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The determination and analysis of Iowa land values

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The determination and analysis of Iowa land values

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CHAPTER I. INTRODUCTION

The continued increase in farm real estate values and the increased activities involving farm property have fostered a growing awareness on the part of many persons, both in and out of the agricultural community, of the need for fair market value estimates of agricultural land. This need may arise from situations such as the following [87]:

1. To buy, sell, trade, or transfer property.
2. To establish the bases for depreciating improvements in tax schedules.
3. To settle insurance or casualty claims.
4. To assess the subject property for real estate tax purposes.
5. To obtain the basis for federal estate or state inheritance taxes.
6. To extend credit to the owner, using the property as security.
7. To liquidate the property, using the asset's sale price to settle all encumbrances.
8. To establish just compensation to the property owner in instances where the government is taking either all or part of the property for public use.

However, supplying a market value estimate does not necessarily indicate the fair market value estimate which is desired for use in a particular situation. The definition of fair market value as used by the General Service Administration reflects the majority of definitions in common usage today:

> Fair Market Value: The highest price estimated in terms of money which the property will bring if exposed for sale in the open market by a seller who is willing but not obliged to sell, allowing a reasonable time to find a buyer who is willing but not obliged to buy, both parties having full knowledge of all uses to which it is adapted and for which it is capable of being used [77].

Given the reasons for needing fair market value estimates and the components of such estimates, a novice may perceive little problem. However, nowhere in the real world is the theory of value perhaps more difficult to apply than in the appraisal of farm real estate.

The measure of a farm's value is the degree of its utility and the scarcity of comparable utilities in the minds of the present and prospective owners [4]. Value is the result of a demand by a desirous person for the rights of use to a property desired. A precise determination of the price for which the rights of ownership will sell must presuppose a precise determination of human reactions [77]. However, there exist multiple desires, multiple sources of satisfaction, and hence multiple reasons for farm ownership with each person possessing a different set of premiums to assign to these factors. Complicating the situation more are the impossibilities of cardinal utility measurements and interpersonal utility comparisons. Therefore, value can only be estimated.

Adding to the problem of estimating fair market value is the fact that no two farms are identical. They differ in size, productivity, improvements, location, community services, etc. Compounding the problem are the dynamics within the agricultural sector generated from both internal and external forces. During the last two decades farm operators have found their competitive positions greatly enhanced through some of the following internal practices [87]:

1. Continued adoption of new technologies, e.g., improved hybrid seed varieties, fertilizers, new insecticides and herbicides, larger and more advanced machinery, mechanized feeding facilities, etc.
2. Addition of increasingly larger amounts of capital.
3. Specialization in those enterprises most advantageous.
4. Sizeable increases in size or volume.

Simultaneously the farm sector is subject to external forces which motivate the activities of all people. These include social institutions, economic adjustments and changes, political or governmental regulations, and physical or natural forces. Combined, these forces result in a high degree of dynamics operating in the farm real estate area.

The three aforementioned problems of the impossibilities of cardinal utility measurements and interpersonal utility comparisons, the extreme heterogeneity between farms, and the rapid changes prevalent within the farming sector have led to a fourth problem, that of the nonexistence of any organized farm real estate markets. At best, national and regional markets are disorganized. At the county level there may be more market organization but still there exist dispersed and frequently unaccounted for actions of bidders, buyers, and sellers. According to Schmutz [77]:

> The consequence of these market characteristics is the added risk to the generally accepted conditions of uncertainty in entrepreneur decision-making.

Realizing the problems in the search for fair market farm value estimates, the appraisal profession has developed three main scientific, or objective, approaches to farm valuation [87].

1. The sales comparison or market value data approach tends to establish that value most closely approximating a farm's present value in the market, providing that recent, nearby, and comparable sales are available. These comparable sales are used to estimate a subject property's present market value.
2. The earnings or income capitalization approach indicates the capitalized value of a farm based upon expected long-term earnings, assuming an appropriate rate of interest.
3. The inventory or cost approach assumes that an informed buyer, free to act without haste or pressure, will not usually offer an amount of money more than the market value of comparable land plus the cost of replacing all buildings and improvements (less depreciation).

Successful use of one or more of the appraisal approaches, however, depends critically on a relevant data base. Historical land value indices and relationships are necessary to generate meaningful current estimates via the appraisal process. The purpose of this study is to present a data base for, and an analysis of, Iowa farmland values. Part II contains a historical account of the changes in Iowa farmland values from 1838 through 1975. Part III discusses the development, use, and shortcomings of the sales and income approaches. In addition, statistical approaches to farmland valuation and major land value surveys for Iowa are examined. Part IV presents a development of a land value data base. Land value survey and soil survey information are combined to generate annual, county farmland value estimates. Part V develops a statistical analysis of some of the determinants of value for Iowa farmland. Finally, Part VI offers a summary and conclusion of the study.

CHAPTER II. HISTORY OF IOWA LAND VALUES: 1838-1975

The history of Iowa land values presents valuable insights into relevant factors affecting the land market and the development of valuation techniques. This summary will be divided into five time periods. The first is 1838-1860. During this period the Federal Government sold the majority of Iowa's land to private individuals. The second period, 1861-1900, witnessed the development of Iowa's present agricultural sector. Most of Iowa's land was divided into actual farms, and the transportation and marketing infrastructure was developed. A period of speculation began in the early 1900's and culminated with the great land boom of 1919 to 1920. This speculative period was followed by a general depression from 1921 through 1940. Mortgage foreclosures became common. At one point, corporate lenders owned 12 percent of Iowa's farmland. The fifth period, 1941-1975, was characterized by war, increasing farm technology, world trade, and increasing farmland values.

1838-1860: Government Sales of Iowa Land

In 1838 the Federal Government began auctioning Iowa land to settlers for a minimum price of $1.25 an acre as established by an act passed in 1820 for the disposal of public lands [32]. Land not sold at auction was placed on the market two weeks later at private entry. This meant that the land was available to anyone paying the minimum price or presenting a military land warrant. On September 4, 1841 President Tyler approved the Land Distribution Act granting preemption rights to pioneers who had taken possession of the land before it was offered for sale. This act was retroactive to June 1840, and it required the settlers to pay the minimum price [47]. The majority of Iowa land sold for military land warrants. These warrants became available largely after the Mexican War, and an extensive secondary market was established to exchange these warrants for money. Soldiers often preferred cash to land and would sell their warrants at a discount [52].

The course of settlement of Iowa land proceeded from the southeast to the northwest [46]. The most valuable land in Iowa through the 1850's was tracts combining timber, dry prairie, water (especially a spring), and nearness to a navigable river. These characteristics were desired for providing, simultaneously, farmable land, shelter, fuel, building and fencing materials, water, and transportation. Early settlers were forced to think first of maintenance and comfort. The presence of timber, fuel, and building stone was considered vastly more important than the richness of the soil [46]. Another feature of the early land market prior to 1860 was the vast difference between the values for improved vs. unimproved farms. The labor cost for developing a farm was greater than the cost of the raw land. The Federal Census listed farms with buildings and broken sod at $10 to $15 an acre while raw land was still available at $1.25, or $2.50 if it was within six miles of a railroad [47] (Table 2.1) [52].

Table 2.1. Percentage of land in farms and the value per acre of this land according to the Federal Census for Iowa

Census Year	Percent of Land in Farms	Value/Acre Land in Farms
1860	28%	$12
1870	43	20
1880	69	23
1890	85	28
1900	96	43

1861-1900: Values Based Upon Income and Improvements

This period of land price increases is termed economic because land prices rose largely, if not entirely because of increased income per acre or increased public expenditures upon roads, ditches, schools, etc. These improvements increased land values by more than the amount of the initial outlay [46].

The Homestead Act of 1862 made the remaining lands under public ownership free for settlement, but this concerned a relatively small amount of land in northwest Iowa. Only 887,840 acres of Iowa land were privately acquired under this provision [100]. By 1870 nearly all Iowa land was under private ownership, but only 43 percent was in farms (Table 2.1), indicating the presence of land speculators [52]. The development of a transportation and marketing infrastructure and an increased population were required to utilize Iowa's natural resources. The coming of the railroads in the late 1860's and 1870's helped supply both requirements.

Migration to eastern and southern Iowa proceeded rapidly without the prospects of the railroad, but the same would not have been true for the settlement of the remainder of Iowa which lacked the natural provision of building and energy resources and river transportation. It was the railroads that supplied the prairie communities with their import needs such as coal from southern Iowa and lumber from Minnesota. For example, in 1868, one year after the Rock Island entered Des Moines, twenty million board feet of lumber were sold in that area [46]. Simultaneously the railroads provided an economically feasible means for exporting the prairie farm commodities. Prior to the rail, an acre of corn on the open prairie was valueless because transportation costs were greater than central market prices. The Government realized the importance of rail transportation to developing areas, and gave free land grants to railroad companies to hasten their spread. As a result, railroads and communities spread out over Iowa, and more land was brought under cultivation.

A second, simultaneous factor causing an increase in production was an "Agrarian Revolution" beginning in 1865. New farm machinery was introduced and perfected; crop and livestock breeding was instituted; and the productivity of all land was increased. Thus the farmer could till more acres with a decrease in per acre costs of production [100].

The rapid settling of the Public Domain and the increased technology applied to the farming sector caused production to increase faster than did industrial population. During the period of 1865-1895 agricultural prices declined. From 1860 to 1900 the high for a bushel of corn was 70 cents in 1864. The average for the forty year period was 33 cents a bushel. For hogs the high was $7.75 a hundred in 1869. The forty year average was $4.56 [52]. This decline was reflected in the value of land. In 1870 the average value for improved farms was $20 an acre; by 1880 it had risen only to $23 (Table 2.1). If not for the improved farming techniques, the drop in commodity prices would have precipitated a depression, or at least a stagnated market. However, although foreclosures were common, a farmer's dollar was buying more [100]. According to the 1921 Yearbook of Agriculture [93], the purchasing power of a bushel of corn in terms of 1913 dollars was greater than the price per bushel for the period 1877-1910.

A fourth major factor stimulating development was immigration into Iowa. Lands were opened at a time when Europe stood ready to send immigrants to the New World [46]. Iowa communities and railroads advertised in the East and in Europe about the opportunities available in Iowa. Information concerning the ease with which Iowa farms could produce large yields with low operating costs relative to other states became widespread. Emigrants from, mainly, Illinois and Ohio and immigrants from Northern Europe streamed across the prairie. In 1865 the population of Iowa was 756,209; by 1895 it was 2,058,069, bringing approximately 90 percent of the land into farming [100].

The population influx exhausted the supply of free lands around 1890. The average value of improved farmland was $28 an acre (Table 2.1). The disappearance of good grades of free land had psychological and real effects [46]. The feeling of impending land scarcity had a significant effect on the speculative demand for farmland. The real effects were the simultaneous decrease in the supply of land and increase in the demand as prospective purchasers were forced to buy at home due to the lack of alternative opportunities farther west. With no decrease in income per acre, the decrease in supply and the increase in demand naturally caused an increase in the price of land. After 1896 the price trends of corn and Iowa farmland began to rise together. By 1900 the average farm value had jumped to $43 an acre (Table 2.1).

Thus, this period witnessed the development of the foundation of Iowa's present agricultural sector. Factors contributing to the rapid development and increasing land values were: 1) income from the rich, treeless, prairie soil; 2) railroads providing a transportation and marketing infrastructure; 3) an "Agrarian Revolution"; and 4) a large immigration.

1901-1920: Speculation

This period may be termed speculative because of the rapid decline in the rate of return for the first decade and a continued low rate of return thereafter while land prices continued upward. Taking a cross-section of Iowa counties during the first decade, the average rental rate for Cherokee, Jefferson, and Montgomery counties increased from $3.48 to $4.40 while the price of land increased from $40.46 to $98.50. The large increase in the price of land relative to the increase in rents resulted in a decline in the rate of return from 8.8 percent in 1900 to 4.5 percent in 1910. Including Story and Fayette counties in the analysis from 1911 through 1920, the average rate of return for 1911-1918 remained at 4.5 percent. In 1919 it rose to 5.0 percent, and dropped to 3.9 percent in 1920 [46]. It was a time when the importance of expectations as a factor of demand became obvious. A constantly increasing part of the purchase price was based upon expected future increases in the price of land. Farm values were becoming based more upon a comparable sales approach with the valuation process being typified by "horseback," or "windshield," appraisals [53].

By 1900 rising corn prices had begun sending the price of farmland on an upward path. There were rational reasons for further land value increases, but the degree of rise in relation to the rate of increase in income indicated the existence of buyers in the market interested in land ownership primarily for annual increases in price. In 1900 the average estimated value of an improved farm was $43 an acre; corn was 30 cents a bushel. In 1910 the average value was $96 an acre; and corn was 49 cents a bushel [14], (Table 2.2).

The rapid decline in the rate of return from 1900 to 1910, and the continued low rate of return in the second decade clearly indicated that a large part of the purchase price was unremunerative regarding annual income. Some farmers and nonfarmer investors began viewing farm ownership as a get-rich scheme. The speculative movement was further stimulated by the price inflation during World War I. In 1914 the price of land was $124 an acre; corn was 60 cents a bushel. By 1919 land was $192 an acre; corn was $1.41 a bushel [14].

Events of the years 1901-1918 set the stage for a speculative splurge that culminated with the farmland boom of 1919-1920. Prices of farm products and farms had risen for so many consecutive years that practically everyone believed the trend would continue. Farmers and investor speculators acquired money to make down payments on farm purchases. From March 1919 to March 1920 farm values rose from an average of $192 to $255 an acre. Many sales were at $400 to $500 an acre [52]. It is probable that very little consideration was given to a level of product prices that could support the high land prices of that year.

Table 2.2. Estimated market value per acre of improved Iowa farmland

Year	Value	Year	Value	Year	Value	Year	Value
1850[a]	$ 6	1917	$160	1941	$ 88	1964	$265
1860	12	1918	174			1965	293
1870	20	1919	192	1942[b]	100	1966	331
1880	23	1920	255	1943	119	1967	362
1890	28	1921	235	1944	130	1968	375
1900	43	1922	194	1945	140	1969	382
		1923	186	1946	149	1970	385
1901[c]	48	1924	171	1947	167	1971	395
1902	58	1925	162	1948	176	1972	440
1903	66	1926	155	1949	177	1973	579
1904	66	1927	145	1950	197	1974	756
1905	67	1928	140	1951	212	1975	989
1906	75	1929	139	1952	209		
1907	78	1930	135	1953	198		
1908	82	1931	117	1954	205		
1909	93	1932	96	1955	215		
1910	96	1933	69	1956	220		
1911	110	1934	75	1957	226		
		1935	80	1958	244		
1912[d]	115	1936	87	1959	252		
1913	118	1937	87	1960	237		
1914	124	1938	88	1961	237		
1915	134	1939	88	1962	241		
1916	153	1940	88	1963	250		

[a]Source: [52].

[b]Source: [36].

[c]Source: [52].

[d]Source: [52].

1921-1940: Depression

The 1921-1940 period was one of depression for the Iowa farm sector. The vast market for agricultural commodities that had existed during and immediately after World War I had vanished. Simultaneously, increased mechanization and technology applied to agriculture along with changing consumer tastes resulted in large scale overproduction [12]. The farmer's purchasing power dwindled as costs increased. Foreclosures became common, and an intensive study was instigated in the 1930's to improve farm loan appraisal technique. The result was the "productivity method," or the income approach. When the depression finally ended, so had the unscientific method of "windshield appraisals."

In 1921 the farm sector suffered the first of a series of troubles. Corn, which had been averaging over $1.00 a bushel and actually selling for $2.00 a bushel in the summer of 1919, plunged to 41 cents. Some farm owners tried to borrow money in order to meet the interest payments on their farm mortgage debt. They hoped that the next year would bring higher corn prices [52]. However, corn prices remained low, averaging only 69 cents a bushel from 1921-1930 [14]. As a result, foreclosures and bank failures became common.

The 1920's were known as the junior mortgage depression because foreclosures were largely of this type. From 1921 through 1930 there was an average of 1,500 foreclosures a year [57]. Farm values during this junior mortgage depression declined steadily. The average estimated value per acre by 1930 had dropped to $135, or down $12 a year (Table 2.2). The senior or first mortgage depression hit in 1931. Corn prices were down to 43 cents a bushel and continued to drop to 23 cents in 1932. Hogs declined from $7.62 a hundred in 1921 to $3.20 in 1932 [14]. These low commodity prices were the main causes of the first mortgage depression. They made it virtually impossible to do much more than pay property taxes and current operating expenses, with nothing left to pay the interest on a first mortgage. In 1932 taxes were double the 1917 level, while farm commodities were selling for only half as much as during the pre-war period [12]. The low point in farm values came in 1933 with an average of $69 an acre. In the years 1932, 1933, and 1934 the number of foreclosures was 6400, 3700, and 3900 respectively [57].

Between the depth of the depression in 1933 and 1940, there was some recovery, but not much. The Federal Government began trying to implement policies which would restore purchasing power to the farmers and simultaneously control production. Estimated farm values had risen to $87 an acre by 1936, but the next four years showed little change. In 1940 the estimated farm values were still averaging $88 an acre. Two main factors were responsible for keeping farm values low in the late 1930's. One was the large supply of farms owned by corporate lenders who wanted to sell. By 1939 these institutions held 12 percent of the Iowa farm area [52]. The second reason was that farmers had just witnessed a 13 year decline in farm prices. Expectations were low. This large supply with the low demand naturally kept the price of farmland down.

1941-1975: Rising Iowa Farmland Values

The years 1941-1975 represented a period of war, increasing farm technology, world trade and rising land values. At the beginning, the income approach was the major land valuation procedure. However, in the mid 1950's, due to changing technology and consumer tastes, the productivity method no longer explained the changes in land values. The comparable sales approach began to assume the dominant role and has maintained that position through the present time.

World War II started farm values on the first major upward trend since the land boom of 1919-1920. Corn, averaging 39 cents a bushel in 1939, was up to $1.00 in 1944 and $1.85 by 1948 [66]. Land values had doubled from $88 an acre to $176. The ingredients for another land boom were present, but an active educational campaign against land speculation and unpleasant memories of the recent past prevented its occurrence [52]. Then came the Cold War and Korean Conflict which helped maintain farm product prices and farm values. Following the Korean Conflict, there was a small decline in values in 1952 to 1953. Then values started up at a steady pace [36].

At this time a new "Agrarian Revolution" began. The implementation of new farm technology, e.g., larger equipment, improved seed hybrids, fertilizers, herbicides, pesticides, etc. showed striking results. In 1954 the average farm size was 178 acres, and the average corn yield was 54 bushels an acre; in 1973 the average farm size was 257 acres and the average yield was 107 bushels [33]. Individual farmers became increasingly specialized in their operations. The marginal product of capital was increasing relative to that of labor, causing increasing capital intensiveness. One man was able to farm more land, and farm enlargement became a major factor in the land market. For farmers to compete with fellow farmers, they had to continue the farm enlargement process to utilize the economies of scale offered by the new farm machinery, and to spread the higher fixed costs over additional acres. Overproduction again became a large problem. The Federal Government passed the Agricultural Act of 1956 which created the Soil Bank Program. It was during this period that the comparable sales approach began receiving increasing emphasis.

In 1965-1967 Iowa land values took their next major jump. According to the annual Iowa Land Value Survey [36] conducted by the Iowa Agricultural Experiment Station, the average value of land in 1956 was $220 an acre; in 1964 it was up only to $265; but by 1967 it had jumped to $362. Farm enlargement was reported as the dominant factor operating in the land market during the 1965-67 period. However, there was still the major problem of overproduction and relatively low commodity prices. In 1967 corn was $1.13 a bushel and beans were at $2.60 [66].

Then in 1972 a combination of global bad weather, increasing populations, increasing income levels, and an apparent easing of world tensions caused an increased effective demand for U.S. farm products on the world market. Suddenly the excess supply of domestic farm commodities vanished. Farm commodity prices and land values soared. In 1972 the average price for corn was $1.11 per bushel. Beans averaged $3.29 a bushel. The average value of an acre of Iowa farmland was $440. During 1973 corn averaged $1.81 a bushel, beans were $6.49, and Iowa farmland averaged $579 an acre, an increase of 31.6 percent since 1972. By the end of 1974 corn was up to $2.87, beans were still at $6.39, and farmland had risen to $756 an acre for a yearly increase of 30.6 percent. This trend in land values continued in 1975. Corn averaged $2.66, beans were $4.93, and land increased in price to $989 an acre, or up 30.8 percent [36, 92]. The increase in farm commodity prices was the principal factor causing a phenomenal 125 percent increase in lard values from November 1, 1972 through November 1, 1975. Iowa farmland appeared to become a prime investment area.

CHAPTER III. FARMLAND VALUATION APPROACHES AND FARMLAND VALUE SURVEYS

Fair market value estimates for farmland are important for the purchase and sale of farm property, farm loans, tax assessments, estate settlements, condemnations, and easements. The necessity for accuracy in these estimates is directly related to the degree of profitability and equity desired. The amount of money at stake is obvious when one considers that the average value of Iowa farmland is nearly $1,000 an acre. Due to the importance of accurate estimates, various land valuation approaches and land value surveys have been developed. The most prevalent valuation approaches are the comparable sales approach and the income approach. Presently, the statistical approach is receiving increasing consideration, especially in academia. Multiple regressions are used to explain the degree to which specific factors explain land values. To establish bench mark values in Iowa, farmland value surveys are conducted by the Federal Census Bureau, the U.S.D.A., the Chicago Federal Reserve, and the Iowa Agricultural Experiment Station. This chapter discusses the usefulness and drawbacks of the prevalent valuation approaches. The major farmland value surveys concerning Iowa will be covered with special attention given to the Iowa Land Value Survey conducted by the Iowa Agricultural Experiment Station.

Farmland Valuation Approaches

The purpose of an appraisal is to determine the market value of a subject property at a particular point in time. This task is often complicated by the imperfectness of the land market and the deficiency of sufficient and dependable data. Therefore, during the history of Iowa farmland valuation, a great deal of controversy has transpired concerning the proper approach. Main emphasis has shifted back and forth between the comparable sales approach and the income approach [98]. Through continuing analysis of the real estate market experience, the comparable sales technique has become the most valid when comparable sales are available. However, for appraisals where a projection of only a purely monetary return is sought for investment or loan decisions, the income approach may still be more relevant. The relatively recent statistical approach draws heavily upon the comparable sales and income approaches for the selection of factors affecting farmland values.[1]

Comparable sales approach

The comparable sales approach to value is an essential part of every farm appraisal. As a method of establishing fair market values on farm real estate, it has become widely accepted as the most authoritative. The prices at which other nearby farms have sold in actual market transactions

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[1]The cost approach mentioned in the Introduction is occasionally used by appraisers, but as Murray states [53]:

> . . . where cost is a factor, it must be included as an approach, but since cost values are limited principally to buildings and other improvements, the cost is a minor procedure in farm appraisal.

are objective rather than subjective values determined by the sellers and buyers of the farms themselves [53].

Sales comparison involves the use of other farms which have recently changed ownership in an open and competitive market; under all conditions requisite to an honest sale; and resulting from negotiations between a buyer and seller, each of whom is reasonably well informed, acting prudently, and neither of whom is under undue stress to buy or to sell. These sale prices presumably include all of the factors affecting value. Hence, the comparable sales approach is definitely realistic.

A comparable sale is defined as a farm or property resembling the subject property in terms of 1) type of farm, 2) farm size, 3) productive capacity, 4) date of sale, 5) location, 6) access roads, 7) extent of the improvements, 8) kind of farm organization, and 9) community facilities. Obviously, comparability does not depend upon a single factor, nor does one or two dissimilarities eliminate the use of a farm in the comparison process [87].

The comparable sales approach is based upon two premises representing applications of the substitution or opportunity cost approach: 1) An informed seller will not sell a property for less than comparable properties are receiving in the market place; and 2) an informed buyer will not pay more for a given property than for an alternative comparable property [87]. However, the prices paid reflect the many idiosyncrasies of farmers, heirs, relatives, businessmen, investors, etc., many of whom have varied motivations. Therefore, the appraiser must not only inspect the various properties which have changed hands, but also be cognizant of the relevant factors operating within the local market.

This approach may be beset with difficulties. The basic heterogeneity of farm real estate and its market imperfections are the principal factors limiting the application of the comparison method [98]. No two parcels of land are exactly alike; never are two sets of improvements identical. It may be difficult to find truly comparable properties in terms of there being no compulsion on either the seller to sell or the buyer to buy; ones for which the date of sale is not too remote in time; and ones for which no particular change has since occurred in the market. Prospective buyers may value each parcel on the basis of differing arrays of conditions because farms often reflect values concerning both tangible and intangible aspects. Market prices are affected by the amounts of land for sale, by the cash and credit resources available, and by the expectations of the potential buyers and sellers. School facilities, community features, sentimental values, and pride of ownership are often of considerable significance. The part-time farmer may place a high value on nonfarm employment opportunities.

Adding to the problem are the facts that: 1) On a per acre basis, good land has a tendency to be underpriced and poor land has a tendency to be overpriced [50, 58, 59, 87]; and 2) farm real estate transactions are often private in nature. Farm sellers and buyers often hesitate to discuss their real motivations for selling or for buying. They are reluctant to disclose the price and terms of the agreement. A bargain to one may be an overpriced luxury to his neighbor, but neither will reveal his true feelings. Also an appraiser may find sales where there is an exceptional buyer or seller. These people canvas the market area over time to find uninformed sellers or buyers. These sales do not approximate fair market value [87].

Given the aforementioned list of problems, the work of the appraiser using the comparable sales approach consists of finding evidence of sales, verifying them, sorting out the comparables, and making adjustments to fit the local market situation.

Income approach

The income approach was the first, definite, step by step approach to farm appraisal. Using this approach, the appraiser's job is to determine the present worth of the future income stream that the farm can generate. This capitalization process[1] is divided into three major steps: 1) estimation of the net income stream; 2) selection of the capitalization rate (discount factor); and 3) processing the net income stream into an estimate of capital value--

$$\text{Value} = \frac{\text{Net Income}}{\text{Capitalization Rate (r)}}$$

Net income can be estimated either by the so-called "landlord" or "owner-operator" income method. Selection of the capitalization rate can

[1]Capitalization refers to the process of converting into present value a series of anticipated future annual installments of income by discounting them into a present worth at a rate which is attracting purchase capital to investments with similar characteristics, such as risk, term, etc. [4].

be based upon either an "income value" or "estimated sale value." Each combination will usually result in a different value estimate.

Murray [53] summarizes the difference between the landlord estimates and the owner-operator estimates as follows:

> Landlord income estimates represent the returns received by the landlord for the annual use of land and buildings. Owner-operator estimates represent the amount which the owner has left as a return on land and buildings after all expenses have been deducted.

The expenses to be deducted under the owner-operator method include not only the normal expenses such as seed, fertilizer, chemical costs, harvesting expenses, storage, labor, machinery repair, livestock and feed, depreciation, taxes, insurance, etc., but also an allowance for unpaid family labor and interest on the owner's investment in equipment. The only expense categories that a landlord must concern himself with are seed, fertilizer, other crop expenses, depreciation and taxes [53]. Therefore the landlord estimating process has four main advantages over the owner-operator type: 1) there exist fewer types of expenses; 2) landlord items are easier to estimate; 3) there is no need for deducting the unpaid labor and management expenses for the owner and his family; and 4) there is a competitive market in which cash rents and rental contracts are established [53]. When considering the owner-operator method, the additional amount to assign for the owner's labor expense poses the largest problem.

Once the net income figure is computed, the next objective is to determine the capitalization rate. This step can be used to obtain two entirely different farm value estimates. An "income capitalization rate" gives an income value, and a "sale value capitalization rate" gives an estimated sale value. The income capitalization rate is selected from the investment market and is based upon some type of opportunity cost of money, e.g., the farm mortgage rate, the interest on savings accounts, the interest on certificates of deposit, etc. The important point is that this approach stresses only income. Nonincome features are entirely excluded. The income value derived from this method may be of vital interest because it indicates the debt paying ability of the farm. Net income alone can show the debt paying ability, but using the net income and a capitalization rate based on some type of opportunity cost makes it possible to more clearly emphasize the farm's value strictly on an income basis [53].

However, buyers are often interested in other facets besides the right to receive a future monetary income stream. A farm property may also provide psychic income through a beautiful home, nice location, etc. A buyer may have future expectations regarding the farm sector. He may anticipate a substantial increase in the future income stream from a farm due to new output increasing technology; or he may expect a constant increase in value due to inflation. With such expectations, one may pay more than a property's current earnings will justify. This provides some of the bases for the sale value capitalization rate [87].

The sale value capitalization rate is obtained by using a group of farms comparable to the farm being appraised. These farms should be comparable to the subject property not only in terms of the date of sale, productive capacity, farm size, extent of the improvements, and location, but also in terms of the nonincome sources of value. The appraiser must derive the estimated net income and the sale values for this group of farms. From these two figures one can compute the rate of return (r):

$$r = \frac{\text{Net Income}}{\text{Value}}$$

This rate of return subsumes consideration for the existing nonincome features. Therefore, applying this rate to the subject farm will naturally provide an estimated market value including the nonincome features [53]. However, once this analysis is completed, one realizes that it is essentially a disguised version of the comparable sales approach.

There is logic to the premise that a farm's capacity to perform constitutes a sound basis for a reasonably permanent value. However, upon further scrutiny one realizes that besides having problems incorporating value estimates for a farm's nonincome features, this approach also lacks the objectivity that is often believed. The application of the income approach in the appraisal of farm real estate requires important assumptions, which often are based upon a wide exercise of judgment regarding the estimation of the future income stream and the proper capitalization rate [98].

A major decision in an income valuation is the crop pattern. A difficulty here in deciding what is typical is that crop patterns often undergo change, frequently to a more intensive use. An example of this is the substitution of soybean production for oats as shown in Table 3.1. The appraiser must be constantly aware of the prevailing trends and changing technology. For example, heavier cropping may not increase net

Table 3.1. Figures on Iowa acreage in millions of acres[a]

	Soybeans	Oats
1953	1.6	5.7
1960	2.6	4.0
1967	5.7	1.8
1973	7.6	1.2

[a]Source: [33].

income proportionally because expenses, especially for fertilizer, rise simultaneously. Once the crop pattern is chosen, yields must be estimated. Then the appraiser must decide what system of prices should be assigned to the output--last year's, or a 3-, 5-, or 10- year moving average. Wendt [98] chooses to summarize the income approach by calling it "a framework for sophisticated guesswork." Although this places too low a premium upon the income approach, Wendt does strike at some of its evident shortcomings.

Statistical approach

The statistical approach to farmland appraisal was utilized beginning in the late 1920's [19, 75]. This approach, sometimes referred to as the scientific method, is based upon the rationale that there exists stable relationships between factors operating in the farmland market and the price of land. Statistical analysis has enabled appraisers to gather comparable sales and income data and develop weights to assign to relevant factors within relatively homogeneous land markets. Simple linear regression analysis, showing the relationship between one independent variable (X) and a dependent variable (Y), has been expanded to various forms of multiple regression analysis. Multiple regression establishes the relationship between a set of independent variables (X_i's) and (Y). Once a reliable equation has been constructed, it can be used for estimating values for other properties and making projections. One must only indicate the existing features of a subject property, place them into the equation, and solve.

Until relatively recently progress with the statistical approach was hampered by three main factors: 1) tedious and extensive hand calculations [53]; 2) lack of data; and 3) professional appraiser aversion [75]. In the last 25 years, with the advent of the computer, a return to increased emphasis upon the comparable sales approach, and the increased educational level of professional appraisers, the appraisal of farm real estate has become subject to increasing sophistication, with statistical analysis being regarded as increasingly important.

An early farm appraisal study using statistical techniques was done by Henry A. Wallace [97] in 1925. He concentrated on county land values in Iowa. Wallace realized that farm appraisal was an art, but that it could benefit from the incorporation of scientific methods. He chose four independent variables and correlated them with the 1925 Federal census estimates. The variables he chose were a 10-year average corn yield per acre, the percentage of land in corn, the percentage of land in small grain, and the percentage of land not plowable. The resulting multiple correlation coefficient (R^2) was 0.9166.[1] As part of his summary Wallace [97] stated:

> The writer does not care to defend this formula as the last word in scientific accuracy. It is his belief, however, that land appraisers in Iowa who are willing to accept the Federal census values as of 1925 will find the formula of some use. In applying it, however, they should keep in mind just how this formula was derived and make their own corrections, so as to fit most accurately the specific time and place.

Wallace showed considerable understanding of the problems encountered when trying to apply a static model to a dynamic, heterogeneous environment.

In 1958 Edward Renshaw [74, 75] published two articles concerning the application of statistics to land appraisal. The first examined the feasibility of developing a crop value index for estimating land values. The conclusion was that such an index can capture only a small subset of the relevant factors operating in the farm land market. The full impact from inflation, loan rates, changing technology, farm expansion, etc. cannot be made a function of a changing cropping pattern [74]. In his second article Renshaw [75] stated that:

> . . . while it may be hopeless to isolate all the factors which buyers take into consideration when purchasing property, it is possible to establish a correlation between real estate values and a select subset of "determining" variables.

Renshaw listed three major obstacles to the development of a statistical approach to appraisal: 1) insufficient and unreliable data; 2) hostility from the appraisal profession; and 3) lack of funding [75].

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[1] $(R^2) = \frac{\text{explained variance}}{\text{total variance}}$

Irving F. Davis, Jr. [19] wrote A Statistical Approach to Real Estate Value with Applications to Farm Appraisal published in 1965. He summarized the theoretical possibilities of using regression analysis in farm appraisal and concluded with six case studies. The first example showed the development of an equation for estimating the price of a 160 acre vineyard. At first, a 30 variable equation was used. It gave an estimated price of $1675 an acre with an ($R^2$) of 0.67 and a standard error of ± $494. This equation was reduced to seven variables to make it more wieldy by appraisers. The price estimate changed to $1823 an acre with an ($R^2$) of 0.64 and a standard error of ± $458. More observations were taken and the equation became modified to 18 variables. This equation gave an estimated price of $2322 an acre with a high (R^2) of 0.92 and a lower standard error of ± $234.

Davis' work demonstrated the process of improving a multiple regression equation for estimating land values. He concluded by emphasizing three cautions that one must exercise when using regression analysis to insure reliable and sufficient data: 1) the sample must be large enough to insure a proper distribution of the relevant variables; 2) the sample must be representative of the subject market area; and 3) one must be careful of the existence of autocorrelation[1] and multicollinearity.[2]

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[1]Autocorrelation exists when serial dependence occurs between the residuals in time series data [39].

[2]Multicollinearity exists when some or all of the variables are perfectly collinear. A less extreme case is one in which some or all of the explanatory variables are highly but not perfectly collinear [39].

In 1966 John Reynolds and John Timmons [76] studied the causes for the widening spread between farms' apparent earning capacity and their selling prices. This had become a national phenomenon beginning in the early 1950's. The variables considered were population, farm enlargement, technical change, the government farm program, expected capital gains, expected net farm income, and the number of voluntary farm transfers. A deflated time series and a cross sectional analysis were both used. The time series approach, reflecting the relatively shorter run reactions, resulted in an (R^2) ranging from 0.946 to 0.973. Reynolds and Timmons concluded that positive effects upon land values were being exerted by:

> . . . expected net farm income, government payments for land diversion, conservation payments, expected capital gains, farm enlargement, nonfarm population density, technological advance and the ratio of debt to equity. But a negative effect was exerted by voluntary transfers of farm land, the capitalization rate and the expected ratio of farm to nonfarm earnings [76].

In 1973 Danny Klinefelter [43] did a similar study for Illinois. The variables analyzed were identical except Klinefelter emphasized inflation and omitted population as variables. All the hypothesized variables appeared to affect land values, but due to the problems of multicollinearity and autocorrelation, the final model included only net rent, average farm size, the number of voluntary transfers, and expected capital gains. The (R^2) was 0.973. Klinefelter stated that the government farm program appeared to be a significant factor, but multicollinearity prevented its inclusion in the final equation. The omission of loan rates was cited as another weakness of this study. This Klinefelter example indicates the complexity involved when one tries to specify all the individual elements that have bearing upon the final sales value for farm real estate.

The U.S.D.A. often applies a statistical approach to its analysis of farmland markets over the nation. An example is a study done by William D. Crowley, Jr. - "Farmland Use Values vs. Market Prices in Three Oregon Land Markets" [15] - published in 1974 by the Economics Research Service. Crowley also was intrigued by the disparity between farms' apparent earning capacity based upon their income strean and their current market values. His objectives were to discover the most significant variables affecting the price of farmland, and to see if and how the importance of these variables varied per region of analysis. The sample used was privately owned farmland under three differing influences: 1) so-called agriculturally influenced land; 2) urban influenced land; and 3) urban recreation influenced land. The independent variables were year of sale, acres in sale, value of the buildings per acre, miles to the nearest paved road, miles to the nearest town of a population ≥ 1,000, and landlord net real estate income per acre. Using multiple regression, the areas analyzed seemed to constitute three separate land markets. The value of buildings per acre was the only variable found significant in all areas. The income and miles to the nearest paved road variables appeared insignificant in the urban influenced area; acres in sale were insignificant in the urban recreation influenced area; and the year of sale was insignificant for the agriculturally influenced area.

The significance of these results lies in their indication of the existence of differing types of agricultural land markets. Heterogeneous land markets require individual analyses for effective current land use planning and forecasting models. Therefore, a first step of any farm real estate model should be the delineation of relatively homogeneous markets.

It is likely that the application of statistics to farmland appraisal will be increasingly emphasized, even though appraisal experience will always be the most important tool in the profession. Farmland appraisal as an area of land economics is too dynamic. To compete, one must utilize all the efficient tools of his trade, including the statistical approach.[1]

Bench Mark Surveys Concerning Iowa

Surveys conducted by Federal and State agencies help provide bench mark valuations for farm real estate. This information is important in the comparable sales approach and beneficial in updating and back dating a value for a subject property. Such surveys concerning Iowa include the Federal Farm Census, the Farm Real Estate Developments conducted by the National Economic Analysis Division of the Economic Research Service (NEAD/ERS), the Agricultural Letter by the Chicago Federal Reserve, and the Iowa Land Value Survey by the Iowa Agricultural Experiment Station. Each provides beneficial information to the appraiser, but each also has its shortcomings.

[1] For more examples of statistical studies on land valuation, refer to Phillips [64].

The Federal Farm Census was first instituted in 1850. It was conducted every ten years until 1925. Since then it has been administered every five years. The most valuable aspect of this survey regarding Iowa farmland values is that average estimated market values are given on a county basis. This high degree of disaggregation provides data for land markets possessing a relatively high degree of homogeneity compared to the other surveys. This allows more reliability to be placed upon the market data. The main drawbacks, however, are that the Census is done only every five years, and the results are published with a long lag. The 1974 Agricultural Census data for Iowa will not be available before April or May, 1976.

The Farm Real Estate Developments done by the NEAD/ERS [73] is a semiannual report as of March 1 and November 1. Average estimated market values are derived on a state basis. The report includes a summary based upon local market information provided by farm real estate brokers, local bankers, county officials, and others. It lists the relevant factors operating within the land market. Although this report overcomes the problem of infrequency, its data is too aggregated for reliable use on a county basis. Only the percent change in the average state estimate can be utilized. Given the various land markets within any state, many districts may show price trends moving diametrically to the overall state average.

The Federal Reserve Bank of Chicago publishes its Agricultural Letter quarterly [8]. In this survey member banks supply information indicating percentage changes in land values and the relevant factors operating in the farm real estate market. The results are for Iowa and its five Economic Regions (Figure 3.1). These percentage figures are useful for adjusting market values through time. The drawbacks to this report are that no actual land value estimates are given, and the degree of market aggregation is too high.

The Iowa Land Value Survey conducted by the Iowa Agricultural Experiment Station was initiated in 1941 under the guidance of William G. Murray [54]. This survey is conducted annually with the cooperation of licensed real estate brokers. Questionnaires (Figure 3.2) are sent to at least seven brokers per county requesting information concerning the farm real estate sector as of November 1. This date is used to capture the high point of land market activity after the fall harvest. Each broker is asked: 1) to estimate the market value for high, medium, and low grade farms in his (her) area; 2) to indicate the number of sales made relative to the previous year; and 3) to specify the most important factors operating in the land market.

The brokers are asked for land value estimates rather than actual sales data because estimates are more reliable for comparing yearly trends. Actual sales data often suffer from problems with wide variations in the quality of land sold and relatively few samples for a particular time and place [53]. The response rate ranges from 72 to 75 percent with approximately 60 percent of the brokers returning their questionnaires within the first two weeks. At least three questionnaires from every county must be returned before the replies are tabulated. The results have traditionally been reported by the Station on a State and

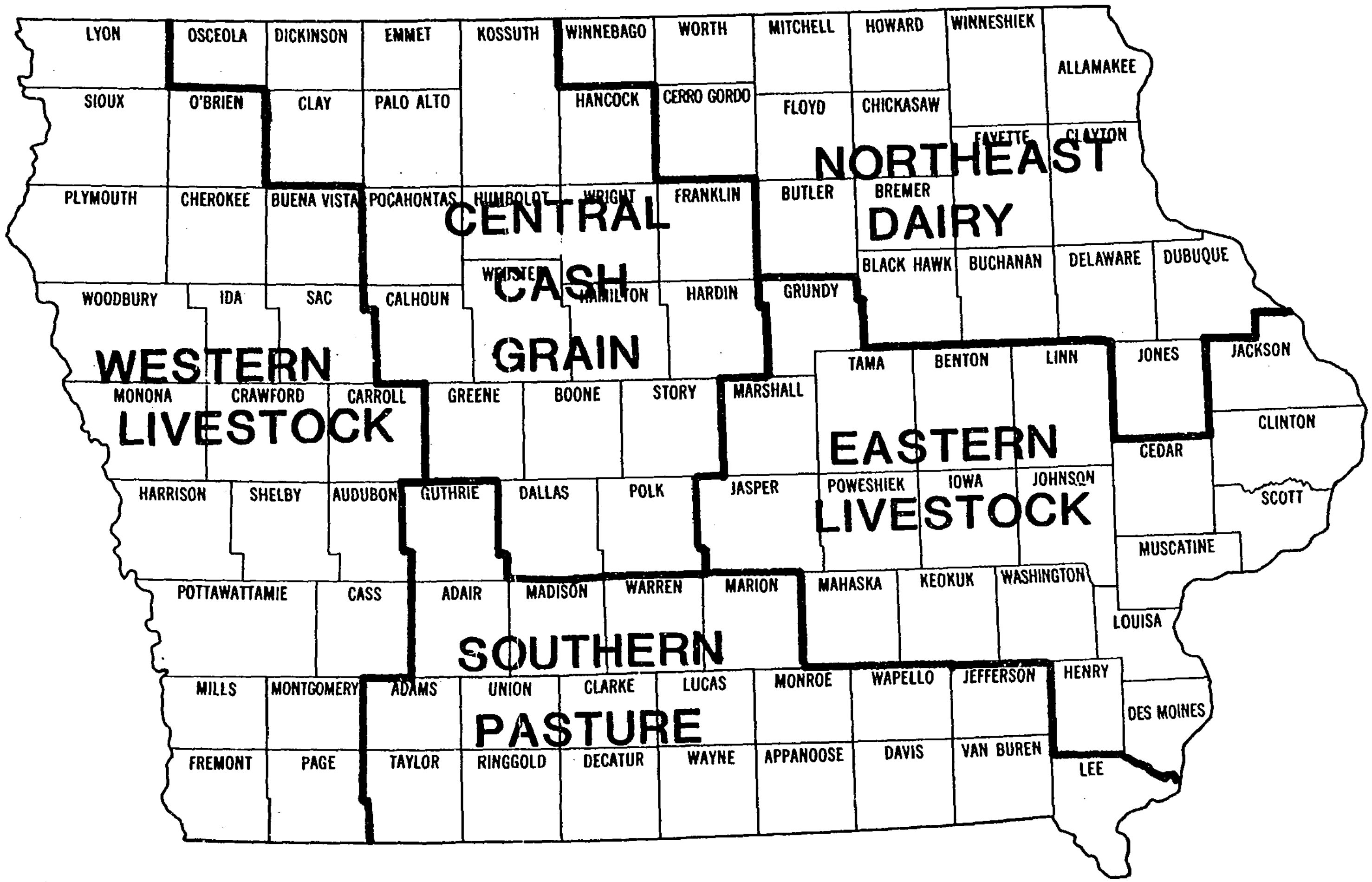

Figure 3.1. Iowa's five Economic Regions.

November 1, 1975

Dear Sir:

Your cooperation in supplying information for the land value survey last November was appreciated. The report received wide news coverage, and you were sent a copy. We would like to have you cooperate again. Please fill in the answers to the questions and return the survey in the enclosed envelope to make this fact-finding survey possible.

Sincerely,

Duane G. Harris
Agricultural Economics

Farm Land Values in Your Territory as of November 1, 1975

1. Values for average-size farms in my territory are:

	1 Year Ago*	Present
High grade farms	$________ per acre	$________ per acre
Medium grade farms	$________ per acre	$________ per acre
Low grade farms	$________ per acre	$________ per acre

2. Number of sales you have made in the last 12 months compared to same period in 1974 is:

   More __________ Same __________ Less __________ (check one)

3. In your opinion, what are the most important factors operating in the land market in your territory this year?

   a. ______________________________

   b. ______________________________

   c. ______________________________

*This was your report to us last year.

P.S. We will send you a copy of the results of this survey.

Figure 3.2. Sample of the Iowa Land Value Survey Questionnaire

area basis rather than on a county basis because it is assumed that many brokers do not confine their business to their county of residence. When the Survey began in 1941, averages were reported for Iowa's five Economic Regions (Figure 3.1). In 1957 the use of nine Crop Reporting Districts was instigated (Figure 3.3). Using the nine areas helped to disaggregate the information, and this division also coincided with that used by the Annual Iowa Farm Census [33, 36].

Average per acre values are computed for high, medium, low, and all grades of land for each district. Deriving averages for high, medium and low grade land is a two-part process. All the reports for a particular grade of land received from a given county are averaged. These averages are then grouped on the basis of the respective districts to obtain an overall district average for that grade of land. The all grade figure is obtained by taking the simple average of the overall high, medium, and low grade averages. The problem with this procedure is that it gives an equal weighting to each grade of land. This implies an equal prevalence of each grade in each district. The result is consistent overvaluation in districts with relatively more lower quality land, and consistent undervaluation in areas with relatively more higher quality land.

The overall State estimates for high, medium, and low grade land are derived by the same procedure used at the district level. All the individual county averages for a particular grade of land are grouped together and averaged. The State average for all grades of land is then based upon the simple average of the estimates derived for the three

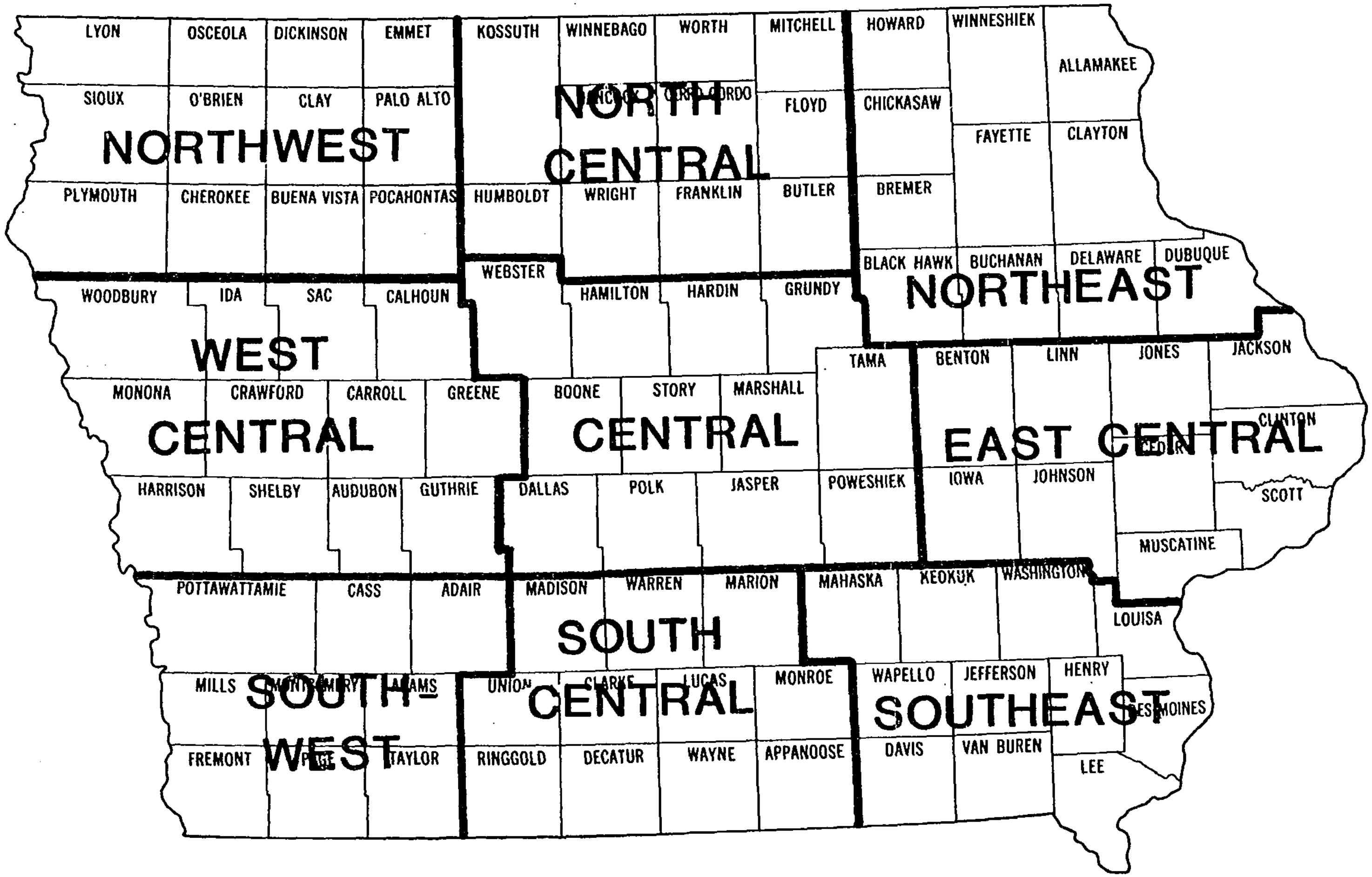

Figure 3.3. Iowa's nine Crop Reporting Districts.

grades of land. This method is based upon the assumption that, over Iowa, there is approximately an equal distribution of each grade of land.

When the yearly report was published, individual county averages were always requested. Therefore, in 1972 information gathered from the Survey was combined with the latest (1969) Farm Census county estimates to develop current county estimates. District percentage changes in land values registered by the Survey from 1969 through 1972 were applied to the 1969 Farm Census figures for counties within the respective districts. In deriving the percentages to apply for each district, the percent changes for high, medium, low and all grades of land were analyzed. The author combined this information with his general knowledge of the land quality in each district to derive an overall percentage figure. For counties touching the boundaries of two or more districts, a simple average of the respective district percentages was applied. For example, Calhoun County in the West Central District (Figure 3.3) had the average of the overall percentage changes in the Northwest, West Central, and Central Crop Reporting Districts applied to it. The reasoning behind this procedure is the assumption that brokers from all three areas work within Calhoun County. Therefore, its values are influenced by the land markets in each District. The disaggregation of the Land Value Survey data to a county basis is an important step in generating a useful data base for indexing and analyzing Iowa land values. The remainder of this study attempts to improve the procedures for developing and utilizing such a data base.

CHAPTER IV. DEVELOPING A PROCEDURE FOR ESTIMATING IOWA FARMLAND VALUES

In this chapter, the disciplines of Soil Science and Economics are combined to develop a procedure for estimating Iowa county farmland values on an annual basis. The problems of excessive aggregation of data and infrequency of data generation that plague existing farmland value surveys for Iowa are alleviated. Since the income generated from soil use determines the major portion of a farm's fair market value, it is hypothesized that dividing Iowa into areas based upon similar soil productivity creates more homogeneous land markets than using convenient boundary lines which divide Iowa into the nine approximately equal-sized, rectangular Crop Reporting Districts.

This chapter begins by briefly discussing the development of Soil Science as an aid to land valuation. The results of this development are then incorporated into the framework of the Iowa Land Survey conducted by the Iowa Agricultural Experiment Station. The traditional nine Crop Reporting Districts are replaced by ten districts based upon similar productive potential. From information based upon this new mapping and upon broker estimates regarding the prevalence of high, medium, and low grade land in their respective business areas, an average dollar value per acre for farmland is estimated on an annual, county basis.

The Contribution of Soil Science to Land Valuation

The basis of scientific farm management is a growing body of knowledge concerning the nature and potential of soils. Soil scientists have been able to transform their knowledge of soils into crop productivity ratings applicable to localized farming areas. Given this information, one can develop income projections and, thereby, derive land value estimates. Murray, Englehorn, and Griffin [59], in a discussion on land valuation, states:

> Valuation of farmland depends, in the main, on farm income, which in turn depends on crop yields and farm prices. Crop yields, to go back still another step, rest largely on soil and climate. Consequently a careful measurement of soil productivity, as determined by crop yields, is a fundamental aspect of farm valuation.

Although land value may be based upon the visible evidence of productivity of the soils, it is questionable as to whether this productivity is due to only the inherent characteristics of the soil or whether the factor of human management should receive emphasis. Therefore, the need exists to transform the properties of soil into an economic framework capable of aiding an appraiser in his valuation process.

The application of soils information to land valuation is hardly a recent practice. The earliest evidence of this approach was in China during the reign of the Yao Dynasty from 2357 to 2261 B.C. [24]. An engineer named Yu developed a classification of soils in which he correlated soil color and structure with productivity [40]. The soils of the kingdom were then grouped into nine classes to serve as a basis for taxation and the administration of agricultural affairs [40]. Unfortunately the enlightened approach did not appear to spread. Other world cultures had either not advanced to the degree of the Chinese, or there was no apparent need for such programs.

By the beginning of the Christian era much was known concerning the maintenance of soil productivity. Writers such as Varro, Pliny, Cato, and Columella [18] had compiled information on scientific farming practices, e.g., crop rotation, terracing, irrigation, etc.; however, this emphasis upon soil husbandry was not correlated with any valuation technique. Soil Science made its next significant advancement in the early 1800's. At that time western Europe became concerned with the problem of feeding an expanding population. Malthus [48] had just published his Essay on the Principles of Population emphasizing the hypothesis that human population increases geometrically while the food supply can increase only arithmetically. The inevitable result from this would be war, disease, and starvation. Because of this need to increase farm productivity, field experimentation began in Europe in 1834 [40]. Unfortunately the work in western Europe was guided by the balance sheet theory of plant nutrition that was proclaimed by Justice von Liebig in 1840 [45]. This theory stated that productivity is directly related to the application of fertilizer. Such a theory considered soil a static factor and failed to realize the dynamic relationship between the soil, its living organisms, and farm management [40]. There was no attempt to classify soil types and develop a method of valuing individual tracts of land based upon their inherent productive potential [31, 40, 41].

The most significant advancement in Soil Science prior to the twentieth century came in Russia. Around 1870, a brilliant school of Soil Science was initiated under the leadership of Dokuchaiev, followed by Sibertsen, Glinka, and Gedroiz [41]. To properly administer the vast country, it was necessary to determine the productivity of Russia's various regions. In 1882 the Government of Nizhni-Novgorod employed Dokuchaiev to administer a program for classifying and mapping Russian soils as a basis for tax assessments. Dokuchaiev divided the assignment into two parts: 1) establishing a natural soil classification and 2) grading the soils by their agricultural productivity. The soils were then rated on a scale ranging from 15 for the poorest to 100 for the best. This scale was used as the basis for tax levies [24]. Five principal factors were recognized as contributing to the properties of the soil: 1) climate, 2) living organisms, 3) parent rock, 4) relief, and 5) age with special emphasis being placed upon climate and vegetation [41].

The development of Soil Science in the United States resembled that of the Russian school. Contemporary with the Russian work, Hilgard from the University of California, derived similar conclusions regarding the high correlation between soil regions, biological regions, and climatic belts [40]. The significance of this pioneering work was not realized until nearly 1900 because the abundance of rich, free farmland caused little concern for the improvement of Soil Science. However, by 1895 concern was growing over the agricultural problems of foreclosures and low commodity prices, and there arose the desire to inventory the lands in the United States [42]. In 1899 the U.S.D.A.'s Division of Soils, under Milton Whitney, began the Soil Survey on a cooperative basis with the land grant colleges and universities. The Federal Government felt that its citizens could be helped in the selection of farmland, in the selection of crops suitable to the particular soils within a given area, and in the management of the soils to develop their full potential [40]. Whitney quickly called attention to the failure of the balance sheet theory in the U.S. Soon after, Curtiss Marbut began his research in soils. Combining some Russian tools with his own research, he began the system of soil classification in the U.S. [40, 49].

Throughout this time period particular attention was given to soil features which appeared to influence the suitability of soils for crops. The need for this information became increasingly apparent during the 1930's. The National Resources Board requested that the Division of Soils prepare a physical classification of all the lands in the U.S. [1], and on December 31, 1934 the Board submitted a finished report to the President, including a section dealing with the physical classification of the productivity of the land. The total land area of the U.S. was divided into five grades with ratings based upon the principal physical conditions influencing productivity, e.g. soil type, topography, rainfall, and temperature [22]. The main drawback of this report was that the information was too aggregated. Appraisers could obtain little or no help from this information in their appraisal work. Progress in the development of Soil Science as a useful farmland valuation tool seemed slow. In 1939 Murray, Englehorn, and Griffin [59] were still making the following statements:

1) In the valuation of farmland the most important and probably the most difficult task is an evaluation of the annual production of the soil.

2) Striking proof of the need for more reliable yield estimates in valuation can be seen in the concentration of farm mortgage foreclosures during the depression.

3) Furthermore, the explanation in every case is that low value land has been over appraised in comparison with the better land. One of the best means of correcting this bias appears to be more emphasis on the difference in productivity of high and low value soils.

In response to these needs, attempts were made to correlate soil characteristics and productivity through the development of soil indices and productivity ratings. One of the earliest efforts in this area was a study by R. Earle Storie in 1933 [85], later revised in 1959 [86]. Realizing that soils vary in their productive capacity, Storie became aware of the need for a method of comparing the relative productive capacities. He theorized that such a soil index or rating would be helpful in land classification and valuation. Storie constructed an index ranging up to 100 percent for soils having the highest productive capacity. The index is obtained by multiplying four factors characterizing the soils. The individual factors are defined as: A - the soil profile, B - the texture of the soil, C - the slope, and X - the modifying conditions, e.g., drainage, alkali content, erosion, acidity, etc. The shortcoming of this approach is that all four factors are given an equal weighting. Studies have shown that depth of soil may be more important in terms of productivity than is the slope within certain ranges [59].

A better alternative, crop suitability ratings, was developed in the Soil Survey. Soil types were classified and then analyzed to determine the effect of such factors as slope, erosion, drainage, cropping patterns, fertility, weather, etc. on the soils' productivity. This information can eliminate much of the guesswork from the appraisal profession if it can be developed on a localized basis. However, such a simultaneously intensive and extensive project required time, money, and improved technology.

After World War II the Soil Survey was termed the Modern Soil Survey [64], utilizing innovations such as aerial maps, enlarged soil maps, and computers. In 1951 Scholtes and Riecken [78] utilized detailed soil survey information for Iowa's Taylor County to derive relative productivity ratings for the individual soils according to their suitability for corn production. Dollar values were then established by the Taylor County assessor for land tracts based upon the different corn suitability ratings.

In 1958 a project called the National Inventory of Soil and Water Conservation Needs [60] was instigated to update the information gathered from the 1934 inventory requested by the National Resources Board. A two percent statistical sample was taken of the soils in each Iowa county. This data was processed, weighted, and expanded to summarize the entire area of each county concerning the major soil uses of rural land and the conservation treatments required to maintain or improve productivity.

Updating of this 1958 inventory was authorized by the Assistant Secretary of Agriculture for Rural Development and Conservation on March 25, 1965 with leadership of the project assigned to the Soil Conservation Commission [60]. Each soil was assigned a corn suitability rating (CSR), reflecting the integrated effect of slope, erosion, drainage, soil depth, parent materials, biosequence, soil type, and weather upon the yield of row crops at a specified management level [22, 24]. These ratings range from zero to 100, with 100 signifying soils that: a) are located in the most favorable weather areas in Iowa, b) have a high yield potential, and c) can be continually row cropped with little erosion loss [25]. To compensate for varying weather conditions over Iowa, the annual mean precipitation and temperature (Figure 4.1) reported in Special Report No. 38, "The Climate of Iowa," by Shaw and Waite [79] were used as guides in developing weather adjustment factors to obtain proper CSR figures. Average CSR's were then developed for each county (Figure 4.2).[1]

These statistics have been used extensively in land use studies and projections [25]. To test the accuracy of the two percent sample, its results were compared with those for four Iowa counties scattered across Iowa -- Plymouth, Buena Vista, Grundy, and Adams -- in which soil samples had been taken from every 40 acre tract. The comparisons show that the respective average county CSR's were either identical or differed by only one point. To test the hypothesis that the CSR's can be used to

[1]Appendix A lists the amounts of land that fall into different CSR categories for each county.

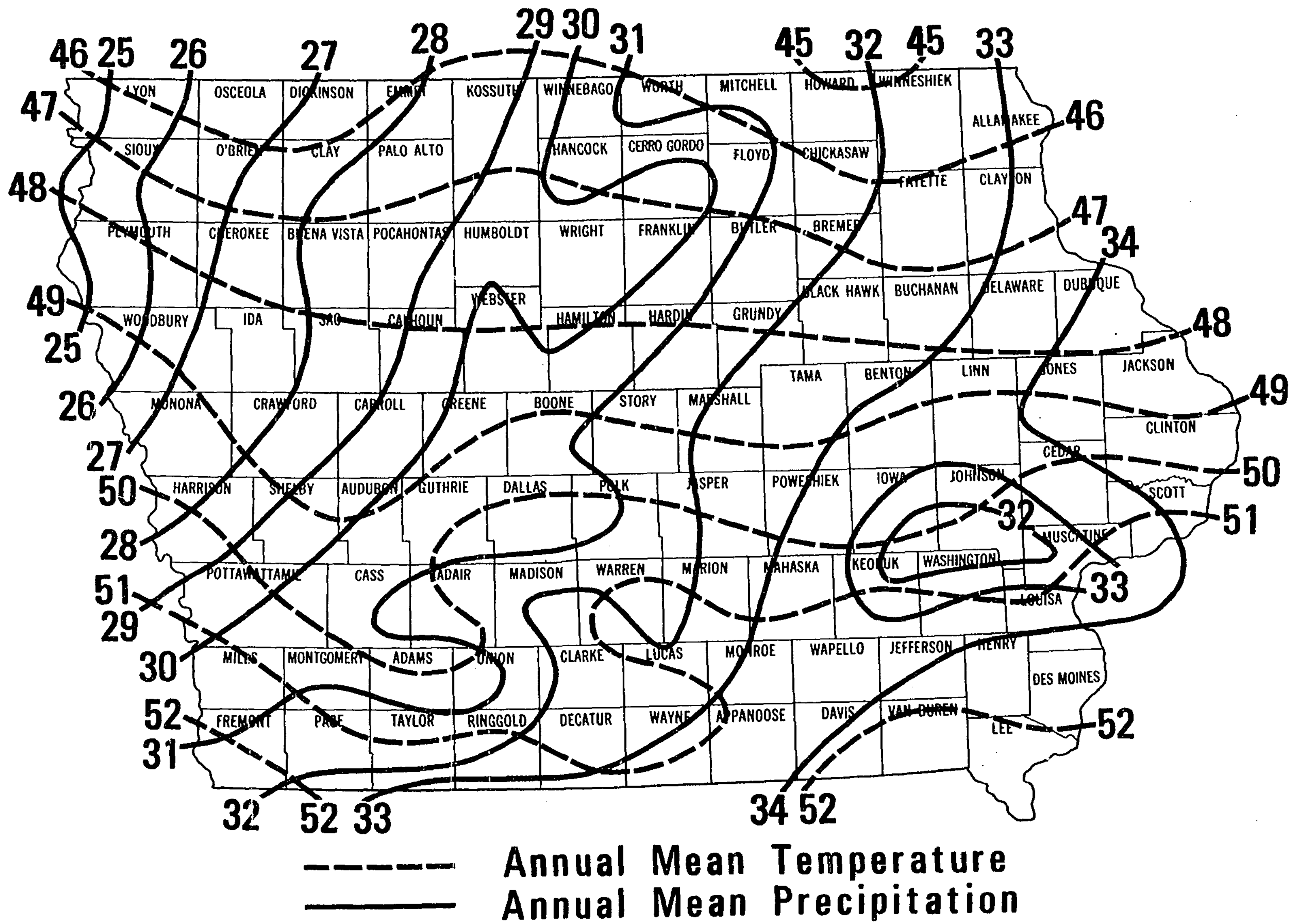

Figure 4.1. Iowa annual mean temperature (degrees) and annual mean precipitation (inches).

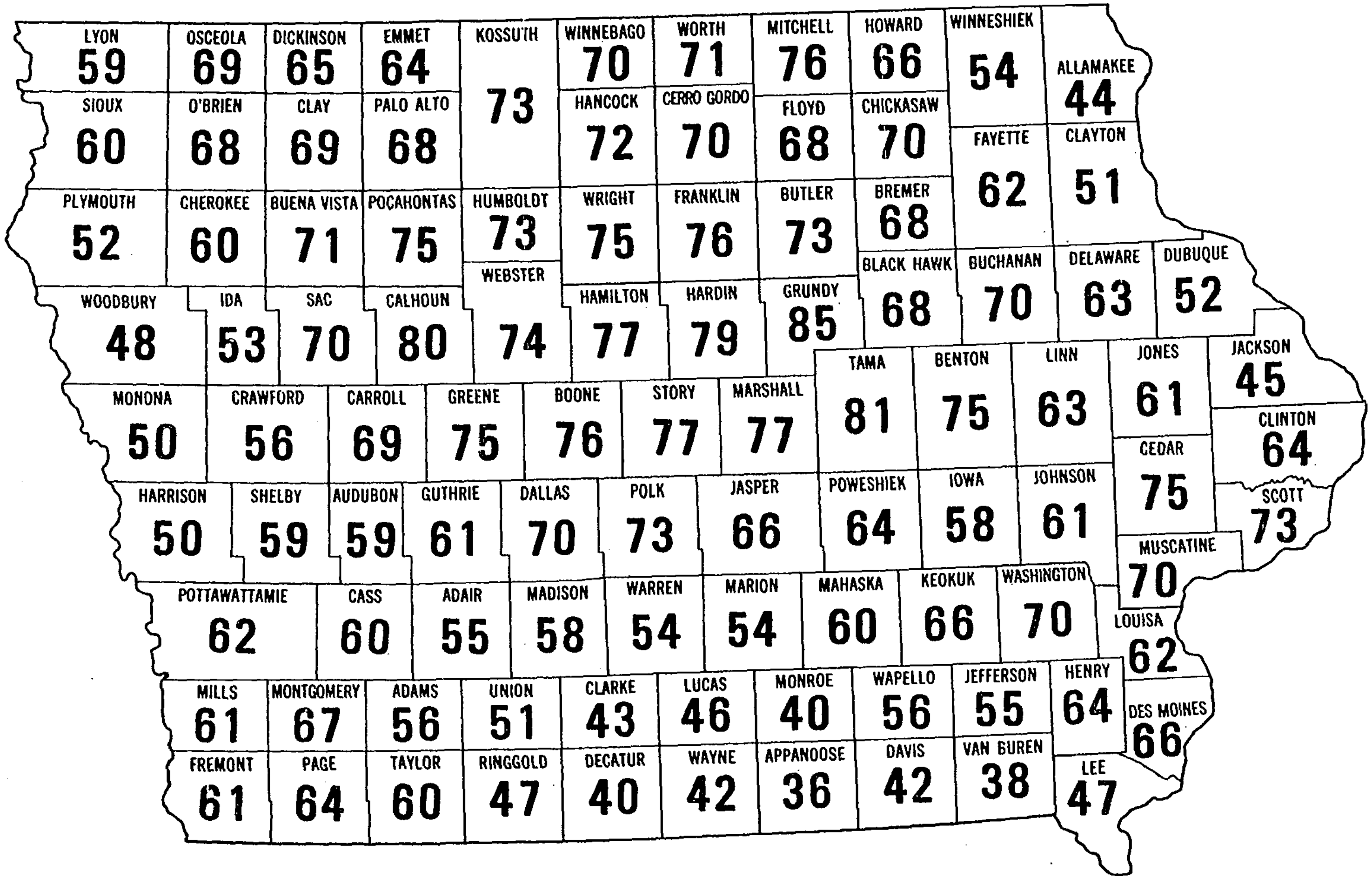

Figure 4.2. Mean corn suitability rating for each county.

explain a large portion of land values, they were regressed against the Farm Census county estimates for 1959, 1964, and 1969. The resulting (R^2)'s from these simple regressions were 0.73, 0.74, and 0.74 respectively. Based upon this evidence, it is contended that for an Iowa farmland value survey, it would be realistic to derive district boundaries by grouping contiguous counties having similar CSR's. This would create homogeneous land market areas.

Incorporating the Use of CSR's into the Iowa Land Value Survey

When one views the nine Crop Reporting Districts used in the Iowa Land Value Survey with respect to county CSR's (Figure 4.3), it becomes obvious that the boundaries can be changed to create more homogeneous groupings relative to soil productivity. Since soil productivity is the basis for the income generating power of farmland -- the major factor in determining land values -- a more realistic mapping is that shown in Figure 4.4. Reviewing the results of past Iowa Land Value Surveys, it is apparent that the alternative mapping greatly reduces the variation between the averages of the broker responses for the counties within a given area. For example, the averages for the different grades of land from the brokers residing in Pocahontas, Calhoun, Sac, Jasper, Poweshiek, Jackson, Davis, and Van Buren counties vary substantially from their respective district averages. The 1975 Survey showed that for these counties the estimates for high grade land varied from the district averages by \$226 to \$691; for medium grade land it was from \$120 to \$432; and for low grade land from \$58 to \$378.

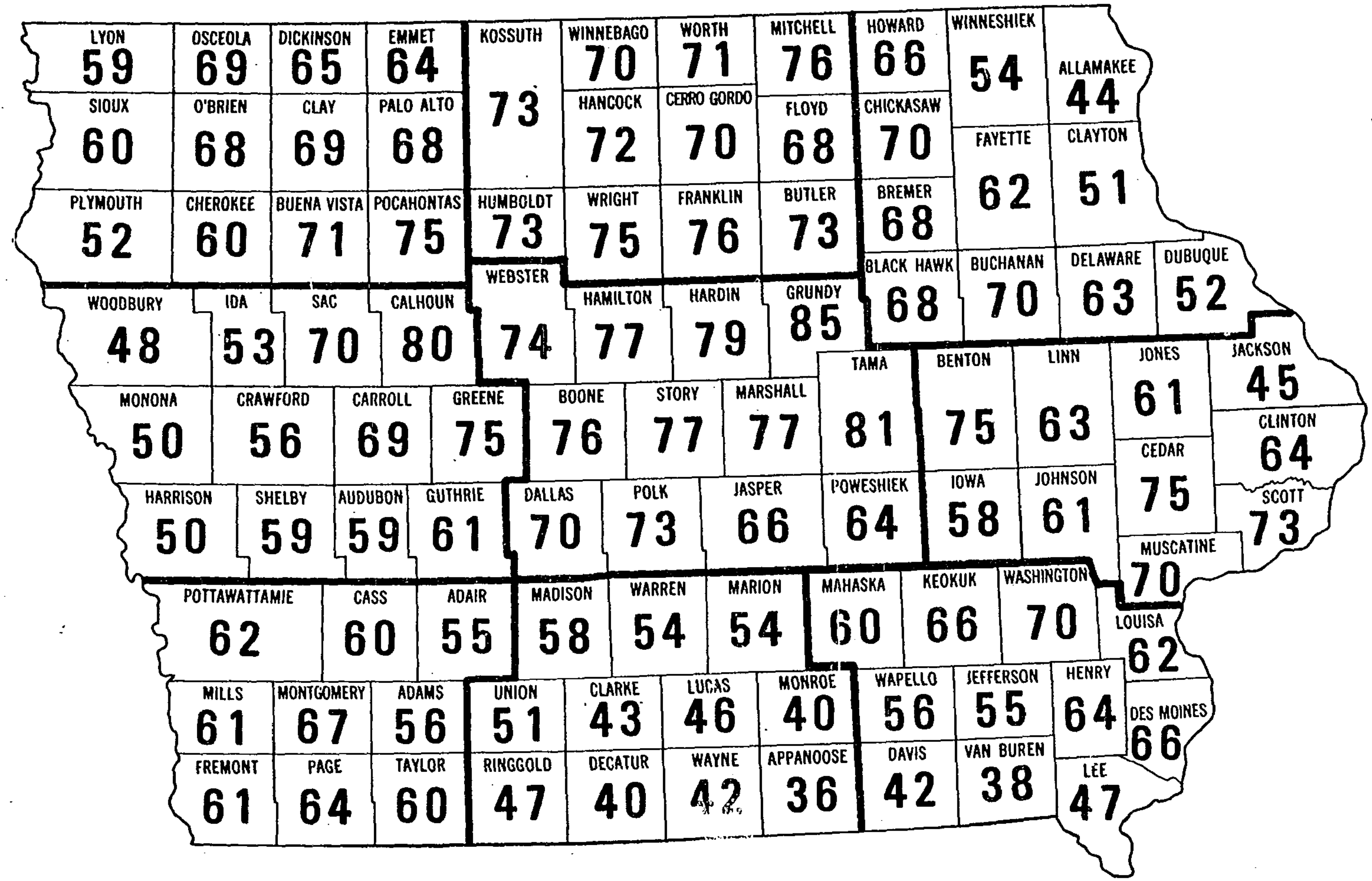

Figure 4.3. Boundaries lines of the nine Crop Reporting Districts and the mean corn suitability rating for each county.

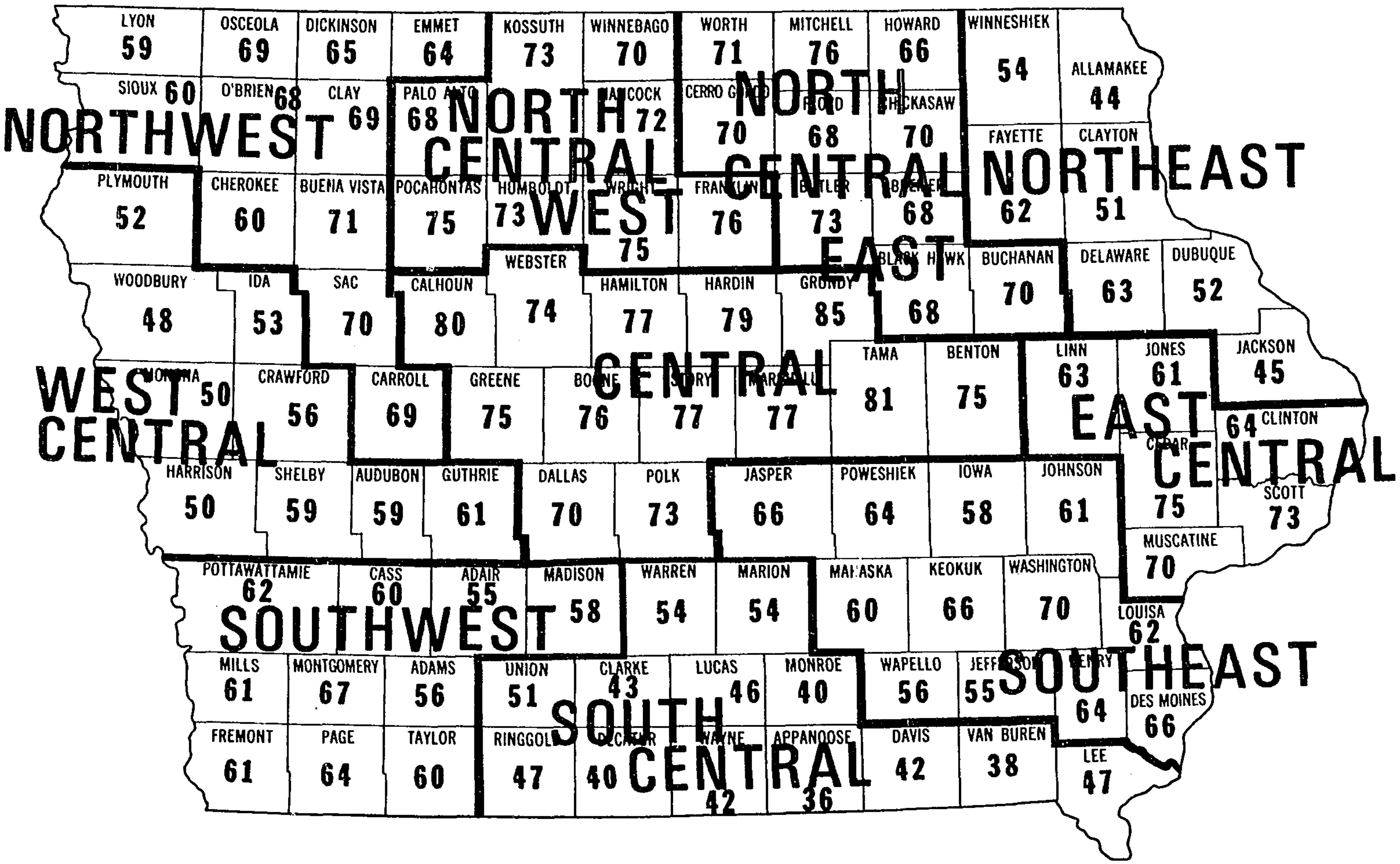

Figure 4.4. Boundary lines of ten Iowa districts based upon areas with similar corn suitability ratings.

A second, larger problem for the Survey is its attempt to derive overall average land value estimates and average percentage changes in land values between years in each district. Assigning equal weights to figures for high, medium, and low grade land in deriving averages assumes an equal prevalence of each grade within a district. Based upon personal interviews with the nine participating brokers from Story County in the Fall of 1972, over half of the land in their area of interest was considered high grade, and less than 15 percent was considered of low quality. As a result of this preliminary information, a question was included in the 1972 Survey questionnaire to determine the brokers' opinions regarding the prevalence of each grade of land in their respective areas. Of the brokers replying, 459, or 79 percent, provided useable information on this additional question. By averaging this data on the ten district basis, a weighting scheme was derived to apply to the average values for high, medium, and low grade farmland. Table 4.1 shows the weights derived for each grade of land in each district.

To test this system of weights, the results from using them in the derivation of average land values per county were compared with the 1969 Farm Census figures. The absolute average difference per county was only 4.3 percent. The distribution of variation was 45 county estimates being lower than that of the Census, and 54 higher. Given this degree of accuracy, the same estimation procedure was used to estimate average county farmland values for the noncensus years from 1964 through 1975. These estimates are listed in Table 4.2.

Table 4.1. The amount of land by grade in each district according to survey estimates by brokers residing within the specified districts

District		High Grade	Medium Grade	Low Grade
Northwest	(NW)	44%	39%	17%
North Central West	(NCW)	54	32	14
North Central East	(NCE)	39	43	18
Northeast	(NE)	29	50	21
West Central	(WC)	33	47	20
Central	(C)	57	29	14
East Central	(EC)	41	39	20
Southwest	(SW)	31	46	23
South Central	(SC)	27	45	28
Southeast	(SE)	32	44	24

In deriving these county estimates, each district is assigned an overall average percentage figure to apply to its counties' most recent Farm Census land value estimates. This percentage is computed by multiplying the system of weights times the percentage change in value for each grade of land since the latest Farm Census report. The percentage change used for each grade is that indicated by the Land Value Survey. The products from this process are then summed to obtain the average percentage change in a district. This percentage is then applied to the latest Census data. For counties that lie on a district boundary, a simple average is taken of the percentages from the districts that the

Table 4.2. Average dollar value per acre of Iowa farmland per county

	1964[a]	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Northwest												
11 Buena Vista	329	360	409	445	457	471	465	476	538	738	985	1333
14 Carroll	348	382	434	472	486	475	464	474	533	705	917	1205
18 Cherokee	303	334	379	409	420	425	416	421	481	634	811	1056
21 Clay	307	337	384	412	422	453	449	458	526	732	974	1326
30 Dickinson	263	289	329	353	361	372	369	376	432	601	800	955
32 Emmet	305	335	381	409	419	401	397	405	465	648	862	1174
60 Lyon	299	327	375	401	405	405	397	397	457	628	817	1040
71 O'Brien	368	403	461	495	499	500	491	490	565	775	1009	1284
72 Osceola	325	356	407	436	441	437	429	428	494	678	882	1122
81 Sac	344	378	431	466	480	498	491	458	568	764	1005	1356
84 Sioux	358	395	449	483	496	487	476	483	551	727	930	1210
North Central West												
35 Franklin	344	377	426	469	490	507	503	520	573	782	1052	1450
41 Hancock	338	372	420	465	482	489	489	505	560	773	1039	1453
46 Humboldt	388	425	481	526	546	551	545	566	632	868	1172	1632
55 Kossuth	342	376	428	459	470	476	472	481	552	769	1023	1393
74 Palo Alto	308	338	385	413	423	431	427	436	500	670	927	1262
76 Pocohontas	352	386	438	476	489	513	505	519	586	804	1073	1452
95 Winnebago	331	364	411	455	472	443	443	457	507	700	942	1316
99 Wright	376	412	466	503	535	541	536	555	612	835	1122	1547

[a]Estimates for 1964 and 1969 are Farm Census figures. The remaining years are estimated from the Iowa Land Value Survey.

Table 4.2. Continued

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
North Central East												
7 Black Hawk	358	391	442	497	515	512	505	521	564	754	1009	1355
9 Bremer	279	306	347	388	403	417	428	446	486	640	824	1070
10 Buchanan	283	310	346	391	405	408	414	428	471	616	801	1041
12 Butler	284	312	352	387	404	431	427	442	488	665	894	1233
17 Cerro Gordo	337	371	419	463	480	453	453	468	518	716	963	1346
19 Chickasaw	238	261	296	331	344	346	355	370	403	531	684	888
34 Floyd	298	328	370	410	425	404	404	417	462	638	859	1200
45 Howard	195	214	242	271	282	278	285	298	324	427	550	714
66 Mitchell	302	332	374	425	439	413	412	422	453	610	813	1097
98 Worth	286	315	355	393	408	423	423	437	484	668	899	1257
Northeast												
3 Allamakee	127	139	154	175	182	209	220	234	258	332	414	518
22 Clayton	167	183	203	230	240	239	252	267	295	380	474	592
28 Delaware	265	291	323	367	381	384	395	408	450	585	752	968
31 Dubuque	245	269	296	336	350	392	409	425	474	606	766	962
33 Fayette	224	246	278	312	324	346	355	370	403	531	684	888
49 Jackson	200	220	242	274	285	308	322	334	373	476	602	756
96 Winneshiek	188	206	234	261	272	261	268	279	304	400	516	670
West Central												
5 Audubon	243	269	305	333	345	369	366	374	426	548	685	873
24 Crawford	241	266	302	325	334	346	338	343	392	517	661	860
39 Guthrie	204	225	255	280	290	319	315	323	364	472	601	776
43 Harrison	198	220	249	274	287	321	320	331	374	466	569	727
47 Ida	280	309	351	378	388	390	381	387	441	582	745	969
67 Monona	218	242	273	296	309	322	314	323	365	462	579	774
75 Plymouth	278	387	349	375	385	392	383	389	444	585	748	974
83 Shelby	273	302	343	374	388	407	403	412	470	604	755	963
97 Woodbury	220	343	276	297	305	334	327	331	378	499	638	830

Table 4.2. Continued

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Central												
6 Benton	326	359	402	449	464	464	463	475	526	694	921	1194
8 Boone	370	403	456	507	526	517	505	523	571	759	1020	1364
13 Calhoun	376	415	472	512	527	562	553	568	642	881	1175	1591
25 Dallas	310	342	387	428	447	473	468	484	542	689	870	1130
37 Greene	363	399	453	492	507	486	476	490	546	722	938	1233
38 Grundy	406	445	503	553	578	570	565	585	645	879	1183	1630
40 Hamilton	391	426	485	530	550	555	549	570	637	874	1181	1644
42 Hardin	346	380	429	471	492	514	510	527	581	793	1066	1470
64 Marshall	327	361	407	447	461	479	469	486	539	718	969	1246
77 Polk	391	435	491	537	554	550	552	569	634	827	1100	1399
85 Story	385	425	480	526	542	537	526	545	604	805	1087	1396
86 Tama	308	339	383	425	439	422	416	429	471	630	846	1105
94 Webster	389	427	482	528	548	543	537	558	623	855	1155	1609
East Central												
16 Cedar	347	386	427	474	488	478	482	493	557	718	956	1194
23 Clinton	303	333	366	416	432	459	479	497	555	710	897	1127
53 Jones	262	288	317	360	374	362	378	392	438	560	707	889
57 Linn	341	375	419	469	486	497	501	519	573	752	986	1260
70 Muscatine	332	370	409	453	467	437	441	541	509	663	874	1091
82 Scott	435	480	523	596	616	609	631	638	722	915	1172	1482
Southwest												
1 Adair	190	211	238	263	274	267	268	277	310	393	498	641
2 Adams	162	182	205	227	237	239	247	255	288	356	442	545
15 Cass	222	247	279	308	322	337	336	347	393	489	598	763
36 Fremont	246	274	309	348	366	375	381	396	450	551	655	798
61 Madison	191	212	240	264	275	281	282	291	326	413	525	674
65 Mills	249	277	313	352	370	376	382	397	451	552	657	800
69 Montgomery	225	250	283	318	335	348	354	368	417	511	608	740

Table 4.2. Continued

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Southwest (Cont'd)												
73 Page	209	233	263	295	311	320	326	338	384	470	559	681
78 Pottawattamie	271	302	340	376	393	394	392	406	460	572	699	892
87 Taylor	146	164	185	204	213	235	243	250	283	350	435	536
South Central												
4 Appanoose	128	144	162	176	181	194	197	203	228	295	391	484
20 Clarke	125	140	158	175	183	197	204	210	237	294	365	449
26 Davis	131	147	166	180	186	200	203	209	235	304	403	499
27 Decatur	104	118	132	144	149	178	187	191	215	269	348	433
56 Lee	199	224	252	274	282	305	310	319	359	464	614	762
59 Lucas	126	143	160	175	181	207	218	223	250	313	404	503
63 Marion	218	243	274	299	309	326	327	337	376	490	652	829
68 Monroe	103	116	130	142	146	179	182	187	211	272	360	447
80 Ringgold	120	135	152	168	175	192	199	205	231	286	355	438
88 Union	148	166	187	207	216	250	259	266	301	373	463	570
89 Van Buren	137	154	173	188	194	204	207	213	240	310	411	509
91 Warren	196	218	246	269	281	306	308	318	356	458	593	747
93 Wayne	129	146	164	179	185	203	214	218	245	307	397	494
Southeast												
29 Des Moines	342	385	433	470	484	419	426	438	493	638	844	1046
44 Henry	273	307	346	375	387	392	399	410	461	597	789	979
48 Iowa	237	262	292	324	335	349	348	358	400	524	695	888
50 Jasper	279	311	350	383	396	398	399	412	459	599	796	1013
51 Jefferson	198	223	251	272	280	290	295	303	341	441	584	724
52 Johnson	328	364	404	448	461	456	460	471	532	692	912	1139
54 Keokuk	226	253	285	308	316	314	308	319	360	481	651	805
58 Louisa	302	336	372	412	425	388	391	400	452	589	776	969
62 Mahaska	264	297	334	363	374	373	379	390	439	568	751	931
79 Poweshiek	261	288	325	357	368	361	353	366	406	541	731	939

Table 4.2. Continued

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Southeast (Cont'd)												
90 Wapello	188	212	238	258	266	260	264	272	306	396	524	649
92 Washington	297	333	374	405	415	409	401	416	468	626	848	1048
State	272	302	338	369	384	392	389	402	451	595	776	1012

county touches. This average is then applied to the latest Census estimate for that specific county. This procedure is used because it is assumed that brokers in each district may do business in adjacent counties. However, if only the corner of a county touches an adjoining district's boundary, and the county's average CSR differs widely from those in the adjacent district, then only the percentage figure for the district within which the county lies is used. For example, O'Brien County lies in the Northwest District and has a CSR of 68 (Figure 4.4). Only its southwest corner touches the West Central District. The average of all the county CSR's in the West Central District is only 54. In this case, the percentage change in land values for only the Northwest District is applied. Appendix B contains a map indicating the districts affecting the land value estimates in each county.

Average values for high, medium, low, and all grades of land at the district level have traditionally been reported by the Iowa Land Value Survey. The individual high, medium, and low grade estimates are not troubled with any weighting problem; however, the all grade figure is. Since the all grade figure is especially emphasized in news coverage, area extension meetings, etc., any procedure which eliminates this weighting problem and increases the accuracy of these estimates is a definite improvement. Now that there exists a reliable process for deriving individual county estimates, these county estimates can be averaged on a district basis to derive an unbiased all grade figure.

In deriving this, rather than take the simple average of the counties within a district, individual county estimates are weighted by the number of acres of farmland per county. The acre figures used in this analysis are from the 1973 Annual Iowa Farm Census [33]. It is reasonable to assume that these figures are useful for years 1964 through 1975 because: 1) they show little change since 1964; 2) they are the latest figures available; and 3) it is assumed that acres taken from farmland affect each county approximately the same. District averages derived using this method for 1964 through 1975 are shown in Table 4.3.

The final estimate to be considered is that for the State average. Each county estimate is again weighted by the number of acres of farmland per county and averaged with all 99 counties. State averages are derived for the years 1964 through 1975. To test the reasonableness of this approach, and also to provide another test of the accuracy of the individual county farmland value estimates, the results were compared with the Farm Census values. These results are shown in Table 4.4.

In summary, this chapter develops a method of improving the land value estimates for Iowa farmland. The State is divided into more homogeneous farmland market areas. Brokers' opinions regarding the prevalence of each grade of land in their area are used in conjunction with their land value estimates. The individual county estimates closely correspond to those of the Farm Census. All grade estimates at the district level no longer have weighting problems, and the overall State averages are extremely close to the values reported in the Census.[1]

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[1]Results derived in this chapter are based upon information from additional questionnaires that had not been received before the results of the previous Iowa Land Value Surveys were published for the years 1964-1974. This could cause differences in the final estimates.

Table 4.3. Average estimated values for high, medium, and low grade farmland and an overall average farmland estimate by district for selected years[a]

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Northwest												
High	418	454	521	558	565	562	559	561	640	894	1175	1516
Medium	313	341	388	415	421	426	415	420	484	653	847	1053
Low	201	226	262	280	279	294	282	279	328	448	573	720
District Ave.	333	358	408	440	450	454	446	448	516	700	915	1198
North Central West												
High	419	467	530	576	596	583	583	606	690	1008	1360	1975
Medium	333	363	412	437	454	445	447	465	536	726	990	1448
Low	237	259	287	307	321	314	314	329	375	507	694	934
District Ave.	341	380	431	445	486	487	464	503	565	775	1042	1434
North Central East												
High	363	392	444	491	515	528	528	544	587	787	1053	1449
Medium	258	283	318	365	377	387	383	391	419	560	754	1007
Low	173	197	222	256	260	259	259	268	285	395	510	672
District Ave.	271	315	356	397	412	419	412	426	467	629	833	1125
Northeast												
High	318	351	387	430	445	472	489	519	563	715	915	1189
Medium	205	223	246	280	293	305	322	344	377	482	603	737
Low	110	120	137	157	166	172	184	193	221	296	354	441
District Ave.	186	220	245	277	288	300	314	328	362	468	595	758

[a]Data taken from the Iowa State Land Value Survey based upon information from licensed farm real estate brokers.

Table 4.3. Continued

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
West Central												
High	378	411	452	485	494	503	491	508	566	719	891	1214
Medium	242	270	305	330	343	353	343	353	398	501	628	845
Low	136	156	182	200	217	220	214	220	257	326	417	529
District Ave.	240	290	299	324	335	343	348	355	404	524	662	859
Central												
High	448	486	558	612	633	653	642	649	725	970	1324	1783
Medium	333	359	403	457	476	485	473	477	528	705	926	1245
Low	218	244	266	301	314	319	306	310	354	456	601	768
District Ave.	353	394	446	490	508	518	504	520	578	774	1033	1378
East Central												
High	446	486	530	625	622	645	647	656	733	929	1241	1618
Medium	307	335	363	428	424	450	469	473	530	670	843	1060
Low	167	192	213	255	256	272	296	300	355	450	551	660
District Ave.	316	366	404	454	470	492	481	506	554	713	923	1163
Southwest												
High	310	338	378	419	443	460	470	485	548	654	784	978
Medium	206	228	257	287	305	317	321	334	379	466	554	667
Low	119	137	158	183	188	204	208	217	248	312	368	444
District Ave.	220	239	270	300	315	328	325	336	381	472	576	720
South Central												
High	270	300	331	356	368	382	393	401	439	545	719	937
Medium	163	187	208	225	231	241	256	259	290	362	469	589
Low	84	94	110	123	129	139	148	153	177	224	283	332
District Ave.	143	162	183	200	207	217	233	240	270	343	446	555

Table 4.3. Continued

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Southeast												
High	437	479	527	568	585	600	593	619	686	904	1261	1606
Medium	265	293	332	353	363	384	372	384	431	575	770	969
Low	130	153	175	195	198	210	209	216	250	342	454	521
District Ave.	263	297	334	365	376	393	370	382	428	561	747	935

Table 4.4. Average dollar value of farmland for the State of Iowa as derived from the Farm Census vs. that of the Iowa Land Value Survey

Year	Farm Census Estimate	Land Value Survey Estimate	% Difference
1964	$272	$267	1.8%
1969	392	394	0.5%

CHAPTER V. DETERMINANTS OF IOWA FARMLAND VALUE

During the farm depression of 1921-1940 appraisers began to rely upon the income approach to farm valuation. This continued until the early 1950's when farmland values began increasing without equivalent increases in net farm income. Concern over this phenomenon resulted in statistical studies in which analysts tried to determine the dominant factors operating in the land market, and to what extent those factors influenced farmland values [15, 43, 76]. Such factors as farm enlargement, technological advancement, expected capital gains, taxes, the Farm Program, population, location, inflation, and others were analyzed.

The objective of this chapter is to identify some of the principal factors currently affecting Iowa farmland values and to estimate the extent of the influence of those factors. The variables examined are net farm income per acre, soil productivity, the percent of land in row crops, the percent of land in other crops, livestock production, farm enlargement, expected capital gains, and population per square mile of farmland. Inflation is assumed to be subsumed into the income and capital gains variables. Information on the above variables was collected for each of Iowa's 99 counties from 1970-1973. This data is used in cross-sectional analyses for each year's data. Next, the data is tested by constrained regression analysis to ascertain if it can all be pooled in order to obtain more reliable estimates for this time period.

Net farm income is a major determinant of farmland value. The higher the expected income stream, the higher is a farm's capitalized present value. Net income per acre figures are derived from adjusted, county gross income and operating expense figures [1969 Farm Census, 90a], divided by the number of acres in farmland per county [Annual Iowa Farm Census, 33]. These county statistics are updated for 1970-1973 by applying relevant percentage changes reported by the Rate of Return on Investment in Crop-Share Rented Land in Iowa Survey conducted annually by the Iowa Agricultural Experiment Station [72]. Although this survey does not consider livestock, the results are reported on a cash basis like those of the Farm Census. Therefore, although the adjusted net income figures are approximate, there are no others available.

Soil fertility, livestock production, farm enlargement, and capital gains through the appreciation of land values all have an effect upon the real or expected return one receives from a farm. A 5-year average corn yield per acre is used in the regression analysis because a 3-year average did not explain as much of the variation in land prices, and a 1-year average yield does not give enough consideration for varying weather conditions. Mean corn suitability ratings are collinear with the percent of land in a county in row crops -- another significant variable used. The average correlation coefficient between the percent of land in row crops and land values for 1970-1973 is 0.88. The correlation coefficient for the percent of land in other crops averages -0.49. In sections of Iowa requiring more crop rotation and contour farming to prevent disinvestment in the soil, this factor may be important.

The heterogeneity of farmland across Iowa has resulted in specialization in different areas of agriculture. Livestock production is especially important to many Iowa farms, and mechanized feeding facilities are capitalized into higher farmland prices. Woodbury and Plymouth counties are examples of counties in which land values are higher than their mean corn suitability ratings predict, but these counties have intensive livestock production which helps to explain their land values. The analysis of this chapter uses a 3-year average of the portion of total cattle and hogs marketed in Iowa that each county supplies.

Farm enlargement has been one of the dominant factors operating in the Iowa farmland market since the early 1950's [36]. Advancing technology has increased the marginal productivity of capital relative to the marginal productivity of labor, enabling a farmer to operate more land with the same labor time. By expanding one's farm size, a farmer can spread the fixed cost of machinery over more acres and take advantage of economies of scale. Therefore, one may pay a premium price for an additional portion of land within a reasonable distance of the home farmstead. However, the farm enlargement process is also characterized by buyers' expectations, consumer preferences, and other nonquantifiable, psychological factors. For example, since there are fewer listings every year [36], one may purchase an additional piece of land now for fear that (s)he will never have the opportunity to buy it again. Also, it is not uncommon for a farmer to pay an apparent unrealistic price for a farm to prevent a neighbor from acquiring it. Actually, the farmer who purchases the land is not only paying for the farm but also for the satisfaction of winning a "grudge match." A third possible case is that while some people invest in art works, jewelry, antiques, etc., many Iowa farmers find security and status in acquiring more land. Besides, in most

Iowa farm communities a man (woman) with a large equity base spending $50,000 to $200,000 for more land is usually considered rational, but if (s)he spends the same amount upon a Picasso, the people think (s)he is irrational. Regardless, it may be impossible to accurately estimate the price at which these farms would have otherwise sold.

To try to capture the effect of farm enlargement, the percent of land going into farm enlargement in each county is measured since 1954, 1959, and 1964. Unfortunately, this approach or any based on average farm size on a 99 county cross-sectional basis does not capture the significance of farm enlargement.

Expectations are a major factor in any market dealing with large investment expenditures. The possibility of appreciation in land values is hypothesized to be a factor in determining demand for farmland. During periods of rising prices, investors are interested in purchasing land as a hedge against inflation and to take advantage of capital gains due to the appreciation in farmland values. The income tax advantage associated with these capital gains makes such investments even more appealing to investors in higher tax brackets. As a proxy for expected capital gains in land values, the geometric mean rate of return based upon the annual appreciation in land values for the three previous years is computed per county and entered into the multiple regression. A geometric mean rather than an average mean is used because, according to Francis and Archer [27], the geometric mean of several periods is the true mean rate of return over the entire time span.[1]

The last variable entered into the regression model is population per square mile of farmland per county. As population increases, farmland values tend to increase for any or all of the three following reasons: 1) indirectly through an increase in the demand for farm commodities; 2) the expansion of nonagricultural uses of land, e.g., residential, industrial, and recreational; and 3) an increase in the number of prospective owners with agricultural or investment motives. The 1970 Population Census [90b] is updated for 1971-1973 by county population estimates published annually by the Bureau of the Census [94, 95].

The results from yearly cross-sectional analyses using the described independent variables vs. the average value of an acre of Iowa farmland by county are:

$$Y_{1970} = \underset{}{-118.92} + \underset{(4.30)}{1.58X_1} + \underset{(2.71)}{2.02X_2} + \underset{(10.91)}{473.92X_3} + \underset{(4.60)}{2079.90X_4} + \underset{(2.21)}{413.74X_5} + \underset{(7.51)}{0.39X_6} \qquad R^2 = 0.90 \tag{5.1}$$

$$Y_{1971} = -119.83 + \underset{(5.47)}{1.98X_1} + \underset{(2.42)}{1.77X_2} + \underset{(12.64)}{504.29X_3} + \underset{(4.57)}{1928.18X_4} + \underset{(2.52)}{465.26X_5} + \underset{(7.47)}{0.37X_6} \qquad R^2 = 0.91 \tag{5.2}$$

---

[1]Geometric mean return = $(\sqrt[n]{(1 + r_1)(1 + r_2)(1 + r_3)}) - 1$. For example, given a $50 investment that doubles in value in one time period, and then depreciates 50 percent in the next time period, the arithmetic average gives a +25 percent average return while the geometric average gives a zero percent average return.

$$Y_{1972} = -174.56 + \underset{(6.36)}{1.54X_1} + \underset{(2.43)}{1.86X_2} + \underset{(14.53)}{637.45X_3} + \underset{(4.13)}{1739.93X_4}$$

$$+ \underset{(3.42)}{629.65X_5} + \underset{(7.83)}{0.38X_6} \qquad R^2 = 0.93 \qquad (5.3)$$

$$Y_{1973} = -217.72 + \underset{(5.18)}{1.22X_1} + \underset{(2.84)}{3.40X_2} + \underset{(11.00)}{647.27X_3} + \underset{(0.58)}{373.32X_4}$$

$$- \underset{(-0.32)}{258.92X_5} + \underset{(6.20)}{0.50X_6} \qquad R^2 = 0.90 \qquad (5.4)$$

where:

Y = average value of an acre of Iowa farmland by county

X_1 = net income per acre in a county

X_2 = 5-year average corn yield per acre in a county

X_3 = percent of land in row crops in a county

$X_4 = \dfrac{\text{3-year average number of cattle marketed in a county}}{\text{3-year average number of cattle marketed in Iowa}}$

X_5 = geometric mean of the appreciation in county farmland values over the previous three years to indicate expected capital gains

X_6 = population per square mile of farmland in a county.

All variables are used in linear form. The t-value for each regression coefficient is shown directly below the coefficient. The t-values are significant at the 95 percent confidence level in all cases except in 1973 for the variables representing cattle marketed and expected capital gains from the appreciation in land value.

To test the feasibility of combining all the data into a pooled cross-section and time-series model, a two-part constrained regression analysis is used to test if the parameters of the relation are the same for all four years' data. In step one an F-test is formed to check the hypothesis that the variation between the intercepts for each of the four years is not statistically significant. This requires that: a) the data be pooled and computed by the ordinary least squares method, and b) the data be pooled with the inclusion of dummy variables representing the intercept terms for 1971, 1972, and 1973. Essentially, part a constrains the intercept for the four years' data to one point while part b allows the intercept to vary. The equation is:

$$\frac{(R_F^2 - R_R^2)/q}{(1 - R_F^2)/(n-k)} = F_{q,(n-k)} \qquad (5.5)$$

where:

R_F^2 = the R^2 of the full model (includes dummy variables)

R_R^2 = the R^2 of the reduced model (no dummy variables)

q = the number of dummy variables

n = the total number of observations

k = the number of variables in the full model (includes intercept terms as variables).

In the second step, an F-test is used to check the hypothesis that the variation between the slopes, or coefficients, of the individual regression lines is not statistically significant. This requires a comparison of the sum of squares for the residual term of the full model vs. the summation of the sum of squares for the residual terms from each year's cross-sectional model. The equation is:

$$\frac{(SSR_F - \Sigma SSR_{to\text{-}tn})/q}{(\Sigma SSR_{to\text{-}tn})/(n-k)} = F_{q,(n-k)} \qquad (5.6)$$

where:

SSR_F = the sum of the squares of the residual for the full model

$\Sigma SSR_{to\text{-}tn}$ = the summation of the sum of the squares of the residual for each individual year considered (year to through year tn)

q = the number of independent variables for each year times the number of years, minus the number of independent variables in the full model (The intercept is considered an independent variable.)

n = the total number of observations

k = the number of independent variables for each year times the number of years (The intercept is considered an independent variable.)

Both tests indicate that the parameters differ, making it invalid to pool all the data.

However, when data for 1973 is excluded, the F-tests indicate that pooling the data is feasible. The F-test to indicate 95 percent confidence that the intercepts are essentially the same requires that the calculations for (5.5) be $\leq F_{.05} = 3.04$. The calculated F value from (5.5) is 0.76. The F-test to indicate 95 percent confidence that the slopes do not vary requires that the calculated value for (5.6) be $\leq F_{.05} = 1.80$. The calculated F value from (5.6) is 1.71. Therefore, it is statistically valid to combine the data for 1970-1972 into a pooled cross-section and time-series model to derive estimates of the significant variables operating in the farmland market for this time period. The pooled model for 1970-1972 is:

$$
\begin{aligned}
Y = -133.45 &+ \underset{(11.47)}{1.83X_1} + \underset{(4.41)}{1.86X_2} + \underset{(22.21)}{528.13X_3} + \underset{(7.57)}{1893.09X_4} \\
&+ \underset{(4.82)}{429.77X_5} + \underset{(12.85)}{0.38X_6} \qquad R^2 = 0.92 \qquad (5.7)
\end{aligned}
$$

The t-values for each regression coefficient are shown directly below the coefficient. All the variables are significant at the 99 percent confidence level, and they explain 92 percent of the variation in land values by county.

For this 1970-1972 time period the coefficient for net income per acre, X_1, indicates that a one dollar difference in county net income per acre is associated with a difference in county per acre land values of $1.83. The coefficient of X_2 indicates that an increase in corn yield of a bushel per acre raises land values by $1.86 an acre. The coefficient for X_3, the percent of land in row crops in a county, indicates that an additional percent of farmland in row crops causes farmland values to rise by $5.28 an acre. The coefficient for the relative amount of cattle production in a county, X_4, indicates that if a county increases its production by an amount equivalent to one percent of the State total, then farm real estate prices increase by $18.93 an acre. The coefficient of X_5 indicates that a one-hundred basis point increase in the geometric mean of the appreciation in county farmland values over the previous three years is associated with a $4.30 per acre increase in the present year's land values. The coefficient for the population variable, X_6, indicates that farmland values increase by $0.38 an acre for each additional person per square mile of farmland in a county.

Whenever the percent of land in other crops is included as a variable in any of these equations, it is statistically insignificant. The variable for cattle marketed is used as a proxy for livestock production because whenever cattle and hogs variables are included simultaneously, their interaction results in only the cattle variable being significant, except in 1973 when neither is significant. Using the hogs-marketed variable without the cattle-marketed variable causes hogs marketed to be significant, but not to the extent of the cattle variable for 1970-1972. In 1973, although both are statistically insignificant, the hogs-marketed variable has a higher t-value than the cattle variable. This may be due to the large advances made in the hog market since its 1971 decline. The geometric mean of the appreciation in county farmland values over the previous three years is significant in all cases except for 1973. However, in 1973 land values increased 31.6 percent while the average percent increase during the previous six years was only five percent. The proxy for expected capital gains did not correlate with the sudden, large increase in land values.

In late 1972 increased foreign demand for U.S. grain commodities began to exert an influence on the net income streams of Iowa farmers. The effect of this increased demand upon corn and soybean prices in Iowa is indicated in Table 5.1.

Table 5.1. Yearly average prices for a bushel of corn and a bushel of soybeans for 1970-1975[a]

Year	Price per Bushel of Corn in Iowa	Price per Bushel of Soybeans in Iowa
1970	$1.17	$2.55
1971	1.21	2.90
1972	1.11	3.29
1973	1.81	6.49
1974	2.87	6.39
1975	2.66	4.93

[a]Source: [92].

This increased foreign demand was caused by apparent easing of world tensions, increasing world population, increasing income levels in countries with effective demand, the devaluation of the American dollar, and global bad weather. Although most of these factors may not be permanent, their effect upon Iowa farm commodity prices created positive expectations regarding Iowa net farm income. This may be a dominant factor operating in the Iowa farm real estate market since late 1972.

CHAPTER VI. SUMMARY AND CONCLUSIONS

Fair market value estimates for farmland are important for the purchase and sale of farm property, farm loans, tax assessments, estate settlements, condemnations, and easements. The necessity for accuracy in these estimates is directly related to the degree of profitability and equity desired. Growing awareness of the rapid increases in the value of Iowa real estate has resulted in increased demand for frequent and reliable information concerning fair market value estimates. However, difficulties arise in the determination of these estimates because: 1) no two personal utility functions are identical; 2) cardinal utility measurements and interpersonal utility comparisons are impossible; 3) no two parcels of real estate are identical; 4) there is a high degree of dynamics in the agricultural sector generated by internal forces -- adoption of new technologies, increased capital intensiveness, specialization, and larger volume -- and by external forces -- social institutions, political or governmental regulations, and physical or natural forces; and 5) there are no organized farm real estate markets.

A historical account of Iowa land values shows the development of the prevalent farm appraisal procedures used to overcome these difficulties. By the early 1860's, most of the public land in Iowa had come into private hands. From then until 1900 values were based largely upon farm income and improvements. The early 1900's was the beginning of a period when a constantly increasing portion of the purchase price was based upon expected future increases in the price of land. The valuation process was characterized by "horseback" or "windshield" appraisals. This process culminated in the farmland boom of 1919-1920, followed by the agricultural depression of 1921-1940. By the 1930's a movement was underway to improve farm loan appraisal techniques. This movement resulted in the productivity method, or income approach, to farm appraisal -- the first, logical, step-by-step approach applied to farmland valuation. The income approach was the major farmland valuation procedure until the mid-1950's. At that time changing technology and consumer tastes resulted in land values increasing without commensurate increases in net income. Due to the prevalence of this lack of income and value correlation, the sales comparison, or market value, approach assumed the dominant role in the appraisal field and has maintained that position to the present time.

The purpose of an appraisal is to determine the market value of a subject property at a particular point in time. The sales comparison approach uses comparable sales to estimate a subject property's present market value. A comparable sale is defined as a farm or property resembling the subject property in terms of 1) type of farm, 2) farm size, 3) productive capacity, 4) date of sale, 5) location, 6) access roads, 7) extent of the improvements, 8) kind of farm organization, and 9) community facilities. Comparability does not depend upon a single factor, nor does one or two dissimilarities eliminate the use of a farm in the comparison process. Principal factors limiting the application of the comparison method are the basic heterogeneity of farms and the imperfectness of the farm real estate market. This latter factor results in deficiency of sufficient and dependable data.

The income approach indicates the capitalized value of a farm based upon expected long-term earnings, assuming an appropriate capitalization rate. However, not only is the estimate for long-term earnings partially subjective, the choice of a proper capitalization rate is a limiting factor of this approach. If an "income capitalization rate," i.e., a rate based upon some type of opportunity cost of money, is selected, then nonincome features are entirely excluded. On the other hand, if buyers are interested in factors other than the right to receive a future income stream, a "sale value capitalization rate" is used. This rate is derived by comparing the net income streams from a group of comparable farms to their respective sale values. Such an approach is only a disguised version of the comparable sales approach.

Therefore, the comparable sales technique is considered most appropriate when comparable sales are available. However, for appraisals where a projection of only purely monetary returns is sought for investment or loan decisions, the income approach may still be more relevant. A third, relatively recent approach is the statistical approach which draws heavily upon the comparable sales and income approaches for the selection of factors deemed as important determinants of farmland values. The statistical approach is especially prevalent within academia, partially due to the access to computer facilities. Correlation methods help to determine the degree to which different variables are associated, and regression models help the appraiser to determine the best functional relationships between the factors and land value. Statistical analysis helps indicate how factors affect land values differently depending upon the farm real estate areas. It is likely that the application of statistics to farmland appraisal will be increasingly emphasized, even though appraisal experience will always be the most important tool in the profession.

Successful use of any appraisal approach, however, depends critically upon a relevant data base. Historical land value indices and current bench mark estimates are useful in generating current estimates via the appraisal process. Land value surveys providing bench mark information for Iowa farm real estate are conducted by the Federal Census Bureau, the National Economic Analysis Division of the Economic Research Service, the Chicago Federal Reserve, and the Iowa Agricultural Experiment Station. The surveys conducted by the first three institutions mentioned are plagued by problems of either excessive aggregation of area data or infrequency of data generation. The Iowa Land Value Survey conducted by the Iowa Agricultural Experiment Station annually surveys licensed real estate brokers in Iowa's nine Crop Reporting Districts. The brokers report estimated values for high, medium, and low grade farmland in their respective areas of business as of November 1.

The published report lists average values for these grades of land and an average for all grades on a district and state level. The all grade estimate is derived by taking a simple average of the estimates for high, medium, and low grade land. This implicitly assumes an equal prevalence of each grade of land in each district. The result is consistent overvaluation in districts with relatively more lower-value land, and consistent undervaluation in districts with relatively more higher-quality land. Beginning in 1972 the Station began deriving current county average farm real estate values by combining Iowa Land Value Survey information with the latest (1969) Farm Census estimates. District percentage changes for high, medium, low, and all grades of land registered by the Survey from 1969 through 1972 were analyzed. The author combined this information with his general knowledge of the land quality in each district to derive an overall percentage figure. These district percentages were then applied to the Farm Census' county estimates to obtain current, county farmland value estimates.

To improve this data base provided by the Iowa Land Value Survey, two adjustments were made. The disciplines of Economics and Soil Science were combined to develop more homogeneous farm real estate markets, and broker opinions regarding the prevalence of each grade of land in their areas were used in conjunction with their land value estimates. The Soil Survey, which was begun in 1899, always paid particular attention to soil factors which appeared to influence the suitability of soils for crops. The need for this information became increasingly apparent during the 1930's. Attempts were made to correlate soil characteristics and productivity. This work eventually resulted in corn suitability ratings (CSR's) which reflect the integrated effects of slope, erosion, drainage, soil depth, parent materials, biosequence, soil type, and weather upon the yield of row crops at a specified level of management. These ratings range from zero to 100, with 100 signifying soils that: a) are located in the most favorable weather areas of Iowa, b) have a high yield potential, and c) can be continually row cropped with little erosion loss. Mean

CSR's were developed for each Iowa county. Since soil productivity is the basis for the income generating power of farmland -- the major factor in determining land values -- county mean CSR's are used to divide Iowa into homogeneous land market areas. This mapping reduces the variation between the averages of the broker responses for counties within given areas.

Using broker opinions regarding the prevalence of each grade of land in their areas alleviated the weighting problem in the derivation of all grade (or average) farmland value estimates from data on high, medium, and low grades of land. Averaging the broker reports on land quality provided a weighting scheme to apply to the average values of each grade of farmland. To test this new system of weights, the results from its utilization in the derivation of average land values per county for 1969 were compared with the 1969 Farm Census figures. The absolute average difference per county was only 4.3 percent. Given this degree of accuracy, the same estimation procedure was used to estimate average, county farmland values for 1964-1975 noncensus years. Given the individual county estimates, all grade land values by district were obtained by weighting each county estimate by the number of acres in farmland per county. This process eliminated the weighting problem plaguing district estimated averages. This same procedure was used in the derivation of State averages. Comparison of these State averages with those from the 1964 and 1969 Farm Census's showed differences of only 1.8 percent and 0.5 percent respectively.

Once a procedure was developed for determining annual Iowa farmland values on a county basis, the next step was to analyze the principal factors currently affecting Iowa farmland values and the extent of their influence. The variables examined were net farm income per acre, soil productivity, the percent of land in row crops, the percent of land in other crops, livestock production, farm enlargement, a proxy for capital gains, and population per square mile of farmland. Inflation was assumed to be subsumed into the income and capital gains variables. Information concerning these variables was collected for each of Iowa's 99 counties for 1970, 1971, 1972, and 1973. A cross-sectional analysis was performed upon each year's data. Then the data was tested by constrained regression analysis to ascertain if it could all be combined into a pooled cross-section and time-series analysis to obtain more reliable estimates for this time period.

The variables used in the final regression analyses were net income per acre (X_1), a 5-year average corn yield per acre (X_2), the percent of land in row crops (X_3), a 3-year average of the portion of total cattle marketed in Iowa that each county supplies (X_4), the proxy for expected capital gains (X_5), and population per square mile of farmland (X_6). All the variables used were in linear form. The t-values for all the coefficients in the yearly cross-sectional analyses were significant at the 95 percent confidence level except in 1973 for the variables representing cattle marketed and expected capital gains.

The constrained regression analysis applied F-tests to determine if the parameters of the relation were the same for all four years' data. This was done by testing the variation in the intercepts and slopes. These tests indicated that the variation in the parameters for the land value analyses was statistically significant for the 1970-1973 time period. However, when data for 1973 was excluded, the F-tests indicated that the variation in the intercepts and slopes of the three years' data was not statistically significant, or that pooling was valid. All variables included in the pooled model were significant at the 99 percent confidence level, and they explained 92 percent of the variation in land values by county. Table 6.1 indicates the effect that a change in one of the independent variables (X_i) had upon per acre estimated county land values for the 1970-1972 time period according to equation 5.7.

Table 6.1. Effect from a change in an independent variable (X_i) upon per acre estimated county land values (Y) based upon equation 5.7

Independent Variable (X_i)	Unit Increase in (X_i)	Dollar Change in Per Acre County Land Values (Y) Caused by a Change in (X_i)
X_1 (net income/acre)	one dollar	+ \$1.83
X_2 (5-year average corn yield/acre)	one bushel	+ \$1.86
X_3 (% of land in row crops)	one percentage point	+ \$5.28
X_4 (% of Iowa cattle marketed)	one percentage point	+ \$18.93
X_5 (expected capital gains)	one percentage point	+ \$4.30
X_6 (population/square mile of farmland)	one person	+ \$0.38

Whenever the percent of land in other crops was included as a variable in any of the models, it appeared statistically insignificant.

Unfortunately this analysis did not capture the significance of farm enlargement. The percent of land going into farm enlargement in each county since 1954, 1959, and 1964 was calculated, but using this approach or any average farm size variable on a 99 county cross-sectional basis does not show the effect of farm enlargement. The variable for cattle marketed was used as a proxy for livestock production because whenever cattle and hogs variables were included simultaneously, their interaction resulted in only the cattle variable being significant, except in 1973 when neither was significant. The geometric mean of the appreciation in county farmland values over the previous three years that was used as a proxy for expected capital gains was significant in all cases except for 1973. However, in 1973 land values increased 31.6 percent while the average percent increase during the previous six years was only five percent. This variable did not correlate with the sudden, large increase in land values. It was at this time, late 1972, when foreign demand began to exert a major influence upon the net income streams of Iowa farmers. The increase in Iowa grain prices created positive expectations regarding net farm income and were capitalized back into higher fa prices.

Suggestions for future work in the determination and analysis of Iowa land values includes: 1) periodic survey of brokers' opinions regarding the prevalence of each grade of land in their business areas, 2) a further attempt at developing a proxy for farm enlargement, and 3) an attempt to develop a proxy for the effect of expected farm income upon Iowa farmland values.

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APPENDIX A. CORN SUITABILITY RATINGS PER IOWA COUNTY

Table A.1. Percent of land within given ranges of corn suitability ratings per Iowa county[a]

(Co. No.)	County	0 -5	5+ -10	10+ -15	15+ -20	20+ -25	25+ -30	30+ -35
Northwest Area								
11	Buena Vista	2.45	0.82	0.01	0.29	3.38	0.18	0.26
14	Carroll	0.73	0.70	0.04	0.73	1.01	0.42	0.23
18	Cherokee	4.49	2.37	0.83	0.21	1.05	6.17	0.48
21	Clay	1.03	0.49	0.14	0.32	4.09	0.38	--
30	Dickinson	1.00	0.48	0.04	0.88	1.91	0.46	1.35
32	Emmet	1.11	0.52	0.56	4.05	2.01	1.18	0.15
60	Lyon	3.13	0.36	0.64	0.77	5.75	0.52	1.02
71	O'Brien	1.43	0.19	0.17	0.03	2.84	0.07	0.62
72	Osceola	0.27	0.23	0.08	0.29	6.33	0.67	0.11
81	Sac	0.39	0.92	0.08	0.43	3.82	0.47	0.77
84	Sioux	2.30	0.34	0.20	0.11	2.63	0.18	0.26
North Central West Area								
35	Franklin	1.10	0.40	0.80	0.15	1.11	0.08	1.66
41	Hancock	0.81	0.38	0.27	0.36	0.96	0.08	0.12
46	Humboldt	0.25	0.81	0.05	0.39	0.44	--	0.68
55	Kossuth	0.16	0.26	0.13	0.48	0.71	0.08	0.08
74	Palo Alto	0.60	0.05	0.18	1.16	3.34	0.94	0.52
76	Pocahontas	--	0.35	0.63	0.15	0.68	0.12	0.11
95	Winnebago	0.55	0.02	0.06	0.39	0.35	0.20	0.07
99	Wright	0.62	0.14	0.47	0.28	0.50	0.25	0.13
North Central East Area								
7	Black Hawk	5.00	0.07	0.56	1.94	3.74	0.30	2.73
9	Bremer	2.94	0.78	0.32	0.92	2.44	--	2.14
10	Buchanan	--	1.04	0.43	0.15	3.07	0.54	0.39
12	Butler	0.93	0.03	0.39	1.67	1.33	0.05	2.63
17	Cerro Gordo	0.11	0.43	0.68	0.88	1.74	0.46	1.52
19	Chickasaw	0.02	--	0.08	3.79	1.03	0.90	0.55
34	Floyd	1.04	0.34	0.83	1.00	0.79	0.29	1.05
45	Howard	1.08	0.71	0.05	2.00	0.53	0.49	1.10
66	Mitchell	1.45	0.23	0.31	0.41	0.46	0.28	0.43
98	Worth	0.54	0.08	1.03	0.44	0.21	0.29	0.52

[a]From 1965 National Inventory of Soil & Water Conservation Needs

35+ -40	40+ -45	45+ -50	50+ -55	55+ -60	60+ -65	65+ -70	70+ -75	75+ -80	80+ -85
0.55	1.91	3.84	0.88	2.94	16.31	1.95	3.77	17.18	32.20
2.49	0.77	3.97	1.31	12.00	16.19	11.80	8.74	0.38	23.18
1.31	1.52	8.16	9.02	6.87	1.65	14.06	27.81	3.47	9.29
0.08	1.88	2.06	8.08	4.46	13.74	8.70	7.39	27.23	11.68
0.32	1.03	4.76	1.44	18.50	1.65	9.32	32.89	21.27	1.69
1.80	1.44	4.80	4.04	15.97	3.53	1.65	28.34	12.95	16.38
0.95	1.79	12.59	4.38	8.07	21.41	22.84	5.04	9.59	0.36
0.07	0.99	2.77	0.21	0.29	33.18	17.96	13.97	24.03	0.04
0.62	1.83	3.89	1.34	9.97	21.16	18.45	11.03	24.52	--
0.60	1.16	6.36	3.27	2.58	19.75	2.60	3.32	25.67	20.23
1.89	2.56	0.61	22.97	0.04	3.55	44.82	7.43	8.32	0.78
0.42	0.37	1.23	1.42	4.31	7.58	2.82	12.58	16.49	15.94
2.49	1.62	2.22	1.67	5.85	9.73	0.52	13.64	22.39	20.28
2.40	0.37	0.77	2.52	9.46	15.70	0.77	0.68	8.37	36.73
0.38	0.38	1.78	3.67	3.48	12.61	4.16	1.25	39.75	30.56
0.04	1.00	2.08	5.66	2.84	11.90	6.71	20.98	29.02	12.95
0.05	0.51	0.72	1.53	4.69	7.12	7.11	2.27	31.13	24.63
1.29	1.42	5.44	4.16	3.86	22.04	1.51	3.68	23.98	22.35
0.49	0.45	2.44	2.80	4.40	8.15	2.48	4.56	20.53	34.36
3.57	0.32	0.88	0.06	1.74	1.80	10.02	28.33	10.74	15.20
2.65	1.10	0.65	0.34	2.48	2.80	5.48	44.16	20.10	8.52
5.84	0.59	1.41	1.28	2.34	3.28	8.00	17.98	24.47	6.17
1.72	0.66	0.17	0.90	2.73	4.23	10.25	34.00	14.06	7.51
0.77	1.33	0.95	2.48	6.28	10.71	3.14	27.24	19.91	13.81
0.67	1.49	0.60	1.14	5.20	6.55	7.38	36.61	12.77	20.72
1.58	1.27	1.59	1.67	9.06	10.98	4.23	35.15	10.75	10.13
1.40	1.26	1.53	4.25	10.68	18.40	4.90	33.94	6.32	10.07
0.86	0.28	0.64	2.58	3.36	4.58	1.07	17.06	17.33	18.53
1.53	0.96	2.68	2.10	6.79	10.33	1.34	23.89	23.46	14.94

Table A.1. Continued

(Co. No.)	County	85+ -90	90+ -95	95+ -100	Average CSR
Northwest Area					
11	Buena Vista	10.95	--	--	71
14	Carroll	15.31	--	--	70
18	Cherokee	0.56	0.59	--	60
21	Clay	6.91	0.80	--	69
30	Dickinson	--	--	--	65
32	Emmet	--	--	--	71
60	Lyon	0.78	--	--	59
71	O'Brien	--	1.14	--	68
72	Osceola	--	--	--	69
81	Sac	7.55	0.04	--	70
84	Sioux	1.00	--	--	60
North Central West Area					
35	Franklin	17.72	11.52	2.31	76
41	Hancock	16.70	--	--	72
46	Humboldt	19.61	--	--	73
55	Kossuth	0.04	--	--	73
74	Palo Alto	--	--	--	68
76	Pocahontas	18.22	--	--	75
95	Winnebago	8.64	--	--	70
99	Wright	16.95	--	--	75
North Central East Area					
7	Black Hawk	6.34	5.19	1.49	68
9	Bremer	1.01	0.26	--	68
10	Buchanan	19.48	2.94	--	70
12	Butler	10.33	6.21	0.20	73
17	Cerro Gordo	7.12	1.06	--	70
19	Chickasaw	0.27	0.30	--	70
34	Floyd	4.18	4.08	--	68
45	Howard	0.72	0.38	--	66
66	Mitchell	13.72	15.40	1.00	76
98	Worth	7.77	1.11	--	71

Table A.1. Continued

(Co. No.)	County	0 -5	5+ -10	10+ -15	15+ -20	20+ -25	25+ -30	30+ -35
Northeast Area								
3	Allamakee	29.2	0.94	7.31	1.56	1.72	-	0.60
22	Clayton	18.5	0.82	1.01	1.37	1.94	2.72	0.62
28	Delaware	--	6.88	3.05	1.00	2.36	2.57	1.54
31	Dubuque	13.46	0.08	1.81	0.50	2.42	1.42	1.43
33	Fayette	7.4	0.48	0.32	1.06	2.45	1.63	2.26
49	Jackson	19.37	0.38	3.54	0.52	6.17	4.03	0.29
96	Winneshiek	12.65	0.82	1.58	1.93	5.63	1.76	1.64
West Central Area								
5	Audubon	0.92	0.15	1.48	3.25	1.33	0.03	1.02
24	Crawford	2.29	2.02	0.76	0.69	2.33	3.22	1.02
39	Guthrie	4.90	1.87	1.86	3.08	4.24	0.77	0.97
43	Harrison	9.70	6.12	1.86	0.35	2.43	7.22	1.11
47	Ida	0.40	1.52	0.14	0.30	1.76	7.62	0.96
67	Monona	5.42	4.74	1.02	3.26	1.68	5.88	3.64
75	Plymouth	2.73	0.64	0.22	0.24	3.26	3.96	1.94
83	Shelby	0.34	0.83	0.45	0.81	1.42	2.50	0.88
97	Woodbury	0.79	2.33	0.54	0.17	1.92	10.00	5.21
Central Area								
6	Benton	0.88	0.28	0.50	2.21	2.03	1.11	1.20
8	Boone	--	0.50	3.23	--	0.81	0.30	1.06
13	Calhoun	0.05	0.01	0.03	0.42	1.02	0.04	0.08
25	Dallas	--	3.00	2.74	0.99	0.88	4.95	1.35
37	Greene	--	2.92	1.44	0.11	--	1.90	1.03
38	Grundy	0.15	--	--	0.05	2.71	--	--
40	Hamilton	1.88	0.48	0.09	0.22	1.13	0.17	--
42	Hardin	--	0.07	0.08	0.21	0.13	1.26	0.49
64	Marshall	1.23	1.27	0.65	1.40	2.32	0.06	0.01
77	Polk	--	2.48	1.27	0.76	0.16	4.84	1.48
85	Story	--	0.35	0.40	1.37	0.56	0.50	0.77
86	Tama	0.66	1.52	0.27	0.42	1.32	3.80	0.25
94	Webster	2.47	0.33	1.85	0.44	2.42	0.59	0.10
East Central Area								
16	Cedar	1.60	0.44	0.39	0.62	2.09	1.29	0.58
23	Clinton	4.44	1.30	1.29	0.72	3.03	1.71	1.49
53	Jones	3.86	0.62	1.54	3.64	5.49	3.62	2.17
57	Linn	5.45	0.74	1.51	2.39	4.63	1.71	2.52
70	Muscatine	2.72	1.13	0.93	0.21	5.05	0.29	0.20
82	Scott	2.14	0.42	0.42	2.90	2.90	2.33	0.07

35+ -40	40+ -45	45+ -50	50+ -55	55+ -60	60+ -65	65+ -70	70+ -75	75+ -80	80+ -85
0.04	--	0.01	0.07	24.66	1.93	12.61	4.51	0.47	9.77
0.96	3.22	6.23	7.45	13.25	3.46	13.48	12.26	1.53	5.90
2.31	2.22	3.25	1.75	6.68	5.26	5.82	11.56	16.42	3.76
1.32	1.88	12.83	3.16	19.33	10.13	10.56	11.03	1.89	2.11
1.06	0.91	3.72	1.80	11.02	15.06	8.94	20.82	4.38	12.42
1.86	1.80	11.34	1.26	21.10	4.98	9.53	4.55	1.20	0.37
1.62	1.27	3.72	3.23	14.07	9.58	10.49	17.88	2.54	4.15
8.43	0.49	12.91	0.29	22.81	16.33	9.60	9.99	0.34	3.69
3.07	6.15	4.44	13.77	16.49	9.29	20.98	4.69	1.25	5.89
5.81	1.29	7.51	2.34	4.10	9.27	10.25	7.84	4.10	13.25
9.23	5.10	5.85	5.47	6.23	9.96	1.94	8.11	9.22	1.57
3.10	6.83	8.00	16.91	12.86	7.56	12.42	12.28	6.19	1.01
17.28	2.80	3.09	8.99	2.84	13.66	7.91	1.84	10.17	2.28
5.69	4.59	6.28	24.64	1.92	11.44	15.50	8.69	5.50	0.79
7.89	1.93	14.88	1.26	23.58	16.54	4.35	0.21	6.02	8.61
13.40	6.56	12.52	12.59	5.01	7.60	6.11	6.13	2.52	6.23
0.96	1.37	2.15	2.12	3.82	4.20	8.59	18.01	4.14	2.64
0.23	0.28	1.00	1.43	3.74	2.74	11.81	4.93	3.12	39.57
0.28	0.04	0.58	2.57	4.47	7.63	0.67	0.76	8.18	46.72
1.98	0.91	3.19	0.87	4.24	1.95	9.94	3.72	0.88	35.60
0.68	0.43	1.39	0.72	3.65	6.22	8.54	2.44	5.73	28.44
0.12	--	0.02	0.20	0.26	0.28	8.47	15.17	9.08	6.66
0.25	0.35	1.08	0.90	3.38	10.82	2.35	4.52	16.41	33.30
0.11	0.18	0.83	0.37	2.38	7.21	11.85	7.07	6.82	28.45
0.39	0.06	0.42	0.84	0.81	2.28	16.15	6.10	31.20	2.52
0.53	2.45	1.18	1.49	3.29	2.79	4.22	7.68	2.84	15.05
1.38	0.50	0.80	2.34	1.10	3.36	13.72	1.41	5.16	22.00
0.42	0.31	3.51	1.24	2.53	3.86	4.71	8.08	--	4.52
0.47	0.16	1.92	0.84	6.33	8.84	1.82	3.34	13.57	32.30
1.52	1.62	3.11	2.68	3.60	3.20	13.46	12.48	10.98	2.74
3.30	4.95	2.07	2.52	9.06	3.48	11.31	22.73	5.09	4.60
2.85	2.25	3.82	3.58	7.40	4.05	10.55	16.11	5.28	3.62
4.88	1.42	3.14	1.13	2.48	2.70	15.67	17.31	7.44	14.33
4.10	5.89	4.48	0.20	3.10	1.52	6.82	12.77	13.79	6.73
0.15	2.33	1.83	1.16	1.64	3.79	15.05	12.43	14.46	3.49

Table A.1. Continued

(Co. No.)	County	85+ -90	90+ -95	95+ -100	Average CSR
Northeast Area					
3	Allamakee	4.53	0.07	--	44
22	Clayton	3.16	2.36	0.04	51
28	Delaware	10.48	7.57	4.52	63
31	Dubuque	3.77	0.82	0.08	52
33	Fayette	3.89	0.41	--	62
49	Jackson	7.62	0.08	--	45
96	Winneshiek	5.09	0.34	--	54
West Central Area					
5	Audubon	6.93	--	--	59
24	Crawford	1.65	--	--	56
39	Guthrie	14.38	2.17	--	61
43	Harrison	3.40	5.16	--	50
47	Ida	0.30	--	--	53
67	Monona	0.24	3.28	--	50
75	Plymouth	1.95	--	--	52
83	Shelby	7.52	0.08	--	59
97	Woodbury	0.14	--	--	48
Central Area					
6	Benton	23.29	15.56	5.04	75
8	Boone	8.58	16.70	--	74
13	Calhoun	25.45	--	--	80
25	Dallas	11.72	11.10	--	70
37	Greene	20.02	15.13	--	75
38	Grundy	12.39	28.82	15.63	85
40	Hamilton	22.3	0.39	--	77
42	Hardin	9.26	13.87	9.36	79
64	Marshall	5.39	17.42	9.47	77
77	Polk	26.13	18.24	2.13	73
85	Story	31.58	12.70	--	77
86	Tama	12.40	37.37	12.80	81
94	Webster	22.09	--	--	74
East Central Area					
16	Cedar	10.98	18.92	7.72	75
23	Clinton	10.38	5.71	0.78	64
53	Jones	13.51	3.48	2.67	61
57	Linn	4.85	5.66	0.04	63
70	Muscatine	2.94	19.81	7.32	70
82	Scott	5.47	20.04	6.78	73

Table A.1. Continued

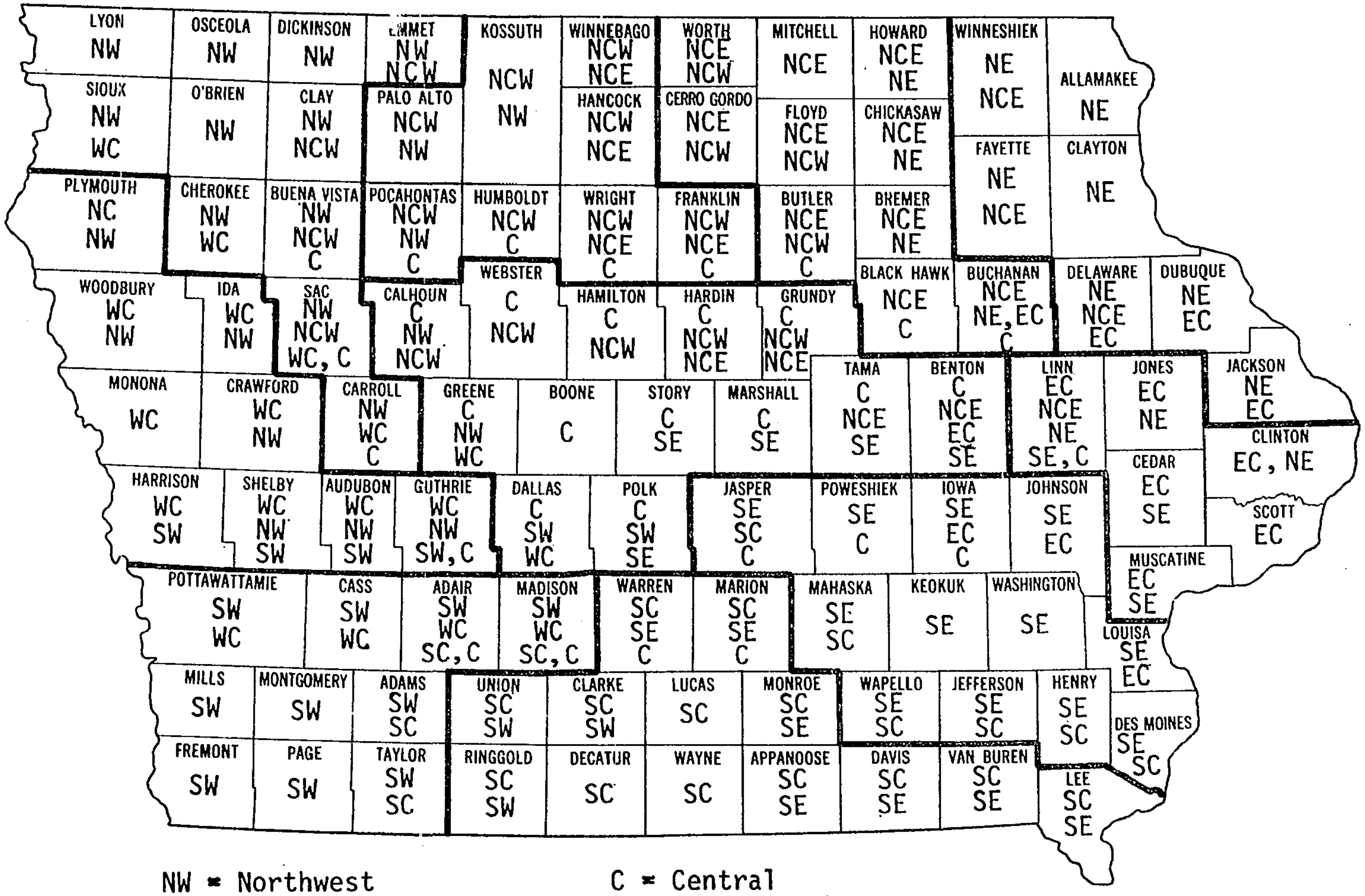
(Co. No.)	County	0 -5	5+ -10	10+ -15	15+ -20	20+ -25	25+ -30	30+ -35
Southwest Area								
1	Adair	3.97	2.87	2.55	1.25	11.88	2.10	1.19
2	Adams	2.36	5.86	2.21	2.09	15.55	2.65	0.05
15	Cass	0.49	6.44	0.92	0.04	9.63	1.00	--
36	Fremont	1.81	2.36	1.06	2.45	1.64	0.72	0.18
61	Madison	8.53	5.20	1.54	1.96	9.34	2.44	1.08
65	Mills	2.09	2.62	2.69	0.11	2.73	4.01	1.78
69	Montgomery	1.09	0.87	1.27	0.73	3.64	2.04	--
73	Page	0.94	0.61	1.79	2.18	1.76	3.20	1.02
78	Pottawattamie	2.00	1.97	0.15	0.07	1.02	4.93	0.18
87	Taylor	0.12	0.41	0.63	0.95	3.09	5.87	0.66
South Central Area								
4	Appanoose	8.48	9.82	3.06	1.43	17.44	9.06	4.70
20	Clarke	5.94	6.53	2.82	6.73	8.67	11.18	3.52
26	Davis	7.46	5.66	1.48	2.69	11.68	14.68	4.85
27	Decatur	4.60	9.67	2.06	3.04	17.52	12.16	2.35
56	Lee	10.58	3.05	6.28	2.40	2.23	7.02	1.54
59	Lucas	10.83	6.04	1.45	7.68	4.99	7.28	0.99
63	Marion	6.98	4.11	0.68	1.14	9.68	2.55	1.15
68	Monroe	8.54	10.78	0.50	0.27	17.47	7.65	1.62
80	Ringgold	0.53	0.74	1.07	0.80	9.33	14.34	4.40
88	Union	5.56	5.66	1.11	1.08	18.85	3.72	0.38
89	Van Buren	7.45	15.78	0.92	0.85	8.54	14.76	2.23
91	Warren	4.75	7.99	1.41	1.60	15.67	1.22	0.11
93	Wayne	3.77	3.22	0.80	3.38	16.86	6.27	4.35
Southeast Area								
29	Des Moines	4.65	2.20	0.30	5.10	3.01	0.74	1.39
44	Henry	1.34	2.27	0.02	0.38	7.36	6.24	0.62
48	Iowa	7.04	1.67	2.41	1.49	4.60	2.50	1.46
50	Jasper	3.87	4.03	0.94	0.92	5.97	1.02	0.32
51	Jefferson	0.66	5.62	0.82	0.16	6.48	9.42	2.94
52	Johnson	8.01	0.47	2.01	0.88	4.46	2.40	1.26
54	Keokuk	0.10	1.14	0.10	0.76	5.49	3.65	1.90
58	Louisa	9.05	5.29	0.08	0.60	4.19	2.38	1.07
62	Mahaska	2.12	2.54	1.14	0.99	11.86	3.00	0.61
79	Poweshiek	6.05	2.01	3.27	1.19	1.78	2.31	2.48
90	Wapello	5.63	3.51	0.10	0.33	9.00	5.38	0.49
92	Washington	0.49	0.56	0.38	--	1.97	2.73	0.73

35+ -40	40+ -45	45+ -50	50+ -55	55+ -60	60+ -65	65+ -70	70+ -75	75+ -80	80+ -85
3.72	1.23	9.33	0.27	6.90	9.39	17.04	7.98	0.43	2.86
1.39	0.82	4.16	0.25	4.16	12.55	10.65	13.74	0.05	3.75
0.32	0.19	1.07	0.16	18.15	19.74	11.82	11.68	--	2.99
10.08	1.86	4.35	7.89	10.19	11.86	7.29	8.30	5.72	10.98
3.14	0.96	2.55	0.73	2.16	4.83	10.00	14.21	1.66	7.12
0.84	3.32	1.46	8.96	14.16	13.84	11.45	7.05	4.19	7.38
1.29	0.47	2.65	1.22	22.36	14.67	10.69	2.11	4.76	9.69
1.78	0.52	4.05	0.29	19.53	17.84	14.67	2.78	5.93	8.00
5.25	2.76	4.14	9.42	9.84	14.30	4.74	11.97	9.41	2.46
1.48	8.14	23.07	1.24	8.82	1.40	12.61	5.73	0.94	10.07
11.78	5.40	1.27	2.06	20.07	1.28	1.69	1.72	--	0.13
8.77	4.90	8.77	2.19	1.27	0.79	10.60	12.36	0.12	--
5.95	1.45	0.35	4.61	22.11	2.12	9.25	4.46	--	0.26
9.29	3.70	6.66	3.25	3.25	0.67	8.60	9.25	--	--
6.49	4.12	6.98	3.10	12.05	6.24	14.33	9.45	1.17	2.32
1.01	5.96	1.50	16.16	0.42	0.87	22.82	2.99	--	--
3.51	6.12	9.45	3.52	7.10	5.63	10.08	10.40	2.94	1.47
11.33	7.08	6.07	1.41	2.92	1.51	8.61	9.46	0.05	--
16.68	1.55	13.46	6.35	1.76	0.80	12.79	10.17	1.41	0.51
7.13	5.13	2.34	1.51	0.69	8.37	6.44	12.77	--	3.36
6.63	8.79	4.04	1.58	10.46	5.11	8.17	3.40	0.72	--
2.59	1.34	4.64	2.82	1.38	1.14	13.59	20.21	5.00	0.74
21.59	4.42	1.09	1.40	23.35	1.71	5.22	1.76	--	--
3.68	4.17	2.24	2.24	7.35	5.36	2.64	6.10	10.63	6.26
4.69	2.96	4.04	2.84	6.52	5.40	10.16	8.42	4.31	1.64
2.58	3.08	3.08	7.73	8.12	8.50	11.13	11.97	1.94	3.54
1.04	0.52	0.81	2.29	3.04	5.53	23.94	11.55	9.84	2.09
8.30	6.64	5.35	2.09	4.53	5.08	18.81	6.48	0.87	0.05
3.08	4.87	4.20	4.02	8.04	5.50	11.82	9.72	4.66	4.58
6.74	0.77	4.15	0.40	13.69	2.42	11.12	9.80	12.47	2.35
1.16	6.38	2.69	2.28	5.95	2.64	3.28	12.15	9.07	5.70
3.16	2.23	2.80	3.61	7.45	5.74	20.39	12.59	1.47	1.65
2.22	1.06	2.53	1.37	3.42	3.04	21.16	10.06	11.33	0.66
13.35	3.74	5.35	2.13	1.68	2.01	15.48	7.99	1.56	0.84
4.57	0.91	4.33	1.96	11.53	2.68	14.24	10.95	6.64	1.19

Table A.1. Continued

(Co. No.)	County	85+ -90	90+ -95	95+ -100	Average CSR
Southwest Area					
1	Adair	12.14	2.80	--	55
2	Adams	12.64	5.06	--	56
15	Cass	13.11	2.26	--	60
36	Fremont	9.34	1.92	--	61
61	Madison	12.99	9.54	--	58
65	Mills	8.47	2.84	--	61
69	Montgomery	16.45	3.98	--	67
73	Page	8.44	4.67	--	64
78	Pottawattamie	10.11	5.37	--	62
87	Taylor	14.76	--	--	60
South Central Area					
4	Appanoose	0.45	0.18	--	36
20	Clarke	4.86	--	--	43
26	Davis	0.95	--	--	42
27	Decatur	3.94	--	--	40
56	Lee	0.65	--	--	47
59	Lucas	8.99	--	--	46
63	Marion	9.18	4.22	--	54
68	Monroe	2.44	2.30	--	40
80	Ringgold	2.09	0.24	--	47
88	Union	13.21	2.68	--	51
89	Van Buren	0.50	0.06	--	38
91	Warren	10.85	2.97	--	54
93	Wayne	0.92	--	--	42
Southeast Area					
29	Des Moines	25.30	6.38	--	66
44	Henry	27.49	3.31	--	64
48	Iowa	14.31	2.83	0.03	58
50	Jasper	10.22	7.08	4.98	66
51	Jefferson	9.80	5.90	--	55
52	Johnson	8.30	9.02	2.69	61
54	Keokuk	12.12	10.83	--	66
58	Louisa	14.96	6.76	4.65	62
62	Mahaska	16.12	0.52	--	60
79	Poweshiek	10.10	9.73	4.03	64
90	Wapello	21.17	0.26	--	56
92	Washington	34.14	--	--	70

APPENDIX B. DISTRICTS AFFECTING COUNTY LAND VALUE ESTIMATES



NW = Northwest	C = Central
NCW = North Central West	EC = East Central
NCE = North Central East	SW = Southwest
NE = Northeast	SC = South Central
WC = West Central	SE = Southeast

Figure B.1. Districts affecting land value estimates in each county.