Giannini Foundation of Agricultural Economics

INFORMATION SERIES 82-2

Appendix To
Structure and Performance of Western Irrigated Agriculture:
With Special Reference to the: Acreage Limitation Policy of the U.S. Department of Interior

Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

PRINTED SEPTEMBER 1982

BULLETIN 1905

APPENDIX TO

STRUCTURE AND PERFORMANCE OF WESTERN IRRIGATED AGRICULTURE:

With Special Reference to U.S. Department of Interior's Acreage Limitation Policy

by

Charles V. Moore,* David L. Wilson, ** and Thomas C. Hatch***

*Charles V. Moore is Agricultural Economist, National Economics Division, Economic Research Service, USDA stationed at the University of California, Davis, and Associate Member of the Giannini Foundation of Agricultural Economics.

**David L. Wilson is Agricultural Economist, Natural Resource Economics Division, Economic Research Service, USDA, Salt Lake City, Utah.

***Thomas G. Hatch is Agricultural Economist, National Economics Division, Economic Research Service, USDA, Washington, D.C.

U.S. Department of Agriculture

ACKNOWLEDGEMENTS

We wish to thank the large number of people and agencies who contributed to the formulation, data collection and analysis contained in this report. Without their assistance the task could have been accomplished.

A partial list includes:

U.S. Department of the Interior:

David Schuy
Richard Wahl
Vern Cooper

U.S. Department of Agriculture:

Harold Stults

Research Assistants:

Henry Geu
Tim Sanders
George Haynes
Tim Phipps
David Gapp
Yahoya Doka
Lane Birch
James Eales
Don Peterson

University of California, Berkeley:

Carlos Benito

Deborah J. Ruggles, Administrative Assistant, managed the great flow of correspondence, typed the many drafts, and contributed much to keeping the project on track.

TABLE OF CONTENTS

APPENDIX TO

STRUCTURE AND PERFORMANCE OF WESTERN IRRIGATED AGRICULTURE:

With Special Reference to U.S. Department of Interior's
Acreage Limitation Policy

INTRODUCTION

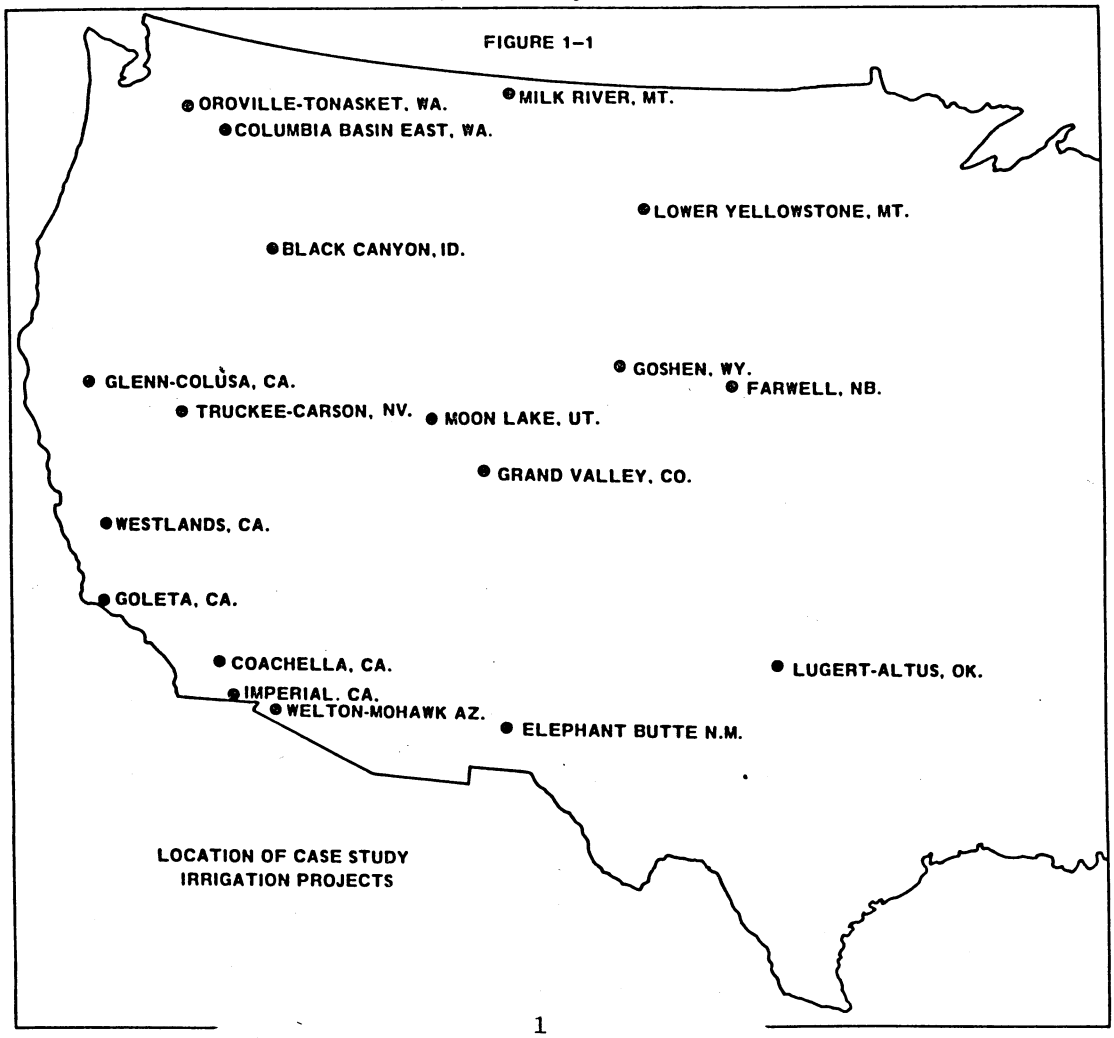
CHAPTER 1

Irrigated agriculture in the 17 western states encompasses the most diverse and energy, capital and labor intensive agricultural production in the United States. The U.S. Census of Agriculture, 1974 reported over 41 million acres of irrigated farmland. A vast majority of this land, 89 percent, is located in the 17 western states. Average gross crop value per crop acre is 51 percent greater on irrigated vs. nonirrigated farms. This ranges from as low as $40 per acre for high elevation pasture lands in the Rocky Mountains to $5,000 per acre for subtropical fruit production in California. Western farms with irrigated land constitute 15 percent of the Nation's agricultural lands but produce 22 percent of the total value of U.S. agricultural production.

OBJECTIVES

The objectives of this report are: (1) to describe the distribution of land ownership and farm operating units in 18 irrigation districts distributed across the western states (see Figure 1-1); (2) to estimate the income generating potential (net cash flow) for farms of differing sizes in the 18 irrigation districts; (3) to estimate the long-run average cost curve or economies of size for farms in the same districts; (4) to estimate the relative riskiness of agricultural production in these 18 districts; (5) since irrigation water is a critical resource on these farms, to estimate the derived demand schedule for this input and estimate the maximum ability to pay for irrigation water in each of these district; (6) analyze and discuss these results within the

FIGURE 1-1



framework of the potential economic impact of farm structure policy with special reference to Department of the Interior's Acreage Limitation Policy.

PROCEDURES

To accomplish this task, 18 irrigation districts receiving federal water were selected for detailed study (see Table 1-1). This was not a random sample, but rather the districts were choosen so that they embraced the entire range of farms (size, type and per acre income found in the area served by Bureau of Reclamation (BOR)). Individual enterprise and farm budgets were then prepared for each of these districts in consultation with local farmer panels, Cooperative Extension Services and universities.

Table 1-1

Characteristics of Irrigation Districts

District	State	1977 Irrigated Acres	Gross Crop Value Per Acre	Major Crops	(Percent)	Growing Season (Days)
Black Canyon #2	ID	46,416	$ 246	Forages	50%	146
				Cereals	24%	
Coachella Valley	CA	78,500	2,169	Fruit	48%	310
				Vegetables	21%	
Columbia Basin East District	WA	123,872	357	Forages	38%	140
				Cereals	30%	
				Vegetables	10%	
Elephant Butte	NM	84,925	682	Cotton	37%	194
				Forages	19%	
				Vegetables	19%	
Farwell	NB	50,051	184	Corn	87%	149
Glenn-Colusa	CA	103,637	364	Rice	50%	260
				Cereals	21%	
Goleta County	CA	6,390	5,788	Fruit	88%	330
Goshen	WY	51,439	240	Forages	35%	131
				Sugar Beets	23%	
Grand Valley Gravity	CO	20,516	268	Forages	52%	153
				Cereals	42%	
Imperial	CA	451,457	723	Alfalfa	39%	348
				Cotton	30%	
				Vegetables	15%	
Lower Yellowstone	MT	29,035	214	Forages	34%	130
				Sugar Beets	32%	
				Cereals	27%	
Lugert-Altus	OK	44,832	241	Cotton	57%	220
				Cereals	37%	
Milk River Malta	MT	42,432	62	Hay	42%	106
				Pasture	19%	
Moon Lake	UT	51,983	34	Pasture	77%	127
				Alfalfa	11%	
Oroville-Tonasket	WA	7,127	1,142	Fruit	94%	173
Truckee-Carson	NV	57,530	159	Alfalfa	62%	130
				Pasture	33%	
Welton-Mohawk	AZ	65,200	622	Alfalfa	30%	348
				Cotton	27%	
Westlands	CA	477,404	527	Cotton	40%	272
				Cereals	22%	
				Vegetables	10%	

Specific assumptions used in developing enterprise and farm budgets are as follows: Prices - Water Resources Council normalized prices were used to determine prices received by farmers in each state. These prices were assumed constant for all farm sizes. Yields - district crop yields were based on the most recent three-year average yields for irrigated crops. Input Costs - costs of production inputs were set at area average 1978 levels. Interest Rate and Capital Costs - actual 1978 Production Credit Association and Federal Land Bank rates in the area were used to determine interest charges on operating capital machinery and land investments. Based on typical PCA and FLB down payment requirements in each area and loan life (5 to 7 years on equipment and 30 years on land and improvement), amortized loan payments were calculated in order to arrive at estimates of net cash flow. A typical crop mix and machinery complement for each farm size was specified by a panel of local growers working with a project research assistant and the local agricultural extension agent. The crop mix was varied by farm size if this reflected conditions within an individual irrigation project.

Financial Viability

Annual net cash flow before taxes to unpaid family labor, management and equity was used as a measure of farm financial feasibility in this study. Net cash flow is the cash available for family living expenses after case production expenses, principal and interest payments on land and machinery loans have been deducted from gross crop sales.

That is:

	Gross Farm Sales
Less:	Cash Production Expenses
Equals:	Gross Margin (Cash)
Less:	Amortized Loan Payments on Land, Improvements and Equipment
Equals:	Return to Family Labor, Management & Equity (cash flow)

The bottom line in the above formula provides one measure of the economic viability of a farm. The assumptions used to determine the bottom line in the study are based on Interior's Proposed Rules and Regulations which state that land ownership by an individual is limited to 160 acres and farm operations in excess of this must be leased, up to a limit of 480 acres. Family organizations of four or more people could farm up to 960 acres receiving federal project water of which not more than 640 acres could be owned [USDI, 1981, attachment I]. Land in excess of legal entitlement must be sold at its "excess" land value. This land value is the appraised value today if the project had never been built.

Cash returns to unpaid labor, management and equity were estimated for four farm sizes, 160 acres, 320 acres, 640 acres and 1,280 acres, based on a typical crop mix for each district where field crops were dominant. Cash returns for three farm sizes, 40 acres, 80 acres and 160 acres, were estimated for three of the 18 projects in which perennial crops (fruit trees) dominate.

Two net cash return estimates were made for each farm size analyzed: First, the net return for a beginning farmer purchasing excess land under terms of commercial lending sources in 1978; and second, the net return for an existing farm operator. Existing farm operators were assumed to have purchased land at an earlier time and at a lower price and mortgage interest rate and to enjoy, therefore, a much higher equity position because of land value appreciation.

In the "existing farmer" analysis, it was assumed that land was purchased in 1958 based on an average turnover rate of 2.5 percent, i.e., 40 years. Thus the average farm has been owned 20 years. Average owners equity for each state was taken from ESCS, 1978 and ranged from 74 to 94 percent.

CHAPTER 2

Malta Irrigation District
Milk River Project, Montana

Malta Irrigation District, comprised of over 40,000 acres of irrigable land, is part of the 120,000 acre Milk River Project. The district is located in north central Montana at about 48.5° N. latitude and 108° W. longitude. The elevation of the irrigable area is about 2,200 feet above sea level. The average annual precipitation over the past 50 year period has been about 12.7 inches and a low of 7 inches. The frost-free growing season for this same period has averaged about 120 days, with a high of 138 days and a low of 106 days. The irrigable land in the District has been classified by BOR as follows:

Class 1	4,530
Class 2	6,008
Class 3	5,392
Class 4a	4,058
Class 4b	20,370
Total	40,358 acres

USBR soil classifications are defined as follows and are used throughout the remainder of this report.

Class 1-Arable. Class 1 land is project land which meets the various parameters and specifications established for that class within a particular agricultural economic setting having relatively the highest level of suitability for continuous, successful irrigation farming measured in terms of net income generated. Net income reflects productivity (productive capacity minus the cost of production) and land development costs. As such, class 1 lands have the highest relative potential payment capacity for the particular setting.

Class 2-Arable. Class 2 is used when a second class is required. It is that land in the same project setting as described for class 1 but having a relatively lower level of suitability for continuous, successful irrigation farming in terms of net income generated.

Class 3-Arable. Class 3 is used when a third class is required. It is that land in the same project setting as described for classes 1 and 2 but having the next lower level of suitability to class 2.

Class 4-Limited Arable. Class 4 is used when a fourth class is required. It is that land which has certain excessive deficiencies that result in restricted utility but which has been shown to be of limited suitability for irrigation as a result of special economic and engineering studies.

Class 5-Nonarable. Lands in this class are nonarable under existing conditions but have potential value sufficient to warrant tentative segregation for special study prior to completion of the classification. The designation of class 5 is tentative and is normally changed to the proper arable class or class 6 prior to completion of the land classification.

Class 6-Nonarable. Lands in this class include those considered nonarable under the existing project or project plan because of failure to meet the minimum requirements of paying OM&R costs as required for arable classes of land, and class 5 land when the extent of such lands or the detail of the particular investigation does not warrant additional investigation.

CROPS

The cropping pattern in the Malta District is dominated by alfalfa hay, meadow hay, irrigated pasture and cereal grains as shown in the District's 1977 crop report (see Table 2-1). Due to the preponderance of forages, livestock to consume these forages is an important sector in the local economy. These crop enterprises are reflected in the farm budgets presented below.

Table 2-1

Crop Acreage, Milk River, Malta District, Montana, 1977

Crop	Acres	Value of Production
Cereals		
Barley	732	$ 35,850
Oats	875	40,654
Wheat	372	15,258
Forage		
Alfalfa Hay	7,375	780,520
Other Hay	16,505	800,595
Irrigated Pasture	6,491	230,430
Silage, Ensilage	519	141,180
Seeds		
Grass (all)	572	32,720
Other & Miscellaneous	37	10,350
Total	33,478	$2,087,557

LAND TENURE

Land in the Malta District is fairly widely held (Gini coefficient, 0.35)[1/] in relatively small parcels as shown in Tables 2-2 and 2-3. The major form of ownership is the traditional husband and wife joint ownership constituting 32 percent of the units covering 51 percent of the land area. Closely held family corporations and partnerships rank second with 32 percent of the owners, but holding 19 percent of the land area. Nonfamily corporations are of only minor importance with less than 1 percent of the units and 1.3 percent of the acreage.

Farm Operations

Farm operating units tend to be larger than ownership units. Whereas the average size of an ownership per owner in Malta District was 107 acres, the average operating unit was 276 acres as shown in Table 2-4. The predominate form of business organization in the district was a family type arrangement with joint spouse and/or with a family member constituting 55 percent of the farms.

Crop mix changes very little by farm size as shown in Table 2-5. Forages, the major crop, occupy almost the same percent of the land on the smallest farm size, 91.8 as on the largest farms in the district, 92.6 percent.

Labor Force

The regular labor force on farms in the district are predominately Caucasian, 93 percent, with the balance made up of a scattering of workers of Hispanic and American Indian or Alaskan origin (see Table 2-6). Farm operators were asked to group their full time employees by employment category and these results are shown in Table 2-7. Farm operator numbers were added to employee numbers to obtain estimates of the full-time labor force. Dividing total workers by the acres in the farm provides a standardized ratio of labor per 1,000 acres and is shown in the right hand column. These data are only rough estimates of labor efficiency by farm size because they are not adjusted for off-farm employment, custom hire operations or part-time employees. However, labor per 1,000 acres does decline rapidly as farm size increases with the minimum point being reached in the 500 to 999 acre farm size.

1/ Gini coefficient ranges from 0 to 1.0. The higher the Gini value, the more concentrated the ownership.

Table 2-2

FORM OF OWNERSHIP BY FARM SIZE, MALTA, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	56	89	90	0	1	0	0	0	236	59.1
Percent	23.7	37.7	38.1	0.0	0.4	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	20	40	38	0	1	0	0	0	99	84.0
Percent	20.2	40.4	38.3	0.0	1.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	6	22	0	0	0	0	0	0	28	91.0
Percent	21.4	78.5	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
260-1,999										
No. of Owners	12	21	0	2	0	1	0	0	36	100.0
Percent	33.3	58.3	0.0	5.6	0.0	2.8	0.0	0.0	100.0	
Totals										
No. of Owners	94	172	128	2	2	1	0	0	399	
Percent	23.5	43.1	32.0	0.5	0.5	0.2	0.0	0.0	100.0	

Table 2-3

LAND BY OWNERSHIP, MALTA, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	2629	5939	3546	0	98	0	0	0	12212	28.6
Percent	21.5	48.6	29.0	0.0	0.8	0.0	0.0	0.0	100.0	
Average									51.7	
100-179										
Acres	2594	6563	4583	0	118	0	0	0	13858	61.0
Percent	18.7	47.3	33.0	0.0	0.8	0.0	0.0	0.0	100.0	
Average									139.9	
180-259										
Acres	1384	5191	0	0	0	0	0	0	6575	76.5
Percent	21.0	78.9	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									234.8	
260-1,999										
Acres	4482	4185	0	613	0	793	0	0	10073	100.0
Percent	44.5	41.5	0.0	6.1	0.0	7.9	0.0	0.0	100.0	
Average									279.8	
Totals										
Acres	11089	21878	8129	613	216	793	0	0	42718	
Percent	25.9	51.2	19.0	1.4	0.5	1.8	0.0	0.0	100.0	
Average	117.9	127.1	63.5	306.5	108.0	793.0	0.0	0.0	107.0	

Table 2-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, MALTA, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Indi-vidually	Other (Gov't, Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	2	6	44	18	3	73	54
Percent	0.0	2.7	8.2	60.2	24.6	4.1	100.0	
100-179								
No. of Farms	0	2	9	19	13	0	43	135
Percent	0.0	4.6	20.9	44.1	30.2	0.0	100.0	
180-259								
No. of Farms	0	0	0	10	2	0	12	224
Percent	0.0	0.0	0.0	83.3	16.6	0.0	100.0	
260-499								
No. of Farms	0	4	4	10	10	0	28	360
Percent	0.0	14.2	14.2	35.7	35.7	0.0	100.0	
500-999								
No. of Farms	0	1	1	7	2	0	11	723
Percent	0.0	9.0	9.0	63.6	18.1	0.0	100.0	
1,000-1,999								
No. of Farms	0	3	0	2	0	0	5	1185
Percent	0.0	59.9	0.0	40.0	0.0	0.0	100.0	
Totals								
No. of Farms	0	12	20	92	45	3	172	276
Percent	0.0	6.9	11.6	53.4	26.1	1.7	100.0	

Table 2-5

IRRIGATED CROP PATTERNS BY FARM SIZE, MALTA, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	255	3140	0	5	18	0	0	3418
Percent	7.4	91.8	0.0	0.1	0.5	0.0	0.0	100.0
100-179								
Total Acres	367	4798	0	0	0	0	0	5165
Percent	7.1	92.8	0.0	0.0	0.0	0.0	0.0	100.0
180-259								
Total Acres	538	1677	0	0	44	0	0	2259
Percent	23.8	74.2	0.0	0.0	1.9	0.0	0.0	100.0
260-499								
Total Acres	898	6606	0	0	0	0	0	7504
Percent	11.9	88.0	0.0	0.0	0.0	0.0	0.0	100.0
500-999								
Total Acres	489	6293	0	0	1076	0	0	7858
Percent	6.2	80.0	0.0	0.0	13.6	0.0	0.0	100.0
1,000-1,999								
Total Acres	317	4019	0	0	0	0	0	4336
Percent	7.3	92.6	0.0	0.0	0.0	0.0	0.0	100.0
Totals								
Total Acres	2864	26533	0	5	1138	0	0	30540
Percent	9.3	86.8	0.0	0.0	3.7	0.0	0.0	100.0

Table 2-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, MALTA, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	13	13	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
100-179						
No. of Employees	10	8	0	2	0	0
Average	0.2	0.1	0.0	0.0	0.0	0.0
180-259						
No. of Employees	2	2	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
260-499						
No. of Employees	38	36	2	0	0	0
Average	1.4	1.3	0.0	0.0	0.0	0.0
500-999						
No. of Employees	11	11	0	0	0	0
Average	0.9	0.9	0.0	0.0	0.0	0.0
1,000-1,999						
No. of Employees	13	11	0	2	0	0
Average	2.4	2.0	0.0	0.3	0.0	0.0
Totals						
No. of Employees	87	81	2	4	0	0
Percent	00.0	93.1	2.2	4.5	0.0	0.0

Table 2-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, MALTA, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees and Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	0	0	13	13	73	86	21.9
Average/Farm	0.	0.	0.1	0.1	1.0	1.1	
100-179							
No. of Workers	1	0	9	10	43	53	9.1
Average/Farm	0.	0.	0.2	0.2	1.0	1.2	
180-259							
No. of Workers	0	0	2	2	12	14	5.1
Average/Farm	0.	0.	0.1	0.1	0.9	1.1	
260-499							
No. of Workers	4	6	28	38	27	65	6.6
Average/Farm	0.1	0.2	1.0	1.4	0.9	2.3	
500-999							
No. of Workers	0	2	9	11	12	23	2.7
Average/Farm	0.	0.1	0.7	0.9	1.0	1.9	
1,000-1,999							
No. of Workers	1	0	11	12	6	18	2.8
Average/Farm	0.1	0.	2.0	2.2	1.1	3.3	
Totals							
No. of Workers	6	8	72	86	173	259	

RESULTS OF TYPICAL FARM BUDGETS

Irrigated land in the Milk River Project of Montana is utilized primarily as a forage and feed grain base for cow/calf livestock operations where the cattle graze on native pasture for a large portion of the year. In developing typical farm budgets for this project, the farmer panel and the research assistant included the livestock and dryland operations along with the irrigated lands. The proposed Interior rules and regulations place a limit only on the amount of land receiving project irrigation water. Therefore, farm budgets were developed based on 160, 320, 640 and 1,280 acres of irrigated land plus the additional dryland typically found with an irrigated land base of this size. Full ownership was assumed for the first 320 acres of irrigated land with the balance on the two larger farms leased in. All dryland was assumed to be owned.

Beginning Farmers

Net returns (cash flow) were negative for all farm sizes under both current market and excess land values. Valuing all nonirrigated land at current market caused the debt service to be relatively high and therefore an important factor contributing to these negative returns (see Table 2-8).

Existing Operators

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments and thus due to land value appreciation, a much higher equity position.

The estimated turnover rate for farms in the western United States is 2.5 percent per year. On the average a farm is transferred every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Using the average debt-asset ratio of 16.9 percent for all Montana Farms in 1978, farm budgets were modified and the results are also shown in Table 2.8.

ECONOMIES OF SIZE

The machinery complement specified by the farmer panel was used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 2-1 and 2-2 show the SRAC for these fixed plants when high value crops, dryland and livestock were limited to the same proportion or numbers as shown in the typical farm budgets.

By fitting an envelope curve to the minimum points of the SRAC a long-Run average cost curve (LRAC) or planning curve was developed (see Figure 2-3). This shows the expected level of average costs when the engineering design capacity of the machinery complements is fully utilized under the two land value assumptions. In general, the larger farms are less efficient but total costs are covered both when land is valued at its current market as well as its excess land value. Because output of the firm is measured in gross sales and not physical units, the low livestock prices may tend to mask the potential efficiencies on the irrigated land.

Price, Yield and Income Variability

A time series of average prices and yields was developed for each field crop in the typical farm budgets. Variability of livestock prices was excluded from the analysis. Using Tintner's Variate Difference Method, estimates were made of the variance of price, yield and gross income. These results are presented in Table 2-9.

To indicate the variability of farm income and therefore the riskiness of farming in the Milk River Project area, the data in Table 2-9 were combined based on the proportion of land in each crop for the minimum points on each SRAC. Total costs were divided by plus and minus one standard deviation of gross sales and plotted about the LRAC. These results are shown in Figure 2-4.

The width of the band plotted about the LRAC becomes wider as farm size increases showing a potential for increased net income but also the potential for increased losses. Assuming these values are normally distributed, the LRAC would be expected to fall within this band about 67 percent of the time or about two out of every three years.

DEMAND FOR IRRIGATION WATER

The derived demand for irrigation water and the ability to pay for that water depends to a large extent on crop profitability, water use per acre and alternative crops, irrigation methods available to the farm operator and water costs.

Table 2-8

Milk River Project, Malta
Irrigation District, Montana

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa (Irr.)	60	Land	$305,250
	Barley (Irr.)	25	Improvements	10,500
	Irrigated Pasture	60	Machinery	90,146
	Wheat/Fallow	1,200	Total	$405,896
	Range	640		
	Farmstead/Waste	15		
	Total Irr.	160		

Financial Summary

Land at Current Market Value (Dry, $325/ac. Irr. $600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$ 40,669	Gross Sales	$40,669
Expenses	51,952	Expenses	28,048
Return to Operator Labor, Mgt., & Equity	$-11,283	Return to Operator Labor, Mgt., & Equity	$12,621

Land at Excess Land Value (Dry, $325/ac. Irr. $325/ac.)

Beginning Farmers	
Gross Sales	$40,669
Expenses	48,880
Return to Operator Labor, Mgt., & Equity	$-8,211

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa (Irr.)	200	Land	$624,000
	Barley (Irr.)	30	Improvements	13,500
	Irrigated Pasture	60	Machinery	129,997
	Wheat/Fallow	1,200	Total	$767,497
	Range	1,280		
	Farmstead/Waste	30		
	Total Irr.	320		

Financial Summary

Land at Current Market Value (Dry, $325/ac. Irr. $600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$87,890	Gross Sales	$87,890
Expenses	96,955	Expenses	52,043
Return to Operator Labor, Mgt., & Equity	$-9,065	Return to Operator Labor, Mgt., & Equity	$35,847

Land at Excess Land Value (Dry, $325/ac. Irr. $325/ac.)

Beginning Farmers	
Gross Sales	$87,890
Expenses	90,810
Return to Operator Labor, Mgt., & Equity	$-2,920

Table 2-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa (Irr.)	160	Land	$1,055,430
	Barley (Irr.)	60	Improvements	17,500
	Irrigated Pasture	260	Machinery	140,941
	Mix Hay (Irri.)	100	Total	$1,213,871
	Wheat/Fallow	2,400		
	Range	2,560		
	Farmstead/Waste	60		
	Total Irr.	640		

Financial Summary

Land at Current Market Value (Dry, $325/ac. Irr. $600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$156,395	Gross Sales	$156,395
Expenses	175,512	Expenses	105,095
Return to Operator Labor, Mgt., & Equity	$-19,117	Return to Operator Labor, Mgt., & Equity	$ 51,300

Land at Excess Land Value (Dry, $325/ac. Irr. $325/ac.)

Beginning Farmers	
Gross Sales	$156,395
Expenses	169,368
Return to Operator Labor, Mgt., & Equity	$-12,973

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa (Irr.)	250	Land	$1,970,564
	Barley (Irr.)	150	Improvements	23,125
	Irrigated Pasture	560	Machinery	167,383
	Mix Hay (Irr.)	200	Total	$2,161,072
	Wheat/Fallow	2,400		
	Barley/Fallow	2,400		
	Farmstead/Waste	130		
	Total Irr.	1,280		

Financial Summary

Land at Current Market Value (Dry, $325/ac. Irr. $600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$314,290	Gross Sales	$314,290
Expenses	356,636	Expenses	232,026
Return to Operator Labor, Mgt., & Equity	$-42,346	Return to Operator Labor, Mgt., & Equity	$ 82,264

Land at Excess Land Value (Dry, $325/ac. Irr. $325/ac.)

Beginning Farmers	
Gross Sales	$314,290
Expenses	350,491
Return to Operator Labor, Mgt., & Equity	$-36,201

FIGURE 2–1
MALTA DISTRICT, MILK RIVER PROJECT
SHORT RUN AVERAGE COSTS
CURRENT MARKET LAND VALUES
UNLIMITED LEASING

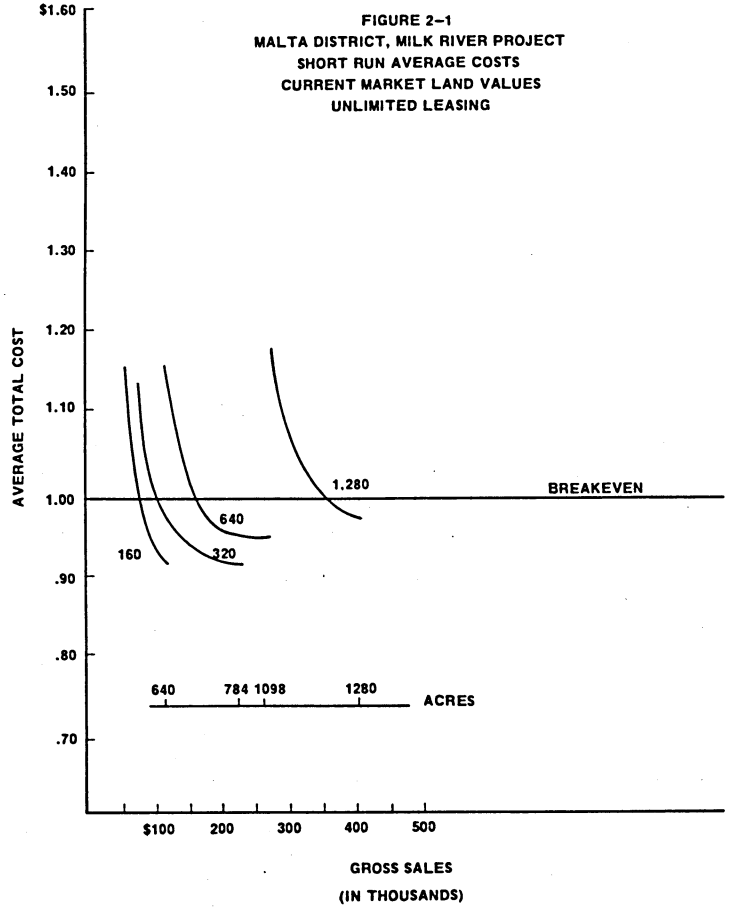


FIGURE 2–2
MALTA DISTRICT, MILK RIVER PROJECT
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

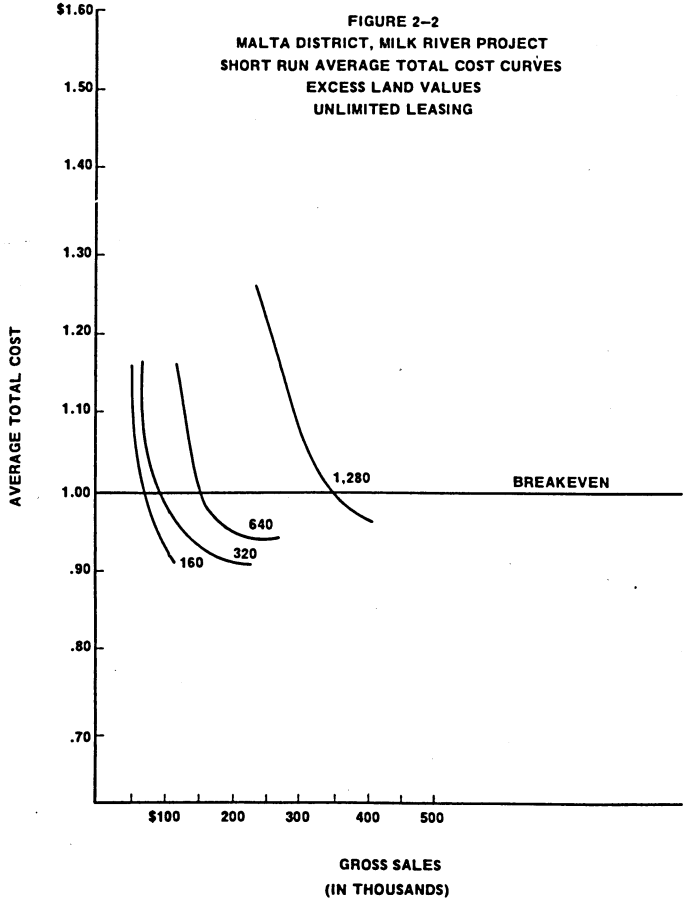


FIGURE 2–3
MALTA DISTRICT, MILK RIVER PROJECT
LONG RUN PLANNING COST CURVES
UNLIMITED LEASING

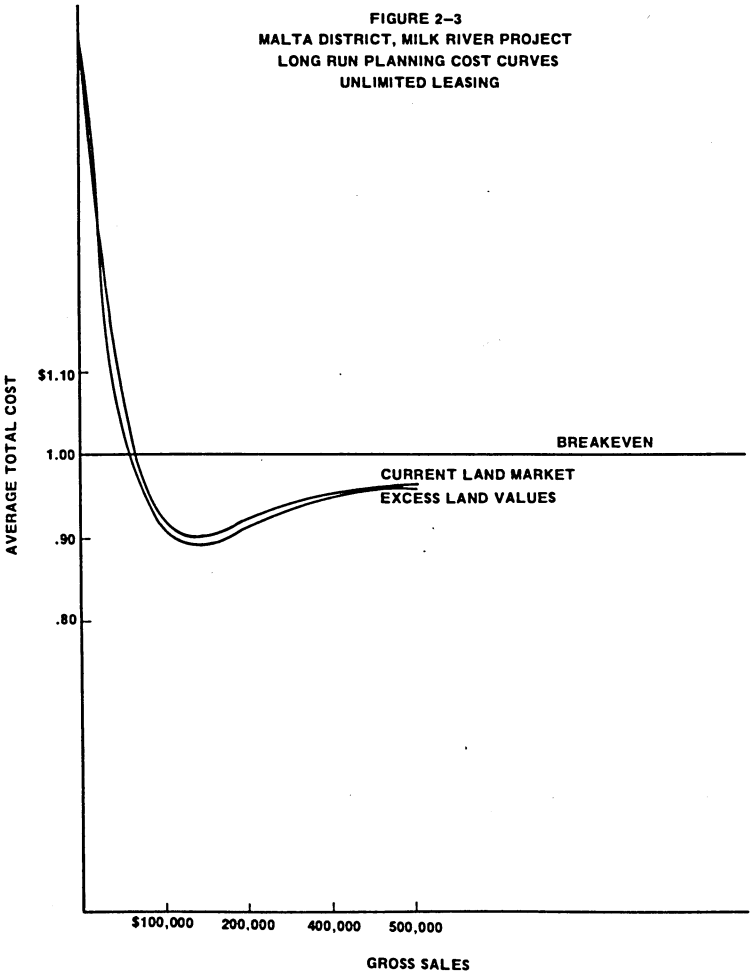


FIGURE 2–4
MILK RIVER
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK

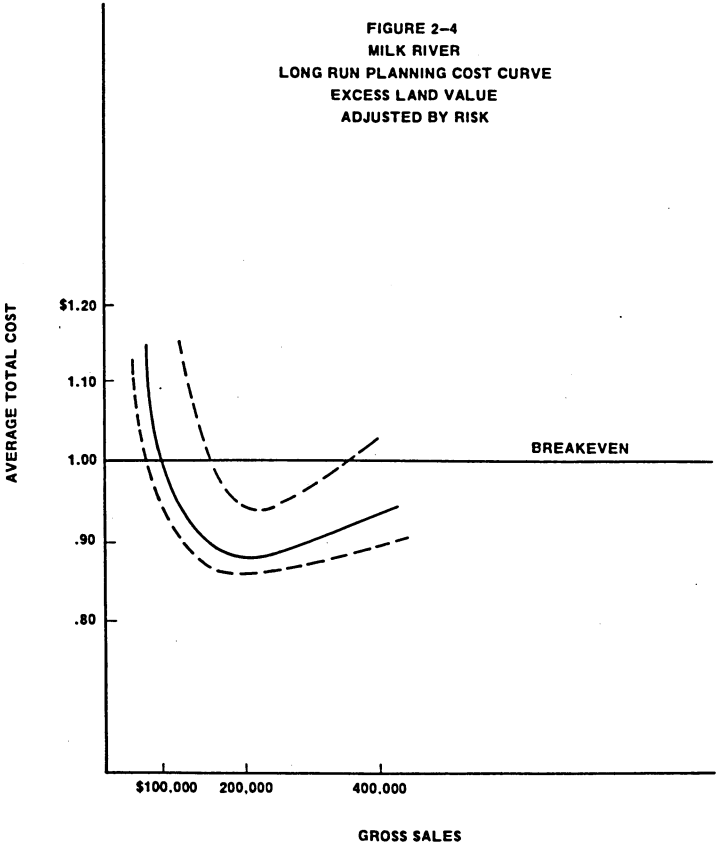


Table 2-9
Standard Deviations of Price, Yield and Gross Income by Crop, Milk River Project, Malta Distict, Montana

Crop	Yield	Price	Gross Income Per Acre
Hay	0.109 ton	$5.17/ton	$ 4.74
Irr. Barley	4.653 bu.	0.10/bu.	3.66
Dry Barley	5.969 bu.	0.10/bu.	21.42
Oats	8.094 bu.	0.10/bu.	8.10
Alfalfa Hay	0.126 ton	2.56/ton	6.90
Irr. Wheat	3.747 bu.	0.18/bu.	5.93
Dry Wheat	4.981 bu.	0.18/bu.	8.05
Irr. Pasture	5.377 a.u.m.	0.11/a.u.m.	5.55

Using procedures outlined in the introductory chapter, a weighted aggregate demand curve was estimated and is shown in Figure 2-5. The vertical dashed line indicates the average delivery 0.8 acre feet per acre and the asterisk indicates the 1978 average total cost ($7.79/acre foot) to the farm operator of that water supply. The downward sloping stepped curve indicates the quantity of water that operators should take as the cost/price of irrigation is varied from 0 to $80 per acre foot. These results indicate at the lower price levels district farm operators could profitably use more water than is currently available to them. However, at a water price in excess of $35 per acre foot, water use would be lower than historic use.

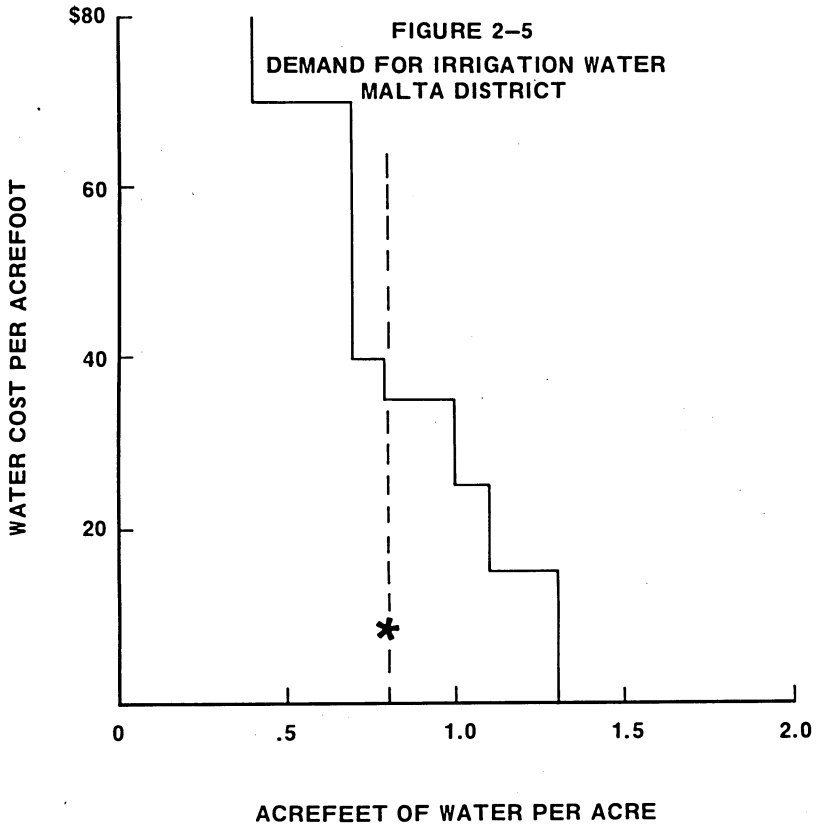
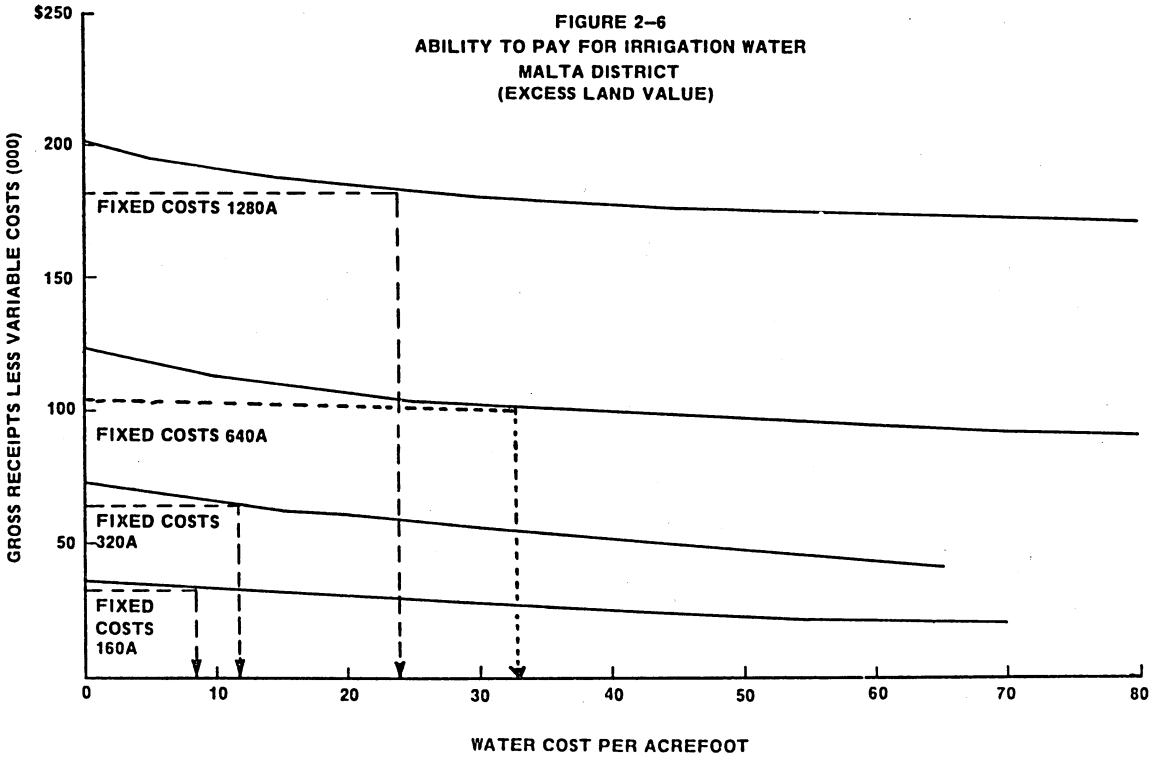


Figure 2-6 graphically presents the ability to pay calculations. Fixed cost levels for each farm size assume excess land values which reflect the value of land without the federal water subsidy and thus the maximum ability to pay. The solid curves for each farm size indicates the net return over variable costs including water cost. The vertical line dropped from the intersection of the fixed cost (dashed horizontal line) and the net return curve (solid curve) indicates the maximum ability to pay. This ability to pay increases with farm size. While the maximum ability to pay is $8.50 per acre foot on the 160 acre farm, it increases to $24.00 per acre foot for the 1,280 acre farm. The BOR estimated full cost of water in the Milk River Project in 1978 was $119.13 per acre foot.



OFF-FARM INCOME

Off-farm income contributes to more fully utilizing under-employed resources such as under-utilized family labor and excess machinery capacity on small farms. It also contributes to stablizing family income during bad crop and livestock years.

No data was available on off-farm income in Malta Irrigation District but information is available for Phillips County where most of the District is located from the 1974 Census of Agriculture.

The Agricultural Census reports 516 farms in Phillips County, Montana with $2,500 or more of gross sales. Table 2-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 2-10

Farm Operators Reporting Days Work Off-Farm

None	236
1 - 49 days	63
50 - 99 days	4
100 - 149 days	7
150 - 199 days	9
200 days or more	48
Total	367

Income and expenses related to selected off-farm income sources are shown in Table 2-11.

Table 2-11

Operator Income From Farm Related Sources
Phillips County, Montana

Number of Farms Reporting	138
Average Per Farm Reporting	$452

Income From Custom Work

Number of Farms Reporting	60
Average Per Farm Reporting	$149

Expenses Related to Off-Farm Work

Number of Farms Reporting	43
Average Per Farm Reporting	$141

Farm operators' spouses and their children also contribute to family income. In Phillips County, 235 farm families reported an average family off-farm income of $1,554 in 1974. These data are not available by farm size.

CHAPTER 3

Moon Lake Project - Utah

The Moon Lake Water Users Association is located around Roosevelt, Utah in Duchesne County. The unit has a service area of about 75,256 acres. Topographically the unit can be divided into two homogeneous areas. The lower area is more level and farms contain a relatively high proportion of tillable land. The high area is more rolling and contains a higher proportion of land in meadow and areas suitable only for irrigated pasture.

CLIMATE

Frost-free growing period for the project ranges from an average of 125 to 132 days with a weighted average of about 127 days. Annual rainfall ranges from 6.8 inches at Myton to 9.07 inches at Duchesne for a weighted average of about 7.17 inches.

SOILS

Most of the lands have demonstrated their agricultural productivity under irrigation for the past 50 years. The lands consist of two major soil types: (1) older alluvial soils, located on the higher benches and (2) the more recent and deeper alluvial soils, located in the valley bottoms.

The benchland soils are of medium texture, brown to reddish-brown in color and are underlain by cobble rock at varying depths. The soils are as shallow as 6 inches and are underlain by moderately hard cemented hardpans which form the top layer of the cobble zone. The hardpan does not constitute a barrier to water movement but does have a retarding effect, thus, giving medium to moderately slow internal drainage characteristics to the soils. Most of the benchlands have a fluctuating water table in the lower cobble zone that reaches its highest level during periods of high runoff in the streams. The water tables are highly aerated and low in salt content making conditions favorable for the production of meadow hay and pasture, which is the predominant agricultural use on the benchlands.

The valley lands consist primarily of deeper materials derived from the shales and sandstones of the Duchesne River and Uintah formations. The soils are predominantly of medium texture and are brown to reddish-brown in color. The internal drainage is medium to moderately slow. Most of these soils are calcareous but have no distinct zone of lime accumulation. Where they are adjacent to deep natural drainage channels, the soils are well drained and are suitable for cultivation under irrigation.

CROPS

The cropping pattern in Moon Lake is dominated by irrigated pasture, meadow hay and alfalfa hay as shown in the 1977 crop report presented in Table 3-1. These crops are reflected in the typical farm budgets presented below.

Table 3-1

Crop Acreages 1977, Moon Lake, Utah

Crop	Acres	Value of Production
Cereals		
Barley	249	$ 16,820
Corn	75	7,594
Oats	155	7,401
Wheat	99	8,762
Other	10	660
Forage		
Alfalfa Hay	6,004	660,440
Other Hay	4,638	382,635
Irr. Pasture	40,223	563,122
Silage	490	90,650
Vegetables		
Potatoes	2	550
Miscellaneous	38	16,500
Total	51,983	$1,755,134

LAND TENURE

A large number of relatively small ownership units characterizes land tenure in the Moon Lake Project. About 86 percent of the owners control 70 percent of the land as shown in Tables 3-2 and 3-3 with a Gini coefficient of 0.36.[1/] The average acreage per owner is 102 acres with only 14 units in excess of 500 acres. The vast majority, 67 percent, are owned jointly with a spouse. Only seven units are owned by nonfamily corporations which are related to less than 1 percent of the land in the district.

FARM OPERATIONS

The average farm size, 226 acres, is more than twice as large as the average ownership unit, 102 acres. As shown in Table 3-4, 207 of the 298 farms in the district are operated jointly with a spouse. No farms were found which were operated by corporations with 10 or more shareholders.

Forages dominated the cropping pattern of the district, but as shown in Table 3-5 the proportion of land in forages changed very little by farm size. Due to the high elevation and short growing season these farm operators have few alternative crops from which to choose.

LABOR FORCE

Except for the three reported farm workers of Hispanic origin, the farm labor force in the district is entirely Caucasian as indicated in Table 3-6.

Table 3-7 presents the results of grouping hired and operator labor into employment categories. Average total employees plus operators per farm remained almost constant by farm size with an average of 1.1 on the smallest farm size group and 1.3 per farm in the 500 to 999 acre group. Only the largest farm size group showed a departure from this relation with 2.9 workers per farm. This labor use pattern is reflected in the labor per 1,000 acres ratio column which shows a rapid decline as farm size increases. Of course, these data are not adjusted for off-farm employment, custom hire services or any livestock enterprises on these farms. The minimum labor input per 1,000 acres of 2.3 is achieved at the 500-999 acre farm size level.

RESULTS OF TYPICAL FARM BUDGETS - LOW AREA

The research assistant and the farmer panel concluded that this district could not be adequately represented by a single set of farm budgets; therefore, the district was divided into two subareas: a lower area with a higher proportion of tillable land and a high area which contains a high proportion of meadow land and a livestock operation. Four farm budgets were prepared to represent the low area, a 160, 320, 640 and a 1,280 acre farm.

As in all of the case-study projects the assumption of full ownership was made for the 160 acre and 320 acre farm. The larger two farms assumed ownership of 320 acres and the balance of the farm to be leased. The 1978 estimated cash rental rate of $22.65 per acre is low, relative to the current market value of land of $750.00 per acre. This relationship provides a significant income advantage to the larger farms which have a high proportion of leased land.

For the beginning farm operator, the 160 acre farm with full ownership of land shows a return to operator labor and management of $-4,877 at current market land values and $-100 at excess land values (see Table 3-8). Only the 1,280 acre farm shows a positive return at current market land values.

Existing Farmers

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments and thus due to land value appreciation, a much higher equity position.

The estimated turnover rate for farms in the western United States is 2.5 percent per year. On the average a farm is transferred every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Using the average debt-asset ratio of 12.6 percent for all Utah farms in 1978, farm budgets were modified and the results are shown in Table 3-8 and 3-9.

Due to the higher equity position, the cash flow for existing farmers is significantly higher than for beginning farmers and is positive for all farm sizes.

1/ Gini coefficient ranges from 0 to 1.0. The larger the coefficient, the more concentrated the ownership.

Table 3-2

FORM OF OWNERSHIP BY FARM SIZE, MOON LAKE, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	36	195	116	0	3	2	0	4	356	62.3
Percent	10.1	54.7	32.5	0.0	0.8	0.5	0.0	1.1	100.0	
100-179										
No. of Owners	14	94	20	2	2	0	0	0	132	85.5
Percent	10.6	71.2	15.1	1.5	1.5	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	12	30	0	0	0	0	0	0	42	92.9
Percent	28.5	71.4	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	5	18	0	3	0	0	0	0	26	97.5
Percent	19.2	69.2	0.0	11.5	0.0	0.0	0.0	0.0	100.0	
500-999										
No. of Owners	2	12	0	0	0	0	0	0	14	100.0
Percent	14.2	85.7	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	69	349	136	5	5	2	0	4	570	
Percent	12.1	61.2	23.8	0.8	0.8	0.3	0.0	0.7	100.0	

Table 3-3

LAND BY OWNERSHIP, MOON LAKE, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	2357	15378	5184	0	65	74	0	120	23178	39.6
Percent	10.1	66.3	22.3	0.0	0.2	0.3	0.0	0.5	100.0	
Average									65.1	
100-179										
Acres	2007	12844	2219	284	284	0	0	0	17638	69.9
Percent	11.3	72.8	12.5	1.6	1.6	0.0	0.0	0.0	100.0	
Average									133.6	
180-259										
Acres	2503	6266	92	0	0	0	0	0	8861	85.2
Percent	28.2	70.7	1.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									210.9	
260-499										
Acres	1660	2758	0	1068	0	0	0	0	5486	94.6
Percent	30.2	50.2	0.0	19.4	0.0	0.0	0.0	0.0	100.0	
Average									211.0	
500-999										
Acres	1059	2108	0	0	0	0	0	0	3167	100.0
Percent	33.4	66.5	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									226.2	
Totals										
Acres	9586	39354	7495	1352	349	74	0	120	58330	
Percent	16.4	67.4	12.8	2.3	0.5	0.1	0.0	0.2	100.0	
Average	138.9	112.7	55.1	270.4	69.8	37.0	0.0	30.0	102.3	

Table 3-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, MOON LAKE, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Indi-vidually	Other (Gov't, Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	0	8	74	13	4	99	64
Percent	0.0	0.0	8.0	74.7	13.1	4.0	100.0	
100-179								
No. of Farms	0	3	8	63	7	0	81	132
Percent	0.0	3.7	9.8	77.7	8.6	0.0	100.0	
180-259								
No. of Farms	0	3	6	20	8	0	37	216
Percent	0.0	8.1	16.2	54.0	21.6	0.0	100.0	
260-499								
No. of Farms	0	7	10	41	4	2	64	348
Percent	0.0	10.9	15.6	64.0	6.2	3.1	100.0	
500-999								
No. of Farms	0	2	4	7	2	0	15	607
Percent	0.0	13.3	26.6	46.6	13.3	0.0	100.0	
1,000-1,999								
No. of Farms	0	0	0	2	0	0	2	1200
Percent	0.0	0.0	0.0	100.0	0.0	0.0	100.0	
Totals								
No. of Farms	0	15	36	207	34	6	298	226
Percent	0.0	5.0	12.0	69.4	11.4	2.0	100.0	

Table 3-5

IRRIGATED CROP PATTERNS BY FARM SIZE, MOON LAKE, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	751	5611	0	4	0	0	0	6366
Percent	11.7	88.1	0.0	0.0	0.0	0.0	0.0	100.0
100-179								
Total Acres	1080	9474	0	0	0	12	0	10566
Percent	10.2	89.6	0.0	0.0	0.0	0.1	0.0	100.0
180-259								
Total Acres	688	7704	0	0	0	0	0	8392
Percent	8.1	91.8	0.0	0.0	0.0	0.0	0.0	100.0
260-499								
Total Acres	2273	19958	0	1	0	0	0	22232
Percent	10.2	89.7	0.0	0.0	0.0	0.0	0.0	100.0
500-999								
Total Acres	536	8017	0	0	0	0	0	8553
Percent	6.2	93.7	0.0	0.0	0.0	0.0	0.0	100.0
1,000-1,999								
Total Acres	168	1852	0	0	0	0	0	2020
Percent	8.3	91.6	0.0	0.0	0.0	0.0	0.0	100.0
Totals								
Total Acres	5496	52616	0	5	0	12	0	58129
Percent	9.4	90.5	0.0	0.0	0.0	0.0	0.0	100.0

Table 3-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, MOON LAKE, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	12	12	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
100-179						
No. of Employees	12	12	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
180-259						
No. of Employees	9	7	2	0	0	0
Average	0.2	0.1	0.0	0.0	0.0	0.0
260-499						
No. of Employees	18	17	1	0	0	0
Average	0.2	0.2	0.0	0.0	0.0	0.0
500-999						
No. of Employees	6	6	0	0	0	0
Average	0.4	0.4	0.0	0.0	0.0	0.0
1,000-1,999						
No. of Employees	3	3	0	0	0	0
Average	1.7	1.7	0.0	0.0	0.0	0.0
Totals						
No. of Employees	60	57	3	0	0	0
Percent	100.0	95.0	5.0	0.0	0.0	0.0

Table 3-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, MOON LAKE, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees and Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	0	2	10	12	99	111	17.4
Average/Farm	0.	0.	0.1	0.1	0.9	1.1	
100-179							
No. of Workers	0	3	9	12	81	93	8.6
Average/Farm	0.	0.	0.1	0.1	1.0	1.1	
180-259							
No. of Workers	0	0	9	9	37	46	5.7
Average/Farm	0.	0.	0.2	0.2	0.9	1.2	
260-499							
No. of Workers	2	2	14	18	63	81	3.6
Average/Farm	0.	0.	0.2	0.2	0.9	1.2	
500-999							
No. of Workers	1	0	5	6	14	20	2.3
Average/Farm	0.	0.	0.3	0.4	0.9	1.3	
1,000-1,999							
No. of Workers	0	0	3	3	2	5	2.4
Average/Farm	0.	0.	1.7	1.7	1.1	2.9	
Totals							
No. of Workers	3	7	50	60	296	356	

Table 3-8

Moon Lake (Low), Utah

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	80	Land	$120,000
	Barley (Irr.)	24	Improvements	12,500
	Corn Silage	24	Machinery	82,867
	Estb. Alfalfa	16	Total	$215,367
	Meadow Hay	11		
	Farmstead	5		
	Total	160		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$23,739	Gross Sales	$23,739
Expenses	28,615	Expenses	14,582
Return to Operator Labor, Mgt., & Equity	$-4,876	Return to Operator Labor, Mgt., & Equity	$ 9,157

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$23,739
Expenses	23,839
Return to Operator Labor, Mgt., & Equity	$ -100

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	160	Land	$240,000
	Barley (Irr.)	48	Improvements	17,500
	Corn Silage	48	Machinery	107,931
	Estb. Alfalfa	32	Total	$365,431
	Meadow Hay	23		
	Farmstead	9		
	Total	320		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$47,606	Gross Sales	$47,606
Expenses	52,617	Expenses	28,591
Return to Operator Labor, Mgt., & Equity	$-5,011	Return to Operator Labor, Mgt., & Equity	$19,015

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$47,606
Expenses	43,065
Return to Operator Labor, Mgt., & Equity	$ 4,541

Table 3-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	320	Land	$240,000
	Barley (Irr.)	96	Improvements	14,300
	Corn Silage	96	Machinery	162,842
	Estb. Alfalfa	64	Total	$417,142
	Meadow Hay	46		
	Farmstead	18		
	Total	640		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$95,212	Gross Sales	$95,212
Expenses	91,833	Expenses	63,888
Return to Operator Labor, Mgt., & Equity	$ 3,379	Return to Operator Labor, Mgt., & Equity	$31,324

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$95,212
Expenses	82,281
Return to Operator Labor, Mgt., & Equity	$12,931

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	640	Land	$240,000
	Barley (Irr.)	192	Improvements	19,300
	Corn Silage	192	Machinery	258,583
	Estb. Alfalfa	128	Total	$517,883
	Meadow Hay	90		
	Farmstead	38		
	Total	1,280		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$190,167	Gross Sales	$190,167
Expenses	176,235	Expenses	141,687
Return to Operator Labor, Mgt., & Equity	$ 13,932	Return to Operator Labor, Mgt., & Equity	$ 48,480

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$190,167
Expenses	166,683
Return to Operator Labor, Mgt., & Equity	$ 23,484

Table 3-9

Moon Lake (High), Utah

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	32	Land	$120,000
	Barley (Irr.)	10	Improvements	13,672
	Corn Silage	10	Machinery	50,628
	Pasture	32	Total	$184,300
	Estb. Alfalfa	6		
	Meadow Hay	64		
	Farmstead	6		
	Total	160		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$18,236	Gross Sales	$18,236
Expenses	23,833	Expenses	11,691
Return to Operator Labor, Mgt., & Equity	$-5,597	Return to Operator Labor, Mgt., & Equity	$ 6,545

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$18,236
Expenses	19,057
Return to Operator Labor, Mgt., & Equity	$ -821

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	64	Land	$240,000
	Barley (Irr.)	19	Improvements	16,344
	Corn Silage	19	Machinery	87,599
	Pasture	64	Total	$343,943
	Estb. Alfalfa	13		
	Meadow Hay	128		
	Farmstead	13		
	Total	320		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$36,225	Gross Sales	$36,225
Expenses	43,820	Expenses	21,161
Return to Operator Labor, Mgt., & Equity	$-7,595	Return to Operator Labor, Mgt., & Equity	$15,064

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$36,225
Expenses	34,268
Return to Operator Labor, Mgt., & Equity	$ 1,957

Table 3-9--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	128	Land	$240,000
	Barley (Irr.)	38	Improvements	23,188
	Corn Silage	38	Machinery	133,363
	Pasture	128	Total	$396,551
	Estb. Alfalfa	27		
	Meadow Hay	256		
	Farmstead	25		
	Total	640		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$72,557	Gross Sales	$72,557
Expenses	72,364	Expenses	46,200
Return to Operator Labor, Mgt., & Equity	$ 193	Return to Operator Labor, Mgt., & Equity	$26,357

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$72,557
Expenses	62,812
Return to Operator Labor, Mgt., & Equity	$ 9,745

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	256	Land	$240,000
	Barley (Irr.)	77	Improvements	35,676
	Corn Silage	77	Machinery	204,890
	Pasture	256	Total	$480,566
	Estb. Alfalfa	51		
	Meadow Hay	512		
	Farmstead	51		
	Total	1,280		

Financial Summary

Land at Current Market Value ($750/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$145,147	Gross Sales	$145,147
Expenses	138,799	Expenses	106,883
Return to Operator Labor, Mgt., & Equity	$ 6,348	Return to Operator Labor, Mgt., & Equity	$ 38,264

Land at Excess Land Value ($350/ac.)

Beginning Farmers	
Gross Sales	$145,147
Expenses	130,247
Return to Operator Labor, Mgt., & Equity	$ 14,900

RESULTS OF TYPICAL FARM

BUDGETS - HIGH

Four farm budgets were developed for the high area represented by a 160, 320, 640 and a 1,280 acre farm. Due to the extensive irrigated pasture and meadow acreage in this portion of the district, a livestock enterprise was defined for each farm size. Assuming a cow-calf operation, 53 cows were maintained on the 160 acre farm, 105 cows on the 320 acre farm, 210 cows on the 640 acre farm and 422 cows on the 1,280 acre farm.

Primarily due to low cattle prices, budgets for all farm sizes showed a large negative return to operator, labor and management. For example, under full ownership the 160 acre farm shows a $-5,597 under current market land values and $-821 using excess land values. As farm size increases, losses also increase as shown in Table 3-9.

For existing farm operators with financial equity, net returns are positive for all farm sizes.

ECONOMIES OF SIZE - LOW

The machinery complement defined by the farmer panel was used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 3-1 and 3-2 show the SRAC for each farm size when the additional land can be leased up to the engineering capacity of the fix plant. The minimum points on these SRAC indicate the profit maximizing crop mix given these assumptions. The acreage represented by minimum ATC for each farm size is shown above the base line in Figure 3-2.

Under unlimited leasing the minimum points on the SRAC reflect the ability of farms to utilize otherwise excess capacity and for the smaller farms to rent a portion of the land.

When an envelope curve is fitted to the minimum points of the SRAC, a long-run planning curve or LRAC is defined and is shown in Figure 3-3. Under either of the two land valuations, current market or excess land value, most of the cost economies are captured by the time gross sales reach about $80,000 or about 600 acres of land for the low area of Moon Lake.

ECONOMIES OF SIZE - HIGH

The same procedures were used to analyze economies of size for the High Area as was used in the Low Area except the livestock enterprise which was constrained at the herd size assumed in the farm budgets in the previous section.

Short-run average cost curves (SRAC) were developed using linear programming. Figures 3-4 and 3-5 show SRAC under the two land values, current market and excess land value. By optimizing the crop mix, some improvement was made in farm income over the farm budgets. As in the Low Area, the 320 acre farm appears to be an anomaly probably due to a misspecification of machinery complement by the farmer panel. Acreage, representing the minimum ATC for each farm size, is shown above the base line in Figure 3-5.

Long-run average cost curves (LRAC) or planning curves were developed by fitting a curve free hand to the minimum points on the SRAC (see Figure 3-6). The results of this analysis indicate that the minimum cost ouput is obtained at a gross sales of about $150,000 utilizing the machinery complement specified for the 640 acre farm and a herd of about 200 cows.

PRICE, YIELD AND INCOME VARIABILITY

As in the other projects, a time series of prices and yields and gross income (P x Q) were developed. The standard deviations (square root of the variance) of these results are presented in Table 3-10.

Table 3-10

Standard Deviations of Price, Yield and Gross Income by Crop
Moon Lake, Utah

Crop	Price	Yield	Gross Income Per Acre
Alfalfa Hay	$2.503/ton	0.232 ton	$ 9.16
Other Hay	2.284/ton	0.274 ton	5.67
Silage	1.100/ton	1.037 ton	16.05
Corn	0.141/bu.	12.769 bu.	31.08
Barley	0.122/bu.	5.255 bu.	14.64
Oats	0.114/bu.	5.105 bu.	11.03
Wheat	0.095/bu.	4.663 bu.	12.28
Irr. Pasture	0.448/a.u.m.	0.583 a.u.m.	2.89

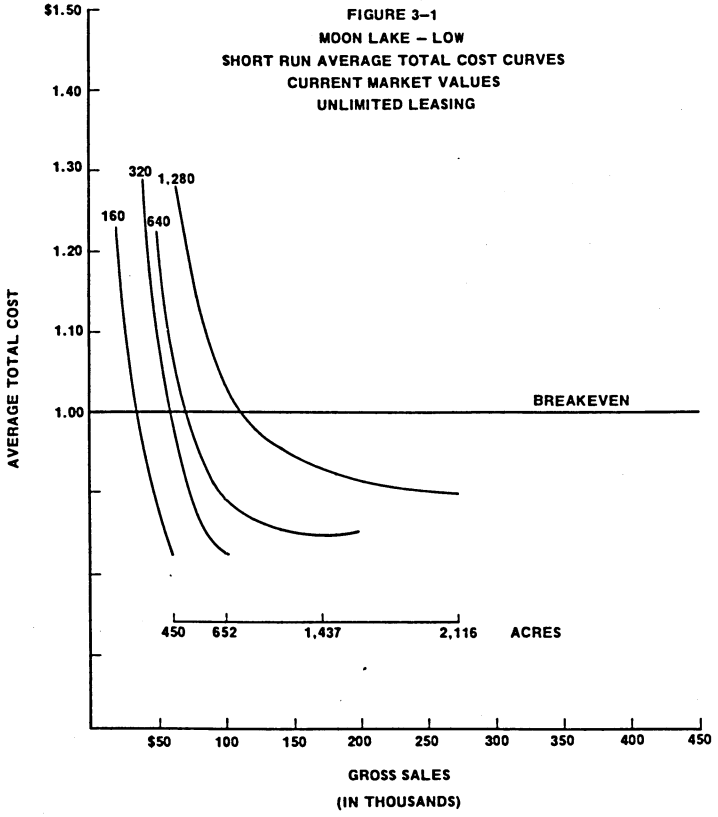


FIGURE 3–1
MOON LAKE – LOW
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
UNLIMITED LEASING
AVERAGE TOTAL COST
$1.50
1.40
1.30
1.20
1.10
1.00
160
320
640
1,280
BREAKEVEN
450
652
1,437
2,116
ACRES
$50
100
150
200
250
300
350
400
450
GROSS SALES
(IN THOUSANDS)

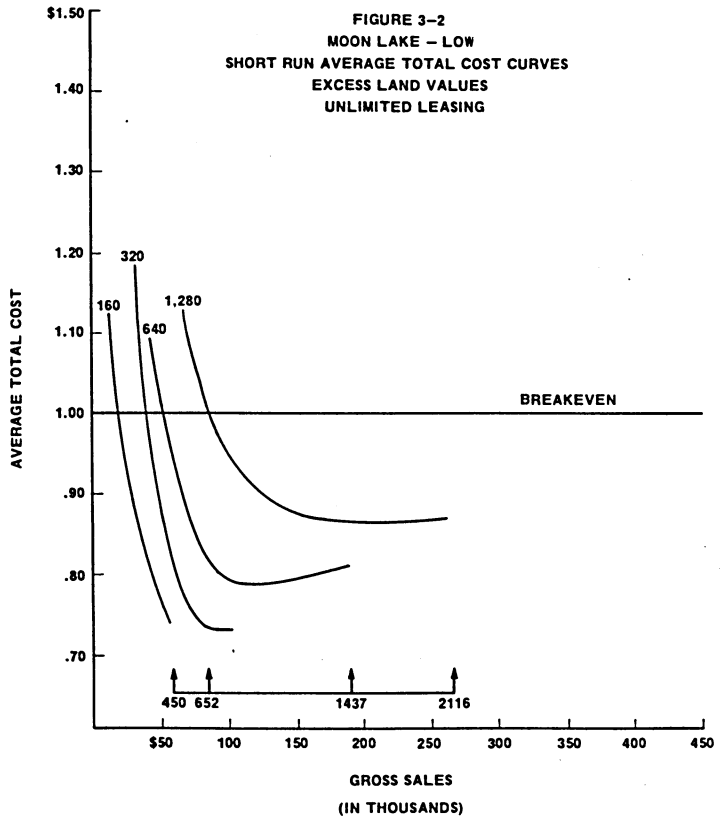


FIGURE 3–2
MOON LAKE – LOW
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING
AVERAGE TOTAL COST
$1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
160
320
640
1,280
BREAKEVEN
450
652
1437
2116
$50
100
150
200
250
300
350
400
450
GROSS SALES
(IN THOUSANDS)

FIGURE 3–3
MOON LAKE – LOW
LONG RUN PLANNING COST CURVE
CURRENT & EXCESS LAND VALUES
UNLIMITED LEASING

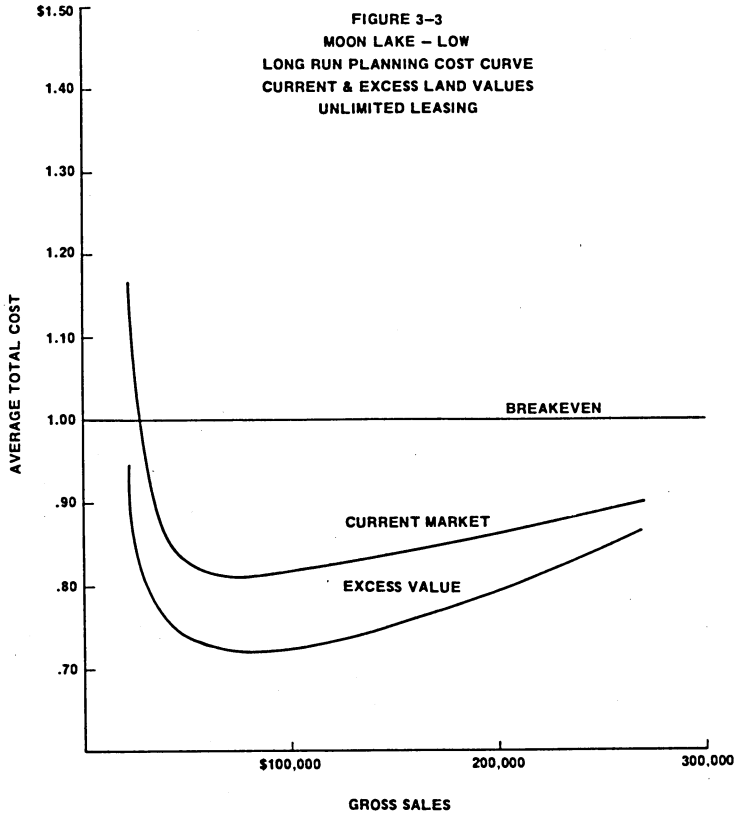
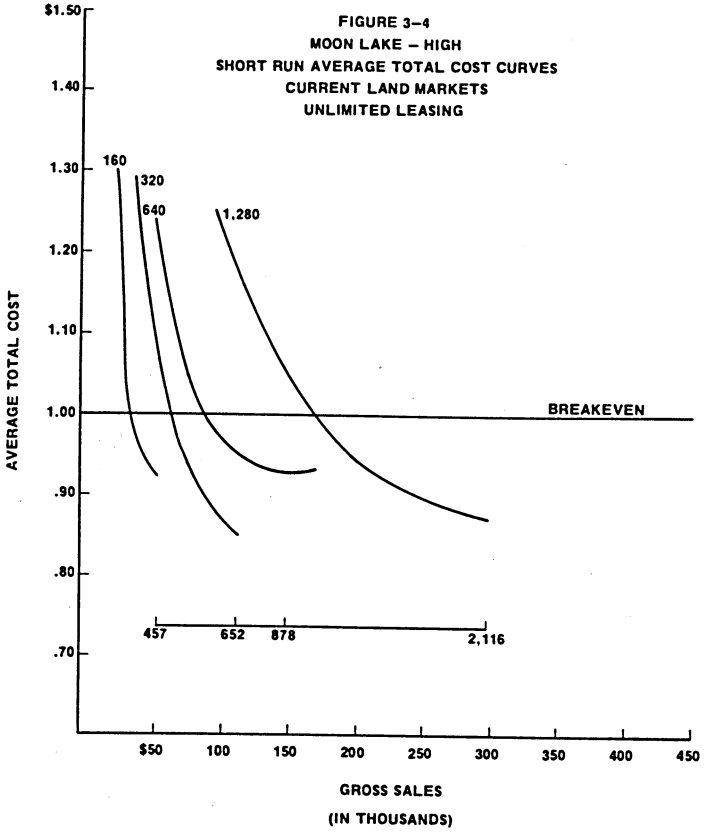


FIGURE 3–4
MOON LAKE – HIGH
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT LAND MARKETS
UNLIMITED LEASING



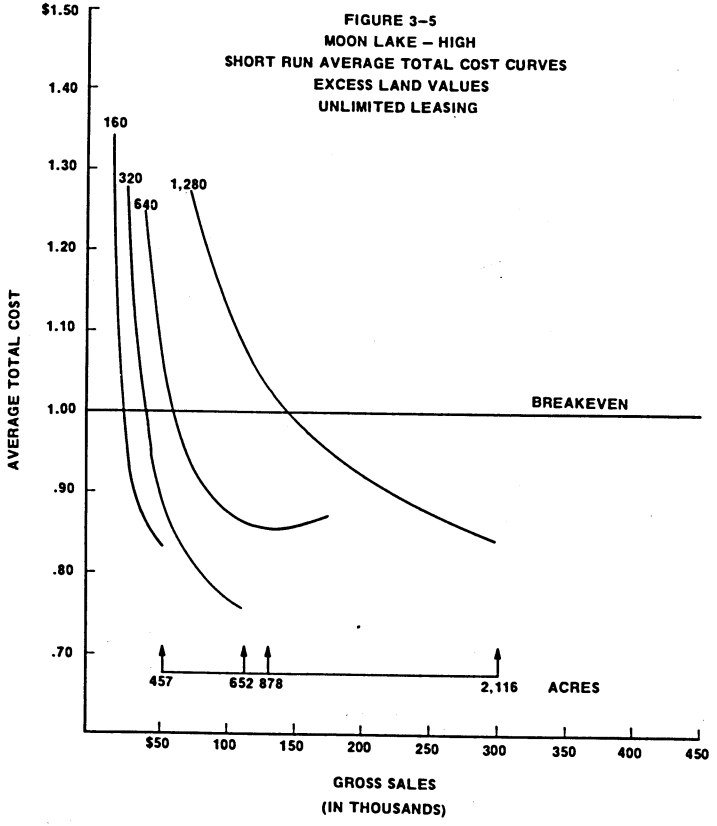


FIGURE 3–5
MOON LAKE – HIGH
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

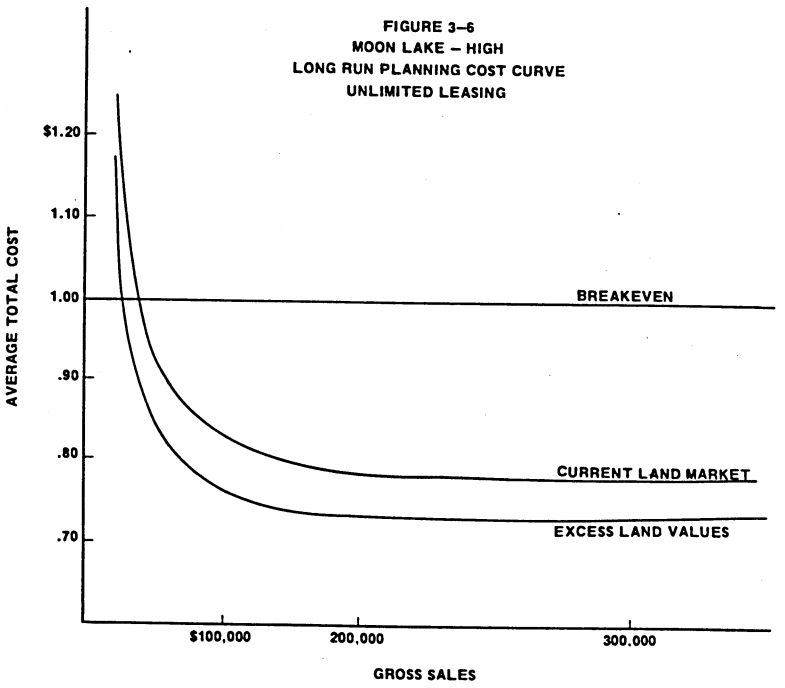


FIGURE 3–6
MOON LAKE – HIGH
LONG RUN PLANNING COST CURVE
UNLIMITED LEASING

To indicate the variability of farm income and costs, the data in Table 3-10 were combined based on the proportion of land in each crop for the crop mix represented by the minimum point on the SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted around the LRAC in Figures 3-7 and 3-8.

Corn for grain followed by silage are the most volatile crops while alfalfa hay and irrigated pasture are relatively the most stable. Assuming gross incomes are normally distributed about the expected or average cost per dollar of gross sales, the LRAC can be expected to fluctuate between these two bounds about 67 percent of the time.

FIGURE 3-7
MOON LAKE (LOW) UTAH-
PLANNING CURVE - AT EXCESS LAND VALUES
ADJUSTED BY RISK

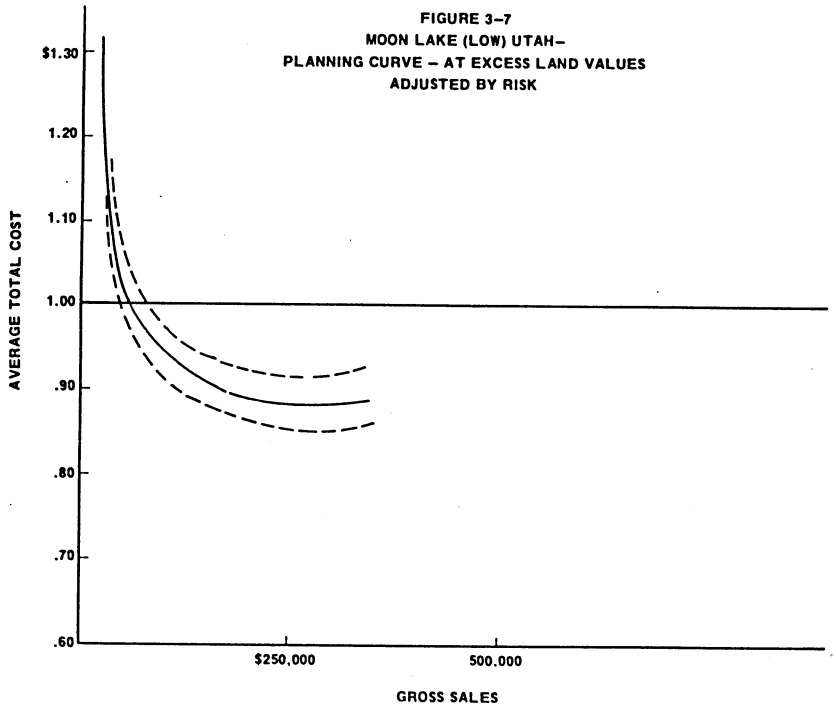
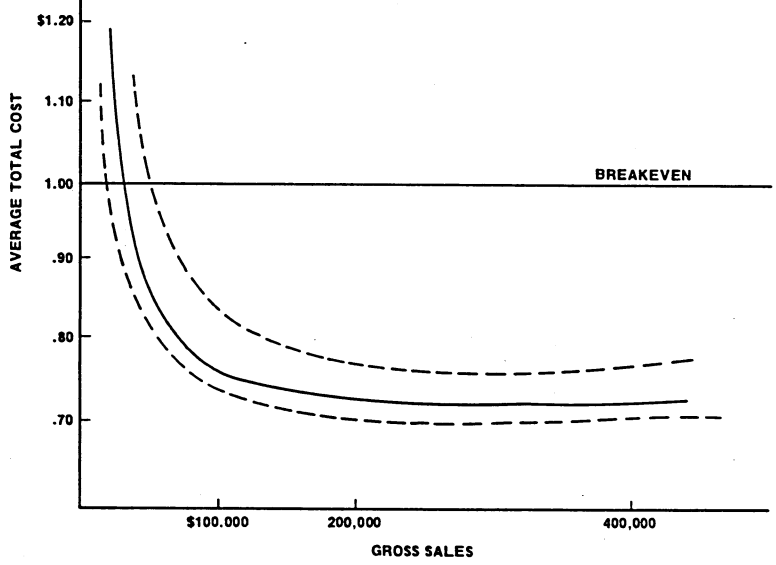


FIGURE 3-8
MOON LAKE – HIGH
LONG RUN PLANNING CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK



DEMAND FOR IRRIGATION WATER

Adjustments to increased water costs in the district are limited by the short growing season, topography and soils. The weighted aggregate demand curve shown in Figures 3-9 and 3-10 was estimated using procedures outlined in the introductory chapter. The vertical dashed line indicates the historic average allocation of 1.8 acre per acre in the district and the asterisk indicates the 1978 average total cost of water ($1.75/per acre foot) delivered to farm headgates. The solid line forming a series of steps in Figures 3-9 and 3-10 depict the optimum quantity of water to be used at each water cost. This analysis indicates that farm operators could profitably use significantly more water than was historically available at the current price in both the low and high areas. The optimum quantity in the low area does not approach the current allocation until water price/cost is increased to about $15 to $20 per acre foot.

The maximum ability to pay for irrigation water is shown graphically in Figures 3-11 and 3-12. The solid dish shaped curves represent the net returns over variable costs including water cost as the price of water is increased for each farm size. The more "dished" the net revenue curve, the more adjustments have occurred in crop mix and irrigation technology in response to a rising water cost. The horizontal dashed lines represent the level of fixed costs for each farm size based on the assumption of excess land values. Thus a vertical line dropped from the intersection to the horizontal axis is the maximum ability to pay for water for each farm size.

The ability to pay for water increases by farm size in both areas due to economies of size. The highest is for the 1,280 acre farms at between $7.00 and $8.00 per acre foot for both areas. This can be compared to the BOR estimated full-cost price for the project of $7.04 per acre foot in 1978.

FIGURE 3–9
DEMAND FOR IRRIGATION WATER
MOON LAKE (LOW AREA)

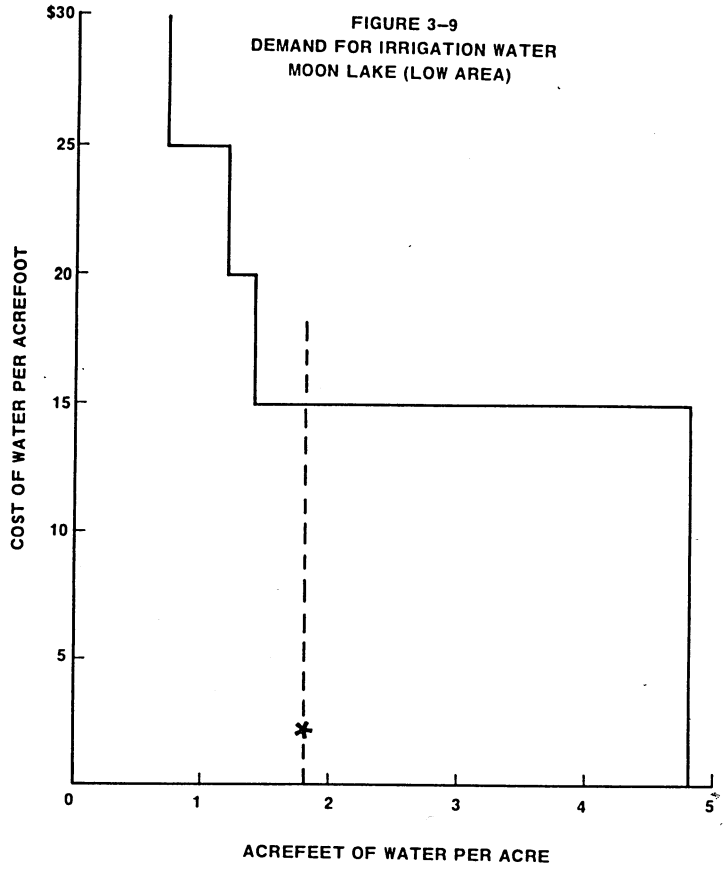


FIGURE 3–10
MOON LAKE (HIGH)
DEMAND FOR IRRIGATION WATER

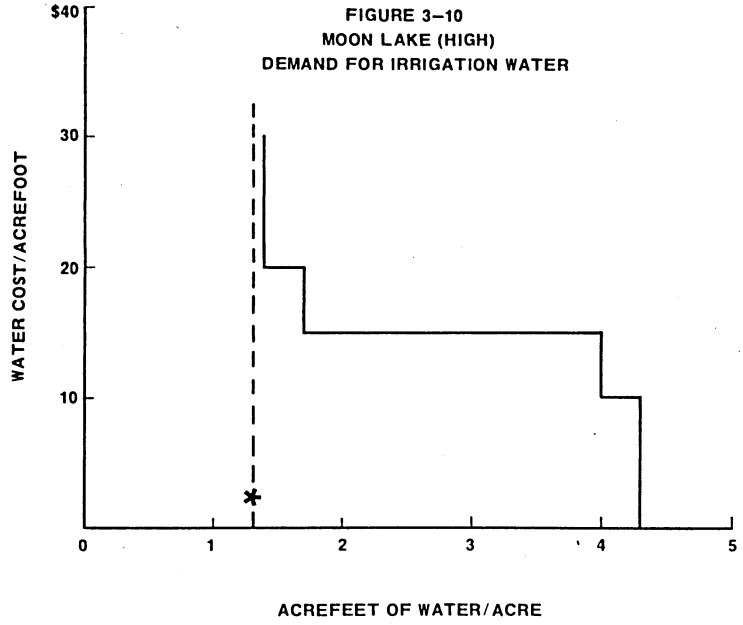


FIGURE 3–11
ABILITY TO PAY FOR IRRIGATION WATER
MOON LAKE (LOW AREA)
(EXCESS LAND VALUE)

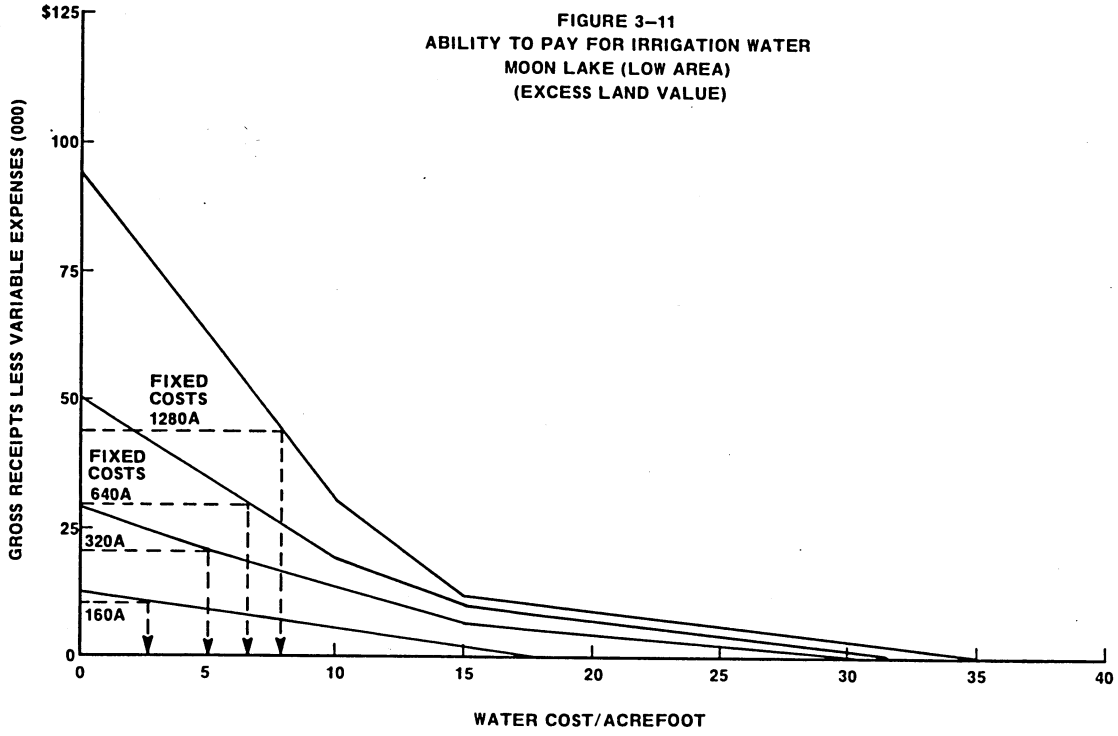
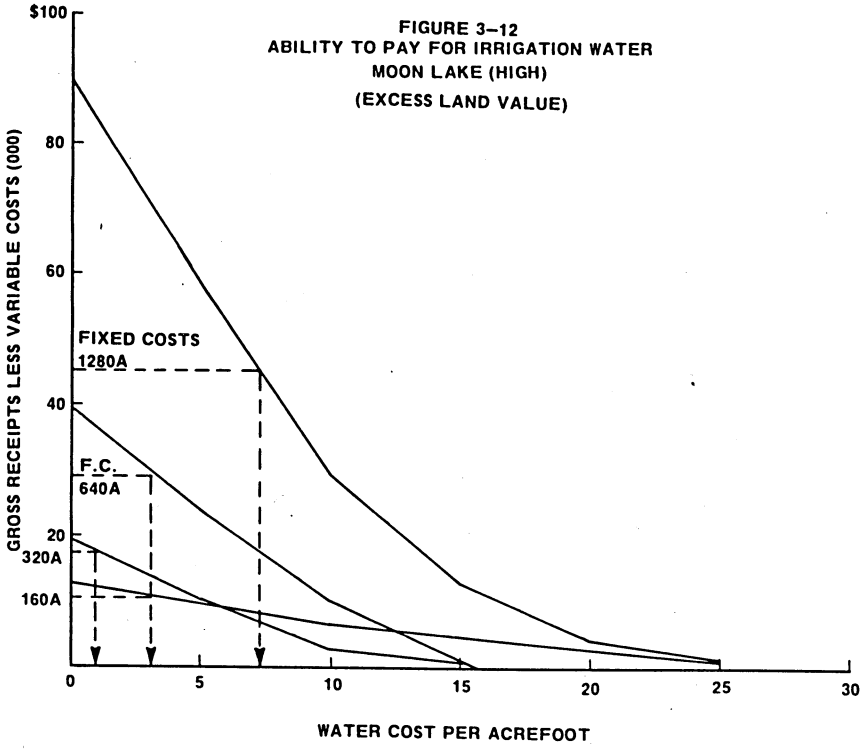


FIGURE 3–12
ABILITY TO PAY FOR IRRIGATION WATER
MOON LAKE (HIGH)
(EXCESS LAND VALUE)



OFF-FARM INCOME

Off-farm income contributes to fuller utilization of under-employed family labor and excess machinery capacity (custom work) and helps stabilize family income. Off-farm income also contributes to the probability of receiving agricultural loans.

No data are available on off-farm income for Moon Lake. However, the U.S. Census of Agriculture, 1974 provides county data on this variable.

Table 3-12

Farm Operators Reporting Off-Farm Work

None	128
1 - 49 days	17
50 - 99 days	9
100 - 149 days	15
150 - 199 days	34
200 days or more	90
Total	293

For Duchesne County, Utah in 1974 there were 402 farms with gross sales of $2,500 or over. Table 3-12 reports 165 farms reporting agriculturally related off-farm work.

Income and expenses related to selected off-farm income sources are shown in Table 3-13.

Table 3-13

Operator Income From Farm Related Sources,
Duchesne County, Utah

Number of Farms Reporting	62
Average Per Farm Reporting	$192
Income From Custom Work	
Number of Farms Reporting	35
Average Per Farm Reporting	$133
Expenses Related to Off-Farm Income	
Number of Farms Reporting	52
Average Per Farm Reporting	$108
Total Family Off-Farm Income	
Number of Farms Reporting	252
Average Per Farm Reporting	$3,300

CHAPTER 4

Truckee-Carson Irrigation District
Newlands Project, Nevada

The Truckee-Carson Irrigation District is located east of Reno, Nevada. Situated in the rain shadow of the Sierra Nevada mountains, the average annual rainfall is only 5.2 inches. Its relatively high altitude provides only an average of 130 days of frost-free growing season.

SOILS

Irrigable lands in the 79,000 acre district have not been classified but localized high water tables and sandy areas limit crop adaptability to some extent.

CROPS

Alfalfa hay covers 62 percent (35,785 acres) of the 57,530 irrigated acres in the district (see Table 4-1). Irrigated pasture ranks second followed by other silage crops. These forage crops support a well-developed livestock industry within the district boundaries as well as being exported to other parts of the state and to northern California.

LAND TENURE

Land ownership in the Truckee-Carson Irrigation District (TCID) is rather widely held with a Gini coefficient of 0.35.[1/] About 71 percent of the landowners own 38 percent of the land; but at the upper end of the distribution 0.5 percent of the owners own 8.5 percent of the land (see Tables 4-2 and 4-3). A large majority of the ownerships are held jointly with a spouse or in a multiple family arrangement. About 72 percent of the land is held under this type of arrangement.

Table 4-1

Crop Acreage, Truckee-Carson District, Newlands Project, Nevada, 1977

Crop	Acres	Value of Production
Cereals		
Barley	678	$ 59,304
Forage		
Alfalfa Hay	35,785	7,872,700
Irrigated Pasture	18,841	438,053
Silage, Ensilage	1,200	546,000
Vegetables		
Cantaloupes, etc.	70	104,990
Other & Miscellaneous	956	142,839
Total	57,530	$9,163,886

1/ Gini coefficient ranges from 0 to 1.0. The larger the value, the more concentrated the ownership.

Table 4-2

FORM OF OWNERSHIP BY FARM SIZE, TRUCKEE-CARSON, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
No. of Owners	63	117	110	5	5	0	0	0	300	70.9
Percent	21.0	39.0	36.6	1.6	1.6	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	5	28	22	3	0	0	0	0	58	84.6
Percent	8.6	48.2	37.9	5.1	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	2	10	18	0	4	0	0	0	34	92.6
Percent	5.8	29.4	52.9	0.0	11.7	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	8	6	14	1	0	0	0	0	29	99.5
Percent	27.5	20.6	48.2	3.4	0.0	0.0	0.0	0.0	100.0	
500-9,999										
No. of Owners	0	0	0	1	0	1	0	0	2	100.0
Percent	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	100.0	
Totals										
No. of Owners	78	161	164	10	9	1	0	0	423	
Percent	18.4	38.0	38.7	2.3	2.1	0.2	0.0	0.0	100.0	

Table 4-3

LAND BY OWNERSHIP, TRUCKEE-CARSON, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	3343	10334	4810	246	234	0	0	0	18967	37.9
Percent	17.6	54.4	25.3	1.2	1.2	0.0	0.0	0.0	100.0	
Average									63.2	
100-179										
Acres	758	5095	2939	508	0	0	0	0	9300	56.5
Percent	8.1	54.7	31.6	5.4	0.0	0.0	0.0	0.0	100.0	
Average									160.3	
180-259										
Acres	478	4051	3808	0	749	0	0	0	9086	74.7
Percent	5.2	44.5	41.9	0.0	8.2	0.0	0.0	0.0	100.0	
Average									267.2	
260-499										
Acres	2612	1568	4013	213	0	0	0	0	8406	91.5
Percent	31.0	18.6	47.7	2.5	0.0	0.0	0.0	0.0	100.0	
Average									289.8	
500-9,999										
Acres	0	0	0	394	0	4067	525	0	4986	100.0
Percent	0.0	0.0	0.0	7.9	0.0	81.6	10.5	0.0	100.0	
Average									1662.0	
Totals										
Acres	7191	21048	15570	1361	983	4067	521	0	50741	
Percent	14.1	41.4	30.6	2.6	1.9	8.0	1.0	0.0	100.0	
Average	92.1	130.7	94.9	136.1	109.2	4067.0	521.0	0.0	119.9	

One anomaly occurs in Table 4-3. A trust was reported in the 500-999 acre class interval, however, the total acreage was only 394 acres. This error appears to be the result of expanding the sample data to the entire district. The impact of this error on the district totals is unknown.

Farm Operations

On the average, farm operating units are larger than land ownership units averaging 322 acres vs. 120 acres for TCID. The predominate form of business organization was a partnership with a spouse or other family member with only 4.5 percent of the farms being operated by corporations as shown in Table 4-4.

Forages dominate the crop mix for the district as described in Table 4-5, with only 14 percent of the land planted to cereals and grain. Corn for silage is included under forages. The crop mix changes very little by farm size except for the farms in the largest size interval reporting 100 percent of the land in forages. However, this may also be due to an error in expanding from the sample data.

Labor Force

Full-time farm workers were predominately Caucasian, but with a significant proportion of American Indians or Alaskan Native ethnic origin, 23 percent as indicated in Table 4-6. Job classifications for these employees are shown in Table 4-7. Total number of employees plus operators increase with farm size as would be expected. However, when standardized on a worker per 1,000 acres of land, the labor input decreased rapidly with increasing farm size. Although these data are not adjusted for crop mix, livestock or off-farm employment, the labor per acre in the largest size class of 1.2 per 1,000 acres is worthy of note.

TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes representative of the Truckee-Carson Irrigation District, 160, 320, 640 and 1,280 acres. Following the Interior Proposed Rules and Regulations, these budgets assume a maximum land ownership of 160 acres for an individual owner and 320 acres for husband and wife. Therefore, the 160 acre and 320 acre farms assume full ownership and the 640 and 1,280 acre farm budgets assume 320 acres in full ownership with the balance of the acreage leased-in at the local rate for cash rentals.

The 1978 cash rental rate of $70 per crop acre is low relative to the current market price for land of $1,800 per acre and an excess land value of $410 per acre, thus providing a significant income advantage to any farm operator who rents a high proportion of his land. This is reflected in the farm budget summaries presented in Table 4-8 as well as later in the economies of farm size analysis.

New Operator

The 160 acre farm utilized custom operations for all field work and shows a return to operator labor, management and equity of $-2,952 at the current market land value and $12,565 under the excess land value for a beginning farmer as shown in Table 4-8.

Net returns to operator labor, management and equity increase with farm size under a crop mix that reflects a constant proportion. The return on the 1,280 acre farm is $68,000 under current market land values and $99,278 under excess land values.

Existing Operators

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments.

The estimated turnover rate for farms in the western United States is 2.5 percent per year. On the average a farm is transferred every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Using the average debt-asset ratio of 19.4 percent for all Nevada farms in 1978, farm budgets were modified and the results are shown in Table 4-8.

Due to the higher equity position, the cash flow for existing farmers is significantly higher than for beginning farmers using current market land values and slightly higher than the returns to beginning farmers under the excess land value assumption.

Table 4-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, TRUCKEE-CARSON, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	3	20	97	46	0.	166.	52.
Percent	0.0	1.8	12.0	58.4	27.7	0.0	100.0	
100-179								
No. of Farms	0	0	1	28	2	3.	34.	134.
Percent	0.0	0.0	2.9	82.3	5.8	8.8	100.0	
180-259								
No. of Farms	0	1	2	18	8	0.	29.	211.
Percent	0.0	3.4	6.8	62.0	27.5	0.0	100.0	
260-499								
No. of Farms	0	6	15	11	4	0.	36.	359.
Percent	0.0	16.6	41.6	30.5	11.1	0.0	100.0	
500-999								
No. of Farms	0	2	6	3	0	0.	11.	746.
Percent	0.0	18.1	54.5	27.2	0.0	0.0	100.0	
1,000-9,999								
No. of Farms	1	0	3	0	0	0.	4.	2142.
Percent	25.0	0.0	75.0	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	1	12	47	157	60	3.	280.	322.
Percent	0.3	4.2	16.7	56.0	21.4	1.0	100.0	

Table 4-5

IRRIGATED CROP PATTERNS BY FARM SIZE, TRUCKEE-CARSON, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	498	7555	0	0	58	0	0	8111
Percent	6.1	93.1	0.0	0.0	0.7	0.0	0.0	100.0
100-179								
Total Acres	927	3369	0	0	0	0	0	4296
Percent	21.5	78.4	0.0	0.0	0.0	0.0	0.0	100.0
180-259								
Total Acres	1006	4499	0	23	0	0	0	5528
Percent	18.1	81.3	0.0	0.4	0.0	0.0	0.0	100.0
260-499								
Total Acres	1734	10070	0	0	0	0	0	11804
Percent	14.6	85.3	0.0	0.0	0.0	0.0	0.0	100.0
500-999								
Total Acres	1240	6634	0	0	0	0	0	7874
Percent	15.7	84.2	0.0	0.0	0.0	0.0	0.0	100.0
1,000-1,999								
Total Acres	666	2542	0	0	0	0	0	3208
Percent	20.7	79.2	0.0	0.0	0.0	0.0	0.0	100.0
2,000-9,999								
Total Acres	0	1597	0	0	0	0	0	1597
Percent	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0
Totals								
Total Acres	6071	36266	0	23	58	0	0	42418
Percent	14.3	85.4	0.0	0.0	0.1	0.0	0.0	100.0

Table 4-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, TRUCKEE-CARSON, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	8	3	0	5	0	0
Average	0.0	0.0	0.0	0.0	0.0	0.0
100-179						
No. of Employees	11	10	0	1	0	0
Average	0.3	0.2	0.0	0.0	0.0	0.0
180-259						
No. of Employees	20	14	0	6	0	0
Average	0.6	0.4	0.0	0.2	0.0	0.0
260-499						
No. of Employees	54	41	3	10	0	0
Average	1.5	1.1	0.0	0.2	0.0	0.0
500-999						
No. of Employees	22	16	0	6	0	0
Average	1.8	1.3	0.0	0.5	0.0	0.0
1,000-1,999						
No. of Employees	6	4	1	1	0	0
Average	1.7	1.1	0.2	0.2	0.0	0.0
2,000-9,999						
No. of Employees	3	3	0	0	0	0
Average	3.7	3.7	0.0	0.0	0.0	0.0
Totals						
No. of Employees	124	91	4	29	0	0
Percent	100.0	73.3	3.2	23.3	0.0	0.0

Table 4-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, TRUCKEE-CARSON, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor/ 1,000 Acres
1-99							
No. of Workers	3	0	5	8	166	174	20.2
Average/Farm	0.	0.	0.	0.	1.0	1.0	
100-179							
No. of Workers	0	3	9	12	35	47	10.0
Average/Farm	0.	0.	0.2	0.3	1.0	1.3	
180-259							
No. of Workers	0	4	16	20	29	49	7.9
Average/Farm	0.	0.1	0.5	0.6	0.9	1.6	
260-499							
No. of Workers	8	10	36	54	36	90	7.0
Average/Farm	0.2	0.2	1.0	1.5	1.0	2.5	
500-999							
No. of Workers	3	2	16	21	11	32	3.6
Average/Farm	0.2	0.1	1.3	1.7	0.9	2.7	
1,000-1,999							
No. of Workers	1	1	3	5	4	9	2.0
Average/Farm	0.2	0.2	0.8	1.4	1.1	2.5	
2,000-9,999							
No. of Workers	0	2	2	4	1	5	1.2
Average/Farm	0.	2.5	2.5	5.0	1.2	6.2	
Totals							
No. of Workers	15	22	87	124	282	406	

Table 4-8

Truckee-Carson

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	105	Land	$288,000
	Corn Silage	8	Machinery	8,500
	Pasture	7	Total	$296,500
	Wheat	30		
	Farmstead	10		
	Total	160		

Financial Summary

Land at Current Market Value ($1,800 Per Acre)

Beginning Farmers		Existing Farmers	
Gross Sales	$38,968	Gross Sales	$38,968
Expenses	41,920	Expenses	25,596
Return to Operator Labor, Mgt., & Equity	$-2,2952	Return to Operator Labor, Mgt., & Equity	$13,372

Land at Excess Land Value ($410 Per Acre)

Beginning Farmers	
Gross Sales	$38,968
Expenses	26,402
Return to Operator Labor, Mgt., & Equity	$12,566

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	213	Land	$576,000
	Corn Silage	15	Machinery	45,925
	Pasture	15	Total	$621,925
	Wheat	61		
	Farmstead	16		
	Total	320		

Financial Summary

Land at Current Market Value ($1,800 Per Acre)

Beginning Farmers		Existing Farmers	
Gross Sales	$78,638	Gross Sales	$78,638
Expenses	72,537	Expenses	37,651
Return to Operator Labor, Mgt., & Equity	$ 6,101	Return to Operator Labor, Mgt., & Equity	$40,987

Land at Excess Land Value ($410 Per Acre)

Beginning Farmers	
Gross Sales	$78,638
Expenses	41,501
Return to Operator Labor, Mgt., & Equity	$37,137

Table 4-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	426	Land	$576,000
	Corn Silage	30	Machinery	93,439
	Pasture	30	Total	$669,439
	Wheat	122		
	Farmstead	32		
	Total	640		

Financial Summary

Land at Current Market Value ($1,800 Per Acre)

Beginning Farmers		Existing Farmers	
Gross Sales	$157,277	Gross Sales	$157,277
Expenses	125,041	Expenses	87,713
Return to Operator Labor, Mgt., & Equity	$ 32,236	Return to Operator Labor, Mgt., & Equity	$ 69,564

Land at Excess Land Value ($410 Per Acre)

Beginning Farmers	
Gross Sales	$157,277
Expenses	94,005
Return to Operator Labor, Mgt., & Equity	$ 63,272

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	852	Land	$576,000
	Corn Silage	60	Machinery	160,236
	Pasture	60	Total	$736,236
	Wheat	244		
	Farmstead	64		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,800 Per Acre)

Beginning Farmers		Existing Farmers	
Gross Sales	$314,554	Gross Sales	$314,554
Expenses	246,312	Expenses	205,457
Return to Operator Labor, Mgt., & Equity	$ 68,242	Return to Operator Labor, Mgt., & Equity	$109,097

Land at Excess Land Value ($410 Per Acre)

Beginning Farmers	
Gross Sales	$314,554
Expenses	215,276
Return to Operator Labor, Mgt., & Equity	$ 99,278

ECONOMIES OF SIZE

The machinery complements specified by the farmer panel were used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 4-1 and 4-2 show the SRAC which includes operator labor at market wage rates for each farm size. A long-run average cost curve (LRAC) can only be developed when all unused capacity in a fixed plant is utilized. To approximate a LRAC, the machinery complement for each farm size was held constant but additional land was added to the base farm size until the engineering design capacity of the machinery complement was exhausted. These SRAC are presented in Figures 4-1 and 4-2.

Figures 4-1 and 4-2 show the SRAC when the acreage constraint is relaxed and farm size is limited by the machinery capacity. Only the 1,280 acre farm had a significant excess machinery capacity as indicated by the 3,664 acres of crop land which could be operated by this machine complement. The costing of land at its excess land value causes very large shifts in the cost and return situation.

When an envelope curve is fitted to the minimum SRAC, a LRAC or planning curve is developed as shown in Figure 4-3 for current market land values (with project) and excess land values (without project). The major difference between the two land values is reflected in the spread between the two LRAC at the left end of the scale.

In general, most of the economies of size are captured when farm size is in the 320-350 acre range and gross sales are approximately $70,000 to $80,000 in 1978 prices and excess land values.

PRICE AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 4-9.

Table 4-9

Standard Deviations of Price, Yield and Gross Income by Crop
Truckee-Carson Irrigation District

Crop	Yield	Price	Gross Income Per Acre
Alfalfa Hay	.434 ton	$ 3.928/ton	$17.00
Corn	17.864 bu.	.396/bu.	25.05
Oats	9.444 bu.	.215/bu.	22.17
Wheat	13.188 bu.	.241/bu.	25.93
Other Hay	1.197 ton	12.645/ton	64.28
Irrigated Pasture	1.455 a.u.m.	1.579/a.u.m.	14.78
Silage	0.943 ton	1.176/ton	17.70

To indicate the variability of farm income and costs, the data in Table 4-9 were combined based on the proportion of land in each crop for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 4-4.

As indicated in Table 4-9, almost all the crops grown in the district are relatively stable income crops and this is reflected in the narrow band width for all farm sizes. Assuming gross incomes are normally distributed, average cost per dollar of gross sales (ATC) can be expected to fall within the width of the band about 67 percent of the time or two out of three years.

DEMAND FOR IRRIGATION WATER

Demand for irrigation water depends on the profitability of the crops that can be grown in an area, their consumptive use, irrigation method and water cost. A weighted average demand curve for the Truckee-Carson District was estimated using a linear programming model and is shown in Figure 4-5. The dashed vertical line depicts the historic average diversion of 3.38 acre feet per acre in the district. The asterisk on the dashed vertical line represents the

FIGURE 4–1
TRUCKEE–CARSON IRRIGATION DISTRICT
NEWLANDS–NEVADA
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

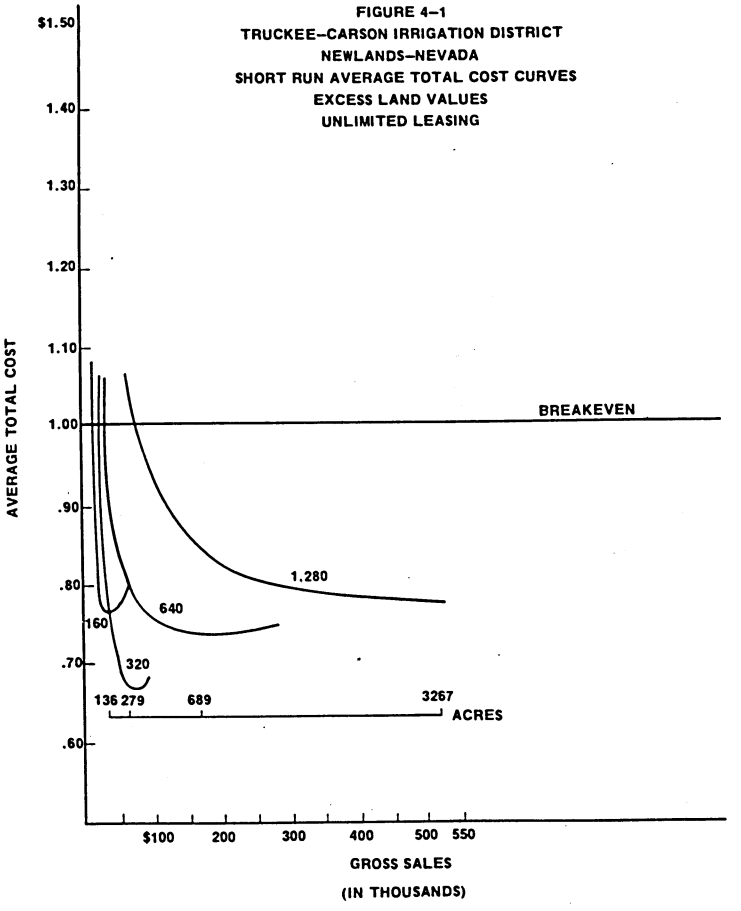


FIGURE 4–2
TRUCKEE–CARSON IRRIGATION DISTRICT
NEWLANDS–NEVADA
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
UNLIMITED LEASING

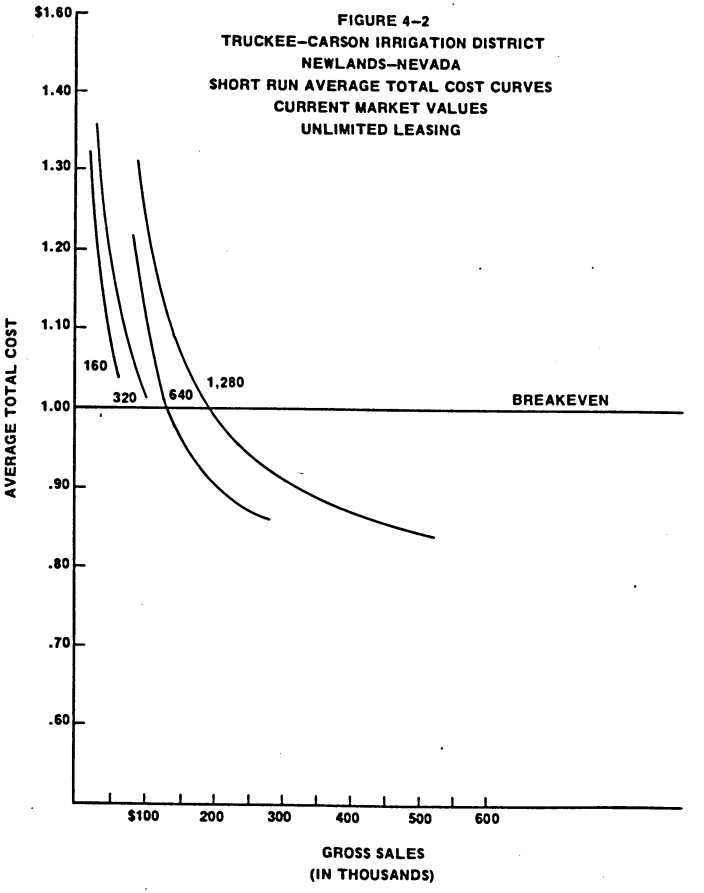


FIGURE 4–3
TRUCKEE–CARSON IRRIGATION DISTRICT
NEWLANDS–NEVADA
LONG RUN PLANNING AVERAGE COST CURVE
UNLIMITED LEASING

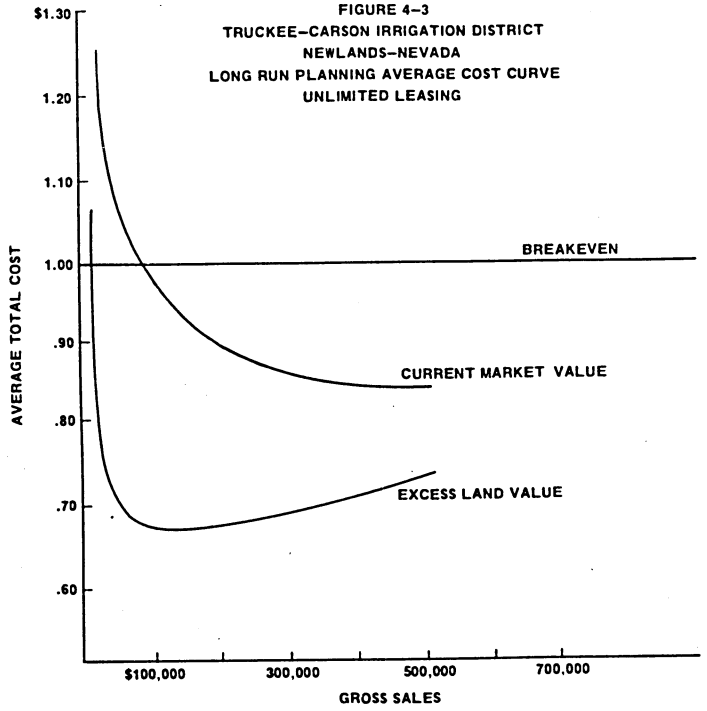
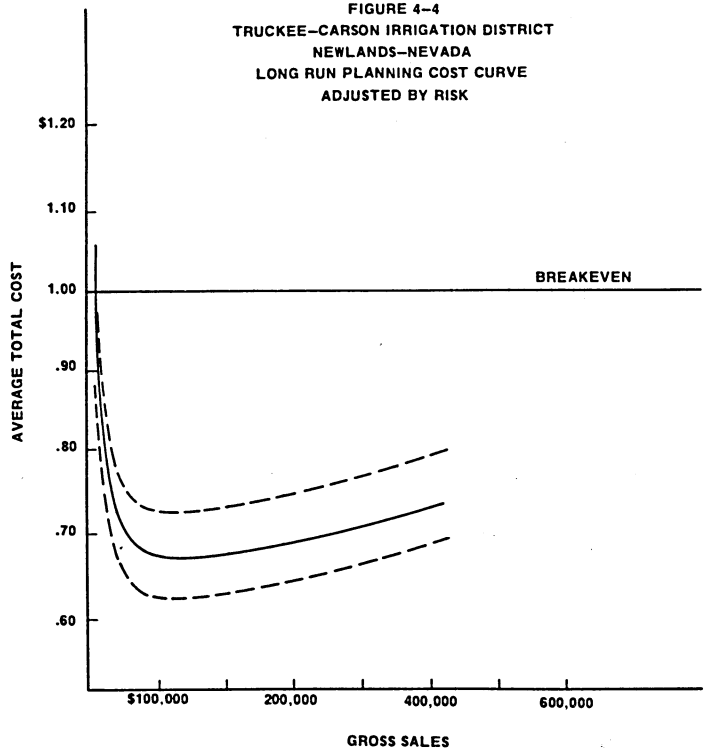


FIGURE 4–4
TRUCKEE–CARSON IRRIGATION DISTRICT
NEWLANDS–NEVADA
LONG RUN PLANNING COST CURVE
ADJUSTED BY RISK



1978 average cost per acre foot delivered to farm headgates of $2.19. This price can be compared with BOR estimated full-cost price of $37.06 per acre foot.

The downward sloping stepped curve reflects the optimum quantity of water as the price/cost of water is varied from 0 to $80 per acre foot. This demand curve is quite steep and inelastic primarily due to the limited number of crops adapted to the short growing season in the area. Based on this demand curve, raising water costs to BOR's full-cost price would reduce water use by about one-third.

The impact of increased water prices on farm income is shown in Figure 4-6. The negatively sloped curve for each farm size plots the net returns over variable costs including water cost. These curves approximate a straight line because of the limited number of crops grown in the district. Horizontal dashed lines represent the level of fixed costs for each farm size assuming excess land values. The level of the fixed costs would be significantly higher if current market land values were shown; however, if Department of the Interior were to attempt recapture of irrigation subsidies, the excess land value would represent the land cost relevant to the maximum ability to pay. Figure 4-6 indicates that the maximum ability to pay exceeds the WPRS full-cost price for all farm sizes.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Churchill County, Nevada reports 316 farms with gross agricultural sales of $2,500 or more. Table 4-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 4-10

Farm Operators Reporting Days Work Off-Farm

None	121
1 - 49 days	16
50 - 99 days	1
100 - 149 days	21
150 - 199 days	21
200 days or more	69
Total	249

Income and expenses related to selected off-farm income sources are shown in Table 4-11.

Table 4-11

Operator Income From Farm Related Sources, Churchill County

Number of Farms Reporting	77
Average Per Farm Reporting	$233
Income From Custom Work	
Number of Farms Reporting	47
Average Per Farm Reporting	$174
Expenses Related to Off-Farm Income	
Number of Farms Reporting	21
Average Per Farm Reporting	$ 91

Farm operators' spouses and their children also contribute to family income. In Churchill County, 199 farms reported an average family off-farm income of $2,165 in 1974. No information is available on off-farm income by size of farm.

FIGURE 4–5
DEMAND FOR IRRIGATION WATER
TRUCKEE – CARSON

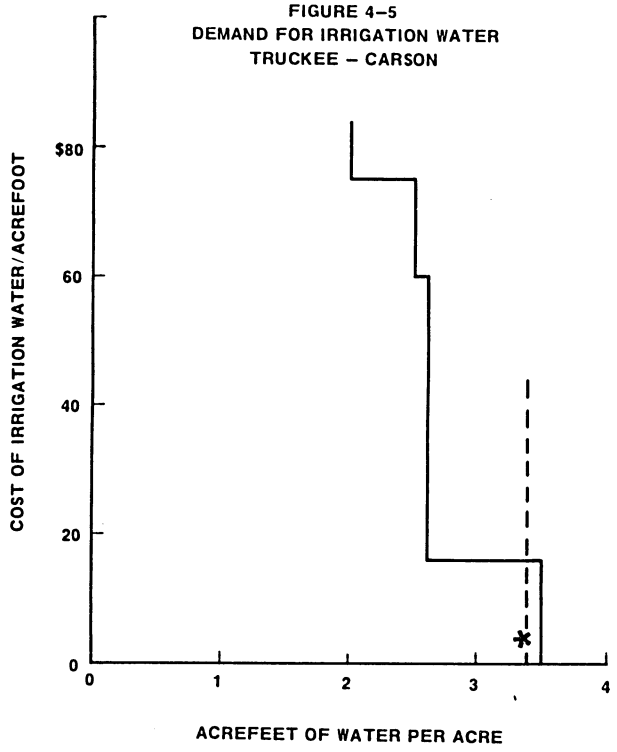
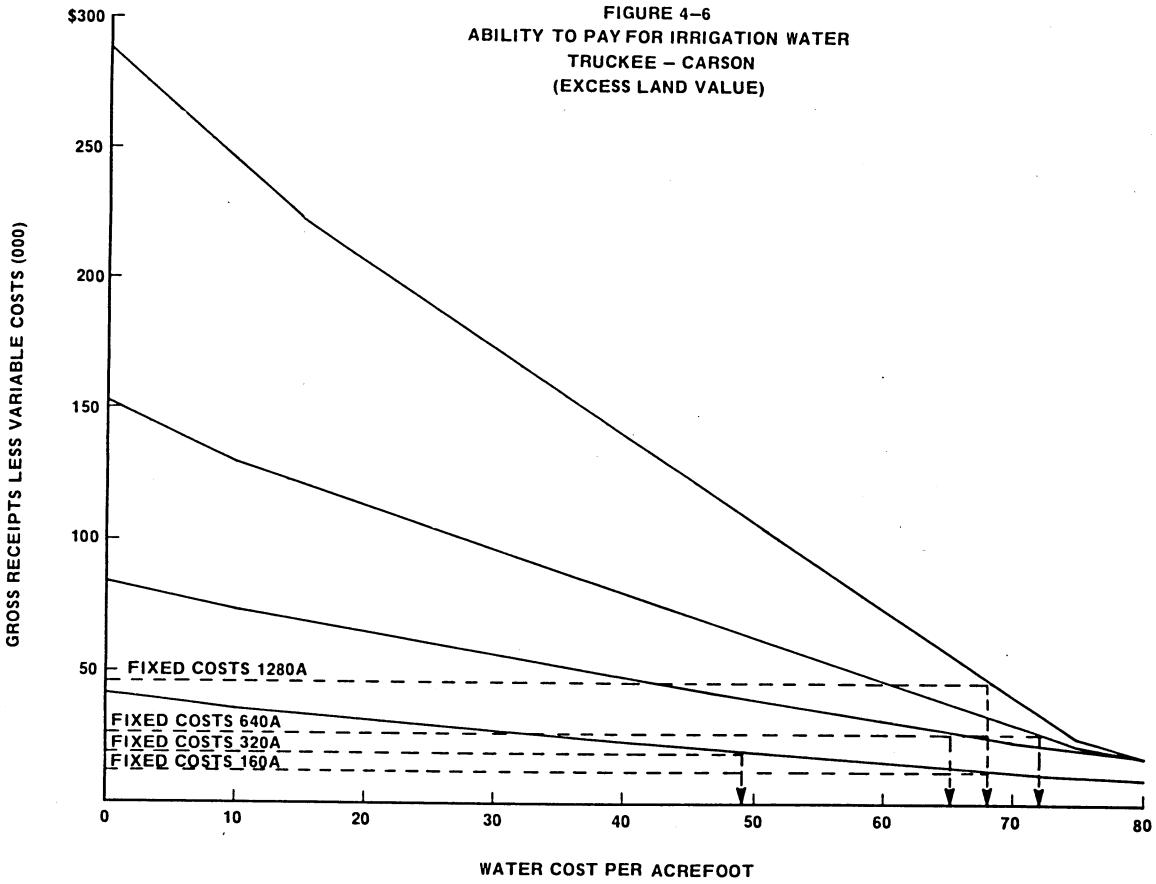


FIGURE 4–6
ABILITY TO PAY FOR IRRIGATION WATER
TRUCKEE – CARSON
(EXCESS LAND VALUE)



CHAPTER 5

Grand Valley, Colorado
Garfield Gravity District

The Grand Valley project is located in western Colorado in Mesa County and draws its water supply from the Colorado River.

CLIMATE

With lands in the unit ranging in elevation from about 4,400 to 4,700 feet above sea level, the unit has a weighted average frost-free growing period of 153 days. Precipitation averages about 8.45 inches per year which means ample supplies of irrigation water are required for an intensive agriculture.

SOILS

Soils of the Grand Valley have primarily an alluvial origin. In general, most soils in the Valley are deep and are sufficiently permeable with subsurface drainage to allow growth of climatically adaptable crops with high yields under proper management. However, in certain areas, usually near the river, poor drainage has caused an accumulation of shallow groundwater and harmful salts.

CROPS

Crop acreage as shown in Table 5-1 indicate the heavy dependence of the Valley on corn and alfalfa hay, about 52 percent of the total. Until recently sugar beets were also important; however, the local sugar mill closed due to economic reasons. Closing of the sugar mill has in turn caused a search by farm operators for an alternative high-value crop which thus far has not been completely successful. The preponderance of corn and forage crops are reflected in the farm budgets presented below.

Table 5-1

Crop Acreage, Grand Valley-Garfield Gravity, Colorado, 1977

Crop	Acres	Value of Production
Cereals		
Corn	4,622	$1,110,478
Other	4,210	781,221
Forage		
Alfalfa Hay	6,039	1,873,040
Irrigated Pasture	1,170	39,578
Silage	2,683	784,000
Other	877	131,850
Miscellaneous Field Crops	144	53,740
Miscellaneous Vegetables	32	55,050
Seed Crops		
Alfalfa	319	235,900
Corn	203	64,354
Other	8	1,920
Fruit	186	251,200
Total	20,493	$5,382,331

LAND TENURE

Ownership of land in Grand Valley is widely dispersed with about 85 percent (290 out of 342 units) of the ownership units in the 1-99 acre size group (see Tables 5-2 and 5-3). No ownership parcels exceed 500 acres in size. The Gini coefficient was estimated at 0.06.[1/] Family type ownerships dominate the ownership structure with land held jointly with a spouse and multiple family arrangements constituting 82 percent of the units and 83 percent of the acreage. Twenty-three ownership units were held by nonfamily corporations, but they were relatively small containing about 3 percent of the land in the district.

Farming Operations

While the average ownership unit was approximately 59 acres, the average operating unit was 146 acres as shown in Table 5-4. The dominate type of business organization for farm operations was a husband and wife arrangement. Over 70 percent of the farms operated in this manner.

Forages and cereal grains were planted to 95 percent of the acreage in the district. Crop mix by farm size data shown in Table 5-5 indicate that the smallest and largest size groups had a significantly higher proportion of land in forages, about 65 percent, than the farms over 100 acres, but less than 500 acres.

Labor Force

Full-time employees were grouped according to ethnic background by farm size as shown in Table 5-6. Data were collected on job categories and added to the number of farm operators to obtain information on the composition and number of workers on farms in the district. The average number of workers per farm increased with farm size but not in the same proportion, as shown in the two right-hand columns in Table 5-7. When total number of workers was standardized on a per 1,000 acre basis, the labor input decreases rapidly as farm size increases. An input of 3.7 laborers per 1,000 acres in the 500 to 999 acre size group is significantly lower than the smaller farm sizes. However, these data are not adjusted for part-time employment, off-farm work, custom operations or the number of livestock raised by the farm.

RESULTS OF TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes representative of the Grand Valley field crop farms, 160, 320, 640 and 1,280 acres. Following the Interior's Proposed Rules and Regulations, these farm budgets assume full ownership for the 160 acre and 320 acre farms. For the 640 and 1,280 acre farms, all land in excess of 320 acres per farm was assumed to be leased-in at the local rate for cash rentals or crop share lease converted to a cash equivalent.

The 1978 cash rental rate of $62 per acre is quite low compared with the current market price for land of $1,900 per acre and an excess land value of $600 per acre. In fact, some land near the City of Grand Junction was selling for as much as $3,500 per acre. Therefore, budgets for farms with a high proportion of rented land, i.e., the 640 and 1,280 acre farm budgets, have a distinct cost advantage over the full ownership farms.

New Operators

Although the proportion of crops for the four farm budgets is approximately the same, the larger two farms have a slightly higher proportion of the land in corn which is a relatively profitable crop and a smaller proportion in barley, a relatively low-profit crop.

Returns to operator labor and management for all farm sizes for both land values (current market and excess) are very low or negative except for the 1,280 acre farm, as shown in Table 5-8. Only the 1,280 acre farm using excess land values shows a significant positive return to operator labor and management, $12,467.

Existing Farmers

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments.

The estimated turnover rate for farms in the western United States is 2.5 percent per year or on the average, a farm is transferred every 40 years. Assuming the average farm was purchased

---

1/ Gini coefficient ranges from 0. to 1.0. The larger the coefficient, the more concentrated the ownership.

Table 5-2

FORM OF OWNERSHIP BY FARM SIZE, GRAND VALLEY, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
No. of Owners	30	151	86	0	15	8	0	0	290	84.8
Percent	10.3	52.0	29.6	0.0	5.1	2.7	0.0	0.0	100.0	
100-179										
No. of Owners	5	21	20	0	0	0	0	0	46	98.2
Percent	10.8	45.6	43.4	0.0	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	0	0	4	0	0	0	0	0	4	99.4
Percent	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	2	0	0	0	0	0	0	0	2	100.0
Percent	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	37	172	110	0	15	8	0	0	342	
Percent	10.8	50.2	32.1	0.0	4.3	2.3	0.0	0.0	100.0	

Table 5-3

LAND BY OWNERSHIP, GRAND VALLEY, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	1175	8257	3559	0	207	412	0	0	13610	67.4
Percent	8.6	60.6	26.1	0.0	1.5	3.0	0.0	0.0	100.0	
Average									46.9	
100-179										
Acres	594	2097	2256	0	0	0	0	0	4947	91.9
Percent	12.0	42.3	45.6	0.0	0.0	0.0	0.0	0.0	100.0	
Average									107.5	
180-259										
Acres	95	0	713	0	0	0	0	0	808	95.9
Percent	11.7	0.0	88.2	0.0	0.0	0.0	0.0	0.0	100.0	
Average									202.0	
260-499										
Acres	850	0	0	0	0	0	0	0	850	100.0
Percent	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									425.0	
Totals										
Acres	2714	10354	6528	0	207	412	0	0	20215	
Percent	13.4	51.2	32.2	0.0	1.0	2.0	0.0	0.0	100.0	
Average	73.3	60.1	59.3	0.0	13.8	51.5	0.0	0.0	59.1	

Table 5-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, GRAND VALLEY, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Indi-vidually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	0	4	66	8	0	78	49
Percent	0.0	0.0	5.1	84.6	10.2	0.0	100.0	
100-179								
No. of Farms	0	0	7	20	3	0	30	136
Percent	0.0	0.0	23.3	66.6	10.0	0.0	100.0	
180-259								
No. of Farms	0	1	6	10	2	0	19	217
Percent	0.0	5.2	31.5	52.6	10.5	0.0	100.0	
260-499								
No. of Farms	0	0	9	10	1	0	20	314
Percent	0.0	0.0	45.0	50.0	5.0	0.0	100.0	
500-999								
No. of Farms	0	0	2	0	1	0	3	599
Percent	0.0	0.0	66.6	0.0	33.3	0.0	100.0	
Totals								
No. of Farms	0	1	28	106	15	0	150	146
Percent	0.0	0.6	18.6	70.6	10.0	0.0	100.0	

Table 5-5

IRRIGATED CROP PATTERNS BY FARM SIZE, GRAND VALLEY, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	1111	2136	0	20	39	0	0	3306
Percent	33.6	64.6	0.0	0.6	1.1	0.0	0.0	100.0
100-179								
Total Acres	1916	1917	44	1	111	0	0	3989
Percent	48.0	48.0	1.1	0.0	2.7	0.0	0.0	100.0
180-259								
Total Acres	1652	1709	93	15	99	0	0	3568
Percent	46.3	47.8	2.6	0.4	2.7	0.0	0.0	100.0
260-499								
Total Acres	2757	3042	133	124	81	17	0	6154
Percent	44.8	49.4	2.1	2.0	1.3	0.2	0.0	100.0
500-999								
Total Acres	713	1409	0	13	0	0	0	2135
Percent	33.3	65.9	0.0	0.6	0.0	0.0	0.0	100.0
Totals								
Total Acres	8149	10213	270	173	330	17	0	19152
Percent	42.5	53.3	1.4	0.9	1.7	0.0	0.0	100.0

Table 5-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, GRAND VALLEY, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	18	10	8	0	0	0
Average	0.2	0.1	0.1	0.0	0.0	0.0
100-179						
No. of Employees	9	9	0	0	0	0
Average	0.2	0.2	0.0	0.0	0.0	0.0
180-259						
No. of Employees	17	17	0	0	0	0
Average	0.8	0.8	0.0	0.0	0.0	0.0
260-499						
No. of Employees	24	21	3	0	0	0
Average	1.1	1.0	0.1	0.0	0.0	0.0
500-999						
No. of Employees	5	5	0	0	0	0
Average	1.3	1.3	0.0	0.0	0.0	0.0
Totals						
No. of Employees	73	62	11	0	0	0
Percent	100.0	84.9	15.0	0.0	0.0	0.0

Table 5-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, GRAND VALLEY, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees and Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	0	2	16	18	78	96	25.3
Average/Farm	0.	0.	0.2	0.2	1.0	1.2	
100-179							
No. of Workers	2	1	6	9	30	39	9.5
Average/Farm	0.	0.	0.1	0.2	0.9	1.2	
180-259							
No. of Workers	4	4	10	18	20	38	8.8
Average/Farm	0.2	0.2	0.5	0.9	1.0	1.9	
260-499							
No. of Workers	6	2	16	24	20	44	6.9
Average/Farm	0.2	0.	0.7	1.1	0.9	2.1	
500-999							
No. of Workers	0	0	5	5	3	8	3.7
Average/Farm	0.	0.	1.3	1.3	0.8	2.2	
Totals							
No. of Workers	12	9	53	74	151	225	

Table 5-8

Grand Valley Colorado, 1978

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	33	Land	$304,000
	Barley (Irr.)	50	Improvements	14,300
	Corn Silage	20	Machinery	66,923
	Corn	30	Total	$385,223
	Estb. Alfalfa	15		
	Farmstead	12		
	Total	160		

Financial Summary

Land at Current Market Value ($1,900/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$ 33,602	Gross Sales	$33,602
Expenses	49,332	Expenses	25,804
Return to Operator Labor, Mgt., & Equity	$-15,730	Return to Operator Labor, Mgt., & Equity	$ 7,798

Land at Excess Land Value ($600/ac.)

Beginning Farmers	
Gross Sales	$33,602
Expenses	32,993
Return to Operator Labor, Mgt., & Equity	$ 609

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	67	Land	$608,000
	Barley (Irr.)	101	Improvements	38,500
	Corn Silage	40	Machinery	352,188
	Corn	61	Total	$998,688
	Estab. Alfalfa	33		
	Farmstead	18		
	Total	320		

Financial Summary

Land at Current Market Value ($1,900/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$ 68,287	Gross Sales	$68,287
Expenses	103,959	Expenses	55,370
Return to Operator Labor, Mgt., & Equity	$-35,672	Return to Operator Labor, Mgt., & Equity	$12,917

Land at Excess Land Value ($600/ac.)

Beginning Farmers	
Gross Sales	$68,287
Expenses	71,281
Return to Operator Labor, Mgt., & Equity	$-2,994

Table 5-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	140	Land	$608,000
	Barley (Irr.)	200	Improvements	27,900
	Corn Silage	80	Machinery	266,740
	Corn	130	Total	$902,640
	Estb. Alfalfa	70		
	Farmstead	20		
	Total	640		

Financial Summary

Land at Current Market Value ($1,900/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$140,506	Gross Sales	$140,506
Expenses	178,753	Expenses	123,467
Return to Operator Labor, Mgt., & Equity	$-38,247	Return to Operator Labor, Mgt., & Equity	$ 17,039

Land at Excess Land Value ($600/ac.)

Beginning Farmers	
Gross Sales	$140,506
Expenses	146,076
Return to Operator Labor, Mgt., & Equity	$ -5,570

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	271	Land	$608,000
	Barley (Irr.)	388	Improvements	27,900
	Corn Silage	170	Machinery	352,188
	Corn	272	Total	$988,088
	Estb. Alfalfa	140		
	Farmstead	39		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,900/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$283,262	Gross Sales	$283,262
Expenses	303,473	Expenses	243,134
Return to Operator Labor, Mgt., & Equity	$-20,211	Return to Operator Labor, Mgt., & Equity	$ 40,128

Land at Excess Land Value ($600/ac.)

Beginning Farmers	
Gross Sales	$283,262
Expenses	270,795
Return to Operator Labor, Mgt., & Equity	$ 12,467

20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates average 5.5 percent. Farm budgets were modified using the average debt-asset ratio of 19.8 percent for all Colorado farms in 1978. The results are shown in Table 5-8.

ECONOMIES OF SIZE

The machinery complement specified by the farmer panel were designated the "fixed plant" in order to derive short-run average cost curves (SRAC). Figures 5-1 and 5-2 show the SRAC for each farm size with operator labor valued at market wage rates. Figure 5-1 depicts the SRAC using current market land values and Figure 5-2 shows the results when excess land values are used. Acreage representing minimum ATC for each farm size is shown above the base line in Figure 5-2.

The minimum points on these SRAC indicate the profit maximizing crop mix given the fixed machinery complements and market limitations. These results are similar to those shown in the typical farm budgets in Table 5-8 with all farm sizes except the 1,280 acre farm which has a high proportion of leased land. That is, valuing land at its excess land value shifts the LRAC below the current market LRAC.

When an envelope curve is fitted to the minimum SRAC, a LRAC or planning curve is developed as shown in Figure 5-3 for the two land value assumptions. The major impact of the excess land values is reflected at the left-hand side of the LRAC due to the higher proportion of owned land on the smaller farms.

PRICE, YIELD AND INCOME VARIABILITY

A time series of annual prices, yields and gross income (P x Q = Gross Income) was developed for each crop in the farm budgets. The variance and standard deviations were estimated for each (see Table 5-9).

Table 5-9

Standard Deviations of Price, Yield and
Gross Income by Crop, Grand Valley, Colorado

Crop	Yield	Price	Gross Income Per Acre
Alfalfa Hay	0.227 ton	$2.085/ton	$ 7.73
Other Hay	0.341 ton	1.286/ton	5.09
Corn	6.873 bu.	0.145/bu.	8.73
Irr. Pasture	0.489 a.u.m.	0.639/a.u.m.	1.19
Silage	1.171 ton	0.806/ton	19.76
Oats	6.163 bu.	0.055/bu.	6.95
Barley	9.094 bu.	0.270/bu.	10.51

Somewhat surprising, barley and silage show the greatest variability of gross income per acre with irrigated pasture being relatively stable.

To indicate the variability of farm costs and income, the data in Table 5-9 were combined based on the proportion of land in each crop for the minimum points on the SRAC. Total costs were then divided by plus or minus one standard deviation of gross sales and plotted about the LRAC in Figure 5-4.

DEMAND FOR IRRIGATION WATER

A linear programming model was used to estimate the impact of large increases in the cost of water. A schedule of prices/costs and water quantities was developed for each farm size. These data were used to develop a weighted average demand schedule over the price/cost range of $0 to $45/acre foot for Grand Valley. The results of this analysis are presented in Figure 5-5. The solid sloped line is the optimum quanity of water for each water price and indicates that at the 1978 average cost to farm headqates of $1.18 per acre foot (the asterisk *), farm operators could productively use an additional 0.8 acre feet per acre than is currently allocated. The

FIGURE 5–1
GRAND VALLEY, COLORADO
UNLIMITED LEASING – CURRENT MARKET LAND VALUES

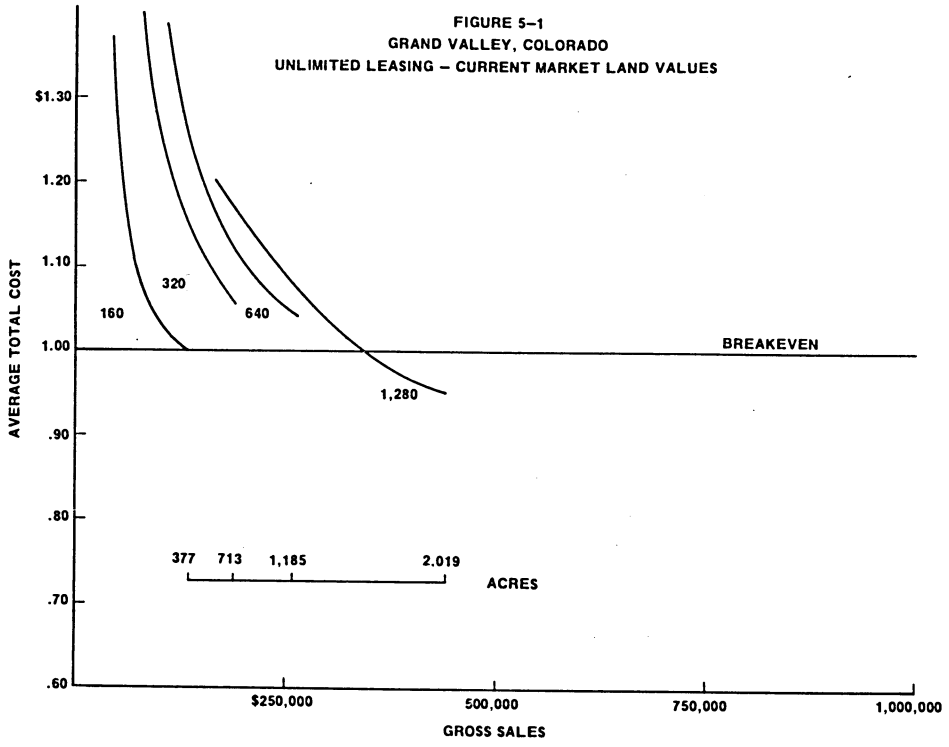


FIGURE 5–2
GRAND VALLEY, COLORADO
SHORT RUN AVERAGE COSTS, UNLIMITED LEASING
EXCESS LAND VALUE

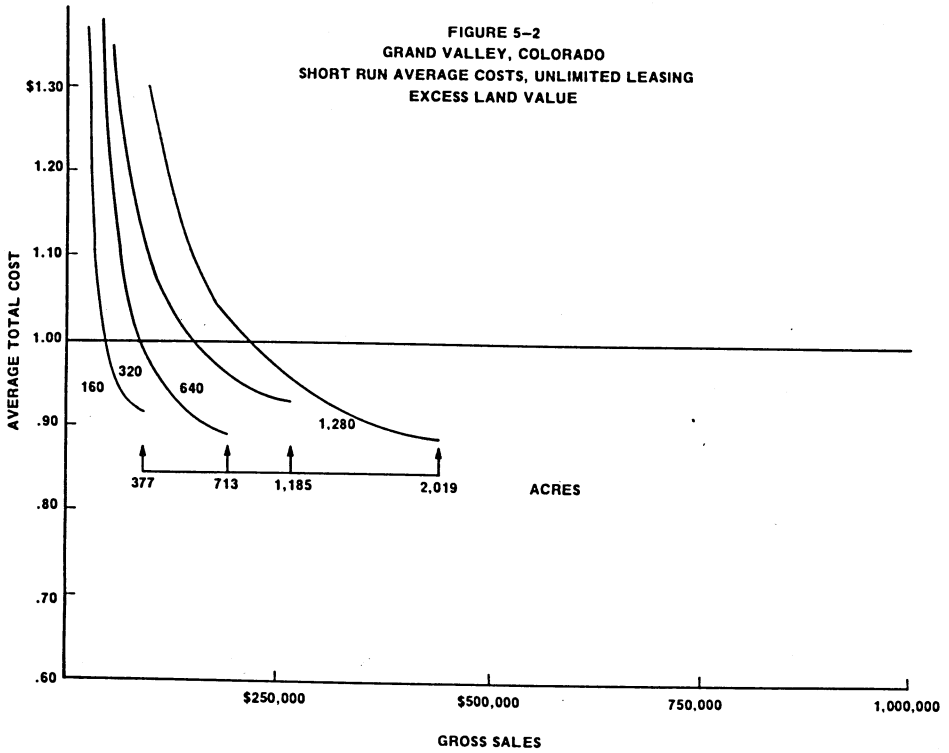


FIGURE 5–3
GRAND VALLEY, COLORADO
UNLIMITED LEASING
PLANNING CURVE

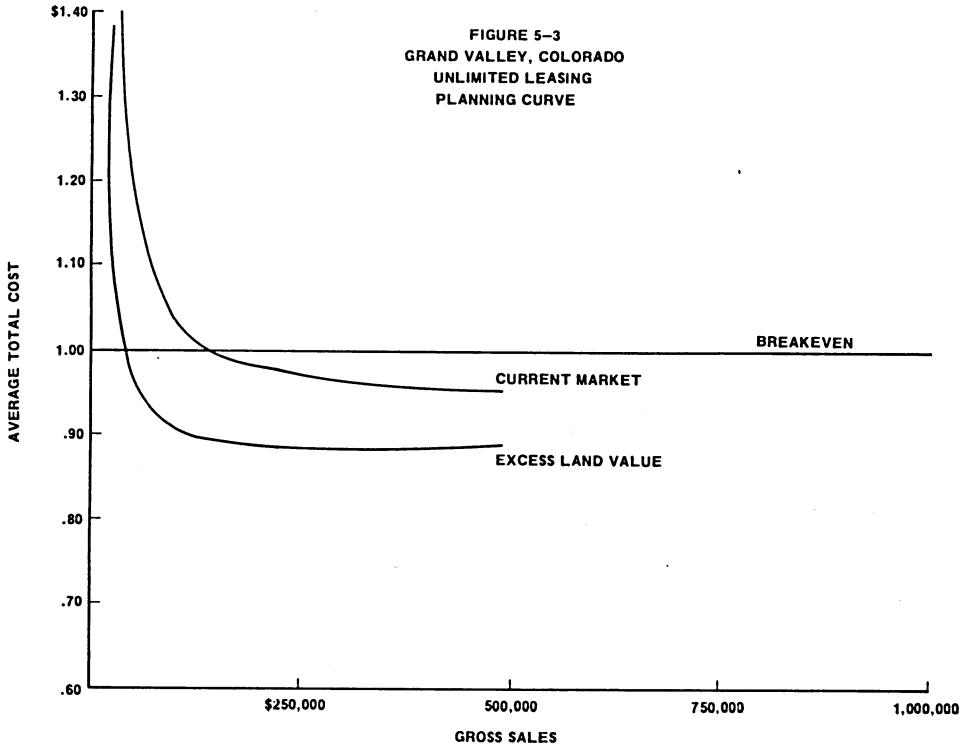
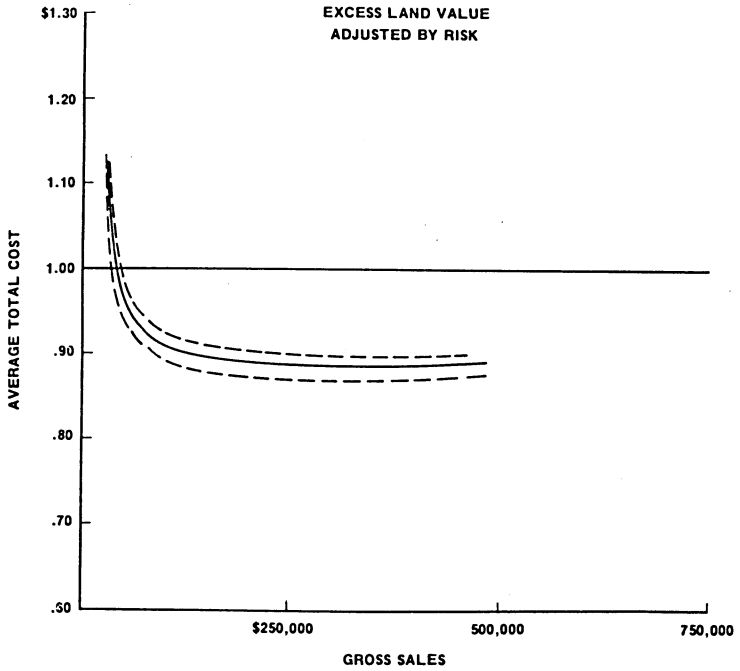
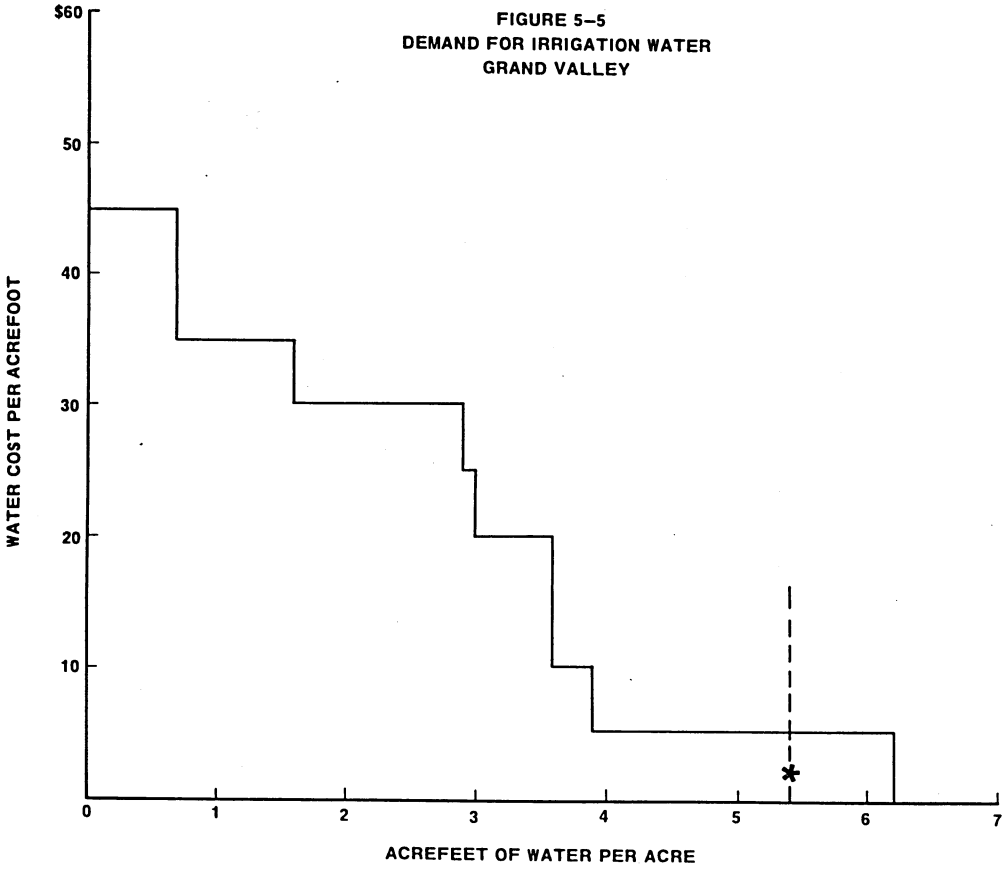


FIGURE 5–4
GRAND VALLEY (COLORADO)
UNLIMITED LEASING PLANNING CURVES
EXCESS LAND VALUE
ADJUSTED BY RISK



vertical dashed line indicates the historic average diversion of 5.4 acre feet per acre. If BOR attempted to recapture the irrigation subsidy by charging the full water cost of $31.10 per acre foot, water use would be expected to decline to about 1.5 acre feet per acre. This would cause a significant shift in the crop pattern and farm income.

FIGURE 5-5
DEMAND FOR IRRIGATION WATER
GRAND VALLEY



Impacts of increased water prices on farm income are shown in Figure 5-6 for each farm size. The dish shaped curve represents the net returns over variable cost including water cost. Fixed costs are indicated by the horizontal dashed lines and a vertical line dropped to the axis from the intersection of the net returns curve and the fixed cost line graphically shows the maximum ability to pay for water. Due to economies of size the maximum ability to pay increases with farm size as shown in Figure 5-6. Since the fixed cost levels assume excess land values, water costs greater than the maximum ability to pay values could cause farm operators to revert to dry-land farming or grazing.

OFF-FARM INCOME

In Mesa County, Colorado off-farm work for farm operators is not an important source of income. Table 5-10 shows data taken from the 1974 Census of Agriculture for the county. For the 761 farms in the county, only 193 reported off-farm income from agriculturally related employment and only 98 reported doing custom work. Of those reporting custom work, the average income per reporting farm was $450 (see Table 5-11).

Table 5-10

Farm Operators Reporting Days Work Off-Farm

None	249
1 - 49	70
50 - 99	26
100 - 149	19
150 - 199	46
200 and Over	165
Total	575

FIGURE 5-6
ABILITY TO PAY FOR IRRIGATION WATER
GRAND VALLEY
(EXCESS LAND VALUE)

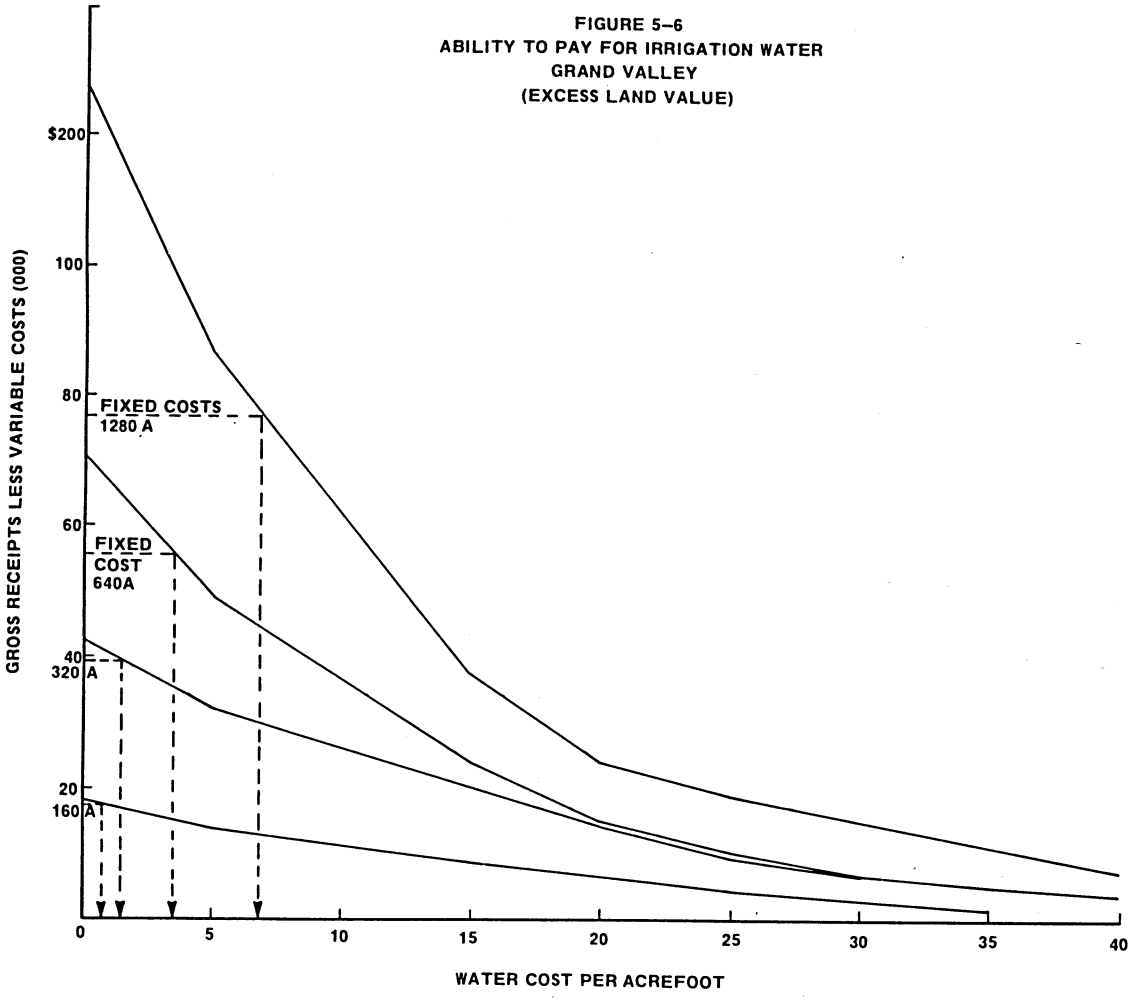


Table 5-11

Operator Income From Farm Related Sources
Mesa County, Colorado

Number of Farms Reporting	193
Average Per Farm Reporting	$890
Income From Custom Work	
Number of Farms Reporting	98
Average Per Farm Reporting	$450
Total Family Income Off-Farm	
Number of Farms Reporting	491
Average Per Farm Reporting	$5,206

The $5,206 per farm reported family off-farm income is quite significant given that 491 or 65 percent of the farms reported income in this category. Given the rapidly growing metropolitan area in nearby Grand Junction, this is not surprising. Further, this income would tend to assist small and beginning farmers build up equity and expand existing operations.

CHAPTER 6

Farwell Irrigation District, Nebraska

The 50,000 acre Farwell District is located in Central Nebraska primarily in Howard County. The district has a full water supply contract with the Water and Power Resources Service and is served by the Sherman Reservoir.

CLIMATE

The average frost-free (32° F) growing season in the Farwell District is 149 days which limits the adaptability of certain temperature sensitive crops. Precipitation averages 23.8 inches per year which allows considerable dryland farming to be conducted in conjunction with irrigated field crops. Both dryland and irrigated crops are reflected in the typical farm budget below.

SOILS

Soils in the district are highly variable and require extensive leveling for surface irrigation. With the advent of center pivot sprinkler systems, significantly less leveling is required to bring land under irrigation.

The BOR has classified irrigable land into three categories:

Class 1		19,922 acres
Class 2		23,369 acres
Class 3		6,760 acres
	Total	50,051

CROPS

Field corn is the dominate crop in the district, occupying 42,000 acres or about 89 percent of the irrigated acreage (see Table 6-1). Corn silage, alfalfa hay and soybeans make up most of the balance of the remaining irrigated acreage in the district.

Table 6-1

Crop Acreages, P.S.M.B.P. Middle Loop Division, Farwell District, Nebraska, 1977

Crop	Acres	Value of Production
Cereals		
Corn	42,053	$7,632,601
Forage		
Alfalfa Hay	1,762	264,240
Silage, Ensilage	2,003	547,355
Stubble Stalks, etc.	---	93,880
Miscellaneous Field Crops		
Soybeans	1,316	212,582
Other & Miscellaneous	1,258	173,876
Total	48,392	$8,924,534

Major dryland crops grown in the district include corn for grain, wheat, alfalfa hay and grain sorghum. All of these crops are included in the typical farm budgets shown below.

LAND TENURE

Ownership of land in Farwell District is slightly more concentrated than the four previous districts discussed with a Gini coefficient of 0.38.[1/] As shown in Tables 6-2 and 6-3, 1.8 percent of the largest owners control 6.9 percent of the land while 73.7 percent of the smallest owners control 54.6 percent of the land.

Most of the 547 ownerships, 58 percent, are held by husband and wife, whereas no land is owned by a nonfamily corporation.

Farm Operations

Farm operating units through leasing are larger than ownership units averaging 200 acres as compared to only 89 acres per owner. As with land ownership, a majority, 67 percent of the farms in Farwell District are operated jointly by a husband and wife (see Table 6-4). Two small farms (less than 100 acres) are operated under a corporate form of business organization.

As indicated in Table 6-1, the crop pattern of the district is dominated by cereals, mostly corn, with the proportion of land in cereals varying only slightly by farm size. The balance of the crop mix is made up of forages and soybeans as shown in Table 6-5.

Another indication of the small average size of farms in the district is that only 35 regular hired workers were reported on the 282 district farms (see Table 6-6); all of these were Caucasian.

All of the regular employees reported in the survey were classified as nonsupervisory laborers as shown in Table 6-7. These hired workers when combined with the farm operators provide a picture of the total labor supply by farm size. The right-hand column in the table shows the labor input standardized on a laborer per 1,000 acres basis. As expected, the input declines as farm size increases especially between the first two size groups. The largest farm size group, 500-999 acres, reported a labor input of 2.3 per 1,000 acres, the lowest in the district. These data should be used with caution because they have not been adjusted for off-farm employment, temporary employees, custom work or any livestock or dryland operations on these farms.

TYPICAL FARM BUDGETS

In conformance with current Interior regulations which limits ownership of irrigable land receiving project water, budgets for four farm sizes representative of typical operations in the district were developed. Irrigable acreage on each farm size was limited to 160, 640 and 1,280 acres of land. An additional amount of dryland was assumed in order to allow for spreading fixed costs over both irrigated and nonirrigated crop enterprises typical of farm units in the district.

Based on the Interior proposed regulations, these budgets assume full ownership for all irrigable land up to 320 acres. Further, it was assumed that all dryland was owned. Due to the low cash rental rates in relation to the current market value of irrigated land, the larger farms with higher proportions of leased land have a significant cost advantage over the smaller fully owned farms.

The typical farms based on the farmer panel's recommendations reflects a highly diversified cropping pattern. All of the irrigated land is planted to corn with a mix of dryland wheat, grain, sorghum, alfalfa hay and pasture. Table 6-8 shows the assumed crop mix, initial investment and return to farm operator's labor, management and equity by size of farm.

Beginning Farmer

For the beginning operator, net returns are negative for all farm sizes under current market land values ($1,200 per acre) or under excess land values ($1,100 per acre). Because of the joint overhead costs and the changing proportion of irrigated and dryland, it is impossible to determine the effect of crop mix and farm size on farm income.

Existing Farmer

The farm budgets were further modified to reflect the cash flow position of existing farmers who purchased land at some previous time at lower land prices and interest rates. Due to land value appreciation, repayment of loan principal and retained earnings, these existing owners have a higher equity.

The estimated turnover rate for farms in the western United States is 2.5 percent of every 40 years. Assuming the average farm was purchased 20 years ago (40 ÷ 2 = 20) existing farms

---

1/ Gini coefficient ranges from 0 to 1.0. The higher the Gini value, the more concentrated the ownership.

Table 6-2

FORM OF OWNERSHIP BY FARM SIZE, FARWELL, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
No. of Owners	69	237	95	0	0	0	0	2	403	73.7
Percent	17.1	58.8	23.5	0.0	0.0	0.0	0.0	0.4	100.0	
100-179										
No. of Owners	42	63	11	2	0	0	0	0	118	95.3
Percent	35.5	53.3	9.3	1.6	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	4	12	0	0	0	0	0	0	16	98.2
Percent	25.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
260-999										
No. of Owners	6	4	0	0	0	0	0	0	10	100.0
Percent	60.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	121	316	106	2	0	0	0	2	547	
Percent	22.1	57.7	19.3	0.3	0.0	0.0	0.0	0.3	100.0	

Table 6-3

LAND BY OWNERSHIP, FARWELL, 1978

Farm Size Acres	Indi-ividual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal State, or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	3475	20405	2671	0	0	0	0	50	26601	54.6
Percent	13.0	76.7	10.0	0.0	0.0	0.0	0.0	0.1	100.0	
Average									66.0	
100-179										
Acres	5634	8415	1550	398	0	0	0	0	15997	87.4
Percent	35.2	52.6	9.6	2.4	0.0	0.0	0.0	0.0	100.0	
Average									135.5	
180-259										
Acres	800	1975	0	0	0	0	0	0	2775	93.1
Percent	28.8	71.1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									173.4	
260-999										
Acres	2318	1041	0	0	0	0	0	0	3359	100.0
Percent	69.0	31.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									335.9	
Totals										
Acres	12227	31836	4221	398	0	0	0	50	48732	
Percent	25.0	65.3	8.6	0.8	0.0	0.0	0.0	0.1	100.0	
Average	101.0	100.7	39.8	199.0	0.0	0.0	0.0	25.0	89.0	

Table 6-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, FARWELL, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Indi-vidually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	2	3	66	38	0	109	49
Percent	0.0	1.8	2.7	60.5	34.8	0.0	100.0	
100-179								
No. of Farms	0	0	9	54	15	0	78	139
Percent	0.0	0.0	11.5	69.2	19.2	0.0	100.0	
180-259								
No. of Farms	0	0	2	46	5	0	53	215
Percent	0.0	0.0	3.7	86.7	9.4	0.0	100.0	
260-499								
No. of Farms	0	0	2	18	10	0	30	342
Percent	0.0	0.0	6.6	59.9	33.3	0.0	100.0	
500-999								
No. of Farms	0	0	6	5	2	0	13	713
Percent	0.0	0.0	50.0	38.5	15.3	0.0	100.0	
Totals								
No. of Farms	0	2	22	188	70	0	282	200
Percent	0.0	0.7	7.8	66.6	24.8	0.0	100.0	

Table 6-5

IRRIGATED CROP PATTERNS BY FARM SIZE, FARWELL, 1978

Farm Size Acres	Cereals and Grain	Forages	Row Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	5390	276	41	0	0	0	0	5707
Percent	94.4	4.8	0.7	0.0	0.0	0.0	0.0	100.0
100-179								
Total Acres	9976	392	194	0	0	0	0	10562
Percent	94.4	3.7	1.8	0.0	0.0	0.0	0.0	100.0
180-259								
Total Acres	9460	869	112	0	0	0	0	10441
Percent	90.6	8.3	1.0	0.0	0.0	0.0	0.0	100.0
260-499								
Total Acres	10013	220	136	0	49	0	0	10418
Percent	96.1	2.1	1.3	0.0	0.4	0.0	0.0	100.0
500-999								
Total Acres	8693	56	202	0	0	0	0	8951
Percent	97.4	0.6	2.3	0.0	0.0	0.0	0.0	100.0
Totals								
Total Acres	43532	1813	685	0	49	0	0	46079
Percent	94.4	3.9	1.4	0.0	0.1	0.0	0.0	100.0

Table 6-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, FARWELL, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	7	7	0	0	0	0
Average	0.0	0.0	0.0	0.0	0.0	0.0
100-179						
No. of Employees	5	5	0	0	0	0
Average	0.0	0.0	0.0	0.0	0.0	0.0
180-259						
No. of Employees	6	6	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
260-499						
No. of Employees	9	9	0	0	0	0
Average	0.2	0.2	0.0	0.0	0.0	0.0
500-999						
No. of Employees	8	8	0	0	0	0
Average	0.6	0.6	0.0	0.0	0.0	0.0
Totals						
No. of Employees	35	35	0	0	0	0
Percent	100.0	100.0	0.0	0.0	0.0	0.0

Table 6-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, FARWELL, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees and Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	0	0	7	7	110	117	21.8
Average/Farm	0.	0.	0.	0.	0.9	1.0	
100-179							
No. of Workers	0	0	5	5	77	82	7.5
Average/Farm	0.	0.	0.	0.	0.9	1.0	
180-259							
No. of Workers	0	0	5	5	53	58	5.0
Average/Farm	0.	0.	0.	0.	0.9	1.0	
260-499							
No. of Workers	0	0	9	9	31	40	3.7
Average/Farm	0.	0.	0.2	0.2	1.0	1.2	
500-999							
No. of Workers	0	0	8	8	13	21	2.3
Average/Farm	0.	0.	0.6	0.6	0.9	1.5	
Totals							
No. of Workers	0	0	34	34	284	318	

Table 6-8

Farwell Irrigation District, Nebraska

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Irrigated Corn	155	Land	$277,500
	Alfalfa Hay (Dry)	30	Machinery	74,561
	Sorghum (Dry)	7	Total	$352,061
	Wheat (Dry)	12		
	Pasture (Dry)	70		
	Idle	26		
	Farmstead/Waste	20		
	Total Irr.	160		

Financial Summary

Land at Current Market Value ($1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$43,225	Gross Sales	$43,225
Expenses	51,602	Expenses	29,265
Return to Operator Labor, Mgt., & Equity	$-8,377	Return to Operator Labor, Mgt., & Equity	$13,960

Land at Excess Land Value ($1,100/ac.)

Beginning Farmers	
Gross Sales	$43,225
Expenses	46,906
Return to Operator Labor, Mgt., & Equity	$-3,681

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Irrigated Corn	310	Land	$583,950
	Alfalfa Hay (Dry)	72	Machinery	221,066
	Sorghum (Dry)	24	Total	$805,016
	Pasture (Dry)	167		
	Idle	54		
	Farmstead/Waste	46		
	Total Irr.	320		

Financial Summary

Land at Current Market Value ($1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$ 88,862	Gross Sales	$88,862
Expenses	112,291	Expenses	55,786
Return to Operator Labor, Mgt., & Equity	$-23,429	Return to Operator Labor, Mgt., & Equity	$33,076

Land at Excess Land Value ($1,100/ac.)

Beginning Farmers	
Gross Sales	$ 88,862
Expenses	99,107
Return to Operator Labor, Mgt., & Equity	$-10,245

Table 6-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Irrigated Corn	619	Land	$603,250
	Alfalfa Hay (Dry)	80	Machinery	270,084
	Wheat (Dry)	30	Total	$873,334
	Pasture (Dry)	185		
	Idle	77		
	Farmstead/Waste	69		
	Total Irr.	640		

Financial Summary

Land at Current Market Value ($1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$164,360	Gross Sales	$164,360
Expenses	187,136	Expenses	120,307
Return to Operator Labor, Mgt., & Equity	$-22,776	Return to Operator Labor, Mgt., & Equity	$ 44,053

Land at Excess Land Value ($1,100/ac.)

Beginning Farmers	
Gross Sales	$164,360
Expenses	173,952
Return to Operator Labor, Mgt., & Equity	$ -9,592

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Irrigated Corn	1,184	Land	$ 620,935
	Alfalfa Hay (Dry)	87	Machinery	386,362
	Wheat (Dry)	33	Total	$1,007,297
	Pasture (Dry)	203		
	Idle	136		
	Farmstead/Waste	93		
	Total Irr.	1,280		

Financial Summary

Land at Current Market Value ($1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$304,068	Gross Sales	$304,068
Expenses	322,260	Expenses	239,168
Return to Operator Labor, Mgt., & Equity	$-18,192	Return to Operator Labor, Mgt., & Equity	$ 64,900

Land at Excess Land Value ($1,100/ac.)

Beginning Farmers	
Gross Sales	$304,068
Expenses	309,076
Return to Operator Labor, Mgt., & Equity	$ -5,008

were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Based on USDA "Balance Sheet of Agriculture," the estimated debt-asset ratio for all assets for Nebraska farms is 18.1. These data were used to modify the existing farm budgets shown in Table 6-8. Due to the significantly higher equity assumed for the existing farmer, cash flows are much more favorable and are positive for all farm sizes, ranging from $14,000 on the 160 acre unit to $65,000 on the 1,280 acre unit.

ECONOMIES OF SIZE

The machinery complement specified by the farmer was used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 6-1 and 6-2 show the SRAC for these fixed plants when high value crops and dryland operations are limited to the same proportion as shown in the typical farm budgets.

The long-run average cost curve (LRAC) can only be developed when all of the capacity in the "fixed plant" is fully utilized. To approximate the LRAC the machinery complement for each farm size was held constant, but unrestricted land leasing was allowed until the engineering design capacity of the machinery complement was fully utilized.

When the full capacity of the machinery complement is utilized, average total costs drop dramatically especially for the small farm sizes. With the additional rented land and machinery used to capacity, minimum average costs for the 160 acre machine complement is achieved at about 375 acres and the 1,280 machine complement at about 1,845 acres. This indicates considerable excess machinery capacity especially on the smaller farm sizes.

When an envelope curve is fitted to the minimum points on the SRAC, a long-run or planning curve is developed as shown in Figure 6-3 for both the current market and excess land values. The results shown in Figure 6-3 indicate: First, that most of the economies of size are achieved by the time gross sales reach the $150,000 per year output which is approximated by the 160 acre SRAC operating on 375 acres. Second, the benefits of the excess land values accrue to the smaller farm sizes as evidenced by the larger absolute difference between the LRAC at the left-hand end of the curves.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for corn. The variability of price, yield and gross income was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 6-9.

Table 6-9

Standard Deviations of Price, Yield and Gross Income for Corn
Farwell Irrigation District

Crop	Yield	Price	Gross Income Per Acre
Irrigated Corn	8.03 bu.	.054/bu.	$13.947

Because only corn was grown on irrigated land in the farm budget, the total variance of farm gross income increases with increasing farm size while the variability per acre remains constant.

DEMAND FOR IRRIGATION WATER

For the Farwell District, the derived demand for irrigation water is primarily dependent on corn yields and prices, alternative irrigation methods, and the profitabilty of dryland farming and the cost of water. If water costs rise too high, farm operators will revert to dryland farming.

Using the procedures outlined in the introductory chapter, a weighted aggregate demand curve was developed and is shown in Figure 6-4. The vertical dashed line represents the historic farm headgate delivery of 1.2 acre feet per acre and the asterisk represents the 1978 average total cost of $10.50 per acre foot. For comparison purposes the BOR estimated full-cost price is $135.50 per acre foot.

The aggregate demand curve is represented by the downward sloping stepped curve which indicates that at 1978 water prices/costs, Farwell District farm operators could profitably utilize an additional one acre foot per acre of irrigation water. Only if water costs/prices increased

FIGURE 6–1
FARWELL IRRIGATION DISTRICT
SHORT RUN AVERAGE TOTAL COST
CURRENT LAND MARKET
UNLIMITED LEASING

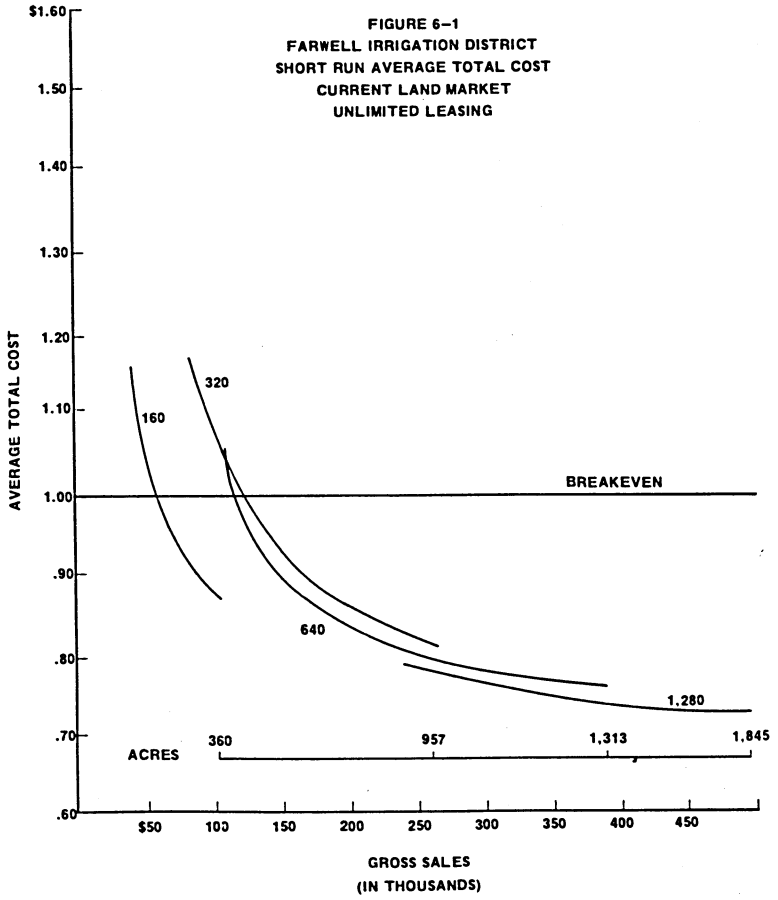


FIGURE 6–2
FARWELL IRRIGATION DISTRICT
SHORT RUN AVERAGE TOTAL COST
EXCESS LAND VALUES
UNLIMITED LEASING

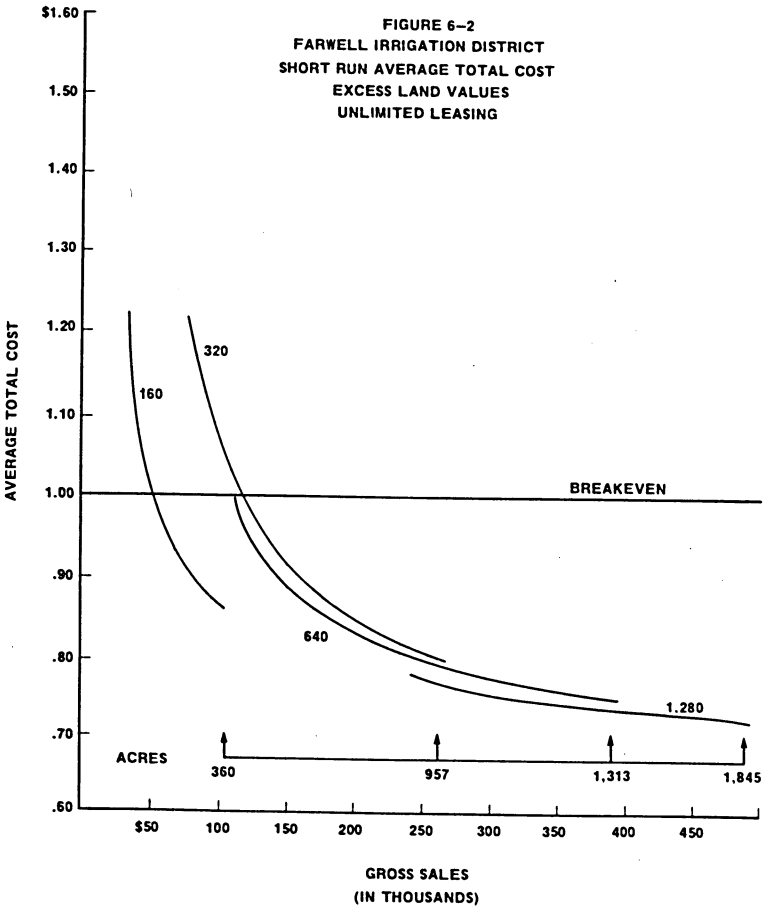


FIGURE 6–3
FARWELL IRRIGATION DISTRICT
LONG RUN PLANNING COST
UNLIMITED LEASING

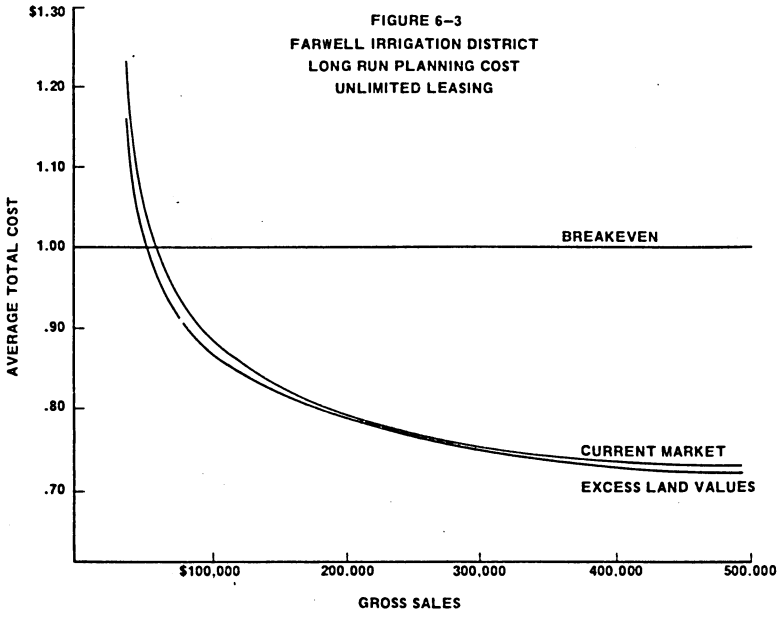
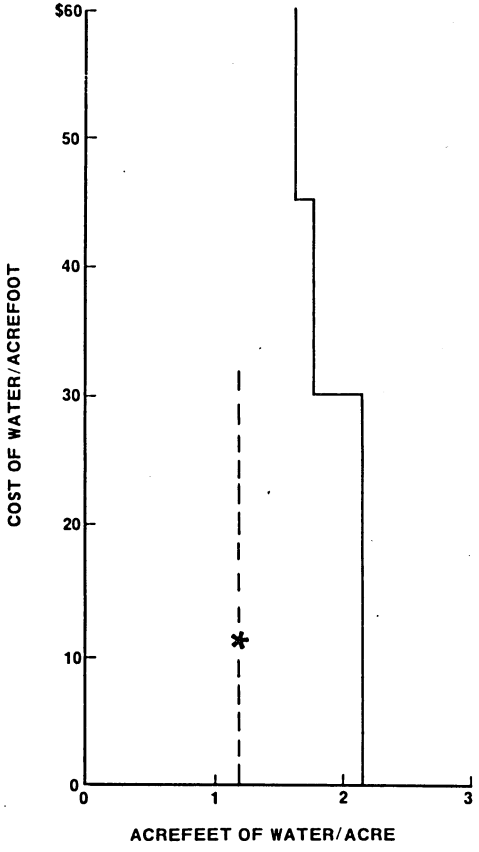


FIGURE 6–4
DEMAND FOR IRRIGATION WATER
FARWELL

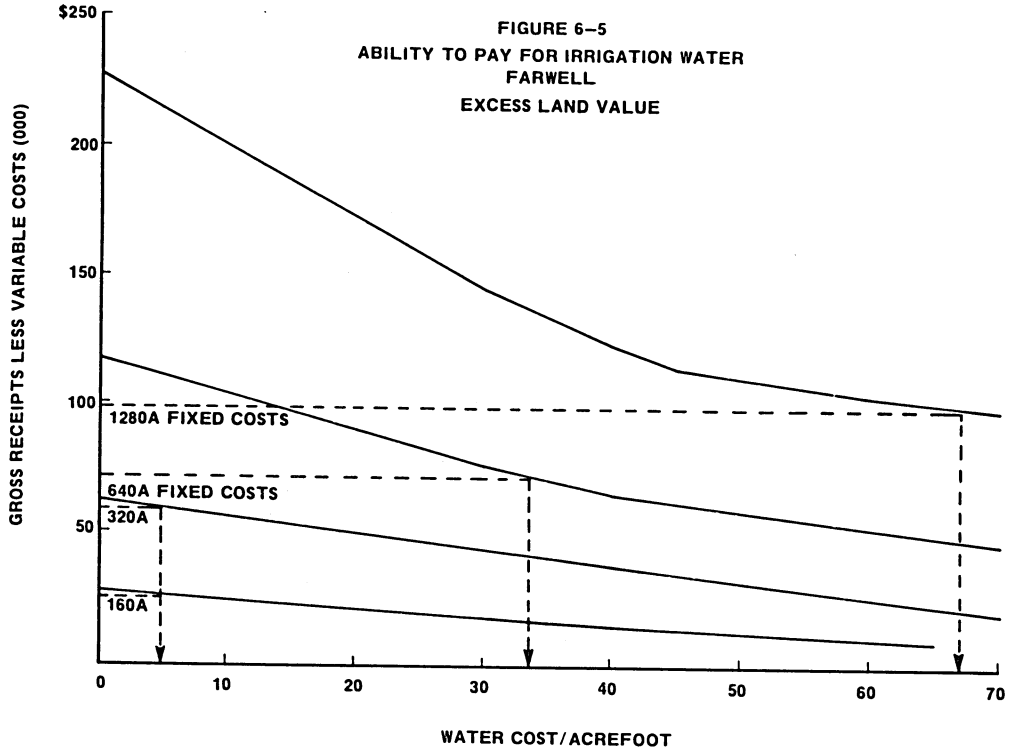


significantly to about $45 per acre foot would the economic demand approach the current allocation.

Figure 6-5 presents graphically the maximum ability to pay for irrigation water. The negatively sloped solid curves trace the net return over variable cost including water cost for each farm size. The horizontal dashed lines represent the level of fixed costs assuming land at its excess land value. Since the excess land value is the current value of the land without the project, the intersection of the net returns curve and the fixed cost level determines the maximum ability to pay for water. If water was priced higher than this, farm operators would be better off without the project.

Maximum ability to pay varies widely by farm size due to the economies of size discussed earlier, ranging from about $5.00 per acre foot for the two smaller farms to over $65.00 per acre foot for the largest size farm.

FIGURE 6-5
ABILITY TO PAY FOR IRRIGATION WATER
FARWELL
EXCESS LAND VALUE



OFF-FARM INCOME

Off-farm work contributes to two important objectives to farm operators, especially small farm operators. First, it allows for more complete utilization of under-employed resources such as family labor and unused machinery capacity. Second, it enhanced and stabilized family income which is an important consideration for lending institutions when making farm loans.

No primary survey data was collected in this study on off-farm income within the irrigation district or project; however, the U.S. Census of Agriculture of 1974 reports these data on a county basis.

The Census of Agriculture for Howard County, Nebraska reports 721 farms with gross agricultural sales of $2,500 or more. Table 6-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 6-10

Farm Operators Reporting Days Work Off-Farm
Howard County, Nebraska 1974

None	308
1 - 49	64
50 - 99	17
100 - 149	19
150 - 199	16
200 or More	86
Total	510

Over 20 percent of the farm operators reported working off the farm in Howard County and 17 percent reported working 200 or more days off-farm. Income and expenses related to selected off-farm income are shown in Table 6-11.

Table 6-11

Income and Expenses Related to Selected Off-Farm Income
Howard County, Nebraska

	Number	Average
Income From Farm Related Sources	253	$794
Custom Work	97	$296
Expense-Agriculturally Related Work	73	$218

Operators' spouses and their children also contribute to family income from both agriculturally and nonagriculturally related sources. In Howard County, 370 farms reported an average family off-farm income of $2,237 in 1974. No information is available on off-farm income by farm size.

CHAPTER 7

Goshen Irrigation District
North Platte Project, Wyoming

The 48,000 acre Goshen Irrigation District is located in southeastern Wyoming and receives its water supply from a reservoir on the north fork of the Platte River.

CLIMATE

The 131 day frost-free growing season in the district has a strong influence on the heavy investment in large tractors and other machinery capacity. In order to grow corn and sugar beets under such a short average growing season, land preparation and harvesting operations must be timely. Average annual precipitation for the district is 14.27 inches.

SOILS

In the Goshen Unit, the principal soil factors that influence crop adaptability are the soils with textures that are either too sandy or too heavy. In general, the soils range from loamy sands to slowly permeable clays with the predominate soil texture being a fine sandy loam. The loamy sands have relatively low water holding capacities, while most of the clay soils are characterized by slow infiltration rates and are usually more difficult to manage under irrigation. Problems, due to subsurface drainage, are experienced in part of the areas that are underlain by Brule clay or Brule shale. Reduced crop yield are usually experienced in these areas, due to varying concentrations of salts and/or alkali within the roots zone.

Soils in the district have been classified as follows:

Class I	13,709 acres
Class II	13,606 acres
Class III	11,481 acres
Class IV	5,036 acres
Class V	4,805 acres
Total	48,637 acres

CROPS

The crop pattern is dominated by sugar beets, alfalfa hay and corn, both for grain and for silage as shown in Table 7-1. Dry edible beans, although commanding a smaller acreage, contribute almost $2 million per year to the gross agricultural value of the district. Average gross value of agricultural production in the district in 1977 was $240 per acre.

Table 7-1

Crop Acreage, Goshen District, Wyoming, 1977

Crop	Acres	Value of Production
Cereals		
Barley	1,348	$ 127,049
Corn	6,778	994,333
Oats	1,227	58,037
Forage		
Alfalfa Hay	10,870	1,847,900
Irrigated Pasture	6,228	249,120
Silage or Ensilage	6,778	1,694,500
Stubble Stalks, etc.		134,400
Miscellaneous Field Crops		
Beans, Dry & Edible	5,681	1,888,933
Sugar Beets	11,642	5,187,294
Other & Miscellaneous	887	165,399
Total	51,439	$12,346,965

LAND TENURE

Land ownership in the Goshen Irrigation District is very widely dispersed with a Gini coefficient of 0.16.[1/] Of the 567 land ownerships in the distict, 409 or 72 percent of them are less than 100 acres. These landowners control approximately 50 percent of the land as shown in Tables 7-2 and 7-3. Land ownership is primarily a family arrangement with over 70 percent of the owners being either husband and wife or a multiple family arrangement. No nonfamily corporations owned land within the district.

Farm Operations

While the average ownership unit was 84 acres, the average farm size was considerably larger at 229 acres as shown in Table 7-4. Although no corporations owned land in the district, 10 farms were operated under a corporate business structure; however, none of these were larger than 500 acres in size. Over two-thirds of the farms were operated jointly with husband and wife.

Table 7-5 presents data on crop pattern by farm size. The proportion of land in forages, including silage, was higher in both the smallest farm size group and the larger size group (1,000 - 1,999 acres) than in the remaining farm size categories. The large size group reported a smaller percentage of land in dry beans and sugar beets than the smaller farms, indicating that cropping intensity is less on these larger farms.

Labor

Ethnic origin of regular farm workers is almost entirely Caucasian (87 percent) with only 15 percent of Hispanic origin. All of the latter were classified as laborers. These data are shown in Table 7-6.

Survey respondents were asked to group their regular employees by type of work; the results are displayed in Table 7-7. Due to the small average size of farms in the district, only two farms reported having managers and nine farms reported foremen.

Total labor input to the farm is approximated by combining regular employees plus farm operators. The right-hand column in Table 7-7 standardizes the labor input on a per 1,000 acre basis. This labor input declines rapidly up to about 200 acres and then becomes fairly constant. The lowest labor input per 1,000 acres (4.3) was found on the largest size farms. Readers should be cautioned that these data are not adjusted for off-farm work, custom services, temporary help or any livestock raised on the farm.

TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes representing the typical crops grown in the district, 160, 320, 640 and 1,280 acres. Based on the Interior's Proposed Rules and Regulations, these budgets assume full ownership for all land up to 320 acres. Land in farms over 320 acres was assumed to be leased at the local cash rent equivalent of $100 per acre.

Beginning Farmers

Results of beginning farmers assumed to have purchased land at the current market price of $1,250 per acre and 1978 interest rates were negative for the 160 and 640 acre farm size (see Table 7-8). For beginning farmers assumed to have purchased excess land at $605 per acre, returns to unpaid labor, management and equity (cash flow) were slightly positive on the 160 acre farm, $13,000 for the 320 acre farm and negative for the two largest farm sizes due to the high cash rents and hired labor.

Existing Farmers

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments.

The estimated turnover rate for farms in the western United States is 2.5 percent per year or on the average, a farm is transferred every 40 years. Assuming the average farm was purchased 20 years ago (40 ÷ 2 = 20 years) existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates average 5.5 percent. Using the average debt-asset

---

1/ Gini coefficient ranges from 0 to 1.0. The larger the value, the more concentrated the ownership.

Table 7-2

FORM OF OWNERSHIP BY FARM SIZE, GOSHEN, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
No. of Owners	41	159	208	1	0	0	0	0	409	72.1
Percent	10.0	38.8	50.8	0.2	0.0	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	24	93	5	5	0	0	0	0	127	94.5
Percent	18.8	73.2	3.9	3.9	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	9	3	1	2	0	0	0	0	15	97.1
Percent	60.0	20.0	6.6	13.3	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	10	6	0	0	0	0	0	0	16	100.0
Percent	62.5	37.5	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	84	261	214	8	0	0	0	0	567	
Percent	14.8	46.0	37.7	1.4	0.0	0.0	0.0	0.0	100.0	

Table 7-3

LAND BY OWNERSHIP, GOSHEN, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	2683	13141	7889	38	0	0	0	0	23751	49.7
Percent	11.2	55.3	33.2	0.1	0.0	0.0	0.0	0.0	100.0	
Average									58.0	
100-179										
Acres	3504	11937	670	738	0	0	0	0	16849	85.0
Percent	20.7	70.8	3.9	4.3	0.0	0.0	0.0	0.0	100.0	
Average									132.6	
180-259										
Acres	1979	97	259	472	0	0	0	0	2807	90.9
Percent	70.5	3.4	9.2	16.8	0.0	0.0	0.0	0.0	100.0	
Average									187.1	
260-499										
Acres	3509	854	0	0	0	0	0	0	4363	100.0
Percent	80.4	19.5	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									272.6	
Totals										
Acres	11675	26029	8818	1248	0	0	0	0	47770	
Percent	24.4	54.4	18.4	2.6	0.0	0.0	0.0	0.0	100.0	
Average	138.9	99.7	41.2	156.0	0.0	0.0	0.0	0.0	84.2	

Table 7-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, GOSHEN, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	1	10	50	4	0	65	65
Percent	0.0	1.5	15.3	76.9	6.1	0.0	100.0	
100-179								
No. of Farms	0	3	3	46	7	2	61	140
Percent	0.0	4.9	4.9	75.4	11.4	3.2	100.0	
180-259								
No. of Farms	0	2	16	33	8	0	59	218
Percent	0.0	3.3	27.1	55.9	13.5	0.0	100.0	
260-499								
No. of Farms	0	4	8	28	3	0	43	338
Percent	0.0	9.3	18.6	65.1	6.9	0.0	100.0	
500-999								
No. of Farms	0	0	3	3	3	0	9	554
Percent	0.0	0.0	33.3	33.3	33.3	0.0	100.00	
1,000-1,999								
No. of Farms	0	0	1	1	0	0	2	1157
Percent	0.0	0.0	50.0	50.0	0.0	0.0	100.0	
Totals								
No. of Farms	0	10	41	161	25	2	239	229
Percent	0.0	4.1	17.1	67.3	10.4	0.8	100.0	

Table 7-5

IRRIGATED CROP PATTERNS BY FARM SIZE, GOSHEN, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	1245	2146	802	0	0	0	0	4193
Percent	29.6	51.1	19.1	0.0	0.0	0.0	0.0	100.0
100-179								
Total Acres	2894	3238	2267	0	0	0	0	8399
Percent	34.4	38.5	26.9	0.0	0.0	0.0	0.0	100.0
180-259								
Total Acres	4205	4105	4335	45	0	0	0	12690
Percent	33.1	32.3	34.1	0.3	0.0	0.0	0.0	100.0
260-499								
Total Acres	3976	5928	4097	0	47	0	0	14048
Percent	28.3	42.1	29.1	0.0	0.3	0.0	0.0	100.0
500-999								
Total Acres	1665	2346	1689	0	0	0	0	5700
Percent	29.2	41.1	29.6	0.0	0.0	0.0	0.0	100.0
1,000-1,999								
Total Acres	592	1294	189	0	0	0	0	2075
Percent	28.5	62.3	9.1	0.0	0.0	0.0	0.0	100.0
Totals								
Total Acres	14577	19057	13379	45	47	0	0	47105
Percent	30.9	40.4	28.4	0.0	0.0	0.0	0.0	100.0

Table 7-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, GOSHEN, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	5	5	0	0	0	0
Average	0.0	0.0	0.0	0.0	0.0	0.0
100-179						
No. of Employees	13	13	0	0	0	0
Average	0.2	0.2	0.0	0.0	0.0	0.0
180-259						
No. of Employees	12	12	0	0	0	0
Average	0.2	0.2	0.0	0.0	0.0	0.0
260-499						
No. of Employees	45	39	6	0	0	0
Average	1.0	0.9	0.1	0.0	0.0	0.0
500-999						
No. of Employees	20	11	9	0	0	0
Average	1.9	1.0	0.8	0.0	0.0	0.0
1,000-1,999						
No. of Employees	7	7	0	0	0	0
Average	3.9	3.9	0.0	0.0	0.0	0.0
Totals						
No. of Employees	102	87	15	0	0	0
Percent	100.0	85.2	14.7	0.0	0.0	0.0

Table 7-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, GOSHEN, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees and Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	0	0	5	5	66	71	16.8
Average/Farm	0.	0.	0.	0.	1.0	1.0	
100-179							
No. of Workers	0	4	9	13	60	73	8.6
Average/Farm	0.	0.	0.1	0.2	0.9	1.2	
180-259							
No. of Workers	0	0	12	12	59	71	5.5
Average/Farm	0.	0.	0.2	0.2	1.0	1.2	
260-499							
No. of Workers	2	5	36	43	42	85	6.0
Average/Farm	0.	0.1	0.8	1.0	1.0	2.0	
500-999							
No. of Workers	0.	0	20	20	11	31	5.4
Average/Farm	0.	0.	1.4	1.9	1.0	3.0	
1,000-1,999							
No. of Workers	2	0	5	7	2	9	4.3
Average/Farm	1.1	0.	2.7	3.9	1.1	5.0	
Totals							
No. of Workers	4	9	87	100	240	340	

Table 7-8

Goshen Irrigation District

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	20	Land	$200,000
	Corn	40	Improvements	41,225
	Dry Beans	40	Machinery	141,445
	Sugar Beets	40	Total	$382,670
	Oats	4		
	Farmstead	16		
	Total	160		

Financial Summary

Land at Current Market Value ($1,250/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$51,197	Gross Sales	$51,197
Expenses	54,831	Expenses	33,337
Return to Operator Labor, Mgt., & Equity	$-3,634	Return to Operator Labor, Mgt., & Equity	$17,860

Land at Excess Land Value ($605/ac.)

Beginning Farmers	
Gross Sales	$51,197
Expenses	47,681
Return to Operator Labor, Mgt., & Equity	$ 3,516

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	50	Land	$400,000
	Corn Silage	50	Improvements	54,300
	Corn Grain	50	Machinery	203,486
	Dry Beans	64	Total	$657,786
	Sugar Beets	64		
	Oats	10		
	Farmstead	32		
	Total	320		

Financial Summary

Land at Current Market Value ($1,250/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$96,895	Gross Sales	$96,895
Expenses	98,199	Expenses	60,808
Return to Operator Labor, Mgt., & Equity	$-1,304	Return to Operator Labor, Mgt., & Equity	$36,087

Land at Excess Land Value ($605/ac.)

Beginning Farmers	
Gross Sales	$96,895
Expenses	83,900
Return to Operator Labor, Mgt., & Equity	$12,995

Table 7-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	100	Land	$400,000
	Corn Silage	100	Improvements	129,500
	Corn Grain	100	Machinery	413,177
	Dry Beans	108	Machinery	$942,677
	Sugar Beets	148		
	Oats	20		
	Farmstead	64		
	Total	640		

Financial Summary

Land at Current Market Value ($1,250/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$193,791	Gross Sales	$193,791
Expenses	196,918	Expenses	147,227
Return to Operator Labor, Mgt., & Equity	$ -3,127	Return to Operator Labor, Mgt., & Equity	$ 46,564

Land at Excess Land Value ($605/ac.)

Beginning Farmers	
Gross Sales	$193,791
Expenses	182,619
Return to Operator Labor, Mgt., & Equity	$ 11,172

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	200	Land	$ 400,000
	Corn Silage	200	Improvements	207,040
	Corn Grain	460	Machinery	604,172
	Sugar Beets	226	Total	$1,211,212
	Oats	66		
	Farmstead	128		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,250/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$418,104	Gross Sales	$418,104
Expenses	406,577	Expenses	342,985
Return to Operator Labor, Mgt., & Equity	$ 11,527	Return to Operator Labor, Mgt., & Equity	$ 75,119

Land at Excess Land Value ($605/ac.)

Beginning Farmers	
Gross Sales	$418,104
Expenses	392,278
Return to Operator Labor, Mgt., & Equity	$ 25,826

ratio of 16.8 percent for all Wyoming farms in 1978, farm budgets were modified and the results are shown in Table 7-8.

Due to the higher equity position, the cash flow for existing farmers is significantly higher than for beginning farmers and is positive for all farm sizes.

ECONOMIES OF SIZE

The specified machinery complements was used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 7-1 and 7-2 show the SRAC which includes operator labor at market wage rates for each farm size. The minimum points on these SRAC indicate the optimum crop mix given the machinery complement. Although acreage of high value crops were restricted based on market limitations, these results are similar to the typical farm budgets presented in Table 7-8. The average total cost per dollar of gross sales is below the breakeven level of $1.00 for all farm sizes. The heavy investments in truck transport, labor, housing and the expense of supervisory labor caused costs to be significantly higher on the 1,280 acre farm size. In order to estimate the long-run planning curve, farm size was allowed to grow to the engineering design capacity of the fixed machinery complement. These data indicate positive cash flows for all farm sizes with a significant increase when land is costed at its excess land value.

When an envelope curve is fitted to the minimum points on the SRAC, a long-run LRAC or planning curve is developed. This is shown in Figure 7-3 for the two land values. Excess land values have the greatest impact at the left-hand end of the curve as indicated by the spread between the two curves.

Viewing the shape of the LRAC for excess land, most of the economies of size are captured by the time farm gross sales reaches about $250,000. This translates into a farm of approximately 500 acres under the assumptions of this study.

PRICE AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 7-9.

Table 7-9

Standard Deviations of Price, Yield and Gross Income by Crop
Goshen Irrigation District

Crop	Yield	Price	Gross Income Per Acre
Sugar Beets	1.834 ton	0.749/ton	$17.86
Dry Beans	2.125 cwt	2.002/cwt	37.52
Alfalfa Hay	0.161 ton	2.435/ton	6.03
Corn	7.448 bu	.071/bu	12.78
Oats	4.246 bu	0.141/bu	1.97

To indicate the variability of farm income and costs, the data in Table 7-9 were combined based on the proportion of land in each crop for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 7-4.

As shown in Table 7-9, most of the major crops grown in the district must be considered relatively stable crops. This is also reflected in the narrow band around the LRAC in Figure 7-4. This band indicates the range within which average costs can be expected to fall within about 67 percent of the time or about two out of every three years.

DEMAND FOR IRRIGATION WATER

Irrigation water demand in the Goshen District is related to the consumptive use of crops grown in the district, their profitability, the irrigation methods used and the cost of water. A weighted average demand curve was estimated using a linear programming model for each farm size and weighting the results by the proportion of land in each farm size class. Results are presented graphically in Figure 7-5. The dashed vertical line indicates the historic diversion

FIGURE 7–1
GOSHEN
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
UNLIMITED LEASING

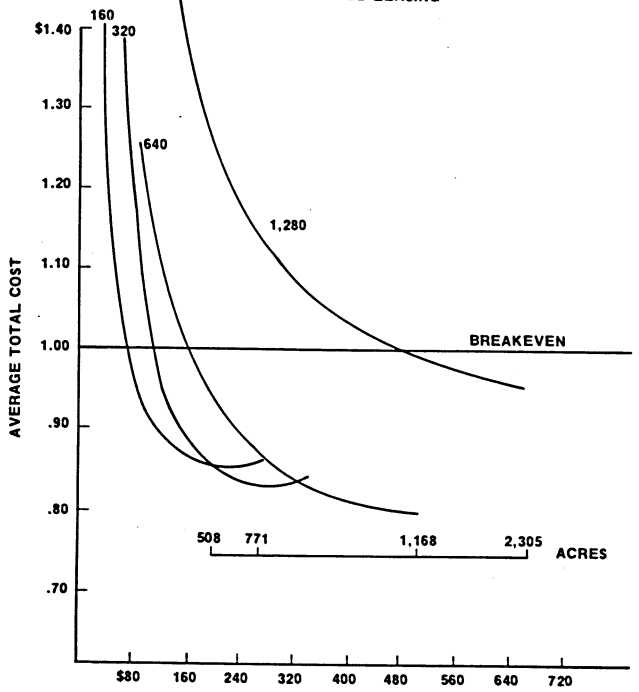


FIGURE 7–2
GOSHEN
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

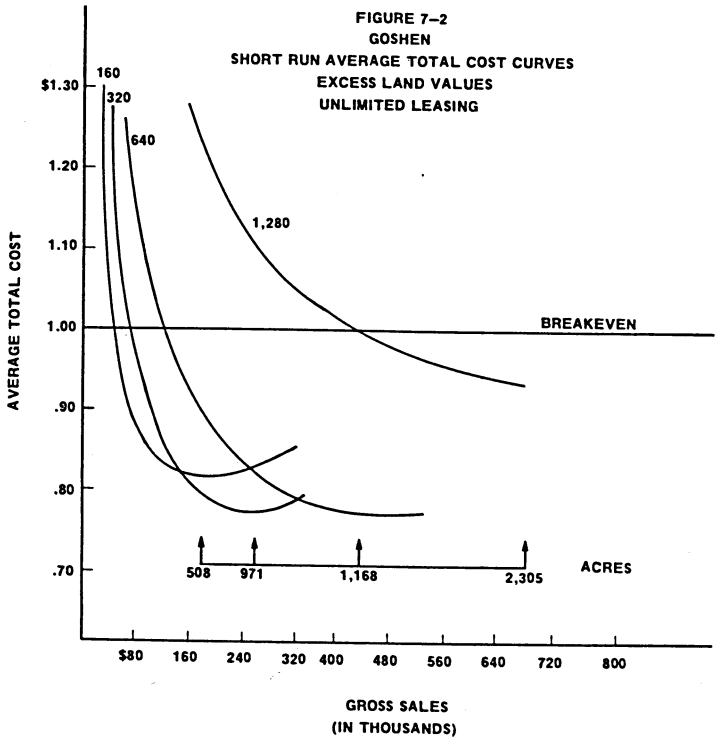


FIGURE 7–3
GOSHEN
LONG RUN PLANNING COST CURVES
UNLIMITED LEASING

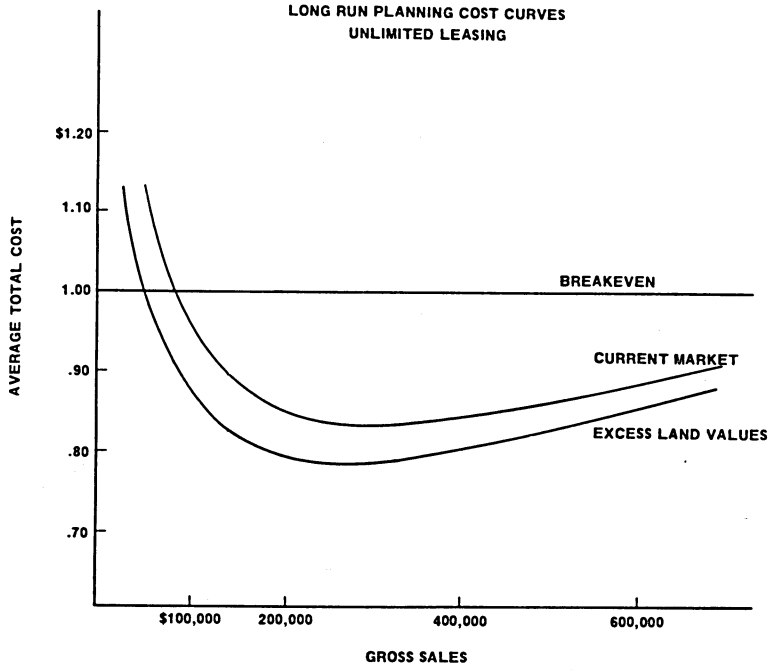
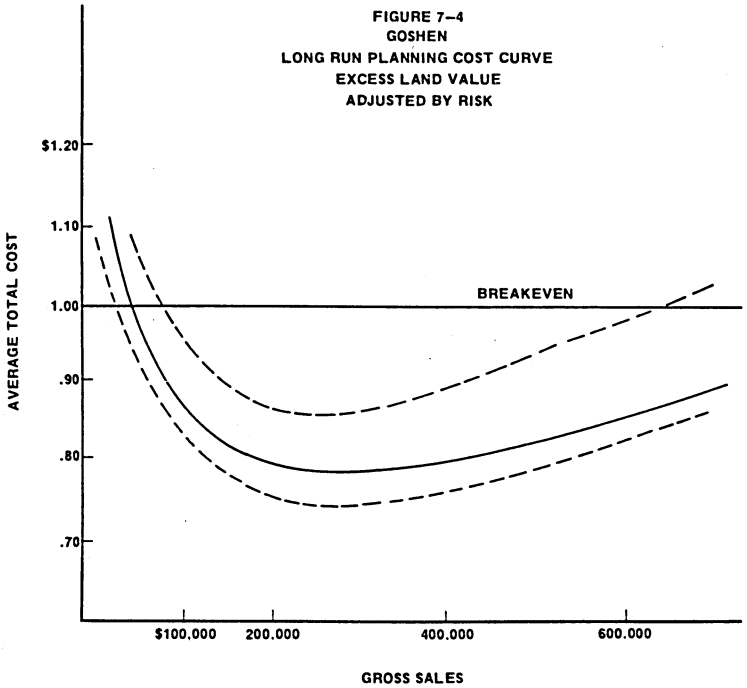


FIGURE 7–4
GOSHEN
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK



per acre in the district of 2.1 acre feet. The asterisk indicates the 1978 average total cost at the farm headgate of $4.22 per acre foot. In comparison, the BOR full-cost price was estimated at $22.96 per acre foot.

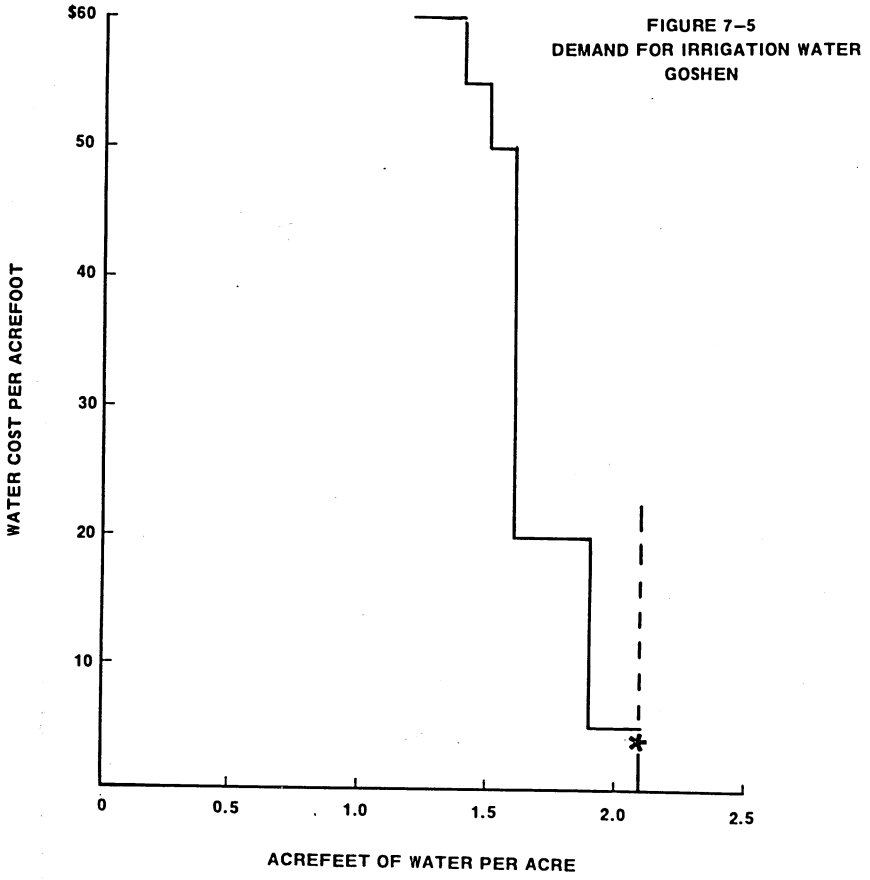


FIGURE 7-5
DEMAND FOR IRRIGATION WATER
GOSHEN

The downward sloping solid line indicates that district farmers are optimally utilizing the current water supply at the 1978 price. An increase in water costs/prices to the WPRS full-cost level would be expected to cause a decrease in the water demanded to about 1.6 acre feet per acre, a 24 percent reduction.

Impacts on farm income of increased water costs/prices are shown in Figure 7-6. The negatively sloping dish shaped curves trace the net returns over variable costs including water costs for each farm size for all but the 1,280 acre farm. Results for the latter farm size were an anomally and are not shown. The more curvature to the dish, the greater number of adjustments in crop mix and irrigation methods as water costs increase. Dashed horizontal lines indicate the level of fixed costs. These fixed costs assume excess land values since the maximum ability to pay would be a water cost which captured all land value enhancement due to the water project. A vertical line from the intersect of the net returns curve and the fixed cost level indicates this maximum ability to pay. The results shown in Figure 7-6 indicate that both the 320 acre and 640 acre farms could pay more than the WPRS full-cost price for project water but the smallest farm size would have difficulty in doing so. The ability to pay for the 320 acre farm exceeds that of the 640 acre farm due to the diseconomies of size found in the cost-size relationships discussed earlier when farm acreage was limited to that specified for the machinery complement, i.e., 320 acres and 640 acres.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Goshen County, Wyoming, reports 716 farms with gross agricultural sales of $2,500 or more. Table 7-10 shows the number of these farms reporting agriculturally related off-farm work.

FIGURE 7-6
ABILITY TO PAY FOR IRRIGATION WATER
GOSHEN

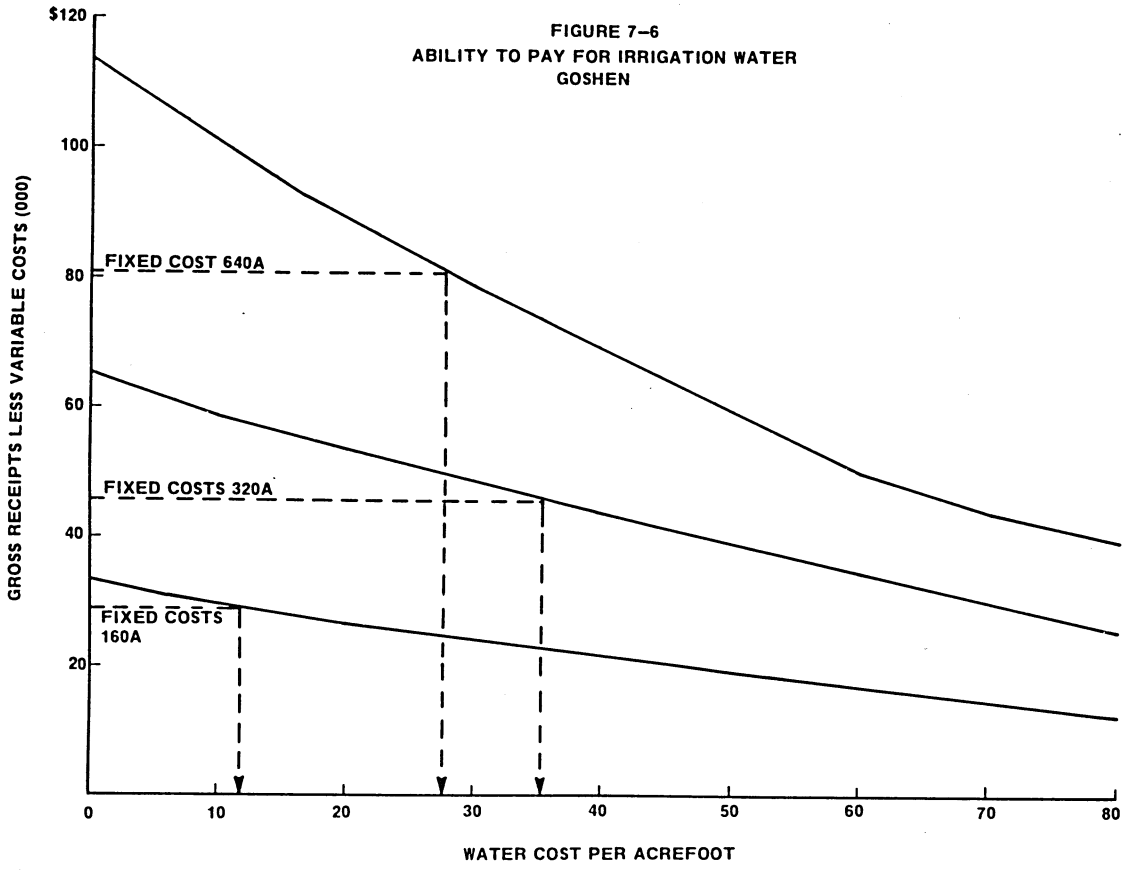


Table 7-10

Farm Operators Reporting Days Work Off-Farm

None	354
1 - 49 days	52
50 - 99 days	20
100 - 149 days	21
150 - 199 days	9
200 days or more	65
Total	521

Income and expenses related to selected off-farm income sources are shown in Table 7-11.

Table 7-11

Operator Income From Farm Related Sources, Goshen County

Number of Farms Reporting	285
Average Per Farm Reporting	$1,516
Income From Custom Work	
Number of Farms Reporting	83
Average per Farm Reporting	$ 259
Expenses Related to Off-Farm Income	
Number of Farms Reporting	92
Average Per Farm Reporting	$ 351

Farm operators' spouses and their children also contribute to family income from agriculturally and nonagriculturally related sources. In Goshen County, 324 farms reported an average family off-farm income of $2,015 in 1974. No information is available on off-farm income by size of farm.

CHAPTER 8

Lugert-Altus Irrigation District
W.C. Austin Project, Oklahoma

The Lugert-Altus District is located in southern Oklahoma near the Red River and is one unit of the W.C. Austin Project.

CLIMATE

The climate is characterized by hot, dry summers and relatively mild winters. The average annual rainfall is 25.6 inches with most of the rainfall being in the spring and fall months. There is an average of 220 days between killing frosts.

SOILS

The major soils in the Lugert-Altus Irrigation District are of the Tillman-Hollister association. These soils are of clay loam texture and comprise the largest irrigated acreage in the county. These two soils occur in such an intermingled pattern that it is not possible to show them separately on a map. The Tillman soils are of a better type with the Hollister soils being tighter and more difficult to work.

There are 47,123 acres of Class 1-4 lands in the district and no Class 5 land.

CROPS

The district's crop report shown in Table 8-1 reflects the predominance of cotton (57 percent) and irrigated wheat. In addition to crops grown on irrigated land, typical farming operations in the area also include a significant amount of dryland farming based on the 25.6 inches of annual rainfall. The combination of irrigated and rainfed crops provides some stability to total farm income and allows farm operators to better utilize their fixed investment in farm machinery. This combination is reflected in the typical farm crop mixes discussed in a later section.

Table 8-1

Crop Acreage, Lugert-Altus District, Oklahoma, 1977

Crop	Acres	Value of Production
Cereals		
Sorghums	4,527	$ 816,917
Wheat	12,019	789,482
Forage		
Alfalfa Hay	781	162,500
Irrigated Pasture	776	31,720
Miscellaneous Field Crops		
Cotton Lint, Upland	25,379	8,351,750
Cotton Seed, Upland	(25,379)	828,506
Other & Miscellaneous	1,350	184,218
Total	44,832	$11,165,093

LAND TENURE

A widely distributed land ownership pattern characterizes the Lugert-Altus District with a Gini coefficient of 0.24.[1/] Ownership is about equally distributed between individuals, husbands

1/ Gini coefficient ranges from 0 to 1.0. The higher the value, the more concentrated the ownership.

and wives and multiple family arrangements (partnerships and family corporations) with from 29 to 36 percent of the ownership units as shown in Table 8-2. Nonfamily corporations constitute slightly over 1 percent of all ownerships and hold only about 2 percent of the acreage. Two-thirds of the ownership units are less than 100 acres; however, these control only 38 percent of the acreage. Two large landowners own units in the 500 to 999 acre size group averaging 767 acres.

Farm Operations

Table 8-3 displays the acreage by type of ownership. The average acreage per owner is only 94 acres as compared to the average farm size of 259 acres shown in Table 8-4. Farm operating units are like ownership, a family-type business association with 83 percent of the farms being operated in this manner, either husband and wife or unincorporated individuals. However, two closely held farming corporations were reported in the 2,000 to 3,999 acre size group. The Gini coefficient for farm operating units was 0.53 which indicates that control of the land is significantly more concentrated than ownership.

Field crops, primarily upland cotton, dominate the crop mix (Table 8-5), with the proportion of the land in these crops increasing with farm size. The farms of less than 100 irrigated acres plant an average of 63 percent of the land to cotton while the largest farms plant about 88 percent of their land to this crop. Cereals and grain are the second most important crop group according to acreage planted and the proportion of land in these crops decreases as farm size increases. Except for the small acreage of seed crops, crop intensity appears to increase with farm size.

Labor

Farm operators were asked to indicate the number and ethnic origin of their regular employees. The data in Table 8-6 show that farm workers in central Oklahoma are about equally divided between Caucasians and Hispanics with a small percentage of American Indians, Alaskan natives and Blacks. As expected the average number of employees increases with farm size, the largest farms averaging 7.7 workers per farm. Total employees plus farm operators were accumulated by job categories and are presented in Table 8-7. The right-hand column in Table 8-7 presents a standardized ratio of labor input per 1,000 acres of land by farm size. Although these data have not been adjusted for custom work, off-farm employment, temporary help, livestock or dryland acreage, they show a large decline after farm size exceeds 100 acres. The lowest ratio, 3.5 workers per 1,000 acres, was on the largest farm size.

RESULTS OF TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes representative of the district, 160, 320, 640 and 1,280 acres. Following the Interior's Proposed Rules and Regulations, these budgets assume a maximum land ownership of 160 acres for an individual owner and 320 acres for a husband and wife. Therefore, the 160 acre and 320 acre farms assume full ownership and the 640 and 1,280 acre farm budgets assume 320 acres in full ownership with the balance of the acreage leased-in at the local rate for cash rentals.

The 1978 cash rental rate of $55.00 per crop acre is low relative to the current market price for land of $1,200 per acre and an excess land value of $765 per acre, thus providing a significant cash flow advantage to any farm operator who rents a high proportion of his land. This is reflected in the farm budget summaries presented in Table 8-8 as well as later in the economies of farm size analysis.

Beginning Operators

At current market and excess land values, a beginning farm operator could expect a negative net return (cash flow) on all farm sizes due to the relatively high cost of land in relation to farm incomes at current interest rates (see Table 8-8). This, in part, is due to the assumption of a high proportion of dryland grain. This land was assumed to be all owned.

Existing Operators

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments and thus due to land value appreciation, a much higher equity position.

Table 8-2

FORM OF OWNERSHIP BY FARM SIZE, LUGERT-ALTUS, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
No. of Owners	64	108	135	0	5	0	0	0	312	66.6
Percent	20.5	34.6	43.2	0.0	1.6	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	62	39	2	2	0	0	2	0	107	89.4
Percent	57.9	36.4	1.8	1.8	0.0	0.0	1.8	0.0	100.0	
180-259										
No. of Owners	15	14	0	0	0	0	1	0	30	95.8
Percent	50.0	46.6	0.0	0.0	0.0	0.0	3.3	0.0	100.0	
260-499										
No. of Owners	8	7	0	0	0	2	1	0	18	99.6
Percent	44.4	38.8	0.0	0.0	0.0	11.1	5.5	0.0	100.0	
500-999										
No. of Owners	2	0	0	0	0	0	0	0	2	100.0
Percent	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	151	168	137	2	5	2	4	0	469	
Percent	32.1	35.8	29.2	0.4	1.0	0.4	0.8	0.0	100.0	

Table 8-3

LAND BY OWNERSHIP, LUGERT-ALTUS, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	3499	8956	4175	0	242	0	0	0	16872	38.2
Percent	20.7	53.0	24.7	0.0	1.4	0.0	0.0	0.0	100.0	
Average									54.0	
100-179										
Acres	8207	5837	326	380	0	0	328	0	15078	72.4
Percent	54.4	38.7	2.1	2.5	0.0	0.0	2.1	0.0	100.0	
Average									140.9	
180-259										
Acres	3145	2754	0	0	0	0	128	0	6027	86.1
Percent	52.1	45.6	0.0	0.0	0.0	0.0	2.1	0.0	100.0	
Average									200.9	
260-499										
Acres	2456	909	0	0	0	735	480	0	4580	96.5
Percent	53.6	19.8	0.0	0.0	0.0	16.0	10.4	0.0	100.0	
Average									254.4	
500-999										
Acres	1535	0	0	0	0	0	0	0	1535	100.0
Percent	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									767.5	
Totals										
Acres	18842	18456	4501	380	242	735	936	0	44092	
Percent	42.7	41.8	10.2	0.8	0.5	1.6	2.1	0.0	100.0	
Average	124.7	109.8	32.8	190.0	48.4	367.5	234.0	0.0	94.0	

Table 8-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, LUGERT-ALTUS, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/Family Over 18	Jointly With Spouse Only	Indi-vidually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	0	3	30	13	0	46	56
Percent	0.0	0.0	6.5	65.2	28.2	0.0	100.0	
100-179								
No. of Farms	0	0	3	20	22	0	45	134
Percent	0.0	0.0	6.6	44.4	48.8	0.0	100.0	
180-259								
No. of Farms	0	0	2	3	11	1	17	215
Percent	0.0	0.0	11.7	17.6	64.7	5.8	100.0	
260-499								
No. of Farms	0	0	4	9	11	0	24	375
Percent	0.0	0.0	16.6	37.5	45.8	0.0	100.0	
500-999								
No. of Farms	0	6	2	2	6	0	16	788
Percent	0.0	37.5	12.5	12.5	37.5	0.0	100.0	
1,000-1,999								
No. of Farms	0	0	2	0	0	0	2	1519
Percent	0.0	0.0	100.0	0.0	0.0	0.0	100.0	
2,000-3,999								
No. of Farms	0	2	1	0	0	0	3	2889
Percent	0.0	66.6	33.3	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	0	8	17	64	63	1	153	259
Percent	0.0	5.2	11.1	41.8	41.1	0.6	100.0	

Table 8-5

IRRIGATED CROP PATTERNS BY FARM SIZE, LUGERT-ALTUS, 1978

Farm Size Acres	Cereals & Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	459	138	1070	0	12	0	9	1688
Percent	27.1	8.1	63.3	0.0	0.7	0.0	0.5	100.0
100-179								
Total Acres	527	644	2879	0	427	0	0	4477
Percent	11.7	14.3	64.3	0.0	9.5	0.0	0.0	100.0
180-259								
Total Acres	383	122	2682	0	0	0	0	3187
Percent	12.0	3.8	84.1	0.0	0.0	0.0	0.0	100.0
260-499								
Total Acres	1223	259	5295	0	0	0	0	6777
Percent	18.0	3.8	78.1	0.0	0.0	0.0	0.0	100.0
500-999								
Total Acres	849	662	8456	0	0	0	0	9967
Percent	8.5	6.6	84.8	0.0	0.0	0.0	0.0	100.0
1,000-1,999								
Total Acres	96	136	2028	0	0	0	0	2260
Percent	4.2	6.0	89.7	0.0	0.0	0.0	0.0	100.0
2,000-3,999								
Total Acres	831	0	5841	10	0	0	0	6672
Percent	12.5	0.0	87.5	0.2	0.0	0.0	0.0	100.0
Totals								
Total Acres	4368	1961	28251	10	439	0	9	35038
Percent	12.4	5.5	80.6	0.0	1.2	0.0	0.0	100.0

Table 8-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, LUGERT-ALTUS, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	6	6	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
100-179						
No. of Employees	4	0	4	0	0	0
Average	0.0	0.0	0.0	0.0	0.0	0.0
180-259						
No. of Employees	17	16	1	0	0	0
Average	0.9	0.9	0.0	0.0	0.0	0.0
260-499						
No. of Employees	18	12	6	0	0	0
Average	0.7	0.4	0.2	0.0	0.0	0.0
500-999						
No. of Employees	34	12	19	2	1	0
Average	2.1	0.7	1.2	0.1	0.0	0.0
1,000-1,999						
No. of Employees	8	3	4	0	1	0
Average	4.9	1.8	2.4	0.0	0.6	0.0
2,000-3,999						
No. of Employees	23	3	19	0	1	0
Average	7.7	1.0	6.3	0.0	0.3	0.0
Totals						
No. of Employees	110	52	53	2	3	0
Percent	100.0	47.2	48.1	1.8	2.7	0.0

Table 8-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, LUGERT-ALTUS, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor/ 1,000 Acres
1-99							
No. of Workers	0	0	6	6	46	52	20.0
Average/Farm	0.	0.	0.1	0.1	1.0	1.1	
100-179							
No. of Workers	0	0	4	4	45	49	8.0
Average/Farm	0.	0.	0.	0.	0.9	1.0	
180-259							
No. of Workers	1	1	16	18	17	35	9.2
Average/Farm	0.	0.	0.9	1.0	0.9	1.9	
260-499							
No. of Workers	1	2	15	18	25	43	4.6
Average/Farm	0.	0.	0.6	0.7	1.0	1.7	
500-999							
No. of Workers	0	2	31	33	15	48	3.9
Average/Farm	0.	0.1	1.9	2.1	0.9	3.0	
1,000-1,999							
No. of Workers	0	0	8	8	2	10	4.0
Average/Farm	0.	0.	4.9	4.9	1.2	6.1	
2,000-3,999							
No. of Workers	0	2	21	23	3	26	3.5
Average/Farm	0.	1.9	7.0	7.7	1.0	8.7	
Totals							
No. of Workers	15		101	110	153	263	

Table 8-8

Lugert-Altus Irrigation District
W.C. Austin Project, Oklahoma

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Irrigated Cotton	122	Land	$420,600
	Irrigated Sorghum	30	Improvements	10,800
	Dryland Wheat	492	Machinery	77,916
	Waste	16	Total	$509,316
	Farmstead	8		
	Total Irr.	160		

Financial Summary

Land at Current Market Value (Dry, $450/ac. Irr. $1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$ 79,408	Gross Sales	$79,408
Expenses	91,091	Expenses	61,723
Return to Operator Labor, Mgt., & Equity	$-11,683	Return to Operator Labor, Mgt., & Equity	$17,685

Land at Excess Land Value (Dry, $450/ac. Irr. $765/ac.)

Beginning Farmers	
Gross Sales	$79,408
Expenses	86,231
Return to Operator Labor, Mgt., & Equity	$-6,823

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Irrigated Cotton	243	Land	$841,200
	Irrigated Sorghum	61	Improvements	21,600
	Dryland Wheat	984	Machinery	132,700
	Waste	32	Total	$995,500
	Farmstead	16		
	Total Irr.	320		

Financial Summary

Land at Current Market Value (Dry, $450/ac. Irr. $1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$158,667	Gross Sales	$158,667
Expenses	178,097	Expenses	120,686
Return to Operator Labor, Mgt., & Equity	$-19,430	Return to Operator Labor, Mgt., & Equity	$ 37,981

Land at Excess Land Value (Dry, $450/ac. Irr. $765/ac.)

Beginning Farmers	
Gross Sales	$158,667
Expenses	168,377
Return to Operator Labor, Mgt., & Equity	$ -9,710

Table 8-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Irrigated Cotton	456	Land	$1,299,300
	Irrigated Sorghum	122	Improvements	43,200
	Dryland Wheat	1,970	Machinery	237,437
	Waste	64	Total	$1,579,937
	Farmstead	32		
	Total Irr.	640		

Financial Summary

Land at Current Market Value (Dry, $450/ac. Irr. $1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$317,469	Gross Sales	$317,469
Expenses	345,163	Expenses	254,269
Return to Operator Labor, Mgt., & Equity	$-27,694	Return to Operator Labor, Mgt., & Equity	$ 63,200

Land at Excess Land Value (Dry, $450/ac. Irr. $765/ac.)

Beginning Farmers	
Gross Sales	$317,469
Expenses	335,443
Return to Operator Labor, Mgt., & Equity	$-17,974

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Irrigated Cotton	973	Land	$2,214,600
	Irrigated Sorghum	243	Improvements	86,400
	Dryland Wheat	3,940	Machinery	404,470
	Waste	128	Total	$2,705,470
	Farmstead	64		
	Total Irr.	1,280		

Financial Summary

Land at Current Market Value (Dry, $450/ac. Irr. $1,200/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$635,086	Gross Sales	$635,086
Expenses	654,911	Expenses	534,122
Return to Operator Labor, Mgt., & Equity	$-19,825	Return to Operator Labor, Mgt., & Equity	$100,964

Land at Excess Land Value (Dry, $450/ac. Irr. $765/ac.)

Beginning Farmers	
Gross Sales	$635,086
Expenses	645,191
Return to Operator Labor, Mgt., & Equity	$-10,105

The estimated turnover rate for farms in the western United States is 2.5 percent per year. On the average a farm is transferred every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Using the average debt-asset ratio of 17.5 percent for all Oklahoma farms in 1978, farm budgets were modified and the results are shown in Table 8-8.

Due to the higher equity position, the cash flow for existing farmers is significantly higher than for beginning farmers and is positive for all farm sizes.

ECONOMIES OF SIZE

The specified machinery complements were used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 8-1 and 8-2 show the SRAC which includes operator labor at market wage rates for each farm size. The minimum points on these SRAC indicate the optimum crop mix given the machinery complement. Although acreage of high-value crops were restricted based on market limitations, these results are similar to the typical farm budgets presented in Table 8-8. The average total cost per dollar of gross sales is above the breakeven level of $1.00 for all farm sizes. Inclusion of corn and grain sorghum increased costs on the 1,280 acre farm.

When an envelope curve is fitted to the minimum points on the SRAC, a long-run LRAC or planning curve is developed. This is shown in Figure 8-3 for the two land values. Excess land values have the greatest impact at the left-hand end of the curve as indicated by the spread between the two curves.

Viewing the shape of the LRAC for excess land, most of the economies of size are captured by the time farm gross sales reach about $220,000. This translates into a farm of approximately 640 acres under the assumptions of of this study.

PRICE AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 8-9.

Table 8-9

Standard Deviations of Price, Yield and Gross Income by Crop
Lugert-Altus Irrigation District

Crop	Yield	Price	Gross Income Per Acre
Cotton Lint	2.138 cwt	6.090/cwt	$70.56
Cotton Seed	4.095 cwt	1.282/cwt	16.46
Wheat	6.032 bu	.164/bu	16.59
Grain Sorghum	9.731 bu	.077/bu	30.33

To indicate the variability of farm income and costs, the data in Table 8-9 were combined based on the proportion of land in each crop for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 8-4.

As shown in Table 8-9, most of the major crops grown in the district must be considered relatively risky crops. This is also reflected in the wide band around the LRAC in Figure 8-4. This band indicates the range within which average costs can be expected to fall within about 67 percent of the time or about two out of every three years.

DEMAND FOR IRRIGATION WATER

With the high proportion of irrigated land in the district planted to cotton, the economic demand for water depends heavily on the profitability of this crop and irrigated grain and water costs as well as irrigation efficiency achievable in the district.

The vertical dashed line in Figure 8-5 indicates the historic water supplied per acre in the district of 0.52 acre feet per acre. The asterisk located on this vertical dashed line represents the 1978 average cost of water at the farm headgate of $18.58 per acre foot. An indication of

FIGURE 8–1
LUGERT ALTUS
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
UNLIMITED LEASING

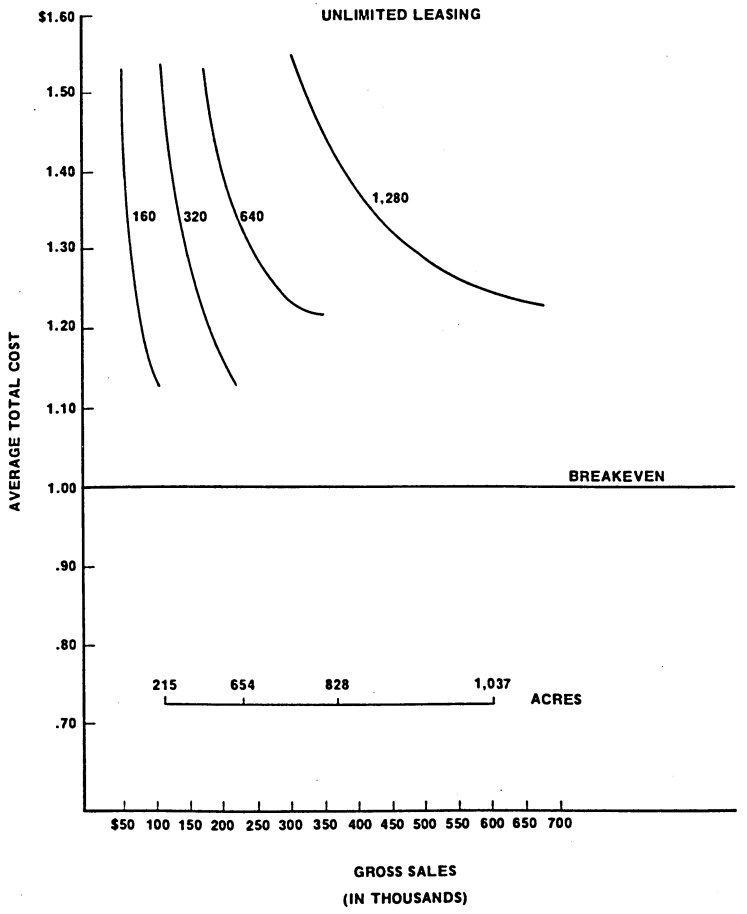


FIGURE 8–2
LUGERT ALTUS
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

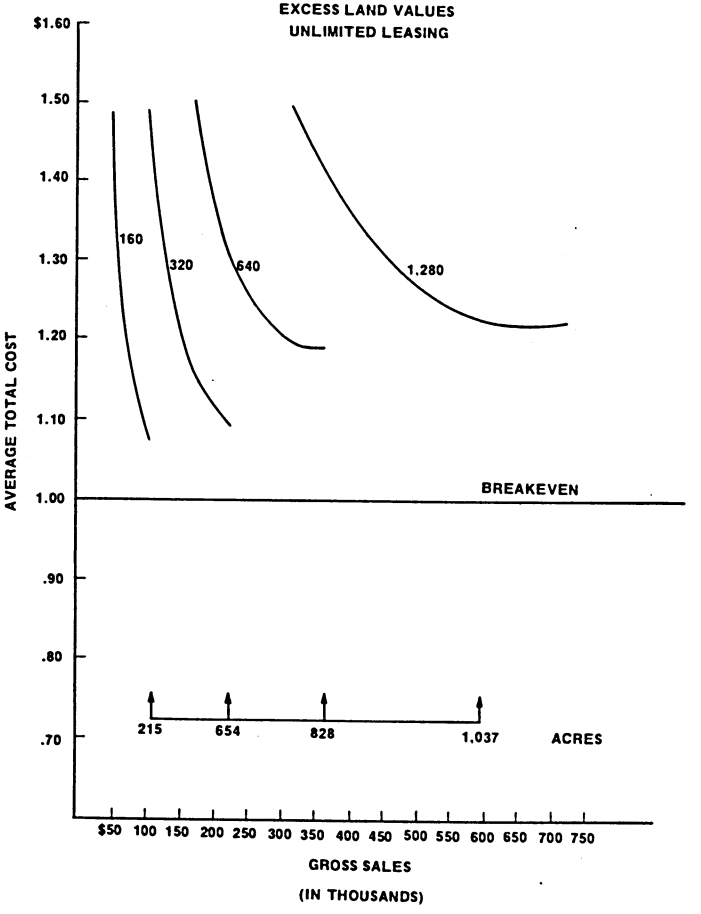


FIGURE 8–3
LUGERT ALTUS
LONG RUN PLANNING COST CURVES
UNLIMITED LEASING

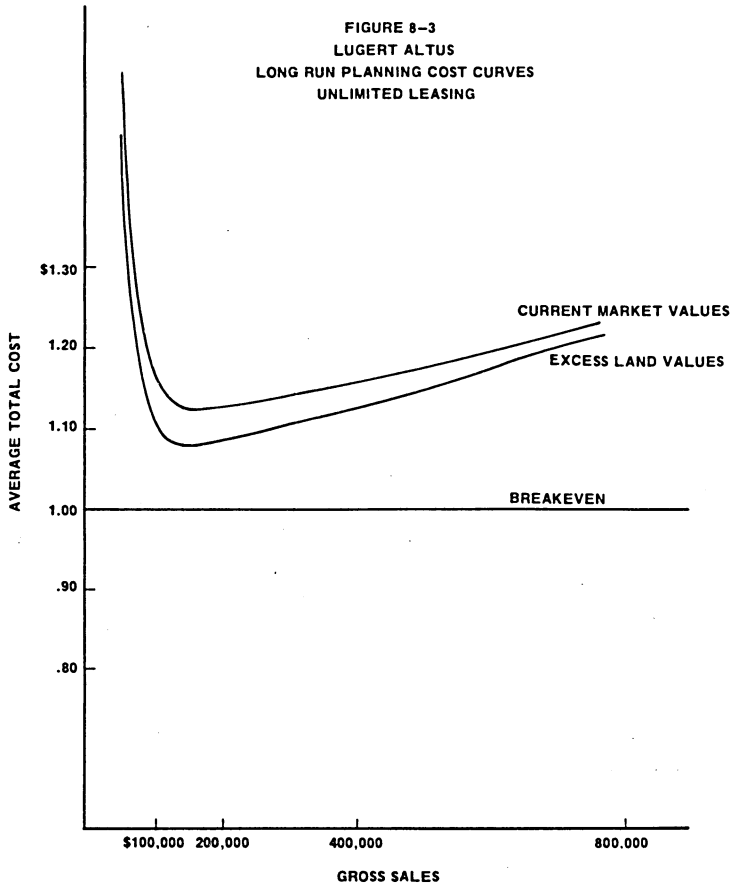
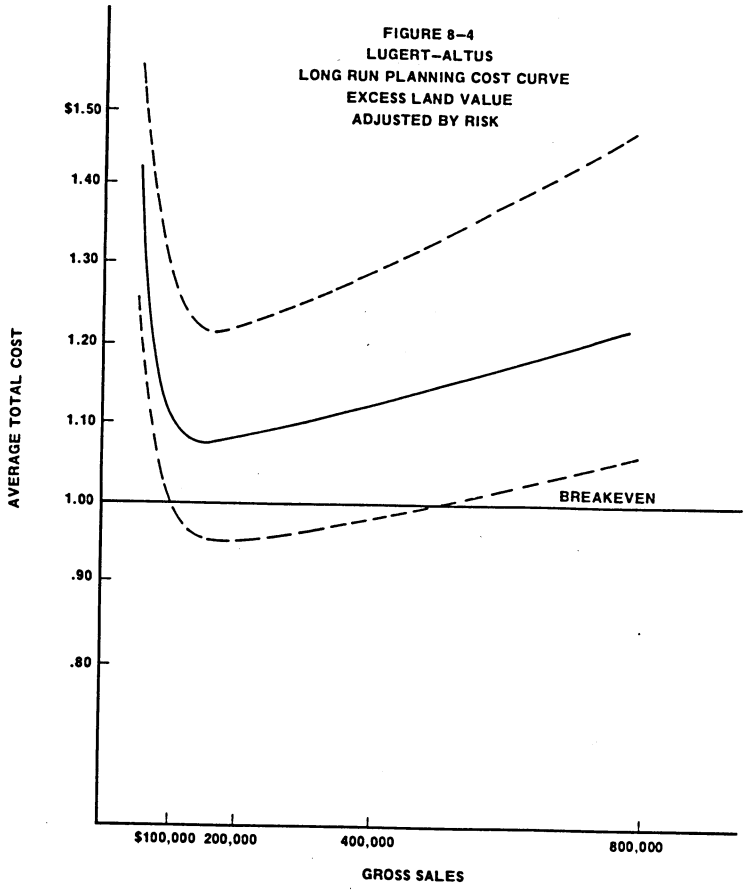


FIGURE 8–4
LUGERT–ALTUS
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK



the magnitude of the federal subsidy in this project and for comparison purposes, the BOR estimated full-cost price is $143.19 per acre foot.

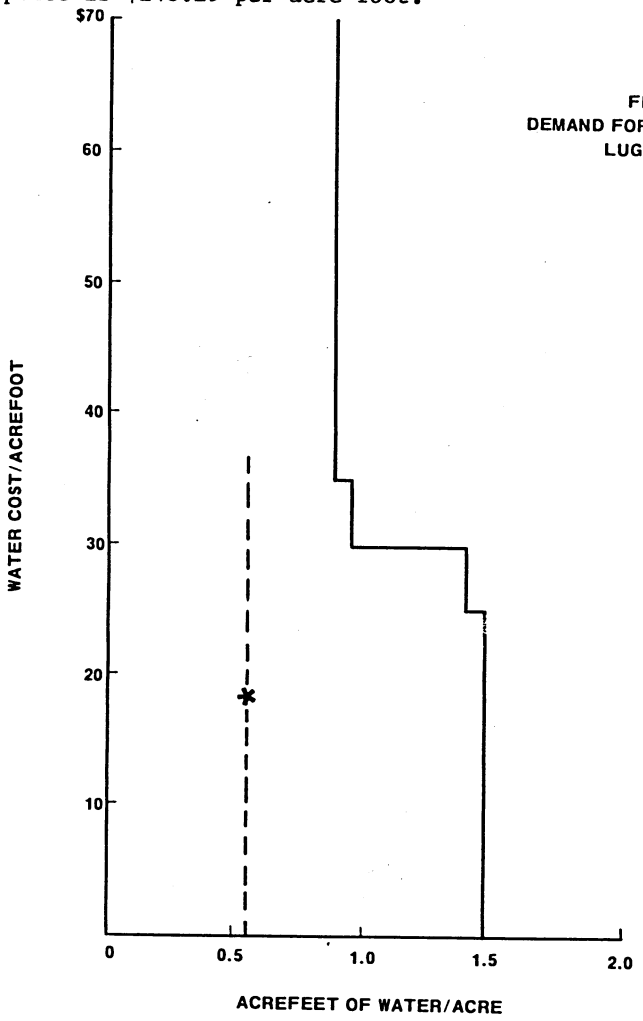


FIGURE 8-5
DEMAND FOR IRRIGATION WATER
LUGERT-ALTUS

The solid downward sloping line in Figure 8-5 represents the derived demand for irrigation water based on the results of the linear programming model. This average demand curve is weighted by the proportion of land in each size group in the districts. Results indicate that district farm operators could profitably utilize almost three times the current allocation per acre at the 1978 water price. If water costs were to increase to $30.00 per acre foot, the optimum quantity of water used would still exceed the historic allocation.

The impact of increased water costs on farm income are shown graphically in Figure 8-6. The solid curve presents net returns over variable costs including water costs plotted against water cost per acre foot. Its negatively sloping "dished" characteristic indicates that net returns decrease but at a decreasing rate as water costs increase due to adjustments in the optimal crop mix and irrigation methods. Fixed costs on these farms are high in relation to net revenue, due for the most part to the ownership of all the dryland assumption used in this study. The dashed horizontal lines at the left-hand margins of the graph indicate this fixed cost level. In every case the level of fixed costs exceeds the net returns over variable cost thus indicating that farm operators would show a net loss even if water had a zero price.

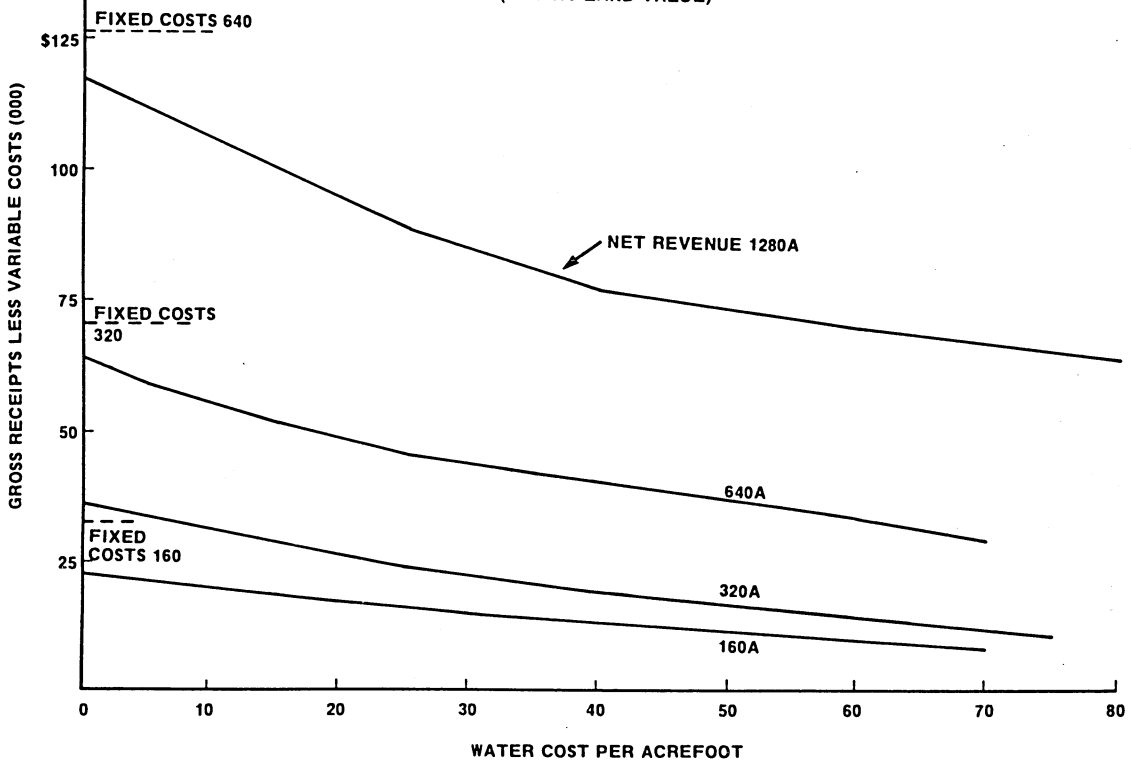
OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S.Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Jackson County, Oklahoma, reports 691 farms with gross agricultural sales of $2,500 or more. Table 8-10 shows the number of these farms reporting agriculturally related off-farm work.

FIGURE 8-6
ABILITY TO PAY FOR IRRIGATION WATER[1]
LUGERT-ALTUS
(EXCESS LAND VALUE)



1 ALL FARM SIZES SHOW LOSS AT ZERO WATER COST

Table 8-10

Farm Operators Reporting Days Work Off-Farm

None	280
1 - 49 days	43
50 - 99 days	15
100 - 149 days	15
150 - 199 days	83
200 days or more	142
Total	578

Income and expenses related to selected off-farm income sources are shown in Table 8-11.

Table 8-11

Operator Income From Farm Related Sources, Jackson County

Number of Farms Reporting	279
Average Per Farm Reporting	$1,069
Income From Custom Work	
Number of Farms Reporting	107
Average Per Farm Reporting	$ 348
Expenses Related to Off-Farm Income	
Number of Farms Reporting	102
Average Per Farm Reporting	$ 240

Farm operators' spouses and their children also contribute to family income. In Jackson County, 393 farms reported an average family off-farm income of $4,249 in 1974. No information is available on off-farm income by size of farm.

CHAPTER 9

Black Canyon District No. 2 - Boise Project, Idaho

The Black Canyon Irrigation District is located in the hilly area in the north and northeast part of Canyon County, the area south of New Plymouth in Payette County and the southwest corner of Gem County.

CLIMATE

The mean annual precipitation ranges from 10 to 12 inches and the mean annual temperature is about 50° F. The average frost-free (32° F) period is about 146 days.

SOILS

An estimated 75 percent of the Black Canyon Irrigtion District is comprised of soils that are hilly or rolling, commonly having a series of long, narrow ridges, mostly between 1/16- to 1/4-mile wide. Small intermittent drainages have formed narrow alluvial bottoms between these ridges. Slopes range from about 1 percent on many of these bottoms to over 40 percent on a few of the hillsides. The underlying material is the stratified sandy and loamy layers of old acid igneous alluvium. This hilly or rolling area is typified by soils with a surface layer of about 6 inches of brownish-gray silt loam, low in organic matter. The subsoils are usually clayey, often with an indurated hardpan. A layer of lime accumulation beginning at depths between 12 and 20 inches is common. Water intake rates are usually slow to moderate and available water-holding capacity is usually moderate.

The rolling nature of the area does not lend itself to efficient surface irrigation. Fields are usually small in area and irregular in shape. This problem is compounded by the fact that the clayey subsoils are not conducive to the heavy leveling needed for efficient field layout. No land classification exists for this area, but it is estimated that using land classification standards designed for surface irrigation, a very significant percentage would fall into the Class 3 category.

CROPS

The cropping pattern of the Black Canyon District is heavily dominated by alfalfa hay with almost 15,000 acres or about 36 percent of the total (see Table 9-1) irrigated crop land. Wheat and barley are the two most important cereal crops followed by corn. Sugar beets are an important cash crop with almost 2,800 acres grown in 1977 making it the third most important crop with respect to generating farm income.

Alfalfa seed and potatoes do not occupy a large land area in the district, but are important income-producing crops. All of these major crops are reflected in the farm budgets shown below.

LAND TENURE

Dispersion of land ownership in the Black Canyon District is the widest of any of the non-perennial crop case-study projects with a Gini coefficient of 0.05.[1/] Almost 92 percent of the land ownership units are less than 100 acres as shown in Table 9-2. None of the land ownership exceed 500 acres. Land in the district is broadly held by individuals and family-type arrangements, both husband and wife as well as family partnerships and family corporations.

Table 9-3 presents the acreages owned by these 801 legal entities with an average ownership of only 60 acres. Six nonfamily corporations own less than 400 acres in total and therefore are not a significant factor in the ownership structure in the district.

Farm Operations

While the average ownership is 60 acres, the average farm size through ownership and leasing is 171 acres as presented in Table 9-4. Farm operations are also a family arrangement with 70 percent of the farms controlled by husbands and wives.

Forages are a predominate part of the district crop mix with 45 percent of the land planted to these crops (see Table 9-5). The proportion of land in forages is highest on the smallest farms and tends to decrease as farm size increases.

1/ Gini coefficient ranges from 0 to 1.0. The larger the value, the greater the concentration.

Table 9-1

Crop Acreage, Black Canyon District, Boise Project, Idaho, 1977

Crop	Acres	Value of Production in Thousands of Dollars
Cereals		
Barley	7,851	$1,015
Corn	1,544	245
Oats	258	10
Wheat	2,820	497
Other	350	40
Forage		
Alfalfa Hay	14,690	2,491
Other Hay	825	108
Pasture	4,810	128
Silage	4,486	847
Straw	---	8
Miscellaneous Field Crops		
Beans	533	223
Sugar Beets	2,778	1,953
Other	585	426
Vegetables		
Potatoes	1,198	1,281
Other	766	373
Seed Crops		
Alfalfa	1,669	1,062
Other	827	488
Fruit		
Apples	295	670
Other	133	240
Total	46,418	$12,105

Vegetables, mostly potatoes, constitute a small percentage of the land but are an important income producer in the district. Except for the smallest farm size the proporiton of land planted to vegetables is fairly constant. Seed crops, especially alfalfa seed, is another low acreage, high income producing crop category. In the case of alfalfa seed, the smallest farms plant a greater than average proportion of the land to this crop. Thus, it is not possible to generalize with respect to any change in cropping intensity and farm size.

Labor

Surveyed farm operators reported 212 regular farm workers on the 459 farms in the district (see Table 9-6). A great preponderance of these workers, 87 percent were Caucasian and 11 percent Hispanic.

The regular labor force, hired and family, was grouped by type of work and farm size. Results of this grouping are presented in Table 9-7. Slightly over two-thirds of the total labor input is provided by farm operators, more than one-half of these, 58 percent, were concentrated on the 312 farms in the less than 100 acre size group. The right-hand column in Table 9-7 presents the standardized labor input on a per 1,000 acre equivalent basis. After the initial drop from the smallest size group the labor input per 1,000 acres decreases as farm size increases but interestingly, the lowest labor input was reported on the 260 to 499 acre size group. It should be noted that these data have not been adjusted for off-farm employment, temporary help, crop mix, custom services hired or noncrop enterprises, such as livestock or such activities as a potato packing shed.

RESULTS OF TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes representative of the Black Canyon #2 Irrigation District, 160, 320, 640 and 1,280 acres. Following the Interior's Proposed Rules and

Table 9-2

FORM OF OWNERSHIP BY FARM SIZE, BLACK CANYON, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
No. of Owners	90	384	252	3	5	0	0	0	734	91.6
Percent	12.2	52.3	34.3	0.4	0.6	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	16	38	0	0	0	1	0	0	55	98.5
Percent	29.0	69.0	0.0	0.0	0.0	1.8	0.0	0.0	100.0	
180- 259										
No. of Owners	0	6	2	0	0	0	0	0	8	99.5
Percent	0.0	75.0	25.0	0.0	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	0	4	0	0	0	0	0	0	4	100.0
Percent	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	106	432	254	3	5	1	0	0	801	
Percent	13.2	53.9	31.7	0.3	0.6	0.1	0.0	0.0	100.0	

Table 9-3

LAND BY OWNERSHIP, BLACK CANYON, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	4433	26467	7123	186	179	0	0	0	38388	79.6
Percent	11.5	68.9	18.5	0.4	0.4	0.0	0.0	0.0	100.0	
Average									52.2	
100-179										
Acres	2089	5367	0	0	0	179	0	0	7635	95.4
Percent	27.3	70.2	0.0	0.0	0.0	2.3	0.0	0.0	100.0	
Average									138.8	
180-259										
Acres	0	809	345	0	0	0	0	0	1154	97.8
Percent	0.0	70.1	29.8	0.0	0.0	0.0	0.0	0.0	100.0	
Average									144.2	
260-499										
Acres	0	1055	0	0	0	0	0	0	1055	100.0
Percent	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									263.7	
Totals										
Acres	6522	33698	7468	186	179	179	0	0	48232	
Percent	13.5	69.8	15.4	0.3	0.3	0.3	0.0	0.0	100.0	
Average	61.5	78.0	29.4	62.0	35.8	179.0	0.0	0.0	60.2	

Table 9-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, BLACK CANYON, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Indi-vidually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	2	30	231	49	0	312	48
Percent	0.0	0.6	9.6	74.0	15.7	0.0	100.0	
100-179								
No. of Farms	1	5	11	46	13	0	76	132
Percent	1.3	6.5	14.4	60.5	17.1	0.0	100.0	
180-259								
No. of Farms	0	4	8	27	3	0	42	210
Percent	0.0	9.5	19.0	64.2	7.1	0.0	100.0	
260-499								
No. of Farms	0	2	7	12	1	0	22	336
Percent	0.0	9.0	31.8	54.5	4.5	0.0	100.0	
500-999								
No. of Farms	0	0	3	4	0	0	7	701
Percent	0.0	0.0	42.3	57.1	0.0	0.0	100.0	
Totals								
No. of Farms	1	13	59	320	66	0	459	171
Percent	0.2	2.8	12.8	69.7	14.3	0.0	100.0	

Table 9-5

IRRIGATED CROP PATTERNS BY FARM SIZE, BLACK CANYON, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	4116	9261	912	83	1765	12	0	16149
Percent	25.4	57.3	5.6	0.5	10.9	0.0	0.0	100.0
100-179								
Total Acres	3181	4192	880	413	902	27	0	9595
Percent	33.1	43.6	9.1	4.3	9.4	0.2	0.0	100.0
180-259								
Total Acres	2557	3074	1313	466	432	1114	0	8956
Percent	28.5	34.3	14.6	5.2	4.8	12.4	0.0	100.0
260-499								
Total Acres	2218	2186	1014	310	561	0	0	6289
Percent	35.2	34.7	16.1	4.9	8.9	0.0	0.0	100.0
500-999								
Total Acres	1292	1595	601	181	297	0	0	3966
Percent	32.5	40.2	15.1	4.5	7.4	0.0	0.0	100.0
Totals								
Total Acres	13364	20308	4720	1453	3957	1153	0	44955
Percent	29.7	45.1	10.4	3.2	8.8	2.5	0.0	100.0

Table 9-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, BLACK CANYON, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	76	73	0	0	0	3
Average	0.2	0.2	0.0	0.0	0.0	0.0
100-179						
No. of Employees	34	31	3	0	0	0
Average	0.4	0.4	0.0	0.0	0.0	0.0
180-259						
No. of Employees	52	37	13	0	0	2
Average	1.2	0.8	0.3	0.0	0.0	0.0
260-499						
No. of Employees	21	17	4	0	0	0
Average	0.9	0.7	0.1	0.0	0.0	0.0
500-999						
No. of Employees	29	26	3	0	0	0
Average	4.6	4.1	0.4	0.0	0.0	0.0
Total						
No. of Employees	212	184	23	0	0	5
Percent	100.0	86.7	10.8	0.0	0.0	2.3

Table 9-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, BLACK CANYON, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees and Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	10	12	54	76	312	388	25.7
Average/Farm	0.	0.	0.1	0.2	0.9	1.2	
100-179							
No. of Workers	0	2	33	35	76	111	11.0
Average/Farm	0.	0.	0.	0.4	0.9	1.4	
180-259							
No. of Workers	1	5	45	51	42	93	10.3
Average/Farm	0.	0.1	1.0	1.1	0.9	2.1	
260-499							
No. of Workers	2	1	18	21	22	43	5.8
Average/Farm	0.	0.	0.8	0.9	1.0	1.9	
500-999							
No. of Workers	2	5	21	28	7	35	7.9
Average/Farm	0.3	0.7	3.3	4.4	1.1	5.5	
Totals							
No. of Workers	15	25	171	211	459	670	

Regulations, these budgets assume a maximum land ownership of 160 acres for an individual owner, 320 acres for a husband and wife. Therefore, the 160 acre and 320 acre farms assume full ownership and the 640 and 1,280 acre farm budgets assume 320 acres in full ownership with the balance of the acreage leased-in at the local rate for cash rentals.

The 1978 cash rental rate of $65 per crop acre is low relative to the current market price for land of $1,600 per acre and an excess land value of $1,200 per acre, thus providing a significant income advantage to any farm operator who rents a high proportion of his land. This is reflected in the farm budget summaries presented in Table 9-8 as well as later in the economies of farm size analysis.

Beginning Farmers

The 160 acre farm assumes full ownership and shows a return to operator labor and management (cash flow) of $-11,359 at current market land values and $-6,583 at excess land values. Returns to operator labor and management are also negative for the 320 and 640 acre farms even though sugar beets are included in the crop mix. The 1,280 acre farm with 960 acres cash rented is the only farm size to demonstrate a positive return to operator labor and management with $28,251 using current market land values and $37,771 when excess land values are used for the 320 acres assumed to be owned by the operator. The 68 acres of high value potatoes contributed to this favorable income result.

Existing Farmers

Farm budgets were modified to reflect the cash flow for existing farm operators who were assumed to have purchased land at an earlier date, at a lower price and financed at a lower interest rate.

Using the estimated turnover rate for all farms in the western United States of 2.5 percent per year, it was assumed the average farm changes hands every 40 years. Thus the average farm was purchased 20 years ago, i.e., 1958 when Federal Land Bank interest rates were 5.5 percent. Based on the average debt-asset ratio of 21.3 percent for all Idaho farms in 1978, farm budgets were modified and the results presented in Table 9-8. Due to their higher equity position and lower interest rates, the cash flow for these existing farmers is significantly higher than for the previously examined beginning farmers and is positive for all farm sizes.

ECONOMIES OF SIZE

The machinery complements specified by the farmer panel were used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 9-1 and 9-2 show the SRAC which includes operator labor at market wage rates for each farm size. The minimum points on these SRAC indicate the optimum crop mix given the machinery complement. Although acreages of high value crops were constrained based on market limitations, these results are similar to the typical farm budgets presented in Table 9-8. A long-run average cost curve LRAC can only be developed when all unused capacity in a fixed plant is utilized. To approximate a LRAC, the machinery complement for each farm size was held constant but additional land was added to the base farm size until the engineering design capacity of the machinery complement was exhausted.

All of the farm sizes show minimum SRAC below the breakeven level indicating a positive net farm income. With the additional rented land, machinery is used to capacity, the 160 acre machine complement reaches a minimum SRAC at about 590 acres of land.

When an envelope curve is fitted to the minimum SRAC, a LRAC or planning curve is developed as shown in Figure 9-3 for current market land values (with project) and excess land values (without project). The major difference between the two land values is reflected in the spread between the two LRAC at the left end of the scale.

In general, most of the economies of size are captured when farm size is in the 900-1,000 acre range and gross sales are approximately $250,000 to $300,000 in 1978 prices.

PRICE AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 9-9.

To indicate the variability of farm income and costs, the data in Table 3 were combined based on the proportion of land in each crop for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 9-4.

Table 9-8

Black Canyon #2
Boise Project, Idaho, 1978

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	70	Land	$192,000
	Barley (Irr.)	39	Improvements	12,600
	Estb. Alfalfa Hay	17	Machinery	54,485
	Estb. Alfalfa Seed	4	Total	$259,085
	Alfalfa Seed	15		
	Setaside	7		
	Farmstead	8		
	Total	160		

Financial Summary

Land at Current Market Value ($1,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$ 35,874	Gross Sales	$35,874
Expenses	47,233	Expenses	26,511
Return to Operator Labor, Mgt., & Equity	$-11,359	Return to Operator Labor, Mgt., & Equity	$ 9,363

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$35,874
Expenses	42,457
Return to Operator Labor, Mgt., & Equity	$-6,583

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	131	Land	$384,000
	Barley (Irr.)	68	Improvements	12,500
	Estb. Alfalfa Hay	33	Machinery	122,460
	Sugar Beets	39	Total	$518,960
	Estb. Alfalfa Seed	4		
	Alfalfa Seed	15		
	Setaside	15		
	Farmstead	15		
	Total	320		

Financial Summary

Land at Current Market Value ($1,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$ 83,276	Gross Sales	$83,276
Expenses	95,048	Expenses	55,243
Return to Operator Labor, Mgt., & Equity	$-11,772	Return to Operator Labor, Mgt., & Equity	$28,033

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$83,276
Expenses	84,498
Return to Operator Labor, Mgt., & Equity	$-1,222

Table 9-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	273	Land	$384,000
	Barley (Irr.)	137	Improvements	14,300
	Estb. Alfalfa Hay	68	Machinery	255,845
	Sugar Beets	68	Total	$654,145
	Estb. Alfalfa Seed	8		
	Alfalfa Seed	31		
	Setaside	29		
	Farmstead	26		
	Total	640		

Financial Summary

Land at Current Market Value ($1,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$163,504	Gross Sales	$163,504
Expenses	180,142	Expenses	136,485
Return to Operator Labor, Mgt., & Equity	$-16,638	Return to Operator Labor, Mgt., & Equity	$ 27,019

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$163,504
Expenses	170,622
Return to Operator Labor, Mgt., & Equity	$ -7,118

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	548	Land	$384,000
	Barley (Irr.)	294	Improvements	33,600
	Estb. Alfalfa Hay	137	Machinery	486,144
	Sugar Beets	69	Total	$903,744
	Potatoes	68		
	Estb. Alfalfa Seed	12		
	Alfalfa Seed	47		
	Setaside	48		
	Farmstead	57		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$360,135	Gross Sales	$360,135
Expenses	331,884	Expenses	275,352
Return to Operator Labor, Mgt., & Equity	$ 28,251	Return to Operator Labor, Mgt., & Equity	$ 84,783

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$360,135
Expenses	322,364
Return to Operator Labor, Mgt., & Equity	$ 37,771

FIGURE 9–1
BLACK CANYON
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT LAND MARKET
UNLIMITED LEASING

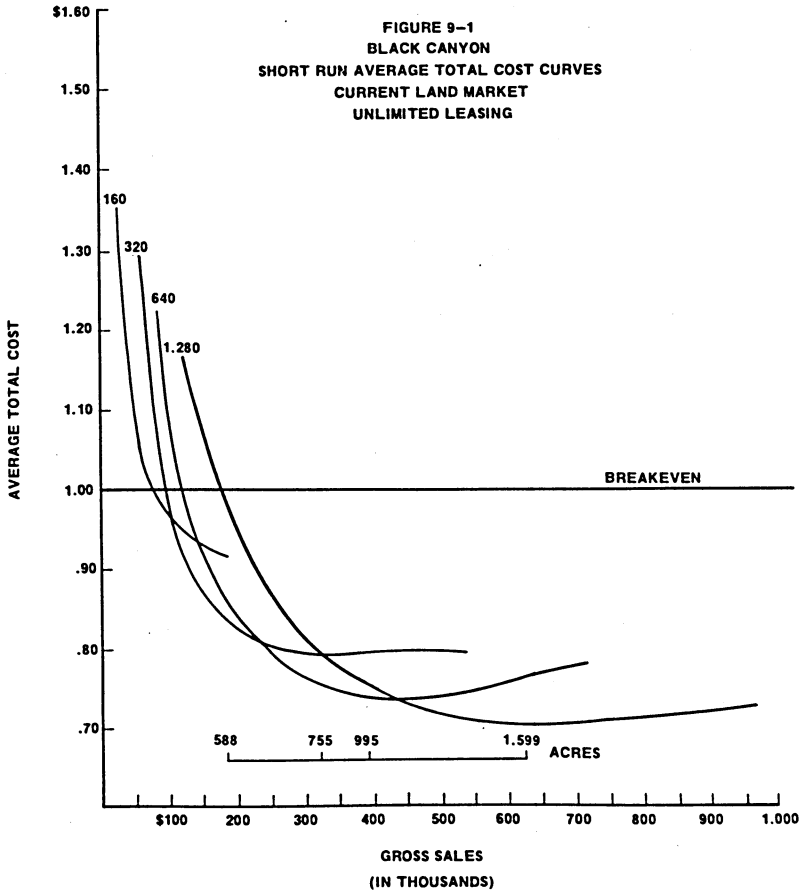


FIGURE 9–2
BLACK CANYON
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

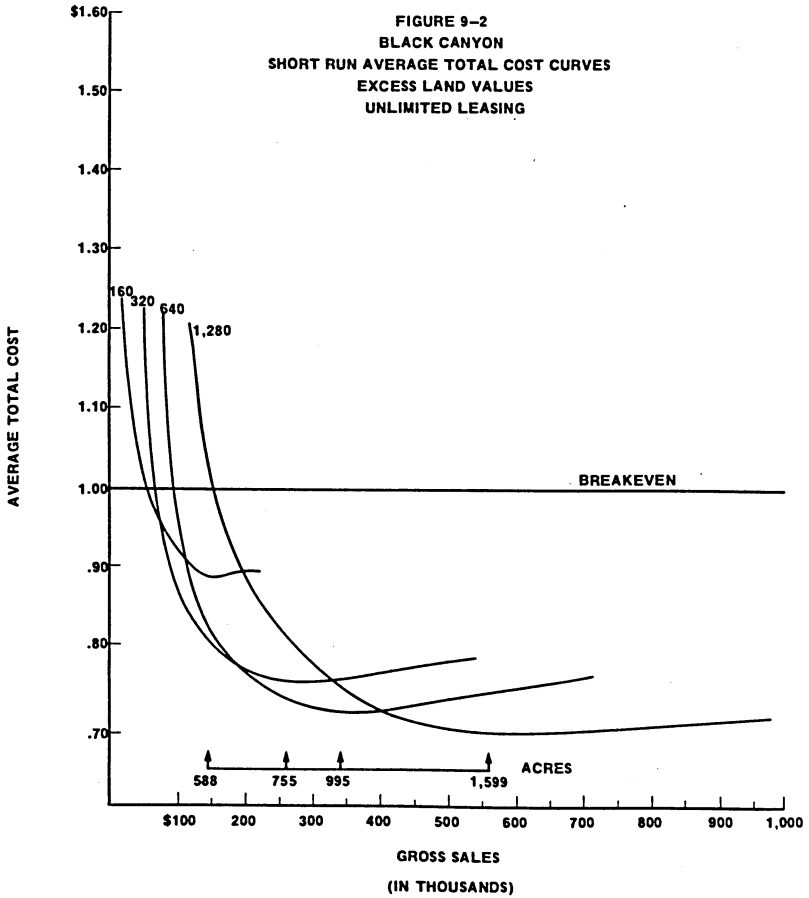


FIGURE 9–3
BLACK CANYON
LONG RUN PLANNING COST CURVES
UNLIMITED LEASING

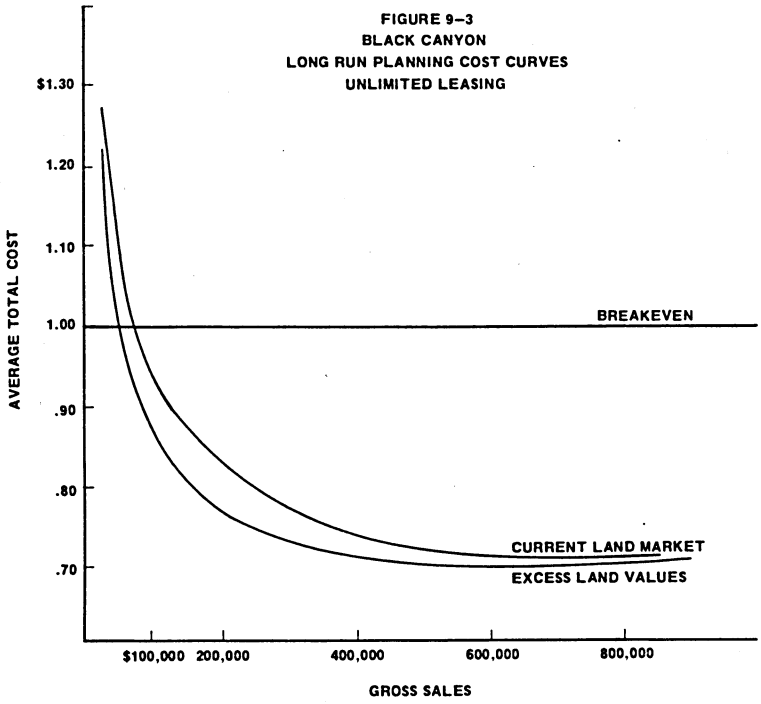


FIGURE 9–4
BLACK CANYON
UNLIMITED LEASING PLANNING CURVE
EXCESS LAND VALUES
ADJUSTED BY RISK

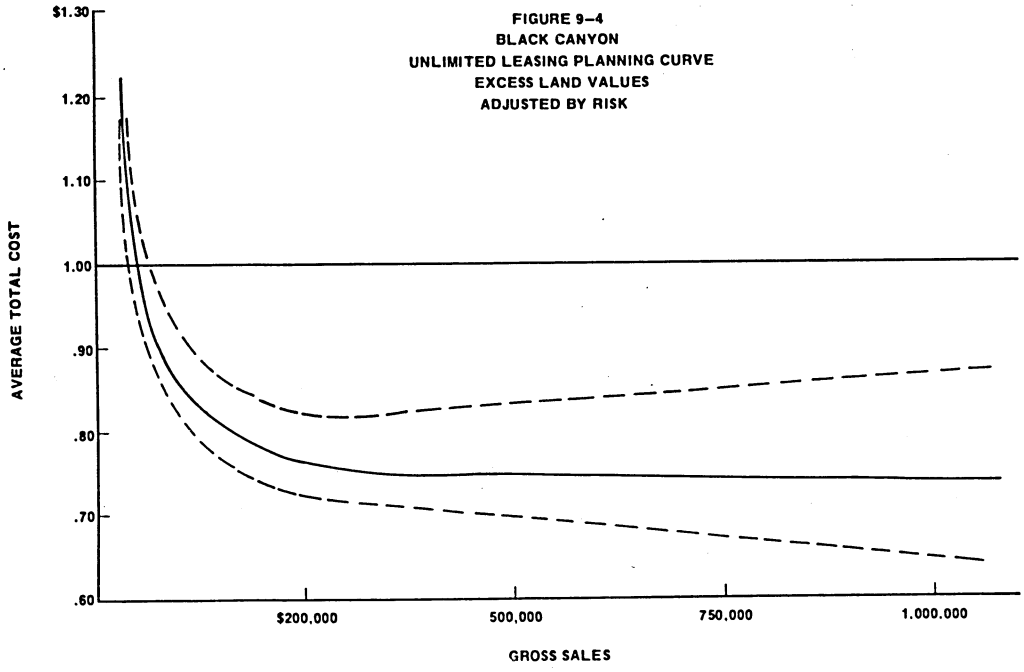


Table 9-9

Standard Deviations of Price, Yield and Gross Income by Crop

Black Canyon #2

Crop	Yield	Price	Gross Income Per Acre
Barley	5.38 bu.	$0.095/bu.	$ 6.57
Potatoes	21.64 cwt.	0.56/cwt.	166.90
Alfalfa Hay	0.095 ton	2.71/ton	7.28
Alfalfa Seed	0.47 cwt.	7.98/cwt.	27.61
Sugar Beets	1.03 ton	2.61/ton	72.68

As indicated in Table 9-9, barley and alfalfa hay are relatively stable income crops and this is reflected in the narrow band width for the smaller farm size; whereas sugar beets and especially potatoes show a relatively high gross income variability per acre and this is reflected by the wider band width at the right-hand side of the LRAC in Figure 9-4. Assuming gross incomes are normally distributed, average cost per dollar of gross sales (ATC) can be expected to fall within the width of the band about 67 percent of the time or two out of three years.

DEMAND FOR IRRIGATION WATER

Given the diversity of crops in Black Canyon and the limited rainfall, the demand for irrigation water is dependent on the cost of water, the profitability of the crops adopted to the area and the water application efficiency of the irrigation methods used.

The vertical dashed line in Figure 9-5 indicates the historic water delivery per acre in the Black Canyon District of 5.2 acre feet. The asterisk located on the dashed line represents the 1978 average cost of water per acre foot, $1.41, delivered to farm headgates. Quantity-price relations (weighted demand) are traced out with the solid stepped curve in Figure 9-5. This analysis indicates that farm operators are optimally utilizing, or at least within measurement error, the current allocation of water to the district at current water costs. However, if water costs/prices were increased to the BOR full-cost price of $15.77 per acre foot, large reductions would occur in the quantity of water demanded, up to a 60 percent decrease. Along with the decrease in demand for water, a drastic change in the crop pattern and irrigation methods would occur. Most of the crop mix change would occur in the acreage of alfalfa hay and pasture in the district.

Impacts of increased water costs on farm income and the ability to pay for water are shown in Figure 9-6. By definition, the excess land value is the current land value without the project. The maximum ability to pay for project water would be that price which reduced farm income to zero assuming excess land values. Any water price in excess of this price would cause landowners to be better off if the project had never been built. In Figure 9-6 the set of negatively sloped curves trace out the farm net returns over variable costs including water costs for each farm size. Horizontal dashed lines indicate the level of fixed costs associated with each farm size assuming debt service on land at its excess land value. A vertical line dropped to the base of the graph from the intersect of the net revenue curve and the fixed cost level graphically indicates the maximum ability to pay for water. Ability to pay increases with farm size with only the 160 acre farm indicating an inability to pay more than the current subsidized water cost. Both the 640 and 1,280 acre farms would be able to pay the BOR estimated full-cost water price.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Canyon County, Idaho reports 1,650 farms with gross agricultural sales of $2,500 or more. Table 9-10 shows the number of these farms reporting agriculturally related off-farm work.

FIGURE 9–5
DEMAND FOR IRRIGATION WATER
BLACK CANYON

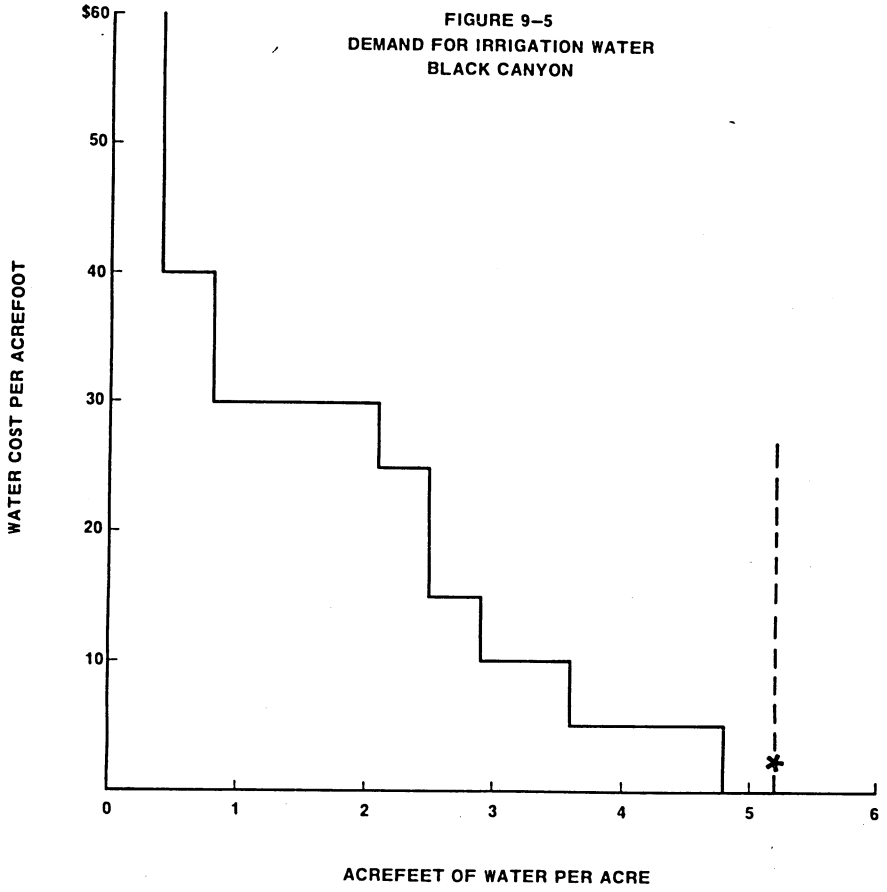


FIGURE 9–6
ABILITY TO PAY FOR IRRIGATION WATER
BLACK CANYON
(EXCESS LAND VALUE)

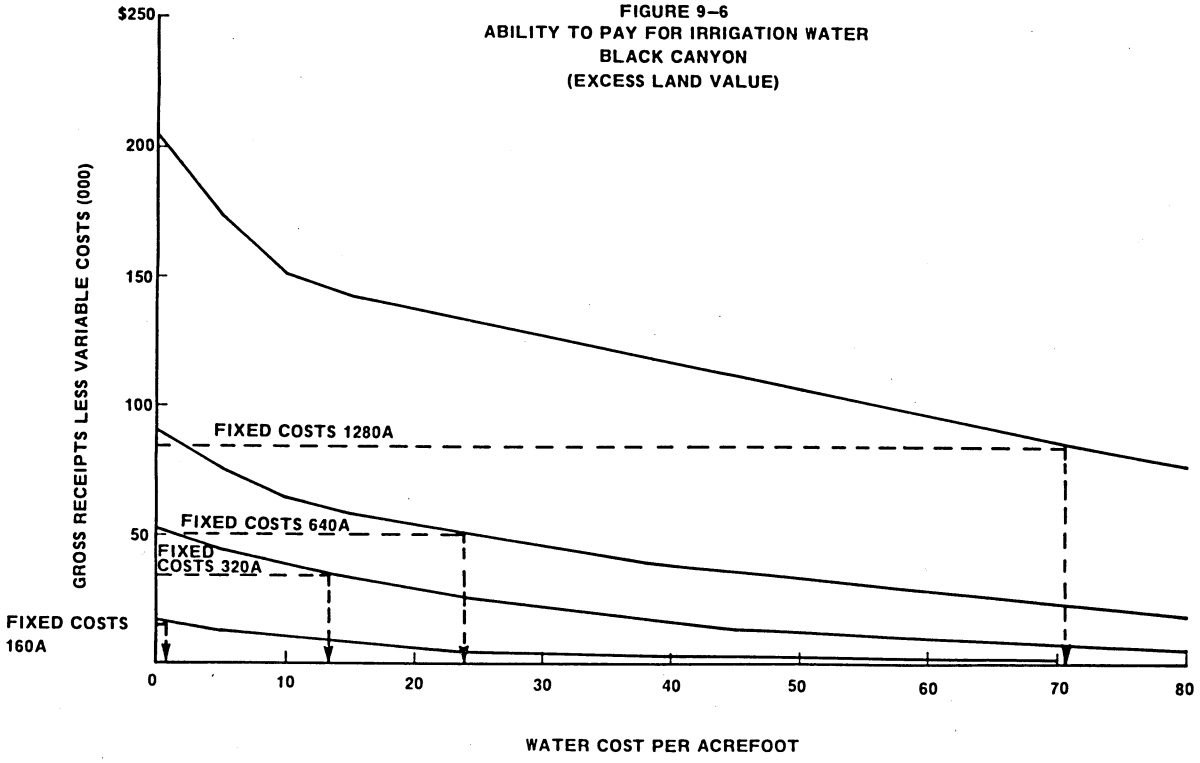


Table 9-10

Farm Operators Reporting Days Work Off-Farm

None	683
1 - 49 days	126
50 - 99 days	54
100 - 149 days	41
150 - 199 days	45
200 days or more	288
Total	1,237

Income and expenses related to selected off-farm income sources are shown in Table 9-11.

Table 9-11

Operator Income From Farm Related Sources, Canyon County

Number of Farms Reporting	587
Average Per Farm Reporting	$4,563
Income From Custom Work	
Number of Farms Reporting	311
Average Per Farm Reporting	$2,546
Expenses Related to Off-Farm Income	
Number of Farms Reporting	65
Average Per Farm Reporting	$ 324

Farm operators' spouses and their children also contribute to family income. In Canyon County, 959 farms reported an average family off-farm income of $7,092 in 1974. No information is available on off-farm income by size of farm.

CHAPTER 10

Lower Yellowstone Irrigation District No. 1, Montana

Lower Yellowstone Irrigation District No. 1, comprised of over 34,000 acres of irrigable land, is part of the 52,000 acre Lower Yellowstone Project. The district is located along the Yellowstone River in northeastern Montana at about 47.5° N. latitude and 104° W. longitude. The elevation of the irrigable area is about 1,900 feet above sea level. The average annual precipitation over the past 50-year period has been about 13.4 inches, with a high of 20 inches and a low of 6 inches. The frost-free growing season for the same period has averaged about 130 days, with a high of 149 days and a low of 106 days.

SOILS

The soils of the district are conducive to sustained irrigation as evidenced by the nearly 70 years of successful project operation. High-value row crops, such as sugar beets and dry beans, are widely grown in the district. Some localized alkali soil areas exist but it is not a widespread problem. The irrigable lands have been classified into four classes as follows:

Class 1	8,600
Class 2	14,913
Class 3	9,123
Class 4	1,815

CROPS

The cropping pattern in Lower Yellowstone is dominated by sugar beets, alfalfa hay, corn silage and small grains as shown in the BOR 1977 crop report presented in Table 10-1. These crops are reflected in the typical farm budgets presented below.

Table 10-1

Crop Acreages, Lower Yellowstone, Montana, 1977

Crop	Acres	Value of Production
Cereals		
Barley	2,698	$ 180,631
Oats	1,495	107,786
Wheat	3,926	376,978
Forages		
Alfalfa Hay	3,923	531,200
Other Hay	521	33,600
Irrigated Pasture	1,746	104,760
Corn Silage	4,018	985,770
Miscellaneous Field Crops		
Dry Beans	1,272	364,734
Sugar Beets	9,179	3,303,707
Other	240	48,696
Total	29,018	$6,037,862

LAND TENURE

Land in the Lower Yellowstone District is widely held with 74 percent of the smallest ownerships containing 55 percent of the land. The Gini coefficient was estimated at 0.13. No ownership exceeded 500 acres with 74 acres being the average as shown in Table 10-2 and 10-3. Most of the land (75 percent) is held by husbands and wives jointly and family partnerships and corporations. Of the 476 ownerships, 21 or 4.3 percent were nonfamily corporations. These corporations held less than 3 percent of the land. One anomaly appears in the data in Table 10-3. In expanding the data from the sample of owners interviewed, an error appears to exist in the acreage reported under nonfamily corporation with 11 or more stockholders in the 260-499 acre size group. Since the original survey schedules were unavailable, the source and impact of this error on the remaining data is unknown.

Table 10-2

FORM OF OWNERSHIP BY FARM SIZE, LOWER YELLOWSTONE, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. or Owners	63	141	129	0	19	0	1	0	353	74.2
Percent	17.8	39.9	36.5	0.0	5.3	0.0	0.2	0.0	100.0	
100-179										
No. of Owners	18	66	10	4	0	0	0	0	98	94.8
Percent	18.3	67.3	10.2	4.0	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	7	0	0	4	0	2	0	0	13	97.5
Percent	53.8	0.0	0.0	30.7	0.0	15.3	0.0	0.0	100.0	
260-499										
No. of Owners	2	10	0	0	0	0	0	0	12	100.0
Percent	16.6	83.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	90	217	139	8	19	2	1	0	476	
Percent	18.9	45.5	29.2	1.6	3.9	0.4	0.2	0.0	100.0	

Table 10-3

LAND BY OWNERSHIP, LOWER YELLOWSTONE, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	3081	10702	4883	0	626	0	52	0	19344	54.9
Percent	15.9	55.3	25.2	0.0	3.2	0.0	0.2	0.0	100.0	
Average									54.7	
100-179										
Acres	2229	7125	1232	572	0	0	0	0	11158	86.7
Percent	19.9	63.8	11.0	5.1	0.0	0.0	0.0	0.0	100.0	
Average									113.8	
180-259										
Acres	1346	0	0	720	0	372	0	0	2438	93.6
Percent	55.2	0.0	0.0	29.5	0.0	15.2	0.0	0.0	100.0	
Average									187.5	
260-499										
Acres	884	1306	0	0	0	64	0	0	2254	100.0
Percent	39.2	57.9	0.0	0.0	0.0	2.8	0.0	0.0	100.0	
Average									187.8	
Totals										
Acres	7540	19133	6115	1292	626	436	52	0	35194	
Percent	21.4	54.3	17.3	3.6	1.7	1.2	0.1	0.0	100.0	
Average	83.7	88.1	43.9	161.5	32.9	218.0	52.0	0.0	73.9	

Farm Operations

Compared to the average ownership unit of 74 acres, the average farm size was 198 irrigated acres. While family-type arrangements accounted for 70 percent of the farms in the district, nonfamily corporations were of little insignificance controlling 6 percent of the farms. Most of these corporate farms were in the larger size groups (see Table 10-4).

Crop pattern of the district is fairly diversified with field crops, cereals and grains and forages predominating in that order (see Table 10-5). The proportion of field crops, primarily sugar beets, tends to increase with farm size; except for farms of less than 100 acres, the difference is not large. On the other hand, the limited acreages of vegetables and seed crops tend to be grown on the smaller farms. It must be concluded that no significant increase in intensification is associated with farm size.

Labor

Farm operators reported only 40 regular employees on the 198 farms in the district as shown in Table 10-6. Virtually all of these hired workers were Caucasian. Data in Table 10-7 report the job categories of these workers. All of the managerial or supervisory positions were held by the farm operators. When farm operators were added to hired labor, a crude estimate of total number of workers by farm size is obtained, as shown in Table 10-7. When standardized on a worker per 1,000 acres, an estimate of the labor efficiency by farm size can be made. The right-hand column presents these results. Labor input per 1,000 acres declines steadily with the minimum input at the 500 to 999 acre farm size of 2.2 workers. These are only rough estimates of labor efficiency because it was not possible to adjust them for off-farm employment, temporary help, custom work, crops grown or livestock on the farm.

RESULTS OF TYPICAL FARM BUDGETS

Four typical farm budgets were developed by the research assistant and the farmer panel to represent the Lower Yellowstone Irrigation District, a 160 acre, 320 acre, 640 acre and 1,280 acre operation. Full ownership was assumed for the 160 and 320 acre farm with the larger farms leasing in any land operated over 320 acres.

The estimated cash rent for farm land in Lower Yellowstone was $59 per acre as compared to a current market value of $1,300 per acre. This relationship between cash rents or their crop share equivalent and land costs provides a significant cost advantage to the larger farm size which have a high proportion of leased land.

Beginning Farm Operator

The 160 acre farm, using current market land values, shows a negative return to operator, labor and management of $-2,551 under 1978 conditions and a return of $3,593 using excess land values as shown in Table 10-8. Returns for all other farm sizes are positive and increase in absolute terms as farms increase in size. Using an excess land value of $750 per acre and a cash rent of $59 per acre, the return on the 1,280 acre farm was $95,723.

Existing Farmers

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments.

The estimated turnover rate for farms in the western United States is 2.5 percent per year. On the average a farm is transferred every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Using the average debt-asset ratio of 16.9 percent for all Montana farms in 1978, farm budgets were modified and the results are shown in Table 10-8.

Due to the higher equity position, the cash flow for existing farmers is significantly higher than for beginning farmers and is positive for all farm sizes.

ECONOMIES OF SIZE

The machinery complements specified by the farmer panel and the research assistant were used as the "fixed plant" in developing the short-run average cost curves (SRAC). Figures 10-1 and 10-2 show the SRAC for each machinery complement. In Figure 10-1, the current market value of land is used and in Figure 10-2 the excess land value is used.

In this analysis the cropping mix is optimized with respect to the machinery capacity subject to the restriction that the proportion of high-valued crops not exceed those shown in the farm

Table 10-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, LOWER YELLOWSTONE, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	0	2	25	25	2	54	50
Percent	0.0	0.0	3.7	46.2	46.2	3.7	100.0	
100-179								
No. of Farms	0	2	4	25	11	0	42	133
Percent	0.0	4.7	9.5	59.5	26.1	0.0	100.0	
180-259								
No. of Farms	0	1	3	26	4	0	34	217
Percent	0.0	2.9	8.8	76.4	11.7	0.0	100.0	
260-499								
No. of Farms	0	6	8	30	2	0	46	341
Percent	0.0	13.0	17.3	65.2	4.3	0.0	100.0	
500-999								
No. of Farms	0	2	1	0	0	0	3	611
Percent	0.0	66.6	33.3	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	0	11	18	106	42	2	179	198
Percent	0.0	6.1	10.0	59.2	23.4	1.1	100.0	

Table 10-5

IRRIGATED CROP PATTERNS BY FARM SIZE, LOWER YELLOWSTONE, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	894	953	652	24	0	0	0	2523
Percent	35.4	37.7	25.8	0.9	0.0	0.0	0.0	100.0
100-179								
Total Acres	1588	1693	1956	92	65	0	0	5394
Percent	29.4	31.3	36.2	1.7	1.2	0.0	0.0	100.0
180-259								
Total Acres	2219	1913	2839	8	0	0	0	6979
Percent	31.7	27.4	40.6	0.1	0.0	0.0	0.0	100.0
260-499								
Total Acres	4435	3837	6386	78	0	0	0	14736
Percent	30.0	26.0	43.3	0.5	0.0	0.0	0.0	100.0
500-999								
Total Acres	624	548	827	0	0	0	0	1999
Percent	31.2	27.4	41.3	0.0	0.0	0.0	0.0	100.0
Totals								
Total Acres	9760	8944	12660	202	65	0	0	31631
Percent	30.8	28.2	40.0	0.6	0.2	0.0	0.0	100.0

Table 10-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, LOWER YELLOWSTONE, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	2	2	0	0	0	0
Average	0.0	0.0	0.0	0.0	0.0	0.0
100-179						
No. of Employees	6	6	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
180-259						
No. of Employees	4	4	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
260-499						
No. of Employees	26	25	1	0	0	0
Average	0.5	0.5	0.0	0.0	0.0	0.0
500-999						
No. of Employees	2	2	0	0	0	0
Average	0.5	0.5	0.0	0.0	0.0	0.0
Totals						
No. of Employees	40	39	1	0	0	0
Percent	100.0	97.5	2.5	0.0	0.0	0.0

Table 10-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, LOWER YELLOWSTONE, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	0	0	2	2	54	56	20.6
Average/Farm	0.	0.	0.	0.	0.9	1.0	
100-179							
No. of Workers	0	0	6	6	42	48	8.6
Average/Farm	0.	0.	0.1	0.1	1.0	1.1	
180-259							
No. of Workers	0	0	4	4	34	38	5.1
Average/Farm	0.	0.	0.1	0.1	0.9	1.1	
260-499							
No. of Workers	0	0	26	26	47	73	4.6
Average/Farm	0.	0.	0.5	0.5	1.0	1.5	
500-999							
No. of Workers	0	0	2	2	3	5	2.2
Average/Farm	0.	0.	0.5	0.5	0.8	1.3	
Totals							
No. of Workers	0	0	40	40	180	220.	

Table 10-8

Lower Yellowstone, Montana

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	25	Land	$208,000
	Corn Silage	20	Improvements	12,600
	Dry Beans	20	Machinery	158,627
	Sugar Beets	50	Total	$379,227
	Spring Wheat	37		
	Farmstead	8		
	Total	160		

Financial Summary

Land at Current Market Value ($1,300/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$50,744	Gross Sales	$50,744
Expenses	53,295	Expenses	32,058
Return to Operator Labor, Mgt., & Equity	$-2,551	Return to Operator Labor, Mgt., & Equity	$18,686

Land at Excess Land Value ($750/ac.)

Beginning Farmers	
Gross Sales	$50,744
Expenses	47,151
Return to Operator Labor, Mgt., & Equity	$ 3,593

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	50	Land	$416,000
	Barley (Irr.)	40	Improvements	21,000
	Corn Silage	60	Machinery	211,088
	Sugar Beets	100	Total	$648,088
	Spring Wheat	54		
	Farmstead	16		
	Total	320		

Financial Summary

Land at Current Market Value ($1,300/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$99,428	Gross Sales	$99,428
Expenses	94,205	Expenses	57,596
Return to Operator Labor, Mgt., & Equity	$-5,223	Return to Operator Labor, Mgt., & Equity	$41,832

Land at Excess Land Value ($750/ac.)

Beginning Farmers	
Gross Sales	$99,428
Expenses	81,916
Return to Operator Labor, Mgt., & Equity	$17,512

Table 10-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	90	Land	$416,000
	Barley (Irr.)	120	Improvements	32,000
	Corn Silage	75	Machinery	257,956
	Sugar Beets	175	Total	$705,956
	Spring Wheat	148		
	Farmstead	32		
	Total	640		

Financial Summary

Land at Current Market Value ($1,300/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$175,463	Gross Sales	$175,463
Expenses	149,229	Expenses	108,545
Return to Operator Labor, Mgt., & Equity	$ 26,234	Return to Operator Labor, Mgt., & Equity	$ 66,918

Land at Excess Land Value ($750/ac.)

Beginning Farmers	
Gross Sales	$175,463
Expenses	136,944
Return to Operator Labor, Mgt., & Equity	$ 38,519

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	150	Land	$416,000
	Barley (Irr.)	200	Improvements	49,000
	Corn Silage	100	Machinery	400,321
	Sugar Beets	400	Total	$865,321
	Spring Wheat	286		
	Dry Beans	80		
	Farmstead	64		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,300/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$375,582	Gross Sales	$375,582
Expenses	292,149	Expenses	243,378
Return to Operator Labor, Mgt., & Equity	$ 83,433	Return to Operator Labor, Mgt., & Equity	$132,204

Land at Excess Land Value ($750/ac.)

Beginning Farmers	
Gross Sales	$375,582
Expenses	279,859
Return to Operator Labor, Mgt., & Equity	$ 95,723

FIGURE 10–1
LOWER YELLOWSTONE
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT LAND MARKET
UNLIMITED LEASING

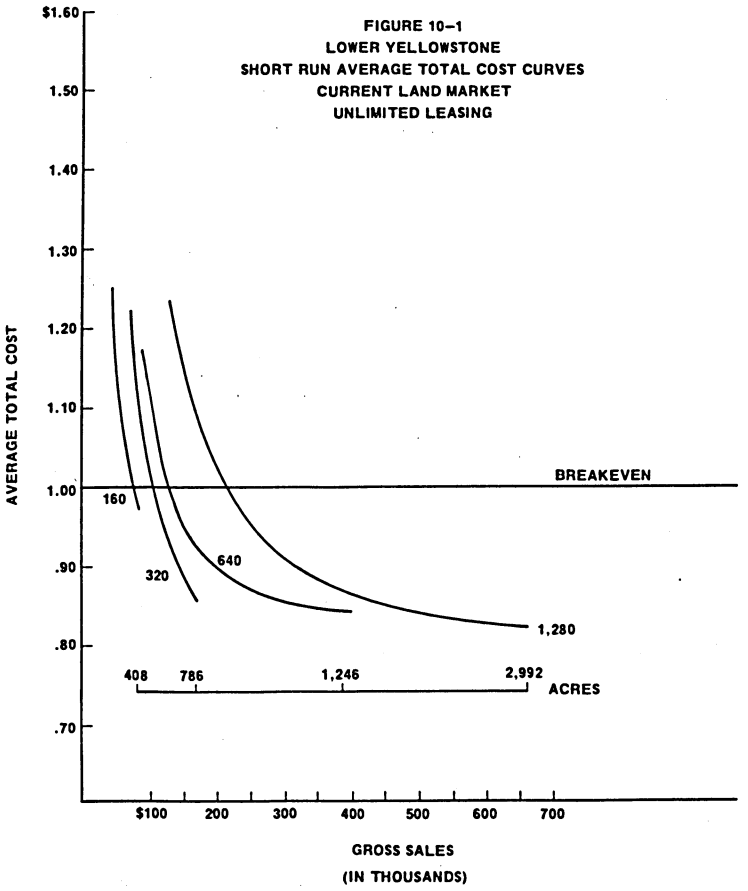
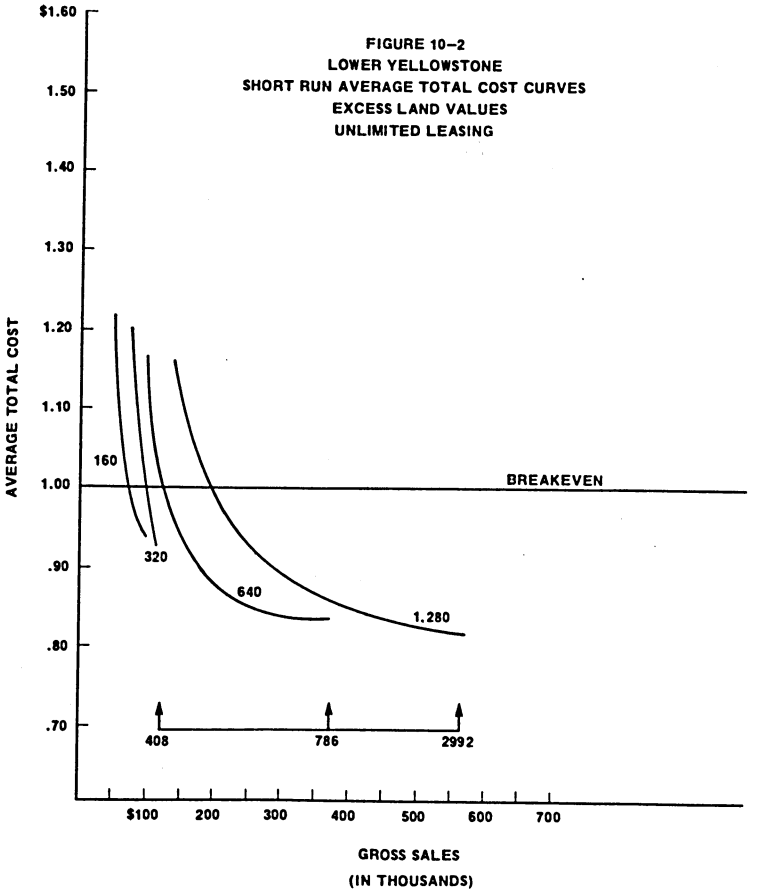


FIGURE 10–2
LOWER YELLOWSTONE
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING



budgets reported in Table 10-8. The results of this analysis indicate that the minimum point on the SRAC for all farm sizes is below the breakeven level indicating a positive return to family labor and equity.

When an envelope curve is fitted to the minimum points in Figure 10-1 and 10-2, a long-run planning curve or long-run average cost curve (LRAC) is developed as shown in Figure 10-3. The LRAC resulting from this indicates a minimum at an output of about $520,000 at 1978 prices. At larger outputs, costs begin to increase reflecting the slightly higher average total costs observed on the largest farm size.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for each of the major crops grown in the district. The variability of price, yield and gross income was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 10-9.

Table 10-9

Standard Deviations of Price, Yield and Gross Income by Crop, Lower Yellowstone No. 1

Crop	Yield	Price	Gross Income Per Acre
Alfalfa Hay	0.182 ton	$2.566/ton	$ 7.14
Corn Silage	1.762 ton	0.974/ton	10.79
Dry Beans	2.326 bu.	2.865/bu.	70.02
Sugar Beets	1.752 ton	1.214/ton	70.90
Spring Wheat	4.052 bu.	0.161/bu.	10.37
Barley	4.912 bu.	0.118/bu.	2.96

To indicate the variability of farm income and average costs, the data in Table 10-9 were combined based on the proportion of land in each crop for the minimum points on the SRAC under unlimited leasing. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 10-4.

DEMAND FOR IRRIGATION WATER

The derived demand for irrigation water depends primarily on the cost/price of water, profitability of crops grown (both irrigated and dryland) and irrigation efficiencies of cost-effective irrigation methods. Using procedures outlined in Chapter 1, estimates were developed by farm size. An aggregate demand curve is presented in Figure 10-5 which was weighted by the proportion of land in each farm size group.

A vertical dashed line is used in Figure 10-5 to indicate the historic water deliveries of 1.8 acre feet per acre. The asterisk located on the vertical dashed line represents the 1978 average cost of water at the farm headgate of $5.28 per acre foot. For comparison purposes the BOR estimated full-cost of water in Lower Yellowstone is $34.62 per acre foot.

The solid decreasing stepped curve in Figure 10-5 depicts the weighted average demand curve. At the 1978 water price/cost, these results indicate that farm operators in the district could profitably utilize additional water supplies. Even if water prices were increased to the BOR full-cost price of about $35 per acre foot, no decrease below historic water use would be expected because the demand curve is still located to the right of the historic allocation or water right.

The impact on farm income of increased water price/cost is shown in Figure 10-6. The solid dish shaped curve traces out the net returns over variable costs including water costs for each farm size. The horizontal dashed lines represent the level of fixed costs, assuming excess land values, for each farm size. Dropping a vertical line to the base of the graph from the intersect of the net returns curve and the fixed costs indicates the maximum ability to pay for water. If water price/cost exceeds this maximum ability to pay, landowners and farm operators would be better off producing only dryland crops.

Ability to pay increases with farm size with only the 640 and 1,280 acre farm indicating an ability to pay which equals or exceeds the BOR full-cost water price. Raising water costs to this level would impose a significant pressure for smaller farm operators to expand acreage or landowners to rent to larger farm operators.

FIGURE 10–3
LOWER YELLOWSTONE
LONG RUN AVERAGE COSTS

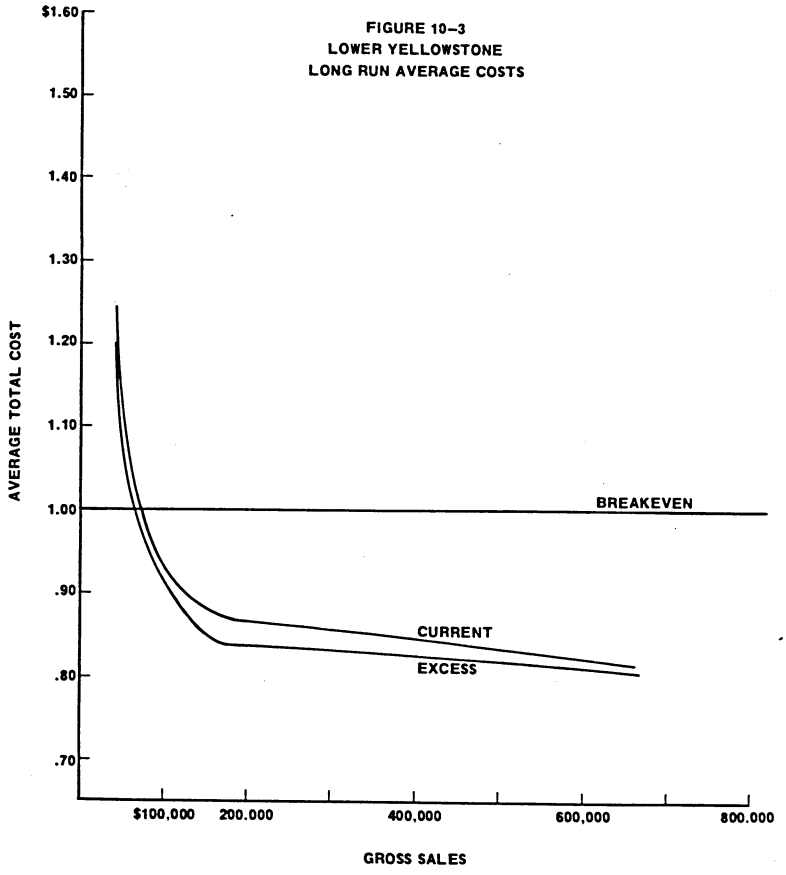


FIGURE 10–4
LOWER YELLOWSTONE
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK

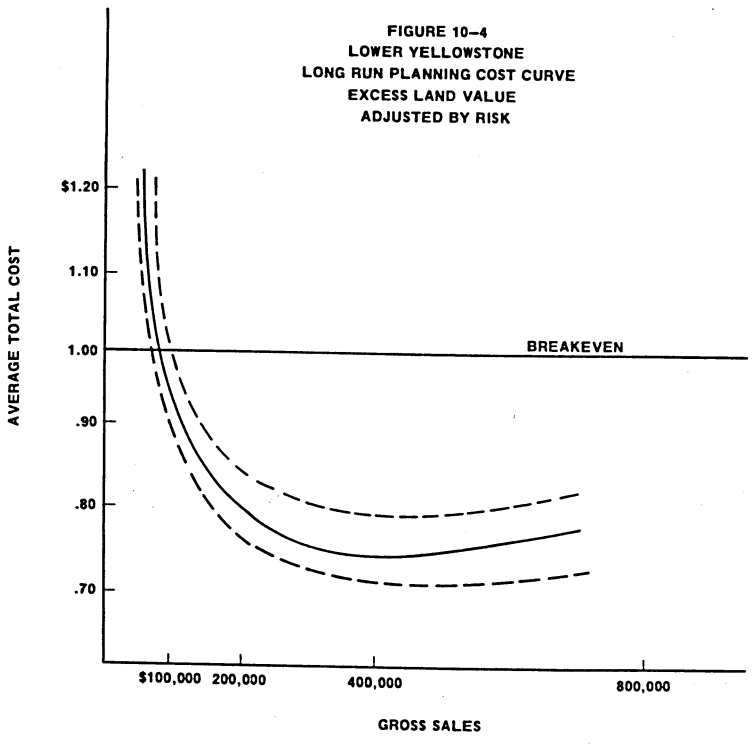


FIGURE 10–5
DEMAND FOR IRRIGATION WATER
LOWER YELLOWSTONE

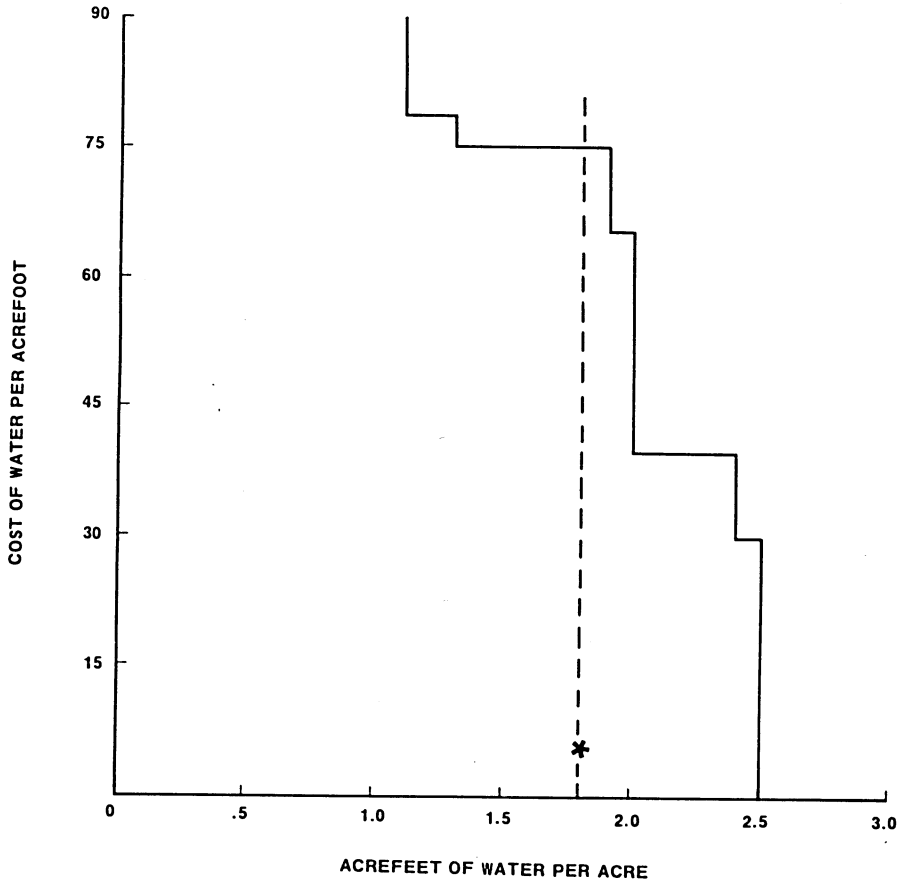
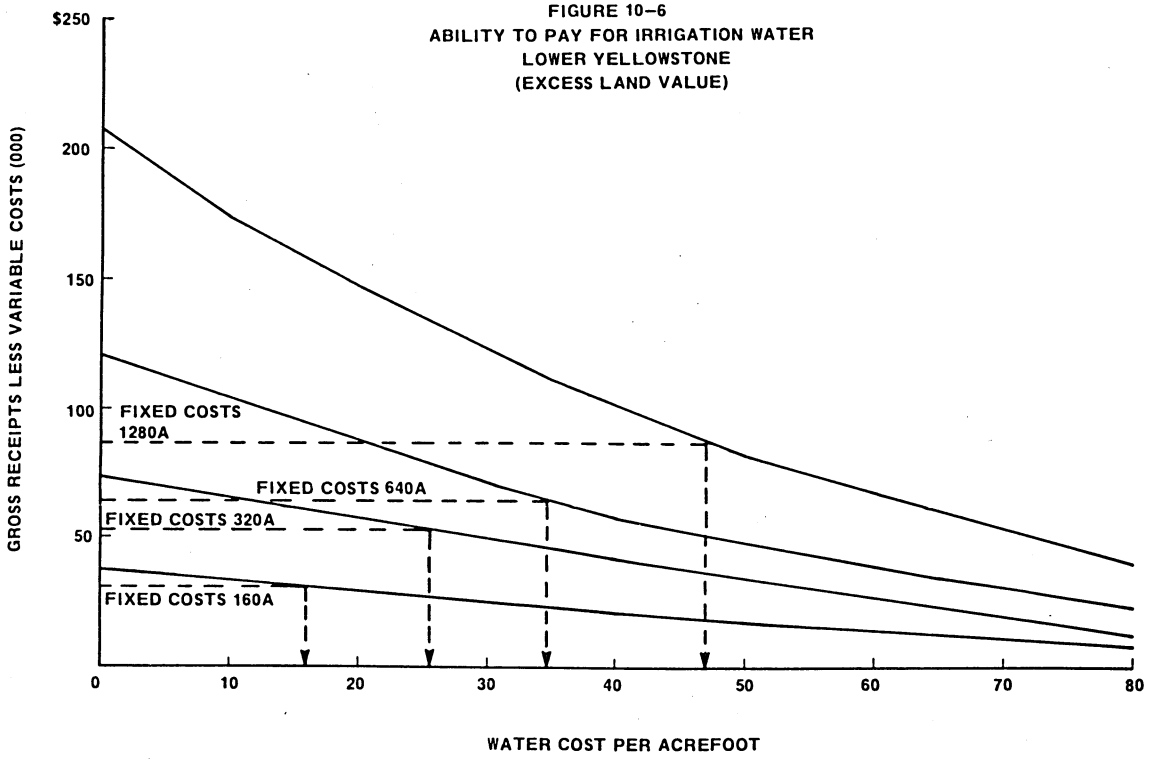


FIGURE 10–6
ABILITY TO PAY FOR IRRIGATION WATER
LOWER YELLOWSTONE
(EXCESS LAND VALUE)



Off-Farm Income

Off-farm employment contributes importantly to farm families; first, it allows fuller utilization of under-employed labor and machinery and second, stabilizes farm income.

No primary data was collected on off-farm income; however, the U.S. Census of Agriculture of 1974 published data for Richland County.

The Census of Agriculture reported 591 farms in Richland County with gross sales of $2,500 or more. Table 10-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 10-10

Farm Operators Reporting Days of Off-Farm Work

None	294
1 - 49 days	50
50 - 99 days	11
100 - 149 days	13
150 - 199 days	16
200 days or more	42
Total	426

Income and expenses related to selected off-farm income sources are shown in Table 10-11.

Table 10-11

Operator Income From Farm Related Sources

Number of Farms Reporting	191
Average Per Farm Reporting	$750

Income From Custom Work

Number of Farms Reporting	74
Average Per Farm Reporting	$195

Expenses Related to Off-Farm Income

Number of Farms Reporting	68
Average Per Farm Reporting	$168

Total Family Income Off-Farm

Number of Farms Reporting	267
Average Per Farm Reporting	$1,676

CHAPTER 11

Glenn-Colusa Irrigation District
Central Valley Project, California

The 103,000 acre Glenn-Colusa Irrigation District is located in the Sacramento Valley of California. The district received 87 percent of its water supply based on privately-owned water rights on the Sacramento River and the remaining 13 percent from the Central Valley Project. Project water is used in July and August, the period of peak consumptive use. Although project water comprises only 13 percent of the total supply, it is estimated to contribute approximately 30 percent of the farm income.

CLIMATE

The Sacramento Valley is characterized by hot summers and mild winters with a 260 day frost-free growing season. Most of the rainfall comes in the winter, 16.1 inches, and an early rain can hamper rice harvesting.

SOILS

No classification has been made by BOR of the district's soils; however, they tend to be heavy clays with a few isolated salt-affected locations.

CROPS

Rice is the predominate crop in the district, covering over 52,000 acres in 1977 and generating over $21,000,000 in crop revenue as shown in Table 11-1. Cereals and forages make up most of the remaining acreage. The average gross crop sales per acre in 1977 was $364.

Table 11-1

Crop Acreage, Glenn-Colusa District, California, 1977

Crop	Acres	Value of Production
Cereals		
Barley	2,249	$ 372,165
Corn	2,924	707,608
Oats	1,945	207,415
Rice	52,293	21,230,958
Sorghums	1,478	159,624
Wheat	13,999	2,956,589
Forage		
Alfalfa Hay	3,171	1,141,560
Irrigated Pasture	5,031	352,170
Miscellaneous Field Crops		
Sugar Beets	1,269	761,400
Soybeans	1,114	95,581
Vegetables		
Tomatoes, Canning	1,849	2,847,460
Nuts		
Almonds	589	497,900
Walnuts	615	553,680
Other & Miscellaneous	15,637	5,806,541
Total	103,637	$37,690,651

LAND TENURE

Due to the small proportion of the district's total water supply received from a federal project, for all practical purposes, no land ownership limitation exists in the Glenn-Colusa District. Thus land ownership patterns have followed trends similar to nonfederal water projects in the Sacramento Valley.

Relative to other districts receiving federal water, the concentration of land ownership in Glenn-Colusa is much greater. For example, of the 1,034 landowners in the district, two ownerships own 8.3 percent of the land (see Tables 11-2 and 11-3). At the lower end of the scale, 60 percent of the owners own only 23.5 percent of the land. Nonfamily corporations are relatively more important in the structure of the district. Fifty-two corporate ownerships, 5.2 percent own 11 percent of the land. Land held in trusts is also important with 36 trusts owning 9.1 percent of the land. While family ownership arrangements (partnerships, family corporations and joint with spouse) are still very important with 72 percent of all ownerships, they own 58 percent of the land.

Farm Operations

The average acreage per ownership unit is 134 acres; the average farm size in the district is 367 acres. Of interest is the fact that some of the ownership units were larger than any of the operating units.

Business organizations formed to operate the land were primarily family arrangements controlling 64 percent of the farms. Individual sole proprietorships made up 27 percent of the farm operators as shown in Table 11-4.

Crop mix varies widely by farm size. For example, in Table 11-5 under cereals and grain which includes rice, the smallest farm size group and the largest farm size group both plant about the same percentage (50.6 to 56.9) of land to these crops. However, in the range of farm sizes of from above 260 acres to 2,000 acres, the percentage is much higher at from 81.2 to 96.1 percent. The smaller farms grow most of the forages, an extensive crop, but also most of the fruits and nuts; whereas seed crops and processing tomatoes are grown on the larger farms. Thus, no generalization can be made that large farms in the district are operated more or less intensively than the small farms.

Labor

The regular farm labor force of 544 employees on the district's 488 farms are mostly Caucasian, 73 percent, and Hispanic, 25 percent, as shown in Table 11-6. Being larger in average farm size than most federal water districts, 40 farm managers and 79 foremen were reported in the Glenn-Colusa District (see Table 11-7). Combining hired farm workers and farm operators provides an estimate of the total labor force by farm size. The labor input was standardized on workers per 1,000 acres and is shown in the last column of Table 11-7. Although not adjusted for crop mix, off-farm employment, custom work or noncrop enterprises, these data indicate a steady decrease in the labor input as farm size increases until the 1,000 to 1,999, farm size then an increasing trend in the labor input, is observed.

TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes representative of the Glenn-Colusa Irrigation District, 160, 320, 640 and 1,280 acres. Following the Interior's Proposed Rules and Regulations, these budgets assume a maximum land ownership of 160 acres for an individual owner or 320 acres for a husband and wife. Therefore, the 160 acre and 320 acre farms assume full ownership with the balance of the acreage leased-in at the local rate for cash rentals.

The 1978 cash rental rate of $74.32 per crop acre is low relative to the current market price for land of $1,700 per acre and an excess land value of $1,200 per acre, thus providing a significant income advantage to any farm operator who rents a high proportion of his land. This is reflected in the farm budget summaries presented in Table 11-8 as well as later in the economies of farm size analysis.

Beginning Operators

At current market land values, a beginning farm operator on 160 acres would be expected to generate only about $3,200 per year cash flow to cover returns to family labor, management and equity, as shown in Table 11-8. Under current land prices and an assumed 100 percent rice acreage, returns to beginning operators remain low or negative for all farm sizes. The per acre return drops on the 1,280 acre farm, compared to the smaller farms due to the inclusion of less

Table 11-2

FORM OF OWNERSHIP BY FARM SIZE, GLENN-COLUSA, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	97.	252.	219.	5.	42.	5.	0.	3.	623.	60.3
Percent	15.5	40.4	35.1	0.8	6.7	0.8	0.0	0.4	100.0	
100-179										
No. of Owners	50.	78.	131.	9.	0.	0.	0.	0.	268.	86.2
Percent	18.6	29.1	48.8	3.3	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	12.	26.	7.	5.	0.	0.	0.	0.	50.	91.0
Percent	24.0	52.0	14.0	10.0	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	28.	15.	15.	5.	0.	0.	0.	0.	63.	97.1
Percent	44.4	23.8	23.8	7.9	0.0	0.0	0.0	0.0	100.0	
500-999										
No. of Owners	6.	0.	3.	11.	2.	0.	0.	0.	22.	99.2
Percent	27.2	0.0	13.6	50.0	9.0	0.0	0.0	0.0	100.0	
1,000-1,999										
No. of Owners	1.	0.	3.	0.	0.	2.	0.	0.	6.	99.8
Percent	16.6	0.0	50.0	0.0	0.0	33.3	0.0	0.0	100.0	
2,000-9,999										
No. of Owners	0.	0.	0.	1.	0.	1.	0.	0.	2.	100.0
Percent	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	100.0	
Totals										
No. of Owners	194.	371.	378.	36.	44.	8.	0.	3.	1034.	
Percent	18.7	35.8	36.5	3.4	4.2	0.7	0.0	0.2	100.0	

Table 11-3

LAND BY OWNERSHIP, GLENN-COLUSA, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	4152.	15671.	10381.	201.	1684.	351.	0.	55.	32495.	23.5
Percent	12.7	48.2	31.9	0.6	5.1	1.0	0.0	0.0	100.0	
Average									52.1	
100-179										
Acres	6573.	11502.	18916.	1227.	0.	0.	0.	0.	38218.	51.2
Percent	17.1	30.0	49.4	3.2	0.0	0.0	0.0	0.0	100.0	
Average									142.6	
180-259										
Acres	2797.	7431.	1738.	973.	0.	0.	0.	0.	12939.	60.6
Percent	21.6	57.4	13.4	7.5	0.0	0.0	0.0	0.0	100.0	
Average									258.7	
260-499										
Acres	9448.	2873.	5753.	1713.	0.	0.	0.	0.	19787.	74.9
Percent	47.7	14.5	29.0	8.6	0.0	0.0	0.0	0.0	100.0	
Average									314.0	
500-999										
Acres	4107.	0.	2070.	6311.	838.	0.	0.	0.	13326.	84.5
Percent	30.8	0.0	15.5	47.3	6.2	0.0	0.0	0.0	100.0	
Average									605.7	
1,000-1,999										
Acres	2486.	0.	4229.	0.	0.	3276.	0.	0.	9991.	91.7
Percent	24.8	0.0	42.3	0.0	0.0	32.7	0.0	0.0	100.0	
Average									1665.1	
2,000-9,999										
Acres	0.	0.	0.	2241.	0.	9221.	0.	0.	11462.	100.0
Percent	0.0	0.0	0.0	19.5	0.0	80.5	0.0	0.0	100.0	
Average									5731.	
Totals										
Acres	29563.	37477.	43087.	12666.	2522.	12848.	0.	55.	138218.	
Percent	21.3	27.1	31.1	9.1	1.8	9.2	0.0	0.0	100.0	
Average	152.3	101.0	113.9	351.8	57.3	1606.0	0.0	18.3	133.6	

Table 11-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, GLENN-COLUSA, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	6	22	86	63	0	177	42
Percent	0.0	3.3	12.4	48.5	35.5	0.0	100.0	
100-179								
No. of Farms	0	1	15	28	31	0	75	139
Percent	0.0	1.3	20.0	37.3	41.3	0.0	100.0	
180-259								
No. of Farms	0	9	15	26	9	0	59	214
Percent	0.0	15.2	25.4	44.0	15.2	0.0	100.0	
260-499								
No. of Farms	0	4	34	39	20	0	97	362
Percent	0.0	4.1	35.0	40.2	20.6	0.0	100.0	
500-999								
No. of Farms	0	13	22	19	8	2	64	650
Percent	0.0	20.3	34.3	29.6	12.5	3.1	100.0	
1,000-1,999								
No. of Farms	1	4	4	2	1	0	12	1259
Percent	8.3	33.3	33.3	16.6	8.3	0.0	100.0	
2,000-2,999								
No. of Farms	0	0	2	0	0	0	2	2387
Percent	0.0	0.0	100.0	0.0	0.0	0.0	100.0	
3,000-3,999								
No. of Farms	0	2	0	0	0	0	2	3390
Percent	0.0	100.0	0.0	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	1	39	114	200	132	2	488	367
Percent	0.2	7.9	23.3	40.9	27.0	0.4	100.0	

Table 11-5

IRRIGATED CROP PATTERNS BY FARM SIZE, GLENN-COLUSA, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	3640	1806	169	133	0	46	1389	7183
Percent	50.6	25.1	2.3	1.8	0.0	0.6	19.3	100.0
100-179								
Total Acres	6603	1997	439	0	0	0	382	9421
Percent	70.0	21.1	4.6	0.0	0.0	0.0	4.0	100.0
180-259								
Total Acres	9239	2271	341	149	142	185	60	12387
Percent	74.5	18.3	2.7	1.2	1.1	1.4	0.4	100.0
260-499								
Total Acres	27806	2535	1301	52	704	0	30	32428
Percent	85.7	7.8	4.0	0.1	2.1	0.0	0.0	100.0
500-999								
Total Acres	33576	3717	2003	766	387	184	685	41318
Percent	81.2	8.9	4.8	1.8	0.9	0.4	1.6	100.0
1,000-1,999								
Total Acres	14191	6	148	30	385	0	0	14760
Percent	96.1	0.0	1.0	0.2	2.6	0.0	0.0	100.0
2,000-2,999								
Total Acres	4557	13	17	541	1307	0	0	6435
Percent	70.8	0.2	0.2	8.4	20.3	0.0	0.0	100.0
3,000-3,999								
Total Acres	3328	381	402	1351	379	0	0	5841
Percent	56.9	6.5	6.8	23.1	6.4	0.0	0.0	100.0
Totals								
Total Acres	102940	12726	4820	3022	3304	415	2546	129773
Percent	79.3	9.8	3.7	2.3	2.5	0.3	1.9	100.0

Table 11-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, GLENN-COLUSA, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	31	28	3	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
100-179						
No. of Employees	52	42	10	0	0	0
Average	0.6	0.5	0.1	0.0	0.0	0.0
180-259						
No. of Employees	75	61	14	0	0	0
Average	1.2	1.0	0.2	0.0	0.0	0.0
260-499						
No. of Employees	141	94	40	7	0	0
Average	1.4	0.9	0.4	0.0	0.0	0.0
500-999						
No. of Employees	155	116	38	0	0	1
Average	2.4	1.8	0.5	0.0	0.0	0.0
1,000-1,999						
No. of Employees	41	30	9	1	0	1
Average	3.1	2.3	0.7	0.0	0.0	0.0
2,000-2,999						
No. of Employees	20	12	8	0	0	0
Average	7.3	4.3	2.9	0.0	0.0	0.0
3,000-3,999						
No. of Employees	29	13	13	0	0	3
Average	16.8	7.5	7.5	0.0	0.0	1.7
Totals						
No. of Employees	544	396	135	8	0	5
Percent	100.0	72.7	24.8	1.4	0.0	0.9

Table 11-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, GLENN-COLUSA, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	3	6	22	31	176	207	27.6
Average/Farm	0.	0.	0.1	0.1	0.9	1.1	
100-179							
No. of Workers	0	3	49	52	75	127	12.1
Average/Farm	0.	0.	0.6	0.6	1.0	1.6	
180-259							
No. of Workers	7	5	63	75	59	134	10.5
Average/Farm	0.1	0.	1.0	1.2	0.9	2.2	
260-499							
No. of Workers	4	15	122	141	97	238	6.7
Average/Farm	0.	0.1	1.2	1.4	0.9	2.4	
500-999							
No. of Workers	14	31	110	155	64	219	5.2
Average/Farm	0.2	0.4	1.7	2.4	1.0	3.4	
1,000-1,999							
No. of Workers	7	7	28	42	13	55	3.4
Average/Farm	0.5	0.5	2.1	3.2	1.0	4.2	
2,000-2,999							
No. of Workers	0	4	17	21	3	24	3.6
Average/Farm	0.	1.4	6.2	7.6	1.0	8.7	
3,000-3,999							
No. of Workers	5	8	16	29	2	31	5.3
Average/Farm	2.9	4.6	9.2	16.8	1.1	17.9	
Totals							
No. of Workers	40	79	427	546	489	1035	

Table 11-8

Glenn-Colusa Irrigation District

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Rice	150	Land	$272,000
	Farmstead	10	Machinery	135,737
	Total	160	Total	$407,737

Financial Summary

Land at Current Market Value ($1,700/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$84,240	Gross Sales	$84,240
Expenses	80,998	Expenses	61,335
Return to Operator Labor, Mgt., & Equity	$ 3,242	Return to Operator Labor, Mgt., & Equity	$22,905

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$84,240
Expenses	75,550
Return to Operator Labor, Mgt., & Equity	$ 8,690

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Rice	300	Land	$544,000
	Farmstead	20	Machinery	214,395
	Total	320	Total	$758,395

Financial Summary

Land at Current Market Value ($1,700/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$168,480	Gross Sales	$168,480
Expenses	169,272	Expenses	132,447
Return to Operator Labor, Mgt., & Equity	$ -792	Return to Operator Labor, Mgt., & Equity	$ 36,033

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$168,480
Expenses	158,374
Return to Operator Labor, Mgt., & Equity	$ 10,106

Table 11-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Rice	600	Land	$544,000
	Farmstead	40	Machinery	330,510
	Total	640	Total	$874,510

Financial Summary

Land at Current Market Value ($1,700/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$336,960	Gross Sales	$336,960
Expenses	330,365	Expenses	288,449
Return to Operator Labor, Mgt., & Equity	$ 6,595	Return to Operator Labor, Mgt., & Equity	$ 48,511

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$336,960
Expenses	319,467
Return to Operator Labor, Mgt., & Equity	$ 17,493

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Rice	600	Land	$ 544,000
	Corn	300	Machinery	554,847
	Sorghum	300	Total	$1,098,847
	Farmstead	80		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,700/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$525,375	Gross Sales	$525,375
Expenses	553,052	Expenses	501,302
Return to Operator Labor, Mgt., & Equity	$-27,677	Return to Operator Labor, Mgt., & Equity	$ 24,073

Land at Excess Land Value ($1,200/ac.)

Beginning Farmers	
Gross Sales	$525,375
Expenses	542,154
Return to Operator Labor, Mgt., & Equity	$-16,779

profitable grain crops, assuming excess land values for the first 320 acres of land significantly increases net farm income, except for the 1,280 acre farm which is still negative.

Existing Operators

Farm budgets were modified to reflect the cash flow situation for existing farm operators who have purchased their land at an earlier time at a lower price and have a lower interest rate on mortgage payments.

The estimated turnover rate for farms in the western United States is 2.5 percent per year. On the average a farm is transferred every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Farm budgets were modified using the average debt-asset ratio of 25.6 percent for all California farms in 1978. The results are shown in Table 11-8.

Due to the higher equity position, the cash flow for existing farmers is significantly higher than for beginning farmers based on current market land values and slightly higher than the returns to beginning farmers under the excess land value assumption.

ECONOMIES OF SIZE

The specified machinery complements were used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 11-1 and 11-2 show the SRAC which includes operator labor at market wage rates for each farm size when the farm acreage is limited to the engineering capacity specified for a machinery complement, i.e., 160, 320, 640 and 1,280 acres. The minimum points on these SRAC indicate the optimum crop mix given the machinery complement. The average total cost per dollar of gross sales is above the breakeven level of $1.00 for all farm sizes except the 320 and 640 acre farm assuming current market land values. Inclusion of corn and grain sorghum increased costs on the 1,280 acre farm. These data indicate positive cash flows for all farm sizes when land is costed at its excess land value.

When an envelope curve is fitted to the minimum points on the SRAC, a LRAC or planning curve is developed. This is shown in Figure 11-3 for the two land values. Excess land values have the greatest impact at the left-hand end of the curve as indicated by the spread between the two curves.

Viewing the shape of the LRAC for excess land, most of the economies of size are captured by the time farm gross sales reaches about $320,000. This translates into a farm of approximately 640 acres under the assumptions of this study.

PRICE AND INCOME VARIABILITY

A time series of average prices and yields was developed for major crops grown in the district. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 11-9.

Table 11-9

Standard Deviations of Price, Yield and Gross Income By Crop
Glenn-Colusa Irrigation District

Crop	Yield	Price	Gross Income Per Acre
Alfalfa Hay	.957 ton	$10.168/ton	$ 88.44
Corn	35.045 bu.	.549/bu.	63.28
Sugar Beets	2.440 ton	8.760/ton	147.99
Wheat	27.831 bu.	.626/bu.	42.49
Grain Sorghum	8.367 cwt.	1.449/cwt.	71.78
Tomatoes	3.579 ton	5.764/ton	362.60
Rice	1.838 cwt.	2.732/cwt.	120.05

FIGURE 11–1
GLENN–COLUSA
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
UNLIMITED LEASING

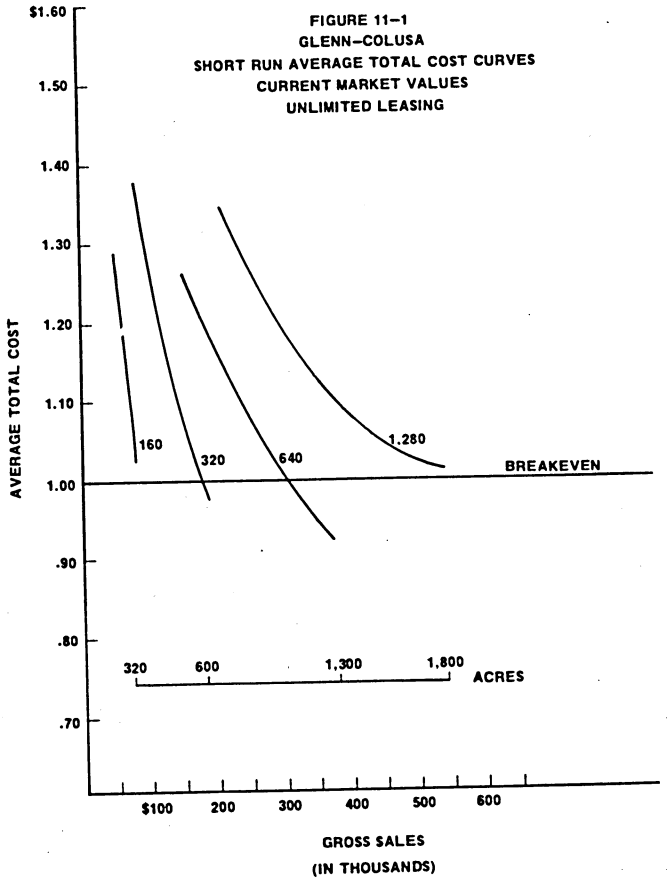


FIGURE 11–2
GLENN–COLUSA
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

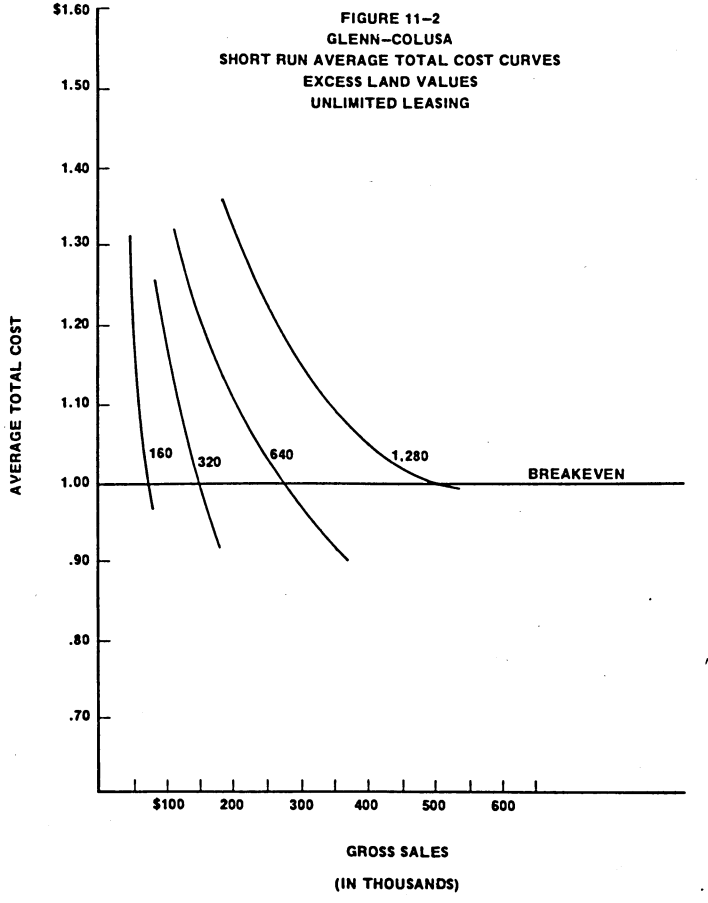


FIGURE 11–3
GLENN–COLUSA
LONG RUN PLANNING COST CURVE

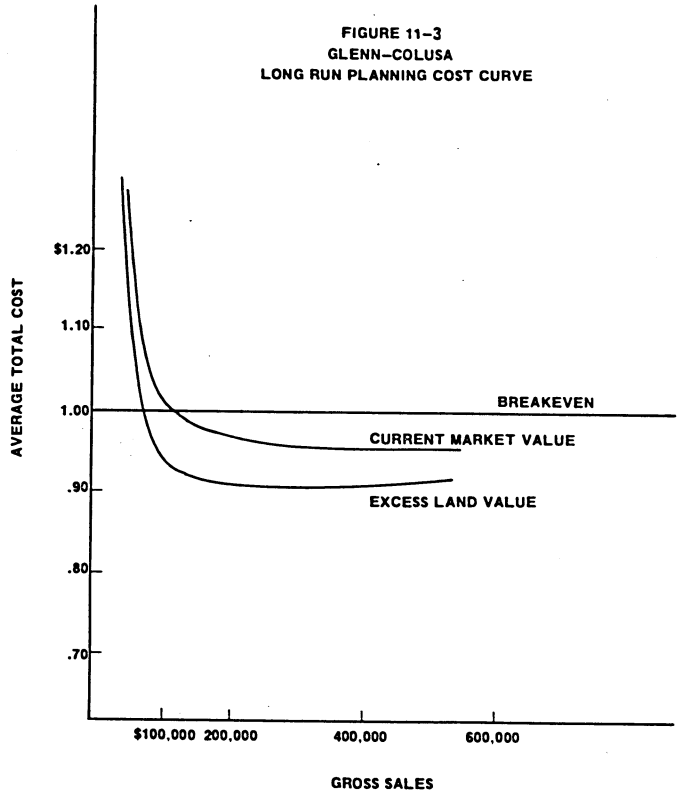
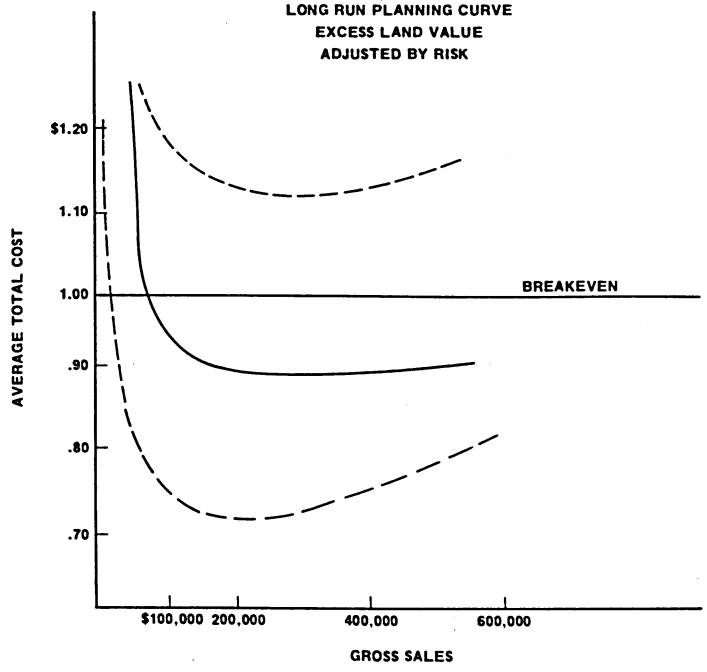


FIGURE 11–4
GLENN COLUSA
LONG RUN PLANNING CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK



To indicate the variability of farm income and costs, the data in Table 11-9 were combined based on the proportion of land in each crop for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 11-4.

As shown in Table 11-9, most of the major crops grown in the district must be considered relatively risky crops. This is also reflected in the wide band around the LRAC in Figure 11-4. This band indicates the range within which average costs can be expected to fall within about 67 percent of the time or about two out of every three years.

DEMAND FOR IRRIGATION WATER

Rice, a very high water-using crop, dominates the crop mix and therefore the demand of water in the district. The derived demand for water depends on the cost of water, profitability of the crops adapted to the district's soils and climate and the application efficiency of the method of irrigation used. The traditional method of irrigating rice is to divert considerably more water than is consumptively used by the crop. In order to maintain minimum levels of flooding in the fields, water is allowed to flow across the field and that which is not used by the plant or deep percolated returns to the water source via a system of drains. Water demand in this study is calculated at the farm headgate.

The vertical dashed line in Figure 11-5 represents the historic delivery to farm headgates in the district of 5.88 acre feet per acre (only 0.7 acre feet of which is federal project water). An asterisk was located on the vertical dashed line to indicate the 1978 average cost (combined local and federal water) of $1.46 per acre foot. The solid negatively sloped stepped line in the graph represents the weighted per acre demand for water if the annual and seasonal supply of water was unlimited. Disparity between the vertical dashed line and the solid line indicates that farm operators could profitably use considerably more water than was historically supplied in the district at the 1978 cost. Figure 11-5 also indicates that even if the BOR estimated full-cost prices of $17.85 per acre foot was charged for all water in the district, farm operators would desire a somewhat greater water supply. However, if the average cost was increased to about $20.00 per acre foot, a sharp drop in rice acreage and thus the quantity of water demanded would be expected to occur.

The impact of increased water costs on farm income can be determined directly from this analysis. In Figure 11-6 the net return over variable costs including water costs for each size farm is shown as a downward sloping curve. Fixed cost levels for each farm size are represented by horizontal dashed lines. Where the dashed lines intersect the solid curves depicts the point where return to management and equity drop to zero. Assuming an excess land value in the fixed costs, a line dropped from this point of intersection to the base of the graph indicates the maximum ability to pay for water.

The maximum ability to pay for water increases with farm size reflecting the economies of size shown earlier. On the largest size farm, additional rice acreage replaced the feed grains shown in the budgets in the optimum crop mix. However, none of the farm sizes analyzed were able to pay the BOR full-cost price for all water diverted.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Glenn County, California, reports 883 farms with gross agricultural sales of $2,500 or more. Table 11-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 11-10

Farm Operators Reporting Days Work Off-Farm

None	360
1 - 49 days	31
50 - 99 days	40
100 - 149 days	27
150 - 199 days	32
200 days or more	186
Total	676

Figure 11-5
DEMAND FOR IRRIGATION WATER
GLENN–COLUSA

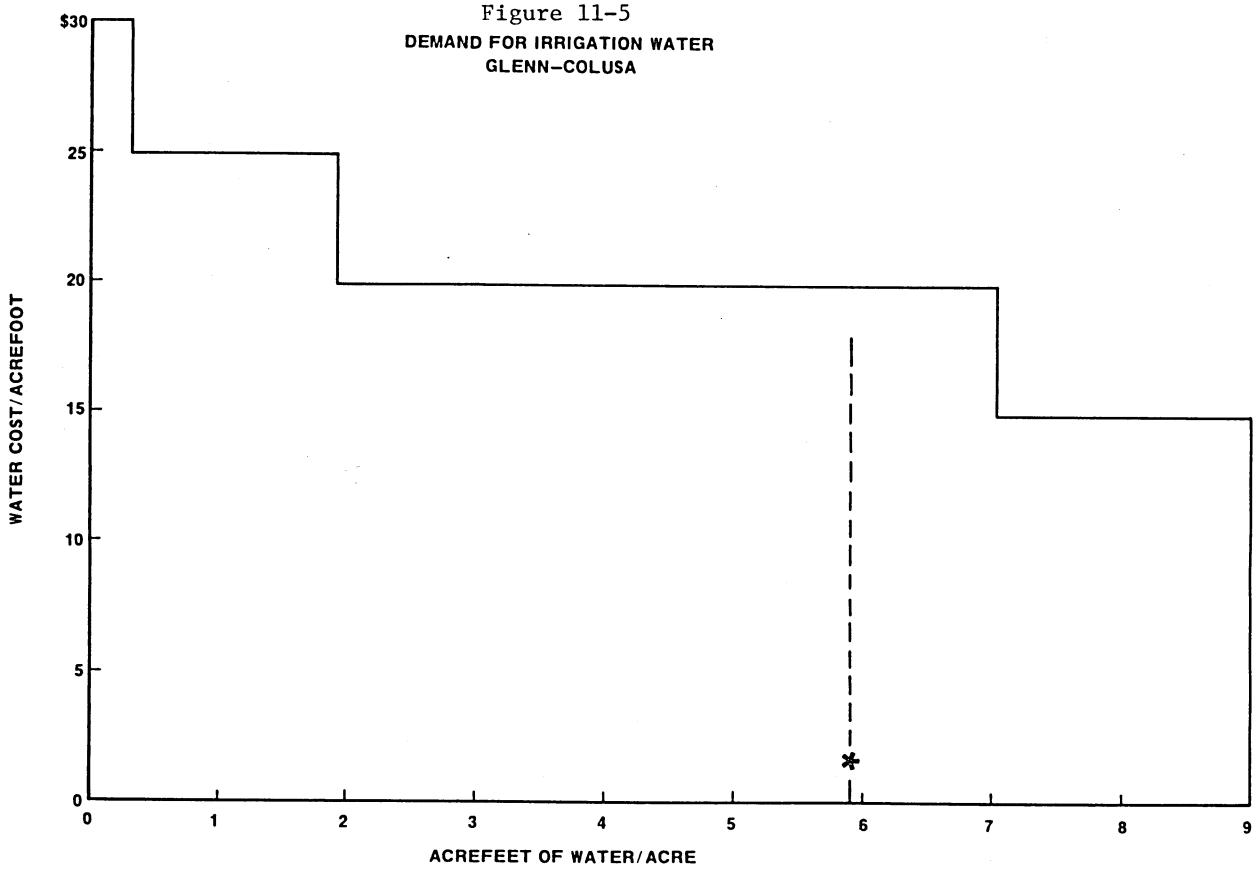
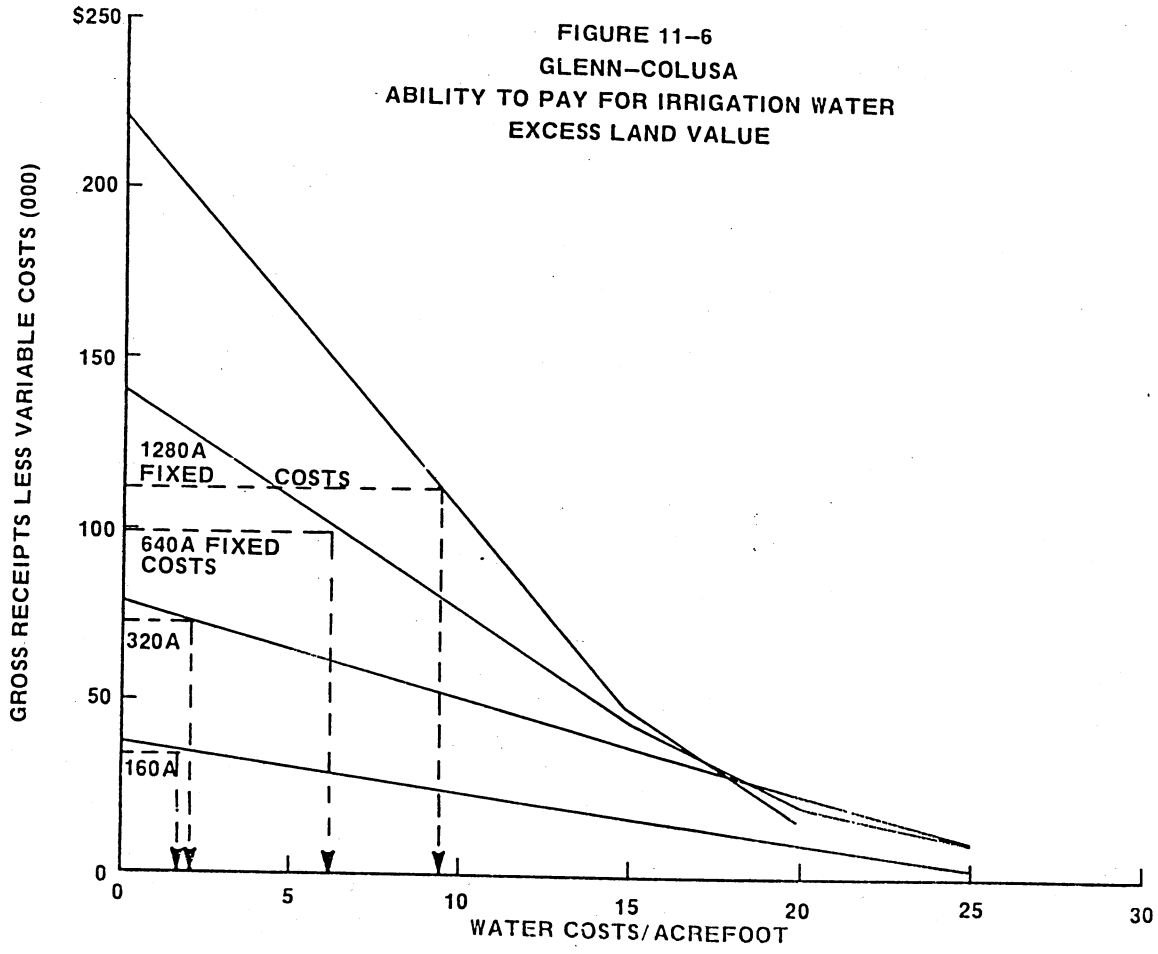


FIGURE 11–6
GLENN–COLUSA
ABILITY TO PAY FOR IRRIGATION WATER
EXCESS LAND VALUE



Income and expenses related to selected off-farm income sources are shown in Table 11-11.

Table 11-11

Operator Income From Farm Related Sources, Glenn County

Number of Farms Reporting	206
Average Per Farm Reporting	$2,023
Income From Custom Work	
Number of Farms Reporting	127
Average Per Farm Reporting	$ 968
Expenses Related to Off-Farm Income	
Number of Farms Reporting	69
Average Per Farm Reporting	$ 460

Farm operators' spouses and their children also contribute to family income from agriculturally and nonagriculturally related sources. In Glenn County, 541 farms reported an average family off-farm income of $6,067 in 1974. No information is available on off-farm income by size of farm.

CHAPTER 12

East Columbia Basin Irrigation District, Columbia Basin Project, Washington

The 124,000 acre East District is located in West Central Washington in Grant and Adams counties and is part of the much larger Columbia Basin Project.

CLIMATE

Mean annual precipitation is approximately nine inches. The district experiences a relatively short growing season of about 140 days with the average January temperature of 27° F. and an average July temperature of about 72° F.

SOILS

Except for about 28,000 acres of gravelly soils located in two blocks, the soils of the district are well suited for a wide variety of field and specialty crops.

CROPS

The cropping pattern of the East District is dominated by alfalfa hay, 28,000 acres; wheat, 21,000 acres; sugar beets, 13,000 acres; and potatoes, 7,000 acres. Although potatoes do not occupy a high percentage of the land in the district, they rank first in total value of production (see Table 12-1). All of these major crops are reflected in the farm budgets shown below. The 124,000 acres in the district produced crops with a gross agricultural value of over $44 million in 1977 or $357 per acre attesting to the high productivity of the district.

Table 12-1

Crop Acreages, East District, Columbia Basin, Washington, 1977

Crop	Acres	Value of Production
Cereals		
Barley	4,301	$ 752,039
Corn	9,113	3,048,904
Wheat	20,842	4,922,243
Forage		
Alfalfa Hay	28,413	6,916,990
Irrigated Pasture	6,790	609,057
Silage, Ensilage	7,659	2,790,192
Miscellaneous Field Crops		
Beans, Dry & Edible	4,487	1,675,393
Spearmint	939	566,192
Sugar Beets	12,786	6,086,392
Vegetables		
Corn, Sweet, Proc.	3,261	1,458,285
Onions, Dry	1,343	620,741
Potatoes, Early	549	796,728
Potatoes, Late	6,673	7,125,359
Seeds		
Alfalfa	7,793	3,122,528
Clover (all)	1,152	449,820
Pea	4,190	1,096,505
Fruit		
Apples	351	811,048
Other & Miscellaneous	3,230	1,405,125
Total	123,872	$44,253,541

LAND TENURE

Land ownership in the East District is widely dispersed with a Gini coefficient of 0.06.[1/] Almost 67 percent of the ownership units are less than 100 acres and no ownership units exceed 500 acres in size. Although family relationships are very important in the tenure pattern of the district, 88 units or over 10 percent of the owners are nonfamily corporations as shown in Table 12-2. These corporations, however, own less than 2,000 acres of land in total as indicated in Table 12-3.

Average acreage per ownership unit in the survey was 149.6 acres, with the preponderance of the land, 73.8 percent, being held jointly by husbands and wives.

Farm Operations

While the average ownership unit in the district was 150 acres, the average farm size was considerably larger at 543 acres as shown in Table 12-4. Control of these farms was mainly by husbands and wives, 72 percent, followed by family partnerships and corporations, 12.5 percent. The survey found 33 nonfamily corporations.

Both the 1977 crop report and the 1978 survey indicate a large acreage of land in the district planted to sugar beets. Subsequent to these reports, sugar mills serving the area closed with little prospect of reopening. Therefore, these results are no longer valid. The general opinion of those knowledgeable of the area was that dry bean and alfalfa hay acreage would expand to replace the sugar beet acreage. Most of the impact of the sugar mill closure would fall on the larger size farms where over 20 percent of the land was planted to beets and dry beans compared to only about 3 percent on the smallest farm size group (see Table 12-5).

Vegetable acreage, mostly potatoes, increased with farm size from only 3.7 percent on the under 100 acre size group to 18.6 percent on the largest size group. Forage and cereal grain crop acreage (less intensive crops) tended to be a smaller proportion of the farms as farm size increased. Thus a generalization that the intensity of farming increased as farm size increased in the district would appear reasonable.

Labor

Survey results show a majority, 58 percent, of the 362 regular farm work force to be Caucasian and 39 percent of Hispanic origin (see Table 12-6). As expected, the number of hired farm workers per farm increased with farm size with only 0.1 hired worker per farm in the less than 100 acre size group up to an average of 15 workers on the largest farms as shown in Table 12-7.

When farm operators are added to hired labor, an estimate of the total labor input is obtained. The right-hand column is an attempt to standardize the labor input on a per 1,000 acre basis. Although not adjusted for off-farm work, temporary labor, crop mix or noncrop enterprises, these data present a rough estimate of labor efficiency. Labor input per 1,000 acres declines as farm size increases. Given the increased intensity of production by farm size shown in Table 12-5, the 50 percent reduction in labor use from the 180-259 acre size group to the over 4,000 acre size group is quite significant.

TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes representative of the East District, 160, 320, 640 and 1,280 acres. Based on the Interior's Proposed Rules and Regulations, these budgets assume full ownership for all land up to 320 acres and leased land for any operating unit over 320 acres.

Lease land was costed at the local prevailing cash rent of $90 per acre for alfalfa and wheat land and $115 per acre for dry bean and potato land. Cash rental rates are low relative to the current market price of $1,500 per acre which provides a cost advantage for the larger farms.

The 160 acre farm assumes full ownership with 50 acres of wheat and 50 acres of alfalfa and 20 acres of potatoes and 22 acres dry beans. With a total investment of about $400,000 in land and machinery, the 160 acre farm has a return to operator labor, management and equity of $5,445 using 1978 normalized prices and costs at current market land values.

Absolute returns to operator labor, management and equity increase as farm size increases as shown in Table 12-8. The 1,280 acre farm with an investment of $1.6 million and 960 acres of rented land shows a return of $90,000 under 1978 cost and return conditions.

1/ Gini coefficient ranges from 0 to 1.0. The higher the value, the greater the level of concentration.

Table 12-2

FORM OF OWNERSHIP BY FARM SIZE, EAST COLUMBIA BASIN, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	70	214	172	0	80	8	10	10	564	66.9
Percent	12.4	37.9	30.4	0.0	14.1	1.4	1.7	1.7	100.0	
100-179										
No. of Owners	51	151	30	5	0	0	0	0	237	95.0
Percent	21.5	63.7	12.6	2.1	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	10	4	21	0	0	0	0	0	35	99.2
Percent	28.5	11.4	60.0	0.0	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	1	2	0	4	0	0	0	0	7	100.0
Percent	14.2	28.5	0.0	57.1	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	132	371	223	9	80	8	10	10	843	
Percent	15.6	44.0	26.4	1.0	9.4	0.9	1.1	1.1	100.0	

Table 12-3

LAND BY OWNERSHIP, EAST COLUMBIA BASIN, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	5267	45393	6107	0	1440	443	541	276	59467	47.2
Percent	8.8	76.3	10.2	0.0	2.4	0.7	0.9	0.4	100.0	
Average									105.4	
100-179										
Acres	6539	45988	4046	603	0	0	0	0	57176	92.5
Percent	11.4	80.4	7.0	1.0	0.0	0.0	0.0	0.0	100.0	
Average									241.2	
180-259										
Acres	1860	1068	4430	0	0	0	0	0	7358	98.3
Percent	25.2	14.5	60.2	0.0	0.0	0.0	0.0	0.0	100.0	
Average									210.2	
260-499										
Acres	349	763	0	1065	0	0	0	0	2177	100.0
Percent	16.0	35.0	0.0	48.9	0.0	0.0	0.0	0.0	100.0	
Average									311.0	
Totals										
Acres	14015	93212	14583	1668	1440	443	541	276	126178	
Percent	11.1	73.8	11.5	1.3	1.1	0.3	0.4	0.2	100.0	
Average	106.1	251.2	65.3	185.3	18.0	55.3	54.1	27.6	149.6	

Table 12-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, EAST COLUMBIA BASIN, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	9	0	12	103	9	8	141	62
Percent	6.3	0.0	8.5	73.0	6.3	5.6	100.0	
100-179								
No. of Farms	0	0	8	99	17	2	126	134
Percent	0.0	0.0	6.3	78.5	13.4	1.5	100.0	
180-259								
No. of Farms	0	4	4	61	3	0	72	221
Percent	0.0	5.5	5.5	84.7	4.1	0.0	100.0	
260-499								
No. of Farms	0	12	20	59	2	0	93	350
Percent	0.0	12.9	21.5	63.4	2.1	0.0	100.0	
500-999								
No. of Farms	1	3	12	24	3	0	43	638
Percent	2.3	6.9	27.9	55.8	6.9	0.0	100.0	
1,000-9,999								
No. of Farms	0	4	5	1	0	0	10	1490
Percent	0.0	40.0	50.0	10.0	0.0	0.0	100.0	
Totals								
No. of Farms	10	23	61	347	34	10	485	543
Percent	2.0	4.7	12.5	71.5	7.0	2.0	100.0	

Table 12-5

IRRIGATED CROP PATTERNS BY FARM SIZE, EAST COLUMBIA BASIN, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1 - 99								
Total Acres	1896	4359	233	293	915	123	0	7819
Percent	24.2	55.7	2.9	3.7	11.7	1.5	0.0	100.0
100 - 179								
Total Acres	3616	6984	1361	1642	2370	0	0	15973
Percent	22.6	43.7	8.5	10.2	14.8	0.0	0.0	100.0
180 - 259								
Total Acres	5029	6617	961	972	1726	159	0	15464
Percent	32.5	42.7	6.2	6.2	11.1	1.0	0.0	100.0
260 - 499								
Total Acres	11169	8027	5313	1434	6409	239	0	32591
Percent	34.2	24.6	16.3	4.3	19.6	0.7	0.0	100.0
500 - 999								
Total Acres	9226	4672	4962	2526	4429	0	0	25815
Percent	35.7	18.0	19.2	9.7	17.1	0.0	0.0	100.0
1,000 - 9,999								
Total Acres	1840	1668	2786	2538	4833	0	0	13665
Percent	13.5	12.2	20.4	18.6	35.4	0.0	0.0	100.0
Totals								
Total Acres	32776	32327	15616	9405	20682	521	0	111327
Percent	29.4	29.0	14.0	8.4	18.5	0.4	0.0	100.0

Table 12-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, EAST COLUMBIA BASIN, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	19	19	0	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
100-179						
No. of Employees	17	13	4	0	0	0
Average	0.1	0.1	0.0	0.0	0.0	0.0
180-259						
No. of Employees	56	46	7	0	0	3
Average	0.7	0.6	0.0	0.0	0.0	0.0
260-499						
No. of Employees	105	56	44	0	0	5
Average	1.1	0.5	0.4	0.0	0.0	0.0
500-999						
No. of Employees	102	41	60	0	0	1
Average	2.3	0.9	1.3	0.0	0.0	0.0
1,000-3,999						
No. of Employees	48	32	16	0	0	0
Average	5.4	3.6	1.8	0.0	0.0	0.0
4,000-9,999						
No. of Employees	15	4	11	0	0	0
Average	15.3	4.0	11.2	0.0	0.0	0.0
Totals						
No. of Employees	362	211	142	0	0	9
Percent	100.0	58.2	39.2	0.0	0.0	2.4

Table 12-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, EAST COLUMBIA BASIN, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	4	4	11	19	141	160	18.4
Average/Farm	0.	0.	0.	0.1	1.0	1.1	
100-179							
No. of Workers	0	0	17	17	126	143	8.4
Average/Farm	0.	0.	0.1	0.1	1.0	1.1	
180-259							
No. of Workers	5	7	44	56	72	128	8.0
Average/Farm	0.	0.	0.6	0.7	0.9	1.7	
260-499							
No. of Workers	10	8	88	106	93	199	6.0
Average/Farm	0.1	0.	0.9	1.1	0.9	2.1	
500-999							
No. of Workers	1	19	83	103	44	147	5.3
Average/Farm	0.	0.4	1.9	2.3	1.0	3.3	
1,000-3,999							
No. of Workers	0	13	35	48	8	56	5.2
Average/Farm	0.	1.4	4.0	5.4	0.9	6.4	
4,000-9,999							
No. of Workers	0	3	12	15	1	16	4.0
Average/Farm	0.	3.0	12.2	15.3	1.0	16.3	
Totals							
No. of Workers	20	54	290	364	485	849	

Table 12-8

East District, Columbia Basin Project, Washington

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	60	Land	$240,000
	Wheat	50	Machinery	117,118
	Potatoes	20	Total	$357,118
	Dry Beans	22		
	Farmstead	8		
	Total	160		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$76,560	Gross Sales	$76,560
Expenses	71,115	Expenses	50,176
Return to Operator Labor, Mgt., & Equity	$ 5,445	Return to Operator Labor, Mgt., & Equity	$26,384

Land at Excess Land Value ($850/ac.)

Beginning Farmers	
Gross Sales	$76,560
Expenses	63,714
Return to Operator Labor, Mgt., & Equity	$12,846

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	120	Land	$480,000
	Wheat	100	Machinery	270,550
	Potatoes	40	Total	$756,550
	Dry Beans	44		
	Farmstead	16		
	Total	320		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$153,120	Gross Sales	$153,120
Expenses	142,227	Expenses	99,936
Return to Operator Labor, Mgt., & Equity	$ 10,893	Return to Operator Labor, Mgt., & Equity	$ 53,184

Land at Excess Land Value ($850/ac.)

Beginning Farmers	
Gross Sales	$153,120
Expenses	127,426
Return to Operator Labor, Mgt., & Equity	$ 25,694

Table 12-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	240	Land	$ 480,000
	Wheat	200	Machinery	611,569
	Potatoes	80	Total	$1,091,569
	Dry Beans	88		
	Farmstead	32		
	Total	640		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$306,239	Gross Sales	$306,239
Expenses	289,713	Expenses	227,655
Return to Operator Labor, Mgt., & Equity	$ 16,526	Return to Operator Labor, Mgt., & Equity	$ 78,584

Land at Excess Land Value ($850/ac.)

Beginning Farmers	
Gross Sales	$306,239
Expenses	274,911
Return to Operator Labor, Mgt., & Equity	$ 31,328

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	480	Land	$ 480,000
	Wheat	400	Machinery	1,062,153
	Potatoes	160	Total	$1,542,153
	Dry Beans	176		
	Farmstead	64		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$612,479	Gross Sales	$612,479
Expenses	548,744	Expenses	462,175
Return to Operator Labor, Mgt., & Equity	$ 63,735	Return to Operator Labor, Mgt., & Equity	$150,304

Land at Excess Land Value ($850/ac.)

Beginning Farmers	
Gross Sales	$612,479
Expenses	533,942
Return to Operator Labor, Mgt., & Equity	$ 78,537

ECONOMIES OF SIZE

The machinery complement specified for each farm size was used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figure 12-1 shows the SRAC which includes operator labor at market wage rates for each farm size when the farm acreage is limited only by the engineering capacity specified for each machinery complement. Figure 11-2 shows the same results except the value of owned land has been reduced to its excess land value of $850 per acre. Under the current market land value (Figure 12-1) minimum points on the SRAC are all below the breakeven level resulting in similar net returns to the typical farm budgets. Average costs for the smaller farms decrease significantly under the assumption of excess land values as shown in Figure 12-2.

When an envelope curve is fitted to the minimum points on the SRAC, a long-run or planning curve is developed as shown in Figure 12-3 for both the current market and excess land values. The results shown in Figure 12-3 indicate: First, that most of the economies of size are achieved by the time gross sales reach the $250,000 per year output, which is approximated by the 640 acre SRAC. Second, the benefits of the excess land values accrue to the smaller farm sizes as evidenced by the larger absolute difference between the LRAC at the left-hand end of the curves.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 12-9.

Table 12-9

Standard Deviations of Price, Yield and Gross Income by Crop
East District

Crop	Yield	Price	Gross Income Per Acre
Alfalfa Hay	0.341 ton	$4.881/ton	$ 28.00
Potatoes	48.579 cwt.	0.305/cwt.	105.69
Sugar Beets	1.530 ton	4.852/ton	118.55
Wheat	6.326 bu.	.234/bu.	19.62
Corn	2.976 bu.	.148/bu.	6.04

Not surprisingly, potatoes and sugar beets showed the highest variability of gross income per acre although potato price variability was lower than anticipated. Corn for grain was the most stable crop considered with a standard deviation of $6.04 per acre gross income.

To indicate the variability of total farm income, the data in Table 12-9 were combined based on the proportion of land in each crop for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 12-4. Due to the slightly increasing proportion of the high gross income variability crops, sugar beets and potatoes, on the larger farm sizes, the width of the band around the long-run average cost curve becomes wider as farm size increases.

DEMAND FOR IRRIGATION WATER

The derived demand for irrigation water is dependent on the profitability of crops suitable to the soils and climate in east central Washington as well as the irrigation efficiency of cost effective irrigation methods and the cost of water.

A solid negatively sloped line in Figure 12-5 traces out the price-quantity relationship for a weighted average of farms in the district. Weights were based on the proportion of total acreage included in each farm size group. The vertical dashed line in Figure 12-5 specifies the historic farm headgate delivery per acre and the asterisk indicates the 1978 average water cost/price of water delivered to the farm of $4.19 per acre foot. For comparison purposes, the BOR estimated full-cost price was $41.68 per acre foot.

FIGURE 12–1
EAST COLUMBIA BASIN
SHORT RUN AVERAGE TOTAL COST CURVES
UNLIMITED LEASING

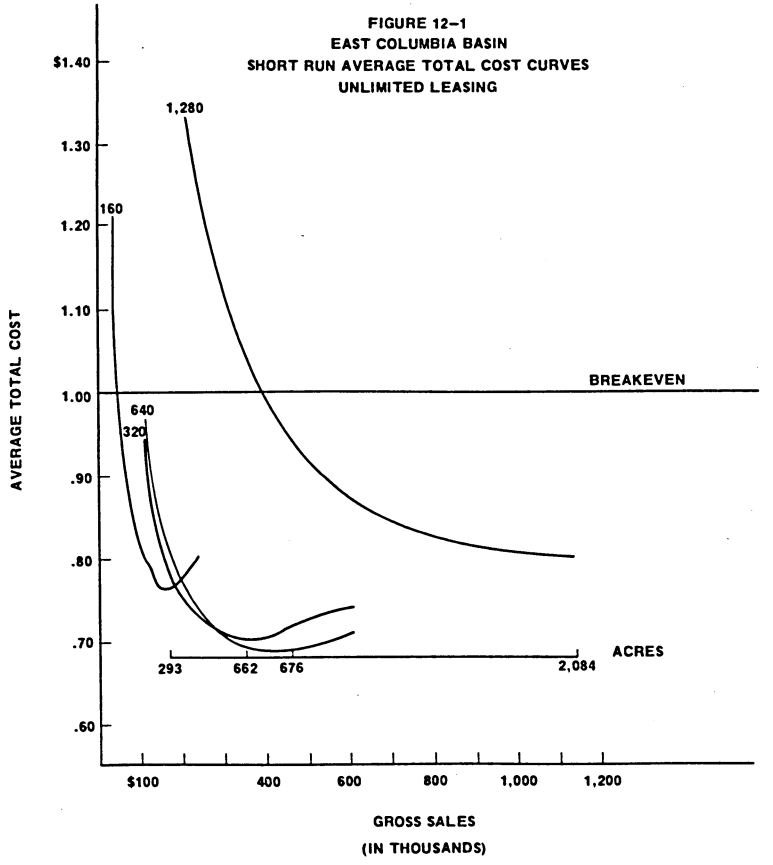


FIGURE 12–2
EAST COLUMBIA BASIN
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

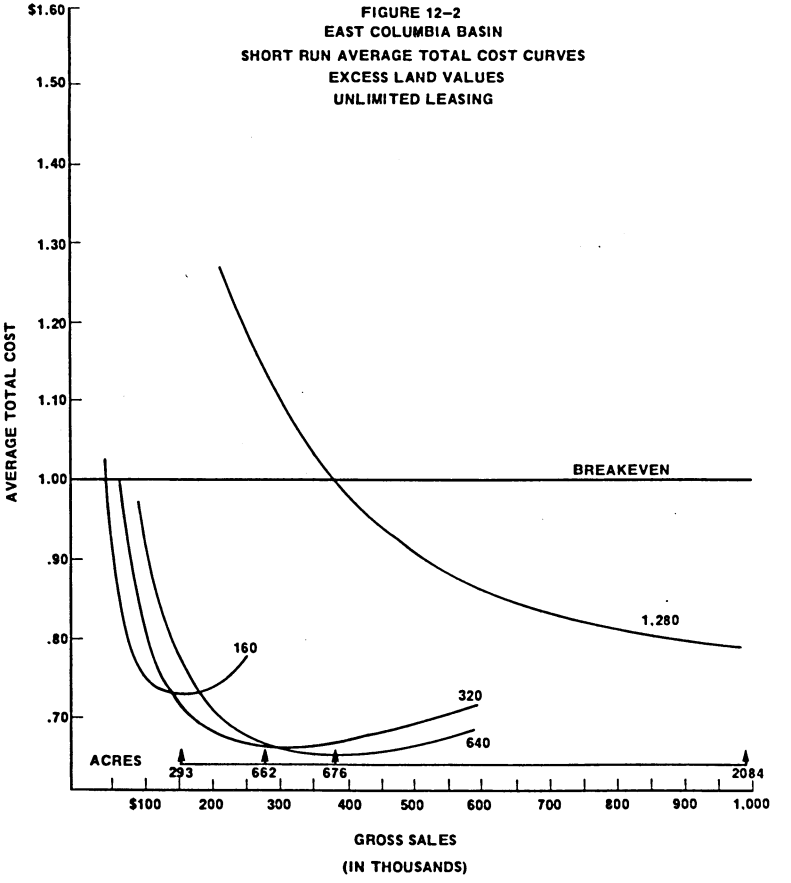


FIGURE 12–3
EAST COLUMBIA BASIN
LONG RUN PLANNING CURVE
UNLIMITED LEASING

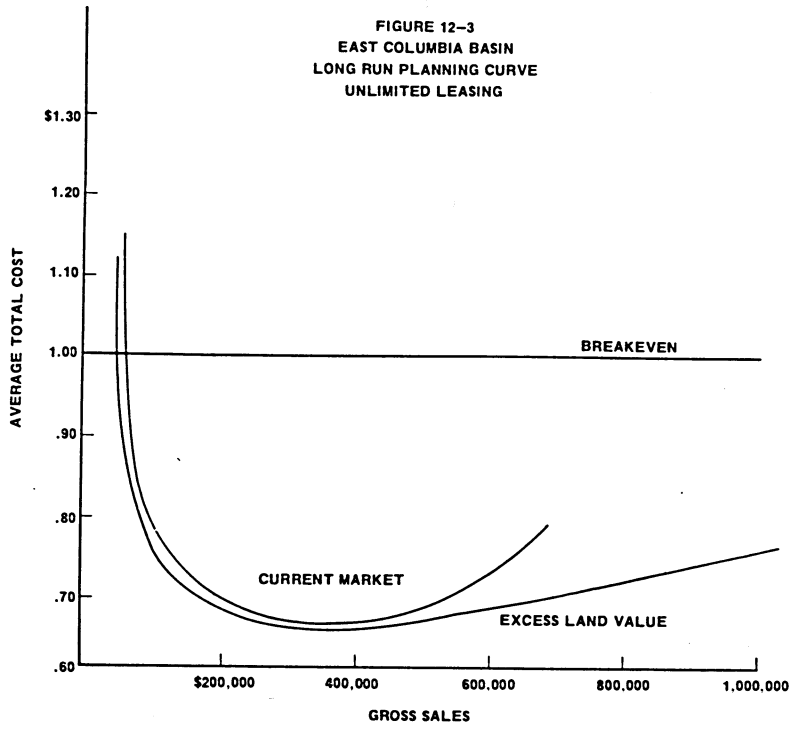
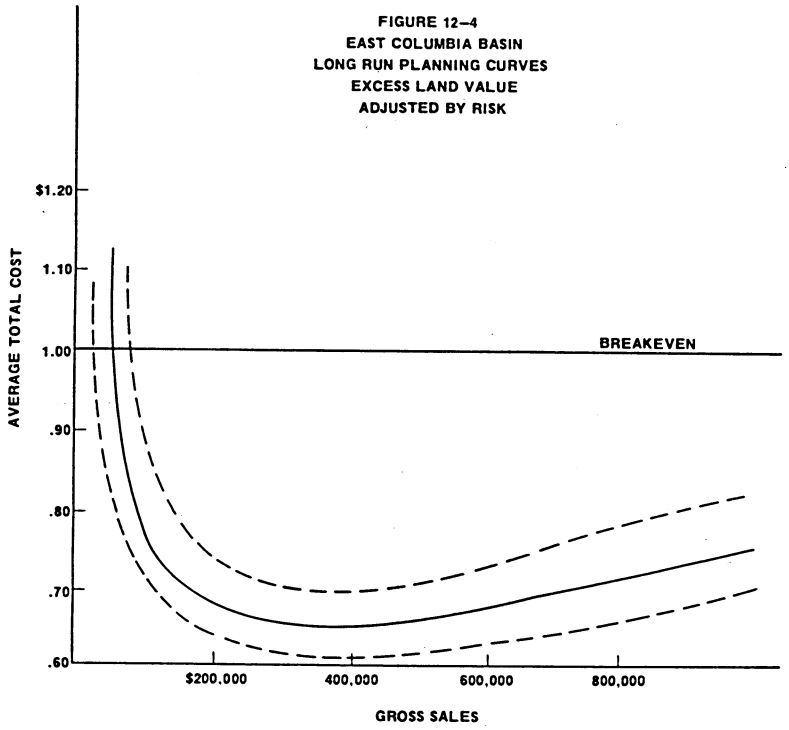


FIGURE 12–4
EAST COLUMBIA BASIN
LONG RUN PLANNING CURVES
EXCESS LAND VALUE
ADJUSTED BY RISK



Results displayed in Figure 12-5 indicate that farm operators are utilizing the optimum quantity of water under the 1978 water price/cost structure. If water cost was increased to something over $25.00 per acre foot, water demand within the district would drop about 7 percent. If water costs were raised to the WPRS full-cost price of $41.68 per acre foot, a reduction of about 17 percent in water use per acre could be expected.

Net farm income would be heavily impacted by increased water costs. Figure 12-6 presents these results. The negatively sloped curves in the graph represent the net returns over variable costs including water costs for each farm size. Horizontal dashed lines indicate the level of fixed costs associated with each farm size assuming excess land values. A vertical line dropped from the intersection of the horizontal dashed line and the solid curve specifies the maximum ability to pay for water for each farm size. Except for the 1,280 acre farm size, ability to pay increases as farm size increases. The 1,280 acre farm indicates a reduced ability to pay for water primarily due to the diseconomies of size observed in the economies of size analysis presented in Figure 12-3.

OFF-FARM INCOME

Off-farm work contributes to two important objectives to farm operators, especially small farm operators. First, it allows for more complete utilization of under-employed resources such as family labor and unused machinery capacity. Second, it enhances and stabilizes family income especially in poor crop years. The level and stability of family income is an important consideration for lending institutions when making farm loans.

No primary survey data was collected in this study on off-farm income within the irrigation district or project; however, the U.S. Census of Agriculture of 1974 reports these data on a county basis.

The Census of Agriculture for Grant County, Washington reports 1,354 farms with gross agricultural sales of $2,500 or more. Table 12-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 12-10

Farm Operators Reporting Days Work Off-Farm
Grant County, Washington

None	641
1 - 49 days	73
50 - 99 days	27
100 - 149 days	32
150 - 199 days	27
200 days or more	183
Total	983

Income and expenses related to selected off-farm income sources are shown in Table 12-11.

Table 12-11

Income and Expenses Related to Selected Off-Farm Income
Grant County, Washington

	Number	Average
Income from Farm Related Sources	459	$4,356
Custom Work	224	2,046
Expenses	165	1,559

Operators' spouses and their children also contribute to family income from both agriculturally and nonagriculturally related sources. In Grant County, 657 farms reported an average family off-farm income of $6,124 in 1974. No information is available on off-farm income by farm size.

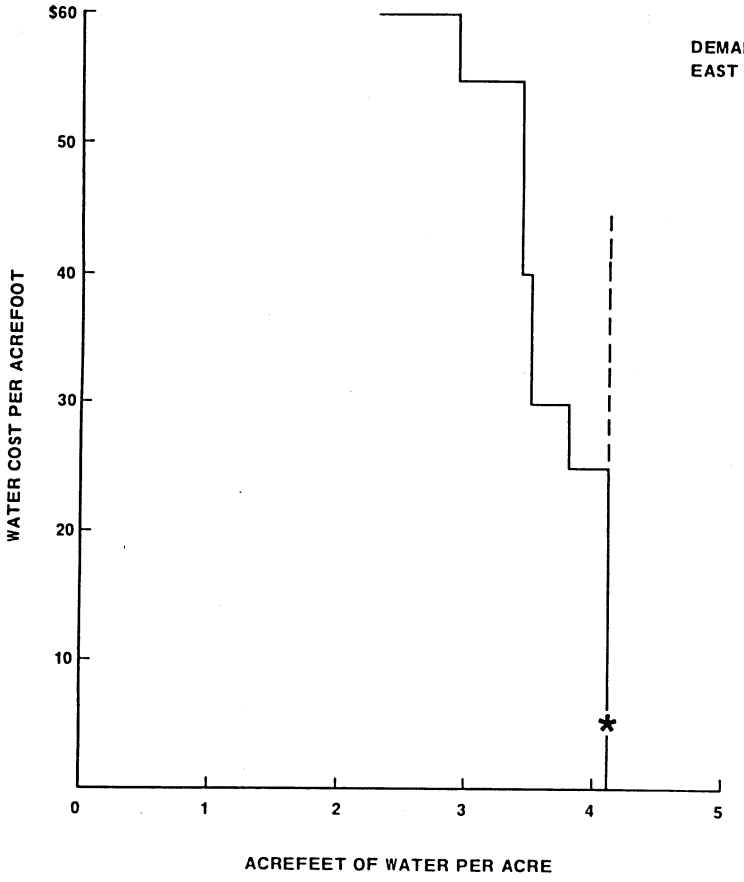


FIGURE 12–5
DEMAND FOR IRRIGATION WATER
EAST DISTRICT, COLUMBIA BASIN

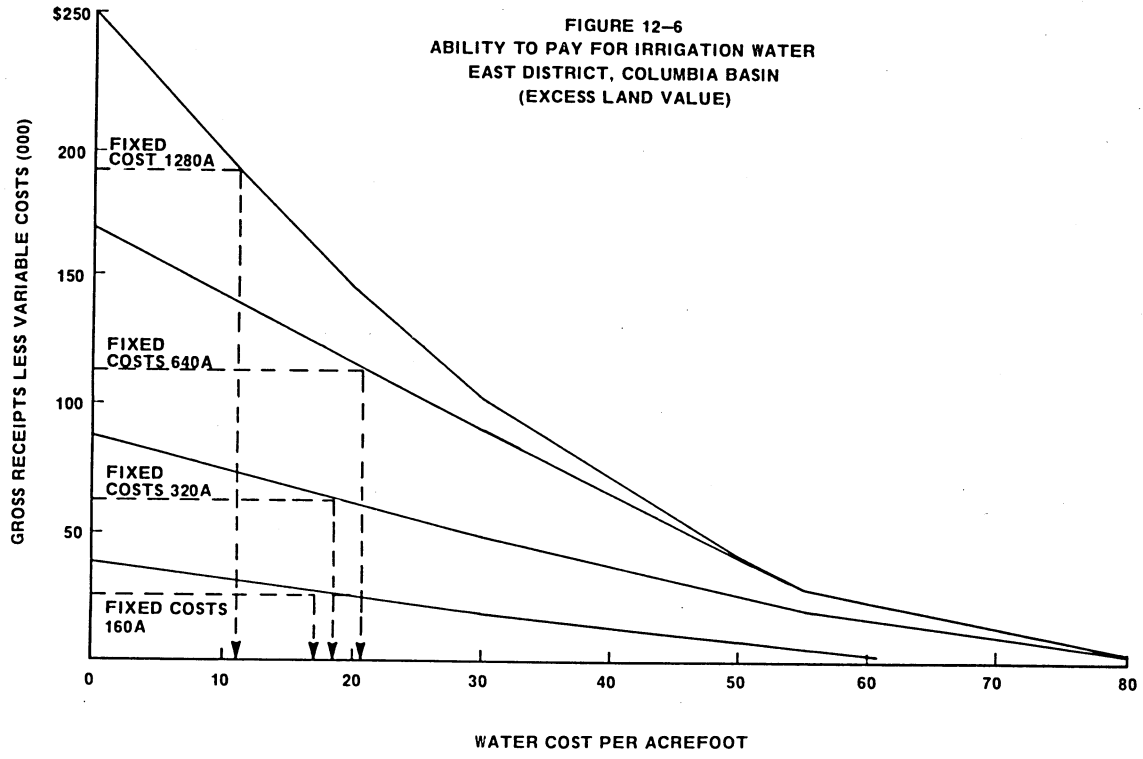


FIGURE 12–6
ABILITY TO PAY FOR IRRIGATION WATER
EAST DISTRICT, COLUMBIA BASIN
(EXCESS LAND VALUE)

CHAPTER 13

Westlands Water District
Central Valley Project, California

Westlands Water District, containing 577,000 irrigable acres, is located primarily in Fresno County in the west-central portion of the San Joaquin Valley.

CLIMATE

The Westlands District enjoys hot, dry summers and mild winters. The average annual precipitation is 6.7 inches which falls mostly in the period from November through March. The average frost-free growing season (above 32° F) is 272 days.

SOILS

Soils in the district can be characterized as medium to heavy in texture with few agronomic limitations. The area along the eastern border of the district contains some salt-affected soils due to a high perched water table. Underground tile drains have been installed in this area. It is expected the drainage system will be expanded in the future.

BOR (Bureau of Reclamation) has classified the irrigable soils in the district as follows:

Class 1	194,625 acres
Class 2	234,752 "
Class 3	79,586 "
Class 4	68,116 "
Total	577,079 acres

WATER SUPPLY AND COST

BOR provides a supplemental water supply to the district. Although this water supply contract is still under negotiation, it is not expected that the surface water supply will exceed 1,278,000 acre feet plus 250,000 acre feet of groundwater per year, or about 2.9 acre feet per eligible irrigable acre.[1/] The 1978 farm headgate cost for project water was $15.80 per acre foot. However this cost is expected to rise in the future when the distribution system and drainage network repayments commence.

Prior to deliveries of project water, district lands were irrigated from private wells. In 1978 the local power company estimated there were still 700 irrigation pump accounts within the district. Pumping lifts range from 300 to over 700 feet and increase as one moves from north to south and from east to west within the district. The modal pump lift was estimated at 500 feet. The variable cost of pumping from the modal lift was estimated at $48.55 per acre feet.

Prior to the project, the district groundwater levels showed a long-term overdraft condition because annual pumping exceeded the groundwater basin's estimated annual safe yield of only 300,000 acre feet. Maintaining withdrawals in balance with this safe yield implies an annual groundwater supply of approximately 0.4 acre feet per acre.

CROPS

The cropping pattern of the district is dominated by cotton (193,000 acres), cereals (104,000 acres) and vegetables (47,000 acres). In terms of value of production for 1977, cotton ranked first, contributing over $125 million and was followed by vegetables, which contributed over $70 million. A wide variety of other field crops, fruits and seed crops make up the balance of the acreage as shown in Table 13-1. In 1977, 69,000 acres of land were fallow due primarily to the drought-induced limited water supply.

LAND TENURE

Westlands is a relatively new district and a large acreage subject to Interior's Acreage Limitation is under recordable contract. Once these agreements to sell excess land have matured, land ownership will be more widely dispersed than that found in the 1978 survey. Based on the

---

1/ See Westlands Case Study Agricultural Appendix C, WPRS, Acreage Limitation EIS, January, 1980.

1978 survey, the Gini coefficient[1/] of land ownership concentration was 0.52, second only to Imperial Irrigation District.

Table 13-1

Crop Acreage, San Luis Unit, Westlands District,
Central Valley Project, California, 1977

Crop	Acres	Value of Production
Cereals		
Barley	104,138	$ 19,274,902
Forage		
Alfalfa Hay	16,855	5,498,980
Miscellaneous Field Crops		
Cotton Lint, Upland	193,346	113,817,446
Cotton Seed, Upland	(193,346)	13,147,520
Vegetables		
Lettuce	4,079	15,387,293
Cantaloupes, etc.	11,136	16,745,649
Tomatoes, Canning	32,217	41,640,500
Seeds		
Alfalfa	11,841	7,193,448
Fruits		
Grapes, Nontable	4,410	2,794,176
Nuts		
Almonds	6,023	2,113,092
Other & Miscellaneous	23,811	13,791,144
Fallow	69,548	---
Total	477,404	$251,404,150

Results of the 1978 ownership survey are presented in Tables 13-2 and 13-3. On the lower end of the ownership scale, 59.3 percent of the owners own only 17.3 percent of the land while at the upper end of the size scale, 0.4 percent of the owners have 23.5 percent of the land. Nonfamily corporations own 22.2 percent of the acreage or 112,549 acres. Multiple family arrangements including corporations and partnerships are the most prominate with 1913 owners owning 37 percent of the land. Nonfamily corporations own 22.2 percent of the acreage or 112,549 acres. Multiple family arrangements including corporations and partnerships are the most prominate with 1,913 owners owning 37 percent of the land.

Farm Operations

Compared to the average acreage per owner of 172 acres, the average farm size reported in the survey was 1,654 acres as shown in Table 13-4. Forty farms of 4,000 acres or larger averaged 7,733 acres per farm. Corporations were the leading form of business organization controlling 37.9 percent of the farms. The survey located 12 farms of less than 100 acres, all of which were joint husband and wife arrangements.

Crop mix varies widely by farm sizes as shown in Table 13-5. The farms in the smallest size category grew only alfalfa hay. Crop mix on the next larger farm size (100-179 acres) was more diversified with almost equal proportions of cereals, forages and row crops. Larger farms, 500 acres and up, appear more diversified but with a fairly constant proportion of land in cotton and sugar beets, about 54 percent. While the proportion of land in cereals and grain also remains

1/ Gini coefficient ranges from 0 to 1.0. The higher the coefficient, the greater the degree of concentration.

Table 13-2

FORM OF OWNERSHIP BY FARM SIZE, WESTLANDS, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-Profit	Total	Cumula-tive Percent
1-99										
No. of Owners	154.	42.	1279.	46.	213.	5.	0.	0.	1739.	59.3
Percent	8.8	2.4	73.5	2.6	12.2	0.2	0.0	0.0	100.0	
100-79										
No. of Owners	330.	24.	494.	33.	54.	7.	0.	0.	942.	91.4
Percent	35.0	2.5	52.4	3.5	5.7	0.7	0.0	0.0	100.0	
180-259										
No. of Owners	13.	6.	33.	0.	0.	0.	0.	0.	52.	93.2
Percent	25.0	11.5	63.4	0.0	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	8.	6.	43.	15.	0.	0.	0.	3.	75.	95.8
Percent	10.6	8.0	57.3	20.0	0.0	0.0	0.0	4.0	100.0	
500-999										
No. of Owners	9.	2.	41.	18.	0.	7.	0.	0.	77.	98.4
Percent	11.6	2.5	53.2	23.3	0.0	9.0	0.0	0.0	100.0	
1,000-1,999										
No. of Owners	2.	2.	23.	1.	0.	6.	0.	0.	34.	99.6
Percent	5.8	5.8	67.6	2.9	0.0	17.6	0.0	0.0	100.0	
2,000-2,999										
No. of Owners	4.	0.	0.	0.	0.	3.	0.	0.	7.	99.8
Percent	57.1	0.0	0.0	0.0	0.0	42.8	0.0	0.0	100.0	
3,000 and Greater										
No. of Owners	1.	0.	0.	1.	0.	2.	2.	0.	6.	100.0
Percent	16.6	0.0	0.0	16.6	0.0	33.3	33.3	0.0	100.0	
Totals										
No. of Owners	521.	82.	1913.	114.	267.	30.	2.	3.	2932.	
Percent	17.7	2.7	65.2	3.8	9.1	1.0	0.0	0.1	100.0	

Table 13-3

LAND BY OWNERSHIP, WESTLANDS, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	6536.	19869.	45949.	2287.	11528.	109.	0.	0.	86278.	17.3
Percent	7.5	23.0	53.2	2.6	13.3	0.1	0.0	0.0	100.0	
Average									49.6	
100-179										
Acres	49283.	21198.	66536.	5234.	6964.	729.	0.	0.	149944.	47.3
Percent	32.8	14.1	44.3	3.4	4.6	0.4	0.0	0.0	100.0	
Average									159.1	
180-259										
Acres	2841.	5658.	6827.	0.	0.	0.	0.	0.	15326.	50.4
Percent	18.5	36.9	44.5	0.0	0.0	0.0	0.0	0.0	100.0	
Average									294.7	
260-499										
Acres	2611.	10087.	13445.	5223.	0.	0.	0.	1306.	32672.	56.9
Percent	7.9	30.8	41.1	15.9	0.0	0.0	0.0	3.9	100.0	
Average									435.6	
500-999										
Acres	8705.	3330.	24656.	12165.	0.	3482.	0.	0.	52338.	67.4
Percent	16.6	6.3	47.1	23.2	0.0	6.6	0.0	0.0	100.0	
Average									679.7	
1,000-1,999										
Acres	2305.	2688.	29818.	781.	0.	9859.	0.	0.	45451.	76.5
Percent	5.0	5.9	65.6	1.7	0.0	21.6	0.0	0.0	100.0	
Average									1336.7	
2,000-2,999										
Acres	11316.	0.	0.	0.	0.	6964.	0.	0.	18280.	80.2
Percent	61.9	0.0	0.0	0.0	0.0	38.0	0.0	0.0	100.0	
Average									2611.4	
3,000 and Greater										
Acres	5289.	0.	0.	8203.	0.	72914.	17823.	0.	104229.	100.0
Percent	5.0	0.0	0.0	7.8	0.0	69.9	17.0	0.0	100.0	
Average									17371.5	
Totals										
Acres	88886.	62830.	187231.	33893.	18492.	94057.	17823.	1306.	504518.	
Percent	17.6	12.4	37.1	6.7	3.6	18.6	3.5	0.2	100.0	
Average	170.6	766.2	97.8	297.3	69.2	3135.2	8911.5	435.3	172.0	

TABLE 13-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, WESTLANDS, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	0	0	12	0	0	12	40
Percent	0.0	0.0	0.0	100.0	0.0	0.0	100.0	
100-179								
No. of Farms	12	12	12	0	12	0	48	145
Percent	25.0	25.0	25.0	0.0	25.0	0.0	100.0	
180-259								
No. of Farms	0	0	0	0	12	0	12	218
Percent	0.0	0.0	0.0	0.0	100.0	0.0	100.0	
260-499								
No. of Farms	0	0	9	0	0	0	9	439
Percent	0.0	0.0	100.0	0.0	0.0	0.0	100.0	
500-999								
No. of Farms	0	45	29	17	0	0	91	690
Percent	0.0	49.4	31.8	18.6	0.0	0.0	100.0	
1,000-1,999								
No. of Farms	1	23	34	12	2	0	72	1461
Percent	1.3	31.9	47.2	16.6	2.7	0.0	100.0	
2,000-2,999								
No. of Farms	3	0	6	3	0	0	12	2427
Percent	25.0	0.0	50.0	25.0	0.0	0.0	100.0	
3,000-3,999								
No. of Farms	0	1	4	0	0	4	9	3339
Percent	0.0	11.1	44.4	0.0	0.0	44.4	100.0	
4,000-or Greater								
No. of Farms	0	19	14	2	5	0	40	7733
Percent	0.0	47.5	35.0	5.0	12.5	0.0	100.0	
Totals								
No. of Farms	16	100	108	46	31	4	305	1654
Percent	5.2	32.7	35.4	15.0	10.1	1.3	100.0	

Table 13-5

IRRIGATED CROP PATTERNS BY FARM SIZE, WESTLANDS, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	0	463	0	0	0	0	0	463
Percent	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0
100-179								
Total Acres	1969	2246	2527	0	0	0	0	6742
Percent	29.2	33.3	37.4	0.0	0.0	0.0	0.0	100.0
180-259								
Total Acres	0	0	2524	0	0	0	0	2524
Percent	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0
260-499								
Total Acres	134	0	2144	0	0	0	0	2278
Percent	5.8	0.0	94.1	0.0	0.0	0.0	0.0	100.0
500-999								
Total Acres	11537	0	23505	5935	740	463	811	42991
Percent	26.8	0.0	54.6	13.8	1.7	1.0	1.8	100.0
1,000-1,999								
Total Acres	12640	2000	39764	15590	3383	1918	0	75295
Percent	16.7	2.6	52.8	20.7	4.4	2.5	0.0	100.0
2,000-2,999								
Total Acres	1158	657	10635	4034	686	0	0	17170
Percent	6.7	3.8	61.9	23.4	3.9	0.0	0.0	100.0
3,000-3,999								
Total Acres	8286	0	14938	6360	166	0	0	29750
Percent	27.8	0.0	50.2	21.3	0.5	0.0	0.0	100.0
4,000-or Greater								
Total Acres	71747	8679	159955	38036	13316	375	1613	293722
Percent	24.4	2.9	54.4	12.9	4.5	0.1	0.5	100.0
Totals								
Total Acres	107471	14045	255993	69955	18291	2756	2424	470936
Percent	22.8	2.9	54.3	14.8	3.8	0.5	0.5	100.0

fairly stable as farm size increases on farms over 500 acres, only farms of this size and larger reported growing the more intensively cultivated vegetables, seed crops, fruits and nuts. The largest farm size, 4,000 acres and over, operated 62 percent of the land in the district and appear to be widely diversified.

Labor

The survey revealed a total of 5,305 full-time or regular employees in the Westlands District. Of this number, Hispanics dominated with 77 percent followed by Caucasians with 21.5 percent as shown in Table 13-6.

Two hundred-seventy eight farm managers were reported on the 4,740 farms in the district, while 4,600 of the regular workers were reported as laborers. These results are presented in Table 13-7. When hired workers were added to farm operators, a rough estimate of the full-time labor input is obtained. Seasonal workers are, of course, in addition to this year-round labor force.

When labor input is standardized on a labor per 1,000 acres, an estimate can be made of the labor efficiency by farm size. These estimates are shown in the last column in Table 13-7. Labor input per 1,000 acres decreases rapidly until farms reach 180 acres and over, then becomes fairly constant but still ranging from 7.5 to 19.3. Part of this variation can be explained by changes in crop mix, custom services, off-farm employment, temporary help and noncrop enterprises such as packing sheds. It is of interest that the lowest labor input was not on the largest farm size group.

TYPICAL FARM BUDGETS

Two sets of farm budgets reflecting two water supply and cost situations were developed. One set of farm budgets, for 160, 320, 640 and 1,280 acre farms, reflects the water supply situation for farms using only project water. The second set assumed the same farm sizes but took into account the additional supply and cost of pumping groundwater.

Consistent with Interior's Proposed Rules and Regulations, these farm budgets assume a maximum land ownership of 320 acres for a husband and wife. All land over 320 acres was assumed to be leased at $110 per acre for land without an irrigation well and at $135 per acre for land relying on both project water and groundwater. The cash rental rates are low relative to the ownership costs of land at current market land values. This provides a cost advantage for the large farms which have a higher proportion of leased land than do small farms.

The farm budgets were developed to reflect three sets of circumstances: (1) the cash flow situation of beginning farmers purchasing land at 1978 market values ($1,500 per acre) and interest rates (9 percent); (2) beginning farmers purchasing excess land at $550 per acre; and (3) the cash flow situation of existing farmers who purchases land at some earlier period at lower land prices and interest rates, and as a result of inflation, have achieved a higher equity position.

The estimated turnover rate for farms in the western United States is 2.5 percent or every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Based on USDA "Balance Sheet of Agriculture," the estimated debt-asset ratio for California farms is 2.57. These data were used to modify the existing farm budgets shown in Tables 13-8 and 13-9.

Project Water Plus Pumping

Results of the typical farm budgets, in which both project and pumped water are used, indicate that for beginning farmers purchasing under current market land values, the return to operator labor, management and equity is positive for all farm sizes except the 320 acre farm and that under excess land values, returns are positive for all farm sizes. With the $550 per acre excess land value and current interest rates, the return to operator labor just about equals the market wage rate.

For existing farmers who have a much higher equity and lower interest rates, the return to operator labor, management and equity is positive for all farm sizes.

Part of the differences in profitability by farm size can be explained by technical economies of size, but the results are made more complex by the fact that the cropping mix changes by farm size.

Project Water Only

The high cost of the drought insurance provided by standby pumps can be seen by comparing budgets for beginning farmers with and without pumping. Although total crop acreage is the same when only project water is used, net returns to unpaid labor, management and equity is higher for

Table 13-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, WESTLANDS, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	12	0	12	0	0	0
Average	1.0	0.0	1.0	0.0	0.0	0.0
100-179						
No. of Employees	104	58	46	0	0	0
Average	2.2	1.2	0.9	0.0	0.0	0.0
180-259						
No. of Employees	12	12	0	0	0	0
Average	1.0	1.0	0.0	0.0	0.0	0.0
260-499						
No. of Employees	68	22	46	0	0	0
Average	7.5	2.4	5.1	0.0	0.0	0.0
500-999						
No. of Employees	591	121	470	0	0	0
Average	6.4	1.3	5.1	0.0	0.0	0.0
1,000-1,999						
No. of Employees	770	275	484	0	11	0
Average	10.9	3.8	6.8	0.0	0.1	0.0
2,000-2,999						
No. of Employees	327	39	288	0	0	0
Average	28.2	3.3	24.8	0.0	0.0	0.0
3,000-3,999						
No. of Employees	217	31	185	0	0	1
Average	24.2	3.4	20.6	0.0	0.0	0.1
4,000-or Greater						
No. of Employees	3204	583	2566	1	18	36
Average	79.3	14.4	63.5	0.0	0.4	0.8
Totals						
No. of Employees	5305	1141	4097	1	29	37
Percent	100.0	21.5	77.2	0.0	0.5	0.6

Table 13-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, WESTLANDS, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	0	0	12	12	12	24	51.8
Average/Farm	0.	0.	1.0	1.0	1.0	2.0	
100-179							
No. of Workers	12	12	81	105	47	152	22.6
Average/Farm	0.2	0.2	1.7	2.2	1.0	3.2	
180-259							
No. of Workers	12	0	0	12	12	24	9.5
Average/Farm	1.0	0.	0.	1.0	1.0	2.0	
260-499							
No. of Workers	1	1	65	67	9	76	19.3
Average/Farm	0.1	0.1	7.2	7.4	1.0	8.4	
500-999							
No. of Workers	39	56	497	592	91	683	10.8
Average/Farm	0.4	0.6	5.4	6.4	0.9	7.4	
1,000-1,999							
No. of Workers	66	107	597	770	70	840	8.1
Average/Farm	0.9	1.5	8.4	10.9	0.9	11.8	
2,000-2,999							
No. of Workers	13	26	288	327	12	339	12.0
Average/Farm	1.1	2.2	24.8	28.2	1.0	29.2	
3,000-3,999							
No. of Workers	12	29	176	217	9	226	7.5
Average/Farm	1.3	3.2	19.6	24.2	1.0	25.2	
4,000-or Greater							
No. of Workers	123	196	2884	3203	40	3243	10.3
Average/Farm	3.0	4.8	71.4	79.3	0.9	80.3	
Totals							
No. of Workers	278	427	4600	5305	302	5607	

Table 13-8

Westlands Water District
(Project Plus Irrigation Well)

Summary of Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Cotton	132	Land	$240,000
	Tomatoes (leased)	20	Improvements	46,400
	Farmstead	8	Machinery	36,226
	Total	160	Total	$322,626

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$86,620	Gross Sales	$86,620
Expenses	86,116	Expenses	76,004
Return to Operator Labor, Mgt., & Equity	$ 504	Return to Operator Labor, Mgt., & Equity	$10,616

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$86,620
Expenses	75,253
Return to Operator Labor, Mgt., & Equity	$11,367

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Cotton	264	Land	$480,000
	Tomatoes (leased)	40	Improvements	92,800
	Farmstead	16	Machinery	80,271
	Total	320	Total	$653,071

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$173,241	Gross Sales	$173,241
Expenses	178,068	Expenses	157,653
Return to Operator Labor, Mgt., & Equity	$ -4,827	Return to Operator Labor, Mgt., & Equity	$ 15,588

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$173,241
Expenses	157,352
Return to Operator Labor, Mgt., & Equity	$ 15,889

Table 13-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Cotton	438	Land	$480,000
	Sugar Beets	90	Improvements	105,600
	Tomatoes (leased)	80	Machinery	233,054
	Farmstead	32	Total	$818,654
	Total	640		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$443,909	Gross Sales	$443,909
Expenses	435,283	Expenses	410,828
Return to Operator Labor, Mgt., & Equity	$ 8,626	Return to Operator Labor, Mgt., & Equity	$ 33,081

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$443,909
Expenses	414,567
Return to Operator Labor, Mgt., & Equity	$ 29,342

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Barley (Irr.)	156	Land	$ 480,000
	Cotton	700	Improvements	131,200
	Tomatoes	160	Machinery	700,000
	Sugar Beets	200	Total	$1,311,652
	Farmstead	64		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$828,917	Gross Sales	$828,917
Expenses	740,212	Expenses	703,152
Return to Operator Labor, Mgt., & Equity	$ 88,705	Return to Operator Labor, Mgt., & Equity	$125,765

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$828,917
Expenses	719,496
Return to Operator Labor, Mgt., & Equity	$109,421

Table 13-9

Westland Water District
(Project Water Only)

Summary of Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Cotton	132	Land	$240,000
	Tomatoes (leased)	20	Improvements	6,400
	Farmstead	8	Machinery	36,226
	Total	160	Total	$282,626

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$86,620	Gross Sales	$86,620
Expenses	82,557	Expenses	73,420
Return to Operator Labor, Mgt., & Equity	$ 4,063	Return to Operator Labor, Mgt., & Equity	$13,200

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$86,620
Expenses	72,198
Return to Operator Labor, Mgt., & Equity	$14,422

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Cotton	264	Land	$480,000
	Tomatoes (leased)	40	Improvements	12,800
	Farmstead	16	Machinery	80,271
	Total	320	Total	$573,071

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$173,241	Gross Sales	$173,241
Expenses	170,949	Expenses	152,487
Return to Operator Labor, Mgt., & Equity	$ 2,292	Return to Operator Labor, Mgt., & Equity	$ 20,754

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$173,241
Expenses	150,233
Return to Operator Labor, Mgt., & Equity	$ 23,008

Table 13-9--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Cotton	438	Land	$480,000
	Sugar Beets	90	Improvements	25,600
	Tomatoes	80	Machinery	223,971
	Farmstead	32	Total	$729,571
	Total	640		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$443,909	Gross Sales	$443,909
Expenses	428,164	Expenses	405,661
Return to Operator Labor, Mgt., & Equity	$ 15,745	Return to Operator Labor, Mgt., & Equity	$ 38,248

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$443,909
Expenses	407,403
Return to Operator Labor, Mgt., & Equity	$ 36,506

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Barley (Irr.)	156	Land	$ 480,000
	Cotton	700	Improvements	51,200
	Tomatoes	160	Machinery	724,077
	Sugar Beets	200	Total	$1,255,277
	Farmstead	64		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$828,917	Gross Sales	$828,917
Expenses	733,053	Expenses	697,945
Return to Operator Labor, Mgt., & Equity	$ 95,864	Return to Operator Labor, Mgt., & Equity	$130,972

Land at Excess Land Value ($550/ac.)

Beginning Farmers	
Gross Sales	$828,917
Expenses	712,337
Return to Operator Labor, Mgt., & Equity	$116,580

all farm sizes. The only two apparent advantages of developing an irrigation well would be (1) a more certain water supply in case of drought and (2) a more uniform seasonal utilization of labor with the larger crop acreage. Based on the budgeted results, pumping appears to be a high cost to pay for the measurable benefits.

For existing farmers with assumed higher equity and lower interest rates, net returns are positive for all farm sizes when using project water only.

ECONOMIES OF SIZE

The machinery complements specified by the farmer panel was used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figures 13-1 and 13-2 show the SRAC which includes operator labor at market wage rates for each farm size when the farm acreage is limited to the engineering capacity for each machinery complement.

Project Plus Irrigation Well

For the beginning farm operator using both project and pumped water, the minimum points on the SRAC except the 1,280 acre machine complement are all above the breakeven level of $1.00 cost per $1.00 of gross sales. Under both current market land values and excess land values, average total cost decreases as the investment in farm machinery and the amount of land farmed increase (see Figures 13-1 and 13-2).

The long-run planning curve, or long-run average cost curve, is estimated by fitting an envelope curve to the minimum points on the SRAC. This was done and is shown in Figure 13-3 for both the current market land value and the excess land value. In Figure 13-3 the LRAC is relatively flat, especially when using excess land values. Most of the economies of size appear to be captured by the time output, measured in terms of gross sales, reach the range of $200,000. Sales in this range translate into the approximate output of a 450 acre farm in this analysis.

Project Water Only

An analysis similar to the foregoing was conducted for farms where the project was the only source of water. The minimum points on the SRAC in Figures 13-4 and 13-5 are the result of optimizing the crop plan subject to the water supply and the machinery complements specified for each size farm. As in the other water supply case discussed above, operator labor is costed at the market wage rate.

For the smaller size farms, costs per unit of output are significantly lower than under the project plus well water situation shown in Figures 13-1 and 13-2. Average costs are about the same on the two larger size farm. However, for beginning farms, all minimum average total cost points are above the breakeven level for current market land values but below for excess land values.

A long-run average cost curve was also developed for this water supply situation. Figure 13-6 shows the LRAC for both land values. Most of the economies of size are captured by the time output, measured in terms of gross sales, reaches $120,000 which translates into about 320 acres of land.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for major crops grown in the district. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 13-10.

Table 13-10

Standard Deviations of Yield, Price and Gross Income by Crop
Westlands Water District

Crop	Yield	Price	Gross Income Per Acre
Cotton Lint	1.756 cwt.	$5.796/cwt	$ 90.86
Lettuce	86.303 cwt.	3.519/cwt	992.31
Tomatoes	2.361 ton	7.153/ton	369.87
Cantaloupes	46.280 cwt.	1.536/cwt.	668.22
Sugar Beets	2.839 ton	9.864/ton	237.87
Alfalfa Hay	1.055 ton	6.949/ton	136.85
Wheat	5.006 cwt.	0.834/cwt.	46.89
Barley	0.077 cwt.	0.597/cwt.	0.16

FIGURE 13-1
WESTLANDS – WITH PUMP
SHORT RUN AVERAGE TOTAL COST CURVE
CURRENT LAND VALUE ($1,500 per acre)
UNLIMITED LEASING

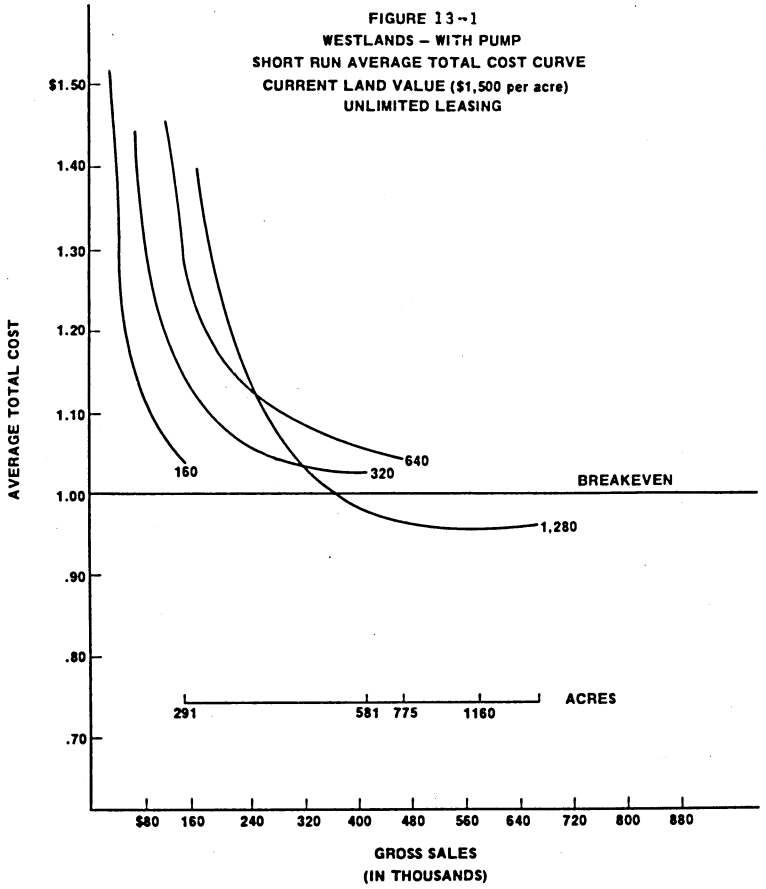


FIGURE 13-2
WESTLANDS – WITH PUMP
SHORT RUN AVERAGE TOTAL COST CURVE
EXCESS LAND VALUE
UNLIMITED LEASING

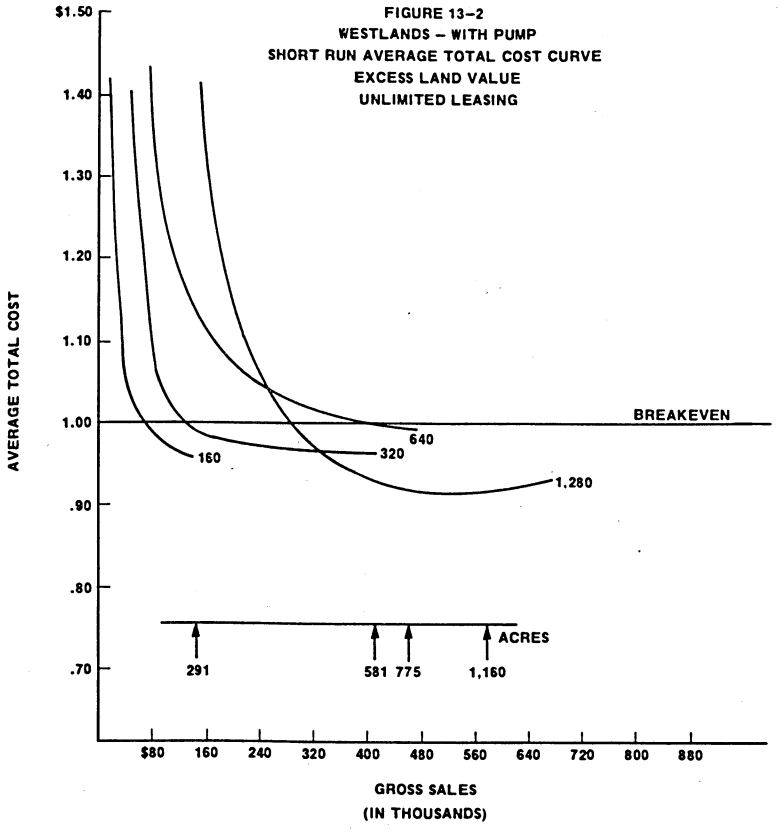


FIGURE 13–3
WESTLANDS – WITH PUMP
LONG RUN PLANNING CURVE
CURRENT & EXCESS LAND VALUES
UNLIMITED LEASING

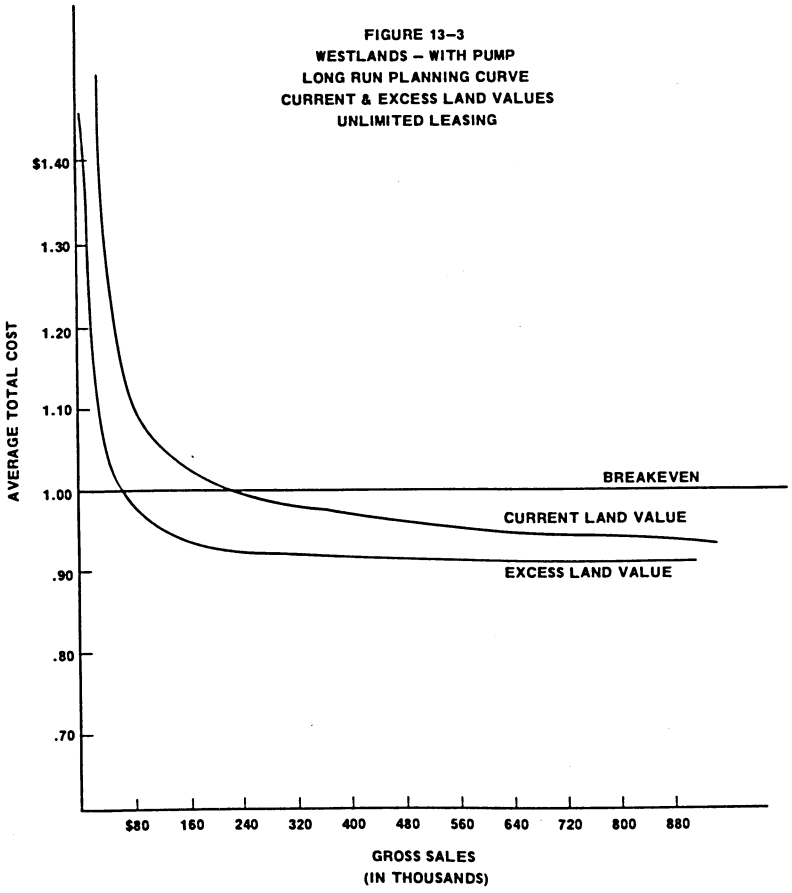


FIGURE 13–4
WESTLANDS – WITHOUT PUMP
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET LAND VALUES
UNLIMITED LEASING

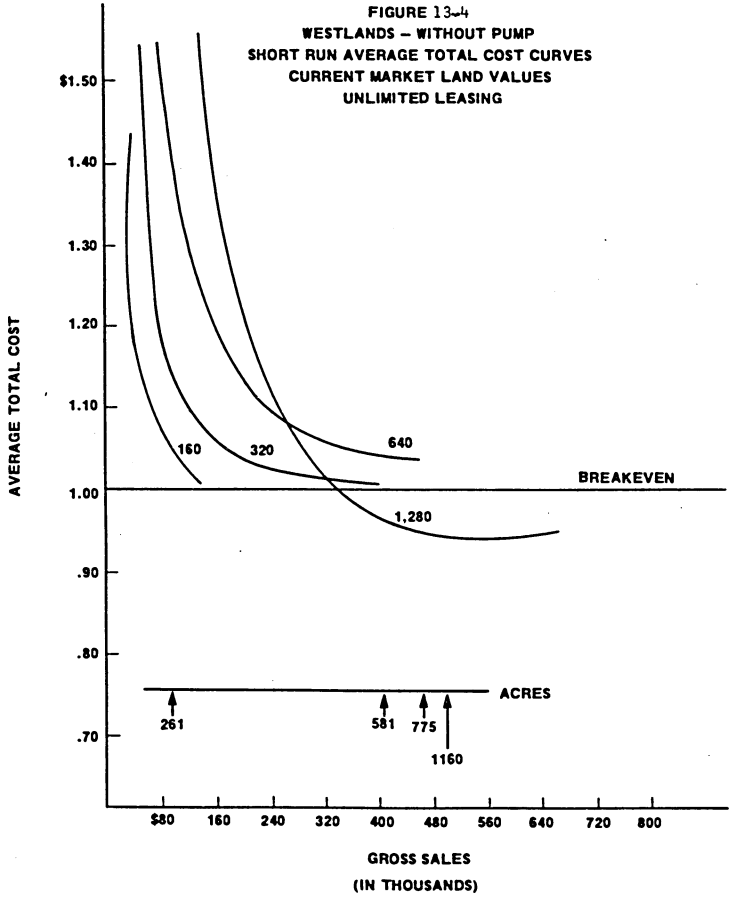


FIGURE 13–5
WESTLANDS – WITHOUT PUMP
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

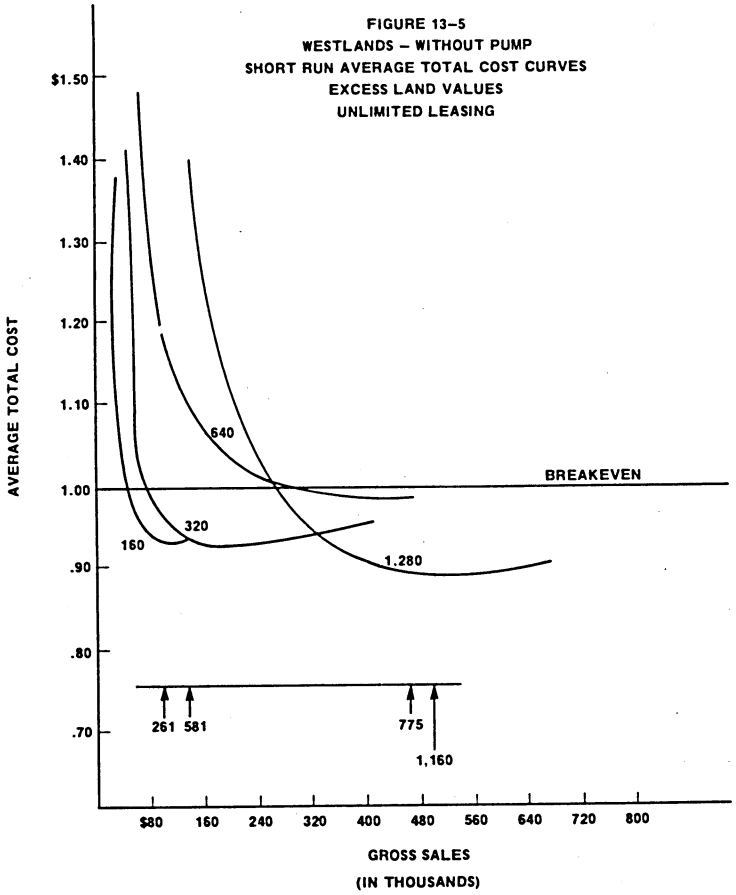
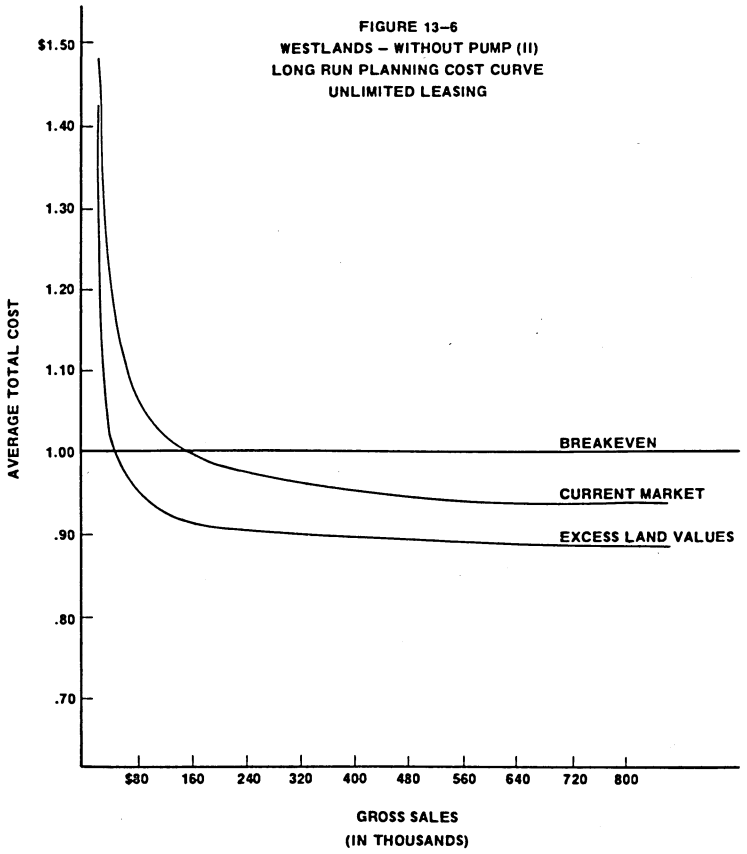


FIGURE 13–6
WESTLANDS – WITHOUT PUMP (II)
LONG RUN PLANNING COST CURVE
UNLIMITED LEASING



To indicate the variability of farm income and costs, the data in Table 13-10 were combined, based on the proportion of land in each crop, for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 13-6.

Figures 13-7 and 13-8 indicate a very wide band around the LRAC within which the costs and returns would be expected to fluctuate about two-thirds of the time.

DEMAND FOR IRRIGATION WATER

Derived demand for irrigation water in Westlands with its diverse soils and crops depends heavily on the profitability of adopted crops, their consumptive use, application efficiency of cost-effective irrigation methods and the cost/price of water.

In Figure 13-9 a vertical dashed line is drawn to represent the historic water supply per acre of eligible land of 2.9 acre feet. The asterisk located on that dashed line indicates the 1978 water cost/price of $15.80 per acre foot delivered to farm headgates. A downward sloping stepped curve traces out the price-quantity relationships (demand curve) estimated from the linear programming model. This is a weighted average demand curve obtained by weighting the demand for each farm size by the proportion of land in the district in each size farm. Results of this analysis indicate that Westlands farm operators are within estimating error, utilizing the available water supply in an optimum manner given the 1978 water cost structure. However, if water costs rise to $25.00 per acre foot or more, a significant, 34 percent, decrease in water use could be expected due to a shift in the cropping pattern and more efficient water-conserving methods. If water cost/prices were increased to the BOR full-cost price of $67.50 per acre foot was implemented, water use per acre would be drastically reduced to about 0.5 acre foot per acre and groundwater pumping would increase substantially.

Impacts of increased water costs on farm income are shown graphically in Figure 3-10. The solid dish shaped curves trace out the net returns over variable costs including water costs for each farm size. Horizontal dashed lines represent the level of fixed costs at excess land values by farm size. A line drawn vertically from the intersection of the net returns curve and the fixed cost level to the base of the graph indicates the maximum ability to pay for irrigation water.

For the 160 acre farm, the maximum ability to pay is estimated at $25 per acre foot with the 320 and 640 acre farms both estimated at $27 per acre foot. Due to economies of size the ability to pay on the 1,280 acre farm size is considerably more at $36 per acre foot. The results indicate that farm operators could pay higher water costs than the 1978 levels but would be unable to pay the WPRS estimated full-cost price.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, it stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable. Although Westlands is structurally quite different from the balance of Fresno County, these are the only data available.

The Census of Agriculture for Fresno County, California reports 5,809 farms with gross agricultural sales of $2,500 or more. Table 13-11 shows the number of these farms reporting agriculturally related off-farm work.

Table 13-11

Farm Operators Reporting Days Work Off-Farm

None	2,220
1 - 49 days	291
50 - 99 days	180
100 - 149 days	169
150 - 199 days	224
200 days or more	1,515
Total	4,599

Income and expenses related to selected off-farm income sources are shown in Table 13-12.

FIGURE 13–7
WESTLANDS – WITH PUMP
LONG RUN PLANNING CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK

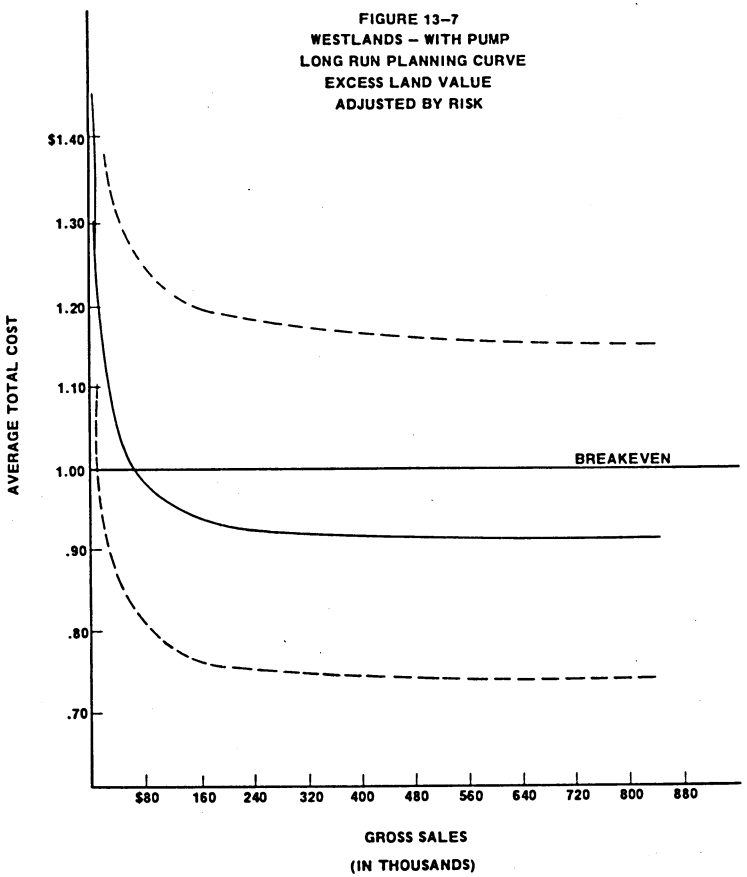


FIGURE 13–8
WESTLANDS – WITHOUT PUMP
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK

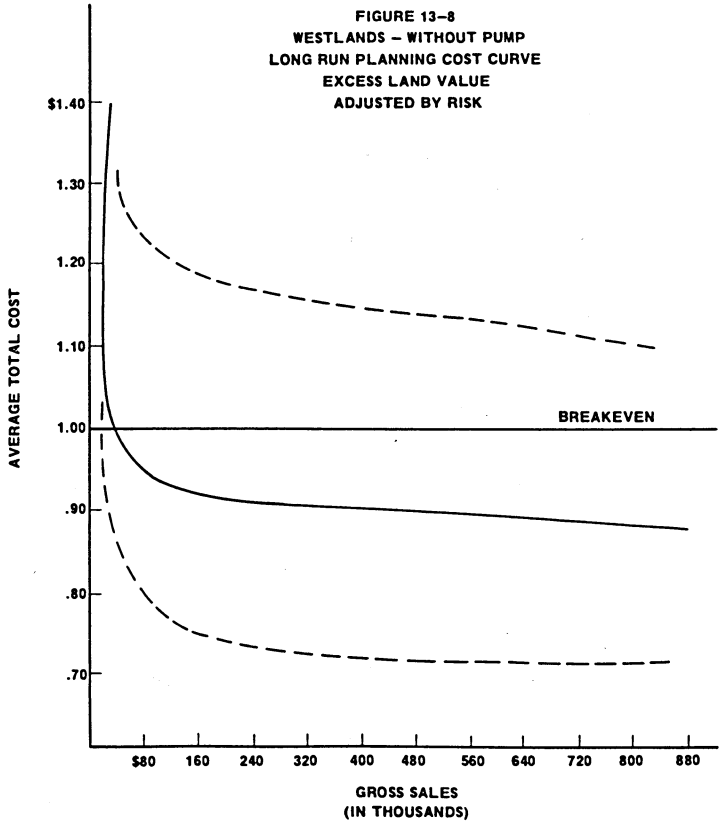


FIGURE 13–9
DEMAND FOR IRRIGATION WATER
WESTLANDS (WITH PUMP)

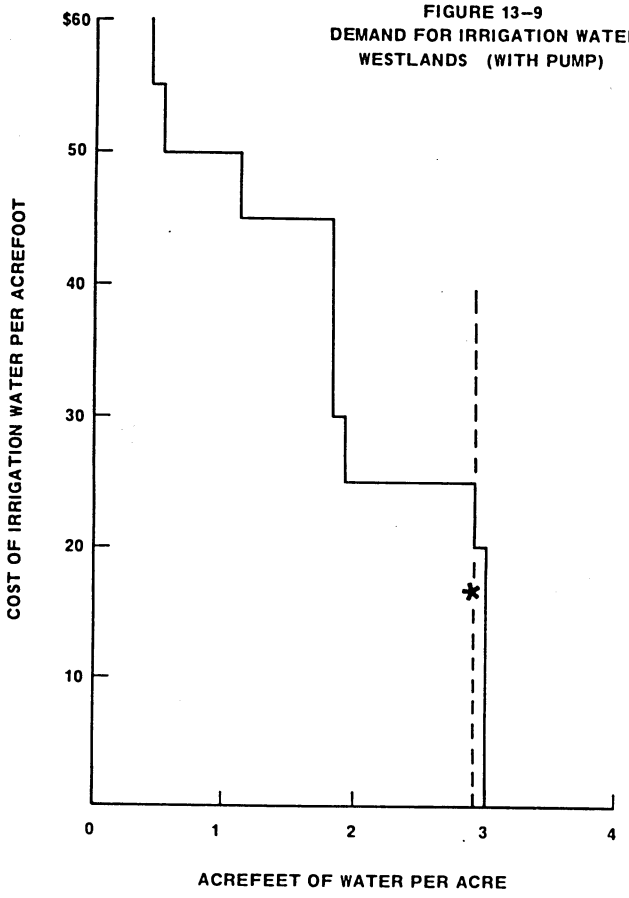


FIGURE 13–10
ABILITY TO PAY FOR IRRIGATION WATER
WESTLANDS (WITH PUMP)
(EXCESS LAND VALUE)

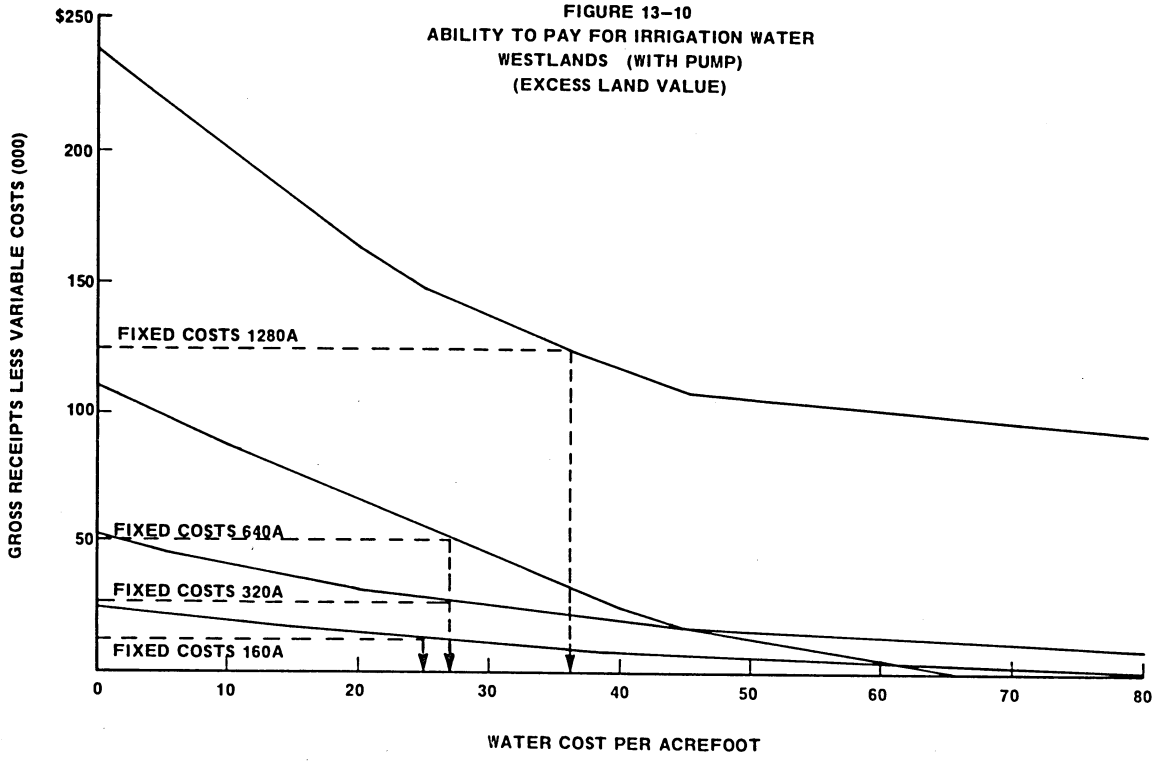


Table 13-12

Operator Income From Farm Related Sources, Fresno County

Number of Farms Reporting	954
Average Per Farm Reporting	$12,660
Income From Custom Work	
Number of Farms Reporting	503
Average Per Farm Reporting	$ 6,909
Expenses Related to Off-Farm Income	
Number of Farms Reporting	372
Average Per Farm Reporting	$ 4,647

Farm operators' spouses and their children also contribute to family income from both agriculturally and nonagriculturally related sources. In Fresno County, 3,662 farms reported an average family off-farm income of $47,977 in 1974. No information is available on off-farm work and income by size of farm.

CHAPTER 14

Elephant Butte District, Rio Grande Project, New Mexico

The Elephant Butte Irrigation District is located along the Rio Grande River in south-central New Mexico in Dona Ana County. It is one of the oldest reclamation projects, receiving water stored in Elephant Butte and Caballo Reservoirs. The irrigated lands in the 90,000 acre district begin north of Hutch and follow the river basin south near El Paso, Texas.

CLIMATE

The climate of Elephant Butte District is characterized by clear, warm, sunny days with low humidity and scant rainfall. The average annual rainfall is 9.1 inches and there is an average of 194 days between killing frosts.

SOILS

The soils within the Elephant Butte Irrigation District are composed of a river-deposited alluvium known as the Gila-Glendale-Vinton association. The soils of this association are dominantly deep, highly stratified and of mixed origin. The surface texture varies from fine sandy loams to clays with the majority being medium sandy loams. These soils are well suited to irrigation farming. There are 90,640 acres of Class 1-4 lands in the district and 11,442 acres of Class 5 lands.

CROPS

The cropping pattern on the 84,000 irrigated crop acres in Elephant Butte District is dominated by cotton, both upland and long staple (32,000 acres: cereals, 9,000 acres; alfalfa hay, 16,000 acres; and vegetables, 15,039 acres). As shown in Table 14-1, chili peppers, while only commanding about 8,000 acres in the district, contribute $12 million to the value of agricultural production in the district.

Table 14-1

Crop Acreage, Elephant Butte District, New Mexico, 1977

Crop	Acres	Value of Production
Cereals		
Barley	2,574	$ 343,541
Sorghums	1,584	200,451
Wheat	4,602	654,534
Forage		
Alfalfa Hay	15,996	4,529,852
Silage, Ensilage	1,640	423,885
Miscellaneous Field Crops		
Cotton Lint, Upland	24,079	9,629,820
Cotton Seed, Upland	(24,079)	999,908
Cotton Lint, Am. Pima	7,763	4,798,920
Cotton Seed, Am. Pima	(7,763)	288,435
Vegetables		
Lettuce	3,305	4,522,532
Onions, Dry	3,764	6,805,124
Peppers (all)	7,970	11,990,685
Nursery	231	1,001,000
Nuts		
Pecans	8,669	10,705,080
Other & Miscellaneous	2,748	1,035,836
Total	84,925	$57,929,603

LAND TENURE

Ownership of land in the Elephant Butte District is moderately concentrated with a Gini coefficient of 0.41.[1/] Slightly over 80 percent of the ownership units are less than 100 acres in size but the owners have only 41 percent of the acreage as shown in Tables 14-2 and 14-3. At the upper end of the scale less than 1 percent of the owners have 11 percent of the land.

Farm ownership is about equally divided among sole proprietorships (individuals), joint ownership with husband and wife and multiple family arrangements including family corporations and partnerships. The survey reported 53 nonfamily corporations but these were all in the less than 100 acre size group and thus owned only 1.2 percent of the acreage. The average acreage per owner was 82 acres.

Farm Operations

Table 14-4 presents information on farm size characteristics. Compared to the average ownership size of 82 acres, the average farm size was 332 acres. While over one-half of the farms were less than 100 acres in size, two farms exceeded 2,000 acres. Both of these farms used the corporate form of business organization whereas farms in the smallest size class were predominately sole proprietors or operated jointly by husbands and wives.

The proportion of land planted to cereals and forages remains fairly constant by farm size as shown in Table 14-5; whereas the proportion of land in cotton declines as farm size increases. The reverse is true of vegetable acreage with the smallest farms reporting only 9 percent of the land to these crops, mostly dry onions and peppers. Interestingly, the farms in the largest size group reported 100 percent of their acreage was planted to pecans.

Being in close proximity to the Mexican border, it is not surprising that 90 percent of the 1,644 regular or full-time employees were of Hispanic decent and only 8.5 percent were Caucasian as shown in Table 14-6.

One measure of the intensity of labor use in farm operations in Elephant Butte is that the smallest farm size class (1-99 acres) reported 24 farm managers and 20 farm foremen (see Table 14-7). Adding regular employees to the number of farm operators, gives a rough estimate of the total labor input on these farms. Inter-farm size comparisons can be made by standardizing on a labor per 1,000 acre basis. These results are shown in the last column in Table 14-7. As farm size increases in Elephant Butte, labor per 1,000 acres declines rapidly until the 260-499 size group is reached and then levels off at about 12. The largest farms, which were totally planted to pecans, reported a labor input of 88.9 laborers per 1,000 acres. These data should be used with caution as measurers of efficiency because they have not been adjusted for off-farm work, temporary help, custom services and noncrop enterprises such as packing sheds.

TYPICAL FARM BUDGETS

Farm budgets were developed for four farm sizes to represent agricultural operations in the district, 160, 320, 640 and 1,280 acres. Based on the Interior's Proposed Rules and Regulations, these budgets assume full ownership for all land up to 320 acres.

Leased land was budgeted at the local prevailing rental rates or their cash equivalent. This was estimated to be $125 per acre. Cash rents are low relative to the current market price for land of $1,800 per acre which gives a cost advantage to the larger farms.

The 160 acre farm (assuming a beginning farmer) growing alfalfa hay, cotton, barley and vegetables showed a return to operator labor, management and equity of $8,900 with an investment in land, improvements and machinery of $490,000 with land at its current market value. When an excess land value of $775 per acre is budgeted, the returns increase to $19,600 due to the smaller debt load (see Table 14-8). Returns to operator labor, management and equity were positive for all other farms budgeted and increase as farm size increases.

A separate set of budgets were constructed to represent the expected returns to existing farmers. Based on the assumption that the average annual turnover rate for farms in the west is 2.5 percent, the average farm was purchased in 1958. Due to appreciation and inflation, the 1977 debt-asset ratio was 15.6 percent. Using 1958 Federal Land Bank and P.C.A. interest rates on the implied smaller debt, net returns to existing farmers was significantly higher than for beginning farmers, $35,000 on the 160 acre farm. Returns increased with farm size as shown in Table 14-8.

1/ Gini coefficient ranges from 0 to 1.0. The higher the value, the more concentrated the ownership.

Table 14-2

FORM OF OWNERSHIP BY FARM SIZE, ELEPHANT BUTTE, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	302.	251.	323.	11.	48.	0.	0.	7.	942.	80.6
Percent	32.0	26.6	34.2	1.1	5.0	0.0	0.0	0.7	100.0	
100-179										
No. of Owners	63.	30.	21.	4.	5.	0.	0.	0.	123.	91.1
Percent	51.2	24.3	17.0	3.2	4.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	17.	13.	0.	2.	0.	0.	0.	0.	32.	93.8
Percent	53.1	40.6	0.0	6.2	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	18.	6.	27.	0.	0.	0.	1.	0.	52.	98.2
Percent	34.6	11.5	51.9	0.0	0.0	0.0	1.9	0.0	100.0	
500-999										
No. of Owners	11.	2.	0.	0.	0.	0.	0.	0.	13.	99.3
Percent	84.6	15.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
1,000-1,999										
No. of Owners	2.	0.	6.	0.	0.	0.	0.	0.	8.	100.0
Percent	25.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	413.	302.	377.	17.	53.	0.	1.	7.	1170.	
Percent	35.2	25.8	32.2	1.4	4.5	0.0	0.0	0.5	100.0	

Table 14-3

LAND BY OWNERSHIP, ELEPHANT BUTTE, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	10711.	17335.	9506.	884.	694.	0.	0.	129.	39259.	40.9
Percent	27.2	44.1	24.2	2.2	1.7	0.0	0.0	0.3	100.0	
Average									41.6	
100-179										
Acres	8339.	3843.	2611.	470.	481.	0.	0.	0.	15744.	53.3
Percent	52.9	24.4	16.5	2.9	3.0	0.0	0.0	0.0	100.0	
Average									128.0	
180-259										
Acres	3710.	2528.	0.	573.	0.	0.	0.	0.	6811.	64.3
Percent	54.4	37.1	0.0	8.4	0.0	0.0	0.0	0.0	100.0	
Average									212.8	
260-499										
Acres	6155.	999.	9721.	0.	0.	0.	300.	0.	17175.	82.2
Percent	35.8	5.8	56.5	0.0	0.0	0.0	1.7	0.0	100.0	
Average									330.2	
500-999										
Acres	5940.	481.	0.	222.	0.	0.	0.	0.	6643.	89.1
Percent	89.4	7.2	0.0	3.3	0.0	0.0	0.0	0.0	100.0	
Average									511.0	
1,000-1,999										
Acres	2145.	0.	8004.	0.	0.	0.	370.	0.	10519.	100.0
Percent	20.3	0.0	76.0	0.0	0.0	0.0	3.5	0.0	100.0	
Average									1314.8	
Totals										
Acres	37000.	25186.	29842.	2149.	1175.	0.	670.	129.	96151.	
Percent	38.4	26.1	31.0	2.2	1.2	0.0	0.6	0.1	100.0	
Average	89.5	83.3	79.1	126.4	22.1	0.0	670.0	18.4	82.1	

Table 14-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, ELEPHANT BUTTE, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	2	2	16	119	120	0	259	43
Percent	0.7	0.7	6.1	45.9	46.3	0.0	100.0	
100-179								
No. of Farms	0	1	19	24	58	0	102	137
Percent	0.0	0.9	18.6	23.5	56.8	0.0	100.0	
180-259								
No. of Farms	0	2	2	18	24	0	46	220
Percent	0.0	4.3	4.3	39.1	52.1	0.0	100.0	
260-499								
No. of Farms	0	0	21	17	20	0	58	361
Percent	0.0	0.0	36.2	29.3	34.4	0.0	100.0	
500-999								
No. of Farms	0	0	9	7	11	0	27	619
Percent	0.0	0.0	33.3	25.9	40.7	0.0	100.0	
1,000-1,999								
No. of Farms	0	1	5	0	2	0	8	1215
Percent	0.0	12.5	62.5	0.0	25.0	0.0	100.0	
2,000-9,999								
No. of Farms	2	0	0	0	0	0	2	4000
Percent	100.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	4	6	72	185	235	0	502	332
Percent	0.7	1.1	14.3	36.8	46.8	0.0	100.0	

Table 14-5

IRRIGATED CROP PATTERNS BY FARM SIZE, ELEPHANT BUTTE, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	220	2814	6263	1065	97	57	1260	11776
Percent	1.8	23.8	53.1	9.0	0.8	0.4	10.6	100.0
100-179								
Total Acres	1286	1866	6476	3250	0	37	582	13497
Percent	9.5	13.8	47.9	24.0	0.0	0.2	4.3	100.0
180-259								
Total Acres	490	2008	5642	1534	33	0	202	9909
Percent	4.9	20.2	56.9	15.4	0.3	0.0	2.0	100.0
260-499								
Total Acres	1308	3110	9072	3791	13	0	2122	19416
Percent	6.7	16.0	46.7	19.5	0.0	0.0	10.9	100.0
500-999								
Total Acres	1121	2663	5835	4866	0	0	852	15337
Percent	7.3	17.3	38.0	31.7	0.0	0.0	5.5	100.0
1,000-1,999								
Total Acres	1263	1641	2850	2685	0	0	171	8610
Percent	14.6	19.0	33.1	31.1	0.0	0.0	1.9	100.0
2,000-9,999								
Total Acres	0	0	0	0	0	0	6989	6989
Percent	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
Totals								
Total Acres	5688	14102	36138	17191	143	94	12178	85534
Percent	6.6	16.4	42.2	20.0	0.1	0.1	14.2	100.0

Table 14-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, ELEPHANT BUTTE, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	133	27	106	0	0	0
Average	0.5	0.1	0.4	0.0	0.0	0.0
100-179						
No. of Employees	204	22	178	0	4	0
Average	1.9	0.2	1.7	0.0	0.0	0.0
180-259						
No. of Employees	117	6	111	0	0	0
Average	2.5	0.1	2.4	0.0	0.0	0.0
260-499						
No. of Employees	193	16	172	0	5	0
Average	3.2	0.2	2.9	0.0	0.0	0.0
500-999						
No. of Employees	178	9	165	3	1	0
Average	6.4	0.3	5.9	0.1	0.0	0.0
1,000-1,999						
No. of Employees	113	5	108	0	0	0
Average	14.3	0.6	13.7	0.0	0.0	0.0
2,000-9,999						
No. of Employees	706	56	650	0	0	0
Average	355.4	28.1	327.2	0.0	0.0	0.0
Totals						
No. of Employees	1644	141	1490	3	10	0
Percent	100.0	8.5	90.6	0.1	0.6	0.0

Table 14-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, ELEPHANT BUTTE, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Total Labor Per 1,000 Acres
1-99							
No. of Workers	24	20	89	133	260	393	34.8
Average/Farm	0.	0.	0.3	0.5	1.0	1.5	
100-179							
No. of Workers	13	9	181	203	102	305	21.8
Average/Farm	0.1	0.	1.7	1.9	0.9	2.9	
180-259							
No. of Workers	6	0	111	117	46	163	16.0
Average/Farm	0.1	0.	2.4	2.5	0.9	3.5	
260-499							
No. of Workers	7	4	182	193	59	252	11.9
Average/Farm	0.1	0.	3.1	3.2	1.0	4.3	
500-999							
No. of Workers	10	8	160	178	28	206	11.9
Average/Farm	0.3	0.2	5.7	6.4	1.0	7.4	
1,000-1,999							
No. of Workers	1	5	106	112	8	120	12.5
Average/Farm	0.1	0.6	13.4	14.2	1.0	15.2	
2,000-9,999							
No. of Workers	10	10	685	705	2	707	88.9
Average/Farm	5.0	5.0	344.8	354.9	1.0	355.9	
Totals							
No. of Workers	71	56	1514	1641	505	2146	

Table 14-8

Elephant Butte Irrigation District

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	14	Land	$288,000.00
	Alfalfa Estb.	14	Improvements	51,500.00
	Barley (Irr.)	14	Machinery	151,508.45
	Cotton, Seed	60	Total	$491,008.45
	Chiles	19		
	Fall Lettuce	19		
	Spring Onion	14		
	Farmstead	6		
	Total	160		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$125,878	Gross Sales	$125,878
Expenses	116,946	Expenses	91,023
Return to Operator Labor, Mgt., & Equity	$ 8,932	Return to Operator Labor, Mgt., & Equity	$ 34,855

Land at Excess Land Value ($775/ac.)

Beginning Farmers	
Gross Sales	$125,878
Expenses	106,258
Return to Operator Labor, Mgt., & Equity	$ 19,620

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	29	Land	$576,000.00
	Alfalfa Estb.	29	Improvements	103,000.00
	Barley (Irr.)	29	Machinery	191,674.75
	Cotton	115	Total	$870,674.75
	Chiles	38		
	Fall Lettuce	38		
	Spring Onion	29		
	Farmstead	13		
	Total	320		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$252,342	Gross Sales	$252,342
Expenses	229,222	Expenses	182,999
Return to Operator Labor, Mgt., & Equity	$ 23,120	Return to Operator Labor, Mgt., & Equity	$ 69,343

Land at Excess Land Value ($775/ac.)

Beginning Farmers	
Gross Sales	$252,342
Expenses	207,846
Return to Operator Labor, Mgt., & Equity	$ 44,496

Table 14-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	58	Land	$ 576,000.00
	Alfalfa Estb.	58	Improvements	206,000.00
	Barley (Irr.)	58	Machinery	307,689.95
	Cotton	228	Total	$1,089,689.95
	Chiles	77		
	Fall Lettuce	77		
	Spring Onion	58		
	Farmstead	26		
	Total	640		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$507,157	Gross Sales	$507,157
Expenses	463,093	Expenses	405,806
Return to Operator Labor, Mgt., & Equity	$ 44,064	Return to Operator Labor, Mgt., & Equity	$101,351

Land at Excess Land Value ($775/ac.)

Beginning Farmers	
Gross Sales	$507,157
Expenses	441,717
Return to Operator Labor, Mgt., & Equity	$ 65,440

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	115	Land	$ 576,000.00
	Alfalfa Estb.	115	Improvements	412,000.00
	Barley (Irr.)	115	Machinery	519,240.90
	Cotton	461	Total	$1,507,240.90
	Chiles	154		
	Fall Lettuce	154		
	Spring Onion	115		
	Farmstead	51		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$1,014,109	Gross Sales	$1,014,109
Expenses	918,317	Expenses	839,935
Return to Operator Labor, Mgt., & Equity	$ 95,792	Return to Operator Labor, Mgt., & Equity	$ 174,174

Land at Excess Land Value ($775/ac.)

Beginning Farmers	
Gross Sales	$1,014,109
Expenses	896,941
Return to Operator Labor, Mgt., & Equity	$ 117,168

ECONOMIES OF SIZE

The machinery complement specified for each farm size was used as the "fixed plant" in order to develop short-run average cost curves (SRAC). Figure 14-1 shows the SRAC which includes operator labor at market wage rates for each farm size when the farm acreage is limited to the engineering capacity specified for each machinery complement. Figure 14-2 shows the same results except the value of owned land has been reduced to its excess land value of $775 per acre. Under the current market land value (Figure 14-1) minimum points on the SRAC are all below the breakeven level resulting in similar net returns to the typical farm budgets. Average costs for the smaller farms decrease significantly under the assumption of excess land values as shown in Figure 14-2.

When an envelope curve is fitted to the minimum points on the SRAC, a long-run or planning curve is developed as shown in Figure 14-3 for both the current market and excess land values. The results shown in Figure 14-3 indicate: First, that most of the economies of size are achieved by the time gross sales reach the $320,000 per year output which is approximated by the 160 acre SRAC. Second, the benefits of the excess land values accrue to the smaller farm sizes as evidenced by the larger absolute difference between the LRAC at the left-hand end of the curves.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 14-9.

Table 14-9

Standard Deviations of Price, Yield and Gross Income by Crop

Crop	Yield	Price	Gross Income Per Acre
Alfalfa Hay	0.365 ton	2.932/ton	$ 15.656
Cotton	87.049 lb.	0.045/lb.	49.913
Onions	32.95 cwt.	2.078/cwt.	772.274
Barley	7.359 bu.	.077/bu.	7.099
Lettuce	29.566 cwt.	1.691/cwt.	709.96

Not surprisingly, lettuce and onions showed the highest variability of gross income per acre, although lettuce price variability was lower than anticipated. Barley was the most stable crop.

To indicate the variability of total farm income, the data in Table 14-9 were combined based on the proportion of land in each crop for the minimum point on each SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 14-4. Due to the high proportion of the high gross income variability crops, the band around the long-run average cost curve is very wide reflecting the risks faced by producers in the district.

DEMAND FOR IRRIGATION WATER

Figure 14-5 presents graphically the price-quantity relationship estimated for the Elephant Butte District using the linear programming model described in the first chapter. The vertical dashed line depicts the historic water supply delivered to farm headgates of 2.14 acre feet per acre. The asterisk located on the vertical dashed line indicates the 1978 average cost of water to farm operators of $6.45 per acre foot. A solid stepped line in the graph traces the weighted average demand for water as the price of water was varied from $0 to $50 per acre foot.

The wide divergence in the optimal quantity of water utilization and the quantity actually used indicates that district farm operators could profitably use considerably more water than is now available. This limitation in the economic supply of water may explain, in part, the large acreage in winter-grown cereal crops and fallow land.

Due to the scarcity of irrigation water in the district, no change in the actual quantity of water taken would be expected until water cost/price reached about $45 per acre foot. If water costs were increased to the BOR full-cost price of $41.68 per acre foot, water demand would decrease by about 34 percent below the maximum supply which could be utilized.

FIGURE 14–1
ELEPHANT BUTTE
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT LAND MARKET
UNLIMITED LEASING

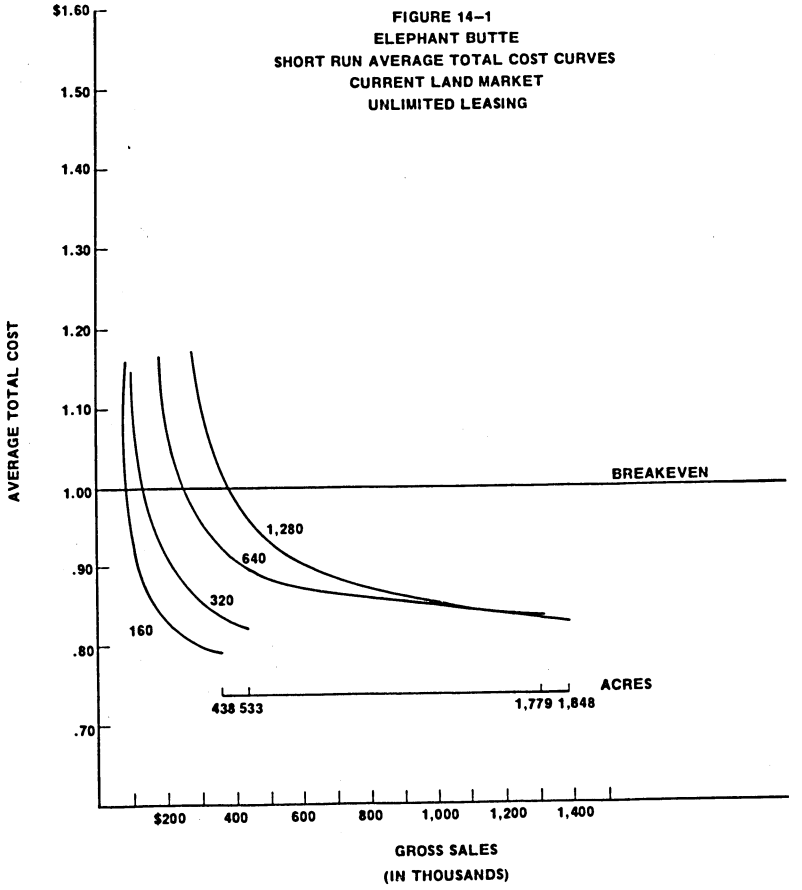


FIGURE 14–2
ELEPHANT BUTTE
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

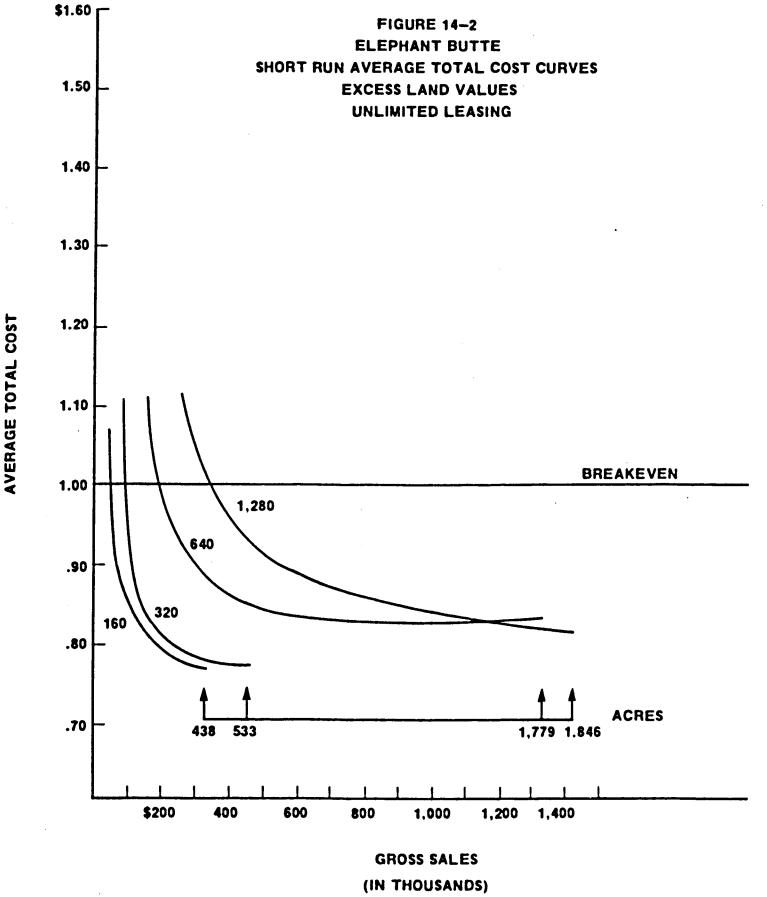


FIGURE 14–3
ELEPHANT BUTTE
LONG RUN PLANNING COST CURVE
UNLIMITED LEASING

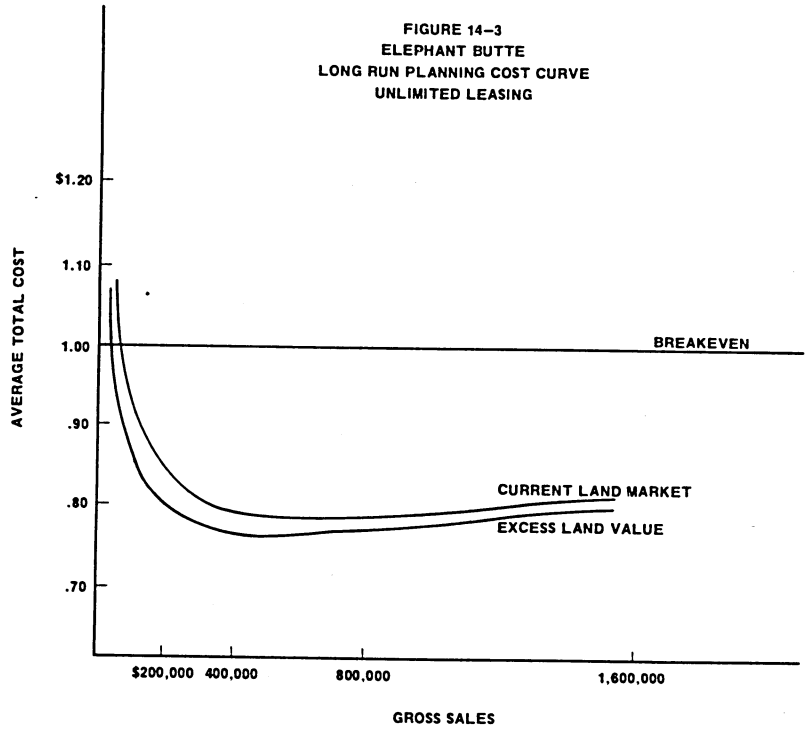


FIGURE 14–4
ELEPHANT BUTTE
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK

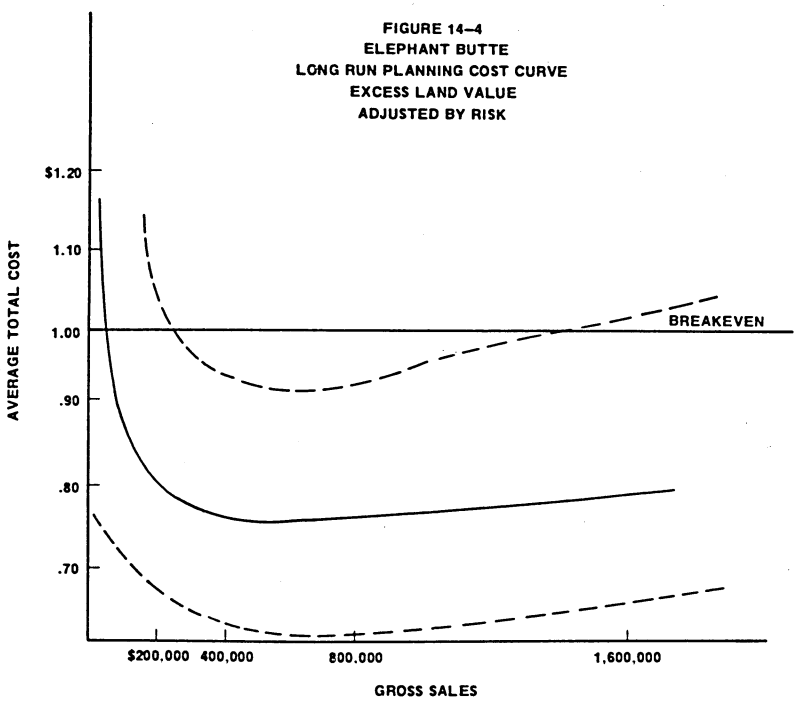


FIGURE 14–5
ELEPHANT BUTTE
DEMAND FOR IRRIGATION WATER

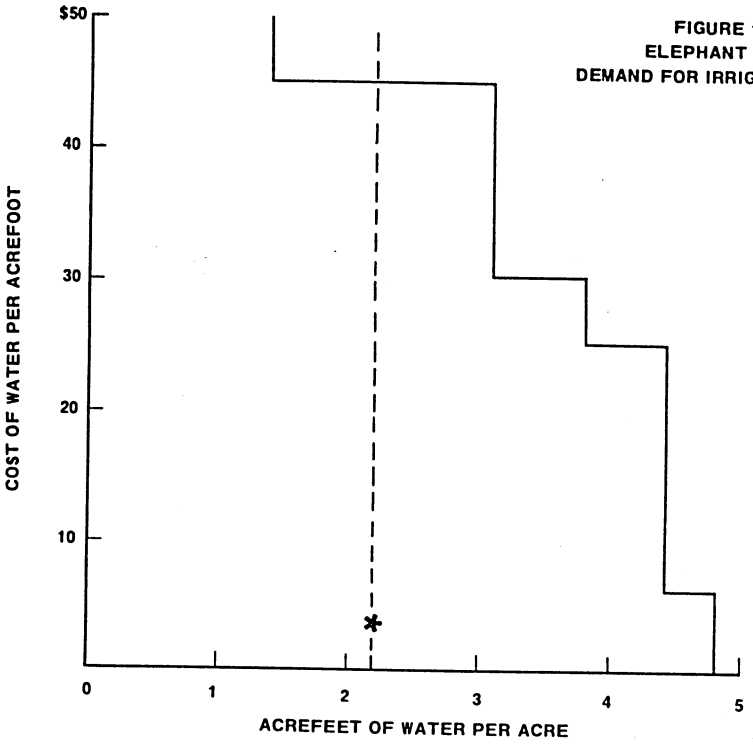
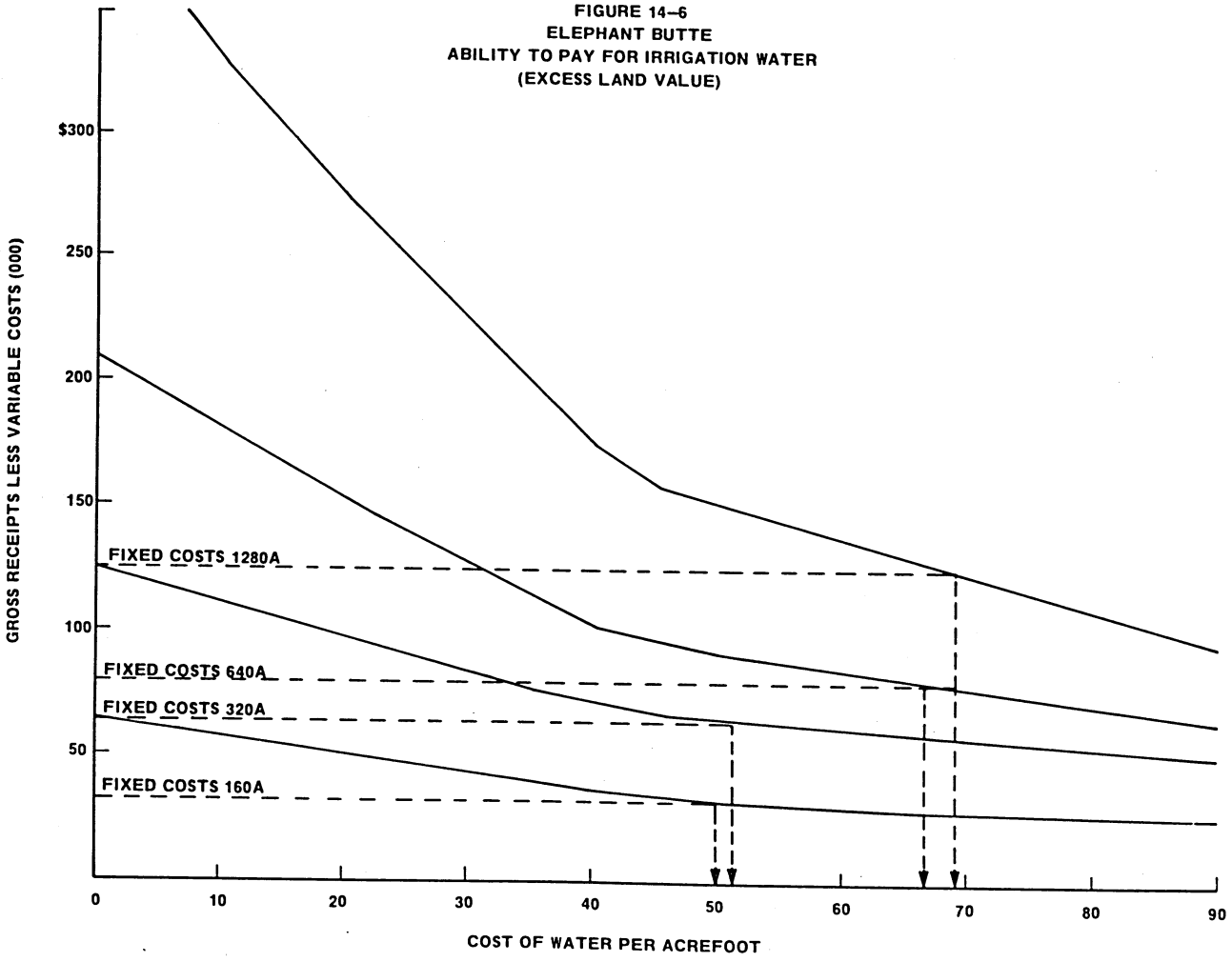


FIGURE 14–6
ELEPHANT BUTTE
ABILITY TO PAY FOR IRRIGATION WATER
(EXCESS LAND VALUE)



Even under optimal water use, increased water cost heavily impact farm income. The results are presented in Figure 14-6. The solid line traces out the net returns over variable costs including water costs for each farm size. This curve is dished reflecting the fact that the crop mix and irrigation method change in response to increased water costs.

A dashed horizontal line in Figure 14-6 indicates the level of fixed costs for each farm size assuming excess land values. The intersection of the dashed horizontal line and the solid curve represents the water cost at which farm income is zero, thus the maximum ability to pay for irrigation water. This analysis indicates that farm operators could pay significantly higher water costs and they could even pay the WPRS full-cost price, if necessary, and still show a positive income assuming excess land values.

OFF-FARM INCOME

Off-farm work contributes to two important objectives to farm operators, especially small farm operators. First, it allows for more complete utilization of under-employed resources such as family labor and unused machinery capacity. Second, it enhances and stabilizes family income especially in poor crop years. The level and stability of family income is an important consideration for lending institutions when making farm loans.

No primary survey data was collected in this study on off-farm income within the irrigation district or project; however, the U.S. Census of Agriculture of 1974 reports these data on a county basis.

The Census of Agriculture for Dona Ana County reports 546 farms with gross agricultural sales of $2,500 or more. Table 14-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 14-10

Farm Operators Reporting Days Work Off-Farm,
Dona Ana County, New Mexico

None	229
1 - 49 days	26
50 - 99 days	11
100 - 149 days	7
150 - 199 days	16
200 days or more	100
Total	389

Income and expenses related to selected off-farm income sources are shown in Table 14-11.

Table 14-11

Income and Expenses Related to Selected Off-Farm Income,
Dona Ana County, New Mexico

	Number	Average
Income from Farm Related Sources	198	972
Custom Work	60	292
Expenses	64	357

Operators' spouses and their children also contribute to family income from both agriculturally and nonagriculturally related sources. In Dona Ana County, 254 farms reported an average family off-farm income of $3,034 in 1974. No information is available on off-farm income by farm size.

CHAPTER 15

Imperial Irrigation District, All American Canal, California

Imperial Irrigation District is located in the southeastern corner of California between the Salton Sea and the border of Mexico. The 451,457 acre district receives all of its water supply from the Colorado River through the All American Canal as a portion of the Boulder Canyon Project.

CLIMATE

The Imperial Valley[1/] is characterized as having a frost-free (above 32° F) period of 348 days. Maximum temperature of 119° F and minimum temperature of 23° F are recorded. Average annual precipitation is 2.35 inches, most of which falls during July and August in one or two storms.

SOILS

The Imperial Valley lands have not been classified by the Bureau of Reclamation. The Soil Conservation Service, U.S. Department of Agriculture has recently completed a soil survey of Imperial Valley including the Imperial Irrigation District. Preliminary information provided by the Soil Conservation Service pertains to "Land Capability Classes" of 582,200 acres. (In the 1977 Annual Report, the district reports serving 501,827 acres of irrigated farm land.)

Capability Class	Percent
Class I	2
Class II	25
Class III	67
Class IV	4
Class VIII	2

Brief descriptions of major soil characteristics which influence crop adaptability are taken from descriptions of predominant soils in each capability class.

Class I - 9,200 Acres

These are deep, well-drained soils with slopes of less than 2 percent on flood plains and basin floors. Typically the surface layer is a pinkish-gray loam about 12 inches thick.

Class II - 147,000 Acres

About 50 percent of these soils may be described as deep, stratified soils with slopes of 0-2 percent. They are located on flood plains and alluvial basin floors. Irrigation has caused perched water tables in the soil at depths of 36-60 inches and the water table may rise to within 18 inches of the surface during periods of heavy irrigation.

An additional 20 percent of the soils in this class are formed in alluvial and aeolian sediments from diverse sources on slopes of 0-2 percent.

The remaining 30 percent of the soils in this class are well suited for irrigation agriculture.

Class III - 391,400 Acres

Soils of this class are formed on flood plains, basins and lakebeds. Two soil profiles discussed below are typical of over 325,000 acres. The first soil is deep, typically pinkish-gray and light brown silty clay to a depth of 60 inches or more.

This soil is used for general field crops and to a lesser extent for winter vegetables and melons. Where soil salinity levels are low, these crops are adaptable. Because of the problems in maintaining a favorable salt balance, the soil is more easily managed for salt-tolerant crops.

Slow movement of water through subsurface layers make water penetration and leaching of soluble salt difficult. Closely spaced underground drains are needed to provide leaching outlets for salinity control and to prevent perched water tables within the root zone.

1/ Weather data for the most recent 10-year period beginning in 1968, except for precipitation which is a long-time average.

Intermingled in an unpredictable pattern with the above described soil is the second soil.

These soils have good potential for general field crops and to a lesser extent for winter vegetables and melons. Where soil salinity levels are low, they are well adapted to these crops. Adequate tile drainage and careful irrigation water management are necessary to maintain a favorable salt balance.

Class IV - 22,500 Acres

Irrigation has caused perched water tables in the soils at depths of 30-60 inches. The water table may rise to within 18 inches of the surface during periods of heavy irrigation.

Class VIII - 12,300 Acres

This class consists of deep soils of undifferentiated texture on flood plains and alleviate basin floors with slopes of less than 1 percent. Agricultural potential is ruled out by high salinity levels and drainage problems. Water tables are within 3 feet of the surface and good gravity outlets for drainage are not available.

Crops

The cropping pattern of the district is dominated by cotton (138,000 acres), alfalfa hay (176,000 acres), wheat (67,000 acres) and sugar beets (60,000 acres). In terms of value of production, the 39,000 acres of winter lettuce ranks first in the valley producing $72 million of agricultural income in 1977. A wide variety of other field crops and vegetables make up the balance of the acreage as shown in Table 15-1.

Table 15-1

Crop Acreages, All American Canal, Imperial District, California, 1977

Crop	Acres	Value of Production
Cereals		
Barley	6,761	$ 1,547,999
Sorghums	7,164	1,676,376
Wheat	67,503	17,557,530
Forage		
Alfalfa Hay	176,328	66,017,224
Miscellaneous Field Crops		
Cotton Lint, Upland	138,118	50,120,352
Cotton Seed, Upland	(138,118)	6,905,900
Sugar Beets	59,789	31,898,361
Vegetables		
Asparagus	3,719	9,069,525
Carrots	4,394	14,044,818
Lettuce	39,248	72,870,979
Cantaloupes, etc.	10,446	14,719,331
Onions, Dry	4,605	11,587,838
Tomatoes, Fresh Market	4,355	7,779,598
Other & Miscellaneous	34,578	20,500,188
Sub Total	557,008	$326,296,019
Less Multiple Crop	105,551	---
Total	451,457	$326,296,019

LAND TENURE

The Imperial Irrigation District holds water rights dating back to the 1890's and has never been subject to the 1902 Reclamation Act restricting land ownership. Concentration of land ownership in Imperial is the highest of all the 18 case-study districts with a Gini coefficient of 0.55.2/

On the small size end of the scale, 41 percent of the owners have only 12 percent of the land as shown in Tables 15-2 and 15-3. At the large farm end of the scale, the largest 5 percent of the owners have 25 percent of the land. The survey reported 159 nonfamily corporations owning land in the district. These corporations owned over 38,000 acres or 8.7 percent of all land in the district. A majority, 54 percent, of the ownership units were owned by some sort of family relationship including family corporations, partnerships and joint husband and wife arrangements. These family arrangements owned just one-half of the districts acreage.

Farm Operations

Average acreage per owner in the district was 268 acres as compared to an average farm size of 1,328 acres, indicating a significant amount of leasing and absentee ownership. Business organizations operating these farms are dominated by family relationships with respect to the number of farms, but most of these operate farms with less than 180 acres (see Table 15-4). Corporate forms of business organization tend to control the larger units. Seventy-five corporations or 13.5 percent of all farms in the district are corporations.

Table 15-5 presents data on the crop mix by farm size. Vegetables, primarily lettuce, are an important crop on all size farms but the proportion tends to increase as farm size increases. Cereals and grain production is more important on the smaller farms and decreases in importance as farm size increases. Other than the smallest farms, there seems to be no consistent relation between farm size and crop mix for forage and field crop production. Thus, little generalization can be made about the intensity of cropping and farm size.

Labor

Agriculture in Imperial is very labor intensive with 5,207 regular or full-time employees as presented in Table 15-6. Due to the close proximity to Mexico, 88 percent of these workers are of Hispanic origin and 12 percent are Caucasian.

Job categories by farm size are shown in Table 15-7. Farm managers were reported on 11 of the 153 farms of less than 100 acres in size. Supervisory labor, farm managers and foremen were more important as farm size increased; for example, in the 1,000 to 1,999 acre size group, 16 managers and 66 foremen were reported on the 74 farms in this group.

Adding the number of regular workers to farm operators provides an estimate of the total year-around labor force by farm size. When these data are standardized on a worker per 1,000 acres of land, a rough estimate of the labor imput is obtained. These results are presented in the last column in Table 15-7. Although not adjusted for off-farm work, seasonal help, crop mix or noncrop enterprises such as custom services or packing sheds, these data do present a picture of the labor intensity on these farms. Nonconsistant pattern of labor use is revealed by these data although the 260 to 499 acre size group reported the lowest labor input per 1,000 acres of 5.3. It should be noted that this size group reported the smallest proportion of vegetables of any size group.

TYPICAL FARM BUDGETS

Due to the large acreage of Class III and IV lands in the district, two sets of farm budgets were prepared. The first attempted to represent costs and returns on the higher quality soils where most of the produce crops and alfalfa hay are grown. The second set of farm budgets attempt to reflect costs and returns on the heavier problem soils where a higher proportion of cotton, wheat and sugar beets are grown.

For each soil type farm budgets were developed for 160, 320, 640 and 1,280 acre farms. Following the Interior's Proposed Rules and Regulations, these farm budgets assume a maximum ownership of 320 acres of land for husband and wife. All land over 320 acres was assumed to be leased at $86 per acre for light soils and $39.50 per acre for heavy soils. These cash rental rates are low compared to ownership costs of land at current market values and interest rates. This provides a cost advantage for larger farms which have a high proportion of leased land.

2/ Gini coefficient ranges from 0 to 1.0. The higher the coefficient, the greater the concentration of ownership.

Table 15-2

FORM OF OWNERSHIP BY FARM SIZE, IMPERIAL, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State of Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
No. of Owners	137.	77.	371.	11.	74.	0.	0.	0.	670.	41.2
Percent	20.4	11.4	55.3	1.6	11.0	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	125.	51.	86.	15.	10.	5.	0.	0.	292.	59.2
Percent	42.8	17.4	29.4	5.1	3.4	1.7	0.0	0.0	100.0	
180-259										
No. of Owners	59.	34.	122.	22.	34.	7.	0.	0.	278.	76.3
Percent	21.2	12.2	43.8	7.9	12.2	2.5	0.0	0.0	100.0	
260-499										
No. of Owners	111.	28.	7.	18.	8.	10.	0.	0.	182.	87.5
Percent	60.9	15.3	3.8	9.8	4.3	5.4	0.0	0.0	100.0	
500- 999										
No. of Owners	41.	32.	18.	19.	3.	0.	5.	0.	118.	94.7
Percent	34.7	27.1	15.2	16.1	2.5	0.0	4.2	0.0	100.0	
1,000-1,999										
No. of Owners	17.	24.	20.	1.	0.	1.	0.	0.	63.	98.6
Percent	26.9	38.0	31.7	1.5	0.0	1.5	0.0	0.0	100.0	
2,000-2,999										
No. of Owners	7.	0.	0.	0.	0.	6.	0.	0.	13.	99.4
Percent	53.8	0.0	0.0	0.0	0.0	46.1	0.0	0.0	100.0	
3,000-3,999										
No. of Owners	0.	8.	0.	0.	0.	1.	0.	0.	9.	100.0
Percent	0.0	88.8	0.0	0.0	0.0	11.1	0.0	0.0	100.0	
Totals										
No. of Owners	497.	254.	624.	86.	129.	30.	5.	0.	1625.	
Percent	30.5	15.6	38.4	5.2	7.9	1.8	0.3	0.0	100.0	

Table 15-3

LAND BY OWNERSHIP, IMPERIAL, 1978

Farm Size Acres	Indi-vidual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumula-tive Percent
1-99										
Acres	7664.	23305.	20606.	376.	1472.	0.	0.	0.	53423.	12.3
Percent	14.3	43.6	38.5	0.7	2.7	0.0	0.0	0.0	100.0	
Average									79.7	
100-179										
Acres	18895.	17298.	12651.	2404.	1215.	490.	0.	0.	52953.	24.5
Percent	35.6	32.6	23.8	4.5	2.2	0.9	0.0	0.0	100.0	
Average									181.3	
180-259										
Acres	13136.	22899.	24969.	4769.	7179.	1367.	0.	0.	74319.	41.6
Percent	17.6	30.8	33.5	6.4	9.6	1.8	0.0	0.0	100.0	
Average									267.3	
260-499										
Acres	39691.	10621.	2113.	6424.	2770.	3189.	0.	0.	64808.	56.5
Percent	61.2	16.3	3.2	9.9	4.2	4.9	0.0	0.0	100.0	
Average									356.0	
500-999										
Acres	26303.	22358.	12116.	14608.	2764.	0.	2278.	0.	80427.	75.0
Percent	32.7	27.7	15.0	18.1	3.4	0.0	2.8	0.0	100.0	
Average									681.5	
1,000-1,999										
Acres	22813.	23781.	24263.	1153.	0.	1481.	0.	0.	73491.	91.9
Percent	31.0	32.3	33.0	1.5	0.0	2.0	0.0	0.0	100.0	
Average									1166.5	
2,000-2,999										
Acres	14236.	0.	0.	0.	0.	12358.	0.	0.	26594.	98.0
Percent	53.5	0.0	0.0	0.0	0.0	46.4	0.0	0.0	100.0	
Average									2045.6	
3,000-3,999										
Acres	0.	5581.	0.	0.	0.	3964.	0.	0.	9545.	100.0
Percent	0.0	58.4	0.0	0.0	0.0	41.5	0.0	0.0	100.0	
Average									1060.5	
Totals										
Acres	142738.	125843.	96718.	29734.	15400.	22849.	2278.	0.	435560.	
Percent	32.7	28.8	22.2	6.8	3.5	5.2	0.5	0.0	100.0	
Average	287.1	495.4	154.9	345.7	119.3	761.6	455.6	0.0	268.0	

Table 15-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, IMPERIAL, 1978

Farm Size Acres	Incorporation With More Than 10 Persons	Incorporation With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	11	15	61	66	0	153	44
Percent	0.0	7.1	9.8	39.8	43.1	0.0	100.0	
100-179								
No. of Farms	0	11	10	40	25	0	86	147
Percent	0.0	12.7	11.6	46.5	29.0	0.0	100.0	
180-259								
No. of Farms	0	9	5	1	1	0	16	188
Percent	0.0	56.2	31.2	6.2	6.2	0.0	100.0	
260-499								
No. of Farms	6	0	20	5	45	0	76	359
Percent	7.8	0.0	26.3	6.5	59.2	0.0	100.0	
500-999								
No. of Farms	1	2	27	24	13	0	67	687
Percent	1.4	2.9	40.2	35.8	19.4	0.0	100.0	
1,000-1,999								
No. of Farms	0	7	29	11	27	0	74	1400
Percent	0.0	9.4	39.1	14.8	36.4	0.0	100.0	
2,000-2,999								
No. of Farms	2	11	21	10	3	0	47	2326
Percent	4.2	23.4	44.6	21.2	6.3	0.0	100.0	
3,000-3,999								
No. of Farms	6	4	5	1	0	0	16	3631
Percent	37.5	25.0	31.2	6.2	0.0	0.0	100.0	
4,000-or Greater								
No. of Farms	2	3	5	3	3	0	16	5096
Percent	12.5	18.7	31.2	18.7	18.7	0.0	100.0	
Totals								
No. of Farms	17	58	137	156	183	0	551	1328
Percent	3.0	10.5	24.8	28.3	33.2	0.0	100.0	

Table 15-5

IRRIGATED CROP PATTERNS BY FARM SIZE, IMPERIAL, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	2429	3293	0	909	0	0	0	6631
Percent	36.6	49.6	0.0	13.7	0.0	0.0	0.0	100.0
100-179								
Total Acres	4339	1808	1273	913	53	0	0	8386
Percent	51.7	21.5	15.1	10.8	0.6	0.0	0.0	100.0
180-259								
Total Acres	0	332	1761	478	0	0	0	2571
Percent	0.0	12.9	68.4	18.5	0.0	0.0	0.0	100.0
260-499								
Total Acres	8139	8562	7135	991	0	0	0	24827
Percent	32.7	34.4	28.7	3.9	0.0	0.0	0.0	100.0
500-999								
Total Acres	13621	14958	12688	5534	2050	0	0	48851
Percent	27.8	30.6	25.9	11.3	4.1	0.0	0.0	100.0
1,000-1,999								
Total Acres	37337	31032	31535	6780	5680	0	0	112364
Percent	33.2	27.6	28.0	6.0	5.0	0.0	0.0	100.0
2,000-2,999								
Total Acres	33093	29793	23857	30678	574	418	0	118413
Percent	27.9	25.1	20.1	25.9	0.4	0.3	0.0	100.0
3,000-3,999								
Total Acres	14012	22578	12202	19113	242	0	0	68147
Percent	20.5	33.1	17.9	28.0	0.3	0.0	0.0	100.0
4,000-or Greater								
Total Acres	14764	26608	21266	17133	2134	0	0	81905
Percent	18.0	32.4	25.9	20.9	2.6	0.0	0.0	100.0
Totals								
Total Acres	127735	138964	111717	82529	10733	418	0	472096
Percent	27.0	29.4	23.6	17.4	2.2	0.0	0.0	100.0

Table 15-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, IMPERIAL, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	59	19	40	0	0	0
Average	0.3	0.1	0.2	0.0	0.0	0.0
100-179						
No. of Employees	289	88	201	0	0	0
Average	3.3	1.0	2.3	0.0	0.0	0.0
180-259						
No. of Employees	51	6	45	0	0	0
Average	3.1	0.3	2.8	0.0	0.0	0.0
260-499						
No. of Employees	67	18	49	0	0	0
Average	0.8	0.2	0.6	0.0	0.0	0.0
500-999						
No. of Employees	262	37	220	0	2	3
Average	3.9	0.5	3.2	0.0	0.0	0.0
1,000-1,999						
No. of Employees	547	112	435	0	0	0
Average	7.3	1.4	5.8	0.0	0.0	0.0
2,000-2,999						
No. of Employees	2539	180	2359	0	0	0
Average	54.6	3.8	50.7	0.0	0.0	0.0
3,000-3,999						
No. of Employees	614	77	517	0	20	0
Average	38.4	4.8	32.4	0.0	1.2	0.0
4,000-or Greater						
No. of Employees	779	75	699	0	4	1
Average	49.3	4.7	44.3	0.0	0.2	0.0
Totals						
No. of Employees	5207	612	4565	0	26	4
Percent	100.0	11.7	87.6	0.0	0.4	0.0

Table 15-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, IMPERIAL, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	11	0	48	59	152	211	31.6
Average/Farm	0.	0.	0.3	0.3	0.9	1.3	
100-179							
No. of Workers	15	24	249	288	86	374	29.9
Average/Farm	0.1	0.2	2.9	3.3	1.0	4.3	
180-259							
No. of Workers	0	14	37	51	16	67	22.3
Average/Farm	0.	0.8	2.3	3.1	1.0	4.1	
260-499							
No. of Workers	10	0	58	68	76	144	5.3
Average/Farm	0.1	0.	0.7	0.9	1.0	1.9	
500-999							
No. of Workers	5	8	250	263	67	330	7.1
Average/Farm	0.	0.1	3.7	3.9	0.9	4.9	
1,000-1,999							
No. of Workers	16	66	465	547	74	621	5.9
Average/Farm	0.2	0.8	6.2	7.3	0.9	8.3	
2,000-2,999							
No. of Workers	24	178	2337	2539	47	2586	23.9
Average/Farm	0.5	3.8	50.2	54.6	1.0	55.6	
3,000-3,999							
No. of Workers	16	45	553	614	16	630	10.8
Average/Farm	1.0	2.8	34.6	38.4	1.0	39.4	
4,000-or Greater							
No. of Workers	18	67	694	779	16	795	9.8
Average	1.1	4.2	44.0	49.3	1.0	50.4	
Totals							
No. of Workers	115	402	4691	5208	550	5758	

The farm budgets were further modified to reflect the cash flow situation of (1) beginning farmers purchasing land at 1978 prices ($1,800 per acre) and interest rates and (2) existing farmers who purchased land at some previous time at lower land prices and interest rates. Due to land value appreciation, these owners have a higher equity position.

The estimated turnover rate for farms in the western United States is 2.5 percent for every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Based on the USDA "Balance Sheet of Agriculture," the estimated debt-asset ratio for all assets for California farms is 25.7. These data were used to modify the existing farm budgets shown in Tables 15-8 and 15-9.

Light Soils

Results of the light or produce soils indicate that at current market land values the cash flow or return to operators unpaid labor, management and equity is positive for beginning farmers at all farm sizes except the 320 acre unit. For existing farmers the cash flow is positive for all farm sizes ranging from $12,644 for the 160 acre unit to $28,297 for the 1,280 acre unit.

Valuing land at an excess land value of $1,700 per acre improves the cash flow position sufficiently for all farm sizes to reflect a positive net return (see Table 15-8). For "Existing" farm operators with higher equities and lower interest rates, cash flows are positive for all farm size.

Heavy Soils

The results of the heavy soil farm budgets shown in Table 15-9 show a negative cash flow for all farm sizes except the 1,280 acre farm for beginning farmers, both at current market and excess land values due to the lower yields and less intensive cropping program in these soils. Existing farmers, due to their assumed more favorable equity position, show a positive cash flow for all farm sizes.

ECONOMIES OF SIZE

Light Soil

The machinery complements developed in cooperation with the farmer panel was used as the "fixed plant" in order to estimate short-run average cost curves (SRAC). Figures 15-1 and 15-2 show the SRAC which includes operator labor at market wage rates for each farm size when the farm acreage is limited to the engineering capacity specified for a machinery complement. The minimum points on these SRAC indicate the optimum crop mix given the land, water and machinery available.

For the beginning farmer the minimum points on the SRAC are all below the breakeven level of $1.00 cost per $1.00 gross sales indicating that under optimum conditions these farms can generate a positive income.

The long-run planning curve or long-run average cost curve is estimated by fitting an envelope curve to the minimum points on the SRAC. This was done and is shown in Figure 15-3 for both the current market land value and the excess land value. In Figure 15-3 the LRAC is relatively flat. Most of the economies of size appear to be captured by the time output, measured in terms of gross sales, reach the range of $200,000. This is approximately the output of a 500 acre farm in this analysis.

Heavy Soils

The above analysis was repeated for the budgets representing costs and returns on the heavy soils. Even though the market value of land is lower for the heavy soils, $1,000 per acre, lower yields and a less intensive cropping pattern results in the minimum points of the SRAC to be above those estimated for the heavy soils. These results for beginning farmers are shown in Figures 15-4 and 15-5. A long-run average cost curve (LRAC) was estimated by drawing an envelope curve tangent to the minimum points of these SRAC.

The LRAC for both current market and excess land values is shown in Figure 15-6. These LRAC are very steep until most of the economies of size are captured at a gross sales of about $600,000 or about 900 acres of land.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 15-10.

Table 15-8

Imperial Irrigation District
(Light Soils)

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	36	Land	$288,000
	Cotton	36	Machinery	55,546
	Sugar Beets	36	Total	$343,546
	Lettuce (double)	36		
	Wheat (double)	36		
	Farmstead	16		
	Total	160		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$82,939	Gross Sales	$82,939
Expenses	81,312	Expenses	64,068
Return to Operator Labor, Mgt., & Equity	$ 1,627	Return to Operator Labor, Mgt., & Equity	$18,871

Land at Excess Land Value ($1,700/ac.)

Beginning Farmers	
Gross Sales	$82,939
Expenses	80,222
Return to Operator Labor, Mgt., & Equity	$ 2,717

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	72	Land	$576,000
	Cotton	72	Machinery	129,880
	Sugar Beets	72	Total	$705,880
	Lettuce (double)	72		
	Wheat (double)	72		
	Farmstead	32		
	Total	320		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$165,877	Gross Sales	$165,877
Expenses	166,329	Expenses	131,034
Return to Operator Labor, Mgt., & Equity	$ -452	Return to Operator Labor, Mgt., & Equity	$ 34,843

Land at Excess Land Value ($1,700/ac.)

Beginning Farmers	
Gross Sales	$165,877
Expenses	164,150
Return to Operator Labor, Mgt., & Equity	$ 1,727

Table 15-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	144	Land	$576,000
	Cotton	144	Machinery	209,065
	Sugar Beets	144	Total	$785,065
	Lettuce (double)	144		
	Wheat (double)	144		
	Farmstead	64		
	Total	640		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$603,258	Gross Sales	$603,258
Expenses	591,333	Expenses	552,567
Return to Operator Labor, Mgt., & Equity	$ 11,925	Return to Operator Labor, Mgt., & Equity	$ 50,691

Land at Excess Land Value ($1,700/ac.)

Beginning Farmers	
Gross Sales	$603,258
Expenses	589,168
Return to Operator Labor, Mgt., & Equity	$ 14,090

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	288	Land	$ 576,000
	Cotton	288	Machinery	463,925
	Sugar Beets	288	Total	$1,039,925
	Lettuce (double)	288		
	Wheat (double)	288		
	Farmstead	128		
	Total	1,280		

Financial Summary

Land at Current Market Value ($1,800/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$1,206,516	Gross Sales	$1,206,516
Expenses	1,142,799	Expenses	1,091,968
Return to Operator Labor, Mgt., & Equity	$ 63,717	Return to Operator Labor, Mgt., & Equity	$ 114,548

Land at Excess Land Value ($1,700/ac.)

Beginning Farmers	
Gross Sales	$1,206,516
Expenses	1,140,619
Return to Operator Labor, Mgt., & Equity	$ 65,897

Table 15-9

Imperial Irrigation District
(Heavy Soils)

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	18	Land	$176,000
	Wheat	36	Machinery	55,546
	Cotton	36	Total	$231,546
	Sugar Beets	54		
	Farmstead	16		
	Total	160		

Financial Summary

Land at Current Market Value ($1,100/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$68,825	Gross Sales	$68,825
Expenses	72,611	Expenses	64,989
Return to Operator Labor, Mgt., & Equity	$-3,786	Return to Operator Labor, Mgt., & Equity	$ 3,836

Land at Excess Land Value ($1,000/ac.)

Beginning Farmers	
Gross Sales	$68,825
Expenses	71,521
Return to Operator Labor, Mgt., & Equity	$-2,696

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	36	Land	$352,000
	Cotton	72	Machinery	129,880
	Sugar Beets	108	Total	$481,880
	Wheat	72		
	Farmstead	32		
		320		

Financial Summary

Land at Current Market Value ($1,100/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$137,651	Gross Sales	$137,651
Expenses	147,552	Expenses	131,849
Return to Operator Labor, Mgt., & Equity	$ -9,901	Return to Operator Labor, Mgt., & Equity	$ 5,802

Land at Excess Land Value ($1,000/ac.)

Beginning Farmers	
Gross Sales	$137,651
Expenses	145,372
Return to Operator Labor, Mgt., & Equity	$ -7,721

Table 15-9--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	72	Land	$352,000
	Cotton	144	Machinery	209,065
	Sugar Beets	216	Total	$561,065
	Wheat	144		
	Farmstead	64		
	Total	640		

Financial Summary

Land at Current Market Value ($1,100/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$275,302	Gross Sales	$275,302
Expenses	288,758	Expenses	271,123
Return to Operator Labor, Mgt., & Equity	$-13,456	Return to Operator Labor, Mgt., & Equity	$ 4,179

Land at Excess Land Value ($1,000/ac.)

Beginning Farmers	
Gross Sales	$275,302
Expenses	286,578
Return to Operator Labor, Mgt., & Equity	$-11,276

Farm Size	Crop	Acres	Inyestment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	144	Land	$352,000
	Wheat	288	Machinery	463,925
	Cotton	288	Total	$815,925
	Sugar Beets	432		
	Farmstead	128		
		1,280		

Financial Summary

Land at Current Market Value ($1,100/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$550,604	Gross Sales	$550,604
Expenses	551,420	Expenses	528,336
Return to Operator Labor, Mgt., & Equity	$ -816	Return to Operator Labor, Mgt., & Equity	$ 22,268

Land at Excess Land Value ($1,000/ac.)

Beginning Farmers	
Gross Sales	$550,604
Expenses	549,240
Return to Operator Labor, Mgt., & Equity	$ 1,364

FIGURE 15–1
IMPERIAL – LIGHT SOILS
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
UNLIMITED LEASING

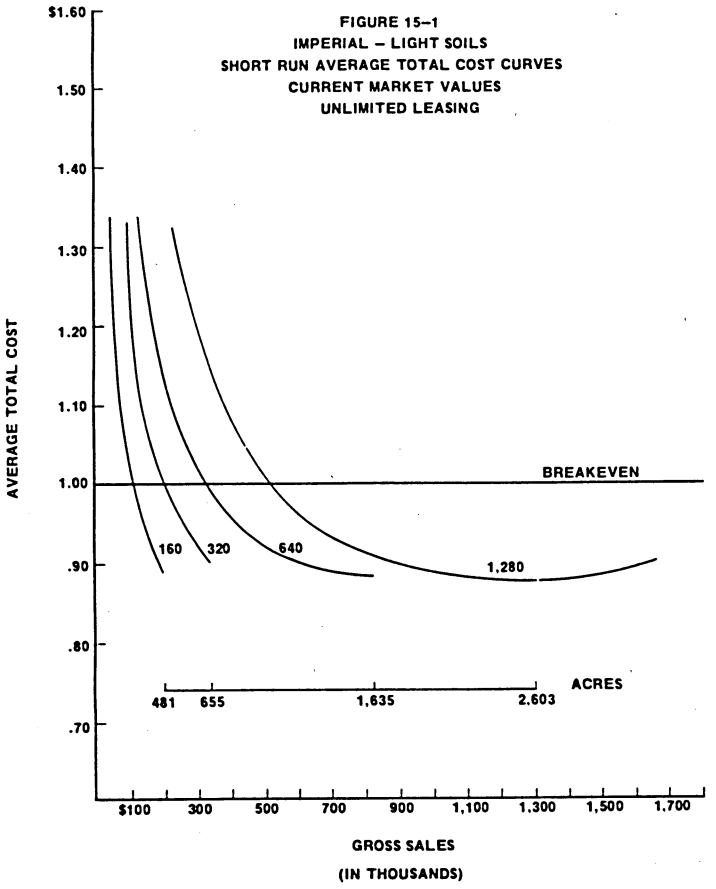


FIGURE 15–2
IMPERIAL – LIGHT SOILS
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

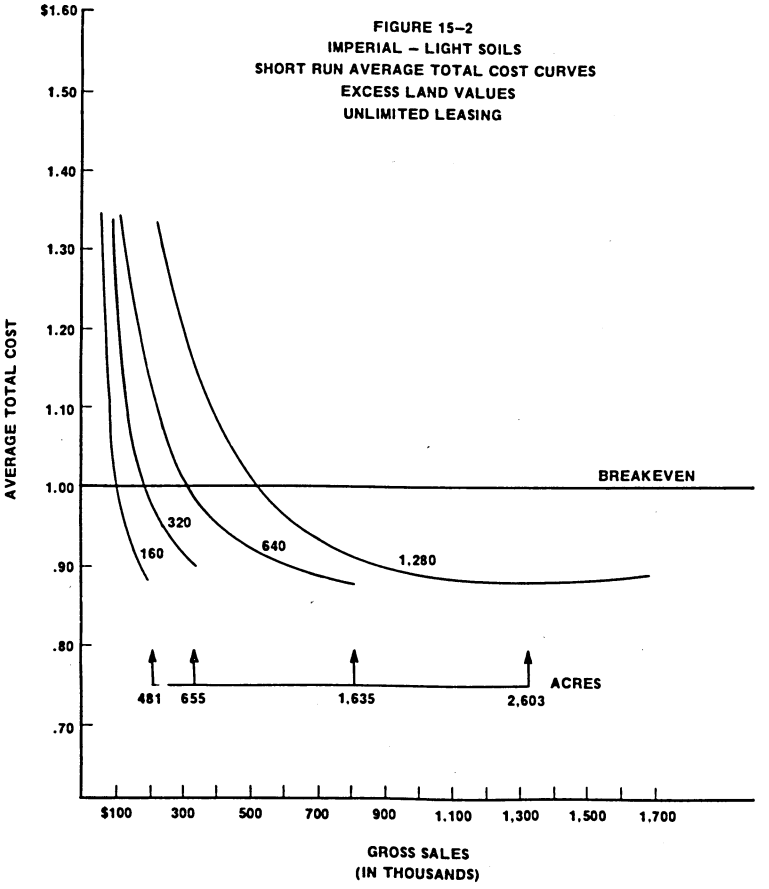


FIGURE 15–3
IMPERIAL – LIGHT SOILS
LONG RUN PLANNING COST CURVES
UNLIMITED LEASING

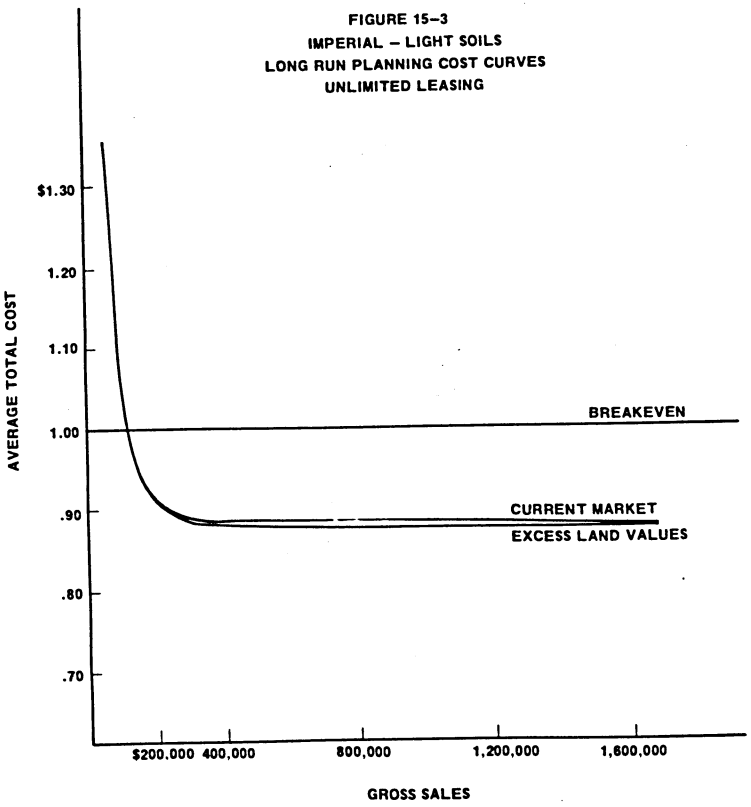


FIGURE 15–4
IMPERIAL II – HEAVY SOILS
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
UNLIMITED LEASING

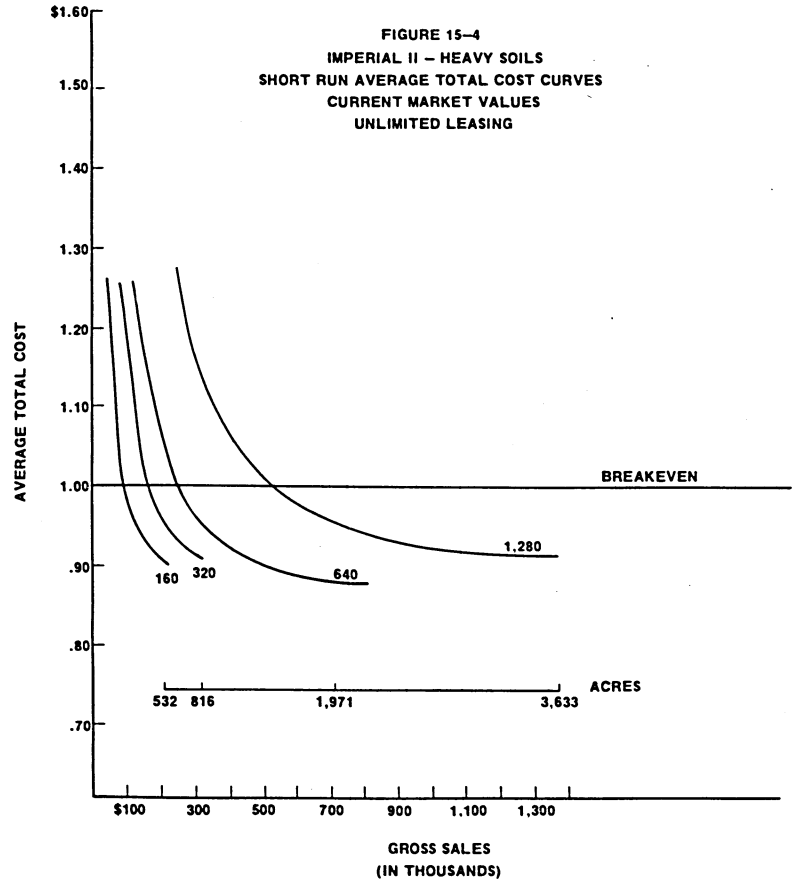


FIGURE 15–5
IMPERIAL II – HEAVY SOILS
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
UNLIMITED LEASING

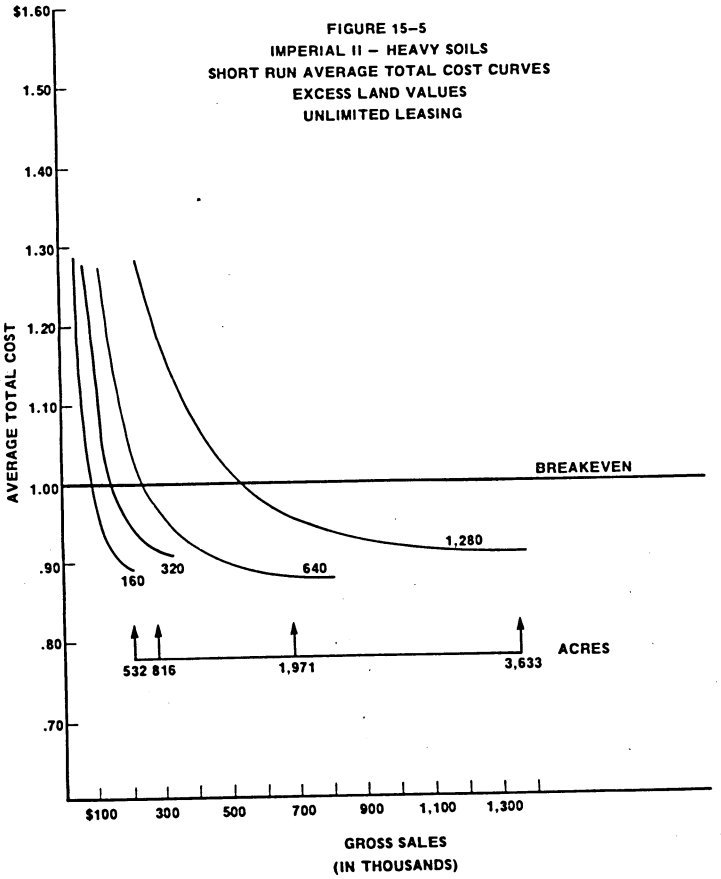


FIGURE 15–6
IMPERIAL II – HEAVY SOIL
LONG RUN PLANNING COST CURVES
UNLIMITED LEASING

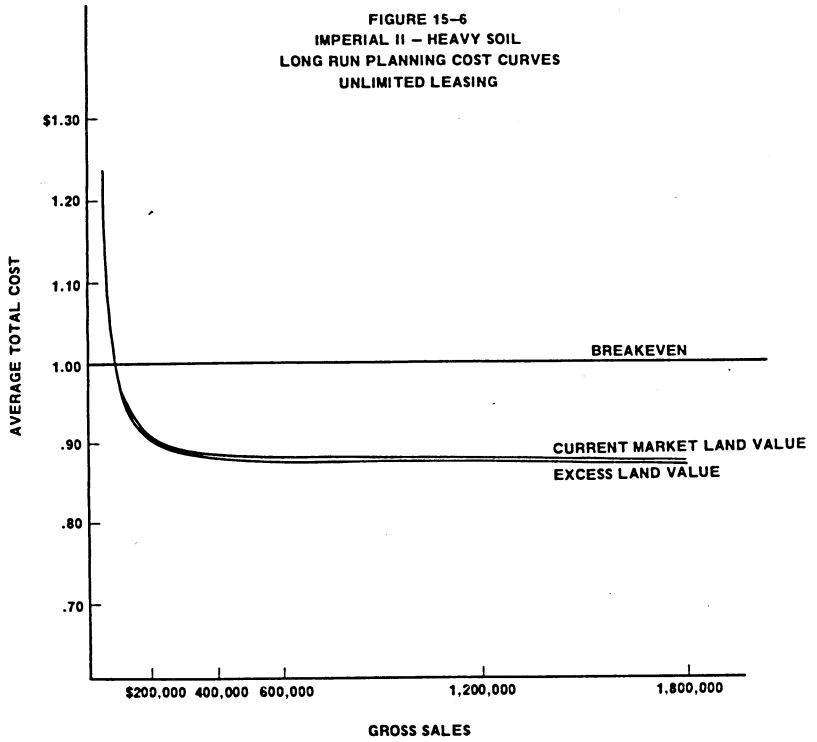


Table 15-10

Standard Deviations of Yield, Price and Gross Income
by Crop, Imperial Irrigation District

Crop	Yield	Price	Gross Income Per Acre
Lettuce	31.317 cwt.	$ 1.475/cwt.	$277.78
Onions	55.895 cwt.	2.489/cwt.	854.26
Barley	1.787 cwt.	0.270/cwt.	10.29
Grain Sorghum	4.807 cwt.	0.173/cwt.	25.85
Wheat	6.757 cwt.	0.219/cwt.	26.57
Alfalfa Hay	.373 ton	2.255/ton	26.86
Cotton Lint	.324 cwt	23.636/cwt.	33.61
Sugar Beets	1.519 ton	4.835/ton	138.93

To indicate the variability of farm income and costs, the data in Table 15-10 were combined based on the proportion of land in each crop for the minimum point on the SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figures 15-7 and 15-8. The LRAC would be expected to fluctuate within the range of plus and minus one standard deviation about 66 percent of the time.

The results of the above calculation indicate the much higher risk (and potential payoffs) of growing vegetable crops on the light soils as compared to the more stable crops on the heavy soils.

DEMAND FOR IRRIGATION WATER

Imperial Irrigation District holds senior appropriative water rights on the Colorado River. The economic demand for this water depends on the profitability of the wide range of crops adaptable to the area, their consumptive use, adoption of cost-effective irrigation methods and the cost/price for water. Demand relations are shown graphically in Figure 15-9 based on the procedures described in Chapter 1 for the light soil area only.

The vertical dashed line in Figure 15-9 indicates the historic farm headgate delivery of 5.8 acre feet per acre by the district. An asterisk locates the 1978 average cost of $4.75 per acre foot. The solid stepped line traces the quantity of water expected to be used as water cost is varied from $0 to $60 per acre foot. Results indicate that farm operators are within estimation error (0.5 percent) of optimally utilizing the existing water supply at current water rates. An increase to $11 per acre foot, the estimated BOR full-cost price would change water use very little. A large increase would be required to significantly change water use per acre in the district. At about $25 per acre foot, water demand would be reduced by about 40 percent to 3.5 acre feet per acre. Further price increases would be expected to reduce water use as shown in the figure.

Increased water costs would have a strong effect on farm incomes. In Figure 15-10 the solid negatively sloped curve traces out the net return over variable costs including water cost by farm size. This curve is dish shaped reflecting the crop mix and irrigation method adjustments as water costs increase. A horizontal dashed line was used in the graph to locate the level of fixed costs, assuming excess land values for each farm size. A line dropped to the base from the intersection of the net revenue curve and fixed costs locates the maximum ability to pay for water. Due to economies of size, ability to pay increases as farm size increases ranging from about $7 per acre foot on the 160 acre farm to $13 per acre foot for the 1,280 acre farm.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

FIGURE 15–7
IMPERIAL II – LIGHT SOIL
LONG RUN PLANNING COST CURVES
EXCESS LAND VALUE
ADJUSTED BY RISK

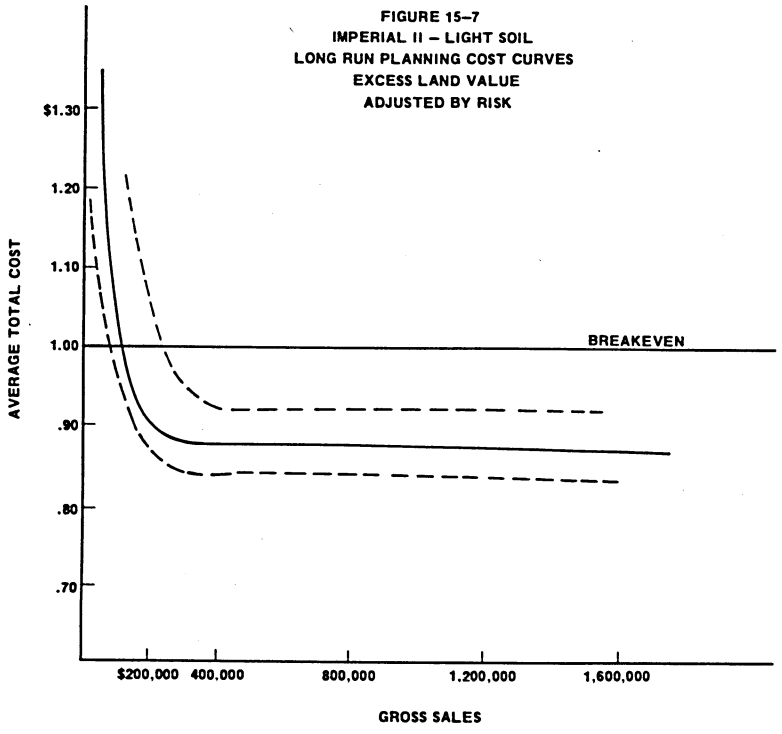


FIGURE 15–8
IMPERIAL II – HEAVY SOIL
LONG RUN PLANNING COST CURVES
EXCESS LAND VALUE
ADJUSTED BY RISK

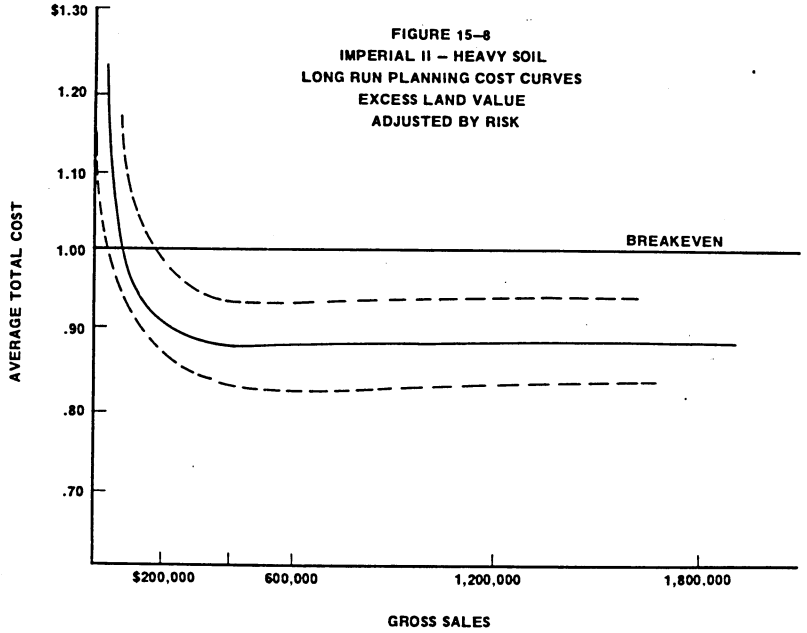


FIGURE 15–9
DEMAND FOR IRRIGATION WATER
IMPERIAL

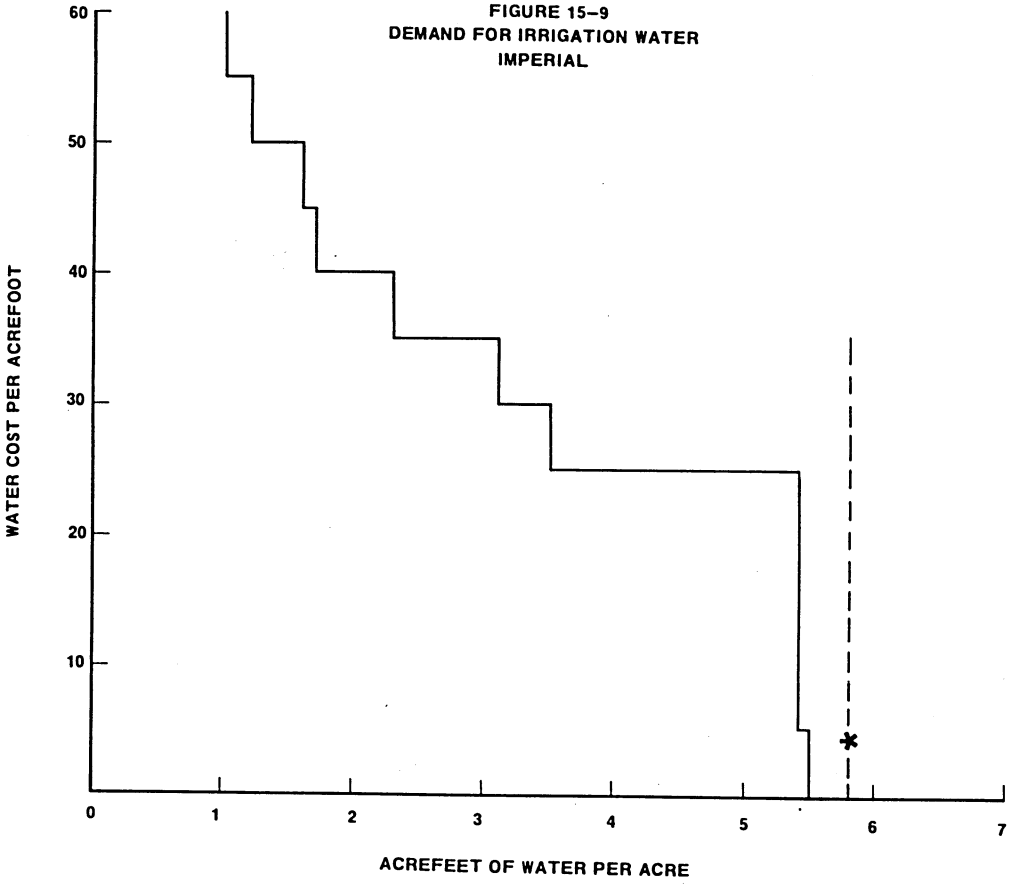
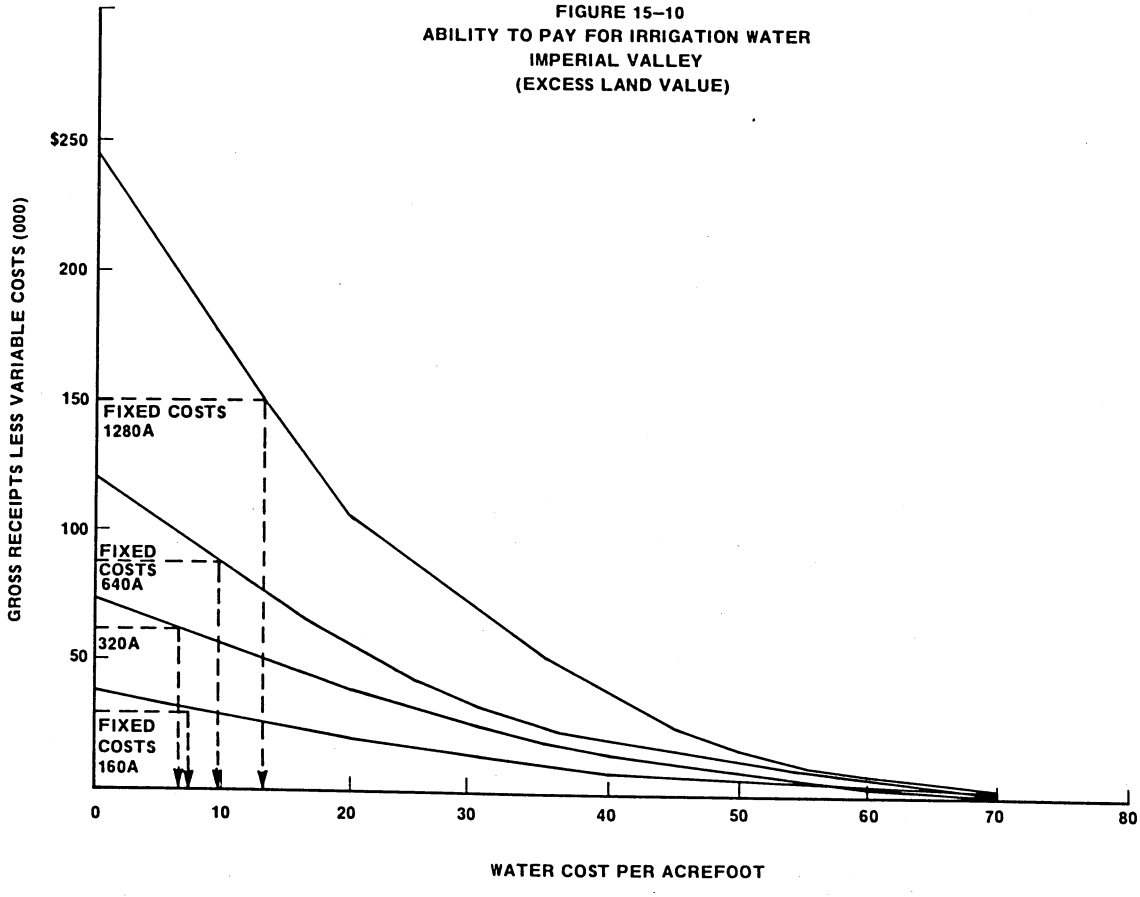


FIGURE 15–10
ABILITY TO PAY FOR IRRIGATION WATER
IMPERIAL VALLEY
(EXCESS LAND VALUE)



No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Imperial County, California reports 715 farms with gross agricultural sales of $2,500 or more. Table 15-11 shows the number of these farms reporting agriculturally related off-farm work.

Table 15-11

Farm Operators Reporting Days Work Off-Farm

None	316
1 - 49 days	20
50 - 99 days	11
100 - 149 days	14
150 - 199 days	14
200 days or more	129
Total	504

Income and expenses related to selected off-farm income sources are shown in Table 15-12.

Table 15-12

Operator Income From Farm Related Sources, Imperial County

Number of Farms Reporting	254
Average Per Farm Reporting	$11,348
Income From Custom Work	
Number of Farms Reporting	113
Average Per Farm Reporting	$ 5,446
Expenses Related to Off-Farm Income	
Number of Farms Reporting	84
Average Per Farm Reporting	$ 4,639

Farm operators' spouses and their children also contribute to family income. In Imperial County, 331 farms reported an average family off-farm income of $4,871 in 1974. No information is available on off-farm work and income by size of farm.

CHAPTER 16

Welton-Mohawk Irrigation District
Gila Project, Arizona

The Welton-Mohawk District is located in southwestern Arizona near the confluence of the Gila and Colorado Rivers and receives its water supply from the Colorado River.

CLIMATE

The Welton-Mohawk[1/] is characterized as having a frost-free (greater than 32° F) period of 348 days. Maximum temperatures of 116° F and minimum temperatures of 24° F are recorded. Average annual precipitation is 2.67 inches, most of which falls during July and August in one or two storms.

SOILS

The irrigable area in the Welton-Mohawk Irrigation and Drainage District has been 75,000 acres until recently. The newly revised irrigable area is 65,200 acres.

In classifying the district lands the WPRS subdivided the lands into four arable classes on the basis of degree of suitability for irrigated farming. Classes 1, 2 and 3 are described as "arable," that is, susceptible of development for irrigated farming. Class 4 is used to designate lands which have an excessive, specific deficiency in one factor that is susceptible of correction. For example, it has been used to designate areas of high salinity and alkalinity.

The classes and acreage in each are tabulated in the following tables.

Irrigable Land Class	Original Irrigable Acreage	Revised Irrigable Acreage
Class 1	19,900	
Class 2	28,600	
Class 3	12,500[2/]	
Class 4	14,000	
Total	75,000	65,200

General Soil Descriptions - Mesa (terrace) Geomorphic unit and Valley (valley floor) Geomorphic unit.

Mesa Soils

In general the mesa lands are composed of loamy sand and sandy loam soils that are rather low in native fertility, have a low organic matter content and possess a base exchange capacity ranging from 4.0 milliequivalents per 100 grams of soil to as high as 20 milliequivalents in some of the desert pavement areas. Moisture-holding capacities vary from 3.0 to over 6.0 inches of plant available water per 4-foot profile. The land classification recognized 80 percent of the arable lands on the mesa as Class 2 and 20 percent as Class 3.

Valley Soils

The soils of the arable valley lands are dominantly silt loam and silty clay loam with intermixed areas of sandy loam and loamy sand. The organic content and inherent fertility are higher than for the mesa soils. Base exchange capacities range from 10 to over 40 milliequivalents per 100 grams of soil and moisture-holding capacity is seldom a limiting factor except in a few areas along the river.

1/ Climatic data reflect the most recent 10-year period beginning in 1968, except for precipitation which is the average of a long-time record.

2/ Includes 5,000 acres of nonarable land in small parcels closely associated with arable lands of all classes.

CROPS

The cropping pattern of the district is dominated by alfalfa hay (21,000 acres) and cotton (18,000 acres) followed by wheat (13,000 acres) and vegetable crops (6,000 acres), primarily winter lettuce. Although lettuce occupies only about 5,000 acres in the district, the high value of this crop contributes over $8 million annually to the area (see Table 16-1). All of these major crops are reflected in the typical farm budgets shown below.

Table 16-1

Crop Acreage, Gila, Welton-Mohawk District, Arizona, 1977

Crop	Area	Value of Production
Cereals		
Sorghums	3,993	$ 693,581
Wheat	13,054	3,475,607
Forage		
Alfalfa Hay	20,966	10,254,072
Miscellaneous Field Crops		
Cotton Lint, Upland	18,669	11,933,220
Cotton Seed, Upland	(18,669)	1,359,675
Vegetables		
Lettuce	5,322	8,756,897
Cantaloupes, etc.	1,048	2,523,971
Seeds		
Grass (all)	2,250	1,473,560
Fruits		
Oranges & Tangerines	2,857	2,199,756
Other & Miscellaneous	1,023	404,242
Total	69,212	$43,074,581

LAND TENURE

Ownership of land in the Welton-Mohawk District is moderately concentrated with a Gini coefficient of 0.32.[1/] At the small farm end of the scale, 58 percent of all landowners have units of less than 100 acres in size. These same owners have only 28 percent of all the land in the district as shown in Tables 16-2 and 16-3. The largest 1 percent of the landowners, on the other hand, own about 10 percent of the land. There is a data anomaly in Tables 16-2 and 16-3 in the nonfamily corporation with 11 or more stockholders. Due to the method used to expand from the sample frame to the entire district, an entry appears in the 500-3,999 acre size class in Table 16-3 but no entry is recorded for the same element in Table 16-2. Because the original interview schedules were not available, this error could not be corrected.

Forms of business organization used to hold these lands is dominated by multiple-family arrangements including partnerships and corporations. These tend to be small ownerships with 166 of the 488 owners falling into the multiple family with less than 100 acres (see Table 16-2). Husband and wife joint ownerships include 26 percent of the owners but own 37.6 percent of all the land.

Farm Operations

While farm land ownership averages 133 acres per owner in the district, the average farm size is considerably larger at 518 acres indicating a high proportion of leasing and absentee ownership (see Table 16-4).

1/ Gini coefficient ranges from 0 to 1.0. The larger the coefficient, the greater the concentration of ownership.

Table 16-2

FORM OF OWNERSHIP BY FARM SIZE, WELTON-MOHAWK, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 Or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	49	49	166	7	13	0	0	0	284	58.2
Percent	17.2	17.2	58.4	2.4	4.5	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	32	56	29	10	9	0	0	0	136	86.0
Percent	23.5	41.1	21.3	7.3	6.6	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	1	8	15	0	0	0	0	0	24	90.9
Percent	4.1	33.3	62.5	0.0	0.0	0.0	0.0	0.0	100.0	
260-499										
No. of Owners	1	12	23	3	0	0	0	0	39	98.9
Percent	2.5	30.7	58.9	7.6	0.0	0.0	0.0	0.0	100.0	
500-3,999										
No. of Owners	0	0	0	1	0	0	4	0	5	100.0
Percent	0.0	0.0	0.0	20.0	0.0	0.0	80.0	0.0	100.0	
Totals										
No. of Owners	83	125	233	21	22	0	4	0	488	
Percent	17.0	25.6	47.7	4.3	4.5	0.0	0.8	0.0	100.0	

Table 16-3

LAND BY OWNERSHIP, WELTON-MOHAWK, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 Or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	2501	7440	7315	436	582	0	0	0	18274	28.1
Percent	13.6	40.7	40.0	2.3	3.1	0.0	0.0	0.0	100.0	
Average									64.3	
100-179										
Acres	4324	12120	3873	1532	1359	0	0	0	23208	63.8
Percent	18.6	52.2	16.6	6.6	5.8	0.0	0.0	0.0	100.0	
Average									170.6	
180-259										
Acres	291	2644	2848	0	0	0	0	0	5783	72.7
Percent	5.0	45.7	49.2	0.0	0.0	0.0	0.0	0.0	100.0	
Average									240.9	
260-499										
Acres	299	2265	7516	1394	0	0	0	0	11474	90.4
Percent	2.6	19.7	65.5	12.1	0.0	0.0	0.0	0.0	100.0	
Average									294.2	
500-3,999										
Acres	0	0	0	3320	0	311	2620	0	6251	100.0
Percent	0.0	0.0	0.0	53.1	0.0	5.0	41.9	0.0	100.0	
Average									1250.2	
Totals										
Acres	7415	24469	21552	6682	1941	311	2620	0	64990	
Percent	11.4	37.6	33.1	10.2	2.9	0.4	4.0	0.0	100.0	
Average	89.3	195.7	92.4	318.1	88.2	311.0	655.0	0.0	133.1	

Nonfamily corporations are very important in operating district farms. Thirty-eight nonfamily corporations, 21.6 percent of all farms, control an estimated 42 percent of the crop land. The Gini coefficient of concentration for farm operating units was estimated at 0.53.

Crops grown by farm size are presented in Table 16-5. The variation in crop mix as farm size increases is greater for Welton-Mohawk than any of the other 17 case-study districts. Although an anomaly exists in the data for the two largest farm sizes, data in Table 16-5 indicate that the proportion of forages in the crop mix declines as farm size increases while field crops (cotton) increase with farm size. No vegetable acreage was reported on farms below 260 acres in size; however, seed crops were very important on these smaller farms. One hypothesis for these results might be that small farms may have difficulty gaining access to market outlets for any lettuce or cantaloupes they could produce, especially given the presence of lettuce specialists moving from area to area leasing land to maintain year-around sales.

Labor

Intensity of production in the district is reflected in the data presented in Tables 16-6 and 16-7 on the size and composition of the hired labor force in the district. Table 16-6 indicates that 54 percent of the 651 regular or full-time employees on farms in the district were Caucasian and 41 percent Hispanic, even though the district is located only a few miles from the Mexican border. Table 16-7 breaks the hired labor force down by job category. One hundred-six, 16 percent, of the labor force were classified in supervisory jobs of managers or foremen with the balance as laborers.

Combining hired labor and operators provides an estimate of the year-around labor force. Standardizing these data on a workers per 1,000 acres provides estimates of the labor input among farm sizes. These standardized figures, shown in the last column in Table 16-7, vary widely. Labor input per 1,000 acres drops rapidly over the first three size groups reaching a minimum in the 260-499 acre group of 6.7. Except for the anomaly reported in the 1,000 to 1,999 acre size class, labor use on the remaining size farms is fairly constant with no consistent pattern revealed.

TYPICAL FARM BUDGETS

Farm budgets were developed for 160, 320, 640 and 1,280 acre farms. Based on the Interior's Proposed Rules and Regulations, these farm budgets assume a maximum ownership of 320 acres of land for husband and wife. All land over 320 acres was assumed to be leased at the 1978 average cash rental rate of $130 per acre. This rental rate is low compared to the $2,600 per acre current market land value and provides a cost advantage to the larger farms.

The farm budgets were further modified to reflect the cash flow position of (1) beginning farmers purchasing land at 1978 excess land prices and interest rates and (2) existing farmers who purchased land at some previous time at lower land prices and interest rates. Due to land value appreciation, repayment of loan principal and retained earnings, these existing owners have a higher equity position.

The estimated turnover rate for farms in the western United States is 2.5 percent of every 40 years. Assuming the average farm was purchased 20 years ago, existing farms were assumed to have been purchased in 1958 when Federal Land Bank interest rates averaged 5.5 percent. Based on USDA "Balance Sheet of Agriculture," the estimated debt-asset ratio for all assets for Arizona farms is 14.6. These data were used to modify the existing farm budgets shown in Table 16-8.

Beginning Farmer

When land is valued at the 1978 market price of $2,600 per acre, beginning farm operators show a negative cash flow for all four farm sizes (see Table 16-8). Cash flows improve when owned land is valued at the excess land value of $1,245 per acre and is positive for all farm sizes. The benefits of the lower land price are dissipated on the larger two farm sizes due to the increasing proportion of leased land.

Existing Farmers

Due to the high equity and lower mortgage interest rates characteristic of long-time farmers as compared to beginning operators, cash flows are more favorable under current market land values. Cash flows ranged from $23,644 on the small farm to $53,311 on the 1,280 acre farm as shown in Table 16-8.

Table 16-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, WELTON-MOHAWK, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	7	7	18	7	0	39	49
Percent	0.0	17.9	17.9	46.1	17.9	0.0	100.0	
100-179								
No. of Farms	0	11	1	33	7	0	52	140
Percent	0.0	21.1	1.9	63.4	13.4	0.0	100.0	
180-259								
No. of Farms	0	2	4	10	0	0	16	225
Percent	0.0	12.5	25.0	62.5	0.0	0.0	100.0	
260-499								
No. of Farms	1	6	100	22	0	3	42	346
Percent	2.3	14.2	23.8	52.3	0.0	7.1	100.0	
500-999								
No. of Farms	4	0	3	5	2	0	14	719
Percent	28.5	0.0	21.4	35.7	14.2	0.0	100.0	
1,000-1,999								
No. of Farms	1	3	0	5	0	0	9	1212
Percent	11.1	33.3	0.0	55.5	0.0	0.0	100.0	
2,000-2,999								
No. of Farms	1	0	0	0	0	0	1	2109
Percent	100.0	0.0	0.0	0.0	0.0	0.0	100.0	
3,000-9,999								
No. of Farms	0	3	0	0	0	0	3	4052
Percent	0.0	100.0	0.0	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	6	32	25	93	16	3	175	518
Percent	3.4	18.2	14.2	53.1	9.1	1.7	100.0	

Table 16-5

IRRIGATED CROP PATTERNS BY FARM SIZE, WELTON-MOHAWK, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	147	629	340	0	297	169	0	1582
Percent	9.2	39.7	21.4	0.0	18.7	10.6	0.0	100.0
100-179								
Total Acres	1416	2543	2854	0	412	0	0	7225
Percent	19.5	35.1	39.5	0.0	5.7	0.0	0.0	100.0
180-259								
Total Acres	326	1945	274	0	509	0	0	3054
Percent	10.6	63.6	8.9	0.0	16.6	0.0	0.0	100.0
260-499								
Total Acres	1327	4862	3835	1595	835	707	0	13161
Percent	10.0	36.9	29.1	12.1	6.3	5.3	0.0	100.0
500-999								
Total Acres	202	3340	3429	184	108	543	0	7806
Percent	2.5	42.7	43.9	2.3	1.3	6.9	0.0	100.0
1,000-1,999								
Total Acres	1059	1985	3337	484	180	0	0	7045
Percent	15.0	28.1	47.3	6.8	2.5	0.0	0.0	100.0
2,000-2,999								
Total Acres	500	30	106	965	0	0	0	1601
Percent	31.2	1.8	6.6	60.2	0.0	0.0	0.0	100.0
3,000-3,999								
Total Acres	619	56	227	138	0	0	11	1051
Percent	58.8	5.3	21.5	13.1	0.0	0.0	1.0	100.0
4,000-9,999								
Total Acres	15	0	263	0	0	0	0	278
Percent	5.3	0.0	94.6	0.0	0.0	0.0	0.0	100.0
Totals								
Total Acres	5611	15390	14665	3366	2341	1419	11	42803
Percent	13.1	35.9	34.2	7.8	5.4	3.3	0.0	100.0

Table 16-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, WELTON-MOHAWK, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	65	29	22	7	7	0
Average	1.6	0.7	0.5	0.1	0.1	0.0
100-179						
No. of Employees	88	64	20	0	4	0
Average	1.6	1.2	0.3	0.0	0.0	0.0
180-259						
No. of Employees	43	11	31	0	1	0
Average	2.6	0.6	1.9	0.0	0.0	0.0
260-499						
No. of Employees	58	35	15	0	8	0
Average	1.3	0.8	0.3	0.0	0.1	0.0
500-999						
No. of Employees	80	27	53	0	0	0
Average	6.1	2.0	4.0	0.0	0.0	0.0
1,000-1,999						
No. of Employees	235	171	60	2	2	0
Average	25.5	18.5	6.5	0.2	0.2	0.0
2,000-2,999						
No. of Employees	9	1	8	0	0	0
Average	20.9	2.3	18.6	0.0	0.0	0.0
3,000-3,999						
No. of Employees	45	7	37	0	1	0
Average	26.8	4.1	22.0	0.0	0.5	0.0
4,000-9,999						
No. of Employees	28	5	23	0	0	0
Average	40.	7.1	32.9	0.0	0.0	0.0
Totals						
No. of Employees	651	350	269	9	23	0
Percent	100.0	53.7	41.3	1.3	3.5	0.0

Table 16-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, WELTON-MOHAWK, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	15	4	48	67	41	108	54.6
Average/Farm	0.3	0.	1.1	1.6	1.0	2.6	
100-179							
No. of Workers	16	4	67	87	53	140	19.0
Average/Farm	0.3	0.	1.2	1.6	1.0	2.6	
180-259							
No. of Workers	2	5	36	43	16	59	16.3
Average/Farm	0.1	0.3	2.2	2.6	0.9	3.6	
260-499							
No. of Workers	7	7	43	57	43	100	6.7
Average/Farm	0.1	0.1	1.0	1.3	1.0	2.3	
500-999							
No. of Workers	2	12	65	79	14	93	9.8
Average/Farm	0.1	0.9	4.9	6.0	1.0	7.0	
1,000-1,999							
No. of Workers	8	16	211	235	9	244	23.0
Average/Farm	0.8	1.7	22.9	25.5	0.9	26.5	
2,000-2,999							
No. of Workers	0	0	8	8	0	8	8.8
Average/Farm	0.	0.	18.6	18.6	0.	18.6	
3,000-3,999							
No. of Workers	2	2	42	46	2	48	8.9
Average/Farm	1.1	1.1	25.0	27.4	1.1	28.6	
4,000-9,999							
No. of Workers	1	3	24	28	1	29	7.2
Average/Farm	1.4	4.2	34.3	40.0	1.4	41.4	
Totals							
No. of Workers	53	53	544	650	179	829	

Table 16-8

Welton-Mohawk Irrigation District, Arizona

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Alfalfa Hay (Irr.)	112	Land	$416,000
	Estb. Alfalfa	37	Machinery	111,515
	Farmstead	11	Total	$527,515
	Total	160		

Financial Summary

Land at Current Market Value ($2,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$69,534	Gross Sales	$69,534
Expenses	73,750	Expenses	45,890
Return to Operator Labor, Mgt., & Equity	$-4,216	Return to Operator Labor, Mgt., & Equity	$23,644

Land at Excess Land Value ($1,245/ac.)

Beginning Farmers	
Gross Sales	$69,534
Expenses	59,635
Return to Operator Labor, Mgt., & Equity	$ 9,899

Farm Size	Crop	Acres	Investment	
320 Acres Irrigated	Alfalfa Hay (Irr.)	124	Land	$ 832,000
	Estb. Alfalfa	42	Machinery	195,781
	Cotton	131	Total	$1,027,781
	Farmstead	23		
	Total	320		

Financial Summary

Land at Current Market Value ($2,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$170,645	Gross Sales	$170,645
Expenses	171,523	Expenses	117,194
Return to Operator Labor, Mgt., & Equity	$ -878	Return to Operator Labor, Mgt., & Equity	$ 53,451

Land at Excess Land Value ($1,245/ac.)

Beginning Farmers	
Gross Sales	$170,645
Expenses	143,293
Return to Operator Labor, Mgt., & Equity	$ 27,352

Table 16-8--Continued

Farm Size	Crop	Acres	Investment	
640 Acres Irrigated	Alfalfa Hay (Irr.)	178	Land	$ 832,000
	Estb. Alfalfa	59	Machinery	280,263
	Cotton	211	Total	$1,112,263
	Wheat (double)	147		
	Lettuce (double)	60		
	G. Sorghum (double)	60		
	Farmstead	45		
	Total	640		

Financial Summary

Land at Current Market Value ($2,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$409,627	Gross Sales	$409,627
Expenses	419,616	Expenses	360,978
Return to Operator Labor, Mgt., & Equity	$ -9,989	Return to Operator Labor, Mgt., & Equity	$ 48,649

Land at Excess Land Value ($1,245/ac.)

Beginning Farmers	
Gross Sales	$409,627
Expenses	391,386
Return to Operator Labor, Mgt., & Equity	$ 18,241

Farm Size	Crop	Acres	Investment	
1,280 Acres Irrigated	Alfalfa Hay (Irr.)	359	Land	$ 832,000
	Estb. Alfalfa	120	Machinery	383,700
	Cotton	422	Total	$1,215,700
	Wheat (double)	294		
	Lettuce (double)	120		
	G. Sorghum (double)	92		
	Farmstead	85		
	Total	1,280		

Financial Summary

Land at Current Market Value ($2,600/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$816,462	Gross Sales	$816,462
Expenses	827,062	Expenses	763,151
Return to Operator Labor, Mgt., & Equity	$-10,600	Return to Operator Labor, Mgt., & Equity	$ 53,311

Land at Excess Land Value ($1,245/ac.)

Beginning Farmers	
Gross Sales	$816,462
Expenses	798,832
Return to Operator Labor, Mgt., & Equity	$ 17,630

ECONOMIES OF SIZE

The machinery complements developed in cooperation with the farmer panel was used as the "fixed plant" in order to estimate short-run average cost curves (SRAC). Figures 16-1 and 16-2 show the SRAC which includes operator labor at market wage rates for each farm size when the farm acreage is limited to the engineering capacity specified for a machinery complement. The minimum points on these SRAC indicate the optimum crop mix given the land, water and machinery available.

For the beginning farmer, minimum points on the SRAC are all below the breakeven level of $1.00 cost per $1.00 gross sales indicating that under optimum conditions these farms can generate a positive income.

The long-run planning curve or long-run average cost curve is estimated by fitting an envelope curve to the minimum points on the SRAC. This was done and is shown in Figure 16-3 for both the current market land value and the excess land value. In Figure 16-3 the LRAC is relatively flat. Most of the economies of size appear to be captured by the time output measured in terms of gross sales reach the range of $250,000 to $300,000. This translates an approximation of the output of a 500 acre farm in this analysis.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for each crop used in the farm budgets. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 16-9.

Table 16-9

Standard Deviations of Yield, Price and Gross Income
by Crop, Welton-Mohawk Irrigation District

Crop	Yield	Price	Gross Income Per Acre
Lettuce	13.418 cwt.	1.023/cwt.	$224.15
Grain Sorghum	0.216 ton	0.917/ton	15.54
Wheat	.137 ton	12.451/ton	27.71
Alfalfa Hay	0.335 ton	3.118/ton	25.58
Cotton Lint	153.697 lb.	0.06/lb.	89.66

To indicate the variability of farm income and costs, the data in Table 16-9 were combined based on the proportion of land in each crop for the minimum point on the SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 16-4. The LRAC would be expected to fluctuate within the range of plus and minus one standard deviation about 66 percent of the time.

DEMAND FOR IRRIGATION WATER

Economic demand for irrigation water depends on the cost of water, profitability of crops adapted to the area, consumptive use of water and application efficiency of cost-effective irrigation methods. An estimate of the derived demand for irrigation water is shown graphically in Figure 16-5. A vertical dashed line was drawn to represent the historic farm headgate delivery of 6.96 acre feet per acre. An asterisk was located on this vertical line to represent the 1978 average cost of $4.80 per acre foot. For comparison purposes, the BOR estimated full-cost price is $29.40 per acre foot. The solid negatively sloped (stepped) curve traces out the optimum quantity of water that farm operators should take at each possible water cost. Results indicate that even at the low subsidized 1978 water cost of $4.80, farm operators are withdrawing water in excess of that found to be efficient in this analysis. If water costs/prices were increased, less water would be demanded. At the BOR full-cost price, water use per acre would be reduced to about 3.4 acre feet per acre, a decrease of 3.5 acre feet per acre under the historic diversion and 2.3 acre feet per acre less than what the model estimated should be used. Given the high cost of removing salts from irrigation return flows prior to dumping them back into the Colorado River, water pricing could provide a useful policy tool.

Impact of increased water costs on farm income is shown graphically in Figure 16-6. The solid negatively sloped curve traces out the net returns over variable cost, including water costs for each farm size. The dished shape to this curve is caused by changes in the crop mix and irrigation methods as water costs increase. Horizontal dashed lines were used to represent

FIGURE 16–1
WELTON–MOHAWK
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET LAND VALUE
UNLIMITED LEASING

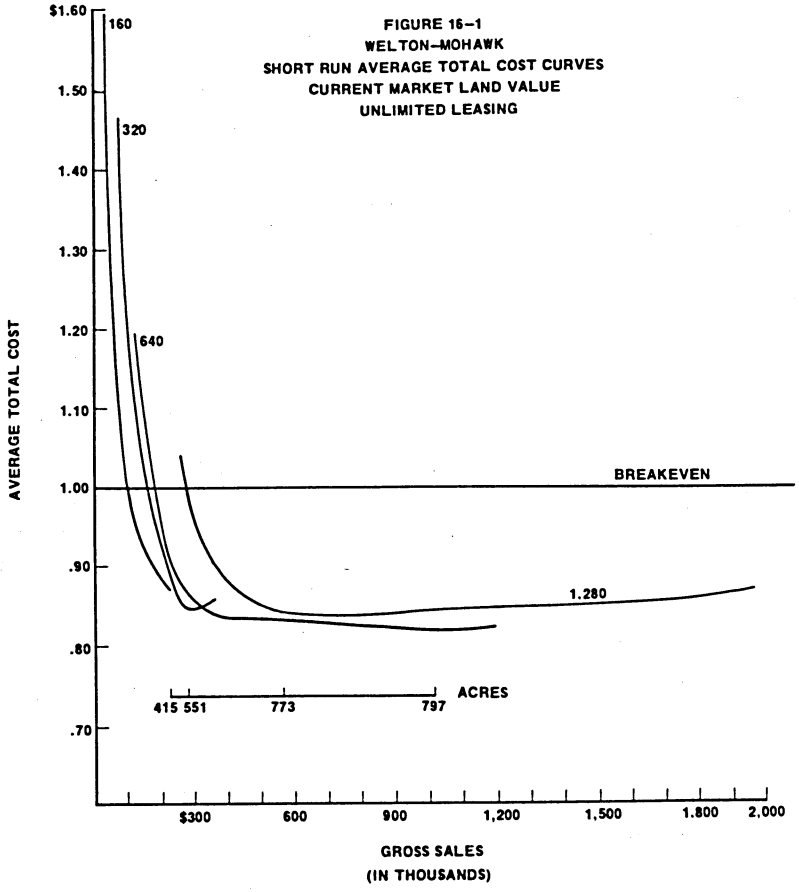


FIGURE 16–2
WELTON–MOHAWK
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUE
UNLIMITED LEASING

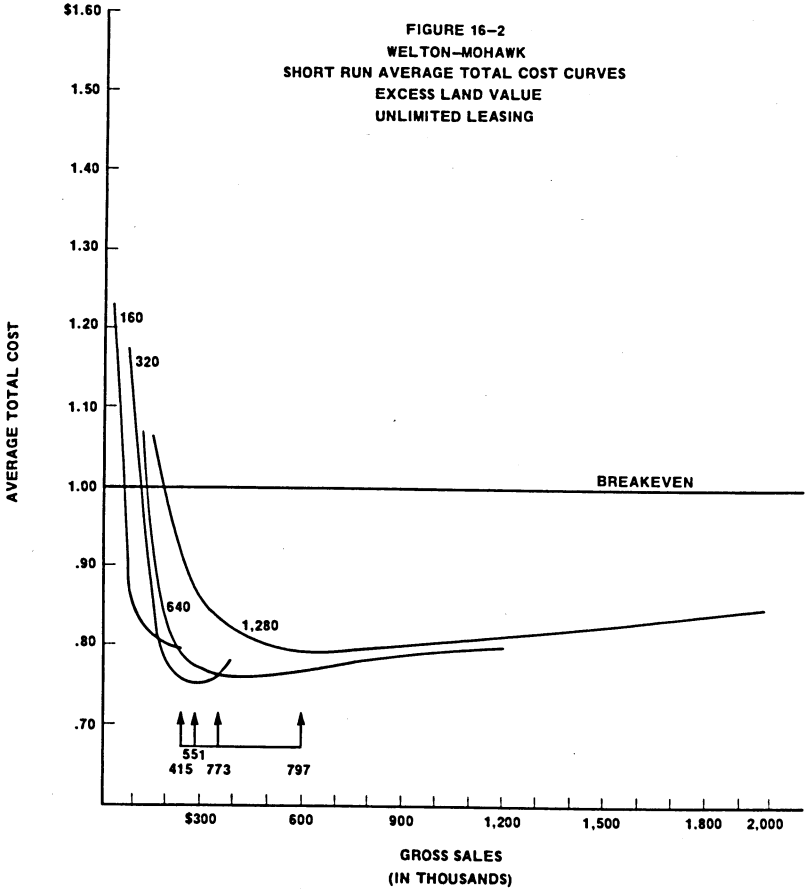


Figure 16-3

Welton-Mohawk
Long Run Planning Curve
Unlimited Leasing

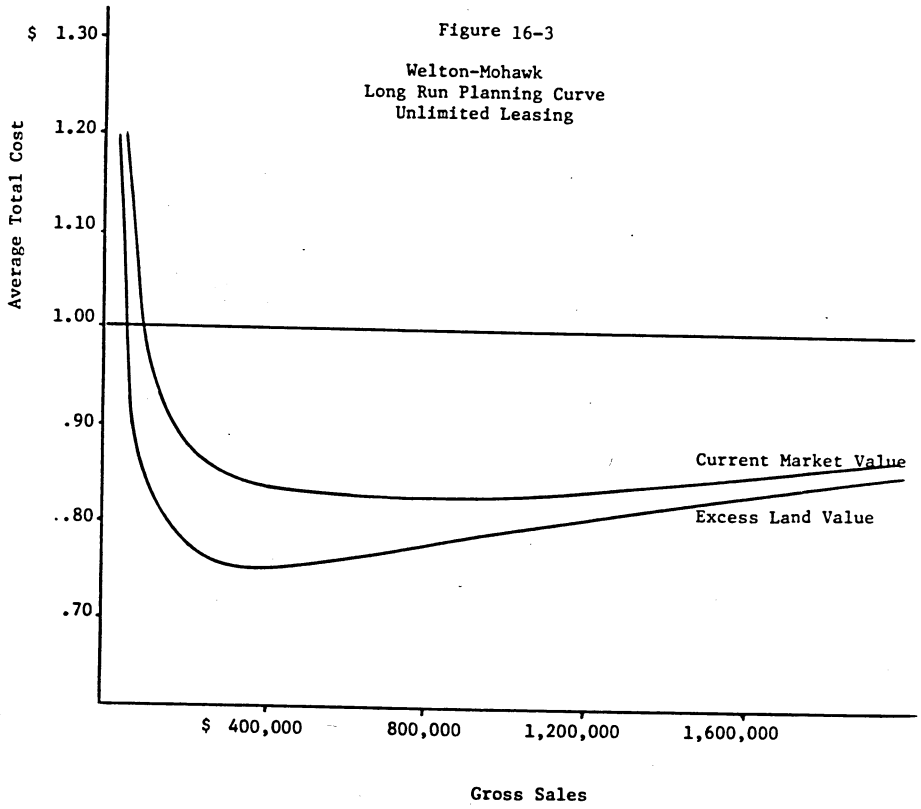


FIGURE 16–4
WELTON–MOHAWK
LONG RUN PLANNING CURVE
UNLIMITED LEASING
EXCESS LAND VALUES
ADJUSTED BY RISK

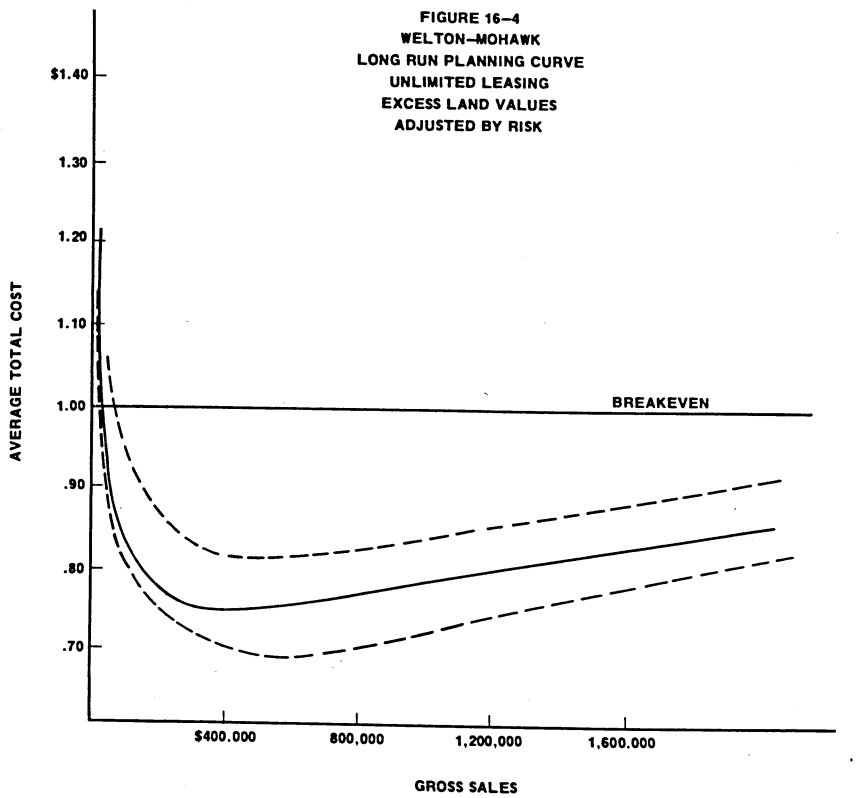


FIGURE 16–5
DEMAND FOR IRRIGATION WATER
WELTON – MOHAWK

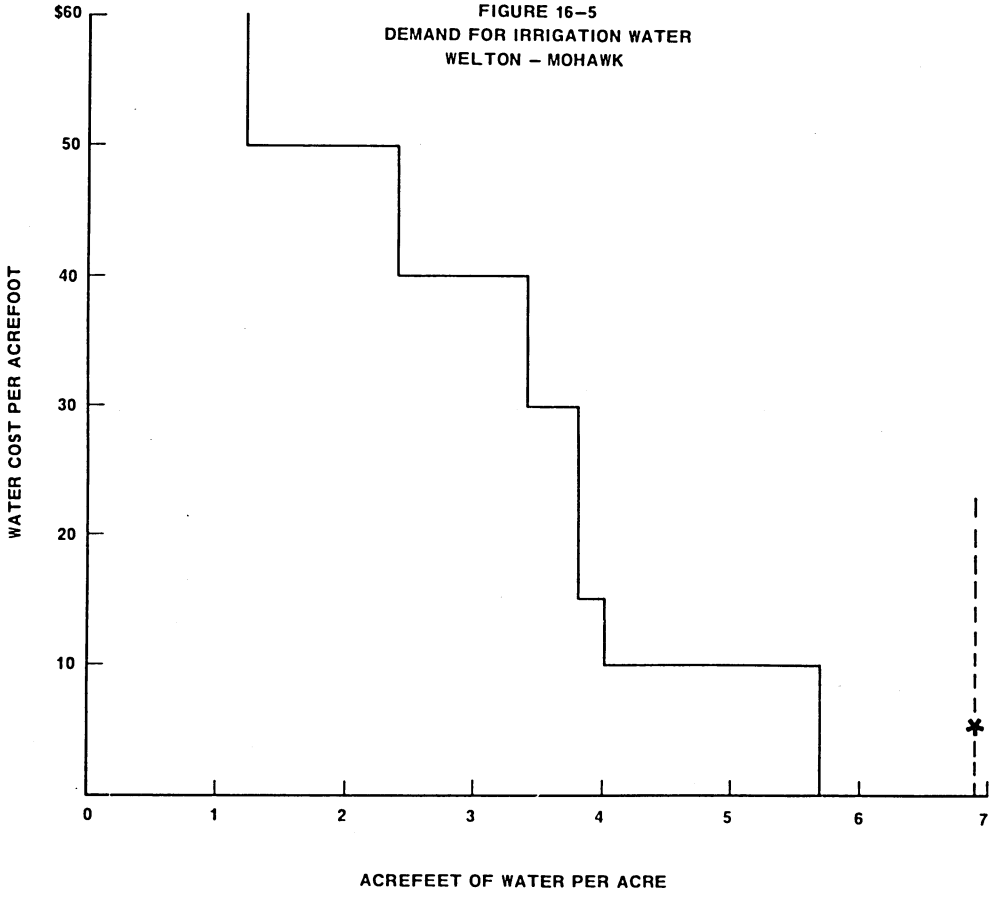
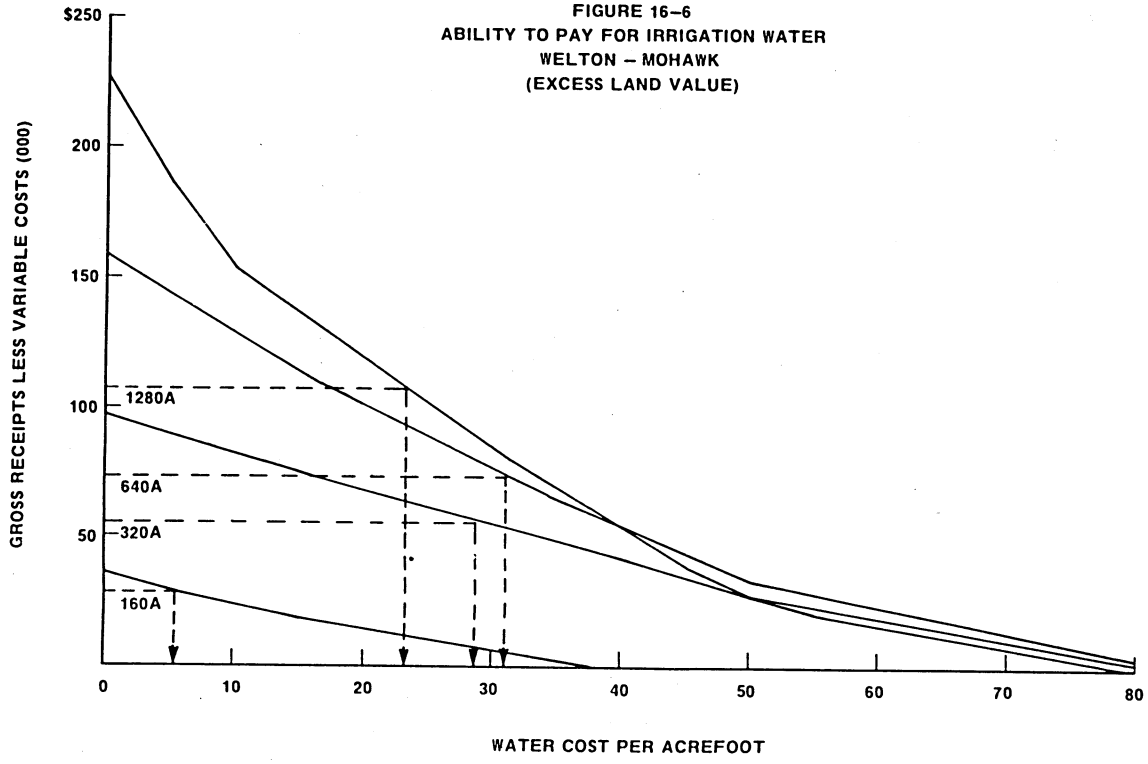


FIGURE 16–6
ABILITY TO PAY FOR IRRIGATION WATER
WELTON – MOHAWK
(EXCESS LAND VALUE)



the level of fixed costs, assuming excess land values, for each farm size. A line dropped to the base of the graph from the intersection of the net returns curve and the fixed cost level locates the maximum ability of that farm size to pay for irrigation water. For Welton-Mohawk District, ability to pay parallels the economies of size curve shown in Figure 16-3 with the maximum ability to pay for the 320 acre and 640 acre farm exceeding the other two farms due to economies and diseconomies of size. Both the 320 and 640 acre farms could pay the WPRS full-cost price but the 160 and 1,280 acre farms would be heavily impacted.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Yuma County, Arizona reports 625 farms with gross agricultural sales of $2,500 or more. Table 16-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 16-10

Farm Operators Reporting Days Work Off-Farm

None	204
1 - 49 days	12
50 - 99 days	13
100 - 149 days	9
150 - 199 days	17
200 days or more	151
Total	406

Income and expenses related to selected off-farm income sources are shown in Table 16-11.

Table 16-11

Operator Income From Farm Related Sources, Yuma County

Number of Farms Reporting	117
Average Per Farm Reporting	$2,508
Income From Custom Work	
Number of Farms Reporting	60
Average Per Farm Reporting	$1,343
Expenses Related to Off-Farm Income	
Number of Farms Reporting	49
Average Per Farm Reporting	$1,065

Farm operators' spouses and their children also contribute to family income. In Yuma County, 301 farms reported an average family off-farm income of $7,091 in 1974. No information is available on off-farm work and income by size of farm.

CHAPTER 17

Oroville-Tonasket District
Chief Joseph Dam Project, Washington

The 9,000 acre Oroville-Tonasket District is located in north-central Washington and receives its water supply from the Chief Joseph Dam.

CLIMATE

The district has an average annual temperature of 50° F and an annual precipitation of 11-1/2 inches. The average frost-free growing season is 173 days at Oroville. Air drainage for orchard crops is good.

SOILS

Lands classified as irrigable for orchards (8,980 acres) have productive soils and favorable topography for sprinkler irrigation. Most have deep, porous understrata which assures adequate internal water drainage. Air drainage, an especially important factor in evaluating the suitability of lands for fruit production, is good.

Soils have developed under a semiarid, cool, temperate climate with little moisture for weathering and leaching. They are composed of reworked glacial, alluvial and windblown materials and in most places overlie deep deposits of coarse glacial outwash. Soil mantles vary from two to five feet in depth. The soils have a fair amount of organic matter and subsoils are calcareous at lower depths. Surface soils generally are loams, silt loams, fine sandy loams, very fine sandy loams and loamy fine sands. Internal water drainage is generally good. Harmful salt levels have not developed and none are expected to occur on those irrigated lands classified as arable within the service area.

Relief of the lands is moderate compared to the surrounding rugged terrain. Terrace lands, where most orchard development has occurred, vary in elevation; the most extensive lie in elevations of 100 feet or less above the river and at elevations of 400 to 600 feet above the river.

Terrace land ranges from nearly level to steep; however, the predominant condition is gently sloping to undulating. Microrelief is generally smooth except for small areas that are hummocky. Topography of the bottom lands is gently sloping and microrelief is smooth. All lands are well suited to irrigation by sprinkler systems.

Lands are used primarily for orchard fruit production. Topography is very important as it relates to orchard air drainage. Enclosed basins or depressions entrap cold air and can result in frost damage to fruit crops. Some bottom lands and low terraces are potential freeze-damage areas. Low lands along or near the river bottom and enclosed higher basins where extreme frost hazards exist are not included in the service area.

Lands are generally free of salt problems. Some small, poorly drained areas are accumulating salts, but these lands lie in low positions and are not well adapted to fruit production. The soils have adequate permeability for leaching of salts if drainage is provided. Surface soils usually test neutral and subsoils slightly alkaline. In some existing orchards, soils are slightly acid due to fertilizer applications. Calcareous soils are generally found below 30 inches.

Acreage Summary

Land Class	Acres
1F	2,310
2F	2,550
3F	4,120
Total Irrigable	8,980
H	610
6W	410
Total Service Area	10,000[1/]

1/ 9,320 acres are irrigated in the Oroville-Tonasket Irrigation District (1970 estimate) and 680 acres are irrigated from other sources.

CROPS

Oroville-Tonasket is planted predominately to apple orchards with only a minor amount of alfalfa hay and pasture as shown in Table 17-1. The average gross crop value per acre in the district was $1,143 in 1977.

Table 17-1

Crop Acreages, Oroville-Tonasket District, Washington, 1977

Crop	Acres	Value of Production
Forage		
Alfalfa Hay	298	$ 80,400
Irrigated Pasture	144	14,450
Fruits		
Apples	6,550	7,912,737
Pears	135	136,080
Total	7,127	$8,143,667

LAND TENURE

Land ownership in the district is widely dispersed with no ownership unit larger than 179 acres and 99 percent of the owners have units of less than 100 acres as shown in Tables 17-1 and 17-2. Land ownerships were primarily joint husband and wife arrangements, 65 percent, followed by family corporations and partnerships. Closely held nonfamily corporations were not insignificant with 40 corporations owning about 9 percent of the land.

Farm Operations

While ownership units were small, averaging only 18.5 acres, the average farm size was 41 acres as shown in Tables 17-3 and 17-4. Family associations were very important in operating farms in the district with over 250 of the 350 farms being operated jointly with spouses in partnerships, including spouses and adult children. None of the farms were over 500 acres in size.

In this unique microclimate, over 92 percent of the land is planted to orchards with the balance planted to alfalfa scattered over a number of the smaller farms. These data are shown in Table 17-5.

Table 17-6 displays the ethnic origin of the 278 regular farm workers reported in the survey. Virtually all of these workers were Caucasian, 87 percent, with the balance scattered across the other categories.

Labor use is very high in the district due to the preponderance of apple acreage. Table 17-7 presents information on employment categories by farm size. On the 342 farms in the district below 100 acres, 41 reported hired farm managers and 52 reported farm foremen. Combining regular hired labor with operator labor provides an estimate of the full-time labor force on these farms. Standardizing these labor data on a workers per 1,000 acres gives an estimate of the labor input by farm size. These results are shown in the last column in Table 17-7. The lowest regular labor input per 1,000 acres was found on the 100 to 179 acre farm size. These data should be used with caution because they have not been adjusted for off-farm work, seasonal labor or the inclusion of packing sheds and other activities in this survey.

TYPICAL FARM BUDGETS

Due to the typical small acreages in apple orchards, three farm size budgets were developed, 40, 80 and 160 acres. Following the Interior's 1977 Proposed Rules and Regulations, all land in these farms was assumed to be owned.

Three farm income estimates were made for each farm size: A beginning farmer purchasing land at the current market price and down payment requirements; the same farmer purchasing land at the excess land value; and an existing farmer who is assumed to have purchased land at a previous time resulting in a much more favorable debt/asset ratio. These data are shown in Table 17-8. Crop mix, yield, machinery and prices received are assumed to remain constant. Only the land values and owner equity are modified for these results.

Table 17-2

FORM OF OWNERSHIP BY FARM SIZE, OROVILLE-TONASKET, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	50	299	71	0	40	0	0	0	460	99.1
Percent	10.8	65.0	15.4	0.0	8.6	0.0	0.0	0.0	100.0	
100-179										
No. of Owners	0	4	0	0	0	0	0	0	4	100.0
Percent	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	50	303	71	0	40	0	0	0	464	
Percent	10.7	65.3	15.3	0.0	8.6	0.0	0.0	0.0	100.0	

Table 17-3

LAND BY OWNERSHIP, OROVILLE-TONASKET, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	1134	4884	1366	0	767	20	0	0	8171	94.8
Percent	13.8	59.7	16.7	0.0	9.3	0.2	0.0	0.0	100.0	
Average									17.7	
100-179										
Acres	0	434	0	0	0	0	0	0	434	100.0
Percent	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									108.5	
Totals										
Acres	1134	5318	1366	0	767	20	0	0	8605	
Percent	13.1	61.8	15.8	0.0	8.9	0.2	0.0	0.0	100.0	
Average	22.6	17.5	19.2	0.0	19.1	20.0	0.0	0.0	18.5	

Table 17-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, OROVILLE-TONASKET, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	0	12	30	222	78	0	342	22
Percent	0.0	3.5	8.7	64.9	22.8	0.0	100.0	
100-179								
No. of Farms	0	1	0	2	1	0	4	145
Percent	0.0	25.0	0.0	50.0	25.0	0.0	100.0	
180-499								
No. of Farms	0	4	0	0	0	0	4	230
Percent	0.0	100.0	0.0	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	0	17	30	224	79	0	350	41
Percent	0.0	4.8	8.5	64.0	22.5	0.0	100.0	

Table 17-5

IRRIGATED CROP PATTERNS BY FARM SIZE, OROVILLE-TONASKET, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	0	615	0	0	46	6715	0	7376
Percent	0.0	8.3	0.0	0.0	0.6	91.0	0.0	100.0
100-179								
Total Acres	0	0	0	0	0	396	0	396
Percent	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
180-259								
Total Acres	0	0	0	0	0	648	0	648
Percent	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
260-499								
Total Acres	0	0	0	0	0	193	0	193
Percent	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
Totals								
Total Acres	0	615	0	0	46	7952	0	8613
Percent	0.0	7.1	0.0	0.0	0.5	92.3	0.0	100.0

Table 17-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, OROVILLE-TONASKET, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	233	200	6	25	2	0
Average	0.6	0.5	0.0	0.0	0.0	0.0
100-179						
No. of Employees	10	10	0	0	0	0
Average	3.1	3.1	0.0	0.0	0.0	0.0
180-259						
No. of Employees	24	24	0	0	0	0
Average	8.0	8.0	0.0	0.0	0.0	0.0
260-499						
No. of Employees	11	7	1	3	0	0
Average	14.7	9.4	1.3	4.0	0.0	0.0
Totals						
No. of Employees	278	241	7	28	2	0
Percent	100.0	86.6	2.5	10.0	0.7	0.0

Table 17-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, OROVILLE-TONASKET, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	41	52	140	233	342	575	76.0
Average/Farm	0.1	0.1	0.4	0.6	0.9	1.6	
100-179							
No. of Workers	0	5	6	11	3	14	30.3
Average/Farm	0.	1.5	1.8	3.4	0.9	4.4	
180-259							
No. of Workers	2	2	20	24	3	27	41.0
Average/Farm	0.6	0.6	6.7	8.0	1.0	9.0	
260-499							
No. of Workers	1	1	9	11	1	12	62.0
Average/Farm	1.3	1.3	12.0	14.7	1.3	16.1	
Totals							
No. of Workers	44	60	175	279	349	628	

Table 17-8

Oroville-Tonasket District, Washington

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
40 Acres Irrigated	Apples	38	Land and Trees	$200,000
	Farmstead	2	Improvements	64,000
	Total	40	Machinery	65,378
			Total	$329,378

Financial Summary

Land at Current Market Value ($1,550/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$111,492	Gross Sales	$111,492
Expenses	74,961	Expenses	55,921
Return to Operator Labor, Mgt., & Equity	$ 36,531	Return to Operator Labor, Mgt., & Equity	$ 55,571

Land at Excess Land Value ($1,500/ac.)

Beginning Farmers	
Gross Sales	$111,492
Expenses	74,815
Return to Operator Labor, Mgt., & Equity	$ 36,677

Farm Size	Crop	Acres	Investment	
80 Acres Irrigated	Apples	76	Land and Trees	$400,000
	Farmstead	4	Improvements	126,000
	Total	80	Machinery	88,878
			Total	$614,878

Financial Summary

Land at Current Market Value ($1,550/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$222,984	Gross Sales	$222,984
Expenses	159,637	Expenses	123,894
Return to Operator Labor, Mgt., & Equity	$ 63,347	Return to Operator Labor, Mgt., & Equity	$ 99,090

Land at Excess Land Value ($1,500/ac.)

Beginning Farmers	
Gross Sales	$222,984
Expenses	159,345
Return to Operator Labor, Mgt., & Equity	$ 63,639

Table 17-8--Continued

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Apples	152	Land and Trees	$ 800,000
	Farmstead	8	Improvements	250,000
		160	Machinery	173,649
	Total		Total	$1,223,649

Financial Summary

Land at Current Market Value ($1,550/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$445,968	Gross Sales	$445,968
Expenses	338,720	Expenses	267,559
Return to Operator Labor, Mgt., & Equity	$107,247	Return to Operator Labor, Mgt., & Equity	$178,409

Land at Excess Land Value ($1,500/ac.)

Beginning Farmers	
Gross Sales	$445,968
Expenses	338,136
Return to Operator Labor, Mgt., & Equity	$107,832

For the beginning farmer these budgets indicate a positive return to unpaid family labor, management and equity for both current market and excess land values. The absolute amount increases as farm size increases.

For existing farmers the capital account was modified based on an estimated turnover rate for farms in the western United States of 2.5 percent per year or once every 40 years. Therefore, the average farm was purchased 20 years earlier. In 1958, the average Federal Land Bank loan carried a 5.5 percent interest rate. Using the estimated debt-asset ratio for Washington of 17.8 percent from the USDA, "Balance Sheet of Agriculture for 1977," the return to labor, management and equity (cash flow) is significantly higher for these existing farm operators.

ECONOMIES OF SIZE

Perennial crops such as trees and vines are not conducive to the procedures used to develop short-run average cost curves (SRAC) in this study. Therefore, an estimate of the SRAC was made by spreading the farm fixed costs, including operator labor at market wage rates, over an increasingly greater output until the maximum acreage for a specified farm size was achieved.

Short-run average cost curves for beginning farmers under both current market and excess land values are shown in Figures 17-1 and 17-2. For both the current market and excess land values, the minimum points on the SRAC are well below the breakeven level of investing $1 of total cost for each $1 of gross income.

The long-run cost or planning curve (LRAC) is estimated by fitting an envelope to the minimum points on the SRAC. These results are presented in Figure 17-3 which show costs declining rapidly until a gross income of about $120,000 is achieved or about 40 acres of apples. There appear to be little or no additional technical economies of size beyond 40 acres because larger farms are multiples of the smaller farm units.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for apples. The variability of price, yield and gross income (P X Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 17-9.

Table 17-9

Standard Deviations of Price, Yield and Gross Income For Apples, Oroville-Tonasket District, Washington

Crop	Yield	Price	Gross Income
Apples	1.725 ton	$39.269/ton	$529.06

Using these data, a 40 acre orchard could expect gross sales to fall within the range of $100,000 $\pm$ $20,000, 66 percent of the time. This variability can also be related to the LRAC. Using the minimum point on each of the SRAC, total costs were divided by plus and minus one standard deviation of gross income. These results are plotted about the LRAC and displayed in Figure 17-4.

DEMAND FOR IRRIGATION WATER

In a monoculture-type producing area such as Oroville-Tonasket where virtually all of the land is planted to apples, very few adjustment alternatives are available to increased water costs. The current or baseline method of irrigation in the district is by solid-set under the trees' sprinklers. The major alternative to sprinkler irrigation is drip irrigation. The analysis indicated that up to $50 per acre foot, drip irrigation would not be cost effective given farm operators were already using spinklers. These results are displayed in Figure 17-5 where the vertical dashed line represents the historic farm delivery of 4.4 acre feet per acre. The asterisk located on the dashed line indicates the 1978 average cost per acre foot of $11.47. The vertical solid line in Figure 17-5 is the derived demand curve. The line indicates that water use per acre would be expected to remain constant regardless of the cost of water, even if the BOR full-cost water price of $21.33 per acre foot was charged. The disparity between the solid and the dashed line indicates that farm operators are applying excess water to their lands.

Water cost is a small proportion of the total cost of producing apples. The impact of increased water cost on farm income is displayed graphically in Figure 17-6. The solid negatively sloped lines trace out the net returns over variable cost including water cost. Horizontal dashed

FIGURE 17–1
OROVILLE–TONASKET
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUES
LIMITED LEASING

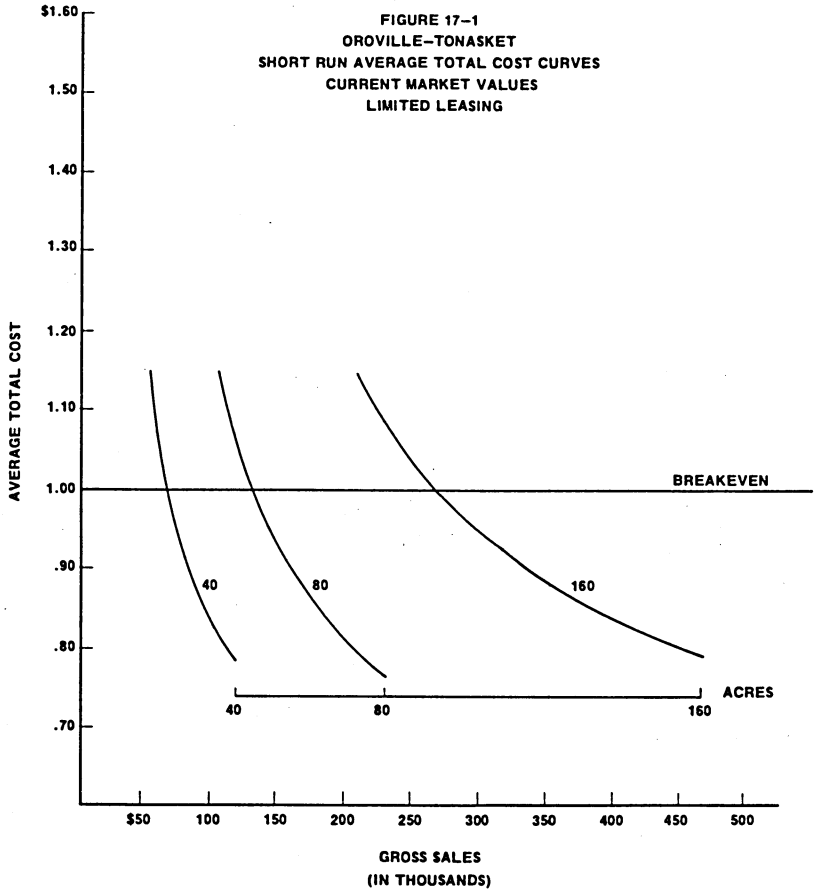


FIGURE 17–2
OROVILLE–TONASKET
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
LIMITED LEASING

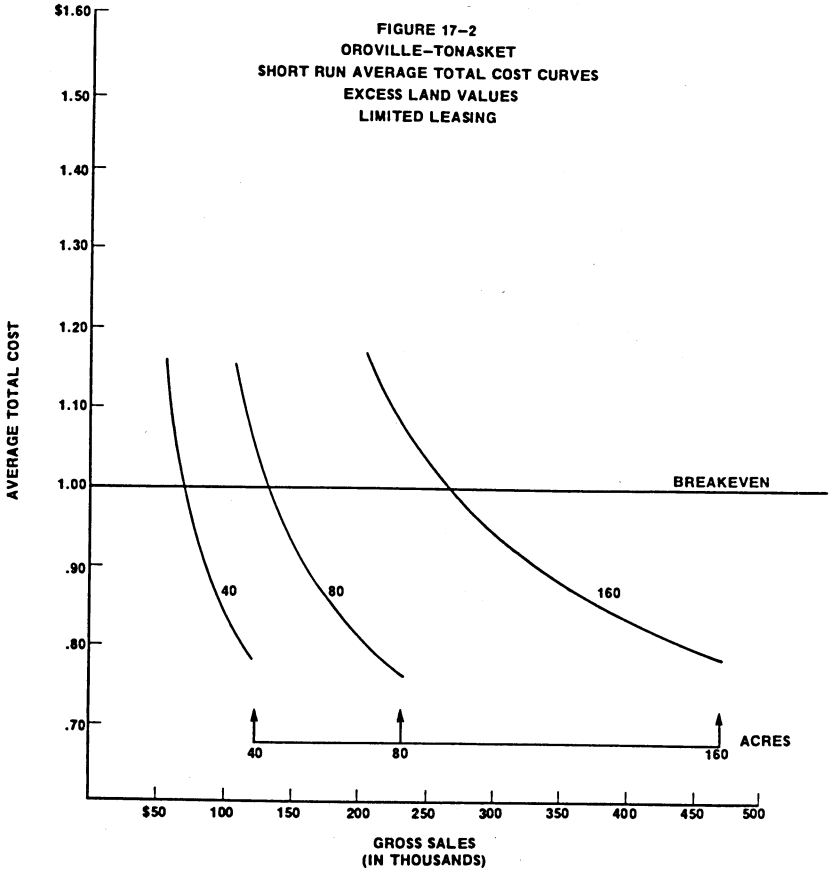


FIGURE 17–3
OROVILLE–TONASKET
LONG RUN PLANNING COST CURVES
LIMITED LEASING

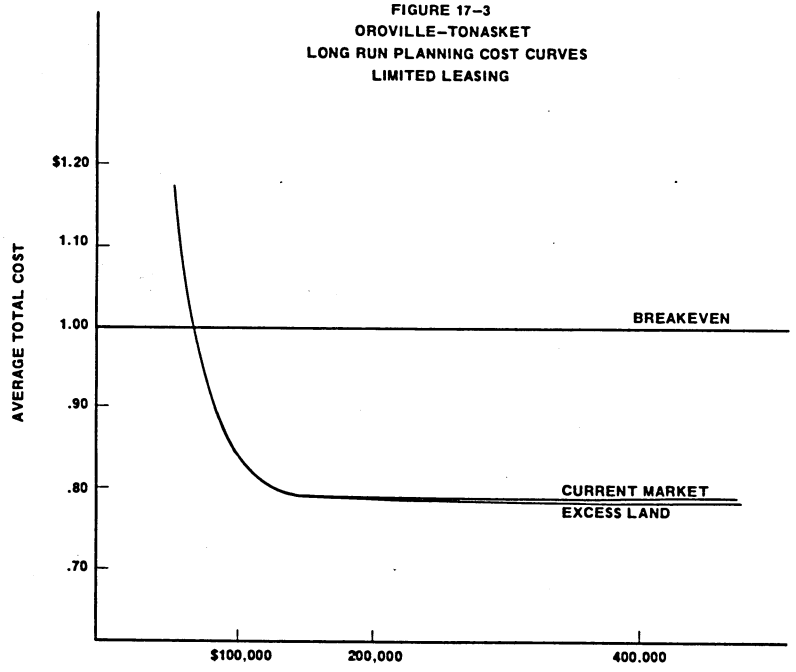


FIGURE 17–4
OROVILLE–TONASKET
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK

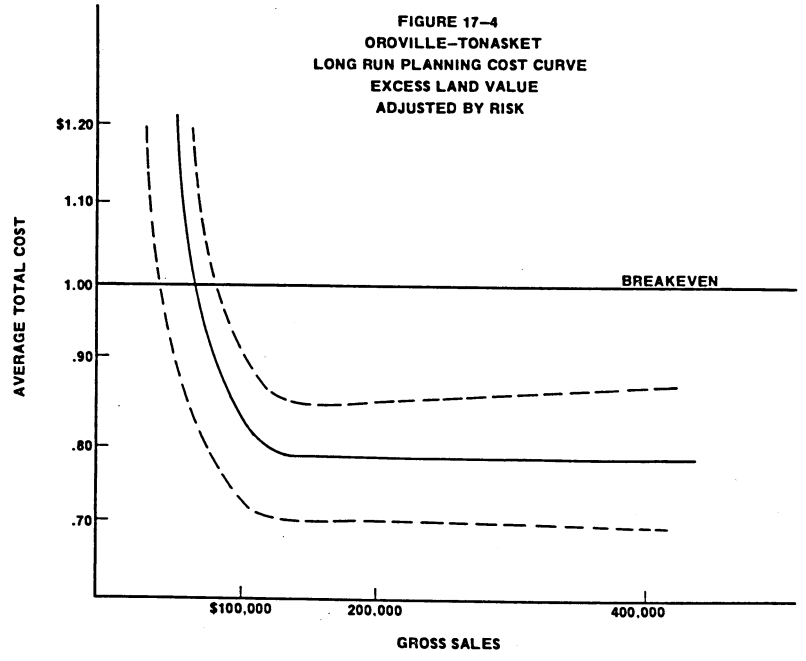


FIGURE 17–5
DEMAND FOR IRRIGATION WATER
OROVILLE – TONASKET

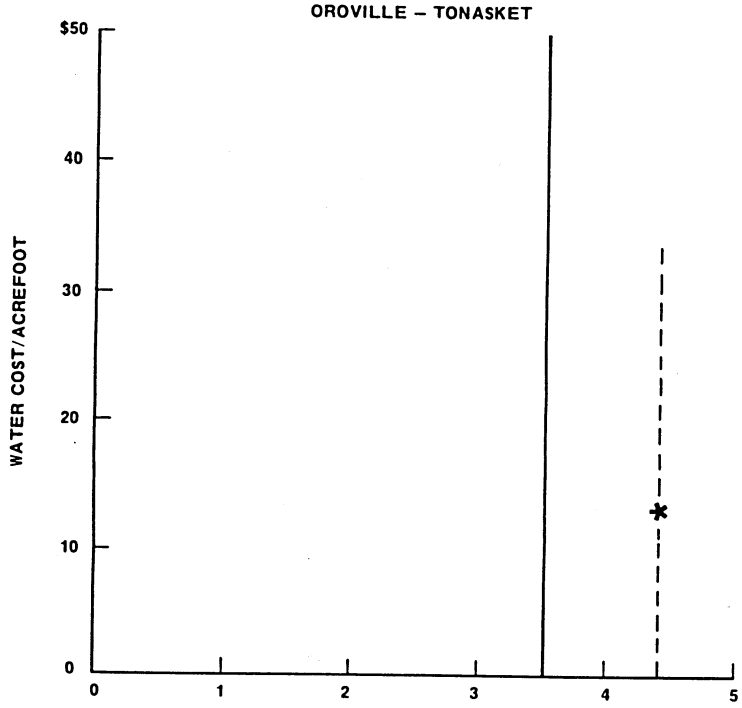
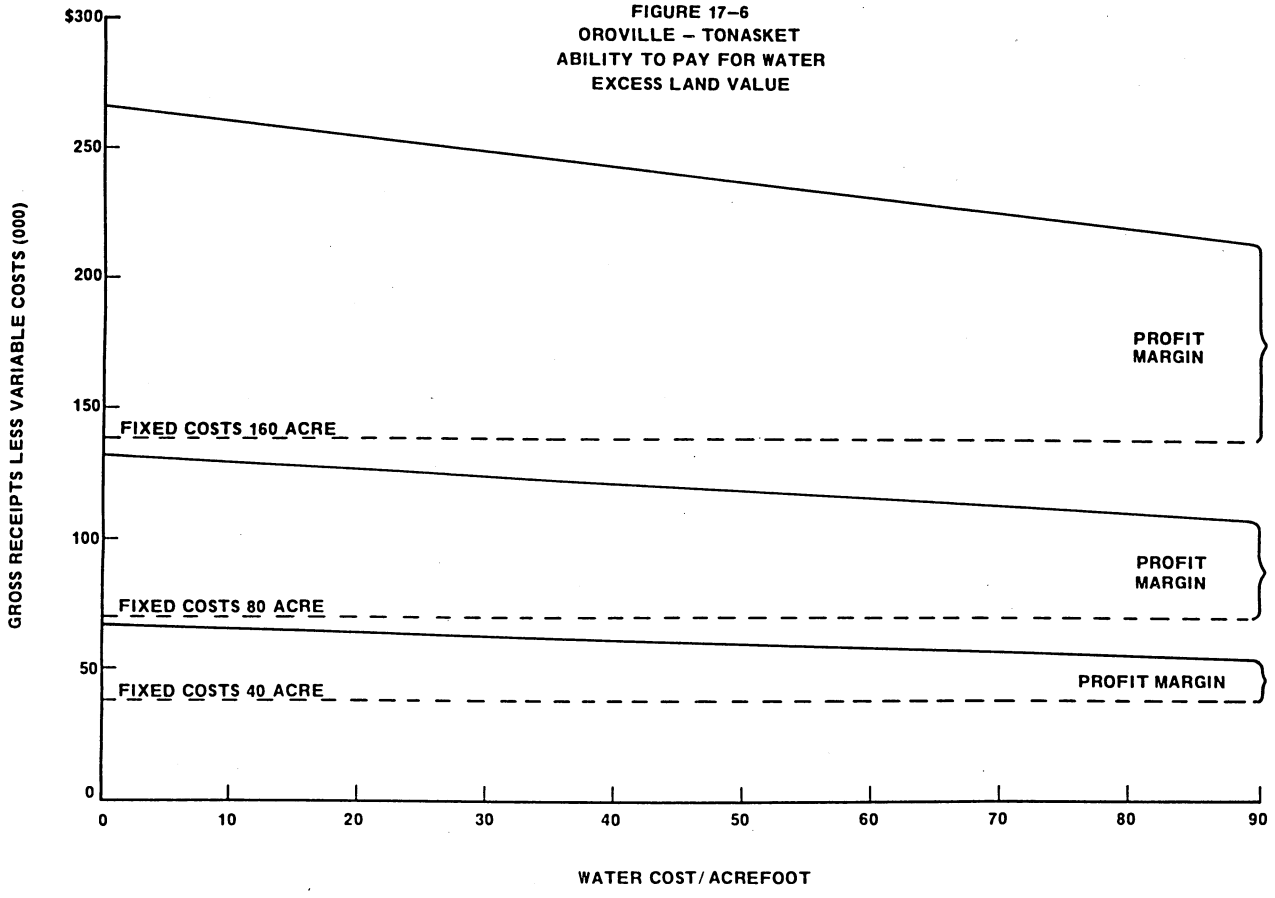


FIGURE 17–6
OROVILLE – TONASKET
ABILITY TO PAY FOR WATER
EXCESS LAND VALUE



lines depict the level of fixed costs for each size farm. Since the two lines do not interect within the range of water costs considered, the vertical difference between the two is considered the profit margin. Thus, the maximum ability to pay for water exceeds $90 per acre foot for all three farm sizes.

OFF-FARM INCOME

Off-farm income contributes to two important objectives of farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, it stabilizes family income in poor crop years which in turn increases probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Okanogan County, Washington reports 923 farms with gross agricultural sales of $2,500 or more. Table 17-10 shows the number of these farms reporting agriculturally related off-farm work.

Table 17-10

Farm Operators Reporting Days Work Off-Farm

None	320
1 - 49 days	48
50 - 99 days	35
100 - 149 days	29
150 - 199 days	36
200 days or more	228
Total	696

Income and expenses related to selected off-farm income sources are shown in Table 17-11.

Table 17-11

Operator Income From Farm Related Sources, Okanogan County

Number of Farms Reporting	181
Average Per Farm Reporting	$531
Income From Custom Work	
Number of Farms Reporting	60
Average Per Farm Reporting	$183
Expenses Related to Off-Farm Income	
Number of Farms Reporting	57
Average Per Farm Reporting	$ 95

Farm operators' spouses and their children also contribute to family income. In Okanogan County, 612 farms reported an average family off-farm income of $5,714 in 1974. No information is available on off-farm work and income by size of farm.

CHAPTER 18

Coachella Water District
Boulder Canyon Project, California

The Coachella Valley lies at the north end of the Salton Sea in southeastern California. The 78,500 acre district receives its water supply through the All American Canal from the Colorado River.

CLIMATE

The Coachella Valley is characterized as having an average frost-free (greater than 32° F) period of 310 days. Maximum temperatures of 122° F and minimum temperatures of 17° F are recorded. Average annual precipitation is 2.54 inches, most of which falls during July and August in one or two storms.

SOILS

The WPRS land classification report of May, 1946 identifies four arable land classes. The classes and acreage in each are tabulated below:

Land	Acreage	Irrigable Acreage
Class 1	24,690	
Class 2	40,740	
Class 3	12,900	
Class 4	2,400	
Irrigable Total	80,730	78,530

Soil Characteristics

There is no regularity in soil texture throughout the valley as the soils are all irregularly stratified. A soil profile five feet in depth may vary in texture from coarse granitic sand to heavy clay and contain layers of fine sandy loam, fine sand and other soil textural types. Other profiles may be of uniform texture throughout. In general, however, the soil is quite coarse at the base of the mountains and becomes finer at the trough of the valley. The finer textures mostly occur near the Salton Sea, but as in other valley "fill" areas there are exceptions to the general rule. The agriculturally important soils are largely sandy loams and silt loams. The coarse sandy soils and fine textured clay soils, although permitting crop production, are more costly to farms than the medium textured soils. The coarse soils are often closely associated with adverse topography due to their nearness to the hills. The fine textured clay soils, in addition to being difficult to cultivate and irrigate, often contain toxic quantities of soluble salts.

The fertility of the project soils is not high and the use of commercial fertilizers, especially those having a high nitrogen and phosphorous content, is essential. Organic matter content of all the soils is low under virgin conditions. These slightly developed desert soils still retain much of the mineral matter contained by the parent material and in this respect are favorable for agricultural development.

CROPS

The Coachella Valley has one of the most diverse cropping patterns of any of the 18 case-study districts. Within this diversification there is specialization by individual growers. Depending on the localized soil type there are vegetable specialists, field crop specialists, citrus and date specialists and fresh table grape specialists. No single speciality dominates the crop pattern as shown in Table 18-1. In terms of gross agricultural value, fresh grapes is the only dominate crop, producing $36 million in sales in 1977. The average gross crop sales per acre for all crops was $2,169 in 1977.

Table 18-1

Crop Acreages, All American Canal, Coachella Water District, California, 1977

Crop	Acres	Value of Production
Cereals		
Wheat	580	$ 64,096
Forages		
Alfalfa Hay	4,253	1,578,702
Irrigated Pasture	1,596	453,551
Miscellaneous Field Crops		
Cotton Lint, Upland	5,400	2,430,000
Cotton Seed, Upland	(5,400)	309,888
Vegetables		
Cabbage	442	1,260,805
Carrots	5,294	9,809,676
Corn, Sweet, Fresh Market	6,073	6,109,863
Lettuce	616	2,273,502
Squash	615	1,036,952
Fruits		
Grapefruit	8,526	11,989,688
Lemons & Limes	2,410	2,779,574
Oranges & Tangerines	5,080	10,204,704
Dates	4,093	10,950,576
Grapes, Table	7,208	36,049,813
Other & Miscellaneous	4,366	9,651,850
Total	56,552	$106,953,240

LAND TENURE

Land ownership in Coachella Valley is moderately concentrated with a Gini coefficient of 0.38.[1/] Seventy-five percent of the landowners have holdings of less than 100 acres. These lands constitute 35.6 percent of all lands in the district as presented in Tables 18-2 and 18-3. At the upper end of the scale, 1 percent of the landowners own 14.4 percent of the land.

Corporate ownership of district lands is high with 138 nonfamily corporations owning about 35 percent of the land. Individual landowners are also prominate owning 22.6 percent of the land. Family arrangements are important in terms of numbers as well as acreage, 37 percent. There are two data anomalies in Table 18-3 under "Individuals"; in the 500-999 acre and 1,000-2,999 acre size groups, entries appear with no corresponding entry in Table 18-2. This error is due to procedures used to expand survey results and its impact on the remaining data is unknown.

Farm Operations

The average ownership unit is 96 acres compared to an average farm size of 336 acres as shown in Tables 18-3 and 18-4. Control of land in the district through ownership plus leasing is highly concentrated with a Gini coefficient for operating units of 0.65.

Sole proprietorship was the dominate farm of business organization with 44 percent of the farms being operated by individuals. Family associations including joint with husband and wife and partnerships and family corporations ranked second with 37 percent falling into these two categories. Interesting, more corporations were involved in landownership, 138, than in farm operations, 48.

Table 18-5 presents crop patterns by farm size. As described earlier, the crop pattern of the district is widely diverse but farm operators tend to specialize in a limited number of

1/ Gini coefficient ranges from 0 to 1.0. The higher the coefficient, the greater the concentration of ownership.

Table 18-2

FORM OF OWNERSHIP BY FARM SIZE, COACHELLA VALLEY, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	141	80	148	0	50	25	13	0	457	75.0
Percent	30.8	17.5	32.3	0.0	10.9	5.4	2.8	0.0	100.0	
100-179										
No. of Owners	21	6	25	0	5	25	0	4	86	89.1
Percent	24.4	6.9	29.0	0.0	5.8	29.0	0.0	4.6	100.0	
180-259										
No. of Owners	8	4	3	0	7	14	0	0	36	95.0
Percent	22.2	11.1	8.3	0.0	19.4	38.8	0.0	0.0	100.0	
260-499										
No. of Owners	9	4	0	0	0	4	0	0	17	97.8
Percent	52.9	23.5	0.0	0.0	0.0	23.5	0.0	0.0	100.0	
500-999										
No. of Owners	0	0	0	0	4	0	4	0	8	99.1
Percent	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	100.0	
1,000-2,999										
No. of Owners	0	0	1	0	0	4	0	0	5	100.0
Percent	0.0	0.0	20.0	0.0	0.0	80.0	0.0	0.0	100.0	
Totals										
No. of Owners	179	94	177	0	66	72	17	4	609	
Percent	29.3	15.4	29.0	0.0	10.8	11.8	2.7	0.6	100.0	

Table 18-3

LAND BY OWNERSHIP, COACHELLA VALLEY, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Non-family Corp. 10 or Less	Non-family Corp. 11 or More	Federal, State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	5384	4916	6657	0	1568	1756	631	0	20912	35.6
Percent	25.7	23.5	31.8	0.0	7.4	8.3	3.0	0.0	100.0	
Average									45.7	
100-179										
Acres	2650	1451	2884	0	844	3231	0	355	11415	55.0
Percent	23.2	12.7	25.2	0.0	7.3	28.3	0.0	3.1	100.0	
Average									132.7	
180-259										
Acres	1419	1632	567	0	1373	2689	0	0	7680	68.1
Percent	18.4	21.2	7.3	0.0	17.8	35.0	0.0	0.0	100.0	
Average									213.3	
260-499										
Acres	3182	1366	64	60	0	1241	0	0	5913	78.1
Percent	53.8	23.1	1.0	1.0	0.0	20.9	0.0	0.0	100.0	
Average									347.8	
500-999										
Acres	326	0	0	0	2238	0	1844	0	4408	85.6
Percent	7.3	0.0	0.0	0.0	50.7	0.0	41.8	0.0	100.0	
Average									551.0	
1,000-2,999										
Acres	266	0	2415	0	0	5320	0	0	8001	100.0
Percent	3.3	0.0	30.2	0.0	0.0	66.5	0.0	0.0	100.0	
Average									1600.2	
Totals										
Acres	13227	9365	12587	60	6023	14237	2475	355	58329	
Percent	22.6	16.0	21.5	0.1	10.3	24.4	4.2	0.6	100.0	
Average	73.8	99.6	71.1	60.0	91.2	197.7	145.5	88.7	95.7	

Table 18-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, COACHELLA VALLEY, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/ Family Over 18	Jointly With Spouse Only	Individually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	10	4	20	46	91	3	174	40
Percent	5.7	2.2	11.4	26.4	52.2	1.7	100.0	
100-179								
No. of Farms	7	5	9	2	12	3	38	132
Percent	18.4	13.1	23.6	5.2	31.5	7.8	100.0	
180-259								
No. of Farms	5	0	9	3	5	0	22	215
Percent	22.7	0.0	40.9	13.6	22.7	0.0	100.0	
260-499								
No. of Farms	2	0	7	1	13	0	23	344
Percent	8.6	0.0	30.4	4.3	56.5	0.0	100.0	
500-999								
No. of Farms	0	5	4	1	1	0	11	661
Percent	0.0	45.4	36.3	9.0	9.0	0.0	100.0	
1,000-1,999								
No. of Farms	4	6	1	0	0	0	11	1401
Percent	36.3	54.5	9.0	0.0	0.0	0.0	100.0	
2,000-2,999								
No. of Farms	0	0	0	0	1	0	1	2020
Percent	0.0	0.0	0.0	0.0	100.0	0.0	100.0	
3,000-3,999								
No. of Farms	1	0	0	0	0	0	1	3540
Percent	100.0	0.0	0.0	0.0	0.0	0.0	100.0	
4,000-or Greater								
No. of Farms	0	0	2	0	0	0	2	4000
Percent	0.0	0.0	100.0	0.0	0.0	0.0	100.0	
Totals								
No. of Farms	28	20	52	53	123	6	282	336
Percent	9.9	7.0	18.4	18.7	43.6	2.1	100.0	

Table 18-5

IRRIGATED CROP PATTERNS BY FARM SIZE, COACHELLA VALLEY, 1978

Farm Size Acres	Cereals and Grain	Forages	Field Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	245	287	624	1116	568	3872	0	6712
Percent	3.6	4.2	9.2	16.6	8.4	57.6	0.0	100.0
100-179								
Total Acres	823	0	5	705	973	2336	0	4842
Percent	16.9	0.0	0.1	14.5	20.0	48.2	0.0	100.0
180- 259								
Total Acres	412	0	42	351	695	3067	0	4567
Percent	9.0	0.0	0.9	7.6	15.2	67.1	0.0	100.0
260-499								
Total Acres	36	1107	854	722	762	3088	0	6569
Percent	0.5	16.8	13.0	10.9	11.5	47.0	0.0	100.0
500-999								
Total Acres	248	1133	465	737	185	4454	0	7222
Percent	3.4	15.6	6.4	10.2	2.5	61.6	0.0	100.0
1,000-1,999								
Total Acres	1116	1228	1674	4986	2309	6606	0	17919
Percent	6.2	6.8	9.3	27.8	12.8	36.8	0.0	100.0
2,000-2,999								
Total Acres	0	0	0	0	0	2653	0	2653
Percent	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
3,000-3,999								
Total Acres	0	0	0	433	0	867	0	1300
Percent	0.0	0.0	0.0	33.3	0.0	66.6	0.0	100.0
4,000-or Greater								
Total Acres	0	0	2375	8587	0	0	0	10962
Percent	0.0	0.0	21.6	78.3	0.0	0.0	0.0	100.0
Totals								
Total Acres	2880	3755	6039	17637	5492	26943	0	62746
Percent	4.5	5.9	9.6	28.1	8.7	42.9	0.0	100.0

commodities. Common specializations include carrots plus sweet corn, field crops including cotton, wheat and alfalfa hay, fresh table grapes, citrus and dates. In Table 18-5 all fruit crops are combined and except for two of the larger size class the proportion of land in fruit does not vary too widely. Vegetable acreage tends to concentrate on the larger size farms.

Labor

One indication of the intensity of production in Coachella Valley is the 1,784 regular or full-time employees on the district's 282 farms. As shown in Table 18-6, 85 percent of these workers are of Hispanic origin.

Table 18-7 presents information on the job titles of hired regular workers on district farms. Approximately 10 percent were hired farm managers and an additional 7 percent were classified as foremen. When hired labor is added to farm operators an estimate of the total year-around labor supply is obtained. Standardizing these data on a labor per 1,000 acres provides an estimate of the labor input that can be compared among farm sizes. Labor input declines as farm size increases. The 260 to 499 acre size group reporting 21.1 laborers per 1,000 acres also reported 67 percent of the land in fruit. The 3,000 to 3,999 acre size group had a data anomaly in crop acreage and should not be considered as accurate. The largest farm size group reported 32.2 laborers per 1,000 acres but also reported 78 percent of the land in vegetables. None of the data in Table 18-7 have been adjusted for crop mix, off-farm work, seasonal labor or noncrop enterprises such as custom services or packing sheds.

TYPICAL FARM BUDGETS

The economic dominance of fresh table grapes was the major reason for choosing this crop to represent the district.

Due to the typical small acreages in grape vineyards three farm size budgets were developed, 40, 80 and 160 acres. Following the Interior's 1977 Proposed Rules and Regulations, all land in these farms was assumed to be owned.

Three farm income estimates were made for each farm size: A beginning farmer purchasing land at the current market price and down payment requirements; the same farmer purchasing land at the excess land value; and an existing farmer who is assumed to have purchased land at a previous time and reflects a much more favorable debt/asset ratio. These data are shown in Table 18-8. Crop mix, yield, machinery and prices received are assumed to remain constant; only the land values and owner equity is modified for these results.

For the beginning farmer these budgets indicate a small positive return to unpaid family labor, management and equity for both current market land values. The absolute amount declines slightly as farm size increases because a higher proportion of total labor employed on the farm is hired and becomes a cash expense.

For existing farmers the capital account was modified based on an estimated turnover rate for farms in the western United States of 2.5 percent per year or once every 40 years. Therefore, the average farm was purchased 20 years earlier ($40 \div 2 = 20$). In 1958, the average Federal Land Bank loan carried a 5.5 percent interest rate. Using the estimated debt-asset ratio for California of 25.7 percent from the USDA, "Balance Sheet of Agriculture for 1977, the return to labor, management and equity (cash flow) is significantly higher for these existing farm operators.

ECONOMIES OF SIZE

Perennial crops such as trees and vines are not conducive to the procedures used to develop short-run average cost curves (SRAC) in this study. Therefore, an estimate of the SRAC was made by spreading the farm fixed costs, including operator labor at market wage rates, over an increasingly greater output until the maximum acreage for a specified farm size was achieved.

Short-run average cost curves for beginning farmers under both current market and excess land values are shown in Figures 18-1 and 18-2. For both the current market and excess land values, the minimum points on the SRAC are very close to the breakeven level of investing $1 of total cost for each $1 of gross income.

An estimate of the long-run cost or planning curve (LRAC) is made by fitting an envelope to the minimum points on the SRAC. These results are presented in Figure 18-3 which show costs declining rapidly until a gross income of about $200,000 is achieved or about 40 acres of fresh grapes. There appear to be no additional technical economies of size beyond this size, larger farms being multiples of the smaller farm units.

PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for major crops in the district. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate

Table 18-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, COACHELLA VALLEY, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	360	62	292	0	0	6
Average	2.0	0.3	1.6	0.0	0.0	0.0
100-179						
No. of Employees	205	26	179	0	0	0
Average	5.3	0.6	4.6	0.0	0.0	0.0
180-259						
No. of Employees	192	26	165	0	0	1
Average	8.8	1.1	7.5	0.0	0.0	0.0
260-499						
No. of Employees	143	22	119	0	0	2
Average	6.2	0.9	5.2	0.0	0.0	0.0
500-999						
No. of Employees	300	22	276	0	1	1
Average	27.5	2.0	25.3	0.0	0.0	0.0
1,000-1,999						
No. of Employees	297	40	254	0	0	3
Average	25.7	3.4	21.9	0.0	0.0	0.2
2,000-2,999						
No. of Employees	44	3	41	0	0	0
Average	33.4	2.2	31.2	0.0	0.0	0.0
3,000-3,999						
No. of Employees	9	3	6	0	0	0
Average	24.5	8.1	16.3	0.0	0.0	0.0
4,000-or Greater						
No. of Employees	234	44	190	0	0	0
Average	128.0	24.0	103.9	0.0	0.0	0.0
Totals						
No. of Employees	1784	248	1522	0	1	13
Percent	100.0	13.9	85.3	0.0	0.0	0.7

Table 18-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, COACHELLA VALLEY, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	85	31	246	362	175	537	76.2
Average/Farm	0.4	0.1	1.4	2.0	0.9	3.0	
100-179							
No. of Workers	27	9	169	205	38	243	47.8
Average/Farm	0.7	0.2	4.3	5.3	0.9	6.3	
180-259							
No. of Workers	13	11	168	192	21	213	45.4
Average/Farm	0.5	0.5	7.7	8.8	0.9	9.7	
260-499							
No. of Workers	19	13	111	143	23	166	21.1
Average/Farm	0.8	0.5	4.8	6.2	1.0	7.2	
500-999							
No. of Workers	8	15	278	301	11	312	43.3
Average/Farm	0.7	1.3	25.5	27.6	1.0	28.6	
1,000-1,999							
No. of Workers	15	26	255	296	12	308	19.0
Average/Farm	1.2	2.2	22.0	25.6	1.0	26.6	
2,000-2,999							
No. of Workers	1	3	39	43	1	44	16.5
Average/Farm	0.7	2.2	29.6	32.7	0.7	33.4	
3,000-3,999							
No. of Workers	0	2	7	9	0	9	6.9
Average/Farm	0.	5.4	19.0	24.5	0.	24.5	
4,000 - or Greater							
No. of Workers	0	15	219	234	2	236	32.2
Average/Farm	0.	8.2	119.8	128.0	1.0	129.1	
Totals							
No. of Workers	168	125	1492	1785	283	2068	
Average/Farm	0.	0.	1.	1.	0.	2.	

Table 18-8

Coachella Water District, California

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
40 Acres Irrigated	Fresh Grapes	38	Land	$229,880[1/]
	Farmstead	2	Improvements	800
	Total	40	Machinery	29,657
			Total	$260,337

Financial Summary

Land at Current Market Value ($2,000/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$190,256	Gross Sales	$190,256
Expenses	177,854	Expenses	163,773
Return to Operator Labor, Mgt., & Equity	$ 12,402	Return to Operator Labor, Mgt., & Equity	$ 26,483

Land at Excess Land Value ($1,450/ac.)

Beginning Farmers	
Gross Sales	$190,256
Expenses	176,356
Return to Operator Labor, Mgt., & Equity	$ 13,900

Farm Size	Crop	Acres	Investment	
80 Acres Irrigated	Fresh Grapes	75	Land	$459,760[1/]
	Farmstead	5	Improvements	800
	Total	80	Machinery	52,175
			Total	$512,735

Financial Summary

Land at Current Market Value ($2,000/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$380,512	Gross Sales	$380,512
Expenses	366,385	Expenses	338,445
Return to Operator Labor, Mgt., & Equity	$ 14,127	Return to Operator Labor, Mgt., & Equity	$ 42,067

Land at Excess Land Value ($1,450/ac.)

Beginning Farmers	
Gross Sales	$380,512
Expenses	363,389
Return to Operator Labor, Mgt., & Equity	$ 17,123

1/ Includes market value of mature vineyards.

Table 18-8--Continued

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Fresh Grapes	150	Land	$919,520[1/]
	Farmstead	10	Improvements	800
	Total	160	Machinery	76,215
			Total	$996,535

Financial Summary

Land at Current Market Value ($2,000/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$761,024	Gross Sales	$761,024
Expenses	751,016	Expenses	702,595
Return to Operator Labor, Mgt., & Equity	$ 10,008	Return to Operator Labor, Mgt., & Equity	$ 58,429

Land at Excess Land Value ($1,450/ac.)

Beginning Farmers	
Gross Sales	$761,024
Expenses	745,024
Return to Operator Labor, Mgt., & Equity	$ 16,000

1/ Includes market value of mature vineyards.

FIGURE 18–1
COACHELLA–CALIFORNIA
(NEW FARMERS)
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET LAND VALUE

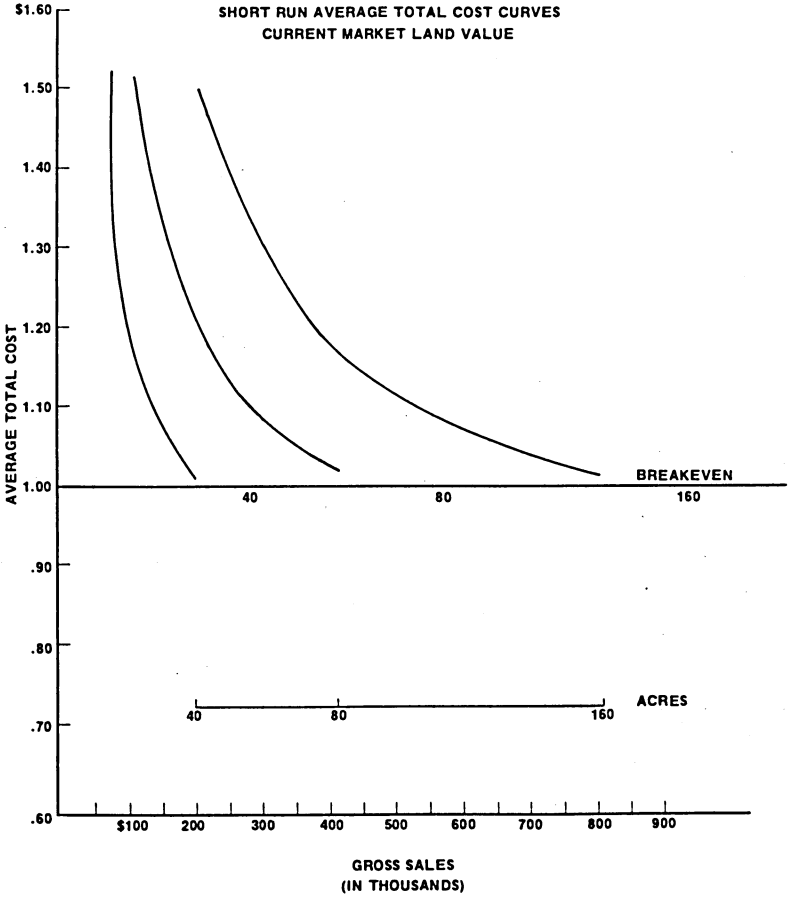
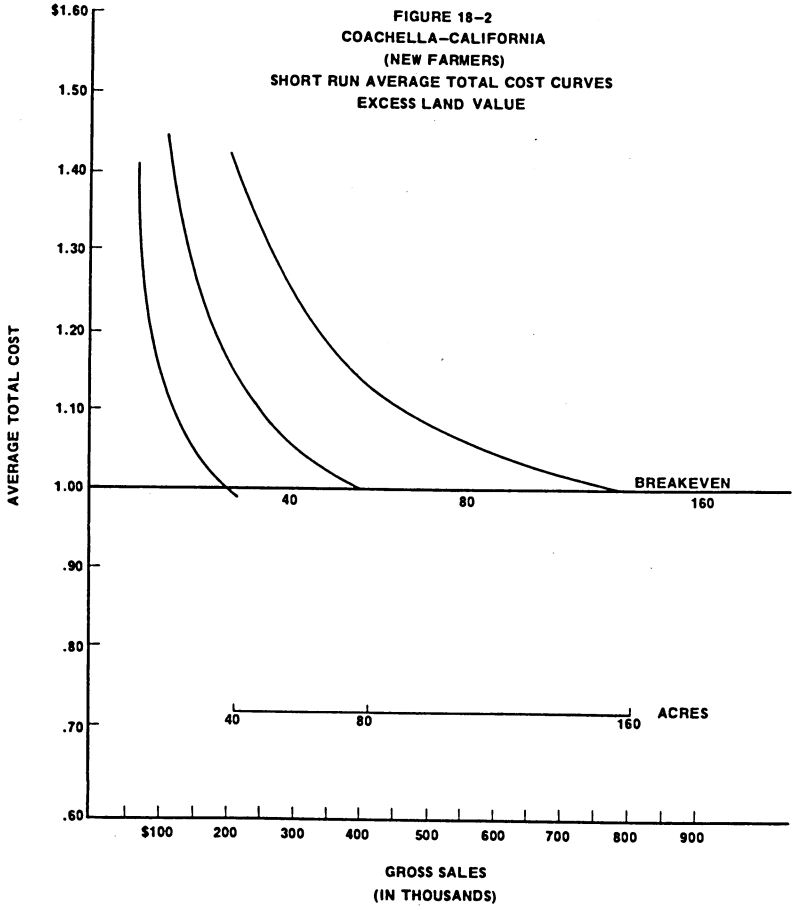


FIGURE 18–2
COACHELLA–CALIFORNIA
(NEW FARMERS)
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUE



Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 18-9.

Table 18-9

Standard Deviations of Yield, Price and Gross Income
by Crop, Coachella Water District

Crop	Yield	Price	Gross Income Per Acre
Fresh Grapes	1.451 ton	84.328/ton	$225.75
Citrus	52.864 cwt.	2.609/cwt.	175.14
Carrots	3.215 cwt.	35.606/cwt.	295.22
Sweet Corn	0.628 ton	20.511/ton	85.32
Alfalfa Hay	0.489 ton	3.85/ton	34.78
Cotton Lint	1.388 cwt.	2.362/cwt.	37.84

To indicate the variability of farm income and costs, the data in Table 18-9 were combined based on the proportion of land in fresh grapes for the minimum point on the SRAC. Total costs were then divided by plus and minus one standard deviation of gross sales and plotted about the LRAC as shown in Figure 18-4. The LRAC would be expected to fluctuate within the range of plus and minus one standard deviation about 66 percent of the time.

DEMAND FOR IRRIGATION WATER

Derived demand for irrigation water used in grape production depends on the profitability of grapes, consumptive use of water, efficiency of irrigation methods and the cost of water. In this study the dominate irrigation method or baseline was furrow irrigation with 96 acre inches of water applied per year. Preliminary analysis indicated that at a water cost of about $20 per acre foot an irrigation system consisting of gated pipe, irrigation management service (IMS) and a tailwater return system would become cost effective on grapes. This is reflected in Figure 18-5. The vertical dashed line in Figure 18-5 depicts the historic farm headgate delivery of 6.3 acre feet per acre in the district. An asterisk located on the dashed line represents the 1978 average cost of water of $7.00 per acre foot. For comparison purposes, the BOR estimated full-cost price is $26.27 per acre foot. The solid line in the graph traces out the optimum quantity of water to be applied as water cost was ranged from $0 to $100 per acre foot. These results indicate that at 1978 water costs, farm operators growing grapes should apply a greater quantity than the average for all lands in the district. If water costs were to increase to $20 per acre foot or above, water use on grapes would be expected to decline to about 6.4 acre feet, close to the current average for all crops in the district.

The impact of increased water costs on farm income is shown graphically in Figure 18-6. The solid lines in the graph indicate the net returns over variable expenses including water costs for each farm size. Horizontal dashed lines represent the level of fixed costs, assuming excess land values, for the three farm sizes. The point of intersection of the solid line and the horizontal dashed line indicates the breakeven point. A line dropped to the base of the graph from this intersection locates the maximum ability to pay for irrigation water. The 40 acre farm indicated the highest ability to pay reflecting its cash flow as shown in Table 18-8. None of the farm size studies were able to pay the WPRS full-cost water price of $26 per acre foot.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators: First, it provides for fuller utilization of under-employed labor and machinery resources. Second, it stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Riverside County, California reports 1,708 farms with gross agricultural sales of $2,500 or more. Table 18-10 shows the number of these farms reporting agriculturally related off-farm work.

FIGURE 18–3
COACHELLA–CALIFORNIA
LONG RUN PLANNING COST CURVES
UNLIMITED LEASING

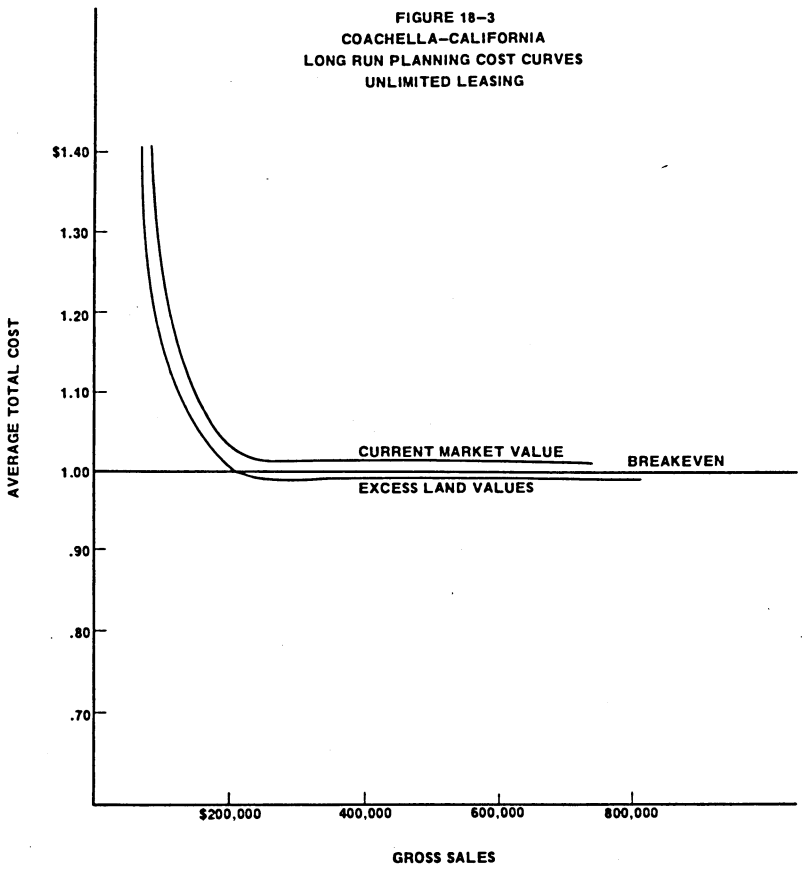


FIGURE 18–4
COACHELLA–CALIFORNIA
LONG RUN PLANNING COST CURVE
EXCESS LAND VALUE
ADJUSTED BY RISK

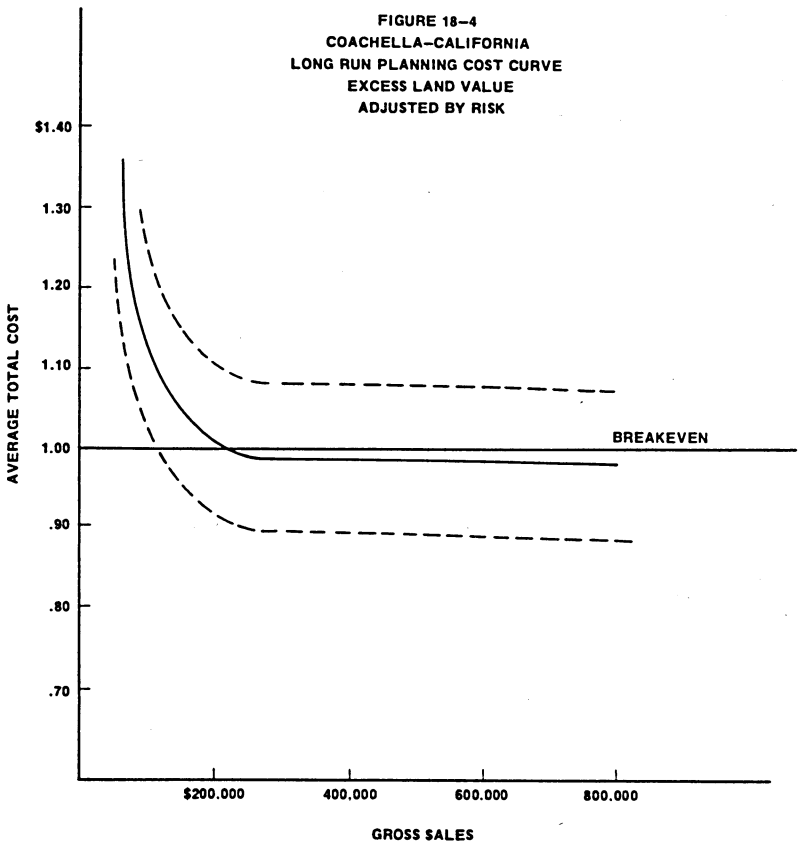


FIGURE 18–5
COACHELLA VALLEY
DEMAND FOR IRRIGATION WATER

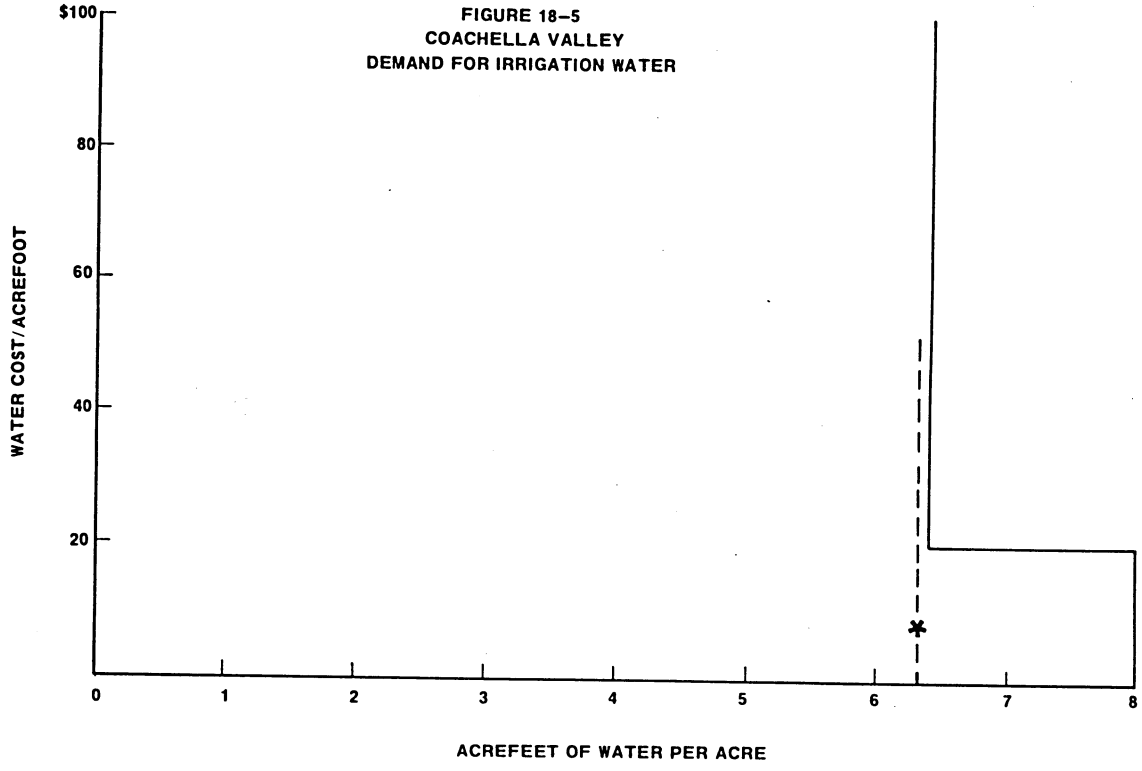


FIGURE 18–6
ABILITY TO PAY FOR IRRIGATION WATER
COACHELLA VALLEY
(EXCESS LAND VALUE)

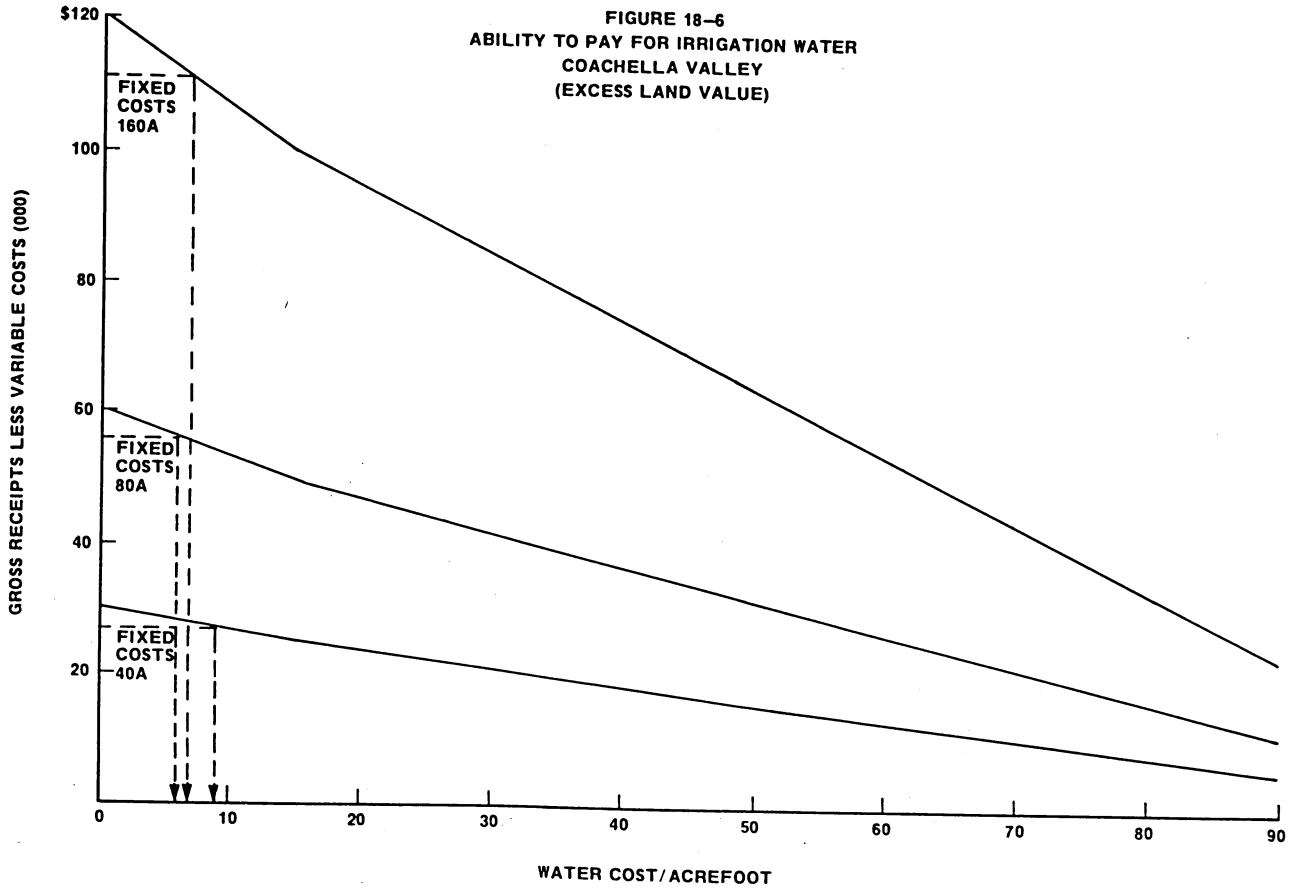


Table 18-10

Farm Operators Reporting Days Work Off-Farm

None	556
1 - 49 days	49
50 - 99 days	52
100 - 149 days	38
150 - 199 days	54
200 days or more	511
Total	1,260

Income and expenses related to selected off-farm income sources are shown in Table 18-11.

Table 18-11

Operator Income From Related Sources, Riverside County

Number of Farms Reporting	272
Average Per Farm Reporting	$3,852
Income From Custom Work	
Number of Farms Reporting	133
Average Per Farm Reporting	$2,301
Expenses Related to Off-Farm Income	
Number of Farms Reporting	110
Average Per Farm Reporting	$1,253

Farm operators' spouses and their children also contribute to family income from both agriculturally and nonagriculturally related sources. In Riverside County, 1,025 farms reported an average family off-farm income of $24,245 in 1974. No information is available on off-farm work and income by size of farm.

CHAPTER 19

Goleta Water District, Cachuma Project, California

The 6,390 acre Goleta County Water District is located in Santa Barbara County, California. It represents a group of small, intensively-cultivated districts with heavy pressure for urbanization.

CLIMATE

The mean annual percipitation is 18.4 inches which is primarily in the period from October to March. Due to its close proximity to the Pacific Ocean, the mild climate provides approximately 330 frost-free growing days per year.

SOILS

A detailed breakdown of soils in the district is not available, but they are considered to be of medium texture with few agronomic limitations except for a few salt-affected locations. Urban pressures have forced some landowners to shift production onto the hillier lands where drip irrigation is common.

CROPS

The mild winter climate explains the heavy emphasis placed on subtropical fruits in the district. The district is noted for the production of avocados, lemons and limes. The only other major income-producing enterprise is commercial nursery (see Table 19-1). Average crop value per acre in 1977 was $5,788.

Table 19-1

Crop Acreages, Cachuma, Goleta County District/Carpenteria/Montecito, California, 1977

Crop	Acres	Value of Production
Forage		
Irrigated Pasture	110	$ 7,150
Nursery	620	17,353,800
Fruits		
Lemons & Limes	2,530	6,534,004
Avocados and Miscellaneous	3,073	12,664,278
Total	6,333	$36,559,232

LAND TENURE

Ownership of land in the Goleta District is moderately concentrated with a Gini coefficient of 0.40.[1/] On the lower range of the scale, 92 percent of the landowners hold 46 percent of the land while at the upper end of the scale, 1 percent of the owners hold 19 percent of the land in the district. No owner holds more than 1,000 acres of land (see Tables 19-2 and 19-3).

Of the 254 landowners, 22 are nonfamily corporations and these legal entities own less than 800 acres in total. The largest single type of owners in the district are individual owners who have 36 percent of the land, followed by multiple family associations including family corporations who have one-third of all the land.

1/ Gini coefficient ranges from 0 to 1.0. The higher the coefficient, the greater the concentration of ownership.

Table 19-2

FORM OF LAND OWNERSHIP BY FARM SIZE, GOLETA, 1978

Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 11 or Less	Nonfamily Corp. 11 or Moore	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
No. of Owners	32.	78.	100.	2.	20.	2.	0.	1.	235.	92.5
Percent	13.6	33.1	42.5	0.8	8.5	0.8	0.0	0.4	100.0	
100-79										
No. of Owners	3.	0.	10.	0.	0.	0.	0.	0.	13.	97.6
Percent	23.0	0.0	76.9	0.0	0.0	0.0	0.0	0.0	100.0	
180-259										
No. of Owners	0.	0.	0.	0.	0.	0.	0.	0.	0.	97.6
Percent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
260-499										
No. of Owners	1.	2.	0.	1.	0.	0.	0.	0.	4.	99.2
Percent	25.0	50.0	0.0	25.0	0.0	0.0	0.0	0.0	100.0	
500-999										
No. of Owners	2.	0.	0.	0.	0.	0.	0.	0.	2.	100.0
Percent	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Totals										
No. of Owners	38.	80.	110.	3.	20.	2.	0.	1.	254.	
Percent	14.9	31.4	43.3	1.1	7.8	0.7	0.0	0.3	100.0	

Table 19-3

ACREAGE OF LAND BY TYPE OF OWNERSHIP, GOLETA, 1978

Farm Size Acres	Individual	Joint With Spouse	Family Multiple	Trust	Nonfamily Corp. 10 or Less	Nonfamily Corp. 11 or More	Fed., State or Local Gov't	Non-profit	Total	Cumulative Percent
1-99										
Acres	728.	1141.	1935.	19.	702.	83.	0.	12.	4620.	46.5
Percent	15.7	24.6	41.8	0.4	15.1	1.7	0.0	0.2	100.0	
Average									19.6	
100-179										
Acres	405.	0.	1371.	0.	0.	0.	0.	0.	1776.	64.4
Percent	22.8	0.0	77.1	0.0	0.0	0.0	0.0	0.0	100.0	
Average									136.6	
180-259										
Acres	0.	0.	0.	0.	0.	0.	0.	0.	0.	64.4
Percent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Average									0.0	
260-499										
Acres	578.	684.	0.	373.	0.	0.	0.	0.	1635.	80.9
Percent	35.3	41.8	0.0	22.8	0.0	0.0	0.0	0.0	100.0	
Average									408.7	
500-999										
Acres	1899.	0.	0.	0.	0.	0.	0.	0.	1899.	100.0
Percent	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	
Average									949.5	
Totals										
Acres	3610.	1825.	3306.	392.	702.	83.	0.	12.	9930.	
Percent	36.3	18.3	33.2	3.9	7.0	0.8	0.0	0.1	100.0	
Average	95.0	22.8	30.0	130.6	35.1	41.5	0.0	12.0	39.0	

Farm Operators

The average land ownership of 39 acres compared to an average farm size of 101 acres reflects an unexpectedly high proportion of leasing and absentee ownership in the district. Table 19-4 presents data on the type of business organization by farm size. No consistent pattern appears in these data with respect to farm size and business organization. Over all, individual sole proprietorships dominate farm operations as well as land ownership, followed by joint operation with a spouse. Crop mix data by farm size is presented in Table 19-5. Due to the dominance of perennial crops, no pattern is apparent in the crop mix by farm size. Minor acreages of cereals, vegetables and row crops appear to be randomly distributed among farm sizes.

Labor

The survey requested information on the number, ethnic composition and job classification of hired regular or full-time farm workers in the district. These data are reported in Tables 19-6 and 19-7. The 90 farms in the district reported 430 year-around employees or about five workers per farm. Seventy-one percent were of Hispanic origin and 23 percent Caucasian. Supervisors, hired farm managers and foremen made up almost 18 percent of the hired work force on these farms.

Adding farm operators to hired labor provides an estimate of the total labor input. Standardizing these labor input data on a labor per 1,000 acres provides an estimate of labor use that can be compared among farm sizes. These estimates are shown in the last column of Table 19-7. Although these data are not adjusted for seasonal labor, off-farm work, custom services or noncrop enterprises such as packing sheds, they do provide an indicator of labor utilization. The smallest farm size group, less than 100 acres, reported an average of 208 laborers per 1,000 acres. This dropped rapidly when larger farms were considered, ranging from 34.8 per 1,000 acres in the 180 to 259 acre size group down to 8.7 in the 260 to 499 acre size group. An important consideration in evaluating these larger size farms would be the presence or absence of a packing shed on the farm. This information was not collected.

TYPICAL FARM BUDGETS

Due to the small groves typical of the area, farm budgets were developed for three farm sizes, 40, 80 and 160 acres. Based on Interior's 1977 Proposed Rules and Regulations, these budgets assume full ownership for all land. To represent the intense operations in the district, these farms were assumed to produce only avocados (see Table 19-8).

The return to family labor, management and equity is positive for beginning farmers on all three farm sizes. As would be expected, returns are higher where land is valued at its excess land value.

For existing farmers the budgets were modified to reflect the assumption that these farmers purchased land at some previous time at a lower land price and interest rate. Land value appreciation and principal repayment have increased the equity of this group. Budgets were modified based on a turnover rate for farms in the western United States of 2.5 percent for every 40 years. The average farm was assumed to have been purchased 20 years ago ($40 \div 2 = 20$) or 1975 with a Federal Land Bank mortgage rate of 5.5 percent. Based on USDA, "Balance Sheet of Agriculture," the estimated debt-asset ratio for all assets on California farms was 25.7 percent. The results of this modification are shown in Table 19-8.

ECONOMIES OF SIZE

Perennial crops such as trees and vines are not conducive to the procedures used to develop short-run average cost-curves (SRAC) in this study. Therefore, an estimate of the SRAC was made by spreading the farm fixed costs (including operator labor) over an increasingly larger output until the maximum acreage for a specified farm size was achieved.

Short-run average cost curves for the two assumed land value situations, current market and excess land value, are shown for all three farm sizes in Figures 19-1 and 19-2. Minimum points on all SRAC are below the breakeven level where $1 is received for each $1 of expenses. This indicates a positive net farm income. The SRAC in Figures 19-1 and 19-2 reflect unpaid family labor at market wage rates.

Technical economies of size were estimated by fitting an envelope curve to the three SRAC in Figures 19-1 and 19-2. The ability of the largest farm to spread fixed machinery costs over more units of production is reflected in the decreasing average costs as farm size increases. It appears that most of the economies of size are captured by the time 160 acres of avocados are in production (see Figure 19-3). Larger farm sizes would be multiples of the 160 acre unit of the production side.

Table 19-4

TYPE OF BUSINESS ORGANIZATION BY FARM SIZE, GOLETA WATER DISTRICT, 1978

Farm Size Acres	Incorp. With More Than 10 Persons	Incorp. With 10 or Fewer Persons	Joint Operation With Partners/ Spouse/Family Over 18	Jointly With Spouse Only	Indi-vidually	Other (Gov't., Estate, Trust, Etc.)	Total	Average Farm Size
1-99								
No. of Farms	1	11	13	23	23	0	71	25
Percent	1.4	15.4	18.3	32.3	32.3	0.0	100.0	
100-179								
No. of Farms	0	1	1	1	1	0	4	134
Percent	0.0	25.0	25.0	25.0	25.0	0.0	100.0	
180-259								
No. of Farms	0	1	1	0	0	0	2	224
Percent	0.0	50.0	50.0	0.0	0.0	0.0	100.0	
260-499								
No. of Farms	0	0	4	0	3	0	7	342
Percent	0.0	0.0	57.1	0.0	42.8	0.0	100.0	
500-1,999								
No. of Farms	2	0	1	1	2	0	6	834
Percent	33.3	0.0	16.7	16.7	33.3	0.0	100.0	
Totals								
No. of Farms	3	13	20	25	29	0	90	101
Percent	3.3	14.4	22.2	27.7	32.2	0.0	100.0	

Table 19-5

CROP PATTERN BY FARM SIZE, GOLETA WATER DISTRICT, 1978

Farm Size Acres	Cereals	Forages	Row Crops	Vegetables	Seeds	Fruits	Nuts	Total
1-99								
Total Acres	0	0	203	71	0	1145	0	1419
Percent	0.0	0.0	14.3	5.0	0.0	80.6	0.0	100.0
100-179								
Total Acres	4	0	0	77	0	211	0	292
Percent	1.3	0.0	0.0	26.3	0.0	72.2	0.0	100.0
180-259								
Total Acres	0	0	0	0	0	302	0	302
Percent	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
260-499								
Total Acres	115	0	109	2	0	314	43	583
Percent	19.7	0.0	18.6	0.3	0.0	53.8	7.3	100.0
500-1,999								
Total Acres	0	7	0	0	0	1585	0	1592
Percent	0.0	0.5	0.0	0.0	0.0	99.5	0.0	100.0
Totals								
Total Acres	119	7	312	150	0	3557	43	4188
Percent	2.8	0.1	7.4	3.5	0.0	84.9	1.0	100.0

Table 19-6

RACIAL/ETHNIC LABOR FORCE BY FARM SIZE, GOLETA WATER DISTRICT, 1978

Farm Size Acres	Total Regular or Full-Time Employees	Caucasian	Hispanic	American Indian or Alaskan Native	Black	Asian or Pacific Islanders
1-99						
No. of Employees	305	53	228	0	0	24
Average	4.2	0.7	3.1	0.0	0.0	0.3
100-179						
No. of Employees	9	1	8	0	0	0
Average	2.3	0.2	2.0	0.0	0.0	0.0
180-259						
No. of Employees	15	13	2	0	0	0
Average	6.8	5.9	0.9	0.0	0.0	0.0
260-499						
No. of Employees	14	5	9	0	0	0
Average	2.0	0.7	1.2	0.0	0.0	0.0
500-999						
No. of Employees	76	20	56	0	0	0
Average	14.4	3.8	10.6	0.0	0.0	0.0
1,000-1,999						
No. of Employees	11	7	3	1	0	0
Average	10.0	6.4	2.7	0.9	0.0	0.0
Totals						
No. of Employees	430	99	306	1	0	24
Percent	100.0	23.0	71.1	0.2	0.0	5.5

Table 19-7

LABOR FORCE EMPLOYMENT CATEGORIES BY FARM SIZE, GOLETA WATER DISTRICT, 1978

Farm Size Acres	Farm Manager	Foreman	Laborers	Total Employees	Total Operators	Total Employees & Operators	Labor Per 1,000 Acres
1-99							
No. of Workers	17	40	247	304	71	375	208.4
Average/Farm	0.2	0.5	3.4	4.2	0.9	5.2	
100-179							
No. of Workers	0	0	8	8	4	12	23.2
Average/Farm	0.	0.	2.0	2.0	1.0	3.1	
180-259							
No. of Workers	1	5	9	15	2	17	34.8
Average/Farm	0.4	2.2	4.1	6.8	0.9	7.7	
260-499							
No. of Workers	4	0	10	14	7	21	8.7
Average/Farm	0.5	0.	1.4	2.0	1.0	3.0	
500-999							
No. of Workers	2	5	68	75	5	80	19.9
Average/Farm	0.3	0.9	12.9	14.2	0.9	15.2	
1,000-1,999							
No. of Workers	1	0	10	11	1	12	9.3
Average/Farm	0.9	0.	9.1	10.1	0.9	10.9	
Totals							
No. of Workers	25	50	352	427	90	517	

Table 19-8

Goleta Water District, Cachuma Project, California

Summary Farm Budgets

Farm Size	Crop	Acres	Investment	
40 Acres Irrigated	Avocados	38	Land	$700,000[1/]
	Farmstead	2	Improvements	800
	Total	40	Machinery	19,845
			Total	$720,645

Financial Summary

Land at Current Market Value ($17,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$129,526	Gross Sales	$129,526
Expenses	92,230	Expenses	55,775
Return to Operator Labor, Mgt., & Equity	$ 37,296	Return to Operator Labor, Mgt., & Equity	$ 73,751

Land at Excess Land Value ($15,500/ac.)

Beginning Farmers	
Gross Sales	$129,526
Expenses	86,782
Return to Operator Labor, Mgt., & Equity	$ 42,744

Farm Size	Crop	Acres	Investment	
80 Acres Irrigated	Avocados	76	Land	$1,400,000[1/]
	Farmstead	4	Improvements	800
	Total	80	Machinery	27,145
			Total	$1,427,945

Financial Summary

Land at Current Market Value ($17,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$259,053	Gross Sales	$259,053
Expenses	188,601	Expenses	116,195
Return to Operator Labor, Mgt., & Equity	$ 70,452	Return to Operator Labor, Mgt., & Equity	$142,858

Land at Excess Land Value ($15,500/ac.)

Beginning Farmers	
Gross Sales	$259,053
Expenses	177,705
Return to Operator Labor, Mgt., & Equity	$ 81,348

1/ Includes market value of mature grove.

Table 19-8--Continued

Farm Size	Crop	Acres	Investment	
160 Acres Irrigated	Avocados	152	Land	$2,800,000[1/]
	Farmstead	8	Improvements	800
		160	Machinery	34,445
	Total		Total	$2,835,245

Financial Summary

Land at Current Market Value ($17,500/ac.)

Beginning Farmers		Existing Farmers	
Gross Sales	$518,107	Gross Sales	$518,107
Expenses	384,901	Expenses	240,849
Return to Operator Labor, Mgt., & Equity	$133,206	Return to Operator Labor, Mgt., & Equity	$277,258

Land at Excess Land Value ($15,500/ac.)

Beginning Farmers	
Gross Sales	$518,107
Expenses	363,109
Return to Operator Labor, Mgt., & Equity	$154,998

1/ Includes market value of mature grove.

FIGURE 19–1
GOLETA–SANTA BARBARA
SHORT RUN AVERAGE TOTAL COST CURVES
CURRENT MARKET VALUE
LIMITED LEASING

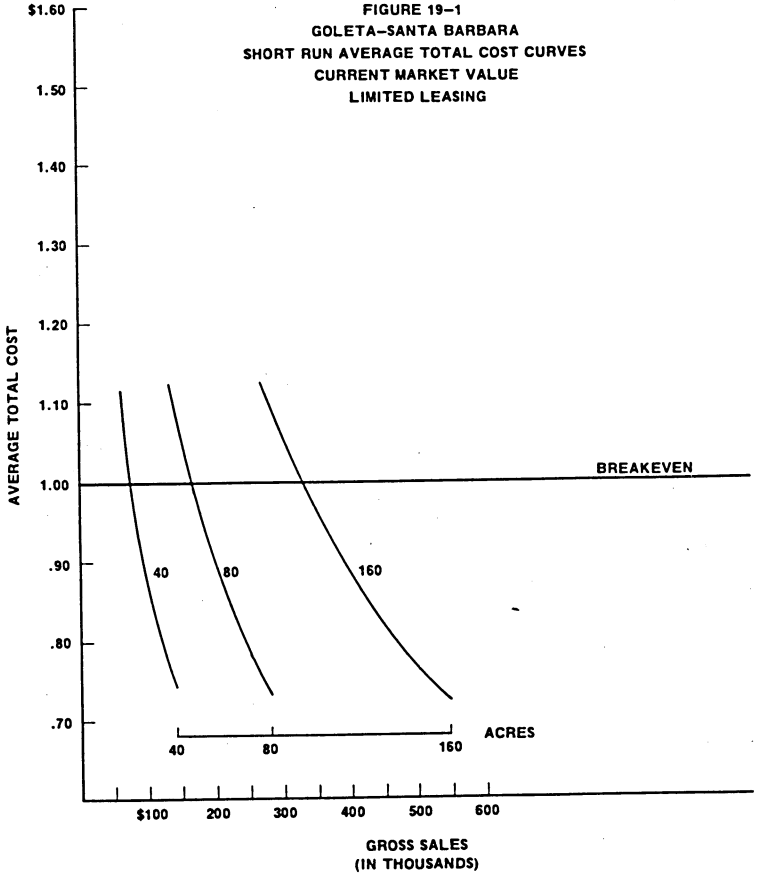
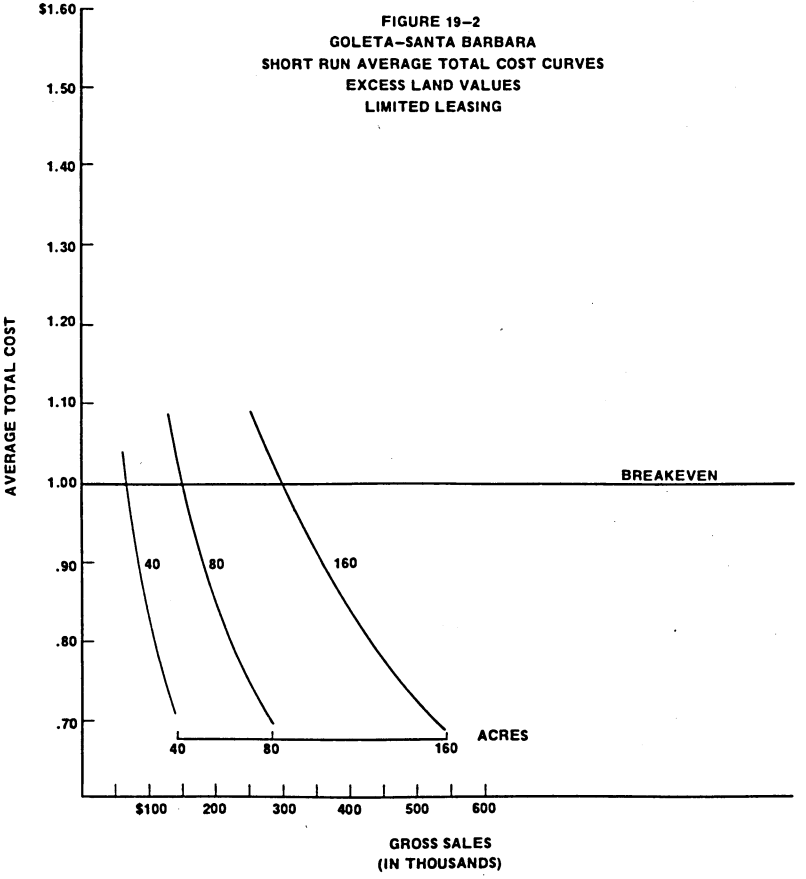


FIGURE 19–2
GOLETA–SANTA BARBARA
SHORT RUN AVERAGE TOTAL COST CURVES
EXCESS LAND VALUES
LIMITED LEASING



PRICE, YIELD AND INCOME VARIABILITY

A time series of average prices and yields was developed for avocados and citrus. The variability of price, yield and gross income (P x Q) was estimated using Tintner's Variate Difference Method. The standard deviations (square root of the variance) of these results are presented in Table 19-9.

Table 19-9

Standard Deviations of Yield, Price and Gross Income Goleta Water District

Crop	Yield	Price	Gross Income Per Acre
Avocados	1.771 ton	$14.024/ton	$614.86
Lemons & Limes	43.335 cwt.	3.886/cwt.	311.49

The results of the above calculations indicate the high risk involved in growing sub-tropical fruit. While the farm budgets indicate a significant expected net farm return, the variability of this return is quite high.

To give an indication of the magnitude of this risk, the data in Table 19-9 were combined with the results of the economies of size work. Total costs were divided by plus and minus one standard deviation of gross sales and plotted about the LRAC in Figure 19-4. The LRAC would be expected to fluctuate within this range about two-thirds of the time.

DEMAND FOR IRRIGATION WATER

Derived demand for water in the Goleta District depends on the profitability of tree fruit, cost of water, the consumptive use of water and the application efficiency of irrigation methods. In farm budgets for Goleta, avocados were assumed to be the only crop grown. Drip irrigation was also assumed because most new plantings have installed this technology.

Figure 19-5 presents graphically the results of the demand analysis. The vertical dashed line in the graph depicts the historic delivery per acre of 1.84 acre feet. An asterisk located on the dashed line represents the 1978 average cost per acre foot of $59.00. For comparison, the BOR full-cost price was estimated at $263.00 per acre foot. A solid line was drawn to represent the quantity of water per acre expected to be taken as the price/cost of water is increased from $0 to $100 per acre foot. The solid line (demand curve) is vertical at 1.55 acre feet per acre indicating that no change would occur in the quantity demanded regardless of the price charged up to $100 per acre foot.

Impact of increasing water costs on farm income is shown graphically in Figure 19-6. The solid negatively sloped lines are the net returns over variable costs, including water, as water cost is increased for each farm size. The horizontal dashed lines indicate the level of farm fixed costs for each farm size. The point where the two lines intersect, such as the 40 acre farm in the figure, represents the water cost which provides a zero net farm income. A vertical line from this intersection to the base of the graph locates the maximum ability to pay for water. In this district the maximum ability to pay for the 40 acre farm was $80 per acre foot. Ability to pay on the two larger farms exceed this $80 figure and thus the difference between the two lines represents the margin of profit.

OFF-FARM INCOME

Off-farm income contributes to two important objectives to farm operators, especially small farm operators. First, it provides for fuller utilization of under-employed labor and machinery resources and second, stabilizes family income in poor crop years which in turn increases the probability of obtaining farm credit.

No primary survey information was collected in this study on off-farm income; however, the U.S. Census of Agriculture of 1974 provides county data on this important variable.

The Census of Agriculture for Santa Barbara County, California reports 886 farms with gross agricultural sales of $2,500 or more. Table 19-10 shows the number of these farms reporting agriculturally related off-farm work.

FIGURE 19–3
GOLETA–SANTA BARBARA
LONG RUN PLANNING COST CURVES
LIMITED LEASING

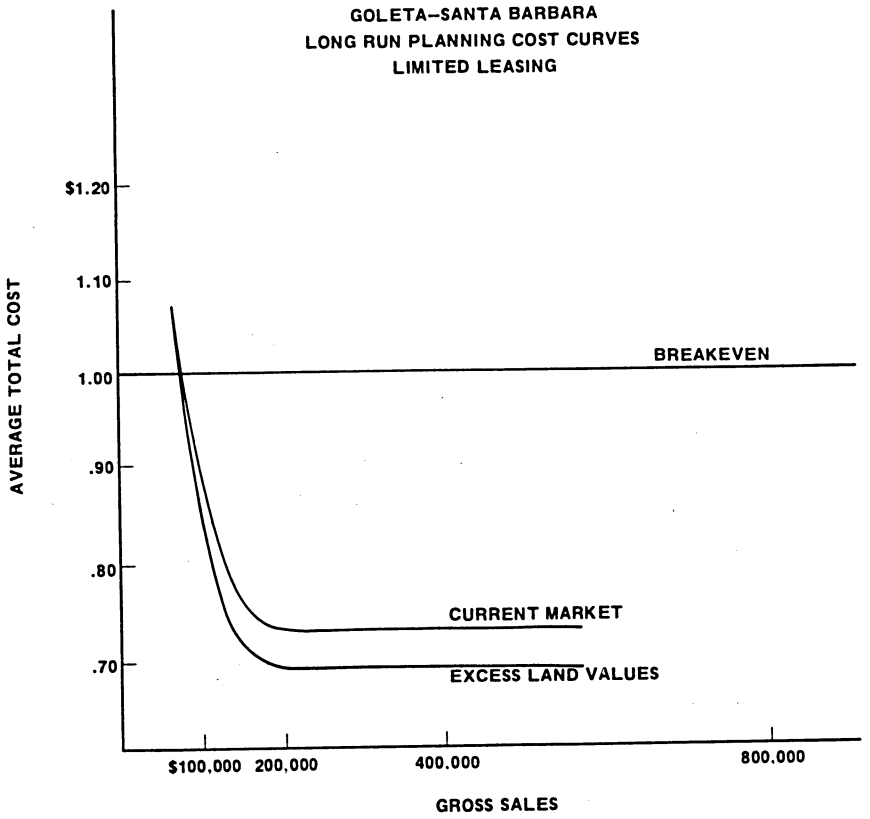


FIGURE 19–4
GOLETA
LONG RUN PLANNING COST CURVES
EXCESS LAND VALUE
ADJUSTED BY RISK

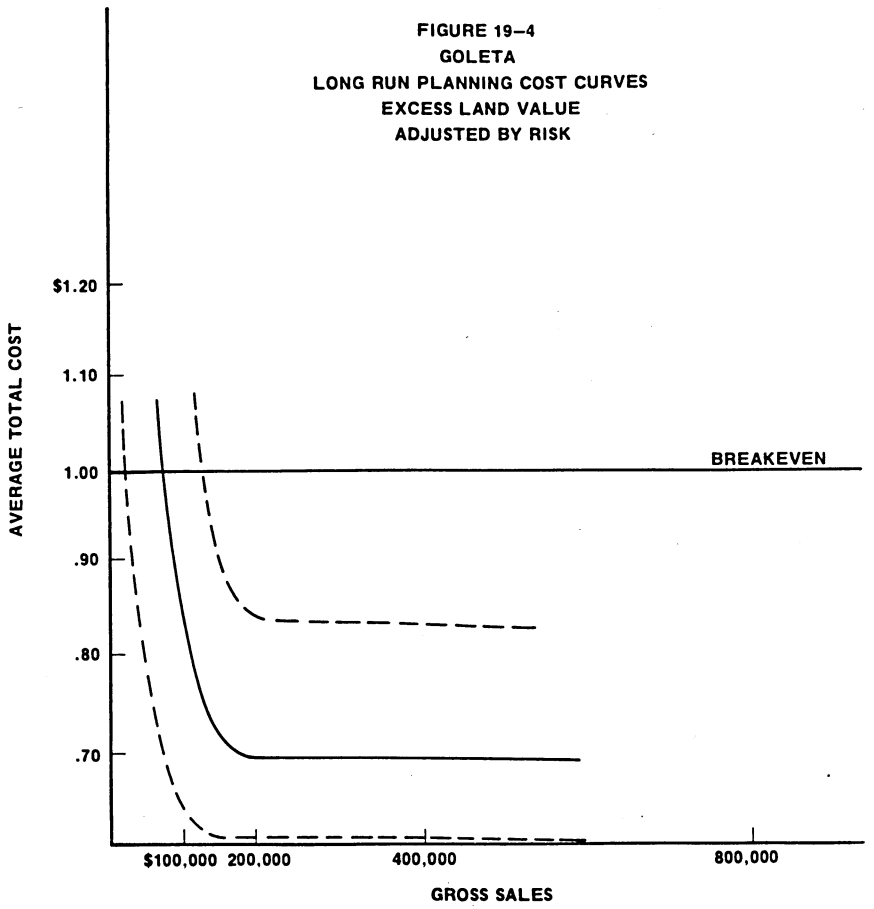


FIGURE 19–5
DEMAND FOR IRRIGATION WATER
GOLETA

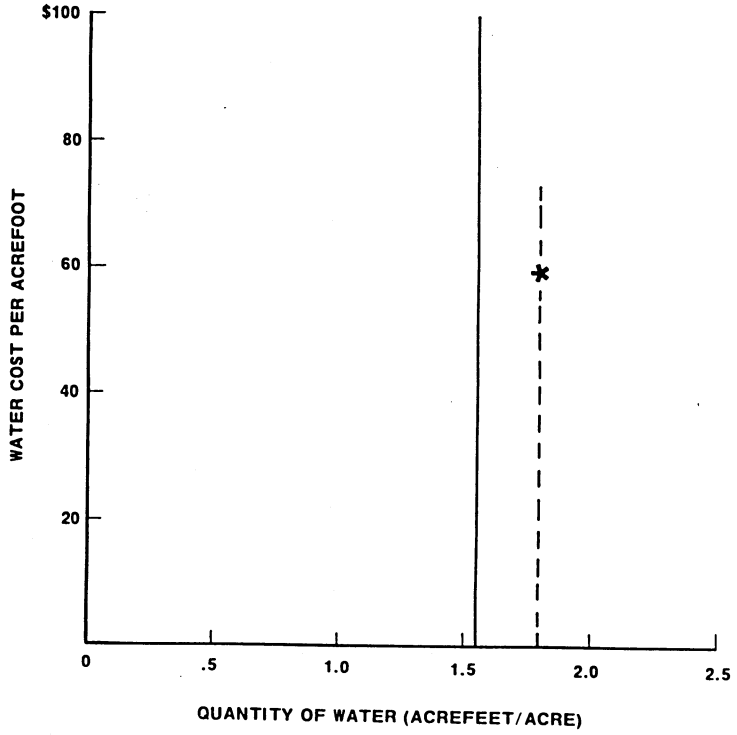


FIGURE 19–6
ABILITY TO PAY FOR IRRIGATION WATER
GOLETA

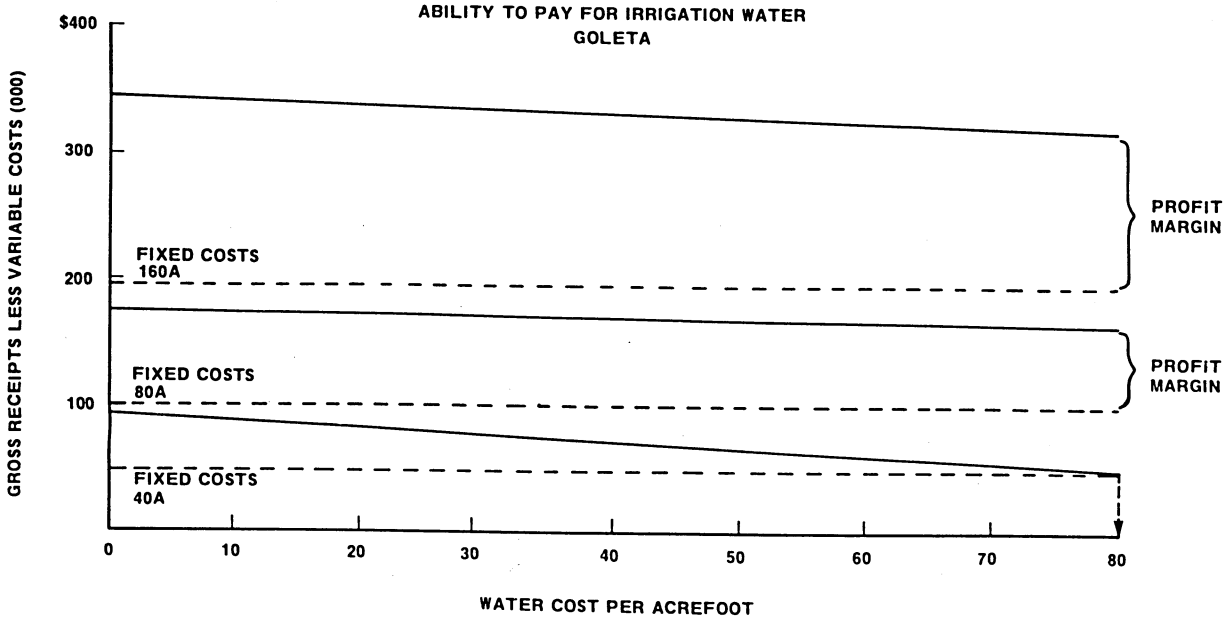


Table 19-10

Farm Operators Reporting Days Work Off-Farm

None	365
1 - 49 days	42
50 - 99 days	17
100 - 149 days	26
150 - 199 days	27
200 days or more	184
Total	661

Income and expenses related to selected off-farm income sources are shown in Table 19-11.

Table 19-11

Operator Income From Farm Related Sources, Santa Barbara

Number of Farms Reporting	164
Average Per Farm Reporting	$1,681
Income From Custom Work	
Number of Farms Reporting	63
Average Per Farm Reporting	$ 630
Expenses Related to Off-Farm Income	
Number of Farms Reporting	63
Average Per Farm Reporting	$ 371

Farm operators' spouses and their children also contribute to family income from both agriculturally and nonagriculturally related sources. In Santa Barbara County, 471 farms reported an average family off-farm income of $11,218 in 1974. No information is available on off-farm work and income by size of farm.

BIBLIOGRAPHY

Seckler, David and Robert A. Young, "Economic and Policy Implications of the 160 Acre Limitation in Federal Reclamation Law," AJAE, Vol. 60, No. 4., November, 1978, p. 575-588.

Water and Power Resources Agency, "Acreage Limitation, Draft Environmental Impact Statement," USDI, January, 1981.

U.S. Department of the Interior, "Acreage Limitations, Reclamation Rules and Regulations," Federal Register, August 25, 1977, Part IV.