IRRIGATION
and Its Effect on the Community

By
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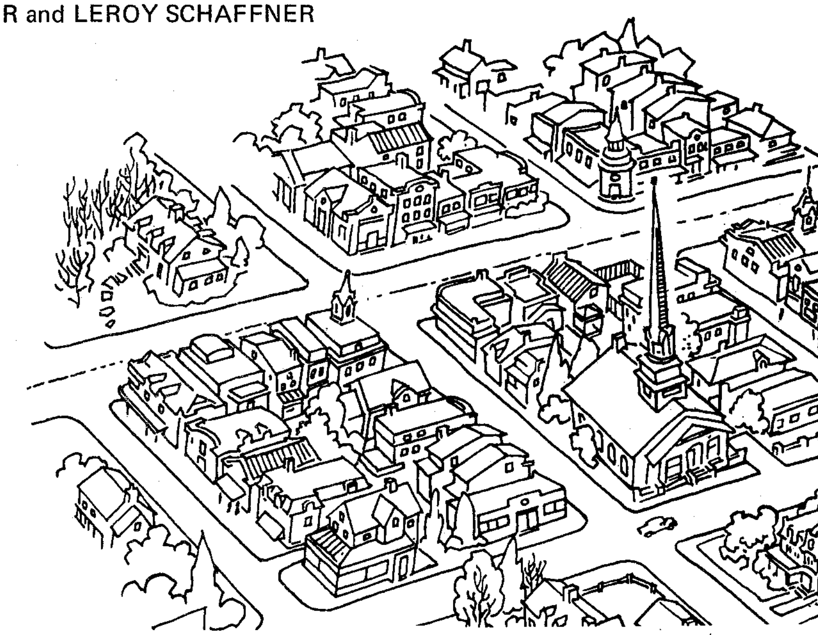

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FOREWORD

Irrigation by private development has been increasing in North Dakota and will continue in the future. The question many ask is what effect does this type of development have on the surrounding business community? Capital for the purchase of the irrigation system and the increased income and expenditures of an irrigation-type agriculture are spent largely in the local community.

This study was undertaken to determine the effect on the business community in southwest central North Dakota of irrigation development. The work was done cooperatively by the Agricultural Economics Departments of the Agricultural Experiment Station and the Cooperative Extension Service, North Dakota State University. It is hoped this report will serve as a useful guide in estimating the effects on a community resulting from irrigation development.

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HIGHLIGHTS

The primary purpose of this report was to estimate the economic impact of irrigation development on the business community in south central North Dakota. The area includes the ten counties in State Region 7, which is located in south central North Dakota. In 1973 there were 19,864 acres irrigated. This was about one-half of one percent of the total cropland acres. More irrigation is being developed each year.

To facilitate expanding the results to larger areas, a single acre was used as the unit of analysis. The change in economic activity after irrigation was evaluated using input-output analysis. Wheat was used to represent the dryland cash crops and corn grain for the irrigated cash crops. The market value was used for the feed and forage crops since it was difficult to include livestock in this type of analysis.

Irrigating an acre resulted in an increase in on-farm expenditures and income of $105.73, compared to dryland. The estimated additional off-farm business volume generated by the multiplier process in the ten-county area was $215.25. In other words, each dollar of added on-farm expenditure and income increased gross business volume by about $2.04 in the area business community.

By applying these results to the existing irrigated acreage, approximately 4.3 million dollars in gross business volume has been generated. There are problems in generalizing in this way because it was necessary to assume that the input-output data used in the budgets were relevant for the period over which irrigation development has occurred. As a result, the conclusions might not be comparable with many of the irrigators' returns who invested in irrigation in a different time period or who have a different crop mix from that used in this report.

If we look only at the coincident location of irrigable soils underlain by ground water, a large physical potential exists for expanding irrigation in the ten-county area. However, much additional work is necessary before an accurate assessment of the physical potential for expanding irrigation from ground water can be made. This additional work includes completing ground water surveys and determining the level of withdrawal that can be sustained by aquifer recharge.

Expansion in off-farm economic activity is based on the assumption that it is profitable for individual farmers to irrigate. Using the crop mix and budgets assumed in this study, the return to capital and management was 7.5 percent. It should be pointed out that this is not a study of the on-farm economic impact of irrigation. The costs and returns achieved by individual irrigators will depend on their unique circumstances.

THE ECONOMIC IMPACT OF IRRIGATION FROM GROUND WATER IN SOUTH CENTRAL NORTH DAKOTA: AN INTERINDUSTRY ANALYSIS

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INTRODUCTION

Irrigation provides an opportunity to stabilize as well as intensify agricultural production. As a supplement to uncertain rainfall, irrigation reduces one of the risks in farming. Irrigation also makes possible a new diversity in farming enterprises and increases production per acre. The higher production under irrigation requires more fertilizer, seed, chemicals and other farm inputs. Hence, irrigation means expanded economic activity for farm supply and other businesses providing goods and services essential to agriculture.

Assessment of the net economic impact of irrigation development is complex and requires the tracing of many interdependent interindustry transactions. Interdependence arises from the fact that each economic sector buys the outputs of other sectors as its inputs or raw materials. For example, farmers buy production inputs such as machinery, fuel, fertilizer and chemicals from the retail sector. Retailers, in turn, require financial services and the services of public utilities. The economic results of this process of spending and respending from irrigation development is a change in economic activity that exceeds the initial on-farm expenditures.

This study outlines changes in economic activity from existing and potential irrigation in a ten-county area in south central North Dakota. The area corresponds to North Dakota State Region 7, which is the same area as the Lewis and Clark Resource Conservation and Development area.[1] The major trade center in Region 7 is Bismarck-Mandan.

A rather large area (13,992 square miles) is studied because it is extremely difficult to estimate the economic impact of irrigation development on a specific town or other small governmental unit with any degree of reliability. Reliability increases with the size of area because more of all initiated economic activity will take place within the area. While this study focuses on ground water irrigation, the economic implications will be similar to those from surface water irrigation after adjustments for relevant public sector costs. The concern of this paper is with the distribution of economic activity associated with increased gross farm income and, of course, the implications for the farm household sector itself.

IMPACT ANALYSIS

This section outlines the costs and impacts of irrigating one acre and

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[1]See Appendix Figure 1 for map of the study area.

traces the steps through the impact analysis. Generalization will be possible by simply expanding the results to the relevant number of acres.

The initial step in the analysis involved specifying how added irrigation will affect the mix of crops produced. The present dryland crop mix can be approximated by using North Dakota Crop Statistics on past land use. The post irrigation crop mix can be estimated by reference to existing crop irrigation within the study area. These crop mix estimates are shown in Table 1.

Table 1. Assumed Crop Mix Under Dryland and Irrigation

Crop	Percent Distribution of Crops Dryland	Irrigation
Alfalfa	17	70
Corn Silage	3	12
Corn Grain		18
Wheat Fallow	29	
Wheat Non-fallow	22	
Summer Fallow	29	
Total	100	100

The next step is to estimate the economic change after irrigation by economic sector. For purposes of analysis, the crop mix change will be applied to a single composite acre. The composite acre before and after irrigation will have the percent distribution of crops shown in Table 1.[2]

Budgets were developed for each of the crops and then the changes in expenditures and farm income were summarized.[3] Table 2 shows the economic sectors and the corresponding expense or income item accruing to each. The

Table 2. Affected Economic Sectors

Sector No.	Sector Name	Corresponding Expense or Income Item
5	Communications and Utilities	Electric power
7	Retail	Irrigation equipment, fertilizer, seed, weed and insect control, fuel, lubricants, machine and irrigation equipment repair
8	Finance, Insurance, Real Estate	Operating capital charge, interest and insurance on irrigation equipment, crop insurance
11	Households	Operator labor and net farm income

[2]This is based on currently irrigated land in the area. In the future it is possible that specialty crops will replace some forage crop acres.

[3]For crop budgets see Appendix 2.

economic sectors in Table 2 are those in which the initial change in economic activity occurred.

The change in economic activity for one acre is shown in Table 3. Electric power necessary to pump water and drive the center pivot system will cost approximately $11.20. Additional inputs necessary to achieve higher crop yields will cost $65.81 and be provided by the retail sector. Insurance and financial services required will cost $21.83. Additional income in the form of wage payments and net farm income accrue to the household sector. The total initial impact of a change from the crop mix shown in Table 1 is $105.73.

Table 3. Change in Composite Acre Costs/Returns by Economic Sector Due to Irrigation Development[a]

Sector No. & Name / Income & Expenditures	(5) Com. & Util.	(7) Retail	(8) Fin., Ins., Real Est.	(11) Household[b]	Total
	dollars				
Dryland farming	-	11.37	1.37	33.04	45.78
Irrigated farming	11.20	65.81	21.83	52.67	151.51
Change in expenditures (dollars)	11.20	54.44	20.46	19.63	105.73

[a]See Appendix 3 for the calculation of these costs and Appendix 2 for crop budgets.

[b]See Appendix 4 for crop yields and prices used in calculating composite acre returns. The household sector receives a labor payment plus net returns after expenses.

Only changes in expenditures are relevant in the analysis. Expenditures for financing, repairing, etc. of farm machinery are not included since these expenditures are incurred for both dryland and irrigated farming and are not greatly different even though the crop mix is not the same. This is also true for land charges either as rent or the opportunity cost of ownership.

The expenditure changes in Table 3 represent only the first round of economic activity. Those receiving income from expenditures will in turn spend part of their increased income locally. This will further increase the business volume of those receiving this income and so on. The magnitude of these changes is reflected by multipliers shown in Table 4. The multipliers in Table 4 indicate that for each dollar of increased expenditures in the Communications and Utilities (number 5) sector, $2.13 will accrue (Gross Receipts Multiplier) to the business community (ten-county area). The same interpretation applies to the other original expenditures sectors. The distribution of impact is indicated by the column values. For example, of the $2.13 for each initial dollar spent, approximately 51 cents will accrue to farm and non-farm households.

Table 4. Business Volume Multipliers Used in Input-Output Model[a]

Sector to Which Increased Business Volume Accrues	Sector of Originial Expenditures			
	5	7	8	11
	Com. & Utilities	Retail Trade	Fin., Ins., Real Estate	Households
1. Ag.: Crop Production	0.0137	0.0666	0.0258	0.0291
2. Mining	0.0011	0.0008	0.0019	0.0028
3. Contract Construction	0.1748	0.0777	0.2458	0.3629
4. Transportation	0.0009	0.0043	0.0017	0.0020
5. Communications and Utilities	1.0611	0.0193	0.0478	0.0361
6. Ag. Processing and Wholesaling	0.0011	0.0043	0.0018	0.0020
7. Retail Trade	0.2310	1.1341	0.4393	0.4946
8. Finance, Insurance, and Real Estate	0.0739	0.0260	1.0917	0.0985
9. Business and Personal Services	0.0122	0.0086	0.0185	0.0243
10. Professional and Social Services	0.0108	0.0052	0.0199	0.0252
11. Households	0.5095	0.2481	0.8517	1.2639
12. Government	0.0417	0.0144	0.0379	0.0417
Gross Receipts Multiplier (Total)	2.1318	1.6097	2.7838	2.3831

[a]Source of coefficients: Unpublished data, Department of Agricultural Economics, North Dakota State University, 1973.

The net economic effect of irrigation is estimated by applying the coefficients in Table 4 to the change in expenditures shown in Table 3. The results are shown in Table 5.

Table 5 shows that the annual change in expenditures from irrigation development of $105.73 (Table 3) generated a gross business volume of $215.25 or a multiple of slightly more than two times the original expenditures. The distribution of the $215.25 to business sectors is indicated in the total column of Table 5. For example, the original change in expenditures ($105.73) generated $83.03 in the retail sector (row 7). Table 5 also indicates changes in area gross business volume that is associated with each expenditure change resulting from irrigation. For example, the increased payments to the communications and utilities sector of $11.20 (Table 3) generates $23.88 of increased business volume in that area (Table 5) and the increased expenditures to the retail trade sector of $54.44 (Table 3) results in a total increased business volume in all sectors of $87.63 (Table 5).

Table 5. Change in Business Volume by Sector Due to Irrigation Development on One Acre

Sector to Which Increased Business Volume Accrues	Sector of Original Expenditure 5 Com. & Utilities	7 Retail Trade	8 Fin., Ins., Real Estate	11 House-holds	Total
1. Ag.: Crop Production	.15	3.63	.53	.57	4.88
2. Mining	.01	.04	.04	.06	.15
3. Contract Construction	1.96	4.23	5.03	7.12	18.34
4. Transportation	.01	.24	.03	.04	.32
5. Communications and Utilities	11.88	1.05	.98	.71	14.62
6. Ag. Processing and Wholesaling	.01	.24	.04	.04	.33
7. Retail Trade	2.59	61.74	8.99	9.71	83.03
8. Finance, Insurance, and Real Estate	.83	1.42	22.34	1.93	26.52
9. Business and Personal Services	.14	.47	.38	.48	1.47
10. Professional and Social Services	.12	.28	.41	.49	1.30
11. Households	5.71	13.51	17.42	24.81	61.45
12. Government	.47	.78	.77	.82	2.84
Total	23.88	87.63	56.96	46.78	215.25

The previous analysis deals with the change in economic activity resulting from irrigating one acre assumed to be representative of irrigable land in the ten-county area. In practice, irrigation means increments of 132 acres for center pivot systems. An expansion of the above analysis to 132 acres would imply that annual expenditures totaling $13,956 would result in a change in gross business volume of approximately $28,413.

This analysis can also be extended to estimate the economic impact associated with existing irrigation. Problems of generalization arise because it is necessary to assume that values used in the budgets, crop yields and prices are relevant for the period over which irrigation development has occurred. The resulting estimate will be an overstatement because current prices and costs are considerably higher than historical prices and costs. With these qualifications in mind, the economic impact of the ten-county area attributable to current irrigation development can be estimated. The total number of acres irrigated in the area is shown in Table 6.

Multiplying the 19,864 acres irrigated in 1973 by $215.25 (Table 5) results in an estimated change in gross business volume of approximately 4.3 million dollars. Noting the qualifications in the last paragraph, this change in gross business volume can be attributed to irrigation now in operation.

Table 6. Acres Irrigated and Irrigation Potential in North Dakota Region 7

County	1973[a] Irrigated Acres	Acres of[b] Irrigable Soils	Acres of Irrigable Soils[b] Underlain by Aquifers
Emmons	915	279,040	N/A
Sioux	480	36,576	N/A
Grant	1,836	279,264	N/A
Morton	2,850	77,600	N/A
Burleigh	5,820	213,344	139,424
Kidder	2,574	407,180	348,300
Oliver	1,755	56,928	18,944
Mercer	1,710	122,944	28,160
McLean	1,924	141,920	69,408
Sheridan	0	60,640	N/A
Total	19,864	1,675,436	604,236

[a]Source: Sidney Black, formerly Agricultural Engineering Specialist in irrigation at North Dakota State University.

[b]Source: Duncan R. Warren, Project Director; Lewis and Clark Resource Conservation and Development Project, Mandan, North Dakota, June, 1974.

PHYSICAL POTENTIAL FOR IRRIGATION

The physical potential for the expansion of irrigation from ground water is a function of the coincident location of irrigable soils and the availability of suitable ground water supplies. Soil surveys outlining irrigable soils are available for all ten counties. These data are summarized in Table 6. Ground water surveys are completed for only about half of the counties. Combining this information, it is possible to at least estimate the acreage potentially feasible for irrigation.

A few qualifiers are in order prior to discussing numerical acreage estimates. First, some land that does not satisfy the definition of what is suitable for irrigation has, at least in the short run, been successfully irrigated.[4] Hence, the irrigation potential may exceed these figures. Secondly, the irrigable acres underlain by ground water may not all be feasible for ground water irrigation. No qualification has been made about the accessibility and capacity of these aquifers for irrigation.[5]

Approximately 64 percent of the irrigable soils are underlain with ground water in the five counties that have completed water surveys. This amounts to approximately 604 thousand acres. If all these acres can be irrigated and

[4]The definition of what soils are suitable for irrigation is available from the Soil Conservation Service, USDA.

[5]A site by site evaluation can be made by Milton Lindvig of the State Water Commission, Bismarck, North Dakota.

current irrigated acreage is included in this total, then only 2 percent of potential is now being irrigated.

For the five counties without completed ground water surveys, it is very difficult to even estimate physical potential for irrigation. The acreage of irrigable soils (733,120 acres) could, however, be considered an extreme upper limit.

Ground water surveys for the remaining five counties are underway or at least in the planning process. After these surveys are available, a more complete assessment of the irrigation potential will be possible. However, it is reasonably safe to say that only a small percentage of the irrigation potential has been tapped in the ten-county area.

PROFITABILITY AND OTHER CONSIDERATIONS

For irrigation development to occur, farm firms must find irrigation profitable relative to alternative uses for capital and management. As indicated in Table 3, irrigating an acre will add $19.63 to farm household income. Of this $2.76 is for the added labor required under irrigation (1.2 hours at $2.30). Subtracting this wage payment yields the change in return to management of $16.87 per acre. The return to capital and management can be estimated by adding back in interest payments for the irrigation investment and for added operating capital, both are charged at 9 percent. The total of these two interest charges is $16.96 per acre. The returns to management and capital is then $33.84 per acre. The rate of return to management and capital is calculated below.

The principle involved is to find the discount rate that equates the present value of the expected income stream with the inital investment outlay. The income stream is $33.84 per acre per year. The per acre investment is $39,500[6]/132 acres or $299.

Assuming a useful life of 15 years for the irrigation system, a discount rate of approximately 7.5 percent will equate the income stream with the initial investment.[7] This 7.5 percent is the rate of return offered by the irrigation investment. The rate of return is the interest rate equivalent to the income the irrigation investment will yield in addition to returning the original capital. This rate of return on an investment in irrigation must be compared to alternative uses of capital and management resources.

Profitability, while very important, is not the only consideration in investment decisions. If irrigation stabilized production, it could increase debt serviceability even if the rate of profit was not significantly improved.

In addition to profitability, the relative labor requirements of dryland and irrigated farming must be considered. Labor requirements for irrigation, given the assumed crop mix, are approximately 75 percent greater than those for dryland farming. The composite acre labor calculations are shown in Table 7.

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[6]See Appendix Table 8 for irrigation systems cost.

[7]It should be pointed out that a higher level of management is required to achieve desired crop yields with irrigation than with dryland farming.

Table 7. Composite Acre Labor Requirements in Hours by Crops for Irrigation and Dryland[a]

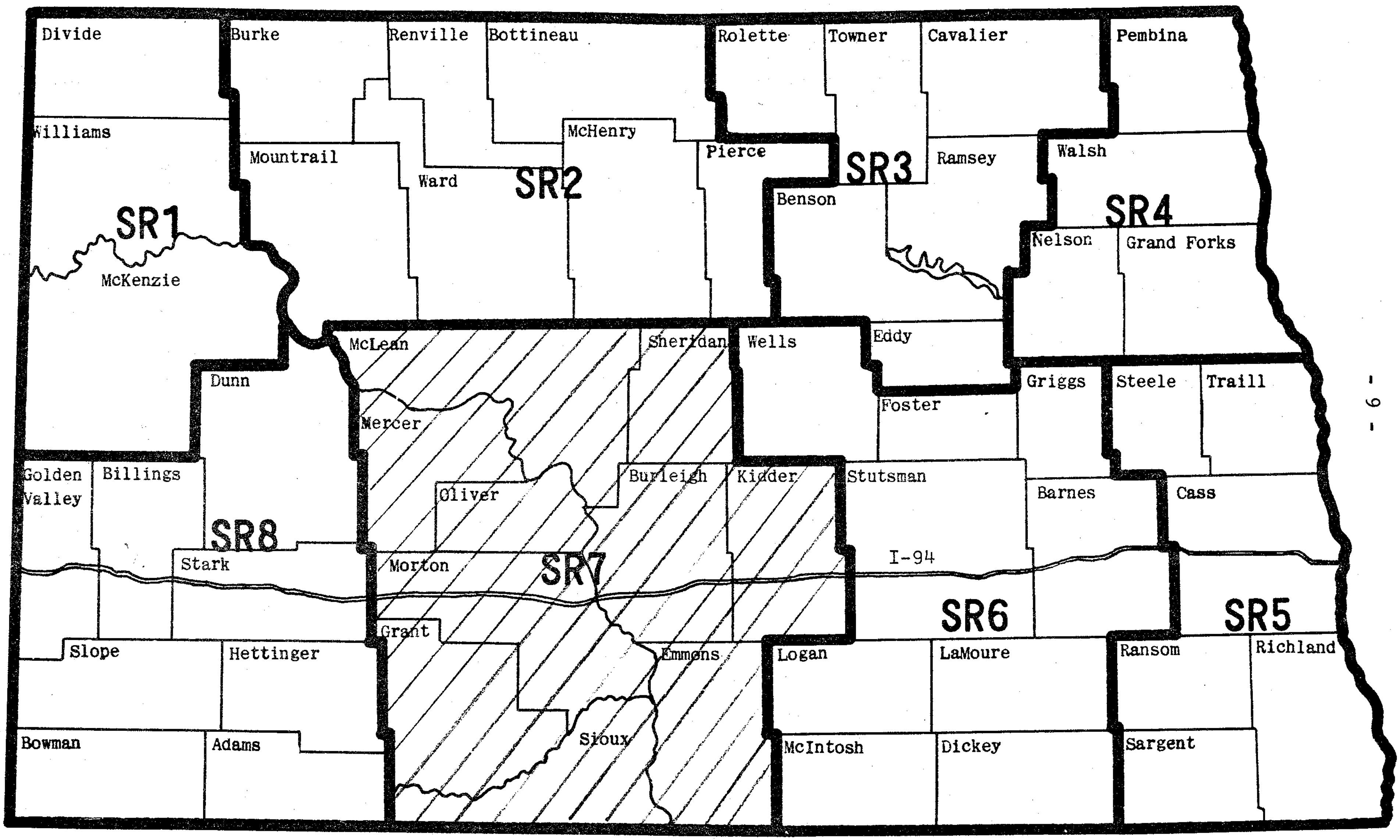
Irrigation	Alfalfa	Corn Silage	Cash Crops[b]	Summer Fallow	Total
Labor requirements	2.60	4.50	2.40		
Percent of composite acre	70.00	12.00	18.00		
Composite labor requirements	1.82	.54	.43		2.80
Dryland					
Labor requirements	1.00	3.20	2.10	.90	
Percent of composite acre	17.00	3.00	51.00	29.00	
Composite labor requirements	.17	.10	1.07	.26	1.60

[a]Labor costs differences are included in the budget comparison between dryland and irrigated farming, but this does not illustrate the need for additional labor hours.

[b]Corn grain was used for the cash crop with irrigation and wheat for dryland.

On 132 acres the added labor requirements will be 158 hours. In addition to added labor requirements, extensive irrigation will mean a basic change in agriculture. Because of the short growing season, at least in the northern part of the study area, irrigation implies forage production. Hence, a shift will be made from a predominantly cash grain agriculture to a forage producing agriculture. The value of forage crops is based on their use as livestock feeds. The demand for forage crops is derived from the demand for red meat and milk. Hence, irrigation development is keyed to the demand for livestock and livestock products. Additional livestock production will necessitate investments in breeding stock, buildings and equipment. This investment will be in addition to the basic irrigation system itself.

It should be pointed out that this is not a study of the farm management implications of irrigation. It is a study of the regional economic impacts of expanding irrigation in west central North Dakota. Of course, some assumptions must be made about the costs and returns of irrigation for a representative farm to estimate regional economic impacts. The costs and returns achieved by individual irrigators will depend on their unique circumstances including such things as the crops grown and the management ability of the farm operator.



Appendix Figure 1. The area cross hatched (SR7) is the subject of this study.

Appendix Table 1

ALFALFA: 1974 ESTIMATED DIRECT COSTS AND PHYSICAL INPUTS FOR DRYLAND AND SPRINKLER IRRIGATION[a]

Item	Dryland	Irrigated
Yield in tons	1.50	5.00
Direct Production Costs		
Fuel and lubricants	.84	2.16
Machine repair	.42	1.08
Fertilizer	8.20	19.10
Weed and insect control	.88	1.25
Seed ($1.60/lb., 4 years)	3.20	4.80
Labor	2.30	5.90
Electric power for irrigation		10.87
Repairs for irrigation system		3.00
Capital charge @ 9% on operating capital	.71	2.12
Total direct production costs	$16.55	$50.28

Physical Input Data

	Dryland	Irrigation
Fuel		
Diesel	2.03 gals. @ 36¢	5.22 gals. @ 36¢
Fertilizer		
P_2O_5	40 lbs. @ 16¢	80 lbs. @ 16¢
K_2O	20 lbs. @ 9¢	70 lbs. @ 9¢
Chemical	.3 lbs., 2, 4DB @ $3.07/lb.	.4 lb., 2, 4DB @ $3.07/lb.
Seed (4 years)	2 lbs. @ $1.60/lb.	3 lbs. @ $1.60/lb.
Labor	1 hour	2.57 hours
Interest	9% for six months	Same

[a]Data assembled by LeRoy Schaffner, Department of Agricultural Economics, North Dakota State University.

Appendix Table 2

CORN SILAGE: 1974 ESTIMATED DIRECT COSTS AND PHYSICAL INPUTS FOR DRYLAND AND SPRINKLER IRRIGATION[a]

Item	Dryland	Irrigated
Yield in tons	6.5	17
Direct Production Costs		
Fuel and lubricants	2.45	3.30
Machine repair	6.05	6.95
Fertilizer	13.60	57.60
Weed and insect control	1.65	1.65
Seed	4.00	6.50
Labor	7.35	10.50
Crop Insurance	1.10	3.56
Electric power for irrigation		11.98
Repairs for irrigation system		3.00
Capital charge at 9%	1.63	4.63
Total direct production costs	$37.83	$109.67

Physical Input Data

	Dryland	Irrigation
Fuel		
Gasoline	0.5 gals. @ 37¢	1.5 gals. @ 37¢
Diesel	6.3 gals. @ 36¢	7.6 gals. @ 36¢
Fertilizer		
Nitrogen	40 lbs. @ 18¢	120 lbs. @ 18¢
P_2O_5	40 lbs. @ 16¢	225 lbs. @ 16¢
Chemical		
Atrazine	2½ lbs. @ $2.50/lb.	2½ lbs. @ $2.50/lb.
Lindane (wireworm)	½ oz./bu. @ $1.50/lb.	Same
Turdan (rootworm)	3/4 lb./acre @ 44¢/lb.	Same
Seed	16,000 viable kernels/A.	26,000 viable kernels/A.
Labor	3.2 hours	4.6 hours
Interest	9% on operating capital for six months	

[a]Data assembled by LeRoy Schaffner, Department of Agricultural Economics, North Dakota State University.

Appendix Table 3

CORN GRAIN: 1974 ESTIMATED DIRECT COSTS AND PHYSICAL INPUTS FOR DRYLAND AND SPRINKLER IRRIGATION[a]

Item	Dryland	Irrigated
Yield in bushels	35	90[b]
Direct Production Costs		
Fuel and lubricants	2.25	2.60
Machine repair	6.05	6.95
Fertilizer	13.60	57.60
Weed and insect control	1.65	1.65
Seed	5.10	8.30
Labor	4.90	5.45
Crop Insurance	2.25	3.55
Electric power for irrigation		11.98
Repairs for irrigation system		3.00
Capital charge @ 9% for 6 months	1.61	4.45
Total direct production costs	$37.41	$105.53

Physical Input Data

	Dryland	Irrigation
Fuel		
Gasoline	0.4 gal. @ 37¢	0.5 gal. @ 37¢
Diesel	5.8 gals. @ 36¢	6.7 gals. @ 36¢
Fertilizer		
Nitrogen	40 lbs. @ 18¢	120 lbs. @ 18¢
P_2O_5	40 lbs. @ 16¢	225 lbs. @ 16¢
Chemical		
Atrazine	2½ lbs. @ $2.50	Same
Lindane (wireworm)	½ oz./bu. @ $1.50/bu.	Same
Turdan (rootworm)	3/4 lb./A. @ 44¢/lb.	Same
Seed	16,000 viable kernels/A.	26,000 viable kernels/A.
Labor	2.13 hours	2.37 hours
Interest	9% on operating capital for six months	

[a]Data assembled by LeRoy Schaffner, Dept. of Agricultural Economics, NDSU.

[b]This yield assumes that corn will be produced only south of Interstate 94.

Appendix Table 4

WHEAT YIELDS AND PRODUCTION COSTS FOR SOUTHWEST CENTRAL NORTH DAKOTA, INCLUDING SHERIDAN, BURLEIGH, KIDDER, EMMONS, LOGAN AND McINTOSH COUNTIES, MARCH 1974

	Wheat on Fallow	Wheat on Nonfallow
Projected yields	25	18
Direct Costs		
Seed	7.06	7.06
Fertilizer	2.46	2.24
Chemicals	.38	.38
Machinery repairs	2.70	2.00
Fuel and lubricants	3.74	2.54
Interest on operating capital	.69	.60
Crop Insurance	1.63	1.63
Custom costs	.71	.72
Labor ($2.30 per hour)	6.90	4.81
Total direct costs	26.27	21.98

Appendix Table 5

COMPOSITE ACRE COSTS OF IRRIGATION BY ECONOMIC SECTOR

Economic Sector		Crop			Composite Acre Cost[a]
		Corn Silage	Corn Grain	Alfalfa	
Com. & Util.	6	$11.98	$11.98	$10.87	$11.20
Retail	8	98.94	100.04	51.33	65.81[b]
Fin., Ins. Real Estate	9	26.11	25.92	20.04	21.83
Household	12[c]	10.50	5.45	5.90	6.37[d]
					$105.21
Rotation (% distribution)		12	18	70	100

[a]The composite acre cost by sector is obtained by multiplying the sector cost by the crop distribution and adding across.

[b]Includes $19.94 charge for depreciation of the irrigation system.

[c]Only labor costs are included in this sector.

[d]The balance of the household sector income shown in text Table 4 represents the return to management.

Appendix Table 6 COMPOSITE ACRE COSTS OF DRYLAND FARMING BY ECONOMIC SECTOR

Economic Sector		Crop					
		Corn Silage	Wheat-Fallow	Wheat Non-Fallow	Alfalfa	Summer Fallow	Composite Acre Cost
Retail	8	27.75	14.94	14.94	13.54	2.11	11.37
Fin., Ins. Real Est.	9	2.73	2.23	2.23	.71	.09	1.37
Household	12[a]	7.35	4.81	4.81	2.30	2.09	3.67
							$16.41
ROTATION (% Distribution)		3	29	22	17	29	

[a]Only labor costs are included in the household sector.

Appendix Table 7. COMPOSITE ACRE RETURNS FOR DRYLAND AND IRRIGATED PRODUCTION

Practice		Alfalfa	Corn Silage	Corn Grain	Wheat Fallow	Wheat Nonfallow
Dryland:						
Yield per acre[a]		1.5	6.5		25.0	18.0
Value per unit[b]		$27.50	$12.00		$3.25	$3.25
Total value per acre		$41.25	$78.00		$58.50	$41.25
Percent distribution		17.0	3.0		29.0	22.0
Composite value per acre	$45.78					
Irrigation:						
Yield per acre[a]		5.0	17.0	90.0		
Value per unit[b]		$27.50	$12.00	$1.90		
Total value per acre		$137.50	$204.00	$171.00		
Percent distribution		70.0	12.0	18.0		
Composite value per acre	$151.51					

[a]Yield estimates by Don Patterson, Soils Department and LeRoy Schaffner, Agricultural Economics, NDSU.

[b]An average of prices received by North Dakota farmers for September 1974 and the previous 27 months.

Appendix Table 8

CENTER PIVOT IRRIGATION SYSTEM INVESTMENT AND ANNUAL FIXED COSTS

Fixed Investment		
Electric drive	$24,000	
Well - 125 ft. @ $50/ft.	6,000	
Pump and motor	7,500	
Pipe - 800 ft. @ $2.50/ft.	2,000	
	$39,500	
		per acre
Annual Fixed Costs		
Depreciation - 15 years straight line	$2,633	$19.94
Interest - 15 years @ 9%	2,267	17.17
Insurance	100	.75
	$5,000	$37.86

[a]Price estimates made by Sidney Black, May 1974.