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# Economics of Federal Irrigation Projects in the Missouri Basin

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## Recommended Citation

Nervik, O.; Kristjanson, K.; Schutz, W.; and Stangeland, S., "Economics of Federal Irrigation Projects in the Missouri Basin" (1954).  
*Agricultural Experiment Station Circulars*. Paper 107.

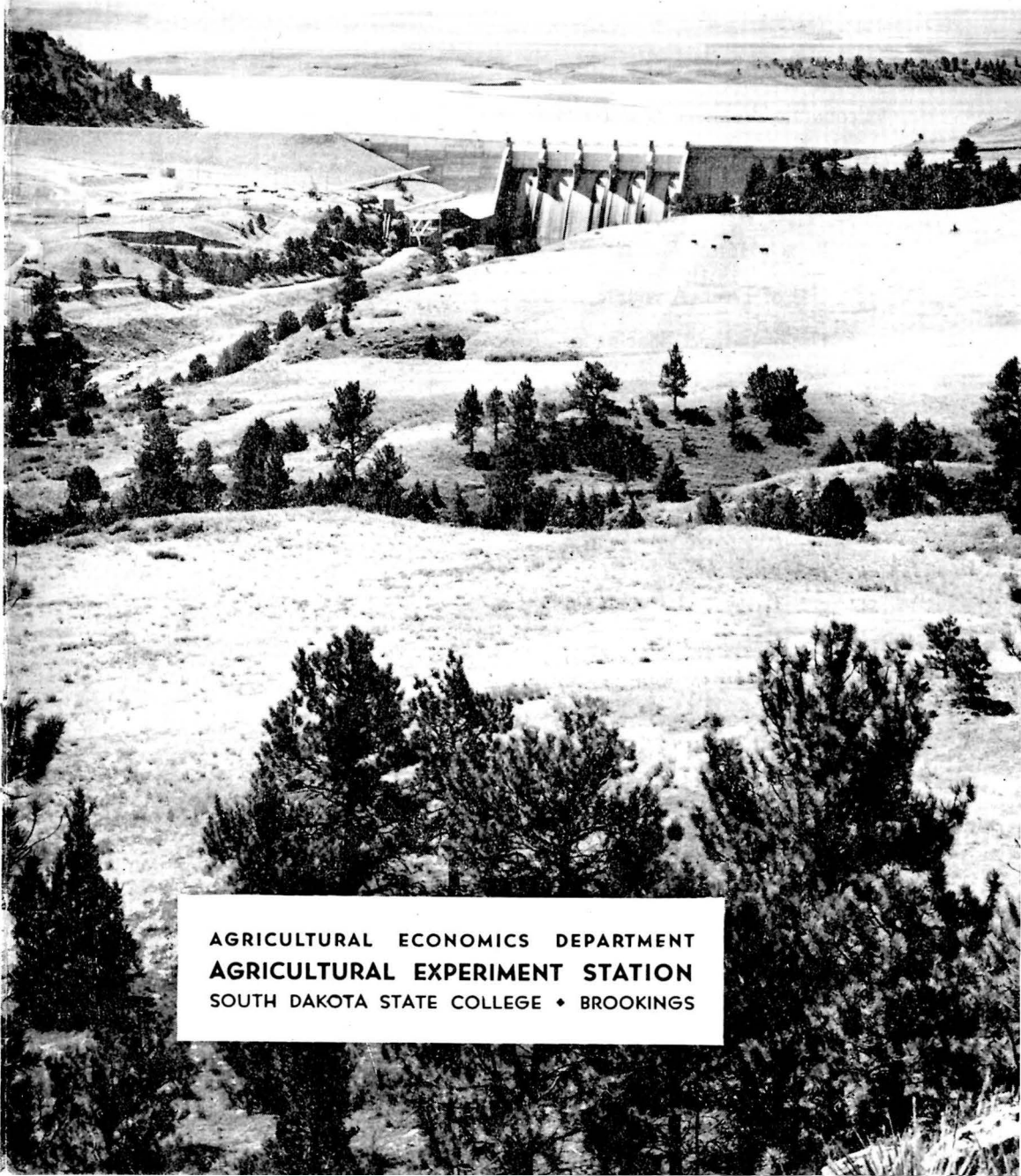
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# Federal Irrigation Projects in the Missouri Basin



AGRICULTURAL ECONOMICS DEPARTMENT  
AGRICULTURAL EXPERIMENT STATION  
SOUTH DAKOTA STATE COLLEGE • BROOKINGS

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The purpose of this report is to discuss the historical development of Federal irrigation projects, repayment experience, and the economic problems which emerge as Federal projects become more costly and move toward the subhumid areas of the Nation. Some of these problems include cost of construction, economic justification, allocation of cost, and repayment expectations.

# Economics of Federal Irrigation Projects in The Missouri Basin

● OTTAR NERVIK, KRIS KRISTJANSON, WILLARD SCHUTZ and SIGURD STANGELAND<sup>1</sup>

## Introduction

A GREATLY expanded Federal program for irrigation development is planned for the Missouri Basin. Under the Flood Control Act of 1944, nearly 5 million acres were proposed for irrigation; and in addition, about half a million acres under irrigation were to receive supplemental water.

Nearly one-half of the new irrigation planned was to be located in North and South Dakota. The Missouri-Souris Unit in North Dakota of more than a million acres and the Oahe Unit in South Dakota of three-quarter million acres are the two largest under consideration. Both units are receiving further study to determine the suitability of the soils for irrigation.

The irrigation facilities in the Missouri Basin would be built and financed largely by the Federal Government. Consequently, certain questions concerning evaluation, accounting of costs, allocations of costs to various purposes, repayments by beneficiaries and similar questions are of public interest. No less important are factors such as the suitability of soils for irrigation, adequacy of water supplies, repayment capacity and related farm problems. However, much less information has been available to the public on some of the over-all economic aspects of the proposed development, and these are the concern of this report. While it is recognized

that there are important benefits from irrigation, these are not taken up here because they have been discussed in other reports.

The study analyzes problems in irrigation development and in irrigation policy. Most of the data presented are from other publications. One of the more important of these is a recent report by the Missouri Basin Survey Commission. The Commission was established by Executive Order on January 3, 1952, to evaluate the Missouri Basin Program.<sup>2</sup>

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The authors wish to thank the many people who reviewed this report, particularly John Muchlbeier and Rex Helfinstine who provided valuable suggestions and comments. The authors, however, assume complete responsibility for the conclusions.

<sup>2</sup>"Missouri Land and Water." The Report of the Missouri Basin Survey Commission. Washington, D. C. 1953.

## Historical Development of Federal Irrigation Policy

AS THE POPULATION moved west and settlers entered the semi-arid and arid regions, it became more difficult for small farmers to establish themselves. In some localities, the first settlers were able to irrigate without expensive irrigation facilities. The amount of land which could be irrigated easily was limited, however, and later settlers had to construct more extensive irrigation works. Such works were often beyond individual means. Consequently, many irrigation works were constructed through cooperative action, or by private companies. Although a large number of settlers were able to obtain farms in this manner, there were still other irrigable areas in the public domain which could not be developed in this way. Sufficient private capital could not be attracted, due largely to poor repayment experience on earlier projects. It was felt, particularly in the West, that Federal aid was necessary to construct irrigation works.

More recently, after the public domain had been largely taken up, many Federal irrigation projects have been proposed for some of the more humid areas of the Plains and a few are now under construction. The largest under consideration are those in central North and South Dakota. Most of this land is in private ownership.

### Early Federal Irrigation Legislation<sup>3</sup>

The first Federal legislation relating to use of water from streams was the Act of 1866, as amended, in which the Federal Government surrendered any control it might have had over the non-navigable streams of the arid region by reason of being the owner of the land. The next Act of Congress dealing with reclamation was the Desert Land Act in 1877 which granted 640 acres of arid land (reduced to 320 in 1890) to an individual

willing to develop the land. The homesteader was required to conduct water to the land, pay \$1.25 per acre, expend at least \$3.00 per acre in improvements and actually reclaim at least an eighth of the land. The Act proved useful but had the disadvantage that the land could not be made security for irrigation loans.

In another Act, October 2, 1888, Congress provided for surveys to determine the extent to which lands of the arid West could be reclaimed by irrigation. Controversy arose, however, over the interpretation of a provision for reserving certain public lands from entry. The Department of the Interior interpreted this provision to mean that entries should not be permitted upon any part of the arid regions which might possibly come within the Act. Congress apparently felt that the Department of the Interior had interpreted the Act beyond the intent of Congress and subsequently repealed this law.

Next, Congress passed the Carey Act of 1894. It tried to remedy the weakness in the Desert Land Act by providing that the cost of irrigation could be made a lien on the land.

<sup>3</sup>For more detailed information see: Ray P. Teele, "The Economics of Land Reclamation," A. W. Shaw Company, Ltd., Chicago and N. Y., 1927; R. R. Renne, "Land Economics," Harper, N. Y., 1947; and Roy E. Huffman, "Irrigation Development and Public Water Policy," The Ronald Press, N. Y., 1953.

Under this Act, the Federal Government ceded a limited acreage to each state containing arid land on condition that the state provide for development. Very few Carey projects succeeded. Many reasons have been advanced for this. Among these are land speculation, inadequate water supply, poor engineering practices, lack of funds or credit, inadequate time for development, and no real need for more farm land at the time.

Public interest in irrigation grew. In 1890, a severe drought led to the formation of the National Irrigation Congress. In 1899, the National Irrigation Association was organized by railroad officials, businessmen, and others. This group later became the National Reclamation Association.

In 1902, Congress passed the Reclamation Act which provided for construction of irrigation works by the Federal Government with provision for repayment of construction costs by water users. Costs were not to include interest. The Reclamation Act established a fund for irrigation development from receipts from sale of public lands. The amount of land for which an owner could obtain water was limited to 160 acres. The settlers were to repay the cost of development within 10 years without interest on deferred payments. In 1914 the repayment period was extended to 20 years, and in 1926 to 40 years. In 1939, a development period of up to 10 years before the 40 annual payments began was authorized.

#### **Beginning of Federal Aid**

The Act of 1866 and the Desert Land Act of 1877 mentioned above, had the objective of removing ob-

stacles to irrigation, with the Federal Government carrying no part of the cost of development. The Carey Act of 1894 gave public land to the states for reclamation. The states, however, received very little for this land, probably no more than cost of administration. The Reclamation Act of 1902 represented a major change in policy. It committed the Government to a program of irrigation development. Public land within reclamation projects could be taken by settlers under the Homestead Act under the provisions stated above. The provision exempting settlers from interest charges placed an increased proportion of the cost of irrigation on the Government as the period of repayment was extended from 10 to 50 years.

#### **Financing Early Projects**

The Reclamation Act of 1902 provided for a reclamation fund. Only a limited amount of money became available for this purpose because of the decline in receipts from public lands and because the repayments by settlers were less than anticipated. Additional funds for irrigation development were made available under the Oil Leasing Act of 1920 which provided that 52.5 percent of the oil royalties from public lands were to be paid into the reclamation fund.

When income from this source also began to decline, an amendment to the Department of the Interior's 1939 Appropriation Act provided a new source of funds. This amendment made available 52.5 percent of all revenue received between 1920 and 1938 by the Treasury from lands within

naval oil reserves.

The same amendment also provided that power revenues, from power developed in connection with Federal irrigation projects be transferred to the reclamation fund. More recently the reclamation fund was abolished

because of problems associated with its administration and because it did not provide the funds needed for extensive development. Funds for Federal reclamation projects are now dependent upon annual congressional appropriations.

## Economic Problems of Public Interest

### Cost of Construction

THE COST of construction of early Federal reclamation projects in the Missouri Basin was estimated at less than \$40 per acre for even the most costly projects. The cost per irrigable acre proved to be higher. One reason for this was that construction costs often were underestimated. Equally important was the fact that the amounts of irrigable land on the projects often were overestimated. In addition, the irrigable acres had to be cut down on some projects because of shortage of water.

In one study, the cost of several projects was later calculated to exceed \$200 per acre and one came to nearly \$400 per acre (Table 1). However, irrigators were not asked to repay more than \$100 per acre on any project and on most projects they were asked to pay much less (Table 2).<sup>4</sup>

Under the Flood Control Act of 1944, extensive irrigation development was authorized for the Missouri Basin. The cost of this proposed irrigation development is estimated to

be about three billion dollars.<sup>5</sup> For the prospective settler and also for the general public, it is of interest to know what the estimated cost per acre is and how it compares with the earlier projects.

According to Bureau of Reclamation estimates, as reported by the Missouri Basin Survey Commission, water cannot be brought to any land

<sup>4</sup>"Ten Rivers in America's Future," A Water Policy for the American People, Vol. 2, The President's Water Resources Policy Commission, Washington, D. C., Dec. 1950, p. 190.

<sup>5</sup>"Missouri, Land and Water," *op. cit.*, pp. 91-92.

Table 1. Average Cost and Charges per Acre on Early Reclamation Projects

Project	Original Estimated Cost per Acre	Actual Cost per Acre to 6/30/23, Based on Acreage Bureau Was Prepared to Supply in 1922	Actual Cost per Acre to 6/30/23, Based on Acreage Actually Irrigated
Huntley, Montana .....	\$25.71	\$ 46.10	\$ 75.50
Milk River, Montana .....	29.48	101.70	372.20
Sun River, Montana .....	28.80	100.00	206.80
Lower Yellowstone, Montana-North Dakota .....	30.90	77.35	200.00
North Platte, Nebraska-Wyoming .....	35.00	84.30	122.90
Williston, North Dakota .....	26.75	60.15	290.00
Belle Fourche, South Dakota .....	29.55	43.15	113.85
Shoshone, Wyoming .....	\$39.18	\$116.40	\$193.80

Source: Ray P. Teele, *op. cit.*, p. 212.

Table 2. Repayment History of Older Bureau of Reclamation Projects in the Missouri Basin\*

Project and Location	Year First Water Delivered	Charge or Cost per Acre	Percent Repaid Since Repayment Began
Belle Fourche, South Dakota	1908	\$ 74	19% in first 37 years
(Old) Buford-Trenton, North Dakota	1908	—	Abandoned
Huntley, Montana	1908	62	39% in first 39 years
Kendrick, Wyoming	1946	76	No payments to date
Lower Yellowstone, North Dakota	1909	71	25% in 30 years
Milk River, Montana	1919	45	17% in 10 years
	1911	—	5% in 18 years
North Platte, Nebraska-Wyoming	1918	100	22% percent in 26 years
	1908	85	39% in 37 years
	1921	85	13% in 22 years
Riverton, Wyoming	1925	—	No payments first 20 years after first delivery of water.
Shoshone, Wyoming	1908	—	2% in 2 years
			6% in 28 years
			37% in 38 years
Sun River, Montana	1909	—	Water rental basis
	1920	—	58% in 39 years
Williston, North Dakota	1908	—	4% in 10 years
			Abandoned, no payment

Source: Reproduced in part from "Ten Rivers in America's Future, *op. cit.*, p. 190.

\*Includes all older projects with total area of about one-half million acres. Does not include Case-Wheeler Water Conservation and Utilization Projects.

not now irrigated for less than \$100 per acre. The first three-fourths million acres of new irrigation will cost up to \$400 per acre. The next three-fourths million acres would cost between \$400 and \$700 per acre. The next one-third million acres will cost from \$700 to nearly \$2500 per acre. For some small projects the cost will run as high as \$4000 to \$4500 per acre.<sup>6</sup>

It can thus be seen that the proposed development will cost considerably more than earlier projects. The cost of construction to bring water to a 160-acre farm could range from \$16,000 to more than \$700,000, depending upon the particular project selected.

### Allocation of Cost

In multiple purpose programs, a part of the cost of irrigation and power must be repaid to the Treasury, while flood control, navigation, and

recreational development require no repayment. This necessitates the allocation of costs to the various purposes. Allocations have a bearing on charges for irrigation water and power. They also have a bearing on what part of the cost is carried by the Federal taxpayer for the non-reimbursable features such as flood control and navigation.

A recent report by a Subcommittee of the Committee on Public Works concluded "that at the present time the agencies of the executive branch are operating in considerable confusion in the problem of allocation of costs."<sup>7</sup> The Missouri Basin Survey Commission Report also noted the different methods, used by the two main Federal construction agencies

<sup>6</sup>"Missouri Land and Water," *op. cit.*, p. 102.

<sup>7</sup>House Committee Print No. 23, "The Allocation of Costs of Federal Water Resource Development Projects." Report to Committee on Public Works from the Subcommittee to Study Civil Works, 82d Congress, 2d Session, p. 29.



in the Basin (Corps of Engineers and the Bureau of Reclamation), for allocating costs and the dispute over this item. For identical projects, the one agency allocated nearly one-half billion dollars more to flood control and navigation than the other, and in turn, nearly one-half billion dollars less to irrigation and power. If the larger amount is allocated to power, for example, power rates currently proposed will carry about half the cost of power. On the other hand, if the larger amount is allocated to flood control and navigation, the cost for those purposes carried by the Federal taxpayer would be about twice the benefits claimed. In other words, the costs can be shifted from one purpose to another but not avoided. It becomes a matter of whether taxpayers in general or direct beneficiaries pay the cost of multiple purpose projects.

Sound methods of allocating costs need to be adopted in order that taxpayers and beneficiaries both may be treated equitably. Until this is done, the public does not know what costs it is expected to carry. The allocations to irrigation in the Basin are still in dispute.

### Repayment of Federal Cost

On the older projects, irrigators found it difficult to meet their obligations, although costs were lower than for the projects proposed today. Because of the difficulties, repayments have been less than were anticipated. According to the President's Water Resources Policy Commission, no project in the Missouri Basin has been able to repay cost according to sched-

ule in 40 years as originally planned (Table 2). In only a few cases has the repayment averaged more than 1 percent per year. In some cases the rate is less than 1 percent per year. At this rate, more than 100 years would be required for irrigators to pay the obligation assumed, with the Government receiving no interest on funds advanced for construction. In view of the fact that the Federal Government pays interest on money borrowed to build projects, the rate of return to the Government has been very low. Several million dollars have been charged off and a few projects have been abandoned.

What are the plans for the repayment of the Federal cost of projects currently under construction or authorized?

The most recent study of this subject was made by the Missouri Basin Survey Commission. According to the Commission report, "irrigators and local districts would pay about 22 million dollars annually on cost of construction."<sup>8</sup> Under present plans this annual payment would run from the tenth to the fiftieth year but this period could be changed.

This same report indicates that the three billion dollars, or more, which would be spent on irrigation would represent an annual cost of from 80 to 91 million dollars assuming 100-year life for the project and an interest cost of 2½ percent.

The 22 million dollars which would be paid annually by water users from the tenth to the fiftieth year is the equivalent in value to about 12 million dollars annually for

<sup>8</sup>"Missouri, Land and Water," *op. cit.*, pp. 97 and 105.

a 100-year period. This annual value of repayments of 12 million dollars can be compared with an annual construction cost of 80 to 91 million dollars. This means that water users may pay as little as 15 percent of the cost of construction, the remainder would be borne by the Federal taxpayer.

This report is not concerned with the problem whether water users could pay more than now contemplated, nor is it implied that they should. The main concern is to show in a general way who, under present plans, would bear the Federal cost of irrigation development. Information available to the public has not been adequate in this regard.

#### **Use of Basin Account**

It can be seen from the above, that payments by irrigators cover only a small part of the Federal cost of irrigation projects. In addition, interest charges should be considered in economic analysis.

What, then, is the explanation of the contention that the cost of construction is repaid to the Federal Government.

As already discussed, the Reclamation Act of 1902 provided for repayment of construction costs by water users, without interest on deferred payments, and later legislation authorized the use of power revenues, from Government constructed projects, to help repay costs of construction of irrigation.

In the present Missouri Basin program, representatives of the Bureau of Reclamation state that any irrigation costs which cannot be repaid by water users will be repaid to the Treasury from power revenues. This

pooling of revenues is known as the Missouri Basin Account.

The Missouri Basin Survey Commission Report reveals, however, that there is a serious question of whether power revenues will more than retire the cost of power even within a 100-year period. There may thus be little, if any, surplus revenue from power to carry the cost of irrigation. Individual projects, with costs in excess of revenues, may not be able to draw upon the Basin Account to show financial feasibility; that is, may not be able to show that the funds will be repaid even without considering interest on irrigation. Insofar as power costs are allocated to the interest-free irrigation account, and interest charged to power is credited to irrigation as now planned, the effect is that the Government recovers no interest on its investment in either power or irrigation. This fact is also little known by the public.

#### **Use of Indirect Benefits for Project Justification**

The proposed Federal program for the development of irrigation in the Missouri Basin is presented as being economically justified as well as financially feasible. That is, it is claimed the benefits exceed the costs and that the costs will be repaid. Repayments have already been discussed. The next question is: how realistic are the benefit-cost ratios?

The need for uniform and acceptable methods for measuring costs and benefits has become widely recognized. The Subcommittee on Benefits and Costs of the Federal Inter-Agency River Basin Committee has done commendable work along this

line and progress has been made.

Benefits are generally classified as direct benefits and indirect benefits. Direct benefits are the value of goods and services resulting from the project and are measured by market value. In irrigation projects the increase in net farm income for instance is a direct benefit. Indirect benefits are values added over and above the value of goods and services from the project, arising from activities brought about by the project.<sup>9</sup> Such indirect benefits could result from increased business activity in the area and similar effects. These indirect benefits are difficult to measure in monetary terms. However, they are used to justify irrigation development. The use of the indirect benefits in this manner has been questioned.<sup>10</sup>

The Missouri Basin Survey Commission also notes the disparity between costs, benefits and revenues. For example, cost of proposed irrigation is estimated by the agencies from 98 to 109 million dollars annually, including operation and maintenance, compared with direct benefits of 81 million dollars annually and indirect benefits of 132 million dollars. Payments for construction costs by water users, however, may be as low as 12 million dollars annually, or less than 15 percent of direct benefits claimed.<sup>11</sup> Another recent report stated: "The examination of present practices and procedures in economic evaluation of water resource projects . . . has clearly indicated the absence of uniform approach by the different agencies or even a completely consis-

tent approach by the same agency."<sup>12</sup> The same report, in discussing the use of indirect benefits to justify irrigation, stated, "It is the view of the subcommittee that even though those devising these computations may not realize their vulnerability, the higher authorities of the agencies who knowingly approve the use of such dubious factors seem to be deliberately participating in an attempt to mislead themselves if not the Congress and the public at large. The use of such hypothecated benefits in a computation would tend to create doubt in the validity of the entire presentation of the agency."<sup>13</sup>

Virtually every study of methods used to evaluate benefits of irrigation questions the present methods of calculating indirect benefits of irrigation and at least one study also questions the disparity between direct benefits and repayments by water users.

If the indirect benefits are used to justify irrigation development it may be asked why individuals who receive these indirect benefits should not pay part of the cost. Some type of conservancy district could be organized in which all residents of the area participate in repayment of the cost according to the benefits they derive from the project.

<sup>9</sup>"Missouri, Land and Water," *op. cit.*, p. 90.

<sup>10</sup>"Proposed Practices for Economic Analysis of River Basin Projects," Report to the Federal Inter-Agency River Basin Committee, by the Subcommittee on Benefits and Costs, Washington, D. C., May 1950.

<sup>11</sup>"Missouri, Land and Water," *op. cit.*, pp. 98-99.

<sup>12</sup>"Economic Evaluation of Federal Water Resource Development Projects." Report to the Committee on Public Works, House Committee Print No. 24, 82d Congress, 2d Session, p. 51.

<sup>13</sup>*Ibid.*, p. 51.

## Importance of Settlement Experience

MUCH OF THE LAND in the early Federal irrigation projects was in the public domain but some had already been homesteaded. A very small part of this land had been fully developed. The land in the project areas currently proposed for development is in established farms and ranches which are privately owned. In view of the Federal limitation on acreage which can be irrigated under one ownership, an examination of the experience with size of farm in irrigation projects would seem relevant. Data from several studies are available.

When the Huntley Project in south central Montana was opened for settlement in 1907, the area was divided into 40-acre tracts. It was assumed that the charges to be levied for construction, operation and maintenance could not be met on any larger unit. The units generally proved inadequate, and by 1935 a gradual increase had brought the average size up to about 85 acres.<sup>14</sup> A survey taken in 1946 indicated that the average size of farm, not including land farmed outside the irrigation project, was 114 acres, of which 90 acres were cropland.<sup>15</sup> Furthermore, 55 percent of the operators had dry land in addition to the irrigated land. For these farmers which have integrated dry and irrigated land, the acreage of dry land averaged 1,014 acres and the irrigated cropland averaged 75 acres per farm. Approximately 95 percent of the dry land was grazing land.<sup>16</sup> Although the average size of farm in this sample may be slightly larger than the average for the project, it is still apparent that the increase in size of the farms has been great.

On the Greenfields division of the Sun River Project in Montana, the farms were 80 acres wherever possible. However, before the Government undertook reclamation, desert land entries had been made because construction of a canal system by pri-

vate enterprise had been contemplated. These entries generally were on 160-acre tracts.<sup>17</sup> Information is not available to give the average size of unit at the present time, but a survey in 1946 indicated that approximately 75 percent of the farms in the area were over 125 acres in size and more than 40 percent were larger than 225 acres.<sup>18</sup>

When the Belle Fourche Project in western South Dakota was opened for settlement in 1908, the area was divided into 40- and 80-acre tracts.<sup>19</sup> A study in 1945 indicated that the average size of farm on the project was 740 acres which consisted of 278 acres of project land and 462 acres of outside land. Of the 278 acres of project land in the average farm, 88 acres were irrigated, 41 acres were dry farmed, and 149 acres were in dryland pasture. The acreage of outside land was used almost entirely for

<sup>14</sup>P. L. Slagsvold, *Agriculture on the Huntley Project*, Montana Experiment Station Bulletin 342, June 1937, pp. 5-7.

<sup>15</sup>Ralph E. Ward and M. M. Kelso, *Irrigation Farmers Reach Out into the Dryland*, Montana Experiment Station Bulletin 464, September 1949, p. 9.

<sup>16</sup>*Ibid.*, pp. 18-19.

<sup>17</sup>P. L. Slagsvold, *An Analysis of the Present Status of Agriculture on the Sun River Irrigation Project*, Montana Experiment Station Bulletin 321, 1936, p. 7.

<sup>18</sup>Roy E. Huffman and D. C. Myrick, "Farm Organization and Production Requirements in Selected Irrigated Areas," *Montana Agricultural Experiment Station Bulletin* 453, pp. 9-10.

<sup>19</sup>Raymond Lund, *Unpublished Report on History of the Belle Fourche Project*, presented to the South Dakota Coordinating Committee, February 25, 1952.

range and pasture.<sup>20</sup>

The problem of inadequate size of farm exists on some recently developed projects. On the Mirage Flats Project in northwestern Nebraska which was opened for settlement in 1947, the farms were platted in 90-acre tracts of Class I land or the equivalent. A study of the project in 1950, revealed that the average farm income of the irrigators was low despite the favorable price-cost relationship which prevailed during the years of settlement.<sup>21</sup> Part of the low income, undoubtedly, was due to the short period of settlement, lack of capital, and low crop yields, but farmers attributed some of the low income to the small size of farm. Furthermore, farmers expressed the opinion that in future irrigation projects the farms should have a larger irrigated acreage or a combination of range and irrigated land.

On the Buffalo Rapids and Kinsey Projects in Montana, 25 percent of the farmers preferred to have a larger acreage and 7 percent of the farmers wished that they had less land.<sup>22</sup> In most instances, those farmers who wanted larger acreages had small farms. The desired increase would bring the size of these farms to about 160 acres. Farmers who wanted smaller acreages had larger than average farms. The desired decrease would bring the size down to about 160 acres.

Thus, it can be seen that size and type of farm are important. This experience on older projects can serve as a guide. In addition, it would be well to consider current trends in technology, to minimize necessary

adjustments in the immediate future.

Many of the farms in the areas where irrigation is now proposed are large. Water will be available, under present Federal law, for only 160 acres in one ownership. Husband and wife could each own 160 acres. Nevertheless, many owners would still have surplus land which would have to be sold. The judgement of prospective buyers about the necessary size of farm would decide the pattern of holdings on the surplus lands. It would be a great help to present owners and prospective buyers alike if a careful analysis of the economic possibilities and problems in irrigation farming were available to them.

On the more successful irrigation projects in the Northern Plains a considerable amount of integration of irrigation and dry-land farming has taken place. Irrigators have obtained grazing land for their livestock, and dry-land farmers have gone into irrigation districts to obtain a feed base for their livestock. This type of integration of dry land and irrigated land within the farm unit can stabilize farm production, and provides good farming enterprises.<sup>23</sup>

<sup>20</sup>John Muehlbeier, "Class and Size of Farm Tenure, and Income, 1945," BAE, USDA and Bureau of Reclamation, USDI, Washington, D. C., October 1947, p. 4.

<sup>21</sup>Kris Kristjanson, "Development of Irrigated Farms on the Mirage Flats Project," South Dakota Agricultural Experiment Bulletin 410, June 1951, p. 4.

<sup>22</sup>Clyde E. Stewart and D. C. Myrick, "Control and Use of Resources in the Development of Irrigated Farms," Montana Agricultural Experiment Station Bulletin 476, October 1951, pp. 21-22.

<sup>23</sup>Elco L. Greenshields and Stanley W. Voelker, "Integration of Irrigated and Dry-land Farming in the North Platte Valley in 1946," BAE, USDA, and Bureau of Reclamation, USDI, Washington, D. C., 1947. Ralph E. Ward and M. M. Kelso, *op. cit.*

Rex Helfinstine and L. W. Schaffner, "Irrigation and Dryland Farming Can Work Together on the Cannonball River," North Dakota Agricultural Experiment Station Bulletin 385, Fargo, June 1953.

Integration between dry land and irrigated land when they are not held in the same farm unit has been less important as a stabilizing factor. In a recent study in South Dakota, an attempt was made to estimate the amount of hay from irrigated farms, which would be purchased by dry-land ranchers.<sup>24</sup> It was estimated from the available data that the amount of stabilization in the dry-

land ranching economy, which would likely be achieved through hay purchases from irrigation projects would be of minor importance. It was concluded that the combination of dry-land and irrigated operations within the same unit would be the most desirable form of integration.

<sup>24</sup>Unpublished material, South Dakota Agricultural Experiment Station.

### Irrigation As A Public Works Project

FEDERAL IRRIGATION development is less costly during periods of depressed economic conditions and the long-term benefits from the projects are the same. In a depression, irrigation is one form of public works which should be considered. But even then, the construction of irrigation projects needs to be compared with other public works, and other measures for stimulating the economy, to determine which would have the most beneficial effect.

The Case-Wheeler Projects were developed as public works projects: "This program grew out of recommendations made to the President by the Northern Great Plains Committee of the National Resources Planning Board in October 1938. The original plan was to build irrigation projects with relief labor, thus reducing the cost which would have to be repaid by the water users, permitting the construction of projects not otherwise considered feasible, and providing employment where it was most needed in the Western areas. It also proposed to develop new lands for the benefit of farm families who most needed assistance—destitute farmers who had been driven off their lands by drought or wind erosion, or those who had been trying

to make a living on dry-land farms too small to support a family."<sup>25</sup>

During the late 1930's and up to World War II, these objectives were attained. However, Federal expenditures for irrigation, flood control, and the like, during the recent period of high prices and full employment far exceeded expenditures for these purposes during the preceding period of low prices and low employment. Looking to the future it may be asked whether public construction of high-cost irrigation projects should not be deferred until they are needed as public works, unless there is a compelling national need for more production.

<sup>25</sup>Kris Kristjanson, *op. cit.*, p. 8.

## Conclusions and Suggestions

IT is the purpose of this report to draw attention to certain economic problems which are of general public interest. It is apparent that many economic questions need to be answered before the public can tell what it is expected to pay and what it will receive in return.

Cost per acre for the proposed Federal program of irrigation development in the Basin is high in relation to the increased production anticipated. Insofar as the projects are built for the purpose of increasing national supplies of agricultural products, it seems advisable to explore further the possibilities of obtaining increased supplies in other ways at lower cost.

The proposed program has been advanced during a period of high construction costs and when the Government is facing a problem of surpluses in agricultural products. The question of timing is important. Some feel that the need for the construction of the projects is urgent and that it is essential that they be completed as quickly as possible. Others are of the opinion that it might be well to defer construction until costs are lower, or public works are needed, or the products from the irrigated areas are in demand. At that time, construction of irrigation should be considered along with other possible alternatives.

Repayment by water users will be low in relation to construction costs. There is a need to re-evaluate the amount of irrigation which is to be developed at public cost. This is particularly important in view of the questions raised by the Survey Commission Report as to whether power revenues will be adequate to repay the cost of power plus a substantial part of the irrigation cost.

Calculation of water charges on the basis of the irrigators' ability to pay, as now done, is a satisfactory method.

Nothing would seem to be gained by showing interest and principal separate in a cost analysis because the irrigator presumably pays all he can, which at best covers only part of the cost of irrigation. Information on repayments made available to the public should show the relationship between repayments and cost of construction, taking into account interest charges. Economic analysis indicates that water users would repay only about 15 percent of the cost if interest is included.

The Missouri Basin Account, as now calculated and presented, is inadequate and incomplete. It does not include all Basin projects nor does it include all features of multiple-purpose projects. The Basin Account does not include all costs, and it does not account for interest as a cost (or show the present value of costs and repayments). Moreover it handles interest on power in such a way that the Government does not recover the cost of interest on the investment in either power or irrigation.

Serious questions arise as to the validity of the calculation of indirect benefits of irrigation. It seems advisable to calculate only costs and direct benefits in project evaluation. Indirect benefits can be described but do

not lend themselves to monetary measurement.

Early Federal irrigation projects were designed to develop arid lands which were not suitable for agriculture without irrigation. The more favorable sites were selected for development first. In most cases the per-acre costs were relatively low. Later, Federal irrigation moved into the more humid areas where agriculture is well established. Benefits from increased production in these areas are

smaller. In addition the costs of construction are much higher. Therefore, it becomes increasingly difficult for irrigators to repay any significant part of the cost of constructing irrigation projects.

This report has been concerned only with problems of irrigation. There is a need for some analysis of costs and benefits with respect to other purposes in river development, such as navigation, flood control, and power.