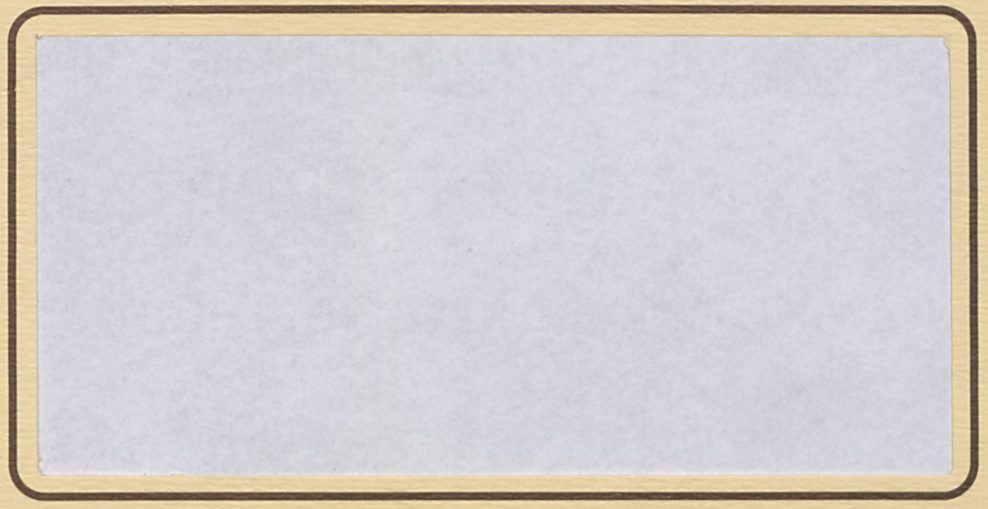
RURAL ECONOMY



PROJECT REPORT

FARMING FOR THE FUTURE

Alberta AGRICULTURE

Department of Rural Economy
Faculty of Agriculture and Forestry
University of Alberta
Edmonton, Canada

Alberta Farmland Asset Returns in the Context of Portfolio Investment

W.E. Phillips, L. Bauer, J.E. Mercier, and G.A. Mumey

Farming for the Future Project #87-0140

Project Report #89-12

This research report comes from the original masters thesis work of J.E. Mercier. See Jeanne E. Mercier. 1988. "Farmland as an Asset in the Context of Portfolio Investment". Unpublished M.Sc. Thesis, Department of Rural Economy, University of Alberta.

The authors are Professor and Chairman, and Professor, Department of Rural Economy, University of Alberta; Manager, Revenue Forecasting, Alberta Department of Energy; and Professor, Faculty of Business, University of Alberta, respectively.

Table of Contents

Table of Figures

Table of Tables

Acknowledgements

The authors are grateful for the support provided by Judy Boucher, Clare Shier, Jim Copeland, Wendy Williamson, Holly Horvath, Barb Johnson and Hildegard Zeidler of the Department of Rural Economy and Mike Bokalo of the Department of Forest Science. Necessary data was supplied by Gary Schufelt of the Farm Credit Corporation and by the Alberta Hail and Crop Insurance Corporation. To them we extend sincere thanks. Finally, and most importantly, this project would not have been possible without the support, particularly financial support, provided by Alberta Agriculture through its Farming for the Future program. For this support we are most grateful.

Abstract

The objectives of this study were two-fold. The first objective was to estimate the total return, in terms of income and capital gain, and the variability from farm land investment in various parts of Alberta for the period 1963 through 1985, and to compare this performance to the stock market and to risk free treasury bills over the same time period. The second objective was to establish a data series of land sales and rental revenue, amenable to annual update, so that land investment risk and return information will be available on a continuing basis.

During the 23 year period, 1963 through 1985, investment in Alberta farmland out-performed the stock market as measured by the TSE 300 composite index. The stock market had an average annual return of 12.7% with a standard deviation of 17.3%. On average, Alberta farmland had a higher return of 20.1% with only a slightly higher standard deviation of 18.8%. The capital gains component in both the farmland and the stock market cases accounted for about two-thirds (more precisely 63%) of the return. Also in both cases, the major amount of variation was associated with the capital gains component.

The calculated alpha value of 0.1157 was also not significantly different from zero suggesting that returns in excess of that required as compensation for risk were not detected. A beta value of -0.1613 was calculated for investment in Alberta farmland. This value was not different from zero at the 5% level of significance and so it can be concluded that farmland returns were uncorrelated with returns in the stock market. Low or zero correlations of returns to agricultural assets and the stock market are not uncommon. This phenomenon may be partially due to variability in weather which is an important element in agricultural returns but uncorrelated with other major economic activity.

1 INTRODUCTION

Land constitutes the single largest asset item in the control of farmers in Alberta. Control may be in the form of direct ownership by the farmer, suggesting that farmers consider land a profitable investment. Alternatively, control may be through rental or lease from a non-farmer suggesting that agricultural land is also a profitable investment in a broader portfolio context. Regardless of the form of control, the risk and return associated with agricultural land investments is of interest to investors, both farm and non-farm, and merits study.

Investment decisions require accurate, unbiased data on past performance for forming future expectations. Improved knowledge of agricultural land investment performance is of interest, not only to private investors, but also from the perspective of formulating and monitoring public policy. Agricultural lenders, both public and private, have a need for information on the sources and magnitude of risk in agricultural investments of which land is a major part.

Land has value in the present because of the future value it is anticipated to generate. When examined in an investment context, farmland has two dimensions; a capital or stock component and an income or flow component. The value of land changes through time in response to changing anticipations about the flow of future income, giving rise to annual capital gains and losses. In addition to producing capital gains and losses land also produces an annual net income or annual rent. Both of these dimensions have their counterparts in the stock market. The value of common stock changes in response to anticipated future performance much as is noted for land. Dividends paid to holders of common stock is analogous to the income component of farmland.

Despite the importance of land in agriculture, only limited knowledge exists about its performance as an investment opportunity. Bauer (1983) estimated the compound nominal rate of return on land investment on dark brown soils in Alberta over the period 1963 through 1982 at 19% with considerable year to year variability. Barry (1980), using national and regional level data in the United States, concluded that land contributed essentially no systematic risk to a diversified portfolio and exhibited returns in excess of those needed to compensate for risk.

The objectives of this study are two-fold. The primary objective is to estimate the total return, in terms of income and capital gain, and the associated variability for farmland investment in various parts of Alberta for the period 1963 through 1985, and to compare this performance to the stock market and risk free treasury bills over the same time period. The secondary objective is to establish a data series of land sales and rental revenue, amenable to annual update, so that land investment risk and return information will be available on a continuing basis.

2 MEASUREMENT OF RISK AND RETURNS

Returns from land, in the context of this study arise from two sources. The capital gain component of land investment returns, which results from the change in the price of land from one period to the next, has a counterpart in common stock. The income component, estimated in the form of rental income, is analogous to the dividend portion of returns from common stock.

2.1 The Capital Gain Component

The capital gain component in farmland investment results from the change in value from the beginning of the year to the end is described in the following relationship.

$$r_{k,t} = \frac{V_{k,t} - V_{k,t-1}}{V_{k,t-1}}$$

where $r_{k,t}$ represents the percentage return from capital gain in period t, $V_{k,t}$ represents the value of land, per acre, at the end of period t and $V_{k,t-1}$ the land value at the beginning of period t.

Expected annual percentage return from capital gain, $\bar{r}_k$, is expressed as the mean annual return computed in the standard manner over a series of n years, in this case 23 years.

$$\bar{r}_k = \frac{1}{n} \sum_{t=1}^{n} r_{k,t}$$

Risk associated with the return from capital gain is expressed as the standard deviation, s_k, and computed in the usual manner as the square root of the sum of squared deviations from the mean.

$$s_k = \left[\frac{1}{n-1} \sum_{t=1}^{n} (r_{k,t} - \bar{r}_k)^2 \right]^{\frac{1}{2}}$$

The quantities $V_{k,t}$ and $V_{k,t-1}$ were estimated from information contained in the Farm Credit Corporation (FCC) land sales registry. This registry contains all agricultural land sales in Alberta known to FCC credit agents since its inception in 1963, whether FCC financing was involved or not. The registry contains an average of more than 1,000 transactions per year.

The sales series was developed on a municipal basis, the most disaggregated basis possible. Missing data on the municipal level were computed using a ten year average composed, as much as possible, of the five preceding and five succeeding years.

To ensure that only agricultural land transactions were considered in this analysis, only those sales involving parcels consisting of 80 acres or more were included. Sales of grazing leases and non-arms-length sales were excluded. The value of buildings, including houses was also excluded so that only the bare land would be considered.

Land values are reported by year and location in the Appendix.

2.2 The Income Component

The annual income from land, analogous to the dividend paid to holders of common stock, is expressed in the following equation.

$$r_{i,t} = \frac{I_t}{V_{k,t-1}}$$

where $I_{i,t}$ and $r_{i,t}$ respectively represent the dollar and percentage returns from rental income in period t, and $V_{k,t-1}$ the land value at the beginning of period t.

Expected annual percentage return from rental income, $\bar{r}_i$ is the mean of annual returns.

$$\bar{r}_i = \frac{1}{n}\sum_{t=1}^{n} r_{i,t}$$

Risk associated with returns from income is expressed as the standard deviation, s_i.

$$s_i = \left[\frac{1}{n-1}\sum_{t=1}^{n}(r_{i,t} - \bar{r}_i)^2\right]^{\frac{1}{2}}$$

While reasonable data were available for the capital gains component through the FCC land registry, this was not the case with the income component. The income component was represented in the analysis as rent collected by a typical landlord. Estimates of rental income were based on an assumed 25% crop share and computed from available price and yield data.

The typical crop share agreement in Alberta (Alberta Agriculture Custom Rates Survey, 1982-1986) involves a one third - two thirds landlord tenant split with the landlord paying real estate taxes in total and one third of the operating costs such as fertilizer and herbicides. Reliable data on fertilizer and herbicide usage were not available and so the less popular one quarter - three quarter crop share basis with the landlord paying the real estate taxes was used. It is assumed that this arrangement, where the landlord accepts a lower gross revenue together with a lower cost, is approximately equivalent in net return to the more popular one third - two thirds landlord - tenant split.

Rental income is described according to the following equation.

$$I_t = [A_{w,t}Y_{w,t}p_{w,t} + A_{o,t}Y_{o,t}p_{o,t} + A_{b,t}Y_{b,t}p_{b,t} + A_{c,t}Y_{c,t}p_{c,t}]A_{s,t}R - T_t$$

where I_t represents the per acre rental income in year t; $A_{w,t}$, $A_{o,t}$, $A_{b,t}$, and $A_{c,t}$ represent the proportion of seeded acres devoted respectively to wheat, oats, barley and Canola; $A_{s,t}$ represents the proportion of total improved acres seeded; $Y_{w,t}$, $Y_{o,t}$, $Y_{b,t}$ and $Y_{c,t}$ respectively represent the per acre yields of wheat, oats, barley and Canola in kilograms; $p_{w,t}$, $p_{o,t}$, $p_{b,t}$ and $p_{c,t}$ respectively represent the per tonne prices of wheat, oats, barley and Canola; R represents the proportion of crop received by the landlord, in this case 25%; and T_t represents the real estate taxes paid by the landlord.

Rental income per acre is reported by year and location in the Appendix.

The four crops chosen to develop the rental income series account for at least 75% of seeded acreage in most municipalities in Alberta from 1973 to 1985 as revealed by Alberta Hail and Crop Insurance Corporation (AHCIC) data. The only exception are four municipalities in the irrigation districts where these four crops accounted for 65%. In the irrigation district the remainder of the acreage was devoted to specialty crops none of which were consistently dominant over time. This would cause a downward bias to rental rates in these municipalities. On the other hand, the higher operating costs associated with specialty crops would tend to offset the bias.

Municipalities were placed into one of three crop zones, based on cropping pattern similarities as determined from AHCIC crop yield data. In Zone 1, wheat accounted for over 40% of the seeded acreage while oats, barley and Canola each accounted for 20% of the remaining acreage. In Zone 2, barley made up over 40% of seeded acreage while wheat, oats and Canola were evenly split over the remaining 60%. In Zone 3, there was no single dominant crop with seeded acreage evenly spread across the four crops. The annual percentages of acreage for each crop in each zone for 1973 to 1985 were regressed against time and the proportions extrapolated back to 1963 to produce a crop distribution for the entire study period. The annual proportions of wheat, oats, barley and Canola, (i.e. $A_{w,t}$, $A_{o,t}$, $A_{b,t}$, and $A_{c,t}$), are shown by year and location in the appendix. A map showing the crop zones is also included in the appendix.

The proportion of seeded acres, $A_{s,t}$ to total improved acres, was determined from summer fallow, $A_{f,t}$ and total improved acreage data, $A_{T,t}$ as reported by Statistics Canada and the Alberta Agriculture Statistics Yearbooks within Crop Districts. Data for improved acres were reported only in census years and were assumed to remain constant for the inter-census years. The data for fallow acres were reported on an annual basis in the Alberta Agriculture Statistics Yearbooks for the period 1963 to 1978 and by the Statistics Branch of Alberta Agriculture from 1979 to 1985. The procedure is shown in the following equation.

$$A_{s,t} = 1 - \frac{A_{f,t}}{A_{T,t}}$$

Crop yields, (i.e. $Y_{w,t}$, $Y_{o,t}$, $Y_{b,t}$ and $Y_{c,t}$), were obtained from the Alberta Agriculture Statistics Yearbooks for the period 1963 - 1985. These data were reported by Agriculture Reporting Areas from 1963 to 1970 and as Census Divisions from 1971 to 1985. The divisions correspond roughly to the three crop zones discussed above. Yields are presented in kilogram per acre by year and location in the appendix.

Prices and grades for crops were obtained from the Agriculture Statistics Yearbooks. The grade weighted average prices per tonne for each crop, (i.e. $p_{w,t}$, $p_{o,t}$, $p_{b,t}$ and $p_{c,t}$) are reported by year in the appendix.

Property taxes were determined from six local administrations in the province: namely the County of Grande Prairie No. 1 to represent the northern part of the province; the County of Vulcan No. 2 to represent the south central part under dry-land conditions; the County of Newel (Brooks) No. 4 to represent the south central part under irrigated conditions; the County of St. Paul No. 19 to represent the parkland region of the province without urban influence; the County of Parkland (Stoney Plain) No. 31 to represent the parkland region of the province with urban influence; and the Special Areas (Hanna) to reflect the dryer east central and south eastern part of the province. No difference was detected with respect to real estate taxes among

the northern, southern or central regions. Neither did urban proximity or Canada Land Inventory (CLI) soil classification appear to have a bearing on real estate taxes. Accordingly, an average provincial per acre tax rate was developed from the information of the six local administrations.

2.3 The Total Return to Farmland Investment

The total percentage return to land, $r_{l,t}$ is the sum of returns from capital gain and returns from income.

$$r_{l,t} = r_{k,t} + r_{i,t}$$

Expected annual total percentage return to land, $\bar{r}_l$ is the mean annual return.

$$\bar{r}_l = \frac{1}{n}\sum_{t=1}^{n} r_{l,t}$$

Risk associated with total returns on land is expressed as the standard deviation, s_l.

$$s_l = \left[\frac{1}{n-1}\sum_{t=1}^{n}(r_{l,t} - \bar{r}_l)^2\right]^{\frac{1}{2}}$$

The investment in land has now been expressed in a manner consistent with returns in other financial assets, enabling comparison to common stocks as in the Toronto Stock Exchange (TSE) 300 and treasury bills (T-Bills).

2.4 Returns to Common Stocks and Treasury Bills

Returns in the stock market are reported routinely in a variety of market indices. The most comprehensive Canadian index, the TSE 300 Composite Index, is a well diversified collection of 300 stocks representing 14 group indices and 41 sub-group indices. The group indices are mines and minerals; gold and silver; oil and gas; paper and forest products; consumer products; industrials; real estate and construction; transportation; pipelines; utilities; communications and media; merchandising; financial services; and management companies.

The TSE 300 Total Returns Index (TRI)[1] provides a measure of investment performance through time taking into consideration both price appreciation and appreciation resulting from re-investment of dividends. Annual returns were obtained according to the following equation.

$$r_{m,t} = \frac{V_{m,t} - V_{m,t-1}}{V_{m,t-1}}$$

where $r_{m,t}$ represents the total return from the market in period t, $V_{m,t}$ represents the value of TRI at the end of period t and $V_{m,t-1}$ the value of TRI at the beginning of period t.

1The TSE 300 (TRI) is calculated on the assumption that dividends are accumulated to the end of the period and then re-invested at the index value on the last day of the period.

TSE 300 TRI monthly returns were averaged to obtain an annual rate. This removed any short lived up or down turns in the stock market at year end and made the TSE 300 series consistent with the annual series developed for farmland.

The rate of return on six month treasury bills was used as an approximation of the risk free rate of return, $\bar{r}_f$. As in the case of the market return, the T-Bill rate was estimated by averaging the month-end rates for each year. The monthly rates were taken as the Thursday tender following the last Wednesday of each month as reported in the Bank of Canada Review and the Bank of Canada Statistical Summary.

2.5 Risk Premium for Common Stocks and Farmland

The risk premium is defined as the return required above the return from a risk free asset to entice a risk averse individual to invest in a risky asset. This can be expressed in the following way.

$$\bar{r}_i = \bar{r}_f + \beta_i[\bar{r}_m - \bar{r}_f]$$

where $\bar{r}_f$ is the expected return of the risk free asset (i.e. the T-Bill), $\bar{r}_m$ the expected return of the market portfolio (i.e. the TSE 300 TRI), $\bar{\beta}_i$ the beta coefficient relating the land investment to the TSE 300, and $[\bar{r}_m - \bar{r}_f]$ the risk premium of the market portfolio over the risk free asset.

The beta for agricultural land, β_i can be estimated using linear regression (ordinary least squares) in the following empirical model.

$$[r_{i,t} - r_{f,t}] = \alpha_i + \beta_i[r_{m,t} - r_{f,t}] + \epsilon_{i,t}$$

where $[r_{i,t} - r_{f,t}]$ and $[r_{m,t} - r_{f,t}]$ are respectively the annual excess returns received respectively for the farmland and the stock market investments in period t, β_i the estimated regression coefficient relating risk in farmland investment to that in the stock market, α_i the estimated regression intercept and $\epsilon_{i,t}$ is the residual error term.

The appropriate measure of risk for a single risky asset in relation to a portfolio of assets is its beta (in this case β_i). Beta depends upon the degree of co-variance between the market and the farmland investment as is evident from the following formulation,

$$\beta_i = \left[\frac{\sigma_{i,m}}{\sigma_m^2}\right] = \rho_{i,m}\left[\frac{\sigma_i}{\sigma_m}\right]$$

where $\sigma_{i,m}$ represents the co-variance between farmland and the stock market, or alternatively, $\rho_{i,m}$ represents the correlation coefficient between the two investments.

The regression intercept is expected to be zero. A positive intercept indicates a return on land in excess of that needed to compensate for non-diversifiable risk. Alternatively a negative intercept indicates a return on land less than that required.

3 RESULTS AND INTERPRETATION

Land sale and crop production data over the 23 year period ending in 1985 were studied for the province as a whole and on a less aggregated basis at the census district and municipal levels. Comparisons were made to the stock market and treasury bill performance over the same time period.

3.1 Farmland Returns, Risk and Risk Premium

The average annual returns, including the capital gain and income components and the total, as well as risk premiums for farmland and for the TSE 300 composite index are presented in Table 1.

TABLE 1

Rates of Return, Risk, and Risk Premium
for Alberta Farmland and the TSE 300

	Capital Gain		Income		Total Return		Risk Premium	
	mean	std	mean	std	mean	std	mean	std
TSE 300	7.7	16.1	4.4	2.5	12.2	17.3	4.1	17.5
ALBERTA	12.7	17.3	7.4	4.2	20.1	18.8	12.1	19.1
CD 1	17.2	35.4	6.1	4.0	23.3	34.9	15.2	35.2
CD 2	13.7	22.7	4.1	2.3	17.8	22.1	9.6	23.2
CD 3	13.4	24.3	6.5	3.3	19.9	24.4	11.8	25.0
CD 4	11.6	28.3	8.8	4.6	20.4	29.1	12.2	28.4
CD 5	12.5	21.4	4.1	2.4	16.6	21.1	8.5	32.3
CD 6	13.4	25.2	4.6	2.4	18.0	24.4	9.9	30.3
CD 7	13.5	19.9	8.7	5.6	22.2	22.6	14.1	19.6
CD 8	13.0	21.2	7.1	3.8	20.1	22.1	12.0	22.4
CD 10	13.2	21.5	8.2	5.3	21.4	23.7	13.3	24.3
CD 11	14.8	25.5	6.9	4.2	21.7	26.3	13.5	24.2
CD 12	13.9	24.3	13.7	7.8	27.6	28.4	19.5	27.5
CD 13	13.5	17.5	11.4	5.9	24.9	20.7	16.9	18.6
CD 14	14.2	32.6	18.1	10.4	32.3	38.1	24.2	30.5
CD 15	11.9	19.0	12.4	7.0	24.3	23.0	16.2	16.8

Note: returns from capital gain and income figures might not sum to total returns because of rounding for purposes of presentation.

The figures presented are for the TSE 300 composite index, for the province as a whole and for the agricultural Census Divisions in the province. For convenience a map of Census Divisions is given in the Appendix. Although sample size limits the usefulness of results on a more disaggregated level, results are, never-the-less, given at the municipal level in the Appendix. A map of Alberta, showing rural municipalities, is included for reference in the Appendix.

The total return to farmland in Alberta over the 23 year study period was 20.1% per annum of which 12.7% arose from capital gain and the remaining 7.4% from rental income. The risk premium above the six month T-Bill rate over this same period was 12.1%. The performance of the stock market during the same period of time had a capital gain of 7.7% and income, in the form of dividends, of 4.4%.

The risk premium of the stock market over the 23 years averaged at 4.1%, considerably lower than the premium earned by holders of agricultural land. This finding is consistent with earlier findings of Kost (1968) and Barry (1980) in the United States.

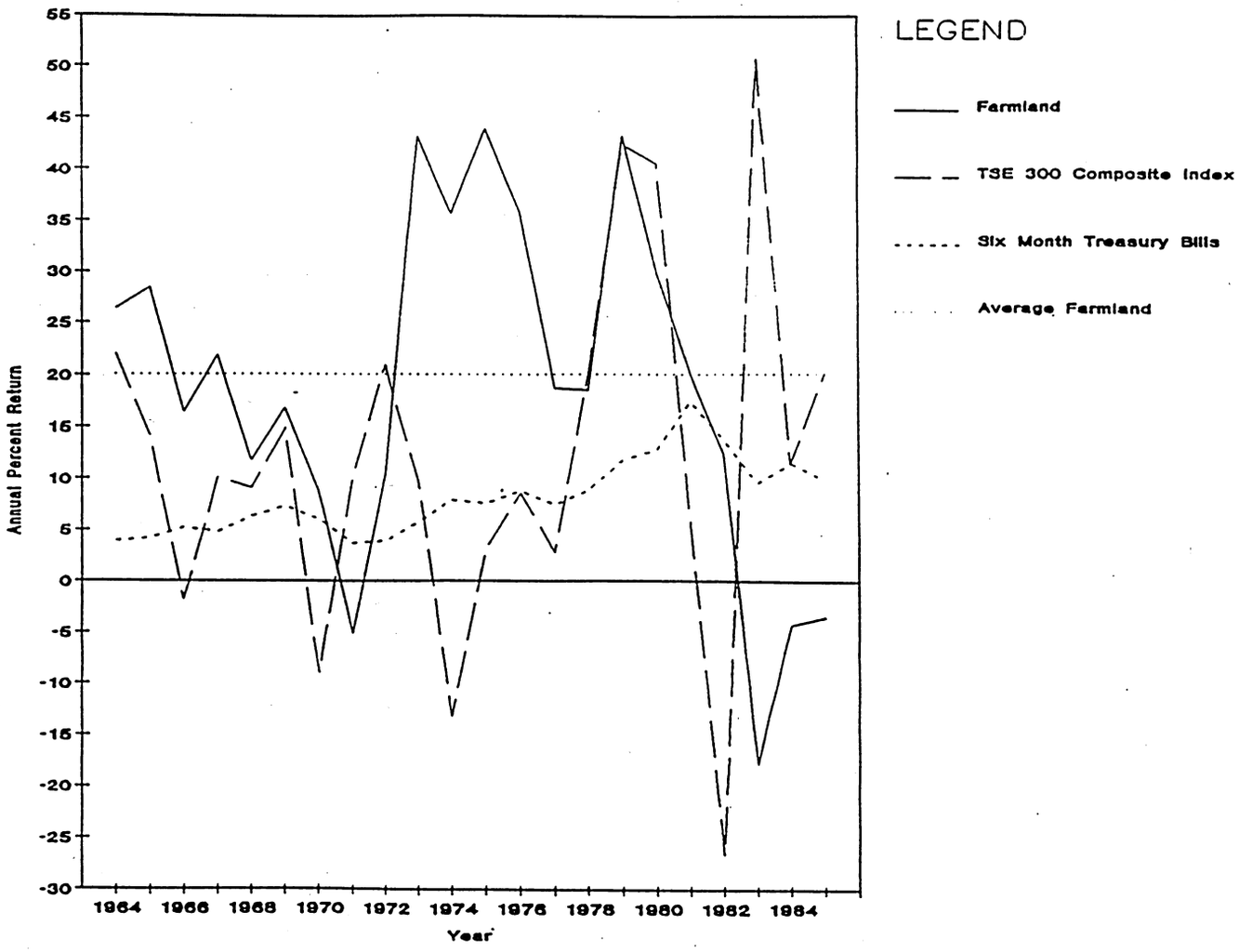
There was a considerable difference in returns from one census division to another. Census Division 5, in south central Alberta had the lowest total return at 16.6%, whereas Census Division 14, in the area west of Edmonton had the highest total return of 32.3%.

The returns reported for Census Divisions in the northern part of the province, which include improvement districts within their boundaries, may contain an upward bias on two accounts. The first source of bias may exist because of land improvement due to land clearing during the study period. Costs of clearing were not available, yet these should be deducted from intra year value changes to derive a more accurate return for capital gain. The second source of bias concerns the yield estimates and crop patterns used may over-state rental income in the northern, more remote, regions. Lack of more precise data resulted in the assumption that rental income in a region such as Rocky Mountain House - Edson area, which is predominantly pasture and hay land, has the same rental income as the central Alberta region of Red Deer - Lacombe, producing higher yielding and higher valued crops.

In summary farmland exhibited a higher rate of return, greater risk premium and higher standard deviation than did the stock market, or of course the treasury bills during the 23 year study period. The performance of Alberta farmland, relative to the stock market and treasury bills, is presented graphically in Figure 1, showing variations, trends and inter-relationships in the three investment alternatives.

Figure 1

Performance of Alberta Farmland, the Stock Market and Treasury Bills
(1963 - 1985)



3.2 Asset Risk and Beta Values for Farmland Investments

Regression time series results of excess returns, showing alpha and beta values, are presented for the province and for agricultural census districts are presented in Table 2. Greater detail, showing tests of significance and other statistical analysis is given in the Appendix.

The more disaggregated level regression results at the municipal level are given in the Appendix. These detailed results should be interpreted with caution because of limited sample size.

TABLE 2

Alpha and Beta Coefficients
for Alberta Farmland and the TSE 300

	Alpha	Beta
TSE 300 TRI	0.0000	1.0000
ALBERTA	0.1157	-0.1613
CD 1	0.1780	-0.5953
CD 2	0.0822	0.0968
CD 3	0.1201	-0.1977
CD 4	* 0.1573	* -0.8578
CD 5	0.0890	-0.2545
CD 6	0.0974	-0.0661
CD 7	0.1414	0.0155
CD 8	0.1154	-0.1041
CD 10	0.1347	-0.1633
CD 11	* 0.1508	-0.3930
CD 12	* 0.1646	* 0.6628
CD 13	* 0.1644	0.0928
CD 14	* 0.2356	0.0705
CD 15	0.1657	-0.1847

* denotes a value for alpha or beta significantly different from zero at the 5% level of significance.

The initial regression analysis generated Durbin - Watsin statistics indicating positive serial correlation in 24 of the 58 cases at the municipal level. The first order auto correlation thus detected was adjusted for by the Cochrane - Orcutt iterative procedure.

The beta for Alberta farmland overall was found to be -0.1613, which is not different from zero at a 5% level of significance. Two of the Census Divisions had statistically significant beta values, one positive, the other negative. Four municipalities, as reported in the Appendix, had beta values significantly different from zero.

Alpha values were positive for the province and all sub-divisions. The provincial alpha value was not significantly different from zero although six of the fourteen Census Divisions had significantly positive alpha coefficients suggesting returns greater than necessary to compensate for the risk involved. Thirty of the municipalities, as shown in the Appendix had significantly positive alpha values.

4 SUMMARY AND CONCLUSIONS

The objectives of this study were two-fold. The first objective was to estimate the total return, in terms of income and capital gain, and the variability from farm land investment in various parts of Alberta for the period 1963 through 1985, and to compare this performance to the stock market and to risk free treasury bills over the same time period. The second objective was to establish a data series of land sales and rental revenue, amenable to annual update, so that land investment risk and return information will be available on a continuing basis.

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5 REFERENCES

Alberta Agriculture. *Rural Real Estate Values in Alberta.* Resource Economics Branch, Agdex 822-1(1971-1986).

Alberta Agriculture. *Agricultural Statistics Yearbook (1963-1986).* Statistics Branch.

Alchian, Armen, A. and Harold Demsetz. Production, Information Costs, and Economic Organization." *American Economic Review.* Volume 67(1972):777-795.

Ashmead, Ralph W. "Financing Alternatives for Canadian Agriculture." Farm Credit Corporation, Ottawa, 1983. Unpublished.

Bank of Canada. "Bank of Canada Review." Various Issues.

Barry, Peter J. "Capital Asset Pricing and Farm Real Estate." *American Journal of Agricultural Economics.* Volume 62(1980):549-553.

Bauer, Leonard. "Farm Properties as a Capital Investment." *AIM*, Volume 27.3(1983):16-28. Appraisal Institute of Canada, Winnipeg, Manitoba.

Brealey, Richard, S. Myers, G. Sick, and R. Whaley. *Principles of Corporate Finance.* First Canadian Edition. Toronto, McGraw-Hill Ryerson Limited, 1986.

Brigham, Eugene F. and Lous C. Gapenski. *Intermediate Financial Management.* Chicago, The Dryden Press, 1985.

Bye, Joanne. "A Survey of Agricultural Land Purchasers in Alberta, 1981." University of Alberta, Department of Rural Economy, Master's Thesis. 1983.

Castle, Emery N. and Irving Hoch. "Farm Real Estate Price Components, 1920-1978." *American Journal of Agricultural Economics.* Volume 64(1982):8-18.

Chiang, Alpha C. *Fundamental Methods of Mathematical Economics.* Third Edition, Toronto, McGraw-Hill Book Company, 1984.

Copeland, Thomas E. and J. Fred Weston. *Financial Theory and Corporate Policy.* Second Edition, New York, Addison-Wesley Publishing Company, 1983.

Crowley, William D. "Actual Versus Apparent Rates of Return on Farmland Investment." *Agricultural Finance Review.* Volume 35(1974):52-57.

Farm Credit Corporation. "Trends in Farm Land Values." Number 19, September, 1985.

Featherstone, Allen M., and Timothy G. Baker. "Farm Sector Real Asset Dynamics." Selected paper, American Agricultural Economics Association annual meeting, Ames, Iowa, 1988.

Grant, Dwight. "Optimal Futures Positions for Producers Who Face Price and Output Risk." Anderson School of Business, University of New Mexico. Preliminary paper, June, 1985.

Green, H.A.J. *Consumer Theory.* Revised Edition, London, The MacMillan Press Ltd., 1976.

Henderson, J.M. and R.E. Quandt. *Microeconomic Theory: A Mathematical Approach.* Third Edition, Toronto, McGraw-Hill Book Company, 1980.

Hoover, Don L. "Agricultural Land Values - Rural and Rural/Urban Fringe: What's Happening?" A presentation to the Appraisal Institute of Canada, Edmonton, 1983.

Jensen, Michael C. and William H. Meckling. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure." *Journal of Financial Economics.* Volume 3(1976):305-360.

Judge, George G., R. Carter Hill, William E. Griffiths, Helmut Lutkepohl, and Tsoung-Chao Lee. *Introduction to the Theory and Practice of Econometrics.* New York, John Wiley & Sons, 1982.

Kost, W.E. "Rates of Return for Farm Real Estate and Common Stock." *American Journal of Agricultural Economics.* Volume 50(1968):213-24.

Leatham, David J., Gregory M. Percy, M. Edward Rister, and James W. Richardson. "Evaluation of Equity Position, Credit Policy, and Capital Gains on Farm Survival and Performance." Western Agricultural Economics Association Annual Meeting, Saskatoon, July 1985.

Levy, Haim. "Equilibrium in an Imperfect Market: A Constraint on the Number of Securities in the Portfolio." *American Economic Review.* Volume 68(1978):643-658.

Lintner, J. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." *Review of Economics and Statistics.* Volume 47(1965):13-37.

Machlup, Fritz. "Theories of the Firm: Marginalist, Behavioral, Managerial." *American Economic Review.* Volume 57(1967):1-33.

Markowitz, H.M. *Portfolio Selection: Efficient Diversification of Investment.* Cowles Foundation Monograph 16. New Haven, Yale University Press, 1959.

Melichar, Emmanuel. "Capital Gains Versus Current Income in the Farming Sector." Paper presented at the American Agricultural Economics Association Annual Meeting, Pullman, Washington, 1979.

Peter C. Nichols and Associates Ltd. "Taxation and Assessment Issues in Educational Finance." in *Financing K-12 Schooling in Alberta.* Alberta Education, 1981.

Phipps, Tim T. "Land Prices and Farm-Based Returns." *American Journal of Agricultural Economics.* Volume 66.4(1984):422-429.

Robison, Lindon J., and Peter J. Barry. "Portfolio Theory and Asset Indivisibility: Implications for Analysis of Risk Management." *North Central Journal of Agricultural Economics.* Volume 2.1(1980):41-46.

Schoney, Richard A. "How Much Can You Pay for Land?" Department of Agricultural Economics, University of Saskatchewan, Based on a report submitted to the United Grain Growers, 1984.

Sharpe, William F. *Investments.* Englewood Cliffs, New Jersey, Prentice Hall, 1978.

Sharpe, William F. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." *Journal of Finance.* Volume 19(1964):425-442.

Skees, Jerry R. and Donald W. Reid. "Consideration of Farmland Value Variation on Farm Firm Survival." *Agricultural Finance Review.* Volume 44(1984):67-72.

Toma, Darrell M. "Farmland Prices in Alberta and Ontario - What About the Future?" *Canadian Appraiser.* Volume 28, Book 2(1984):19-22.

Vanderveer, Lonnie R. "Issues in Agricultural Land Markets: An Empirical Perspective." *Southern Journal of Agricultural Economics.* Volume 17.1(1985):75-87.

Varian, Hal. *Microeconomic Analysis.* First Edition. Norton Publishing, New York, 1978.

6 APPENDIX

TABLE A.1.1

Land Values in Dollars per Acre by Location
(1963-1968)

	1963	1964	1965	1966	1967	1968
Province	44	51	61	63	73	75
Grande Prairie No 1	34	43	45	42	77	75
Vulcan No 2	57	71	63	78	77	99
Ponoka No 3	47	56	71	70	64	73
Newell No 4	59	54	68	66	65	73
Warner No 5	59	55	74	89	87	94
Stettler No 6	36	37	50	44	58	63
Thorhild No 7	31	32	46	48	45	62
Forty Mile No 8	44	44	44	55	60	69
Beaver No 9	36	47	54	57	60	67
Wetaskiwin No 10	52	50	75	49	71	86
Barrhead No 11	32	46	50	63	67	67
Athabasca No 12	25	37	30	39	38	44
Smoky Lake No 13	35	44	34	33	45	68
Lacombe No 14	60	79	67	83	100	106
Wheatland No 16	56	73	65	92	94	81
Mountain View No 17	75	81	96	105	115	110
Paintearth No 18	25	33	34	43	46	52
St. Paul No 19	34	30	29	39	34	49
Strathcona No 20	77	119	122	104	123	206
Two Hills No 21	35	33	40	47	51	47
Camrose No 22	56	72	79	85	87	99
Red Deer No 23	73	67	91	114	110	98
Vermilion River No 24	34	42	57	54	71	62
Leduc No 25	44	47	61	73	73	93
Lethbridge No 26	105	77	113	131	118	131
Minburn No 27	37	46	59	62	71	58
Lac Ste Anne No 28	24	35	45	42	39	56
Flagstaff No 29	47	61	64	80	80	80
Lamont No 30	44	47	62	66	84	90
Parkland No 31	49	50	55	63	80	94

TABLE A.1.1 (continued)

Land Values in Dollars per Acre by Location
(1963-1968)

	1963	1964	1965	1966	1967	1968
Cardston No 6	57	84	93	78	109	98
Pincher Creek No 9	48	59	74	78	74	71
Taber No 14	78	81	82	91	116	69
Willow Creek No 26	60	56	63	69	72	91
Foothills No 31	74	78	89	110	146	135
Rockyview No 44	74	101	101	100	117	138
Starland No 47	39	48	60	53	79	56
Kneehill No 48	83	81	89	114	132	116
Provost No 52	24	24	40	65	55	79
Wainwright No 61	27	34	48	59	60	74
Bonnyville No 87	25	27	32	33	36	33
Sturgeon No 90	67	87	92	102	120	127
Westlock No 92	45	52	60	46	73	78
Smoky River No 130	28	37	46	46	47	52
Spirit River No 133	31	36	38	44	64	59
Peace No 135	37	42	45	48	52	50
Fairview No 136	35	49	62	59	81	75
Medicine Hat ID No 1	38	46	41	37	51	50
Rocky Mtn Hs ID No 10	35	44	49	53	77	56
Edson ID No 14	22	29	32	24	23	34
High Prairie ID No 17	32	48	45	45	47	42
Lac La Biche ID No 18	21	12	18	9	17	42
Spirit River ID No 19	31	34	43	41	50	61
Spirit River ID No 20	33	35	38	45	48	50
Spirit River ID No 21	26	28	42	29	27	38
Spirit River ID No 22	33	39	39	19	34	39
Hanna SA No's 2-4	37	34	32	37	43	57

TABLE A.1.2

Land Values in Dollars per Acre by Location
(1969-1974)

	1969	1970	1971	1972	1973	1974
Province	84	86	77	75	92	142
Grande Prairie No 1	67	59	62	58	71	90
Vulcan No 2	97	83	95	106	110	177
Ponoka No 3	71	80	73	84	93	159
Newell No 4	88	83	84	90	115	172
Warner No 5	84	51	77	104	118	147
Stettler No 6	63	59	64	53	78	117
Thorhild No 7	66	38	59	41	49	99
Forty Mile No 8	74	72	77	62	85	108
Beaver No 9	52	58	50	54	76	98
Wetaskiwin No 10	80	57	78	77	103	117
Barrhead No 11	54	58	84	53	76	91
Athabasca No 12	23	49	50	41	41	79
Smoky Lake No 13	52	36	37	35	48	83
Lacombe No 14	99	87	71	90	111	180
Wheatland No 16	87	92	107	85	133	277
Mountain View No 17	104	98	105	125	157	251
Paintearth No 18	41	51	42	47	44	85
St. Paul No 19	41	54	45	49	67	85
Strathcona No 20	163	232	201	144	168	252
Two Hills No 21	59	48	35	55	55	70
Camrose No 22	88	87	95	88	94	159
Red Deer No 23	86	91	95	112	130	226
Vermilion River No 24	63	52	62	68	64	101
Leduc No 25	176	164	100	111	186	176
Lethbridge No 26	144	131	110	171	220	259
Minburn No 27	52	61	55	62	62	87
Lac Ste Anne No 28	59	61	58	49	58	86
Flagstaff No 29	72	63	70	73	72	111
Lamont No 30	65	31	63	80	76	105
Parkland No 31	97	96	104	92	101	146

TABLE A.1.2 (continued)

Land Values in Dollars per Acre by Location
(1969-1974)

	1969	1970	1971	1972	1973	1974
Cardston No 6	120	103	104	89	146	236
Pincher Creek No 9	84	61	75	83	105	183
Taber No 14	110	152	145	109	129	193
Willow Creek No 26	84	89	83	83	107	182
Foothills No 31	119	134	161	142	221	324
Rockyview No 44	185	146	187	150	214	490
Starland No 47	66	47	82	66	85	122
Kneehill No 48	79	91	94	109	117	203
Provost No 52	60	55	43	60	58	78
Wainwright No 61	67	56	49	53	60	112
Bonnyville No 87	51	53	45	49	45	68
Sturgeon No 90	130	123	180	227	142	237
Westlock No 92	66	89	70	72	95	90
Smoky River No 130	42	42	45	44	53	85
Spirit River No 133	66	61	94	55	63	179
Peace No 135	63	45	50	43	65	85
Fairview No 136	47	39	72	62	61	85
Medicine Hat ID No 1	88	50	80	58	103	161
Rocky Mtn Hs ID No 10	59	66	64	83	100	145
Edson ID No 14	33	27	52	72	40	63
High Prairie ID No 17	23	37	46	53	46	64
Lac La Biche ID No 18	35	33	37	38	36	58
Spirit River ID No 19	42	36	55	54	60	69
Spirit River ID No 20	43	38	40	31	53	60
Spirit River ID No 21	35	32	29	33	51	57
Spirit River ID No 22	15	34	36	36	46	53
Hanna SA No's 2-4	55	58	41	61	60	114

TABLE A.1.3

Land Values in Dollars per Acre by Location
(1975-1979)

	1975	1976	1977	1978	1979
Province	194	252	286	322	447
Grande Prairie No 1	155	174	245	304	414
Vulcan No 2	244	353	404	400	441
Ponoka No 3	184	238	316	395	485
Newell No 4	246	365	359	390	784
Warner No 5	190	230	269	188	297
Stettler No 6	157	247	232	245	321
Thorhild No 7	129	173	273	208	349
Forty Mile No 8	188	303	288	285	474
Beaver No 9	133	166	248	227	279
Wetaskiwin No 10	202	311	365	315	479
Barrhead No 11	123	159	229	258	400
Athabasca No 12	102	114	139	158	289
Smoky Lake No 13	127	120	173	146	273
Lacombe No 14	228	318	360	446	745
Wheatland No 16	328	323	462	662	606
Mountain View No 17	354	546	518	641	796
Paintearth No 18	111	129	183	184	185
St. Paul No 19	111	120	200	190	353
Strathcona No 20	432	538	596	306	424
Two Hills No 21	112	147	215	188	318
Camrose No 22	206	330	331	358	487
Red Deer No 23	299	372	455	590	576
Vermilion River No 24	123	162	189	266	464
Leduc No 25	190	425	486	669	587
Lethbridge No 26	491	719	685	678	988
Minburn No 27	120	182	219	253	340
Lac Ste Anne No 28	118	163	222	236	326
Flagstaff No 29	175	217	277	339	374
Lamont No 30	192	182	338	304	425
Parkland No 31	134	132	387	631	331

TABLE A.1.3 (continued)

Land Values in Dollars per Acre by Location
(1975-1979)

	1975	1976	1977	1978	1979
Cardston No 6	259	221	317	358	534
Pincher Creek No 9	309	306	311	346	578
Taber No 14	281	443	389	524	617
Willow Creek No 26	266	268	319	334	442
Foothills No 31	450	524	795	505	705
Rockyview No 44	522	564	514	589	1290
Starland No 47	207	241	367	313	399
Kneehill No 48	299	353	399	432	575
Provost No 52	151	146	184	120	303
Wainwright No 61	156	232	225	266	316
Bonnyville No 87	99	140	206	221	261
Sturgeon No 90	294	272	473	738	620
Westlock No 92	133	202	258	275	338
Smoky River No 130	82	140	172	240	278
Spirit River No 133	95	111	150	157	179
Peace No 135	167	162	234	393	615
Fairview No 136	110	118	155	216	313
Medicine Hat ID No 1	156	327	316	242	303
Rocky Mtn Hs ID No 10	212	288	228	339	484
Edson ID No 14	100	130	130	179	218
High Prairie ID No 17	88	136	164	182	233
Lac La Biche ID No 18	66	94	104	156	194
Spirit River ID No 19	85	93	166	178	190
Spirit River ID No 20	90	97	121	155	144
Spirit River ID No 21	66	97	113	132	172
Spirit River ID No 22	81	103	114	171	197
Hanna SA No's 2-4	144	155	221	183	155

TABLE A.1.4

Land Values in Dollars per Acre by Location
(1980-1985)

	1980	1981	1982	1983	1984	1985
Province	561	652	714	556	513	478
Grande Prairie No 1	450	440	494	393	326	265
Vulcan No 2	708	713	725	591	688	540
Ponoka No 3	797	804	848	700	614	468
Newell No 4	836	955	955	671	821	715
Warner No 5	419	594	885	654	608	742
Stettler No 6	384	556	438	551	481	389
Thorhild No 7	340	476	452	372	374	401
Forty Mile No 8	370	679	718	501	561	536
Beaver No 9	417	503	588	499	524	411
Wetaskiwin No 10	505	817	593	568	586	489
Barrhead No 11	390	511	577	480	388	499
Athabasca No 12	306	296	368	291	205	282
Smoky Lake No 13	348	413	705	424	363	309
Lacombe No 14	916	812	852	803	679	673
Wheatland No 16	702	1012	943	812	717	601
Mountain View No 17	1037	1223	1177	768	818	719
Paintearth No 18	336	367	435	363	267	364
St. Paul No 19	385	413	923	424	327	304
Strathcona No 20	1213	655	1446	551	1264	495
Two Hills No 21	365	511	542	411	388	351
Camrose No 22	705	773	895	755	548	469
Red Deer No 23	910	956	1315	745	925	669
Vermilion River No 24	494	616	1006	686	463	489
Leduc No 25	1063	1622	2278	729	507	681
Lethbridge No 26	1158	1969	1785	1330	1299	843
Minburn No 27	526	551	511	393	541	448
Lac Ste Anne No 28	318	411	406	349	368	300
Flagstaff No 29	583	579	825	688	583	620
Lamont No 30	427	594	696	532	483	443
Parkland No 31	841	644	800	415	697	831

TABLE A.1.4 (continued)

Land Values in Dollars per Acre by Location
(1980-1985)

	1980	1981	1982	1983	1984	1985
Cardston No 6	341	803	844	647	722	542
Pincher Creek No 9	594	1398	723	641	612	650
Taber No 14	920	1239	1439	1137	928	849
Willow Creek No 26	722	929	702	535	772	594
Foothills No 31	1059	967	890	945	795	717
Rockyview No 44	1188	1537	1160	1028	937	716
Starland No 47	581	647	524	638	375	451
Kneehill No 48	751	873	1185	1112	792	794
Provost No 52	406	674	840	599	539	452
Wainwright No 61	366	596	470	404	452	435
Bonnyville No 87	488	411	364	370	311	328
Sturgeon No 90	851	729	714	731	650	614
Westlock No 92	535	470	442	496	447	393
Smoky River No 130	276	465	342	327	305	301
Spirit River No 133	391	331	360	288	345	277
Peace No 135	727	868	409	298	450	346
Fairview No 136	322	477	297	346	390	434
Medicine Hat ID No 1	386	838	905	422	481	463
Rocky Mtn Hs ID No 10	708	813	536	717	595	599
Edson ID No 14	227	289	276	276	227	162
High Prairie ID No 17	225	253	326	277	249	271
Lac La Biche ID No 18	270	254	258	315	268	261
Spirit River ID No 19	163	361	380	304	284	256
Spirit River ID No 20	204	323	311	230	231	229
Spirit River ID No 21	251	260	304	226	249	241
Spirit River ID No 22	177	402	423	253	271	222
Hanna SA No's 2-4	195	216	310	194	220	204

TABLE A.2.1

Rental Income in Dollars per Acre by Location
(1963-1968)

	1963	1964	1965	1966	1967	1968
Province	6.40	5.70	6.21	7.95	4.75	6.11
Grande Prairie No 1	6.70	6.20	6.36	8.15	4.28	5.79
Vulcan No 2	5.23	4.16	5.25	6.48	3.86	5.33
Ponoka No 3	7.36	6.67	7.03	8.88	5.96	6.86
Newell No 4	5.57	4.54	5.74	7.18	4.23	6.31
Warner No 5	5.57	4.54	5.74	7.18	4.23	6.31
Stettler No 6	6.48	5.32	6.85	8.45	5.15	7.50
Thorhild No 7	7.16	6.52	6.51	8.49	5.63	6.49
Forty Mile No 8	5.05	4.07	5.13	6.60	3.84	5.34
Beaver No 9	6.01	5.43	5.67	7.60	3.96	5.21
Wetaskiwin No 10	7.29	6.69	6.98	8.83	5.87	6.73
Barrhead No 11	7.16	6.52	6.51	8.49	5.63	6.49
Athabasca No 12	7.16	6.52	6.51	8.49	5.63	6.49
Smoky Lake No 13	6.60	6.04	6.17	8.12	4.16	5.66
Lacombe No 14	7.36	6.67	7.03	8.88	5.96	6.86
Wheatland No 16	5.23	4.16	5.25	6.48	3.86	5.33
Mountain View No 17	6.37	5.95	6.30	8.21	5.53	6.40
Paintearth No 18	6.48	5.32	6.85	8.45	5.15	7.50
St. Paul No 19	6.60	6.04	6.17	8.12	4.16	5.66
Strathcona No 20	7.29	6.69	6.98	8.83	5.87	6.73
Two Hills No 21	6.01	5.43	5.67	7.60	3.96	5.21
Camrose No 22	6.01	5.43	5.67	7.60	3.96	5.21
Red Deer No 23	7.36	6.67	7.03	8.88	5.96	6.86
Vermilion River No 24	6.01	5.43	5.67	7.60	3.96	5.21
Leduc No 25	7.29	6.69	6.98	8.83	5.87	6.73
Lethbridge No 26	5.57	4.54	5.74	7.18	4.23	6.31
Minburn No 27	6.01	5.43	5.67	7.60	3.96	5.21
Lac Ste Anne No 28	7.16	6.52	6.51	8.49	5.63	6.49
Flagstaff No 29	6.48	5.32	6.85	8.45	5.15	7.50
Lamont No 30	6.01	5.43	5.67	7.60	3.96	5.21
Parkland No 31	7.29	6.69	6.98	8.83	5.87	6.73

TABLE A.2.1 (continued)

Rental Income in Dollars per Acre by Location
(1963-1968)

	1963	1964	1965	1966	1967	1968
Cardston No 6	5.59	5.24	5.51	7.19	4.64	5.68
Pincher Creek No 9	5.59	5.24	5.51	7.19	4.64	5.68
Taber No 14	5.57	4.54	5.74	7.18	4.23	6.31
Willow Creek No 26	5.59	5.24	5.51	7.19	4.64	5.68
Foothills No 31	6.37	5.95	6.30	8.21	5.53	6.40
Rockyview No 44	6.37	5.95	6.30	8.21	5.53	6.40
Starland No 47	5.23	4.16	5.25	6.48	3.86	5.33
Kneehill No 48	5.23	4.16	5.25	6.48	3.86	5.33
Provost No 52	6.48	5.32	6.85	8.45	5.15	7.50
Wainwright No 61	6.48	5.32	6.85	8.45	5.15	7.50
Bonnyville No 87	6.60	6.04	6.17	8.12	4.16	5.66
Sturgeon No 90	7.29	6.69	6.98	8.83	5.87	6.73
Westlock No 92	7.16	6.52	6.51	8.49	5.63	6.49
Smoky River No 130	6.70	6.20	6.36	8.15	4.28	5.79
Spirit River No 133	6.70	6.20	6.36	8.15	4.28	5.79
Peace No 135	6.70	6.20	6.36	8.15	4.28	5.79
Fairview No 136	6.70	6.20	6.36	8.15	4.28	5.79
Medicine Hat ID No 1	5.05	4.07	5.13	6.60	3.84	5.34
Rocky Mtn Hs ID No 10	7.36	6.67	7.03	8.88	5.96	6.86
Edson ID No 14	7.16	6.52	6.51	8.49	5.63	6.49
High Prairie ID No 17	6.70	6.20	6.36	8.15	4.28	5.79
Lac La Biche ID No 18	6.60	6.04	6.17	8.12	4.16	5.66
Spirit River ID No 19	6.70	6.20	6.36	8.15	4.28	5.79
Spirit River ID No 20	6.70	6.20	6.36	8.15	4.28	5.79
Spirit River ID No 21	6.70	6.20	6.36	8.15	4.28	5.79
Spirit River ID No 22	6.70	6.20	6.36	8.15	4.28	5.79
Hanna SA No's 2-4	5.05	4.07	5.13	6.60	3.84	5.34

TABLE A.2.2

Rental Income in Dollars per Acre by Location
(1969-1974)

	1969	1970	1971	1972	1973	1974
Province	4.86	4.70	4.26	9.70	19.22	16.67
Grande Prairie No 1	4.85	4.74	4.22	10.43	19.43	16.71
Vulcan No 2	3.73	3.46	3.37	6.16	13.27	11.05
Ponoka No 3	5.70	5.76	4.97	11.57	22.68	20.93
Newell No 4	4.33	4.05	3.68	7.59	14.95	12.09
Warner No 5	4.33	4.05	3.68	7.59	14.95	12.09
Stettler No 6	5.04	5.04	4.33	8.67	18.27	15.12
Thorhild No 7	5.50	5.33	4.76	10.85	21.87	19.13
Forty Mile No 8	3.65	3.19	3.37	6.21	13.22	10.41
Beaver No 9	4.45	4.17	4.00	10.00	19.63	16.85
Wetaskiwin No 10	5.64	5.56	4.94	11.59	22.50	19.95
Barrhead No 11	5.50	5.33	4.76	10.85	21.87	19.13
Athabasca No 12	5.50	5.33	4.76	10.85	21.87	19.13
Smoky Lake No 13	4.94	4.64	4.29	10.54	20.08	17.45
Lacombe No 14	5.70	5.76	4.97	11.57	22.68	20.93
Wheatland No 16	3.73	3.46	3.37	6.16	13.27	11.05
Mountain View No 17	5.18	5.11	4.60	10.75	21.60	20.04
Paintearth No 18	5.04	5.04	4.33	8.67	18.27	15.12
St. Paul No 19	4.94	4.64	4.29	10.54	20.08	17.45
Strathcona No 20	5.64	5.56	4.94	11.59	22.50	19.95
Two Hills No 21	4.45	4.17	4.00	10.00	19.63	16.85
Camrose No 22	4.45	4.17	4.00	10.00	19.63	16.85
Red Deer No 23	5.70	5.76	4.97	11.57	22.68	20.93
Vermilion River No 24	4.45	4.17	4.00	10.00	19.63	16.85
Leduc No 25	5.64	5.56	4.94	11.59	22.50	19.95
Lethbridge No 26	4.33	4.05	3.68	7.59	14.95	12.09
Minburn No 27	4.45	4.17	4.00	10.00	19.63	16.85
Lac Ste Anne No 28	5.50	5.33	4.76	10.85	21.87	19.13
Flagstaff No 29	5.04	5.04	4.33	8.67	18.27	15.12
Lamont No 30	4.45	4.17	4.00	10.00	19.63	16.85
Parkland No 31	5.64	5.56	4.94	11.59	22.50	19.95

TABLE A.2.2 (continued)

Rental Income in Dollars per Acre by Location
(1969-1974)

	1969	1970	1971	1972	1973	1974
Cardston No 6	4.65	4.36	4.23	9.09	19.91	18.10
Pincher Creek No 9	4.65	4.36	4.23	9.09	19.91	18.10
Taber No 14	4.33	4.05	3.68	7.59	14.95	12.09
Willow Creek No 26	4.65	4.36	4.23	9.09	19.91	18.10
Foothills No 31	5.18	5.11	4.60	10.75	21.60	20.04
Rockyview No 44	5.18	5.11	4.60	10.75	21.60	20.04
Starland No 47	3.73	3.46	3.37	6.16	13.27	11.05
Kneehill No 48	3.73	3.46	3.37	6.16	13.27	11.05
Provost No 52	5.04	5.04	4.33	8.67	18.27	15.12
Wainwright No 61	5.04	5.04	4.33	8.67	18.27	15.12
Bonnyville No 87	4.94	4.64	4.29	10.54	20.08	17.45
Sturgeon No 90	5.64	5.56	4.94	11.59	22.50	19.95
Westlock No 92	5.50	5.33	4.76	10.85	21.87	19.13
Smoky River No 130	4.85	4.74	4.22	10.43	19.43	16.71
Spirit River No 133	4.85	4.74	4.22	10.43	19.43	16.71
Peace No 135	4.85	4.74	4.22	10.43	19.43	16.71
Fairview No 136	4.85	4.74	4.22	10.43	19.43	16.71
Medicine Hat ID No 1	3.65	3.19	3.37	6.21	13.22	10.41
Rocky Mtn Hs ID No 10	5.70	5.76	4.97	11.57	22.68	20.93
Edson ID No 14	5.50	5.33	4.76	10.85	21.87	19.13
High Prairie ID No 17	4.85	4.74	4.22	10.43	19.43	16.71
Lac La Biche ID No 18	4.94	4.64	4.29	10.54	20.08	17.45
Spirit River ID No 19	4.85	4.74	4.22	10.43	19.43	16.71
Spirit River ID No 20	4.85	4.74	4.22	10.43	19.43	16.71
Spirit River ID No 21	4.85	4.74	4.22	10.43	19.43	16.71
Spirit River ID No 22	4.85	4.74	4.22	10.43	19.43	16.71
Hanna SA No's 2-4	3.65	3.19	3.37	6.21	13.22	10.41

TABLE A.2.3

Rental Income in Dollars per Acre by Location
(1975-1979)

	1975	1976	1977	1978	1979
Province	13.32	16.36	14.71	18.57	21.49
Grande Prairie No 1	12.93	18.51	14.64	18.15	22.23
Vulcan No 2	9.66	10.22	7.66	12.45	14.21
Ponoka No 3	15.89	18.80	19.10	23.01	26.04
Newell No 4	10.80	11.72	8.67	14.19	16.49
Warner No 5	10.80	11.72	8.67	14.19	16.49
Stettler No 6	13.47	13.84	10.41	16.39	18.72
Thorhild No 7	15.09	17.76	18.23	21.75	24.43
Forty Mile No 8	8.86	9.29	7.64	12.24	13.84
Beaver No 9	13.21	18.16	16.27	18.48	22.23
Wetaskiwin No 10	15.52	18.51	18.84	22.91	24.95
Barrhead No 11	15.09	17.76	18.23	21.75	24.43
Athabasca No 12	15.09	17.76	18.23	21.75	24.43
Smoky Lake No 13	13.91	18.63	17.45	19.79	23.95
Lacombe No 14	15.89	18.80	19.10	23.01	26.04
Wheatland No 16	9.66	10.22	7.66	12.45	14.21
Mountain View No 17	15.26	17.66	17.76	21.18	23.76
Paintearth No 18	13.47	13.84	10.41	16.39	18.72
St. Paul No 19	13.91	18.63	17.45	19.79	23.95
Strathcona No 20	15.52	18.51	18.84	22.91	24.95
Two Hills No 21	13.21	18.16	16.27	18.48	22.23
Camrose No 22	13.21	18.16	16.27	18.48	22.23
Red Deer No 23	15.89	18.80	19.10	23.01	26.04
Vermilion River No 24	13.21	18.16	16.27	18.48	22.23
Leduc No 25	15.52	18.51	18.84	22.91	24.95
Lethbridge No 26	10.80	11.72	8.67	14.19	16.49
Minburn No 27	13.21	18.16	16.27	18.48	22.23
Lac Ste Anne No 28	15.09	17.76	18.23	21.75	24.43
Flagstaff No 29	13.47	13.84	10.41	16.39	18.72
Lamont No 30	13.21	18.16	16.27	18.48	22.23
Parkland No 31	15.52	18.51	18.84	22.91	24.95

TABLE A.2.3 (continued)

Rental Income in Dollars per Acre by Location
(1975-1979)

	1975	1976	1977	1978	1979
Cardston No 6	13.73	17.02	16.99	20.34	22.79
Pincher Creek No 9	13.73	17.02	16.99	20.34	22.79
Taber No 14	10.80	11.72	8.67	14.19	16.49
Willow Creek No 26	13.73	17.02	16.99	20.34	22.79
Foothills No 31	15.26	17.66	17.76	21.18	23.76
Rockyview No 44	15.26	17.66	17.76	21.18	23.76
Starland No 47	9.66	10.22	7.66	12.45	14.21
Kneehill No 48	9.66	10.22	7.66	12.45	14.21
Provost No 52	13.47	13.84	10.41	16.39	18.72
Wainwright No 61	13.47	13.84	10.41	16.39	18.72
Bonnyville No 87	13.91	18.63	17.45	19.79	23.95
Sturgeon No 90	15.52	18.51	18.84	22.91	24.95
Westlock No 92	15.09	17.76	18.23	21.75	24.43
Smoky River No 130	12.93	18.51	14.64	18.15	22.23
Spirit River No 133	12.93	18.51	14.64	18.15	22.23
Peace No 135	12.93	18.51	14.64	18.15	22.23
Fairview No 136	12.93	18.51	14.64	18.15	22.23
Medicine Hat ID No 1	8.86	9.29	7.64	12.24	13.84
Rocky Mtn Hs ID No 10	15.89	18.80	19.10	23.01	26.04
Edson ID No 14	15.09	17.76	18.23	21.75	24.43
High Prairie ID No 17	12.93	18.51	14.64	18.15	22.23
Lac La Biche ID No 18	13.91	18.63	17.45	19.79	23.95
Spirit River ID No 19	12.93	18.51	14.64	18.15	22.23
Spirit River ID No 20	12.93	18.51	14.64	18.15	22.23
Spirit River ID No 21	12.93	18.51	14.64	18.15	22.23
Spirit River ID No 22	12.93	18.51	14.64	18.15	22.23
Hanna SA No's 2-4	8.86	9.29	7.64	12.24	13.84

TABLE A.2.4

Rental Income in Dollars per Acre by Location
(1980-1985)

	1980	1981	1982	1983	1984	1985
Province	25.48	25.65	21.22	24.15	18.36	16.37
Grande Prairie No 1	26.77	25.90	18.12	25.10	19.76	16.44
Vulcan No 2	17.15	17.41	12.37	16.60	10.89	10.66
Ponoka No 3	29.90	30.82	30.75	28.86	22.76	20.53
Newell No 4	19.37	19.05	13.41	17.72	11.50	11.39
Warner No 5	19.37	19.05	13.41	17.72	11.50	11.39
Stettler No 6	22.96	22.36	15.97	20.90	13.80	13.46
Thorhild No 7	28.49	29.88	29.83	27.79	21.99	20.05
Forty Mile No 8	16.11	15.94	10.73	14.83	9.57	9.44
Beaver No 9	26.54	26.81	18.24	24.95	19.46	16.16
Wetaskiwin No 10	29.39	29.79	30.02	27.82	22.13	20.16
Barrhead No 11	28.49	29.88	29.83	27.79	21.99	20.05
Athabasca No 12	28.49	29.88	29.83	27.79	21.99	20.05
Smoky Lake No 13	28.64	27.98	19.55	26.35	20.70	17.06
Lacombe No 14	29.90	30.82	30.75	28.86	22.76	20.53
Wheatland No 16	17.15	17.41	12.37	16.60	10.89	10.66
Mountain View No 17	28.11	28.95	28.91	27.28	21.62	19.49
Paintearth No 18	22.96	22.36	15.97	20.90	13.80	13.46
St. Paul No 19	28.64	27.98	19.55	26.35	20.70	17.06
Strathcona No 20	29.39	29.79	30.02	27.82	22.13	20.16
Two Hills No 21	26.54	26.81	18.24	24.95	19.46	16.16
Camrose No 22	26.54	26.81	18.24	24.95	19.46	16.16
Red Deer No 23	29.90	30.82	30.75	28.86	22.76	20.53
Vermilion River No 24	26.54	26.81	18.24	24.95	19.46	16.16
Leduc No 25	29.39	29.79	30.02	27.82	22.13	20.16
Lethbridge No 26	19.37	19.05	13.41	17.72	11.50	11.39
Minburn No 27	26.54	26.81	18.24	24.95	19.46	16.16
Lac Ste Anne No 28	28.49	29.88	29.83	27.79	21.99	20.05
Flagstaff No 29	22.96	22.36	15.97	20.90	13.80	13.46
Lamont No 30	26.54	26.81	18.24	24.95	19.46	16.16
Parkland No 31	29.39	29.79	30.02	27.82	22.13	20.16

TABLE A.2.4 (continued)

Rental Income in Dollars per Acre by Location
(1980-1985)

	1980	1981	1982	1983	1984	1985
Cardston No 6	26.20	28.69	28.72	27.04	21.13	19.17
Pincher Creek No 9	26.20	28.69	28.72	27.04	21.13	19.17
Taber No 14	19.37	19.05	13.41	17.72	11.50	11.39
Willow Creek No 26	26.20	28.69	28.72	27.04	21.13	19.17
Foothills No 31	28.11	28.95	28.91	27.28	21.62	19.49
Rockyview No 44	28.11	28.95	28.91	27.28	21.62	19.49
Starland No 47	17.15	17.41	12.37	16.60	10.89	10.66
Kneehill No 48	17.15	17.41	12.37	16.60	10.89	10.66
Provost No 52	22.96	22.36	15.97	20.90	13.80	13.46
Wainwright No 61	22.96	22.36	15.97	20.90	13.80	13.46
Bonnyville No 87	28.64	27.98	19.55	26.35	20.70	17.06
Sturgeon No 90	29.39	29.79	30.02	27.82	22.13	20.16
Westlock No 92	28.49	29.88	29.83	27.79	21.99	20.05
Smoky River No 130	26.77	25.90	18.12	25.10	19.76	16.44
Spirit River No 133	26.77	25.90	18.12	25.10	19.76	16.44
Peace No 135	26.77	25.90	18.12	25.10	19.76	16.44
Fairview No 136	26.77	25.90	18.12	25.10	19.76	16.44
Medicine Hat ID No 1	16.11	15.94	10.73	14.83	9.57	9.44
Rocky Mtn Hs ID No 10	29.90	30.82	30.75	28.86	22.76	20.53
Edson ID No 14	28.49	29.88	29.83	27.79	21.99	20.05
High Prairie ID No 17	26.77	25.90	18.12	25.10	19.76	16.44
Lac La Biche ID No 18	28.64	27.98	19.55	26.35	20.70	17.06
Spirit River ID No 19	26.77	25.90	18.12	25.10	19.76	16.44
Spirit River ID No 20	26.77	25.90	18.12	25.10	19.76	16.44
Spirit River ID No 21	26.77	25.90	18.12	25.10	19.76	16.44
Spirit River ID No 22	26.77	25.90	18.12	25.10	19.76	16.44
Hanna SA No's 2-4	16.11	15.94	10.73	14.83	9.57	9.44

TABLE A.3.1

Annual Crop Proportions
for Zone 1

	Wheat	Oats	Barley	Canola
1963	42.43%	8.00%	37.72%	11.85%
1964	43.09%	7.95%	37.35%	11.61%
1965	43.76%	7.90%	36.98%	11.36%
1966	44.43%	7.85%	36.61%	11.12%
1967	45.09%	7.80%	36.23%	10.87%
1968	45.76%	7.75%	35.86%	10.63%
1969	46.43%	7.70%	35.49%	10.38%
1970	47.10%	7.60%	35.12%	10.14%
1971	47.76%	7.55%	34.74%	9.89%
1972	48.43%	7.55%	34.37%	9.65%
1973	49.10%	7.50%	34.00%	9.40%
1974	52.50%	12.50%	28.70%	6.30%
1975	57.00%	14.00%	24.40%	4.70%
1976	64.80%	10.50%	22.90%	1.90%
1977	59.10%	11.00%	25.20%	4.70%
1978	57.00%	7.40%	23.70%	11.90%
1979	64.00%	6.10%	18.40%	11.40%
1980	64.20%	5.50%	21.10%	9.20%
1981	67.20%	5.20%	22.40%	5.20%
1982	69.80%	3.90%	24.00%	2.30%
1983	74.40%	2.50%	17.40%	5.80%
1984	64.80%	4.90%	16.40%	13.90%
1985	62.10%	6.80%	16.50%	14.60%

Source: Alberta Hail and Crop Insurance Corporation. "Crop Yield Data."

TABLE A.3.2

Annual Crop Proportions
for Zone 2

	Wheat	Oats	Barley	Canola
1963	18.17%	17.42%	58.50%	5.91%
1964	18.14%	17.29%	58.60%	5.97%
1965	18.52%	17.16%	58.30%	6.03%
1966	18.69%	17.02%	58.20%	6.09%
1967	18.96%	16.89%	58.00%	6.15%
1968	19.33%	16.76%	57.70%	6.21%
1969	19.61%	16.63%	57.50%	6.26%
1970	19.98%	16.50%	57.20%	6.32%
1971	20.15%	16.36%	57.10%	6.38%
1972	20.43%	16.23%	56.90%	6.44%
1973	19.40%	16.10%	58.00%	6.50%
1974	14.80%	19.80%	54.30%	11.10%
1975	17.20%	16.10%	52.90%	13.80%
1976	15.50%	21.40%	59.50%	3.60%
1977	16.00%	15.00%	60.00%	9.00%
1978	14.40%	12.70%	54.30%	18.60%
1979	15.20%	12.40%	46.70%	25.70%
1980	19.60%	9.80%	56.90%	13.70%
1981	20.20%	13.20%	60.50%	6.10%
1982	17.50%	12.50%	59.20%	10.80%
1983	19.30%	10.90%	48.70%	21.00%
1984	18.90%	7.20%	51.40%	22.50%
1985	15.50%	10.70%	55.90%	17.90%

Source: Alberta Hail and Crop Insurance Corporation. "Crop Yield Data."

TABLE A.3.3

Annual Crop Proportions
for Zone 3

	Wheat	Oats	Barley	Canola
1963	26.24%	21.50%	42.80%	9.46%
1964	26.67%	21.29%	42.41%	9.62%
1965	27.11%	21.08%	42.02%	9.79%
1966	27.55%	20.87%	41.63%	9.95%
1967	27.98%	20.66%	41.24%	10.11%
1968	28.42%	20.45%	40.85%	10.28%
1969	28.85%	20.24%	40.46%	10.44%
1970	29.29%	20.03%	40.07%	10.61%
1971	29.73%	19.82%	39.68%	10.77%
1972	30.16%	19.61%	39.29%	10.94%
1973	30.60%	19.40%	38.90%	11.10%
1974	21.60%	21.60%	42.20%	14.70%
1975	28.70%	15.70%	39.80%	15.70%
1976	35.70%	22.40%	36.70%	5.10%
1977	28.30%	19.50%	35.40%	16.80%
1978	26.80%	17.10%	29.30%	26.80%
1979	21.80%	12.90%	28.70%	36.60%
1980	30.40%	8.70%	36.50%	24.30%
1981	34.60%	11.50%	36.50%	17.30%
1982	27.80%	15.70%	39.80%	16.70%
1983	40.40%	8.10%	23.50%	27.90%
1984	35.40%	10.80%	27.70%	26.20%
1985	31.00%	8.00%	28.30%	32.70%

Source: Alberta Hail and Crop Insurance Corporation. "Crop Yield Data."

TABLE A.4.1

Annual Crop Yields in Kilograms per Acre
for Zone 1

	Wheat	Oats	Barley	Canola
1963	673	781	798	494
1964	556	555	647	422
1965	667	734	862	422
1966	789	763	925	480
1967	591	578	679	392
1968	685	718	858	460
1969	720	766	930	369
1970	740	829	963	398
1971	673	758	889	367
1972	704	826	928	426
1973	674	799	869	380
1974	626	692	836	379
1975	803	832	965	413
1976	852	847	1020	433
1977	598	636	826	493
1978	775	811	1055	460
1979	726	793	962	460
1980	863	899	1113	528
1981	919	944	1117	595
1982	894	936	1152	593
1983	862	873	1062	495
1984	582	597	711	403
1985	586	633	798	443

Source: Alberta Agriculture, "Agriculture Statistics Yearbooks." 1963-1985.

TABLE A.4.2

Annual Crop Yields in Kilograms per Acre
for Zone 2

	Wheat	Oats	Barley	Canola
1963	727	833	834	538
1964	686	685	736	422
1965	708	766	729	422
1966	841	834	919	481
1967	683	666	501	392
1968	591	842	864	417
1969	806	848	919	338
1970	827	935	930	397
1971	773	836	834	365
1972	901	952	1010	420
1973	800	878	832	374
1974	759	811	845	370
1975	868	907	934	406
1976	947	936	1028	447
1977	872	930	1048	520
1978	964	960	1086	528
1979	873	909	983	393
1980	1004	1026	1119	478
1981	1109	1149	1192	600
1982	969	1013	1113	528
1983	956	934	982	430
1984	807	775	845	385
1985	767	770	872	403

Source: Alberta Agriculture, "Agriculture Statistics Yearbooks." 1963-1985.

TABLE A.4.3

Annual Crop Yields in Kilograms per Acre
for Zone 3

	Wheat	Oats	Barley	Canola
1963	727	833	835	505
1964	687	685	737	435
1965	708	767	729	401
1966	842	834	918	433
1967	684	667	718	406
1968	703	811	823	386
1969	807	849	918	381
1970	827	934	930	417
1971	773	836	833	382
1972	901	952	1011	446
1973	801	878	831	408
1974	759	812	845	400
1975	868	907	934	435
1976	948	936	1027	489
1977	872	930	1048	545
1978	964	960	1086	542
1979	873	909	983	430
1980	1004	1026	1119	488
1981	1109	1149	1192	607
1982	969	4013	1113	533
1983	956	934	982	450
1984	807	775	845	452
1985	785	772	901	450

Source: Alberta Agriculture, "Agriculture Statistics Yearbooks." 1963-1985.

TABLE A.5

Annual Crop Prices in Dollars per Tonne

	Wheat	Oats	Barley	Canola
1963	61.59	33.77	42.30	97.81
1964	55.59	38.49	45.77	105.83
1965	59.49	43.30	46.40	92.41
1966	60.45	42.91	46.92	96.02
1967	51.71	42.29	38.77	73.63
1968	78.84	29.74	34.96	69.79
1969	44.15	33.59	29.98	89.17
1970	43.36	28.53	29.40	101.41
1971	36.31	33.05	28.41	92.07
1972	51.63	63.42	60.59	154.86
1973	107.59	169.43	122.87	271.56
1974	87.73	161.46	101.31	306.79
1975	71.19	104.93	69.24	222.00
1976	58.82	74.72	115.38	278.16
1977	65.58	63.81	92.78	279.14
1978	92.72	61.88	83.10	301.05
1979	103.49	56.73	153.07	304.53
1980	107.07	113.41	133.26	319.38
1981	103.59	97.09	117.33	321.34
1982	79.84	85.44	84.47	270.37
1983	99.43	92.55	122.93	438.89
1984	87.01	95.60	113.69	371.13
1985	91.22	83.38	92.10	290.64

Source: Alberta Agriculture, "Agriculture Statistics Yearbooks." 1963-1985.

TABLE A.6

Statistical Analysis by Municipal District
Alpha Values

	Alpha	T-Stat	Error
Province	0.1157	1.1759	0.0982
Grande Prairie No 1	0.1447	1.6333	0.0886
Vulcan No 2	0.0966	1.6188	0.0597
Ponoka No 3	0.1329	1.5757	0.0844
Newell No 4	0.1180	1.8960	0.0622
Warner No 5	*0.1309	2.2060	0.0000
Stettler No 6	0.2012	1.4888	0.1351
Thorhild No 7	*0.2316	2.8980	0.0000
Forty Mile No 8	*0.1544	2.3040	0.0000
Beaver No 9	*0.1555	2.0971	0.0000
Wetaskiwin No 10	*0.1478	2.1150	0.0000
Barrhead No 11	*0.1978	3.4240	0.0000
Athabasca No 12	*0.2851	3.3120	0.0000
Smoky Lake No 13	0.1840	1.8328	0.1004
Lacombe No 14	0.1243	1.4258	0.0872
Wheatland No 16	0.1311	1.9210	0.0683
Mountain View No 17	0.0919	0.9505	0.0967
Paintearth No 18	*0.2130	3.1320	0.0000
St. Paul No 19	*0.1620	2.4730	0.0000
Strathcona No 20	*0.1417	5.5661	0.0000
Two Hills No 21	*0.1735	2.2785	0.0000
Camrose No 22	0.1086	1.2591	0.0863
Red Deer No 23	0.1416	2.0306	0.0697
Vermilion River No 24	*0.1883	2.9900	0.0000
Leduc No 25	*0.2086	2.2280	0.0000
Lethbridge No 26	0.0970	1.3100	0.0740
Minburn No 27	0.1533	1.9623	0.0781
Lac Ste Anne No 28	*0.1959	2.3508	0.0000
Flagstaff No 29	0.1252	1.7161	0.0729
Lamont No 30	*0.1748	2.1940	0.0000
Parkland No 31	0.2562	2.0810	0.1231

* denotes significance at the .05 level

TABLE A.6 (continued)

Statistical Analysis by Municipal District
Alpha Values

	Alpha	T-Stat	Error
Cardston No 6	0.1622	1.9140	0.0848
Pincher Creek No 9	0.1631	1.8900	0.0863
Taber No 14	0.1275	2.0690	0.0616
Willow Creek No 26	0.1215	1.5721	0.0773
Foothills No 31	0.0994	1.6240	0.0612
Rockyview No 44	0.1154	1.2720	0.0907
Starland No 47	0.1271	1.7510	0.0726
Kneehill No 48	0.0970	1.2935	0.0750
Provost No 52	*0.2415	2.3430	0.0000
Wainwright No 61	0.1777	1.9380	0.0917
Bonnyville No 87	*0.1929	2.3045	0.0000
Sturgeon No 90	0.1140	1.7380	0.0656
Westlock No 92	*0.1363	2.3040	0.0000
Smoky River No 130	*0.1871	2.9350	0.0000
Spirit River No 133	0.2293	2.0720	0.1107
Peace No 135	*0.1738	2.1370	0.0000
Fairview No 136	*0.1694	2.6180	0.0000
Medicine Hat ID No 1	*0.2164	3.1389	0.0000
Rocky Mtn Hs ID No 10	0.1433	1.8861	0.0760
Edson ID No 14	*0.2356	2.6170	0.0000
High Prairie ID No 17	*0.2163	3.1884	0.0000
Lac La Biche ID No 18	*0.3308	3.5390	0.0000
Spirit River ID No 19	*0.2147	3.0290	0.0000
Spirit River ID No 20	*0.1936	3.1880	0.0000
Spirit River ID No 21	*0.2143	3.5420	0.0000
Spirit River ID No 22	*0.3232	4.7589	0.0000
Hanna SA No's 2-4	*0.1727	3.1620	0.0000

* denotes significance at the .05 level

TABLE A.7

Statistical Analysis by Census District
Beta Values

	Beta	T-stat	Error	Durbin Watson
Province	-0.1613	-1.2145	0.1328	1.4062
Grande Prairie No 1	-0.0651	-0.1974	0.3301	2.0643
Vulcan No 2	-0.1257	-0.4328	0.2904	1.8791
Ponoka No 3	-0.1320	-0.4980	0.2650	2.0846
Newell No 4	0.0171	0.0490	0.3473	1.6994
Warner No 5	-0.1729	-0.5220	0.3311	1.7760
Stettler No 6	0.2986	0.6354	0.4700	2.0844
Thorhild No 7	-0.3033	-0.6800	0.4460	2.0972
Forty Mile No 8	-0.4932	-1.3180	0.3741	2.3499
Beaver No 9	-0.2152	-0.8331	0.2583	1.8944
Wetaskiwin No 10	0.1881	0.4820	0.3902	2.0012
Barrhead No 11	-0.2947	-0.9140	0.3225	1.9320
Athabasca No 12	-0.6178	-1.2860	0.4804	2.1106
Smoky Lake No 13	0.3149	0.7949	0.3961	1.9898
Lacombe No 14	0.0989	0.3780	0.2616	2.0188
Wheatland No 16	-0.5690	-1.4940	0.3809	1.5727
Mountain View No 17	-0.1896	-0.9794	0.1936	2.0689
Paintearth No 18	-0.3431	-0.9040	0.3796	1.8946
St. Paul No 19	0.1339	0.3660	0.3658	2.0973
Strathcona No 20	-0.3660	-1.0420	0.3512	1.7628
Two Hills No 21	-0.0462	-0.1303	0.3544	2.0330
Camrose No 22	-0.1192	-0.4737	0.2517	2.0345
Red Deer No 23	*-0.7447	-2.6078	0.0000	1.9811
Vermilion River No 24	-0.3661	-1.0420	0.3514	1.5174
Leduc No 25	-0.4096	-0.7840	0.5224	1.9825
Lethbridge No 26	-0.1171	-0.2840	0.4124	1.5997
Minburn No 27	-0.0841	-0.3208	0.2623	1.8631
Lac Ste Anne No 28	-0.1812	-0.7273	0.2492	1.8115
Flagstaff No 29	0.2590	1.0927	0.2370	2.0750
Lamont No 30	-0.2556	-0.5750	0.4445	1.8720
Parkland No 31	-0.4072	-0.5930	0.6870	2.4967

* denotes significance at the .05 level

TABLE A.7 (continued)

Statistical Analysis by Census District
Beta Values

	Beta	T-stat	Error	Durbin Watson
Cardston No 6	-0.5186	-1.0960	0.4732	2.5079
Pincher Creek No 9	0.0682	0.1420	0.4815	2.1886
Taber No 14	-0.3753	-1.0920	0.3437	1.8291
Willow Creek No 26	-0.1402	-0.4545	0.3084	1.6985
Foothills No 31	0.0728	0.2130	0.3417	1.7688
Rockyview No 44	0.1477	0.2920	0.5065	1.8828
Starland No 47	0.3910	0.9650	0.4051	2.2798
Kneehill No 48	-0.3740	-1.6318	0.2292	1.8715
Provost No 52	-0.0242	-0.0420	0.5767	2.0273
Wainwright No 61	-0.1083	-0.3457	0.3133	1.9943
Bonnyville No 87	0.3492	1.0644	0.3281	2.0370
Sturgeon No 90	-0.0312	-0.0850	0.3660	2.1001
Westlock No 92	0.2847	0.8620	0.3303	1.8944
Smoky River No 130	-0.1010	-0.2840	0.3556	1.7531
Spirit River No 133	-0.2920	-0.4730	0.6173	2.4493
Peace No 135	0.2845	0.6270	0.4538	1.5537
Fairview No 136	0.3809	1.0560	0.3607	2.0329
Medicine Hat ID No 1	-0.7460	-1.5070	0.4950	1.9965
Rocky Mtn Hs ID No 10	*0.7741	2.8170	0.0000	2.0417
Edson ID No 14	0.0708	0.1864	0.3795	1.8470
High Prairie ID No 17	-0.5001	-1.6683	1.9020	1.6493
Lac La Biche ID No 18	0.1481	0.2840	0.5213	1.4833
Spirit River ID No 19	-0.5209	-1.3170	0.3955	2.2604
Spirit River ID No 20	-0.2202	-0.6500	0.3388	1.5334
Spirit River ID No 21	0.0792	0.2350	0.3371	1.6000
Spirit River ID No 22	*-1.0278	-2.1158	0.0000	2.0437
Hanna SA No's 2-4	*-0.8370	-2.7470	0.0000	2.1390

* denotes significance at the .05 level

TABLE A.8

Statistical Analysis by Census Division
Alpha Values

	Alpha	T-stat	Error	95% conf interval	
				Minimum	Maximum
CD 1	*0.1780	3.0366	0.0000	0.0000	0.0000
CD 2	0.0822	1.1420	0.0720	-0.0679	0.2323
CD 3	0.1201	1.7124	0.0701	-0.0262	0.2664
CD 4	*0.1572	2.9764	0.0000	0.0000	0.0000
CD 5	0.0890	1.1191	0.0795	-0.0769	0.2549
CD 6	0.0974	1.2460	0.0782	-0.0657	0.2604
CD 7	0.1414	1.7459	0.0810	-0.0275	0.3102
CD 8	0.1154	1.3959	0.0826	-0.0570	0.2878
CD 10	0.1347	1.5278	0.0881	-0.0492	0.3185
CD 11	*0.1508	2.5577	0.0000	0.0000	0.0000
CD 12	*0.1646	2.4237	0.0000	0.0000	0.0000
CD 13	*0.1644	2.3157	0.0000	0.0000	0.0000
CD 14	*0.2356	2.6146	0.0000	0.0000	0.0000
CD 15	0.1657	1.8436	0.0899	-0.0218	0.3531

* denotes significance at the .05 level

TABLE A.9

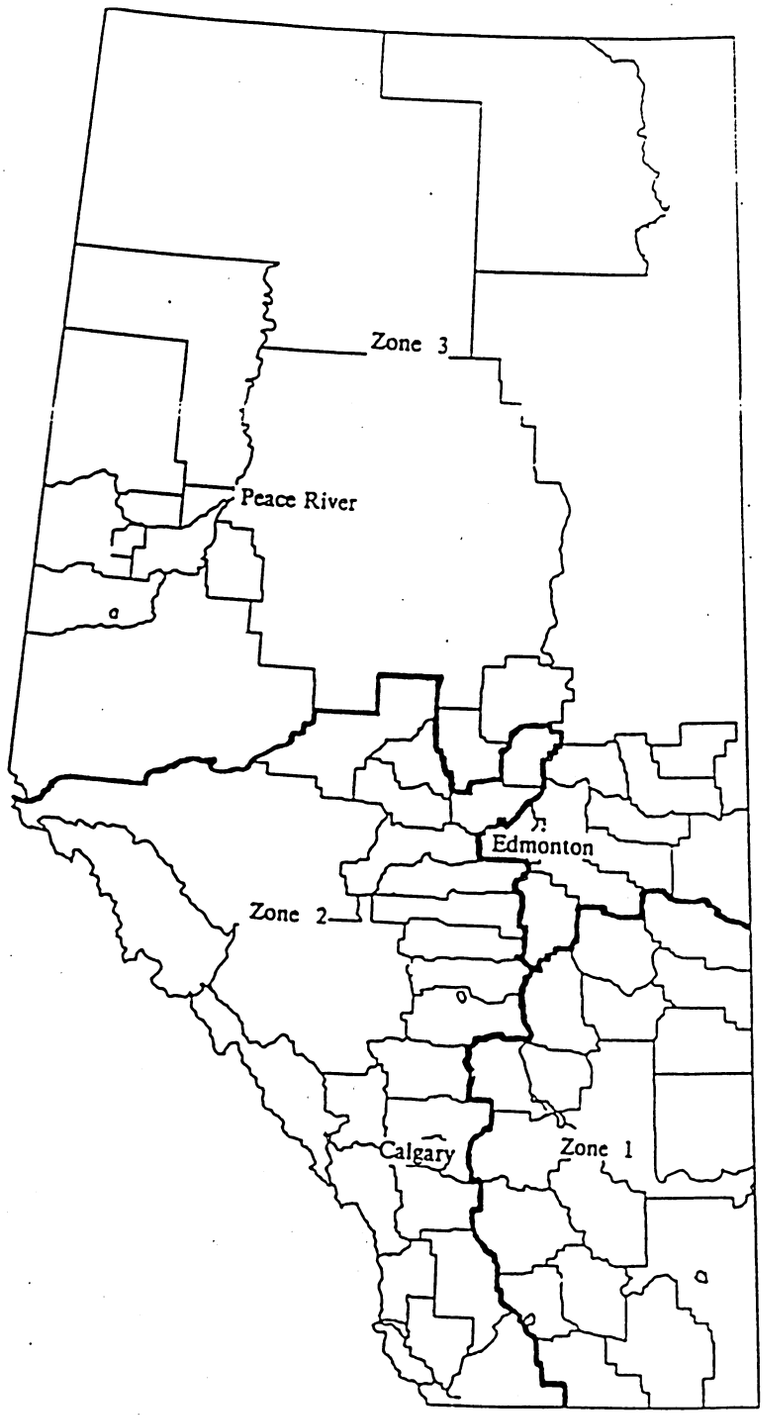
Statistical Analysis by Census District
Beta Values

	Beta	T-stat	Error	95% conf interval		Durbin
				Minimum	Maximum	Watson
CD 1	-0.5953	-1.4674	0.4057	-1.4416	0.2510	1.9274
CD 2	0.0968	0.3681	0.2629	-0.4516	0.6451	1.9465
CD 3	-0.1977	-0.6774	0.2919	-0.8065	0.4111	1.7977
CD 4	*-0.8578	-2.7779	0.0000	0.0000	0.0000	1.9594
CD 5	-0.2545	-1.2018	0.2118	-0.6963	0.1873	1.9624
CD 6	-0.0661	-0.2173	0.3041	-0.7005	0.5683	2.0625
CD 7	0.0155	0.0730	0.2121	-0.4270	0.4580	2.1006
CD 8	-0.1041	-0.4414	0.2357	-0.5958	0.3877	2.2198
CD 10	-0.1633	-0.7396	0.2208	-0.6239	0.2973	2.0286
CD 11	-0.3930	-1.2581	0.3124	-1.0447	0.2586	1.9622
CD 12	*0.6628	2.2100	0.0000	0.0000	0.0000	2.0888
CD 13	0.0928	0.4367	0.2126	-0.3506	0.5362	1.9494
CD 14	0.0705	0.1857	0.3796	-0.7213	0.8622	1.8469
CD 15	-0.1847	-0.9778	0.1889	-0.5787	0.2093	1.8692

* denotes significance at the .05 level

Figure A.1

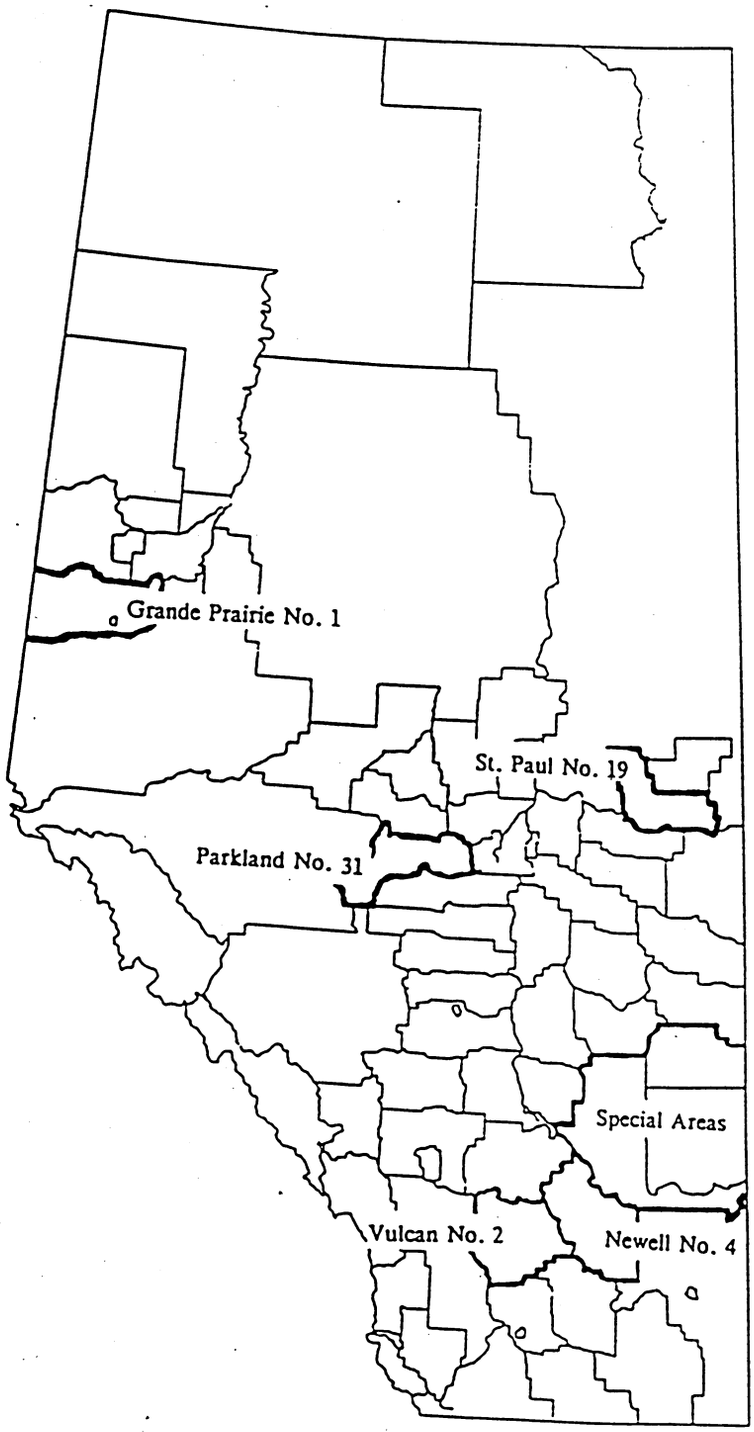
Alberta Crop Zones.[2]



2Modified from Alberta Bureau of Statistics, "Alberta Statistical Review, Fourth Quarter, 1985"

Figure A.2

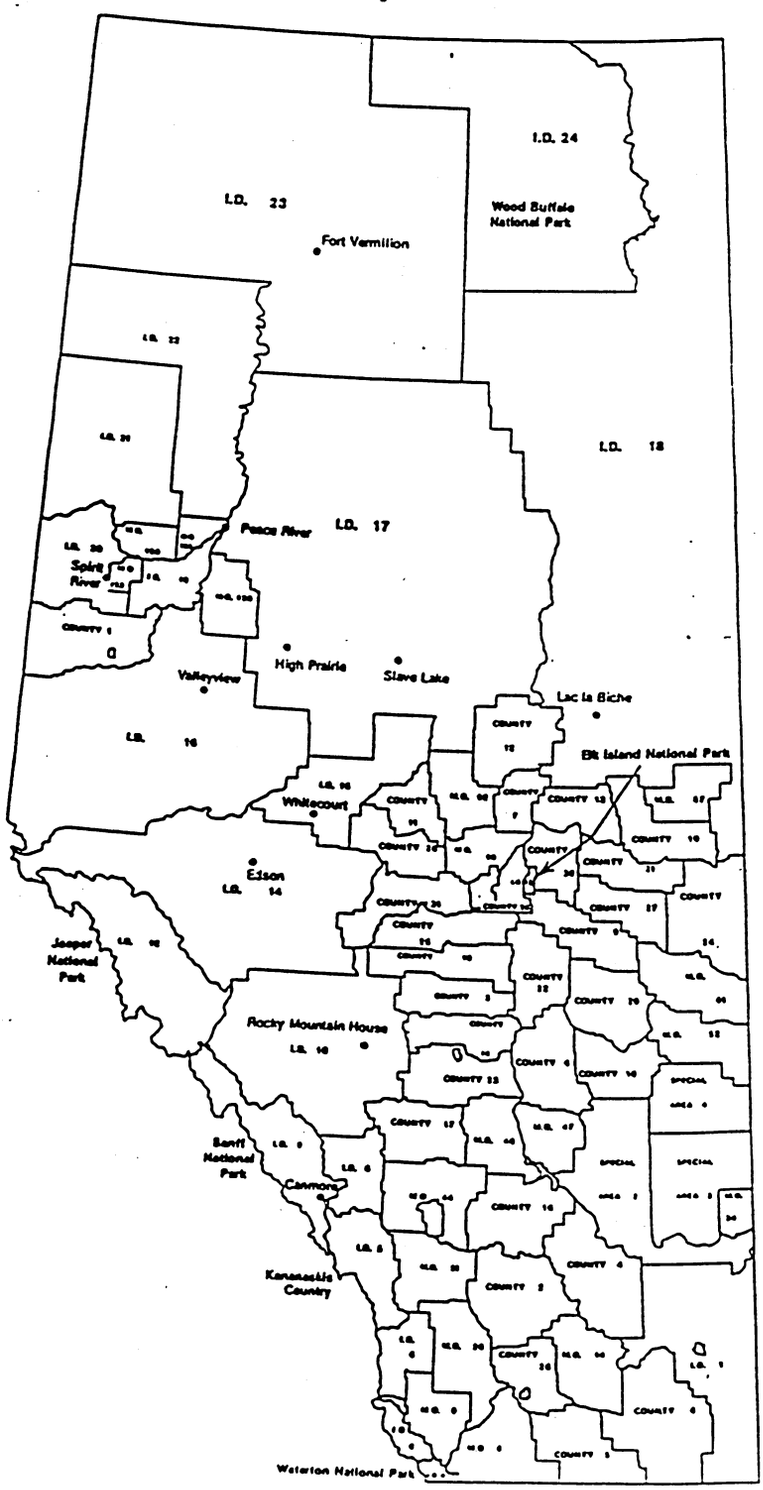
Representative Municipalities Selected
for Calculating Real Estate Taxes.[3]



3Modified from Alberta Bureau of Statistics, "Alberta Statistical Review, Fourth Quarter, 1985"

Figure A.3

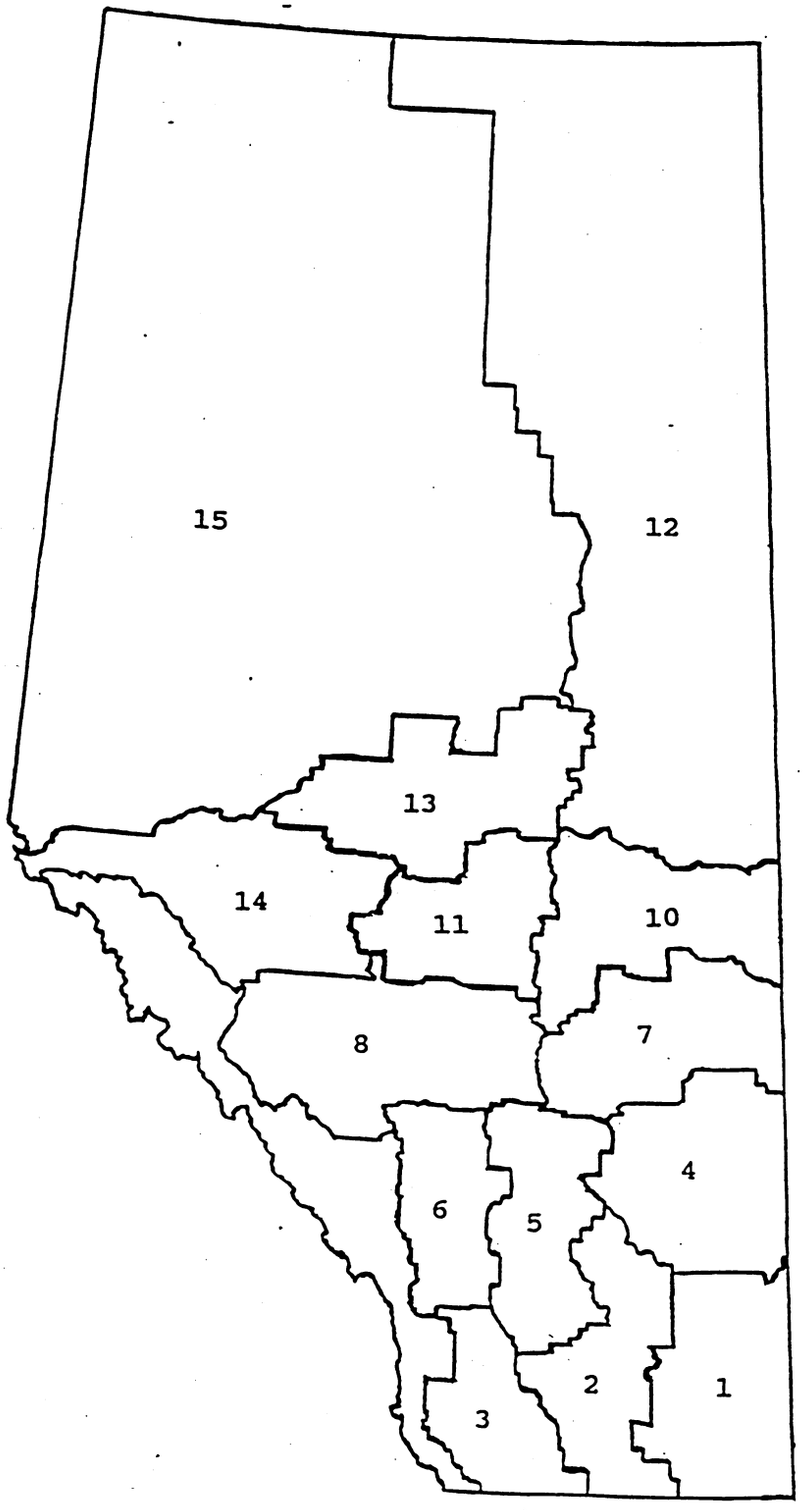
Alberta Rural Municipalities.[4]



4Modified from Alberta Bureau of Statistics, "Alberta Statistical Review, Fourth Quarter, 1985"

Figure A.4

Alberta Census Divisions.[5]



5Modified from Alberta Bureau of Statistics, "Alberta Statistical Review, Fourth Quarter, 1985"