1973

# Grain Elevator Differences Along the Cash Grain Boundary: A Restructuring of the Boundary

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# GRAIN ELEVATOR DIFFERENCES ALONG THE CASH GRAIN BOUNDARY: A RESTRUCTURING OF THE BOUNDARY

(TITLE)

BY

KENNETH L. FOLKERTS

**THESIS**

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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MASTER OF ARTS

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

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YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
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Help was also appreciated from Miss Vicky O'Day for typing this manuscript several times before it was completed and for the typing of the final copy. Thanks also to Jeff Amenda for valuable help in taking and developing pictures. Although too numerous to mention, I would also like to thank the many elevator managers for their time and cooperation during the interviews and Lowell Hill for his help in preparing the interview sheet.

Kenneth L. Folkerts
May, 1973

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# CHAPTER I

## INTRODUCTION

One of the investigations conducted by geographers is to define regions for study and to focus on the similarities and differences among these regions.[1] To do this, hypothetical boundaries must be defined and drawn that distinguish one region from another. These boundaries seldom are sharply defined, and the differences in two regions are usually least pronounced near these boundaries. Here the greatest concentration of study and care must take place in order to define as precise a boundary as possible and to divorce this boundary from political and other systematic division lines.

The purpose of this paper is to examine certain areal differences and distributions among county grain elevators[2] along a previously defined southern boundary of

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[1]James, Preston E. and Clarence F. Jones, ed., American Geography Inventory and Prospect (Syracuse: University Press, 1954), p. 21.

[2]The definition of country elevators was suggested from an interview with Lowell Hill, Associate Professor of Agricultural Economics at the University of Illinois. He defines a country elevator as one which receives greater than 50% of its grain directly from farmers.

the cash grain region in Illinois,[3] and to use those differences and distributions in an attempt to redefine and refine or reinforce the boundary of the cash grain region to include the different aspects of a dominant cultural feature of the area, grain elevators. Volume of grain handled, elevator capacities, shipping destinations, sales of feeds and seeds, recent expansions, number of employees hired, and existence of drying facilities will be used to examine differences in elevators and to use these differences along with the distribution of the elevators as indicators in establishing the basis for the new definition of the cash grain boundary.

## Methodology

The definition of the southern boundary of the cash grain region in Illinois is of interest partly because the author was born, raised, and educated near this boundary. The study of country grain elevators was of particular interest since the author has spent several summers working in a grain elevator and the author's father is a member of the board of directors of a grain elevator cooperative.

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[3]A definition and location of this boundary is presented later in this study. For a precise description of this boundary see Ross, R. C., and H. C. M. Case, "Types of Farming in Illinois, An Analysis of Differences by Areas." University of Illinois Agricultural Experiment Station Bulletin 601 (Urbana: University of Illinois Press, 1956).

Both of these elevators are located near the classical cash grain boundary. Having a main interest in agricultural geography, a detailed study of a familiar agricultural region and a cultural feature resulting from it make this paper an interesting as well as satisfying venture for the author.

An interview sheet was devised to record the information gathered about each elevator (Appendix A). As the author traveled along most of the major state and county highways of the area, each elevator operator along these highways was approached for an interview. At the time of passing a few elevators were closed or the managers were too busy to grant an interview. Because of a lack of time and funds only a few of these elevators were approached a second time. However, since these were few in number compared with the more than fifty elevators interviewed, the results of the study were not affected.

After the elevator managers had been interviewed, a correlation of different results was used to determine if contrasts existed in the elevators north and south of the cash grain boundary. This correlation was performed by a computer program written by the author (Appendix B). All elevators from which an interview was gained were plotted on a map to show their locational relationship to the cash grain boundary. This map was then helpful in redefining the boundary to include the differences in these elevators.

Several maps and photographs were used to implement this study. Those maps compiled by the author were duplicated by the use of a Rotolite Diazo copier. The photographs taken were enlarged to highlight the details shown.

An outline of the thesis was prepared. The next chapter will give a brief discussion of the past and present definitions and locations of the cash grain boundary. Emphasis will be placed on the factors used to define the different types of farming[4] in this area. The third chapter will be a detailed study of the differences and distributions among the elevators revealed through the interviews and correlation results. These results will form the basis for a definition of a cash grain elevator and will be used in the new definition of the boundary. This redefinition and relocation of the boundary will constitute the fourth chapter. The final section of this study will be a summary, conclusion and prospect.

## Review of Literature

A review of the literature shows that few grain elevator studies have been oriented towards differences

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[4] For a definition and location of types of farming regions in Illinois see Ross, R. C. and H. C. M. Case, "Types of Farming in Illinois, An Analysis of Differences by Areas." University of Illinois Agricultural Experiment Station Bulletin 601 (Urbana: University of Illinois Press, 1956).

existing by types of farming regions. One of the earliest studies to deal with grain elevators was done by Stewart, Norton and Richey in 1928 when they established the major market areas of Illinois grain.[5] This dealt primarily with terminal market location. When elevators became more dominant on the Illinois landscape as a result of larger grain production and subsequent cash sale of grain from Illinois farms, the studies turned to the business aspect of their operation. In 1941 L. J. Norton published an article dealing with country grain elevators.[6] This publication examined their organization and operation from a managerial viewpoint. Not until 1958 was a study involving spatial patterns of elevators released. A study on changes in spatial grain price patterns from 1946-1958 was published by the North Central Regional Publications 107.[7] This publication discussed price differences for grain

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[5]Stewart, C. L., L. J. Norton and L. F. Richey, "Market Destinations of Illinois Grain," University of Illinois Agricultural Experiment Station Bulletin 315 (Urbana: University of Illinois Press, 1928).

[6]Norton, L. J., "Business policies of Country Grain Elevators," University of Illinois Agricultural Experiment Station Bulletin 477 (Urbana: University of Illinois Press, 1941).

[7]North Central Regional Publication 107, "Changes in Spatial Grain-Price Patterns in the United States and in the North Central Region 1946-1958." University of Illinois Agricultural Experiment Station Bulletin 663 (Urbana: University of Illinois Press, 1960).

among states and major markets. Emphasis was again placed on business organization of elevators by D. A. Storey in 1963 and 1964 with two publications, one on the organization and operation of the large grain processors, terminal elevators, and subterminal elevators,[8] and the other on the organization and operation of country elevators.[9] Recently an intensive study of elevators has been undertaken by Lowell Hill at the University of Illinois. Some of the publications coming from this study deal with factors affecting location and number of grain elevators,[10] a report on the elevator capacity in Illinois counties,[11] the quantity of corn that is moved from farms to elevators,[12] and

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[8]Storey, D. A., "Organization and Operation of Illinois Grain Processors, Terminal Elevators, and Subterminal Elevators," University of Illinois Agricultural Experiment Station Bulletin 692 (Urbana: University of Illinois Press, 1970).

[9]Storey, D. A. and Gillfillan, R. A., "Illinois Country Grain Elevator Financial Organization and Operation, 1961-62," University of Illinois Agricultural Experiment Station Bulletin 702 (Urbana: University of Illinois Press, 1964).

[10]Van Oppen, Matthais and Lowell Hill, "Grain Elevators in Illinois: Factors Affecting Their Number and Location." Department of Agricultural Economics Agricultural Experiment Station (Urbana: University of Illinois Press, 1970).

[11]Hill, Lowell, "Adequacy of Elevator Capacity in Illinois Counties," University of Illinois College of Agriculture Cooperative Extension Service Circular 1015 (Urbana: University of Illinois Press, 1970).

[12]Van Oppen, M. K., and L. D. Hill, "Estimating the Quantity of Corn Moved from Farms to Elevators in Illinois Counties," Illinois Agricultural Economics, Vol. 10 (January, 1970), p. 19-24.

a study of differences in corn prices paid to farmers among Illinois country elevators.[13]

Studies dealing with types of farming regions have produced many classifications of agricultural regions, but few if any take into account differences in grain elevators between two regions on a state basis. One of the first to give a major classification of world agriculture was D. Whittlesey in 1936. His classification was quantitatively based on five different aspects: (1) the crop and livestock association; (2) the methods used to grow the crops and produce the stock; (3) the intensity of application to the land of labor, capital, and organization, and the outturn of product which results; (4) the disposal of the products for consumption; (5) the ensemble of structures used to house and facilitate the farming operations.[14] Just before Whittlesey's classification on a world basis, H. C. Case and K. H. Myers in 1934 and later R. C. Ross and H. C. M. Case in 1956, published a study on types of farming regions in Illinois.[15] These studies were both based on census data for farm production of

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[13]Davis, Leroy and Lowell Hill, "Spatial Price Differentials for Corn Among Illinois Country Elevators," Urbana, 1970 (xeroxed).

[14]Whittlesey, D., "Major Agricultural Regions of the Earth," Annals of the Association of American Geographers (Dec., 1936), p. 209.

[15]Case, H. C. M. and K. H. Myers, "Types of Farming in Illinois, An Analysis of Differences by Areas." Uni-

grain and livestock which were broken down to only the township level of data. In 1962 Leverett Hoag did a study on location determinants for cash grain farming[16] examining such factors as physical, cultural and climatic reasons for this type of farming. A similar study for world agricultural regions was undertaken by Spencer and Horvath in 1963.[17]

For other sources dealing with agricultural regions and grain elevators see the bibliography at the end of this paper. The literature discussed above and the bibliography are not intended to be an exhaustive list of publications in this field but do show many of the publications that are related to this paper.

The lack of eagerness of other authors to concentrate on differences in kinds of cultural features between two types of farming regions has brought some skepticism from other people in this field as to the usefulness of such a study. It is helpful to prove the value of one's

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versity of Illinois Agricultural Experiment Station Bulletin 403, 1934; Ross, R. C. and H. C. M. Case, "Types of Farming in Illinois, An Analysis of Differences by Areas," University of Illinois Agricultural Experiment Station Bulletin 601, 1956 (Urbana: University of Illinois Press).

[16]Hoag, L. P., "Location Determinants for Cash-Grain Farming in the Corn Belt," The Professional Geographer, XIV (May, 1962).

[17]Spencer, J. E. and R. H. Horvath, "How Does an Agricultural Region Originate?" Annals of the Association of American Geographers, 53 (March, 1963).

research to such critics. That this study is necessary is brought out by one of America's foremost agricultural geographers, John Fraser Hart, in a statement from his paper, "Geographic Covariants of Types of Farming Areas." He states, "Geographers need to understand the factors which create types of farming areas and the features which result from the existence of such areas."[18] This paper will attempt to determine certain factors such as amount of grain sold to elevators, sizes of elevators, functions performed by the elevators, and other factors that affect the location of the cash grain region and the effect of these factors on differences and distribution of a feature, country grain elevators, of this region.

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[18]Hart, John Fraser, "Geographic Covariants of Types of Farming Areas," pp. 7-9 of E. S. Simpson, ed.; Agricultural Geography, IGU. Symposium Research Paper No. 3 (Liverpool: University of Liverpool Department of Geography, 1965), p. 7.

## CHAPTER II

## LOCATION AND DEFINITIVE FACTORS FOR THE PRESENT BOUNDARY

The cash grain boundary of Illinois has been defined in two publications, both of which are bulletins of the University of Illinois Agricultural Experiment Station. The first was written by H. C. M. Case and K. H. Myers in 1934. The other, written by R. C. Ross and H. C. M. Case in 1956, was an updated version of the first with few changes in any of the criteria used. Both of these works contain a definition of a type of farming region. It is defined as "an area in which one or more dominant types of farming can be distinguished and in which natural and economic conditions are almost uniform."[19] The main portion of these studies is devoted to an explanation of the natural and economic conditions affecting the types of farming regions throughout the state and a description of the different regions found. An examination of these con-

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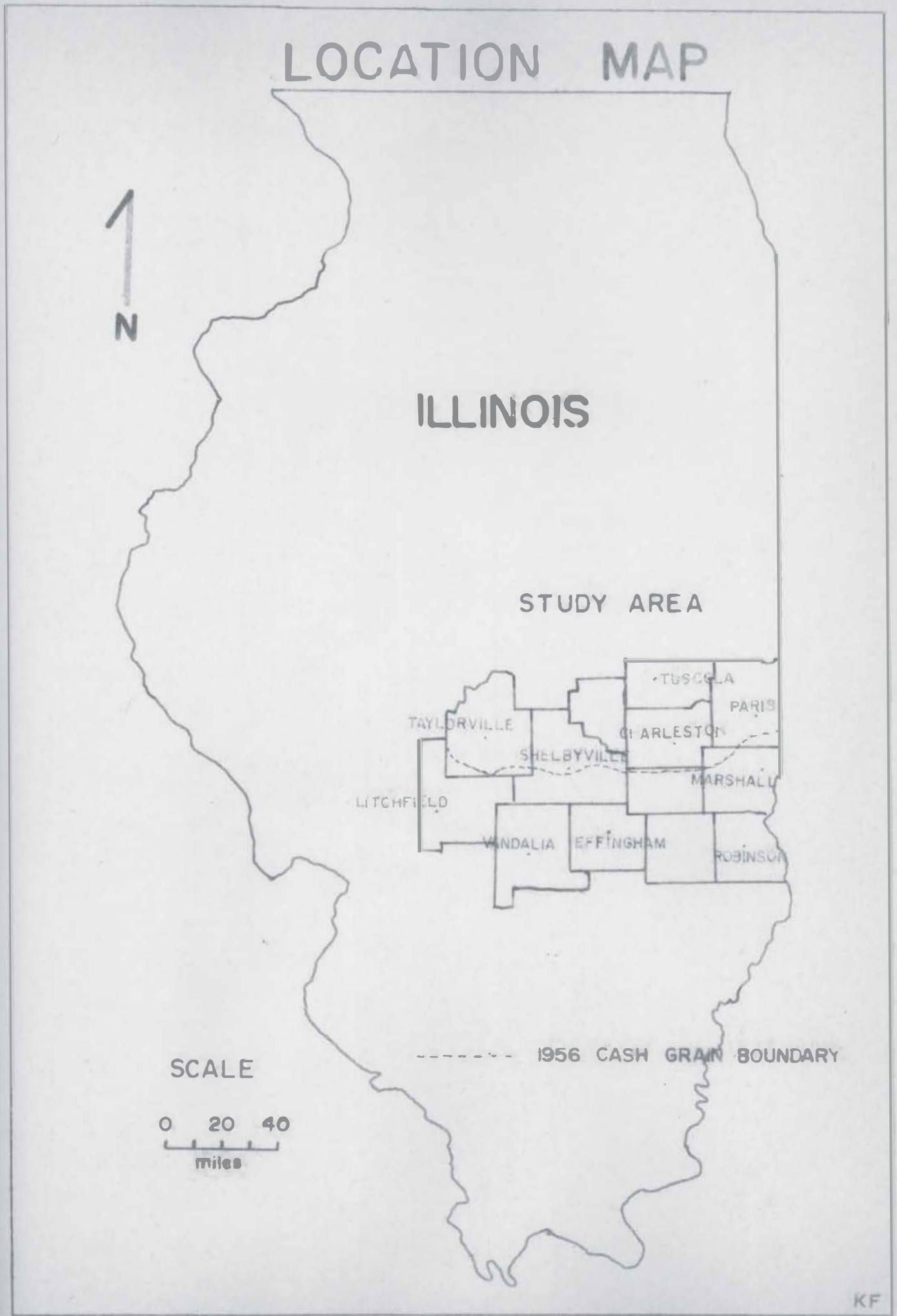
[19]Case, H. C. M. and K. H. Myers, "Types of Farming in Illinois, An Analysis of Differences by Areas," University of Illinois Agricultural Experiment Station Bulletin 403, 1934, pp. 99; Ross, R. C. and H. C. M. Case, "Types of Farming in Illinois, An Analysis of Differences by Areas," University of Illinois Agricultural Experiment Station Bulletin 601, 1956, p. 5 (Urbana: University of Illinois Press).

ditions and the locations given for the southern boundary of the cash grain region will be presented here to show the need for a new definition based upon another viewpoint.

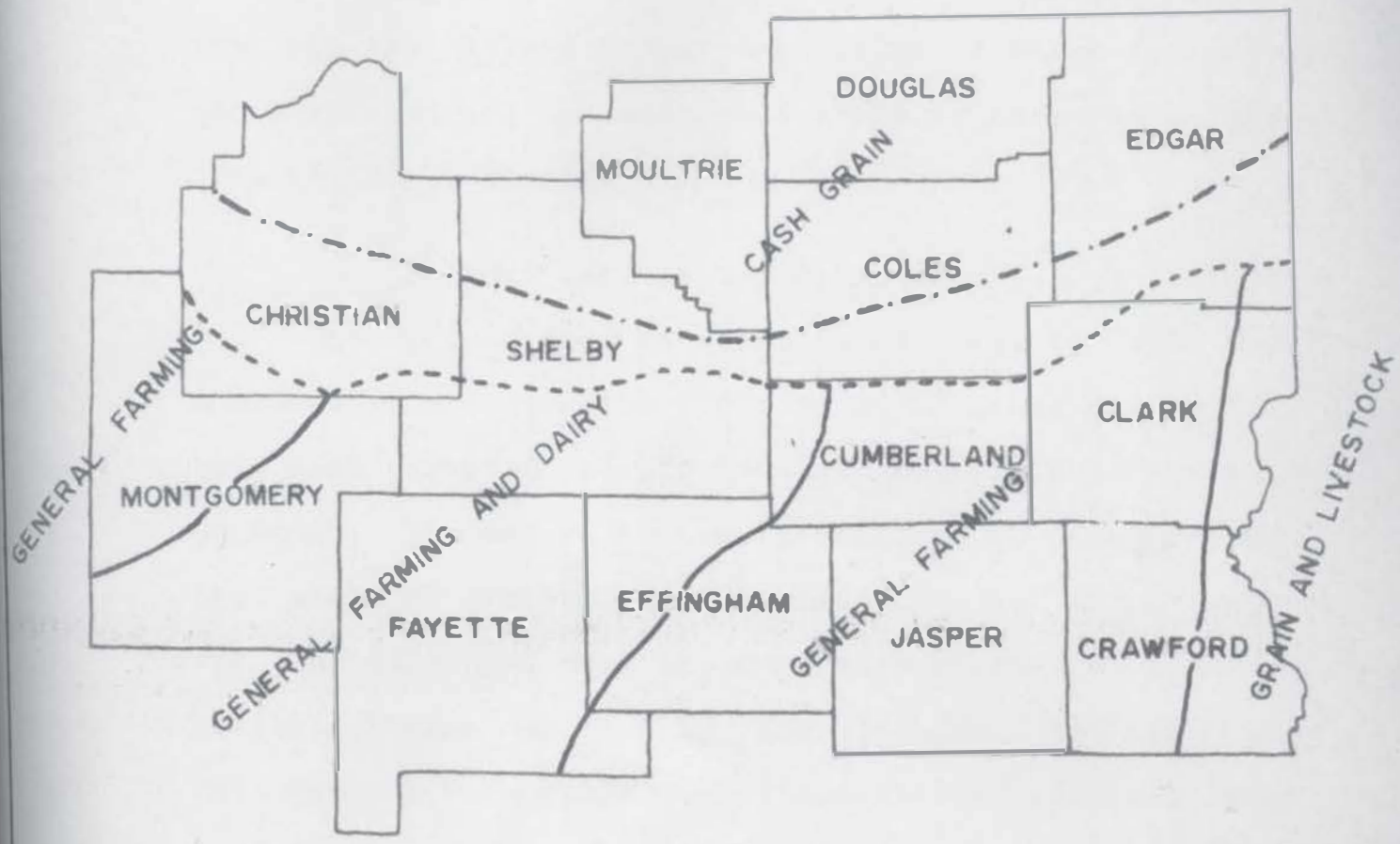
## Location

The southern edge of the cash grain boundary, according to Case, Myers, and Ross, is located in the south central part of Illinois (Figure 2-1). In the 1934 study this boundary was placed through the center of Edgar, Coles, Shelby, and Christian counties (Figure 2-2). By the time the study had been completed in 1956, the location of the boundary had moved southward an average of approximately 10 miles in these counties and had even moved out of these counties in some places. The latest definition of the boundary was given to extend from the Indiana border on the east, through the southern part of Edgar County, along the boundary of Coles and Cumberland counties, through the center of Shelby County and along the border of Montgomery and Christian counties before turning northward (Figure 2-2). This boundary divides the cash grain region to the north from the general farming, general farming and dairy, and the grain and livestock regions to the south.

The distinct southward movement of the location of this boundary in the 22 years from 1934 to 1956 leaves a


LOCATION MAP
N
ILLINOIS
STUDY AREA
TUSCOLA
PARIS
TAYLORVILLE
CHARLESTON
SHELBYVILLE
MARSHALL
LITCHFIELD
VANDALIA
EFFINGHAM
ROBINSON
1956 CASH GRAIN BOUNDARY
SCALE
0 20 40
miles
KF

# SOUTHERN BOUNDARY OF THE CASH GRAIN REGION




## SCALE

0 10 20 30 40

miles

## LEGEND

BOUNDARY OF 1934

BOUNDARY OF 1956

BOUNDARY OF GENERAL FARMING REGIONS

## SOURCE

TYPES OF FARMING IN ILLINOIS

KF

FIGURE 2-2

question as to its movement in the 17 years from 1956 to the present. The location of the boundary probably will have moved southward again because of the increasing acreage in cash grain farms south of the present boundary[20] and its definition needs to be updated. The factors used to locate the boundary in 1934 and 1956 have changed through time and necessitate either a revision of these factors or the derivation of new ones upon which to base the definition of the boundary.

## Factors Used in the Definition

The factors used in these two studies by Case, Myers, and Ross in defining the types of farming regions in Illinois were broken down into two main categories, natural and economic. The natural category includes such factors as land surface, drainage, soils, rainfall, and temperature. The land surface factor includes such aspects as topography, glacial depositions, and altitude. The economic factors used were markets, transportation, capital, labor, land tenure, types of tenancy agreements, changes in land values, changes in the size of farms, and technological advances in farming methods.[21]

These factors were used to define types of farming

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[20]This information was found by comparing the figures for cash grain acreage from the 1964 and 1969 U.S. Census of Agriculture.

[21]Case, H. C. M. and K. H. Myers; and Ross, R. C. and H. C. M. Case, op. cit., pp. 99-123, pp. 7-26.

on a state basis and some are not relevant in defining a boundary in as small an area as the thirteen county area surrounding the southern border of the cash grain boundary. For example, Table 1 and Figure 2-3 show the climatic data for this region. The differences in average

TABLE 1

Temperature and Precipitation

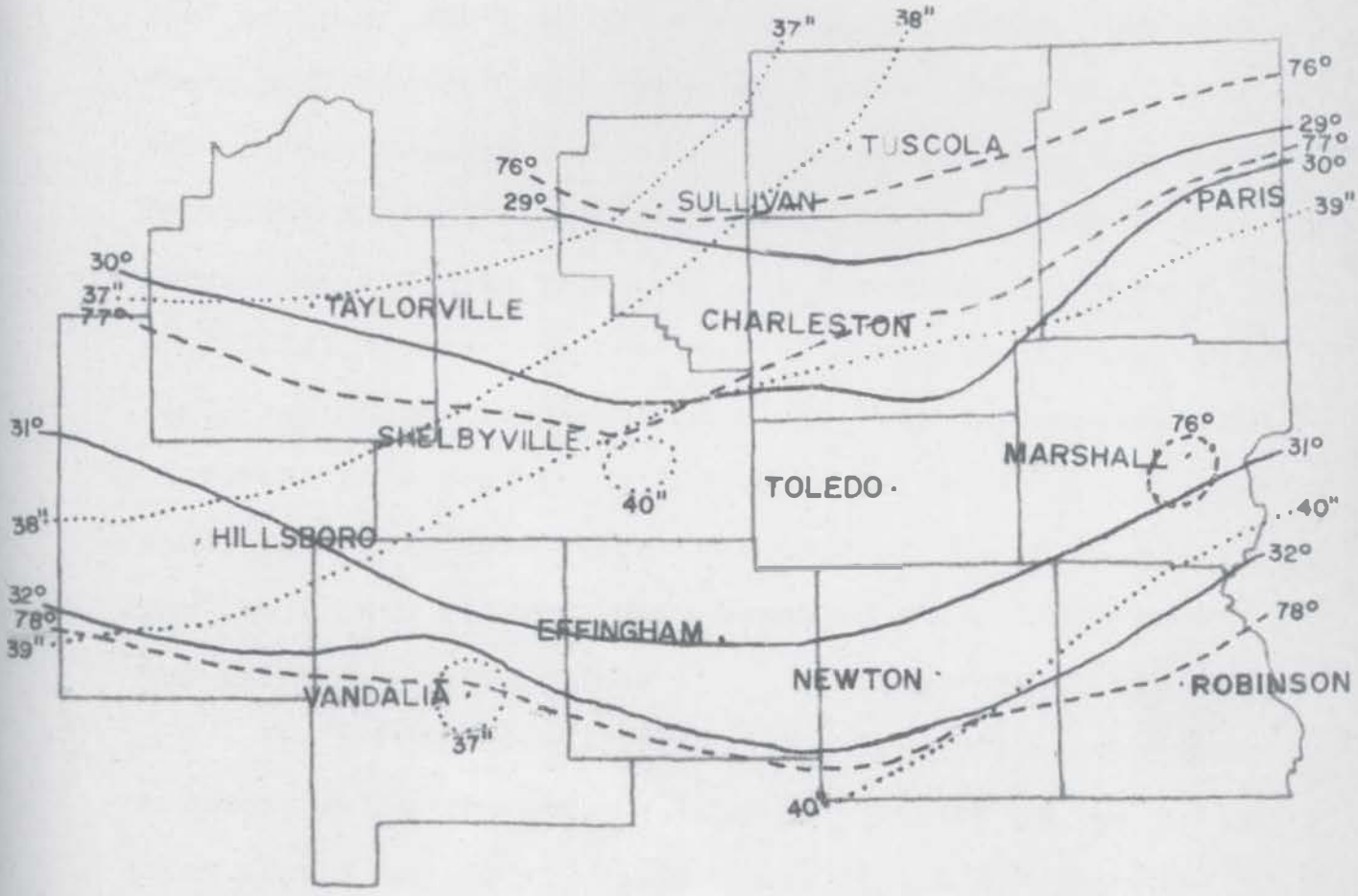
| | Av. Jan. Temp. (°F) | Av. July Temp. (°F) | Av. Annual Precip. (inches) (°F) |
|---|---|---|---|
| Edgar | 30.3 | 77.1 | 38.94 |
| Coles | 29.5 | 77.2 | 38.50 |
| Douglas | 26.8 | 75.5 | 38.42 |
| Moultrie | 28.8 | 76.2 | 37.04 |
| Christian | 30.2 | 76.9 | 36.72 |
| Montgomery | 31.6 | 77.7 | 38.10 |
| Shelby | 30.1 | 77.0 | 40.48 |
| Fayette | 32.3 | 78.1 | 36.21 |
| Effingham | 31.0 | 77.1 | 39.61 |
| Jasper | 31.6 | 77.9 | 39.83 |
| Crawford | 32.6 | 78.2 | 40.97 |
| Cumberland* | | | |
| Clark | 30.9 | 75.7 | 39.30 |

*Cumberland County has no recording station for weather data.

Source: Climatological Data, Illinois Annual Summary, 1971.

precipitation and temperature for those counties with the highest and lowest values are less than five inches and six degrees respectively. The temperatures and precipitation in all counties of the study area are adequate for a proper growing season for the crops grown throughout this

# AVERAGE TEMPERATURE AND PRECIPITATION




## SCALE

0 10 20 30 40

miles

## LEGEND

——— AVE. JAN. TEMP.

- - - - - AVE. JULY TEMP.

..... AVE. ANNUAL PRECIP.

SOURCE

1971 ILLINOIS CLIMATOLOGICAL DATA

KF

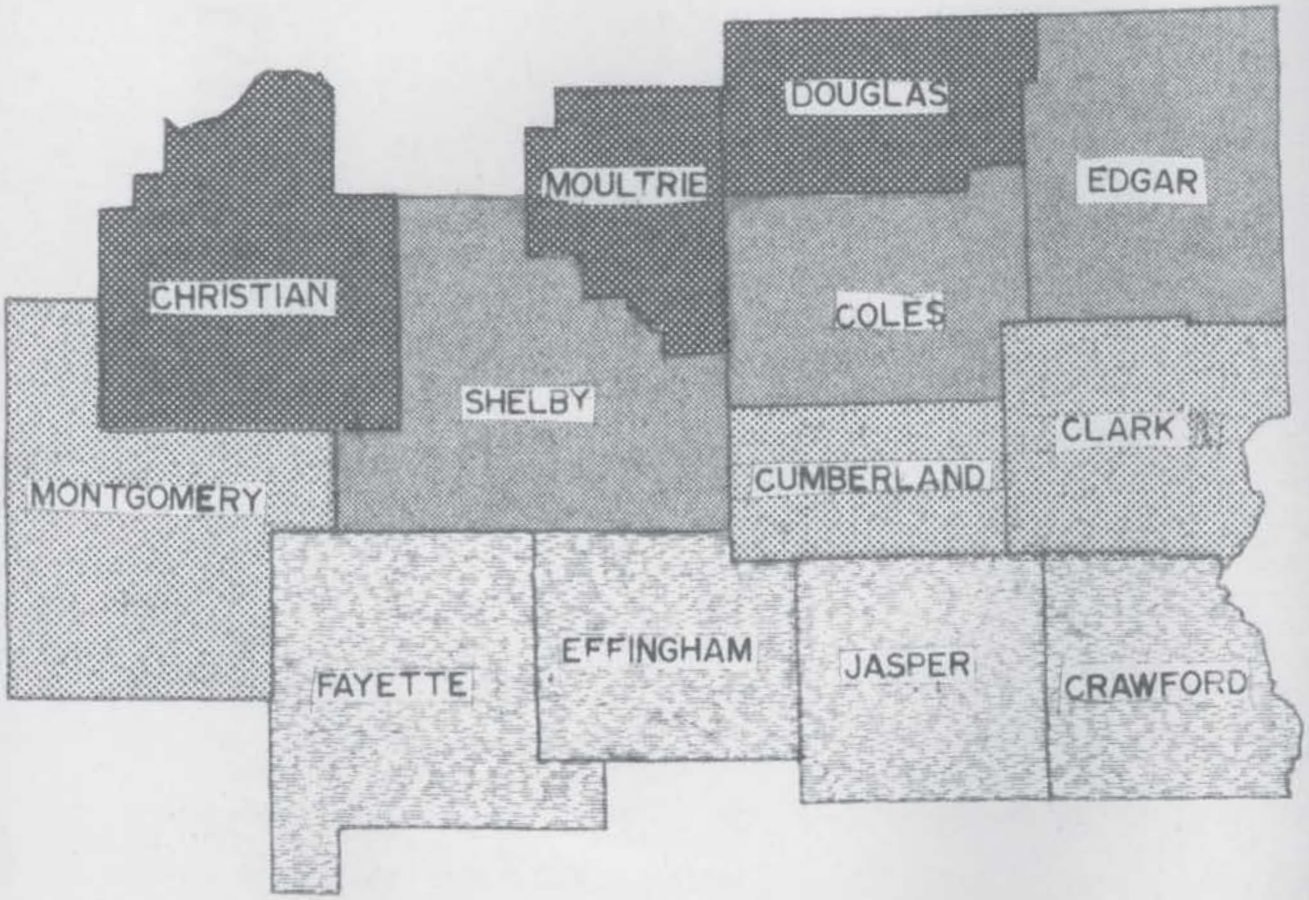
FIGURE 2-3

area and therefore have little effect upon the location of this boundary.

Several other natural factors vary considerably in this area but are capable of being altered by man to eliminate many of the differences. The topography includes relief of up to 200 feet for the area as a whole, but most of these differences occur near the Wabash, Embarrass, Little Wabash, and Kaskaskia rivers. Natural drainage and soil fertility are quite different from the flat interfluvial areas compared with those regions bordering the rivers, but artificial drainage in the form of drainage ditches, tiled land, and channelized streams along with the application of fertilizers containing the necessary amounts of potassium, nitrogen, phosphorus, and many of the trace elements for the growth of crops have lessened these differences and allowed a more uniform yield of crops across the boundary. The production potential of grain in the counties, however, still remains the important factor in the definition of the boundary. Table 2 and Figure 2-4 show the differences in yields per acre for corn and soybeans for these counties. The differences in yields show a much greater production potential in those counties north of the present boundary than those south of that boundary. The building of dams and reservoirs such as the Shelbyville Dam and Reservoir and bulldozing and clearing of

# YIELDS OF CORN AND SOYBEANS BY COUNTIES, 1969

(BUSHELS PER ACRE)




SCALE

0 10 20 30 40
miles

LEGEND

| | CORN | SOYBEANS |
|---|---|---|
| | > 118 | > 39 |
| | 109 – 118 | 36 – 39 |
| | 92 – 100 | 33 – 34 |
| | < 90 | < 31 |

SOURCE

1969 U.S. CENSUS OF AGRICULTURE

KF

FIGURE 2-4

TABLE 2

YIELDS OF CORN AND SOYBEANS IN SELECTED COUNTIES, 1969 (bushels per acre)

| County | Corn | Soybeans |
|---|---|---|
| Moultrie | 124.3 | 40.2 |
| Douglas | 122.1 | 39.6 |
| Christian | 119.0 | 39.2 |
| Coles | 117.5 | 38.8 |
| Edgar | 114.4 | 37.8 |
| Shelby | 109.3 | 36.1 |
| Cumberland | 98.3 | 33.5 |
| Montgomery | 98.0 | 33.4 |
| Clark | 92.4 | 33.2 |
| Effingham | 89.6 | 30.1 |
| Jasper | 83.2 | 30.0 |
| Crawford | 80.2 | 28.3 |
| Fayette | 74.9 | 26.2 |

Source: 1969 Census of Agriculture.

wooded areas have made cultivatable much of the land formerly unsuitable for cropland. These projects extend much of the land area available for cash grain development and contribute to the increasing number of acres in cash grain farms south of the 1956 boundary.

Certain of the economic factors are also quite similar throughout the area and are of little importance now to the development of the cash grain boundary. Transportation facilities are adequate in these counties with three interstate highways, interstate 55, 57, and 70, several major state routes, routes 1, 16, 29, 32, 40, 45, 49, 121, 127, 128, 130, 133, and 150, numerous county roads, and

several railroads serving the area. Little outside labor is hired by the farmers of this region. The necessary labor is usually supplied by the farmer and his family,[22] causing labor requirements as well as transportation requirements to be of little importance for cash grain development in this area.

Most of the remaining relevant natural and economic factors used in the study were incorporated into the main factors used by Case, Myers, and Ross in determining the boundary of the cash grain region. These factors include the type of farm, such as cash grain, dairy, livestock, general, vegetable, and poultry which reflect availability of markets for the products, labor, and capital; the crops grown; the livestock and livestock products produced; and farm tenure which includes tenancy agreements.[23]

Through the interviews of several elevator managers, differences in these remaining factors were found to appear in differences in such factors as amounts and kinds of grain received, functions performed, and capacities of

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[22]This information was taken from a study on farming in selected areas north and south of the cash grain boundary. The data were collected in the summer of 1972.

[23]Case, H. C. M. and K. H. Myers; and Ross, R. C. and H. C. M. Case, op. cit., pp. 175-177, pp. 45-48.

the local country grain elevators. Through these elevators the crops are marketed, and feed is purchased for the livestock. Therefore, these factors can be used to give insight into the types of farms, kind and amount of crops grown, and livestock produced in the area.

# CHAPTER III

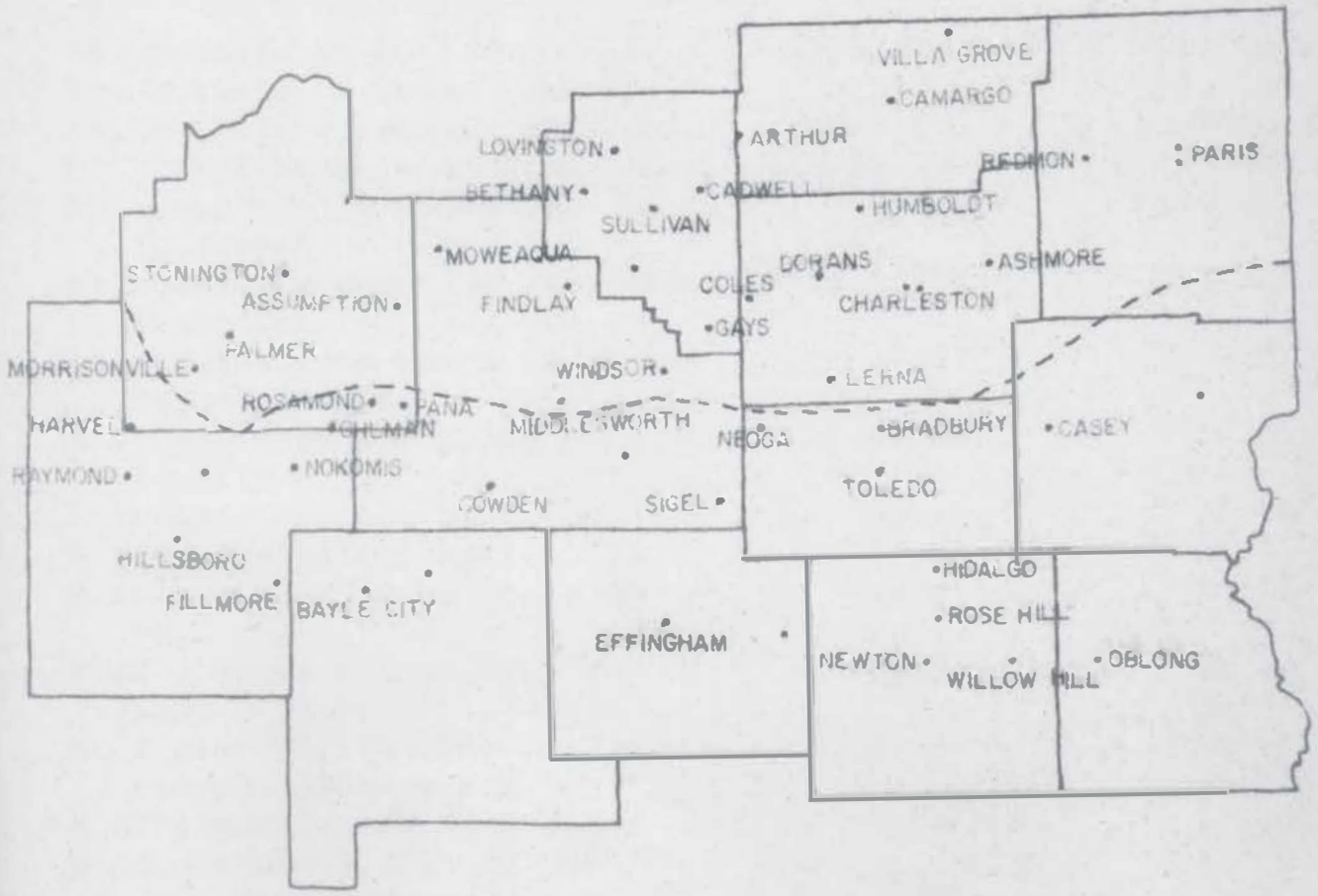
## DIFFERENCES IN ELEVATORS NORTH AND SOUTH OF THE CLASSICAL BOUNDARY

Even though the location of the elevators in the study were separated by less than a hundred-mile band in a north-south direction, the differences encountered are extreme in some instances. There are great differences in size, types of functions performed, amount of grain received, and shipping destinations for the grain. In order to examine the differences thoroughly and to provide a basis for establishing a new definition of the boundary, the elevators were divided into two groups, those north of the existing cash grain boundary and those south of that boundary (Figure 3-1). The results of the interviews were tabulated and correlated in order to present these results in an understandable form (Table 3 and Figure 3-2).

### Elevator Types and Sizes

There are three main types of elevator structures that are used for holding grain. These are the wooden buildings with overhead bins, most of which were built before the mid-1940's, the concrete silos, built succeeding this time and the concrete structures built from about

# LOCATION OF ELEVATORS USED IN STUDY




## SCALE

0 10 20 30 40

miles

## LEGEND

------ 1956 CASH GRAIN BOUNDARY ACCORDING TO ROSS AND CASE

• LOCATION OF ELEVATOR

KF

FIGURE 3-1

TABLE 3

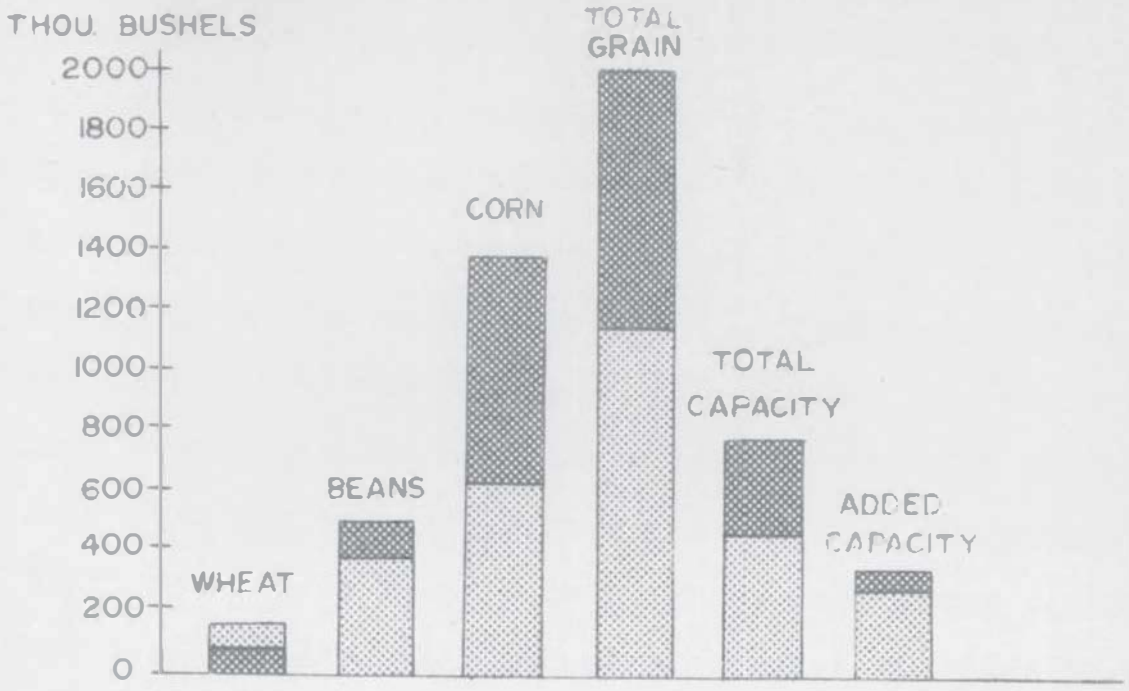
STATISTICS ON GRAIN ELEVATORS

| | North of Boundary | South of Boundary |
|---|---|---|
| Av. bushels of corn received | 1,392,000 | 623,000 |
| Av. bushels of beans received | 518,000 | 387,000 |
| Av. bushels of wheat received | 79,000 | 149,000 |
| Av. total bushels of grain rec. | 1,988,000 | 1,125,000 |
| Av. capacity of elevators (bushels) | 767,000 | 434,000 |
| Av. capacity added by expansion (bushels) | 338,000 | 265,000 |
| Av. radius from which grain received (miles) | 8.37 | 9.05 |
| % of elevators shipping corn locally | 33.30 | 36.80 |
| % shipping mainly by truck | 48.10 | 45.00 |
| % shipping mainly by rail | 33.30 | 25.00 |
| % shipping 50-50 by truck and rail | 18.50 | 30.00 |
| % of elevators expanding in last 5 years | 55.50 | 65.00 |
| % of elevators hiring more employees after expansion | 13.30 | 30.70 |
| % of elevators selling feeds | 40.00 | 80.00 |
| % of elevators selling seeds | 51.80 | 85.00 |
| Av. no. of employees hired | 6.10 | 7.10 |
| Av. no. of workers employed by elevators selling feed | 6.50 | 8.00 |
| % of elevators which store grain | 85.00 | 75.00 |
| % of elevators having grain dryers | 81.40 | 80.00 |

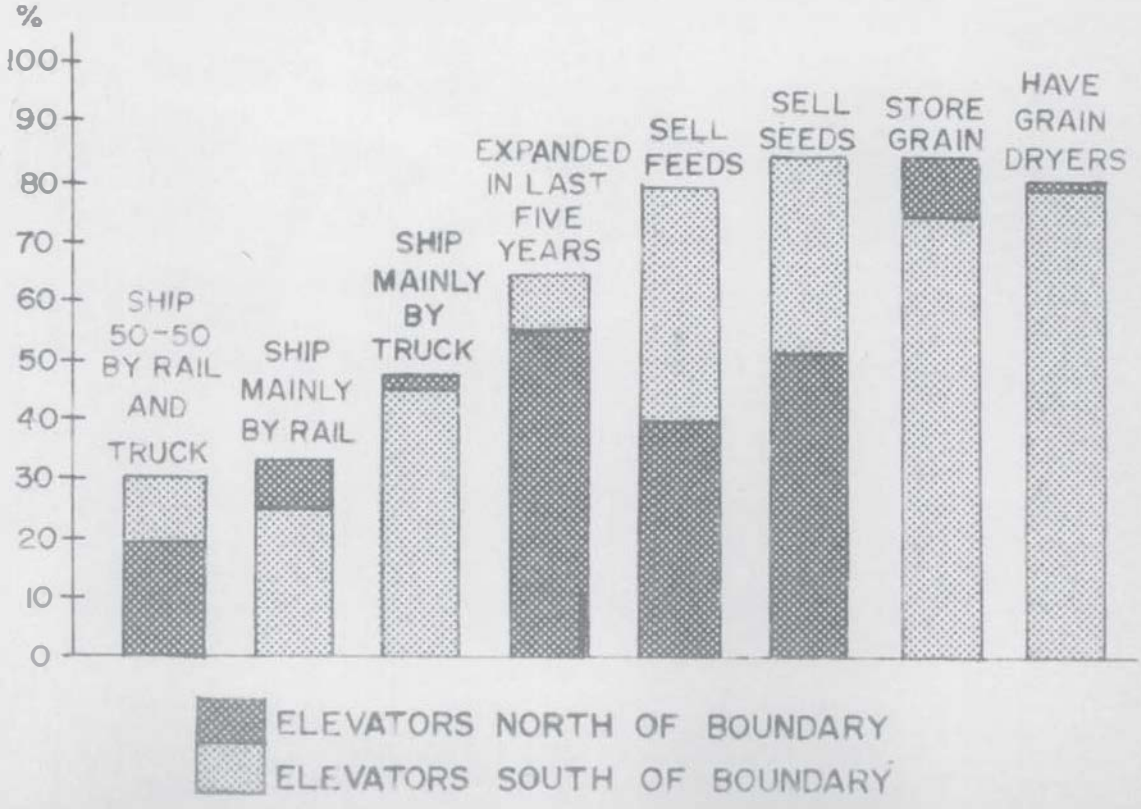
1960 to the present. Every elevator included in the study north of the cash grain boundary except one is either a concrete silo, concrete structure or a combination of the

# DIFFERENCES AMONG GRAIN ELEVATORS

## AVERAGE CAPACITY AND BUSHELS OF GRAIN RECEIVED




## SHIPPING METHODS, FUNCTIONS, AND EXPANSION



three types of structures. South of the boundary there were a few examples of just wooden building structures, although most elevators were a combination of older wooden buildings and concrete silos. Figures 3-3, 3-4, 3-5, and 3-6 show the three main types of structures along with an example of a combination of types. Figure 3-5 is most representative of the type of structure of those elevators north of the boundary while Figures 3-4 and 3-5 are more representative of those elevators south of the boundary. The new concrete structures north of the boundary reflect not only a large flow of grain into these structures, but also an increasing amount of flow in the last few years.

There is a marked difference in the capacities of the elevators resulting from the different types. Although this capacity varies with the number and size of structures, the wooden buildings have the least capacity and the concrete structures the greatest capacity. On the average the northern elevators, with more concrete structures, had almost double the capacity for grain, 767,000 bushels,[24] compared with those south of the boundary,

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[24]Unless otherwise stated, the capacities of these elevators were measured in bushels of shell corn.

Fig. 3-3.--An example of the wooden building with overhead bins type of elevator structure located south of the boundary. (Rieke Elevator--Nokomis, Illinois).

Fig. 3-4.--The concrete silo type of elevator structure. This elevator is located north of the boundary. (Palmer Grain Co.--Palmer, Illinois).

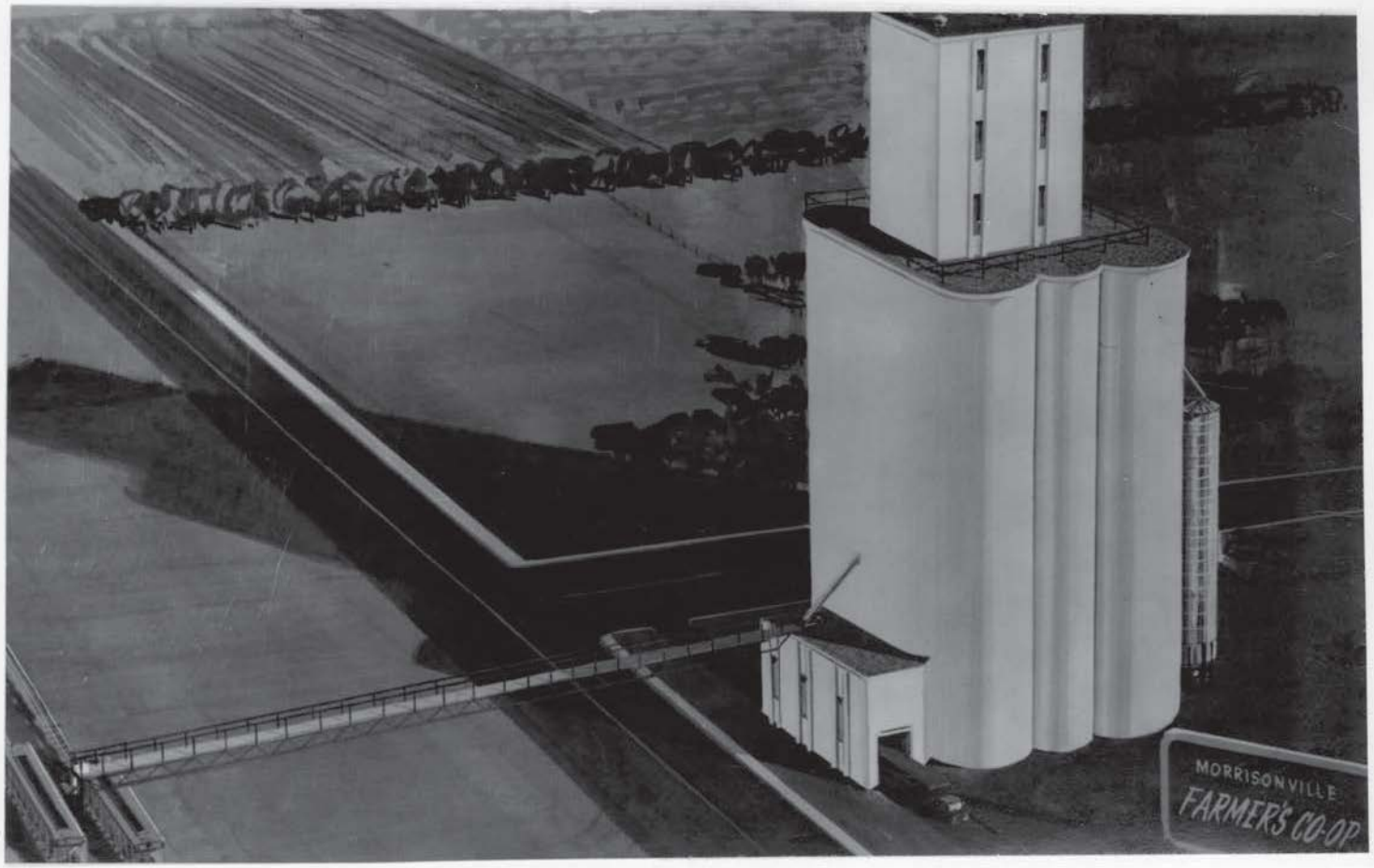



Fig. 3-5.--The concrete structure built for grain storage. This is the newest and most popular type now built. (Morrisonville Farmer's Co-op--Morrisonville, Illinois).

Fig. 3-6.--An example of a combination of types of grain storage located south of the boundary. Both buildings are still used. (Mid-Illinois Farmer's Elevator--Pana, Illinois).

434,000 bushels. However, individual elevators varied from over 4,000,000 bushel capacity to under 25,000 bushel capacity. The largest elevator in capacity was located north of the boundary while the smallest in capacity was located south of the boundary. The larger capacities of the northern elevators result from a larger cash sale of grain in the northern counties (Figure 3-7 and Table 4).

TABLE 4

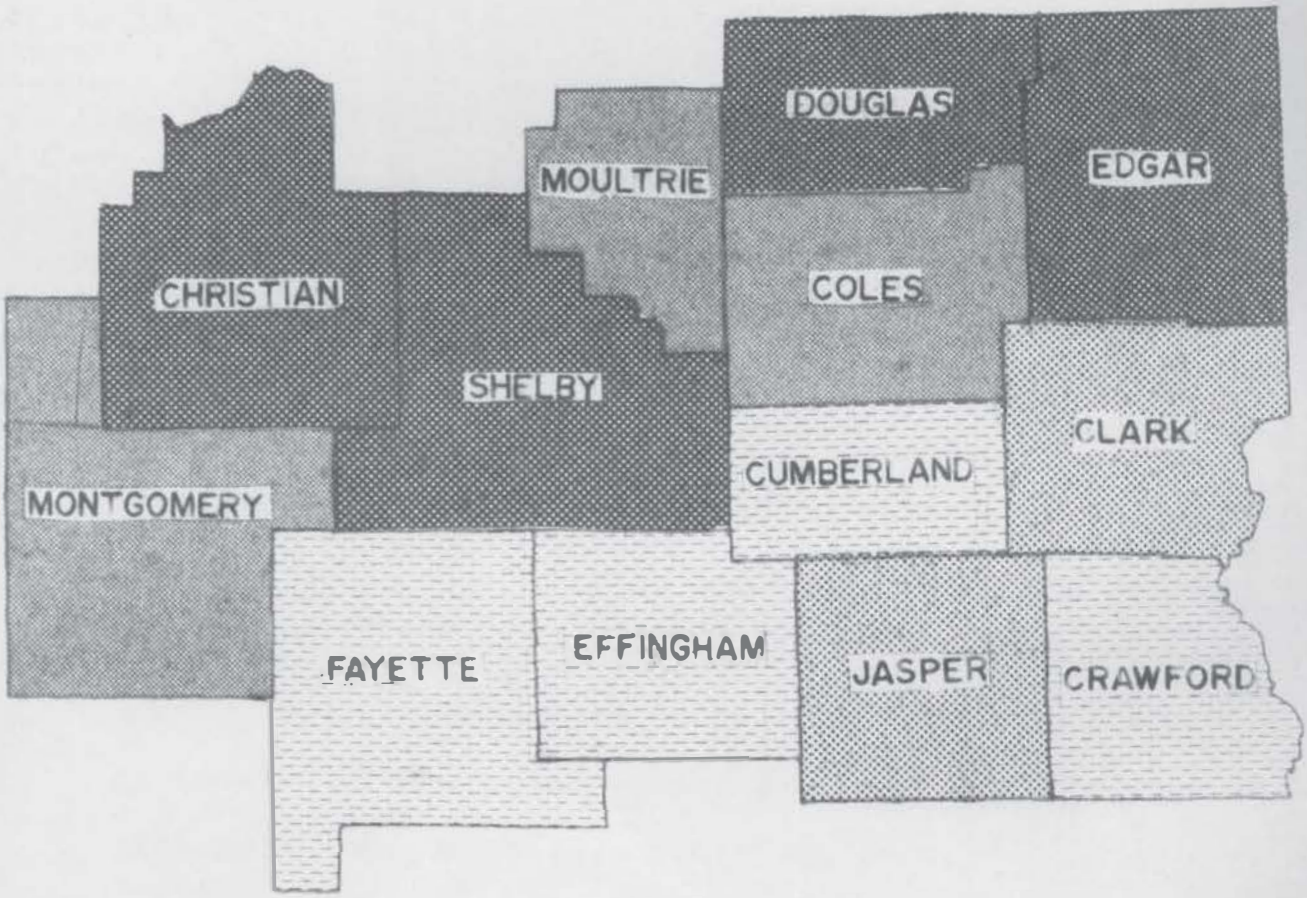
PRODUCTION AND SALES OF CORN AND SOYBEANS (THOUSANDS OF BUSHELS)

| County | Corn | | Soybeans | |
|---|---|---|---|---|
| | Production | Sales | Production | Sales |
| Christian | 18,555 | 10,126 | 5,744 | 4,454 |
| Edgar | 14,303 | 9,146 | 4,013 | 3,640 |
| Shelby | 14,603 | 9,292 | 4,264 | 3,828 |
| Douglas | 13,354 | 9,489 | 2,787 | 2,573 |
| Coles | 11,445 | 7,554 | 3,109 | 2,587 |
| Moultrie | 9,422 | 6,031 | 2,245 | 2,138 |
| Effingham | 5,801 | 1,997 | 1,820 | 1,891 |
| Montgomery | 10,384 | 4,148 | 3,941 | 3,109 |
| Clark | 7,695 | 2,907 | 3,001 | 2,693 |
| Jasper | 6,643 | 2,589 | 3,001 | 2,504 |
| Fayette | 5,016 | 1,835 | 2,534 | 2,167 |
| Crawford | 5,839 | 2,110 | 1,933 | 1,910 |
| Cumberland | 5,452 | 2,867 | 1,963 | 1,593 |

Source: 1971 Illinois Agricultural Statistics.

Table 5 and Figure 3-8 show the capacities of elevators by counties. With the exception of Effingham

# TOTAL PRODUCTION AND SALES OF CORN AND SOYBEANS BY COUNTIES, 1971




SCALE

0 10 20 30 40
miles

LEGEND

| | PRODUCTION (THOU. BUSHELS) | SALES |
|---|---|---|
| | > 16,000. | > 12,000. |
| | 11,000--15,000 | 7,000 --11,000 |
| | 9,000-11,000 | 5,000-6,000 |
| | < 8,000. | <5,000. |

SOURCE

1971 ILLINOIS AGRICULTURAL STATISTICS

KF

FIGURE 3-7

TABLE 5

CAPACITY OF ELEVATORS BY COUNTIES*

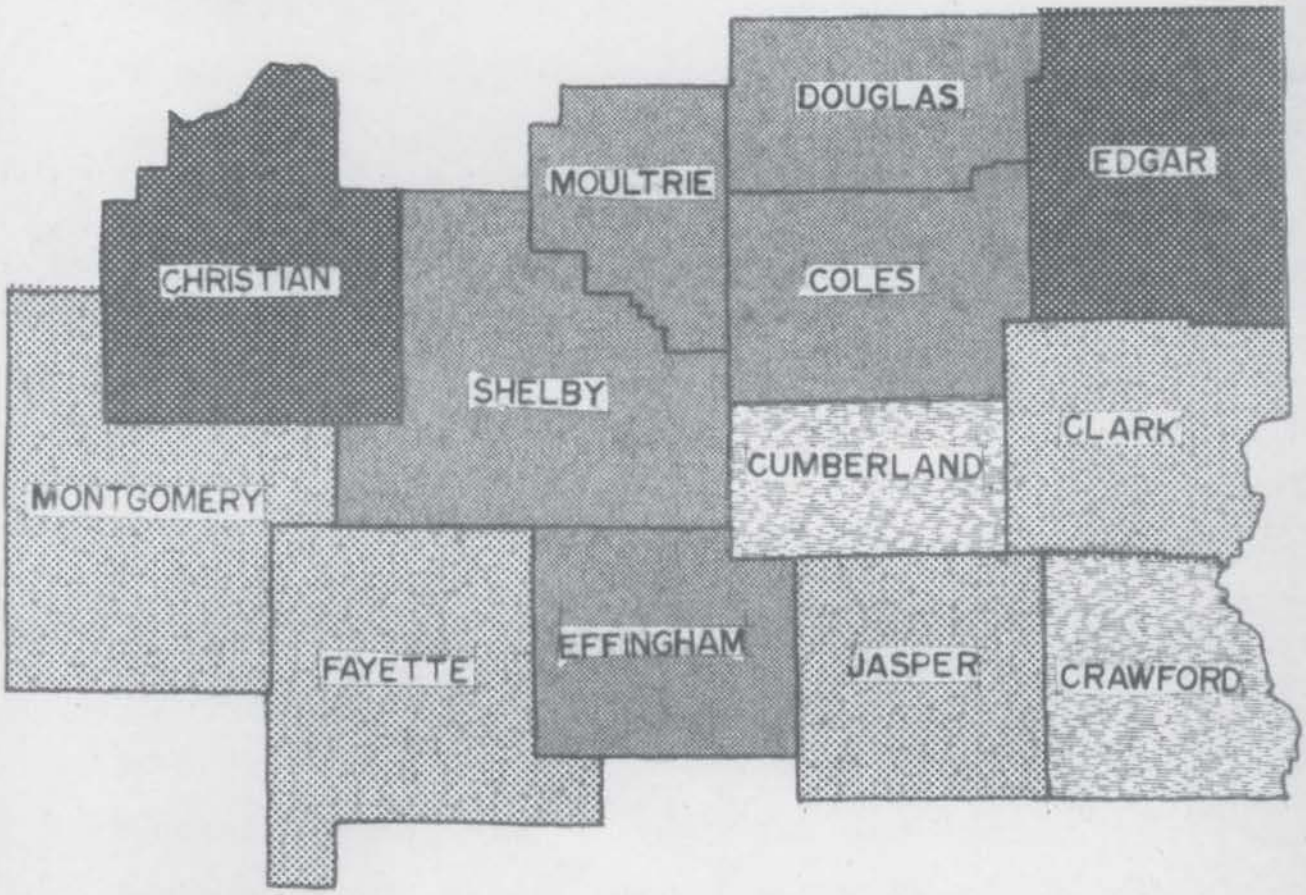
| County | Av. elevator capacity (bushels) | Total capacity for county (bushels) | ratio of production to capacity |
|---|---|---|---|
| Christian | 616,000 | 12,936,000 | 1.87 |
| Edgar | 336,000 | 6,384,000 | 2.87 |
| Shelby | 278,000 | 3,892,000 | 4.85 |
| Douglas | 215,000 | 3,870,000 | 4.17 |
| Coles | 231,000 | 3,696,000 | 3.94 |
| Moultrie | 253,000 | 3,542,000 | 3.29 |
| Effingham | 315,000 | 3,150,000 | 2.42 |
| Montgomery | 123,000 | 2,829,000 | 5.06 |
| Clark | 207,000 | 1,656,000 | 6.46 |
| Jasper | 189,000 | 1,512,000 | 6.38 |
| Fayette | 106,000 | 1,272,000 | 5.94 |
| Crawford | 116,000 | 812,000 | 9.57 |
| Cumberland | 32,000 | 160,000 | 46.34 |

*Includes all elevators, not just country grain elevators.

Source: Grain Elevators in Illinois, Factors Affecting Their Number and Location.

County, every county with over 3,000,000 bushel capacity is located either north of the boundary or contains the cash grain boundary. The elevators in each county which contains or is located north of the boundary have an average capacity of over 200,000 bushels per elevator. Only two of those counties located south of the boundary, Clark and Effingham counties, have average capacities for all elevators greater than 200,000 bushels per elevator. Table 4 and Figure 3-7 show the production of corn and soybeans in these counties. Correlations of

# TOTAL CAPACITY OF ELEVATORS BY COUNTIES




SCALE

0 10 20 30 40

miles

LEGEND

BUSHELS

> 6,000,000

3,000,000 – 4,000,000

1,000,000 – 3,000,000

< 1,000,000

SOURCE

GRAIN ELEVATORS IN ILLINOIS, FACTORS AFFECTING THEIR NUMBER AND LOCATION

KF

FIGURE 3-8

.87 and .79[25] were found between the total capacity of elevators and the total production of corn and soybeans and total capacity and total cash sale of corn and soybeans respectively in these counties, explaining the larger capacity of elevators north of the boundary. Comparing total production of corn and soybeans with total capacity of the elevators of each county, all the counties north of the boundary have a ratio betwen production and capacity of less than 5, while all those south of the boundary except Effingham County, have ratios greater than 5 (Table 5) because less of the production of corn is sold and less capacity is needed by each elevator.

A greater percentage, 65%, of elevators south of the boundary have expanded their capacity in the last five years compared with only 55.5% of the elevators north of the boundary, although the southern elevators did not expand by as many bushels on the average as did the northern elevators. The southern elevators expanded by 265,000 bushels on the average while the northern elevators expanded by an average of 338,000 bushels. The smaller expansion by southern elevators is also a result of the smaller cash sale of grain in the southern counties. Much

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[25] A good correlation factor is usually considered to be above .90. To account for the approximations and rounding of many of these figures by elevator managers, a correlation approximating .90 will be considered good for this study.

of the expansion by southern elevators is undertaken to replace the outdated wooden buildings. The new structures built usually have a larger capacity than the older wooden buildings. This expansion has not always taken the form of any of the types of structures mentioned above. Instead, some of the expansion has occurred in the form of sheds (Figure 3-9) and steel bins (Figure 3-10). These types of structures are cheaper than the concrete silos or the concrete structures but have less capacity for grain and deteriorate faster. A steel bin varies in capacity up to 100,000 bushels and a shed will hold normally up to 10,000 bushels. These smaller structures can be built by elevator operators with budgets that would not allow for a concrete structure. The concrete structures can be built to almost any capacity, but most of those encountered had capacities of 300,000 to 500,000 bushels. Any expansion of this size at one time necessitates the building of a concrete structure.

## Volume and Kind of Grain Received

The volume of grain received by each individual elevator correlates very closely (a correlation factor of .89) with its capacity. The volume of grain received by both the northern and southern elevators is nearly three times their total capacity. The average total amount of grain received by elevators north of the

Fig. 3-9.--Expansion of capacity by use of a metal shed used for storing grain. This elevator is located north of the boundary. (Sullivan Grain Co.--Sullivin, Illinois).


Fig. 3-10.--Expansion of capacity by use of steel bins at elevator located north of the boundary. (Moultrie Grain Assn.--Lovington, Illinois).

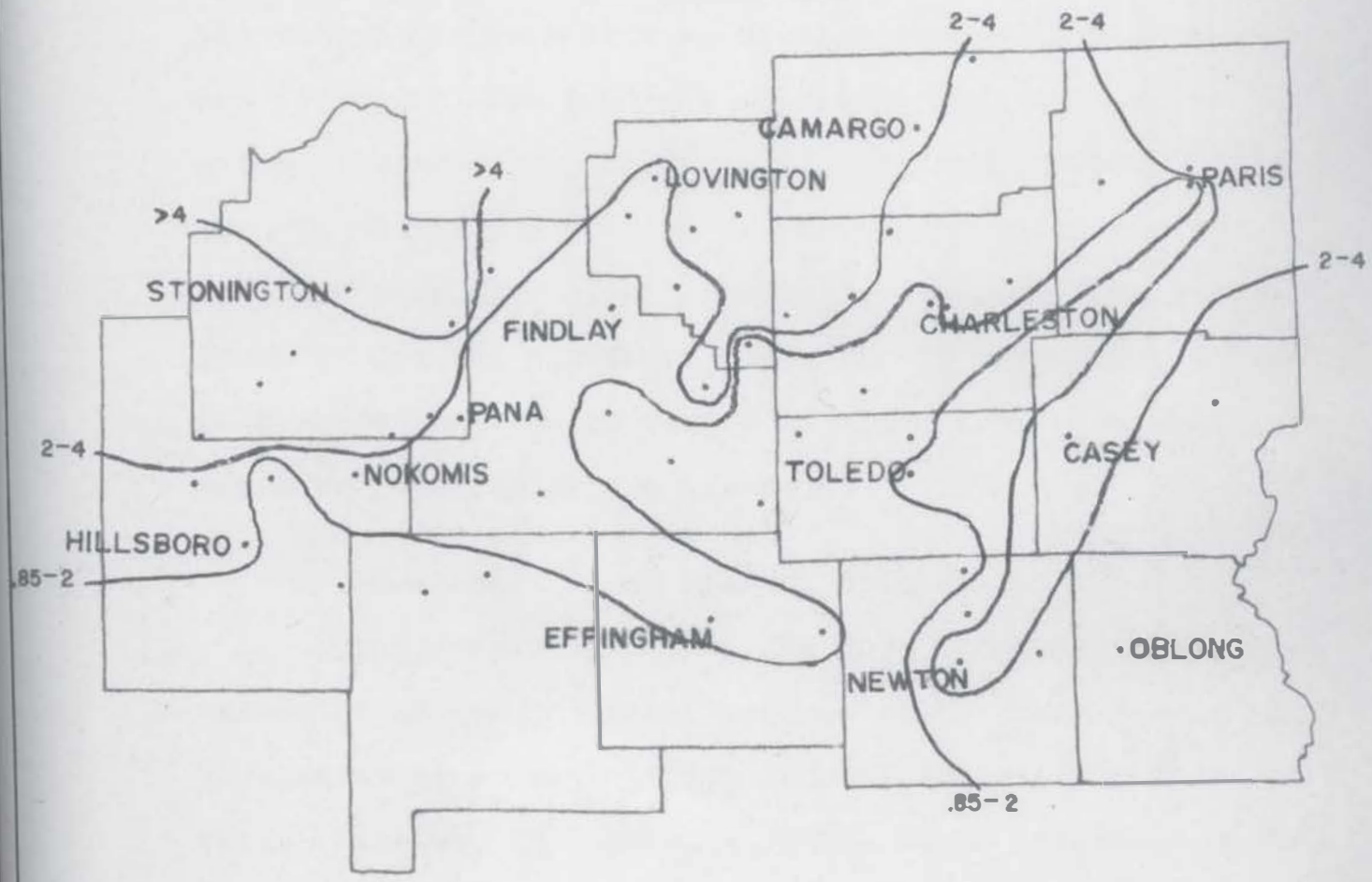
boundary is 1,988,000 bushels, almost 900,000 bushels per elevator more than that received by those south of the boundary again resulting from the large cash grain sales in counties north of the boundary (Figure 3-11).

The amounts of the different kinds of grain received by the elevators reflect their location north or south of the boundary. North of the cash grain boundary an average of over 1,300,000 bushels of corn is received by each elevator and a little less than half this amount of soybeans is received. South of the boundary, only 623,000 bushels of corn and 387,000 bushels of beans are received by each elevator, because of the smaller production and cash sales of corn and soybeans in the southern counties. There is a difference of slightly over 125,000 bushels between the amount of beans received by each elevator north of the boundary and those south of the boundary. This difference is even smaller for the amount of wheat received with the south receiving an average of 70,000 bushels more wheat per elevator than the north. The amount of wheat received, however, does not correlate significantly (a correlation factor of only .18) with the amount of corn received. There is very little oats, normally under 10,000 bushels, received by any of the elevators in this region, however, there was a larger percentage of elevators south of the boundary receiving oats because more

# AVERAGE BUSHELS OF GRAIN RECEIVED BY ELEVATORS PER YEAR

AVERAGED OVER LAST THREE YEARS

(IN MILLIONS)




SCALE

0 10 20 30 40

miles

LEGEND

• LOCATION OF ELEVATOR

KF

FIGURE 3-11

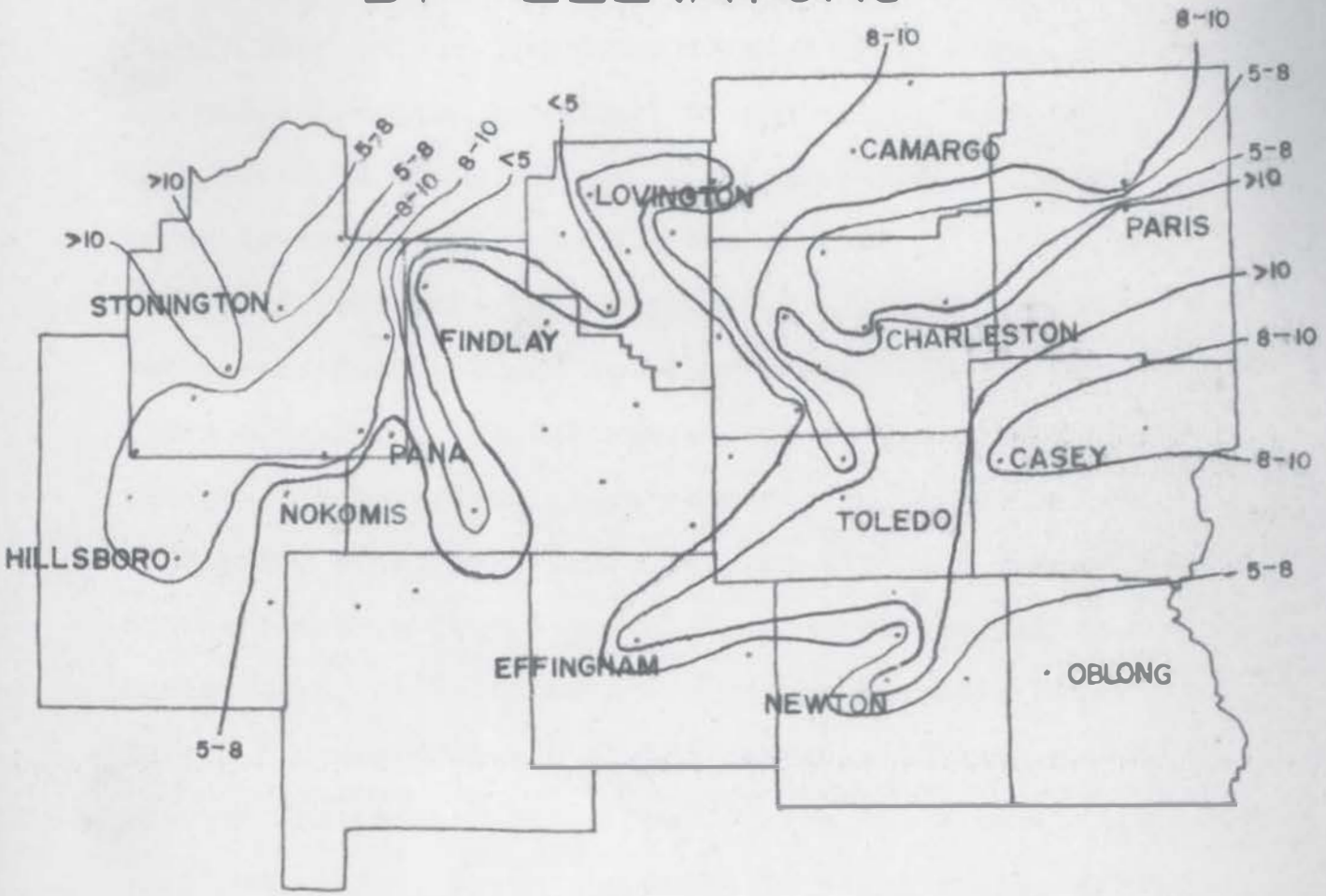
elevators here use oats for mixing in the feeds sold to farmers.

The radius in miles from which the grain is received shows the concentration of grain farming around each elevator. The northern elevators received most of their total volume of grain from an average radius of 8.37 miles per elevator. The southern elevators required over 9 miles in radius from which to receive about 900,000 less bushels of grain per elevator than those north of the boundary showing smaller production and less cash sale of grain around the elevators south of the boundary. Figure 3-12 shows the average radius in miles from which the grain is received by the elevators.

### Destination and Mode of Shipment

Surprisingly little of the corn received by the elevators is shipped to local markets even though nearby markets exist at several towns, such as Tuscola, Teutopolis, Paris, Decatur, St. Louis, East St. Louis, Browns, and Wayne City, throughout and adjacent to the study area. Most of the corn is shipped to the southern states of Texas, Arkansas, Mississippi, and Louisiana to be used for feed by feedlots and the poultry industry. Some of the corn is shipped to New Orleans and the East Coast for export. The amount of corn received by each elevator makes little difference on the shipping destination since only

# AVERAGE RADIUS IN MILES FROM WHICH GRAIN IS RECEIVED BY ELEVATORS




SCALE

0 10 20 30 40
miles

LEGEND

• LOCATION OF ELEVATOR

KF

FIGURE 3-12

33.3 percent of elevators north of the boundary and 36.8 percent of elevators south of the boundary ship all their corn locally. The remaining elevators shipped most of their corn to markets outside the state.

The shipment of soybeans and wheat is almost entirely sent to local markets because of the large soybean and wheat processors located in the area. With the exception of three managers, all elevator managers listed Decatur as one of their main soybean markets. Other local markets listed were Taylorville and St. Louis. A few elevators shipped soybeans to other states and for export to other countries, but the number was insignificant for comparison. Most of the elevator managers listed St. Louis as a shipping point for wheat, but the elevator managers north of the boundary listed other major markets at Alton and Springfield, while those south of the boundary shipped to Teutopolis also because of the nearness of this market to most of the southern counties. There was a small amount of wheat shipped by these elevators to other states and for export to other countries.

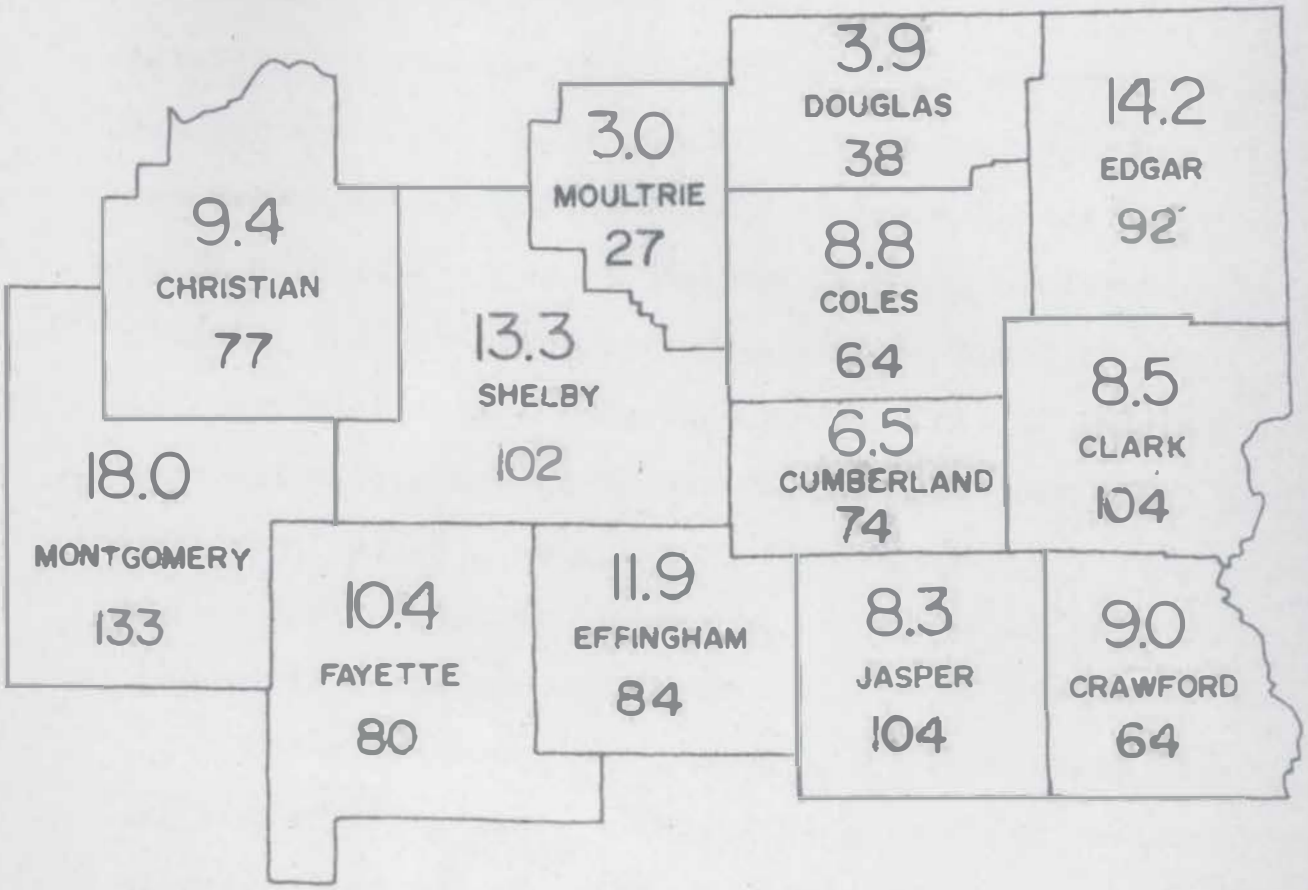
The major mode of shipment for all grains was by truck. This method accounted for nearly half of the shipment method. Most of the grain shipped in this way is sent to markets within 100 miles of the elevators, accounting for most of the transportation of beans and

wheat taken to local markets. One-third of the northern elevators and one-fourth of the southern elevators moved their grain mainly by rail. Most elevator managers expressed difficulty in acquiring boxcars for shipment forcing them to rely on shipment by trucks. Some of the larger elevators had the facilities and capacity for loading a hundred-car train with corn and had little difficulty receiving this number of cars, which explains part of the reason for the larger number of elevators north of the boundary shipping by rail. Eighteen and one-half percent and 30% of the northern and southern elevators, respectively, shipped their grain by a 50-50 combination of rail and truck.

## Functions and Employment of Elevators

The number of functions performed by elevators is related to their location north or south of the boundary. Eighty percent of those elevators south of the boundary sell feed while only 40% of those north of the boundary serve this function. Most of those elevators north of the boundary selling feed were located near the cash grain boundary. Figure 3-13 shows the number of hogs and cattle marketed by each county. The southern counties marketed more cattle and hogs than those north of the boundary and required more feed sales. Eighty-five percent of the southern elevators sell seeds to the farmers, while only

# CATTLE AND HOG MARKETINGS BY COUNTIES 1970




SCALE

0 10 20 30 40
miles

LEGEND

10.0 NO. OF CATTLE (THOU. HEAD)

100 NO. OF HOGS (THOU. HEAD)

SOURCE

1971 ILLINOIS AGRICULTURAL STATISTICS

KF

FIGURE 3-13

50% of the northern elevators performed this service. The elevators without these functions were mainly large elevators handling grain only.

There is little correlation (a correlation factor of only .58) between the amount of grain received by an elevator and the number of employees hired. North of the boundary, the number of workers employed averaged out to 6.1 per elevator, while south of the boundary the average was 7.1 employees per elevator. Those southern elevators which sold feed hired an average of eight employees explaining the larger number of employees hired by the southern elevators. Only 21.4 percent of all the elevators undergoing expansion hired more employees after that expansion, usually only two or three more. The rest of the elevators employed either the same number of workers they employed before expansion or in some cases even less.

Two differences not listed above were those of storing and drying grain. Eighty-five percent of northern elevators and 75% of southern elevators stored grain for farmers who would later sell the stored grain to these elevators. This storage relieves some farmers of building large storage units on their own farms. The ability to store grain depends upon the capacity of the elevator and most elevators with less than 100,000 bushel capacity do not have the available space for storage. The percentage of elevators with grain driers was almost even for the

northern and southern elevators with 81.4% and 80% respectively. Driers are extremely important to the elevators since many farmers harvest their corn with up to 30% moisture content in order to harvest early and be capable of harvesting large acreages. The allowable moisture at most of the main terminal markets is 15.5%.

The differences in the elevators north and south of the present boundary become more significant when applied to a definition of a type of farming region. Without this purpose they become merely statistics without much real meaning. The next chapter will be an attempt to redefine the cash grain boundary based upon these differences in elevators.

# CHAPTER IV

## DEFINITION AND LOCATION OF THE NEW BOUNDARY

Table 3 and Figure 3-2 show that the major factors contributing to the differences in the elevators north and south of the cash grain boundary are the kinds and amounts of grain received, the capacity of the elevators, and the functions performed. Other important factors include the radius in miles from which the grain is received, amount of expansion that has occurred in the last five years, and destination of the shipment of the grain. These factors reflect the concentration of grain farming and the presence of livestock in the area, and therefore, divide the cash grain region from the grain and livestock, general farming, and general farming and dairy regions.

### Definition of a Cash Grain Elevator

Even though a cash grain boundary is drawn through this area, the elevators may not always conform in size and types to their location north or south of that boundary. Furthermore, since 17 years have past since the boundary was last defined, a new definition cannot be developed simply by tabulating the results of the interviews taken north and south of the boundary because of possible movements in

the location of that boundary since 1956. Therefore, a method must be found to use the results of the interviews but to allow for any movements in the boundary over the last few years and exceptions in the size and types of elevators along that boundary. This allowance should not be so large nor so small that it becomes meaningless. Therefore, a confidence interval[26] was set up on each side of the averages for each factor. This interval ranges from the average minus 10% of that average to the average plus 10% of that average.

First, all elevator interviews were averaged together to get an average figure for each factor concerned. The averages per elevator found for these factors were 1,556,500 bushels of total grain received per year, 907,500 bushels of corn received per year, 452,500 bushels of beans received per year, 114,000 bushels of wheat received per year, 600,500 bushel average capacity, 301,500 bushels of expanded capacity in the last five years and 8.71 miles for the average radius from which the grain is received. Then to each average, 10% of that average was added to the average to form the upper limit of the interval and 10% of that average was subtracted from the average to form the lower limit of the interval. Adding and subtracting the 10% allowance figures for each of

---

[26]A confidence interval is usually used to include a certain percentage of elements within a probability range. Here it is used to include several elevators within an average range for elevators.

these averages, the ranges for the factors of an average elevator of this region become 1,400,850 - 1,712,150 bushels for total amount of grain received per year, 816,750 - 998,250 bushels of corn received per year, 407,250 - 497,750 bushels of beans received per year, 102,600 - 125,400 bushels of wheat received per year, 540,450 - 660,500 bushels for total capacity of the elevators, 271,350 - 331,650 bushels for expanded capacity in the last five years, and 7.84 - 9.58 miles for the average radius from which the grain is received.

Any elevator which has figures for these factors fitting into these ranges for all the factors is an average elevator belonging on the boundary of the cash grain region. An elevator which belongs north of this boundary and, therefore, defined as a cash grain elevator must receive more than 998,250 bushels of corn per year, 497,759 bushels of beans per year, 1,712,150 bushels of total grain per year, and have a capacity greater than 660,500 bushels with over 331,650 bushels expanded capacity having occurred over the last five years. It should receive less than 102,600 bushels of wheat per year, and receive its total amount of grain from a radius less than 7.8 miles. It also should not have the function of selling feed. Any elevator which has no factors falling either within the range for average elevators or within the definition of a cash grain elevator, belongs south of the cash grain

boundary (Table 6).

TABLE 6

DEFINITION OF ELEVATORS BELONGING NORTH OF, SOUTH OF, AND ON THE CASH GRAIN BOUNDARY

| | North of Boundary | On Boundary | South of Boundary |
|---|---|---|---|
| Av. corn received (bushels) | 998,250 | 816,750 - 998,250 | 816,750 |
| Av. beans received (bushels) | 497,750 | 407,250 - 497,750 | 407,250 |
| Av. wheat received (bushels) | 102,600 | 102,600 - 125,400 | 125,400 |
| Av. total grain received (bushels) | 1,712,150 | 1,400,850 - 1,712,150 | 1,400,850 |
| Av. total capacity (bushels) | 660,500 | 540,450 - 660,500 | 540,450 |
| Av. expanded capacity (bushels) | 331,650 | 271,350 - 331,650 | 271,350 |
| Av. radius from which grain received (miles) | 7.84 | 7.84 - 9.58 | 9.58 |

## Location of New Boundary

In order to establish the southern boundary of the cash grain region based upon this definition of a cash grain elevator, each elevator was ranked according to how well it fit the definition. The interviews taken at each of these elevators were examined and a table was prepared showing the number of factors of the definition each pos-

sessed (Table 7). For each of the seven factors listed in the definition, the elevators were given a mark in the "north" column, for north of the boundary, if any of the figures for the elevators fit the definition. If any of these figures fell within the ranges for average elevators then they received a mark in the "within" column and if their figures for these factors were below the range they received a mark in the "south" column, for south of the boundary.

After this was completed, those interviews showing an approximately even number of marks in the "north" and "south" columns, such as 4 "north" and 3 "south" or vice versa, were examined for their shipping destinations for corn and their function of selling feed. If they did not sell feed and most of the corn was shipped out of the state the elevators were classified as cash grain. If they sold feed and shipped locally they were classified as belonging south of the boundary and if they had an even number of marks in the "north" and the "south" columns they were classified as belonging on the boundary.

The elevator locations were then placed on a map by a symbol identifying them as belonging north, south, or on the boundary (Figure 4-1). The boundary line was then drawn as smoothly as possible to divide the cash grain elevators from the elevators belonging south of the boundary. Some interpolation was necessary where large dis-

TABLE 7

CLASSIFICATION OF ELEVATORS

| Number of elevator* | North | South | Within |
|---|---|---|---|
| 1 | 2 | 5 | |
| 2 | 4 | 2 | 1 |
| 3 | 5 | 2 | |
| 4 | 4 | 1 | 2 |
| 5 | 5 | 2 | |
| 6 | 3 | 4 | |
| 7 | 5 | 2 | |
| 8 | 4 | 2 | 1 |
| 9 | 5 | 2 | |
| 10 | 2 | 5 | |
| 11 | 6 | 1 | |
| 12 | 2 | 6 | |
| 13 | 5 | 1 | 1 |
| 14 | 4 | 2 | 1 |
| 15 | 4 | 2 | 1 |
| 16 | 2 | 5 | |
| 17 | 6 | | 1 |
| 18 | 2 | 4 | 1 |
| 19 | 5 | 1 | 1 |
| 20 | 2 | 4 | 1 |
| 21 | 1 | 6 | |
| 22 | 1 | 6 | |
| 23 | 6 | 1 | |
| 24 | 5 | 2 | |
| 25 | 6 | 2 | |
| 26 | 5 | 2 | |
| 27 | 1 | 6 | |
| 28 | | 7 | |
| 29 | 2 | 5 | |
| 30 | 1 | 6 | |
| 31 | | 7 | |
| 32 | 1 | 5 | 1 |
| 33 | 3 | 4 | |
| 34 | 1 | 6 | |
| 35 | | 7 | |
| 36 | 1 | 6 | |
| 37 | 1 | 6 | |
| 38 | 1 | 6 | |
| 39 | 3 | 4 | |
| 40 | 1 | 6 | |
| 41 | 1 | 6 | |
| 42 | 3 | 3 | 1 |
| 43 | 1 | 6 | |

TABLE 7

CLASSIFICATION OF ELEVATORS (CON'T)

| Number of elevator* | North | South | Within |
|---|---|---|---|
| 44 | 1 | 6 1 | |
| 45 | 5 | 11 | |
| 46 | 4 | 111 | |
| 47 | | 5 11 | |
| 48 | 1 | 5 1 | |
| 49 | 111 | 111 | 1 |
| 50 | 11 | 1111 | 1 |
| | | | |
| | | | |
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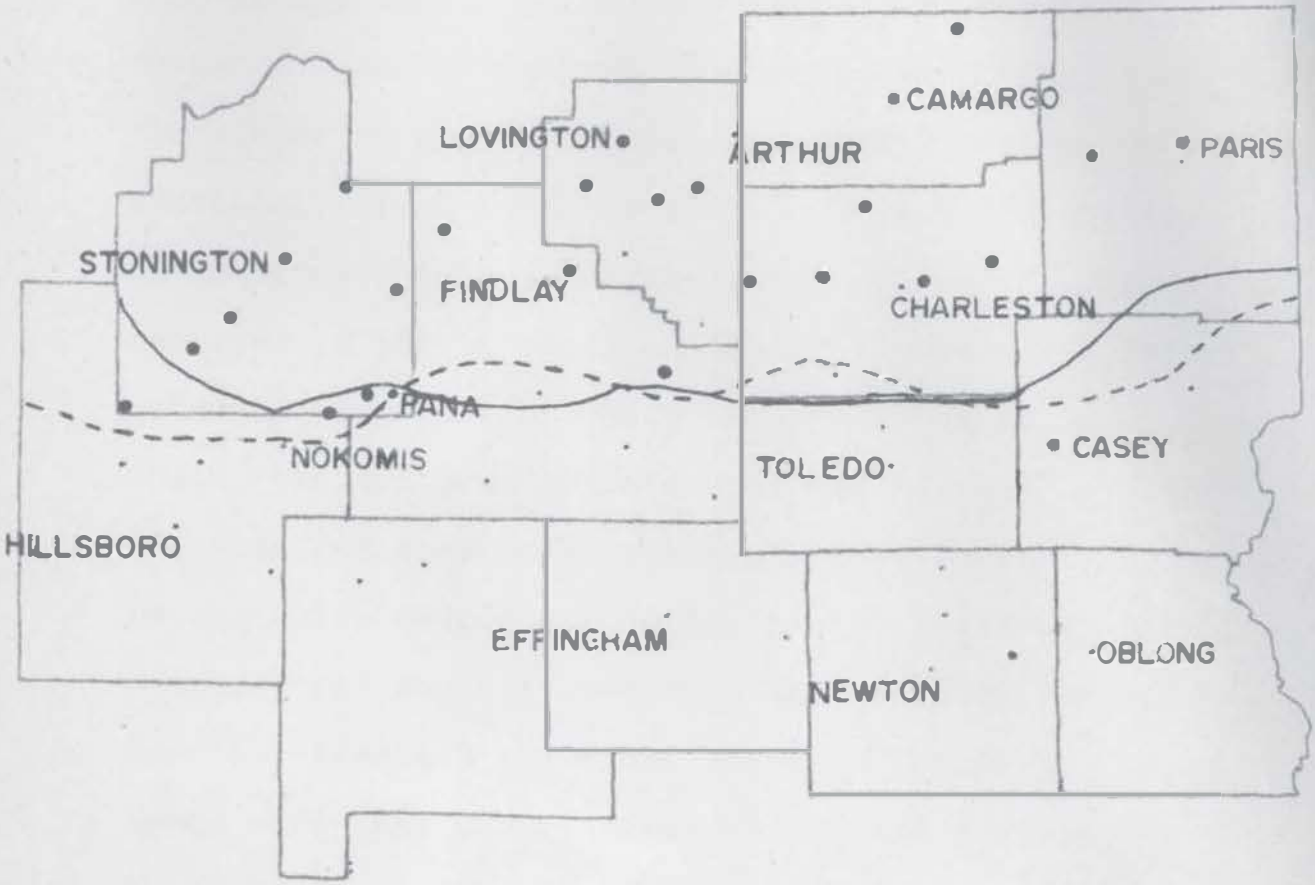
# NEW LOCATION OF THE CASH GRAIN BOUNDARY




SCALE

0 10 20 30 40

miles

LEGEND

- CASH GRAIN ELEVATOR
- ELEVATOR BELONGING ON BOUNDARY
- ELEVATOR BELONGING SOUTH OF BOUNDARY
- – – – NEW CASH GRAIN BOUNDARY
- ——— 1956 CASH GRAIN BOUNDARY ACCORDING TO ROSS AND CASE

KF

FIGURE 4-1

tances existed between elevators. Exceptions were allowed to exist where it would have been impossible to extend the boundary to include or exclude certain elevators.

The boundary, drawn from the elevator interviews, begins in the southeast corner of Edgar County, runs through the center of Clark County, through the northeast corner of Cumberland County, into Coles County, through the center of Shelby County, and finally through the southeast corner of Christian County and the northern part of Montgomery County (Figure 4-1). There are several exceptions in the location of the elevators along this boundary, but many of these are easily explained. In some areas, the cultural practices of the farmers have lessened the need for elevators. This practice is true especially in the Amish settlement in the region bordering Coles, Douglas, and Moultrie county. Here much of the grain is used for feed and therefore stays on the farms. In some towns more than one elevator exists and competition between these elevators reduces the volume of grain received by one or the other of these elevators forcing one to rely upon other functions such as a grain bank[27] for feed for the farmers. South of the boundary, the elevators were

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[27]A grain bank is a service provided by an elevator whereby a farmer can store his grain in the elevators and can get the grain back a little at a time as he needs it for feed. This grain is not sold to the elevator so it is not included in amount of grain received by an elevator.

located farther apart and many received almost as much grain as those north of the boundary, but from a much greater radius in miles. All the exceptions cannot be explained, however, and some were allowed to remain without explanation so the boundary would not be disrupted. The new boundary conforms very closely to the one drawn by Ross and Case in 1956 (Figure 4-1). The eastern and western ends of the new boundary lie approximately five miles south of the older boundary, but the central part of the new boundary conforms closely to the older one and runs north and south of that boundary in some places. The ends of the 1956 boundary were farther north than the central part and these parts have been refined southward. The central part of the older boundary has been reinforced by the new boundary to run fairly close to the center of Shelby County and the border of Coles and Cumberland counties.

This new boundary is in no way intended to be a precise cutoff between cash grain farming and the other types of farming that exist in the region. The accuracy of this boundary is contingent upon the reliability of the information given by the elevator managers interviewed, and the definition used to establish the cash grain elevators. In areas where managers refused to give interviews or where elevators had recently closed, the boundary will be least precise. The location of the boundary drawn is

the best location that can be drawn based upon the information that was gathered. Comparing the locational relationship of the two boundaries in Figure 4-1, no gross inaccuracies can be found to exist in the position of the new boundary. Since the new boundary is not connected to systematic division lines, it has proved a fairly reliable method of refining and reinforcing the cash grain boundary.

# CHAPTER V

## SUMMARY, CONCLUSION, PROSPECT

Since 1956 there has been no attempt to redefine the boundary of the cash grain farming region in Illinois that has resulted in a redefinition of that boundary. An outdated definition based upon some factors that no longer pertain to this boundary was still in existence. This paper develops a different method of determining the southern boundary of the cash grain region based upon differences in country grain elevators located throughout an area surrounding the boundary defined in 1956. Country grain elevators were chosen for this purpose since they reflect the amount of grain produced and the presence of livestock in an area.

Elevator managers throughout the area were interviewed about information concerning the amount and kinds of grain received, the capacity of the elevators, the destination of the shipment of grain, the kinds of functions performed, the number of employees hired, and the expansion that has occurred in the last five years. Statistical comparisons were made for these factors for the elevators located north and south of the 1956 boundary. The

major differences noted were in kinds and amounts of grain received, total capacity of the elevators, expanded capacity of the elevators, the radius in miles from which the grain is received, and whether or not an elevator performed the function of selling feed. These factors were then chosen to define a cash grain elevator.

The elevator interviews were tabulated to find the averages for each of the major differences encountered. A 10% confidence interval of each average was added to and subtracted from each average and a cash grain elevator was defined as one which had figures above the upper limit of the intervals for these factors. The definition of a cash grain elevator is one which receives more than 998,250 bushels of corn per year, 497,750 bushels of soybeans per year, 1,712,150 bushels of total grain per year, and has a total capacity greater than 660,500 bushels with over 331,650 bushels capacity having been added in the last five years. It should receive less than 102,600 bushels of wheat per year and receive its total amount of grain from a radius of less than 7.8 miles. It should not perform the function of selling feeds.

The new southern boundary of the cash grain farming region in Illinois was then drawn immediately south of the location of the cash grain elevators just defined. A few exceptions in the location north and south of the boundary

were allowed for certain elevators in order not to interrupt the boundary. The new southern boundary of the cash grain region is defined to run from the southeast corner of Edgar County, through the center of Clark County, through the northeast corner of Cumberland County, into Coles County, through the center of Shelby County, and finally through the southeast corner of Christian County and the northern part of Montgomery County. The new boundary differs from the 1956 boundary on the eastern and western ends where it lies south of the older boundary. The new boundary reinforces the location of the central part of the older boundary.

The major conclusions to be drawn from this study are: (1) the elevators located north of the cash grain boundary are built mainly from concrete silos and concrete structures, receive an average of 1,392,000 bushels of corn per year, 518,000 bushels of beans per year, 79,000 bushels of wheat per year, 1,988,000 total bushels of grain per year, have an average capacity of 767,000 bushels with 338,000 bushels added capacity having been built in the last five years, receives most of the grain from an average radius of 8.37 miles, and does not perform the function of selling feeds. Most of these factors are a result of a large production and cash sale of grain in the northern counties. (2) the elevators located south of the boundary

are built mainly from a combination of concrete silos and wooden buildings, receive an average of 623,000 bushels of corn per year, 387,000 bushels of beans per year, 149,000 bushels of wheat per year, 1,125,000 bushels of total grain per year, have an average capacity of 434,000 bushels with 265,000 bushels of added capacity having been built in the last five years, receive most of the grain from an average radius of 9.05 miles and perform the function of selling feeds and seeds. These averages differ from the northern elevators because of a smaller production and cash sale of grain and a larger production of livestock in the southern counties. Most of the other factors are approximately the same for the northern and southern elevators. (3) Based upon these factors, country grain elevators are important indicators of the location of the cash grain boundary, and form a reliable method for defining that boundary.

This study was limited to only the southern boundary of the cash grain farming region in Illinois. A study based upon this method now needs to be made to define the remaining portions of the cash grain boundary in the state. The same technique might be used for cash grain studies in other states and even other countries. Other types of farming regions could be defined using other kinds of cultural features that are of particular importance in those regions. A study of this type could also be used to locate

an elevator in an agricultural region and to help choose the proper type and size of the elevator to be located.

Elevators throughout the study area are undergoing many changes. Over half the elevators in the study area have undergone expansion in the last five years with over 60% of those south of the boundary having undergone expansion during this time. This expansion, showing greater sales of grain, lends evidence that future locations of the cash grain boundary may continue to move southward. With this increased size of elevators, many small elevators which have not been expanded are being closed and others are being merged together to form cooperatives and associations. The elevators of the future in this area may be large structures with several million bushels capacity and receiving grain from tens of miles of distance, thereby reducing the number and density of elevators. This specialization of serving one function, that of handling grain only, will result from increasing cash grain acreage to the south, but may also affect the type of farming in the area through more favorable prices and increased grain handling services. The elevators, through these changes, will be indicators of changes in farming practices such as the amount of grain and livestock produced, types of crops grown, and methods used by farmers to store and sell their grain. Therefore, country grain elevators will remain to

this area important indices of farming types and the boundaries which divide them.

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# APPENDIX A

## Interview Sheet for

## Elevator Study

GRAIN ELEVATOR STUDY
EASTERN ILLINOIS UNIVERSITY

1. Firm name _____

2. Address _____

_____

3. Location if not at exact address

4. Would you consider your firm to be mainly a
   a. Country elevator (gt. than 50% of grain received from farmers) _____
   b. Terminal elevator (gt. than 50% of grain received from other elevators. Has terminal market location) _____
   c. Sub-terminal elevator (gt. than 50% of grain received from other elevators. Does not have terminal market location) _____
   d. Export elevator _____

5. Approximately how many bushels of grain per year do you handle directly from

| farmers: | | from other elevators: | |
|---|---|---|---|
| corn | _____ | corn | _____ |
| beans | _____ | beans | _____ |
| wheat | _____ | wheat | _____ |
| oats | _____ | oats | _____ |
| other | _____ | other | _____ |

What is the approximate radius (in miles) from hich the farmers bring their grain?
_____

6. What is your total elevator capacity in bushels of shelled corn? _____
What is your storage capacity in bushels of shelled corn? _____
Do you handle any sealed grain stored for the government? If so how many bushels _____ and what is your storage capacity? _____

7. List in order your main means of shipment--rail_____, trucks_____, water_____
To what destination do you ship your

| corn | soybeans | wheat | other |
|---|---|---|---|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

8. Do you sell feeds _____; Seeds_____?
List in order your feed sales and seed sales.

9.

| | |
|---|---|
| hog feed _____ | corn _____ |
| beef cattle _____ | soybeans _____ |
| dairy cattle _____ | wheat _____ |
| poultry _____ | oats _____ |
| | clover, alfalfa, etc. _____ |

9. How many people do you employ? _____

10. Have you expanded your facilities in the last five years? _____ if so, by how many bushels? _____ How many people did you employ after the expansion?
_____

11. Do you have facilities for drying grain? _____

# APPENDIX B

## Fortran IV (G) Program

## for Correlation

```
      C     PROGRAM TO FIND CORRELATION
      C     GEOG. 595  KEN FOLKERTS
            DIMENSION XRAY(100),YRAY(100),XRA(100),YRA(100)
            DIMENSION XRASQ(100),YRASQ(100),XYRAY(100)
      C
      C     HERE THE X AND Y VALUES ARE READ INTO ARRAYS.
            M=1
      20    READ (5,100,END=30) XRAY(M),YRAY(M)
      100   FORMAT (2(F7.2,2X))
            M=M+1
            GO TO 20
      C
      30    M=M-1
            SUMX=0.0
            SUMY=0.0
      C
      C     HERE THE MEANS OF X AND Y ARE FOUND.
            DO 40  J=1,M
            SUMX=SUMX+XRAY(J)
      40    SUMY=SUMY+YRAY(J)
      C
            XBAR=SUMX/M
            YBAR=SUMY/M
            SUMXSQ=0.0
            SUMYSQ=0.0
            SUMXY=0.0
      C
      C     HERE THE X,Y,XSQ,YSQ,ANO XY TABLES ARE COMPUTED.
            DO 50  J=1,M
            XRA(J)=XRAY(J)-XBAR
            XRASQ(J)=XRA(J)*XRA(J)
            SUMXSQ=SUMXSQ+XRASQ(J)
            YRA(J)=YRAY(J)-YBAR
            YRASQ(J)=YRA(J)*YRA(J)
            SUMYSQ=SUMYSQ+YRASQ(J)
            XYRAY(J)=XRA(J)*YRA(J)
      50    SUMXY=SUMXY+XYRAY(J)
      C
      C     HERE THE CORRELATION VALUE IS COMPUTED.
            P=SUMXSQ*SUMYSQ
            Q=SQRT(P)
            R=SUMXY/Q
      C
      C     HERE THE INFORMATION IS PRINTED.
            WRITE (6,104)
      104   FORMAT (' ',' CAP X',8X,'CAP Y',10X,'X',12X,'Y',11X,'XSQ',10X,
           A 'YSQ',11X,'XY')
            WRITE (6,106)
      106   FORMAT (' ','      ')
            DO 60  I=1,M
      60    WRITE (6,102) XRAY(I),YRAY(I),XRA(I),YRA(I),XRASQ(I),YRASQ(I),
           A XYRAY(I)
      102   FORMAT (' ',7(F8.2,5X))
            WRITE (6,105)
      105   FORMAT (' ','________',5X,'________',31X,'________',5X,
           A '________',5X,'________')
            WRITE (6,103) XBAR,YBAR,SUMXSQ,SUMYSQ,SUMXY
      103   FORMAT (' ',2(F8.2,5X),26X,3(F8.2,5X))
```

FORTRAN IV G LEVEL 21 MAIN DATE = 73076

```
0042                WRITE (6,101) R
0043          101   FORMAT ('0','R= ',E14.7)
0044                RETURN
0045                END
```