2.76	2.65	2.01
	8	2.67	2.85	2.67	2.85	.76	2.03 <sup>1</sup>	1.31		.70	1.84	.74	2.26 <sup>1</sup>	2.095 <sup>1</sup>	1.74
	9	2.67	2.63	2.67	2.63	.56	1.03	1.45 <sup>1</sup>	.82		1.67	.85	2.26 <sup>1</sup>	2.095 <sup>1</sup>	1.69
	10					2.55 <sup>1</sup>	2.425 <sup>1</sup>	2.005 <sup>1</sup>	2.235 <sup>1</sup>	1.97 <sup>1</sup>	0 <sup>1</sup>	1.15 <sup>1</sup>	1.76 <sup>1</sup>	.43 <sup>1</sup>	.49 <sup>1</sup>
	11	2.04 <sup>1</sup>	3.10	3.14	3.10	1.78	1.74	2.25	1.222 <sup>1</sup>	1.519 <sup>1</sup>	1.27 <sup>1</sup>	.50	1.72	1.77	1.34
	12								2.51 <sup>1</sup>		1.76 <sup>1</sup>			1.25 <sup>1</sup>	1.55 <sup>1</sup>
	13					2.48 <sup>1</sup>	2.68 <sup>1</sup>	2.48 <sup>1</sup>	2.095 <sup>1</sup>	2.095 <sup>1</sup>	.49 <sup>1</sup>	.79 <sup>1</sup>	1.25 <sup>1</sup>		.49 <sup>1</sup>
	14					2.99 <sup>1</sup>	2.917 <sup>1</sup>	2.63 <sup>1</sup>	2.63 <sup>1</sup>	2.483 <sup>1</sup>	.43 <sup>1</sup>	.76 <sup>1</sup>	1.55 <sup>1</sup>	.49 <sup>1</sup>	

<sup>1</sup> Denotes rail transportation.

<sup>2</sup> No transportation costs were charged for intraregional movements. The other blanks indicate that the activities were assumed not to exist prior to programming.