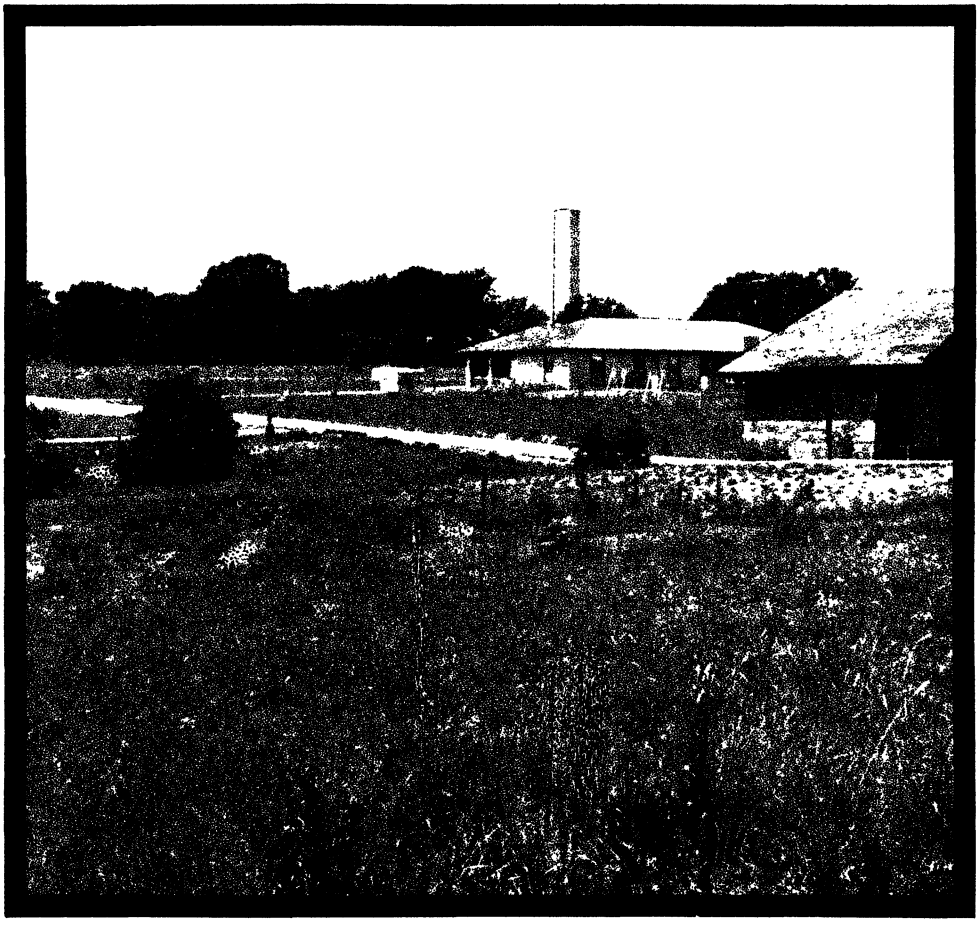
AN ANALYSIS OF RURAL REAL ESTATE IN EASTERN OKLAHOMA



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An Analysis Of Rural Real Estate Values In Eastern Oklahoma

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The rural real estate market in Oklahoma and the United States has generally been characterized by increasing prices in the 1970's. During the 1973 to 1979 period, farm real estate values in the United States increased by 56.0 percent [3]. In Oklahoma over the same period, farm real estate values increased by 50.5 percent [4].

Such increases in rural real estate values have generated interest in identifying the factors that affect real estate prices. According to theory, the value of real estate is determined by the returns that can be generated from the most profitable enterprise that a particular tract of real estate is capable of supporting. The increases in rural real estate values appear to be greater than can be justified by farm income. One explanation given is that the non-agricultural demands for rural real estate have increased rapidly in certain areas. Special pressures exist on rural real estate that is near highly populated residential and recreational areas. In these areas the non-agricultural demand for rural real estate is extremely high.

The factors that determine the value of rural real estate are of interest to a variety of individuals. These individuals include assessors, appraisers, developers, farmers and non-farmers who wish to live or recreate in a rural setting. Due to the existence of two separate use demands for rural real estate, agricultural and non-agricultural, there is a need for meaningful methods of estimating values of rural real estate that account for these differences in its use.

Objectives

The general objective of the study is to examine the factors that cause variations in rural real estate values in an area of Oklahoma experiencing substantial non-agricultrual as well as agricultural real estate-use pressures. The specific objectives are to:

1. Identify rural real estate characteristics in selected counties.
2. Identify and quantify the physical factors associated with inter-tract variation in rural real estate prices in selected counties.
3. Develop and test models to explain rural real estate values in selected counties.

Study Area

The study area included Adair, Cherokee and Muskogee counties in eastern Oklahoma. Maps of these counties are shown in Figure 1. The primary reasons for selecting these Eastern Oklahoma counties include the availability of accurate soil survey information, availability of rural real estate sales data and the fact that a significant number of rural real estate transactions have occurred in the area in recent years.

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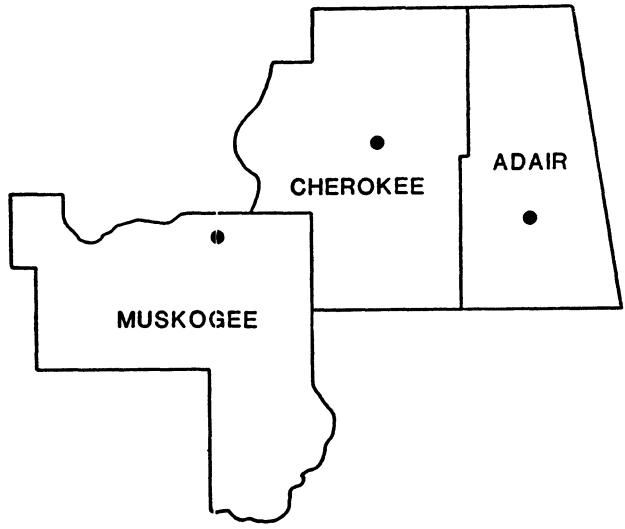

Figure 1. Map of Adair, Cherokee and Muskogee County

The three counties are rather typical of rural Eastern Oklahoma. Considerable rural industry as well as agricultural and recreation related activities exist in the counties.

Models

In the general method of analysis utilized to explain study area real estate values, plus multiple linear regression, the following three basic models were utilized in this research to explain the variation in rural real estate values located within the study area:

1. models of values of all rural real estate,
2. models of values of rural agricultural real estate and
3. models of values of rural non-agricultural real estate.

These general model types are specified in the following paragraphs.

Models of Values of All Rural Real Estate

For the purposes of this research, factors affecting study area rural real estate values aggregated over all uses were specified as follows:

$$Y = f(X_1,X_2,X_3,X_4,X_5,X_6,X_7)$$

where

- Y = Value per acre for rural real estate,
- X_1 = Date of sale,
- X_2 = Size of tract in acres,
- X_3 = Location of real estate within a rural water district (binary code),
- X_4 = Soil Slope,
- X_5 = Value of Improvements per acre,
- X_6 = Real estate use (agricultural or non-agricultural binary code) specified by County Assessors,
- X_7 = Distance to nearest county seat.

This general model was applied to the total study area and the individual counties in the study area.

Models of Values of Rural Agricultural Real Estate

The general form of models used to explain variability in values of agricultural real estate in the study area is as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6)$$

where

Y = Value per acre for agricultural real estate,
X_1 = Date of sale,
X_2 = Size of tract in acres,
X_3 = Value of improvements per acre,
X_4 = Improved agricultural real estate (crops and improved pasture or forest and rangeland, binary code),
X_5 = Soil slope,
X_6 = Distance to nearest county seat.

Alternative methods were employed to define agricultural real estate. Sub-models were estimated for each alternative. The first method of defining agricultural real estate was that real estate designated as agricultural by the county assessors in the study area. Using these designations, the model of the value per acre of agricultural real estate was applied to designated agricultural tracts in the study area (Adair, Cherokee and Muskogee Counties).

A second alternative for defining agricultural real estate was to make assumptions that all tracts of real estate that are greater than specified sizes are used for agricultural purposes and that smaller tracts are non-agricultural. Value per acre models were estimated for parcels of real estate greater than 5 acres, greater than 10 acres and greater than 20 acres for the study area taken as a whole and for the individual counties.

Models of Values of Rural Non-Agricultural Real Estate

The general form of models used to explain the value per acre for non-agricultural real estate in the study area was specified as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5)$$

where

Y = Value per Acre for Non-Agricultural Rural Real Estate,
X_1 = Date of Sale,
X_2 = Size of tract in acres,
X_3 = Value of improvements per acre,
X_4 = Location of real estate within a rural water district (binary code),
X_5 = Distance to nearest county seat.

Alternative designations of non-agricultural real estate were derived in a similar manner as were designations of agricultural real estate. One method used to define non-agricultural real estate was to use the County Assessors' designations. County Assessors' records specify real estate use by three categories—agricultural, residential and commercial.

A non-agricultural real estate use variable was developed by aggregating assessors' designations of residential and commercial lands. Using this definition of non-agricultural real estate use and the general models specified above, models were estimated for value

per acre for non-agricultural real estate tracts in the entire study area and in each individual county (Adair, Cherokee and Muskogee).

Another method used to define non-agricultural real estate was to assume that all tracts of rural real estate less than a specified size were used for non-agricultural purposes. Value per acre models were estimated for parcels of real estate less than or equal to 5 acres, less than or equal to 10 acres and less than or equal to 20 acres for the entire study area taken as a whole and for the individual counties.

Description of Variables and Data Collection

Data utilized in this study to analyze rural real estate values in the study area consisted of information describing real estate transaction for the years 1976, 1977 and 1978.

Legal records for all study area rural estate transactions, which were recorded during this time period and which involved parcels greater than one acre in size, were examined. Those transactions that were clearly not market transactions were eliminated. Data were collected on the remaining transactions. These data were collected from several sources including legal records in county offices, state and federal agency data banks and general public information sources as specified below.

Value Per Acre of Real Estate

The value per acre for tracts of rural real estate that changed ownership in the study area during the time period of the study was estimated from revenue stamps on the warranty deeds filed in the county clerk's office. Market values for such tracts were estimated by using the following formula:

$$TMV = (RS/TR)\ 1000$$

where

TMV = Tract Market Value,

RS = Value of Revenue Stamps,

TR = Tax Rate per $1,000 of value.

The tax rate was determined at the time the sale took place. A tax rate of $1.10 for every $1,000.00 of the sale value was used to estimate market value for rural real estate sales that took place before August 1978. For sales that took place after July 1978 a tax rate of $1.50 for every $1,000.00 of the sale value was used.

The value of rural estate was adjusted for general inflation by using the consumer price index (2) to convert all real estate market value data to 1976 dollars. To determine the value per acre for the real estate the total value was divided by the size of the tract in acres.

Date of Sale

The date of sale associated with the transaction of a tract of real estate was obtained by month and year from the warranty deed in the county clerk's office. Each month in the time period considered in the study (January 1976 through December 1978) was chronologically assigned a number from 1 to 36. For example, January 1976 was assigned the number 1, February 1976 was assigned the number 2, etc. The date of sale variable was included in all models of the value per acre for rural real estate estimated in this study.

Special factors paricularly related to the fact that real estate is an absolutely limited resource should cause real estate prices to increase at a rate greater than the general economy inflation rate. Therefore, date of sale was expected to be positively related to value per acre of real estate.

Size of Tract

The sizes of the tracts of real estate considered in this analysis were entered into appropriate models in acres. Such information was obtained from record books in county assessors' offices using owners' names and legal descriptions from the warranty deeds in the county clerks' offices. The size of tract variable was included in all of the models estimated in this study.

The amount of credit that is required for the purchase of larger tracts of real estate is difficult for most people to finance. Due to this the value per acre for the large tracts of real estate tend to be lower than the value per acre for the smaller tracts of real estate. The expected relationship between the size of the tract and the value per acre of real estate is negative.

Rural Water District

The variable that signified that a tract of real estate was located inside a rural water district was determined by data available from the Oklahoma Conservation Commission. The Oklahoma Conservation Commission has prepared county based maps of rural water districts in Oklahoma, including those in the study area counties. This variable only designates the tracts of real estate that were inside a rural water district and not the tracts of real estate on which water taps were located. A variable to identify tracts of real estate on which water taps were located would be more appropriate for the analysis of rural real estate values. However, such specific data were not available.

The rural water district variable was specified by a one (1) if a tract of real estate was in a rural water district and a zero (0) if the tract of real estate was not in a rural water district. The rural water district variable was included only in the non-agricultural real estate value models estimated in this study.

When non-agricultural tracts of real estate were located inside a rural water district the potential of being connected into the water line was expected to increase the value per acre of the tract of real estate. Therefore, the location of a tract of real estate inside a rural water district was expected to have a positive influence on the value per acre for real estate.

Soil Slope

Data on soil slope in the study were obtained from the Oklahoma Foundation for Research and Development Utilization, Inc. This organization provided county maps of soil slopes in 40-acre cells as determined by the Soil Conservation Service of the United States Department of Agriculture. The slope of the soil on a 40-acre tract as reported was an average over the area and reported as one slope. The percent of slope was broken down into three different groups as follows:

1. zero to three percent,
2. three to eight percent and
3. greater than eight percent.

The slope of real estate parcels considered in this study were assumed to be the midpoints of the range reported for that parcel except a slope of 8.5 percent was assumed for parcels which had indicated slopes of greater than eight percent. The soil slope variable was included only in models of agricultural real estate.

On rural real estate utilized for agricultural purposes the value per acre of the real estate was expected to decrease as the percent of soil slope increased. The usefulness of agricultural real estate is decreased with a steeper slope. As the usefulness of agricultural real estate declines, the value of such real estate decreases.

Value of Improvements per Acre

The value of the improvements that were present on tracts of real estate sold in the study area were estimated from information in the county assessors' offices. To estimate the market value of the improvements, assessment rates for improvements were applied to the assessed values of the improvements as indicated below:

$$MVI = AVI/AR$$

where

MVI = Market Value of Improvements,

AVI = Assessed Value of Improvements,

AR = Assessment Rate.

The assessment rates utilized in these calculations were mean assessment rates by property classes as reported by the Oklahoma Tax Commission [2]. These rates are presented in Table 1. The value of improvements on a tract of land was divided by the size of the tract in acres to calculate the value of improvements per acre. The value of improvements per acre variable was included in each of the models estimated.

Table 1. Mean Assessment Rates By Property Classes By Year[a]

	Residential	Commercial	Agricultural
Adair			
1976	12.36	13.92	4.71
1977	12.70	14.89	8.67
1978	10.36	14.03	8.67
Cherokee			
1976	13.13	13.02	4.65
1977	11.98	12.28	6.59
1978	11.73	13.52	6.63
Muskogee			
1976	14.94	14.32	5.04
1977	13.82	14.16	5.48
1978	12.21	13.94	5.48

[a]Taken from [2].

The relationship between the value of improvements per acre and the value of real estate was expected to be positive. The value of improvements on a tract of real estate was expected to be included in the value of the sale of the property.

Improved Agricultural Real Estate

Data on the improved agricultural real estate variable was obtained from the Oklahoma Foundation for Research and Development Utilization, Inc. This organization has compiled in a computerized data system Soil Conservation Service Information on agricultural land use patterns for counties throughout Oklahoma, including the study area counties. The land use patterns are reported for 40-acre cells. The land use classifications are forest land, rangeland, pastureland and cropland.

For this study, forest and rangeland were grouped together. If a tract of real estate was classified as forest or rangeland, then the value of the improved agricultural real estate variable was zero. Pasture and cropland were also grouped together. If a tract of real estate was pasture or cropland, the value of the improved agricultural real estate

variable was one. The improved agricultural real estate variable was included only in the models of agricultural real estate estimated in this study.

Cropland and improved pasture produce higher yields and greater cattle gains than forest or rangeland. This will result in a higher income from the real estate. Therefore, the relationship between improved agriculture real estate and the value per acre of real estate was expected to be positive.

Non-Agricultural Real Estate

The non-agricultural real estate use variable was determined by data in study area county assessors' offices. In the record books in the county assessors' offices, the assessed values of real estate and improvements and the size in acres for the rural tracts of real estate are specified by real estate use categories. These categories are agricultural, residential and commercial. The reason for the breakdown of the assessed values was that different assessment rates were used for agricultural, residential and commercial property.

If a tract of real estate was determined to be residential or commercial by the county assessors, a value of one was assigned to the non-agricultural real estate use variable. The non-agricultural real estate use variable was included only in the models of values of all rural real estate.

The pressure placed on a rural real estate for non-agricultural uses is great. This pushes the value of real estate that is used for non-agricultural uses above the value for agricultural real estate. Therefore, positive relationships were expected between the non-agricultural real estate use variable and the value per acre for rural real estate.

Distance to the Nearest County Seat

For each parcel of real estate considered in this study, the distance to the nearest county seat was measured in highway miles. A map from the Oklahoma Highway Department was used to determine the measurement. The distance from the real estate tract to the nearest county seat was measured. It was possible for a tract of real estate located in one county to be closer to the county seat of another county. This variable was included in all models of rural real estate values.

The greater the distance that must be traveled from a tract of real estate to reach the major market in the area the greater the operating expense required for the operation of the real estate. This translates into a lower value per acre for the real estate. Therefore, a negative relationship was expected between the distance to the nearest county seat and the value per acre for rural real estate.

Results

The estimation procedure selected to analyze the data collected was the Statistical Analysis System (SAS). SAS is a computer routine developed by Barr and Goodnight [1] that is extremely flexible in data organization and manipulation. SAS also lends itself particularly well to multiple regression analysis.

The general forms of the models specified earlier in this chapter were applied to the data and evaluation on the basis of certain criteria. These criteria were (1) the amount of variation in the dependent variable explained by the equation as measured by the coefficient of determination (R^2), (2) the significance of the equation and each variable in it and (3) the consistency of the sign of each variable's coefficient with economic theory.

Models of Value of All Rural Real Estate

The general model of values of all rural real estate was estimated for the study area as a whole and for the individual counties of the study area. The specific form for the model is as follows:

$$VPA = a + b_1 DOS + b_2 SIZ + b_3 SRS = b_4 RWD + b_5 SSL + b_6 IPA + b_7 NAG + b_8 DNC + b_9 SRD$$

where

VPA = Value per acre,
DOS = Date of sale,
SIZ = Size of tract,
SRS = Square root of size of tract,
RWD = Rural water district,
SSL = Soil Slope,
IPA = Value of improvements per acre,
NAG = Non-agricultural real estate,
DNC = Distance to the nearest county seat,
SRD = Square root of the distance to the nearest county seat,

Table 2. Models Of Value Of All Rural Real Estate[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	1068.3254	1398.0609	254.4697	3129.9609
	(.2405)	(.3174)	(.8354)	(.0920)
DOS	44.9273	44.0080	22.9646	79.2230
	(.0012)	(.0420)	(.1449)	(.0054)
SIZ	8.6603	6.8783	25.6826	9.5601
	(.1367)	(.2331)	(.0591)	(.4596)
SRS	-175.6568	-223.4772	-456.3412	-165.8084
	(.1359)	(.1537)	(.0326)	(.5093)
RWD	755.0358	-403.7762	101.8301	817.4678
	(.0126)	(.6834)	(.7640)	(.2048)
SSL	50.8775	-84.0370	-328.3499	48.1956
	(.3279)	(.3055)	(.4547)	(.6556)
IPA	0.4920	0.3510	0.4187	0.4840
	(.0001)	(.0001)	(.0001)	(.0001)
NAG	4413.2468	1662.1618	2741.0952	8250.9029
	(.0001)	(.0201)	(.0001)	(.0001)
DNC	33.2077	24.4135	-216.3474	290.1349
	(.7028)	(.8566)	(.1254)	(.0722)
SRD	-511.44417	-120.2092	1140.8883	-2353.1559
	(.3170)	(.8744)	(.1231)	(.0207)
R±	.4440	.3947	.3902	.5262
N	1116	168	427	421
F	98.16	11.45	36.75	50.71
PR > F	.0001	.0001	.0001	.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" values.

Table 3. Means Of The Variables In The Models Of Value Of All Rural Real Estate

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	2887.8108	2028.3988	2022.6277	4313.7791
DOS	19.1146	17.5773	19.9430	18.6912
SIZ	32.3834	43.2791	31.4569	29.1953
SRS	4.5968	5.0004	4.7287	4.2706
IPA	2732.8509	2204.0248	1855.2139	4042.4887
SSL	4.0954	5.0536	3.6345	3.5178
DNC	10.2765	12.0657	8.8624	11.3325
SRD	3.0153	3.3103	2.8158	3.1473

The results are shown in Table 2 and the means of the variables are shown in Table 3. The F-tests indicated that the models were significant at the .0001 level.

Date of Sale. Date of sale had a significant impact on the value per acre for all rural real estate in the study area as well as on the individual county models. Its impact on the value per acre in Cherokee County was not as significant as it was for the other counties but worth considering.

Based on the value of the coefficient for the date of sale it can be said that the value of real estate in the study area, adjusted for normal inflation, increased by an estimated $44.93 per acre per month due to the impact of time related factors such as increasing demand for rural real estate for recreational and investment purposes. The range of this variable's estimated impact was from $22.96 per acre per month in Cherokee County to $79.22 per acre per month in Muskogee Couunty.

In preliminary runs, square root of date of sale was examined as an independent variable, however, the coefficients of the date of sale and the square root of the date of sale variable were not significant.

Size of Tract. To examine the impact of the size variable on each of these models both the size in acres and the square root of the size must be considered together. Table 4 shows the total estimated impacts of size based on the four models.

The size of the tract of real estate in acres had a varying impact on the value per acre for rural real estate, but in general, size of tract appears to be inversely related to real estate value per acre. For the Cherokee County model, the size variables are quite significant and for the Muskogee County model the variables are not significant. In the total model and the Adair County model, size of tract variables are only marginally significant.

Rural Water District. The dummy variable stating that a tract of land is in the boundaries of a rural water district was significant in the general study area model. It was not significant, however, in the county models. Based on this analysis, the value

Table 4. Impact Of Size Of Tract In Acres Variables On Value Per Acre For All Rural Real Estate

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
5	-30.6178	-43.0927	-76.3584	-27.5158
20	-16.1813	-24.7261	-38.8538	-13.887
100	-8.9054	-15.4694	-19.9515	-7.0207
200	-3.7605	-8.9239	-6.4056	-2.1643

per acre for rural study area real estate increases by an estimated $775.04 if the tract is located inside a rural water district.

Soil Slope. Soil slope did not significantly affect the value of real estate in the total model or any of the county models as reported in Table 4. This was probably due to the fact that much of the real estate considered in this study was utilized for either forests, cattle, residential or recreational purposes. Soil slopes are seldom deterrents to any of these uses.

Value of Improvements per Acre. As was expected, the value of improvements per acre is an important variable in these models. In the total study area, this variable had a coefficient of 0.4920. From this it can be said that, in general, for rural study area real estate, for every dollar of improvements per acre the value of the real estate per acre increased by $0.4920. The range of the coeffiecient for the study area counties was from 0.3510 in Adair County to 0.4840 in Muskogee County.

Non-Agricultural Land Use. A major factor in the value per acre of rural study area real estate was the dummy variable stating whether or not the property was used for non-agricultural purposes. The impact of this factor was expected to be positive, and in the models this was determined to be significantly true. The coefficient for the study area model was $4,413.25 per acre. The range of the county coefficients was from $1,662.16 in Adair County to $8,250.90 in Muskogee County.

Distance to the Nearest County Seat. The distance to the nearest county seat was measured by the miles to the county seat from the property along the highways. The impact of this factor was significant only in the model of Muskogee County rural real estate. The relationship between distance to the nearest county seat and value of rural real estate appeared to be slightly significant for Cherokee County. However, this relationship was estimated as being positive (Table 5) which was difficult to explain from a theoretical standpoint.

Models of Values of Agricultural Real Estate

The general model of values of agricultural real estate was estimated for the study area as a whole and for the individual counties of the study area. The specific form for the model is as follows:

$$VPA = a + b_1\,DOS + b_2\,SIZ + b_3\,SRS + b_4\,IPA + b_5\,SSL + b_6\,IAG + b_7\,DNC + b_8\,SRD$$

where

VPA = Value per acre,
DOS = Date of sale,
SIZ = Size of tract,
SRS = Square root of size of tract,
IPA = Value of improvements per acre
SSL = Soil slope,
IAG = Improved agricultural land,
DNC = Distance to the nearest county seat,
SRD = Square root of distance to the nearest county seat.

Two different definitions were used to determine agricultural real estate in the study area. The first definition used was the county assessors' definition of agricultural real estate. The second definition of agricultural real estate was a size of tract method. The specific agricultural real estate value model was applied using both definitions of agricultural real estate.

Table 5. Impact Of Distance To Nearest County Seat In Miles On Value Per Acre For All Rural Real Estate

Miles	Cherokee County Model	Muskogee County Model
5	293.8733	-762.2284
20	38.7630	-236.0467
25	11.8303	-180.4963

Agricultural Real Estate as Designated by County Assessors

The couunty assessors in the study area determined what was agricultural real estate. Using this definition of agricultural real estate, the agricultural model was applied to the study area as a whole and the individual counties in the study area. The results are shown for the study area as a whole and for individual counties in Table 6. The means of the variable are presented in Table 7. The F-test indicates that all of the models were significant at the .001 level.

Table 6. Models Of Value Of All Rural Agricultural Real Estate Based On Assessors Definition Of Agricultural Real Estate[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	4108.8731	1839.9293	2826.4722	6162.8895
	(.0001)	(.1849)	(.0001)	(.0001)
DOS	30.3679	47.8437	15.1644	35.9658
	(.0001)	(.0024)	(.0358)	(.0099)
SIZ	7.0616	3.3511	21.2253	7.6763
	(.0092)	(.3167)	(.0008)	(.1787)
SRS	-210.8707	-99.1806	-420.3880	-214.0973
	(.0003)	(.3035)	(.0001)	(.0570)
IPA	0.2660	0.5209	0.1598	0.2652
	(.0001)	(.0001)	(.0001)	(.0001)
SSL	35.7517	-42.2369	-25.6029	-3.4535
	(.2202)	(.4656)	(.6360)	(.9470)
IAG	104.1883	48.2986	131.8703	-102.9723
	(.5444)	(.8848)	(.7450)	(.7624)
DNC	202.5409	76.6383	93.8741	319.9526
	(.0001)	(.5356)	(.1192)	(.0001)
SRD	-1665.3030	-711.4865	-612.3783	-2635.8509
	(.0001)	(.3689)	(.0590)	(.0001)
R^2	.4408	.4317	.3521	.4703
N	663	101	227	335
F	64.45	8.73	17.01	36.19
P > F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" values.

Table 7. Means Of The Variables In The Models Of Value Of Agricultural Real Estate Based On Assessors Definition Of Agricultural Real Estate

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	1463.7021	1047.1944	917.4862	1959.3985
DOS	18.7662	17.2079	19.8502	18.5014
SIZ	40.1532	60.9281	37.4726	35.7061
SRS	5.3066	6.3469	5.3682	4.9513
SSL	3.5492	3.6861	3.6588	4.2329
IPA	2000.7075	993.7435	1011.3851	2974.6763
DNC	11.8198	13.6882	10.2358	12.3298
SRD	3.2707	3.6025	3.0639	3.3107

Date of Sale. Date of sale had a significant impact on the values of assessor defined agricultural real estate in the three study area counties individually as well as in the study area as a whole. Study area agricultural real estate values, adjusted for normal inflation, increased by an estimated $40.37 per acre per month over the time period of the study due to time related factors. The range of coefficients for the individual counties was from $15.16 in Cherokee County to $47.84 in Adair County.

Size of Tract. The size of the tract of assessor defined agricultural real estate in acres had a significant influence in the entire study area. The models of the individual counties' agricultural real estate were also significantly influenced by the size of tract. To examine the impact of the size of tract on each of these models, both the size in acres and the square root of the size must be considered together. Table 8 shows the total impacts of size of tract in each of the four models.

Table 8. Impact Of Size Of Tract In Acres Variables On Value Per Acre For Agricultural Real Estate Determined By Assessors Definition Of Agricultural Real Estate

Acres	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
5	-87.2426	-41.0038	-166.7779	-88.0709
20	-40.0905	-18.8264	-72.7765	-40.1973
50	-22.7600	-10.6752	-38.2265	-22.6016
100	-14.0255	-6.5669	-20.8135	-13.7334
200	-7.8492	-3.6620	-8.5006	-7.4627

Value of Improvements Per Acre. The value of improvements per acre was a very significant variable in the models of value per acre for assessor defined agricultural real estate. In the entire study area, for every dollar of improvements per acre, the value per acre for agricultural real estate increased by an estimated $0.2660. This relationship also was identified in the individual county models. The range of the coefficient of the value of improvements per acre variable on the county models was from 0.1598 in Cherokee County to 0.5209 in Adair County.

Date of Sale. Date of sale had a significant impact on the values of agricultural real estate defined by tract size in the three study area counties individually as well as in the study area as a whole. Study area values of agricultural real estate, as defined by tract size, adjusted for normal inflation, increased by an estimated $15.61 per acre

per month over the time period of the study due to time related factors. The range of coefficients for the individual counties was from 8.9148 in Cherokee County to 41.8337 in Adair County.

Size of Tract. The size of the tract of greater than 5 acre tracts had a significant influence in the study area model. The individual county models were not as significantly affected by the size of tract as the model for the study area as a whole. The size of tract did not significantly affect agricultural real estate in Adair County. The total effect of the size of tract variables on the Cherokee and Muskogee County models as well as for the study area model are presented in Table 12.

Value of Improvements per Acre. The value of improvements per acre was a very significant variable in the value per acre for agricultural real estate as defined by tract size. For the entire study area, it can be stated that for every dollar of improvements per acre the value of agricultural real estate per acre increased by only $0.3515. The range of the coefficients of the value of improvements per acre in the individual county models was from 0.2786 in Muskogee County to 0.6047 in Adair County.

Soil Slope. The soil slope did not have a significant impact on the value of assessor defined agricultural real estate for the study area as a whole or for any of the three counties considered individually.

Improved Agricultural Real Estate. The improved agricultural real estate variable did not have a significant impact on the value per acre of assessor defined agricultural land in the study area as a whole or for any of the individual counties in the study area.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles had a significant impact on the value of assessor defined agricultural real estate in the study area. The distance in miles was also significant in the individual county models with the exception of the Adair County model. The total effect of the distance to the nearest county seat in the entire study area and Cherokee and Muskogee Counties is presented in Table 9.

Table 9. Impact Of The Distance To The Nearest County Seat On The Value Per Acre Of Agricultural Real Estate Based On The Assessors Definition Of Agricultural Real Estate

Miles	Study Area Model	Cherokee County Model	Muskogee County Model
5	-542.2052	-179.9898	-858.835
20	-169.8322	-43.0578	-269.4416
25	-130.5197	-28.6016	-207.2176

Agricultural Real Estate as Designated by Size of Tract

When the size of tract was used to estimate the value of agricultural real estate several different acreage breakdowns were used. These included greater than 5 acres, greater than 10 acres and greater than 20 acres. The models of all rural real estate greater than 5 acres were determined to contain the best results and were chosen to be discussed in the following pages. Table 10 presents the results of the models of values of rural real estate greater than 5 acres. The means of the variable in the models are presented in Table 11. The F-test indicated that all of the models were significant at the .001 level.

Table 10. Results Of Models Of Values Of Rural Real Estate Greater Than 5 Acres[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	1704.9945	127.3083	1434.4201	2912.8171
	(.0001)	(.8829)	(.0001)	(.0001)
DOS	15.6109	41.8337	8.9148	15.4642
	(.0001)	(.0017)	(.0343)	(.0431)
SIZ	3.1624	2.2761	4.6315	3.9999
	(.0314)	(.4458)	(.2060)	(.1912)
SRS	-101.3964	-59.9439	-97.3541	-138.2086
	(.0014)	(.4763)	(.1055)	(.0352)
IPA	0.3515	0.6047	0.4265	0.2786
	(.0001)	(.0001)	(.0001)	(.0001)
SSL	1.9321	-39.7064	20.6405	-19.3156
	(.9020)	(.4129)	(.6737)	(.4864)
IAG	157.5491	182.0184	133.9601	-62.2068
	(.0974)	(.5306)	(.6721)	(.7271)
DNC	64.6091	0.9866	41.7444	100.5836
	(.0051)	(.9905)	(.2743)	(.0119)
SRD	-523.9871	-32.1741	-375.6683	-838.6040
	(.0001)	(.9466)	(.0660)	(.0023)
R^2	.3969	.3378	.4596	.4216
N	789	120	405	264
F	64.16	7.08	48.23	23.24
PR > F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

Table 11. Means Of Variables In Rural Real Estate Greater Than 5 Acres In Size Models

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	1018.5919	833.7332	884.8962	1307.7202
DOS	18.4461	17.4333	19.1827	17.7765
SIZ	44.5623	59.6910	39.9932	44.6967
SRS	5.8185	6.4311	5.6459	5.8049
IPA	1015.5719	762.8758	798.9057	1462.8197
SSL	4.3929	4.7747	4.6039	5.0447
DNC	10.9576	12.3726	9.1852	13.0322
SRD	3.1332	3.3726	2.8825	3.4092

Table 12. Impact Of Size Of Tract In Acres Variables On Value Per Acre For Agricultural Real Estate Determined By Tracts Greater Than 5 Acres

Acres	Study Area Model	Cherokee County Model	Muskogee County Model
5	-42.1834	-38.9066	-57.8089
20	-19.5105	-17.1375	-26.9045
50	-11.1772	-9.1364	-15.5457
100	-6.9772	-5.1039	-9.8210
200	-4.0074	-2.2525	-5.7729

Soil Slope. The soil slope did not have a significant impact on the value of agricultural real estate as defined by tract size for the study area as a whole or for any of the three counties considered individually.

Improved Agricultural Real Estate. The improved agricultural real estate variable had a significant impact on the value of agricultural real estate in the entire study area. If a tract of real estate in the study area was cropland or improved pastureland, the value per acre increased by an estimated $157.54. The improved agricultural real estate variable did not have a significant impact on the value of agricultural real estate in the individual counties of the study area.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles had a significant impact on the value of study area agricultural real estate as defined by tract size. The distance in miles was also significant in Muskogee County and marginally significant in Cherokee County. The distance in miles was not significant in Adair County. The total effect of distance to the nearest county seat in the entire study area as well as Cherokee and Muskogee Counties is presented in Table 13.

Table 13. Impact Of The Distance To The Nearest County Seat On The Value Per Acre Of Agricultural Real Estate Based On Tracts Greater Than 5 Acres

Miles	Study Area Model	Cherokee County Model	Muskogee County Model
5	-169.7250	-126.2596	-274.4515
20	-52.5580	-42.2576	-86.9340
25	-40.1883	-33.3893	-67.1372

Models of Values of Non-Agricultural Real Estate

The general model of values of non-agricultural real estate was estimated for the study area as a whole and for the individual counties of the study area. The specific form for the model is as follows:

VPA = a + b DOS + b SIZ + b SRS + b RWD + b IPA + b DNC + b SRD

where

VPA = Value per acre,
DOS = Date of sale,
SIZ = Size of tract,
SRS = Square root of size of tract,
RWD = Rural water district,
IPA = Value of improvements per acre,
DNC = Distance to the nearest county seat,
SRD = Square root of distance to the nearest county seat.

Two different definitions were used to designate non-agricultural real estate in the study area. The first definition used was the county assessors' definition of non-agricultural real estate. The county assessors' definition of non-agricultural real estate used was explained in the discussion of the agricultural real estate use variable earlier in this chapter. The second definition of non-agricultural real estate was based on size of tract. The specific non-agricultural real estate value model was applied using both definitions of non-agricultural real estate.

Non-Agricultural Real Estate as Designated by County Assessors

The county assessors in the study area have designated non-agricultural real estate for assessment purposes. Using this definition of non-agricultural real estate, the non-agricultural model was applied to the study area as a whole and to the individual counties in the study area. The results are shown in Table 14 and the means of the variables that are in the model are presented in Table 15. The F-test indicates that all of the models are significant at the .0001 level with the exception of the Adair County model.

Date of Sale. Date of sale did not have a significant impact on the values of assessor defined non-agricultural real estate in the study area model. The date of sale variable also did not have a significant impact on the individual county models with the excep-

Table 14. Results Of Models Of Values Of Rural Non-Agricultural Real Estate Based On Assessors Definition Of Non-Agricultural Real Estate[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	5503.2678	5540.4706	-2279.9916	24047.2021
	(.1144)	(.3559)	(.6340)	(.0046)
DOS	63.1136	68.3075	18.5078	183.0602
	(.2246)	(.3510)	(.7870)	(.0894)
SIZ	511.5229	415.4161	408.4609	2464.5985
	(.0101)	(.6938)	(.0413)	(.0025)
SRS	-5129.8731	-3550.2529	-4204.5635	-18134.9696
	(.0012)	(.4852)	(.0235)	(.0008)
RWD	2738.2269	-513.4920	1769.3913	617.9025
	(.0176)	(.8992)	(.1823)	(.8330)
IPA	0.8119	0.1901	0.7919	0.7275
	(.0001)	(.2859)	(.0001)	(.0001)
DNC	-477.0166	-14.9961	-1291.3223	-607.2300
	(.2760)	(.9731)	(.0464)	(.5902)
SRD	2334.8096	476.3567	7538.2086	1585.8195
	(.2958)	(.8425)	(.0175)	(.7797)
R^2	.4642	.1691	.5027	.5201
N	238	46	107	85
F	28.46	1.10	14.30	11.92
PR > F	.0001	.3801	.0001	.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

Table 15. Means Of Variables In Rural Non-Agricultural Models Based On Assessors Definition Of Non-Agricultural Real Estate

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	8504.9773	4912.3074	5969.7445	13640.6565
DOS	20.4789	17.8913	22.5140	12.3176
SIZ	3.9986	2.9776	4.9067	3.4081
SRS	3.7186	3.5438	3.9167	3.5639
IPA	6070.2727	5595.1581	4524.7476	8272.9369
DNC	7.9117	11.5109	6.9813	7.1353
SRD	2.6055	3.2018	2.4554	2.4716

tion of Muskogee County. In Muskogee County, assessor defined non-agricultural real estate values increased by an estimated $183.06 per acre per month over the time period of the study due to time related factors.

Size of Tract. The size of the tract of assessor defined non-agricultural real estate had a significant influence in the study area model. The individual county models were also significantly influenced by the size of tract with the exception of Adair County. The impact of the size of tract with the exception of Adair County. The impact of the size of tract on the entire study area model and the Cherokee and Muskogee County models are presented in Table 16.

Rural Water District. The dummy variable signifying that a tract of real estate is located inside a rural water district had a significant impact on assesor defined non-agricultural real estate in the study area as a whole but not on the individual county models. If an assessor defined non-agricultural tract of real estate in the study area was located inside a rural water district, the value per acre increased by an estimated $2,738.23 per acre.

Value of Improvements per Acre. The value of improvements per acre was a very significant variable in explaining the value per acre for assessor defined non-agricultural real estate in the study area. In the individual county models, the value of improvements per acre had a significant impact with the exception of the Adair County model. In the entire study area, for every dollar of improvements per acre the value of assessor defined non-agricultural real estate increased by an estimated $0.8119 per acre. In the Cherokee County model, the coefficient on the value of improvements per acre variable was 0.7919 and in the Muskogee County model it was 0.7275.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles did not significantly affect the value per acre of assessor defined non-agricultural real estate in the study area. In the individual county models, only the Cherokee County

Table 16. Impact Of Size Of Tract In Acres Variables On Value Per Acre For Non-Agricultural Real Estate Determined By Assessors Definition Of Non-Agricultural Real Estate

Acres	Study Area Model	Cherokee County Model	Muskogee County Model
5	-4003.9966	-1471.8796	-5645.6060
10	-1110.6853	-921.1387	-3270.1789
20	-635.5516	-531.7081	-1590.5037
50	-213.9507	-183.1541	-100.0734

model was significantly affected by the distance to the nearest county seat. The relationship between the distance variables and the value of assessor defined non-agricultural real estate in Cherokee County was positive. This was not as expected based on economic theory. Due to this and the fact that the other models were not significantly affected by this variable, the effect of the distance to the nearest county seat on the value of assessor defined non-agricultural real estate in Cherokee County is not clear.

Non-Agricultural Real Estate as Designated by Size of Tract

When the size of tract was used to estimate the value of non-agricultural real estate, three different acreage breakdowns were used. These different breakdowns included less than or equal to 5 acres, less than or equal to 10 acres and less than or equal to 20 acres. The models of all rural real estate less than or equal to 5 acres were determined to contain the most meaningful results and were chosen to be analyzed in the following pages. The results of the models of values of rural real estate less than or equal to 5 acres are presented in Table 17. The means of the variables in the less than 5 acre models are presented in Table 18. The F-test indicated that all of the models were significant at the .0001 level.

Table 17. Results Of Models Of Values Of Real Estate Less Than Or Equal To 5 Acres In Size[a]

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
Intercept	29408.8551	7436.6614	14932.4157	62845.2734
	(.0001)	(.5550)	(.2094)	(.0001)
DOS	88.8901	66.0043	35.6433	150.7505
	(.0188)	(.3508)	(.5986)	(.0255)
SIZ	6761.1976	1070.2093	3786.2776	16022.6769
	(.0093)	(.8354)	(.3855)	(.0007)
SRS	-27902.3169	-5510.7884	-17716.0904	-63035.5849
	(.0011)	(.7361)	(.2199)	(.0001)
RWD	2391.7942	-251.8873	404.8913	-318.7999
	(.0047)	(.9494)	(.7643)	(.8525)
IPA	0.1425	0.2022	0.2525	0.3118
	(.0004)	(.2328)	(.0047)	(.0001)
DNC	-139.2945	14.6354	-1392.3376	-450.5761
	(.6464)	(.9715)	(.0209)	(.4713)
SRD	-263.9295	159.7504	6702.7945	486.4779
	(.8684)	(.9432)	(.0259)	(.8827)
R^2	.2980	.1549	.3135	.5100
N	327	48	122	157
F	18.43	1.05	7.44	22.15
PR > F	0.0001	0.0001	0.0001	0.0001

[a]Numbers appearing in parentheses represent the observed significance level of the variable as determined by the "student-t" value.

Table 18. Means Of Variables In The Models Of Values Of Tracts Less Than Or Equal To 5 Acres In Size

	Study Area Model	Adair County Model	Cherokee County Model	Muskogee County Model
VPA	5674.4494	5015.0627	5799.5234	9368.5533
DOS	20.7647	17.9375	22.4672	20.2293
SIZ	3.0209	2.2493	3.1226	3.1295
SRS	3.6564	3.4237	3.6841	3.6908
IPA	6796.4552	5806.8973	5361.8110	8380.2760
DNC	8.6657	11.2917	7.7911	8.4745
SRD	2.7358	3.1547	2.5943	2.7070

Date of Sale. Date of sale had a significant impact on the value of less than 5-acre tract real estate in the study area as a whole and on the Muskogee County model. The Adair and Cherokee County models were not significantly affected by the date of sale variable. The value of less than 5-acre tract real estate in the study area as a whole increased by an estimated $88.89 per acre per month due to time related factors. An increase of $150.75 per acre per month was estimated for Muskogee County.

Size of Tract. The size of the tract of less than 5-acre real estate had a significant effect on the entire study area model. Of the individual county models, only the Muskogee County model was significantly influenced by the size of tract. Estimated impacts of the size of tract on the entire study area and on Muskogee County are presented in Table 19.

Table 19. Impact Of Size Of Tract In Acres Variables On Value Per Acre For Non-Agricultural Real Estate Determined By Tracts Less Than Or Equal To 5 Acres In Size

Acres	Study Area Model	Muskogee County Model
2	-12968.7180	-28550.2100
3	-9348.2126	-20370.9360
5	-5717.0970	-12167.6920

Rural Water District. The dummy variable signifying that a tract of real estate was located inside a rural water district had a significant impact on less than 5-acre real estate in the study area as a whole but not on the individual county models. If a less than 5-acre tract of land in the study area was in a rural water district, the value per acre increased by an estimated $2,391.79 per acre.

Value of Improvements per Acre. The value of improvements per acre was a significant factor determining value per acre for less than 5-acre non-agricultural real estate in the study area. The value of improvements per acre had a significant impact on the individual county models with the exception of Adair County. In the entire study area, for every dollar of improvements per acre the value of non-agricultural real estate increased by an estimated $0.1425. In the Cherokee County model, the coefficient on the value of improvements per acre variable was 0.2525 and in the Muskogee County model it was 0.3118.

Distance to the Nearest County Seat. The distance to the nearest county seat in miles did not significantly affect the value per acre of less than 5-acre real estate in the study area. The coefficient for distance to nearest county seat appears to be significant for the Cherokee County model; however, it is difficult to explain theoretically.

Concluding Remarks

Several factors were found to be particularly important in explaining rural real estate values in the study area. These are date of sale, size of tract, value of improvements per acre, distance to nearest county seat and definitions of agricultural and non-agricultural real estate.

The inflation rate in the local real estate market being higher than the inflation rate for the general economy was the important factor measured by the date of sale variable. This phenomenon may be a result of buyers' expectations of continuing inflation and their view of real estate as a store of real value.

The greater capital outlays required for the purchase of large tracts of agricultural real estate reduces the number of potential buyers, making size of tract an important variable in determining rural real estate values. Most small tracts of non-agricultural real estate are placed on the market.

The value of improvements per acre is an important variable in explaining the values of all rural real estate, agricultural real estate and non-agricultural real estate. However, the coefficients for this variable were consistently less than one. There are two plausible explanations for less than unitary coefficients. The first is that the sellers of rural real estate did not know the real market value of the improvements and sold for less than full value. The second is that the county assessors' value of improvements may be biased by replacement costs which are greater than actual market values of the improvements as sited.

The total relationship between the distance to the nearest county seat and value of rural real estate was generally significant and negative as expected. As the distance from the primary market increased, the value of real estate decreased at a decreasing rate. The definitions of agricultural and non-agricultural real estate were of importance in this study. The two definitions resulted in different values of coefficients in the models. The definition of agricultural real estate that appeared to be most effective was the greater than 5 acres definition. The county assessor's definition appeared to contain some non-agricultural real estate, resulting in confusion when comparisons were made with this approach. If a tract of real estate that is less than 5 acres in size is intended for a non-agricultural purpose, the county assessor's office might not recognize this change. Therefore, the model of agricultural real estate based on the greater than 5-acre definition was considered the most useful when applied to the objectives of this study.

The non-agricultural real estate market presented a different aspect to the problem. The county assessors' definition of non-agricultural real estate was probably the most accurate. This was due to the fact that real estate that the county assessor's office has identified as non-agricultural real estate most likely is non-agricultural real estate regardless of size of tract.

Limitations and Future Research Needs

Primary limitations of this study were related to the specification and availability of the data, particularly the lack of consistent, reliable data to differentiate agricultural and non-agricultural land uses. A more exact method of separating agricultural and non-agricultural real estate would benefit the analysis of rural real estate values.

Another limitation of the study was the inaccuracy inherent in the method of determining the value of improvements per acre on rural real estate. A study of rural real estate values using a more accurate method of determining the value of improvements per acre would be useful.

An additional weakness in the study relates to the necessity of using tax stamps from warranty deeds to determine the sale prices of real estate. A more accurate method of determining real estate values would have strengthened the analysis herein.

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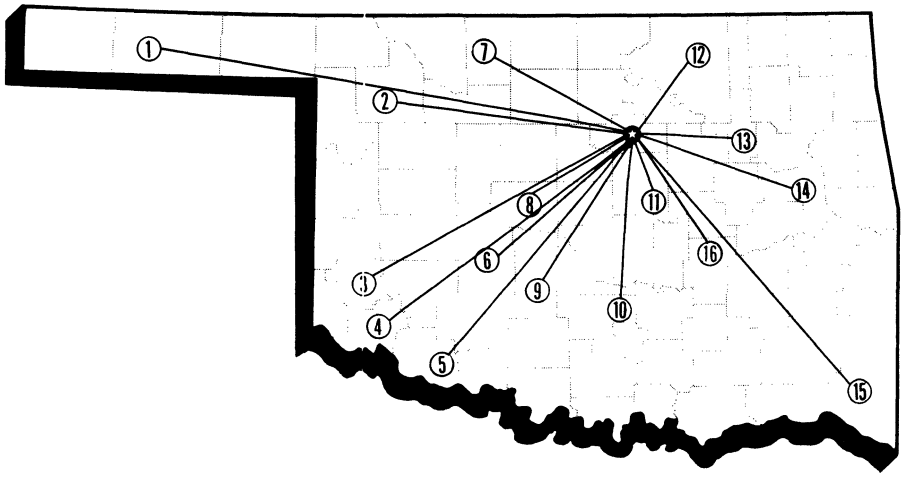

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2. Southern Great Plains Field Station — *Woodward*
3. Sandyland Research Station — *Mangum*
4. Irrigation Research Station — *Altus*
5. Southwest Agronomy Research Station — *Tipton*
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