The Mormon Role in Irrigation Beginnings and Diffusions in the Western States: An Historical Geography

Kelly C. Harper
Brigham Young University - Provo
THE MORMON ROLE IN IRRIGATION BEGINNINGS AND DIFFUSIONS

IN THE WESTERN STATES: AN HISTORICAL GEOGRAPHY

A Thesis
Presented to the
Department of Geography
Brigham Young University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
Kelly C. Harper

August 1974
This thesis, by Kelly C. Harper, is accepted in its present form by the Department of Geography of Brigham Young University as satisfying the thesis requirement for the degree of Master of Science.

Richard H. Jackson, Committee Chairman

Alan H. Grey, Committee Member

July 31, 1974

Robert L. Layton, Department Chairman
ACKNOWLEDGMENTS

I would like to acknowledge the help of the many people who assisted in the preparation of this thesis. I wish to especially thank Dr. Richard H. Jackson for suggesting the topic to me and for directing my study through to its conclusion. I would also like to extend my appreciation Dr. Alan H. Grey and Dr. Soren F. Cox for their helpful suggestions and corrections. Thanks must also go to Mr. Seth Budge for his research contributions.

I would also like to acknowledge, with thanks, the support and encouragement of my parents throughout my education and the patient help and support of my wife.
# TABLE OF CONTENTS

Chapter

I. INTRODUCTION ................................................. 1
   Purpose and Scope
   Justification
   Research Design

II. THE EARLY BEGINNINGS OF IRRIGATION IN THE WESTERN
    UNITED STATES PRIOR TO THE MORMON EXPERIENCE ........ 5
    Prehistoric Irrigation
    The Spanish and Irrigation
    Irrigation Beginnings State by State
    Summary

III. MORMON AWARENESS OF: THE GREAT BASIN; THE REGION'S
     ENVIRONMENT; AND IRRIGATION .............................. 25
     The Great Basin Destination
     Mormon Study and Knowledge of
     the Great Basin Environment
     The Mormon Knowledge of Irrigation
     Summary

IV. DIFFUSION OF IRRIGATION TO THE MORMONS:
    A HYPOTHESIS ................................................. 37
    Diffusion from the Spanish
    Other Sources of Diffusion
    Summary

V. DIFFUSION OF IRRIGATION FROM THE MORMONS ............... 51
   Direct Diffusion
   Indirect Diffusion
   Summary

VI. INFLUENCE AND STATUS OF PRESENT DAY MORMON
    IRRIGATION ..................................................... 77
    Water Law as an Indication of Diffusion
    Mormon Methods as an Indication of Diffusion
Chapter

Present-day Status of Mormon Irrigation
Summary

VII. SUMMARY .................................................. 85

BIBLIOGRAPHY .................................................. 86
# LIST OF MAPS

<table>
<thead>
<tr>
<th>Map</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Spatial Extent of Irrigation in the Western States:</td>
<td>24</td>
</tr>
<tr>
<td>Prehistoric - 1847</td>
<td></td>
</tr>
<tr>
<td>2. Major Diffusion Routes</td>
<td>49</td>
</tr>
<tr>
<td>3. Minor Diffusion Routes</td>
<td>50</td>
</tr>
<tr>
<td>4. State of Deseret</td>
<td>52</td>
</tr>
<tr>
<td>5. Sites of Mormon Colonization and Irrigation:</td>
<td>76</td>
</tr>
<tr>
<td>1847 - 1912</td>
<td></td>
</tr>
<tr>
<td>6. Sprinkler Irrigation as a Percentage of Total</td>
<td>83</td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

The art of irrigation is of ancient origin. Its beginnings have yet to be accurately delimited, and there is still considerable disagreement among scholars concerning where and when irrigation was first practiced. It seems to be the opinion of many that the first use of irrigation occurred in Egypt. However, the ancient peoples of China, India, Mesopotamia, and America also practiced irrigation. In dealing with this great antiquity and worldwide use of irrigation, it is difficult to determine the diffusion patterns associated with it. Many questions remain unanswered about the diffusion and spread of irrigation techniques from the original centers of development.

Questions dealing with the antiquity, origins, and diffusion of irrigation on a worldwide basis are beyond the scope of this thesis. Whatever the answers may be, it is obvious that irrigation has continued to gain importance down through the centuries. Today it has great significance in many countries. In the United States irrigation farming has developed from an unknown number of acres centuries ago to more than fifty million acres today.¹

During this great growth irrigation has played an important role in settlement and development of the Western States. This thesis is devoted to the study of that development. It is hoped that some

contribution, however small, may be made to the already considerable work that has been written on irrigation in the Western States.

Purpose and Scope

The purposes of this work are several and center around the beginnings and diffusion of irrigation in the Western United States. First, it is the purpose of this thesis to show the spatial extent of early irrigation attempts in the Western States in the years preceding the settlement of the Mormons in the Great Basin. Second, since the Mormon leaders were aware of their destination in the Great Basin before the western exodus began and since they had studied the environment of that area, it is a contention of this work that they also realized irrigation would be necessary. Third, it is a purpose of this work to present and examine the hypothesis that irrigation in the Western United States originated in the Spanish settlements of the Southwest, that it diffused to the Mormons who established it securely in Utah, and that Utah then served as a secondary source area from which irrigation know-how then diffused to other Western States. Fourth, in conjunction with this proposed hypothesis it is a purpose of this thesis to indicate the possible paths or routes of these diffusions. Fifth, it is the final purpose of this work to determine the present influence and status of Mormon irrigation in the Rocky Mountain Region.

The scope of this study is primarily limited to the Intermountain region of the United States. California, Oregon, and Washington are not

---

dealt with in great depth. Studies in Colorado, Montana, and Wyoming have been restricted to the western mountain portions of these states.

**Justification**

In the last fifty years of geographic thought three major views or traditions have been emphasized. As reviewed by Edward J. Taaffe in his recent article, "The Spatial View in Context," each of these three views or traditions--area study, man-land relationships, and spatial organization--has led to useful findings. Taaffe also indicates that future geographic thought and work will likely represent a combination of these geographic traditions.\(^1\) Justification of this study as a geographic work may be made since two views or traditions, man-land relationships and spatial organization, are emphasized in this study in a historical context. More importantly, justification of this study may be made on the basis of its originality. No other recent work has attempted to analyze the diffusion routes of irrigation practices in the Rocky Mountain States. Earlier works relied heavily on anecdotal information, were incomplete, and are now seriously out of date. This study attempts to provide the answers to significant questions concerning the spatial spread of irrigation and represents an important addition to historical geography.

**Research Design**

Since this study is historical as well as geographical in nature, archival work has been an important source of information. Brigham Young University Library, The L. D. S. Church Historian's Office, various

government agencies, and various libraries, archives, and special collections throughout the Rocky Mountain area have been searched for pertinent information. Wherever possible original sources have been consulted.

Maps and air photos have also been analyzed to help determine possible routes of diffusion and the spatial extent of irrigation, past and present.

Field work has also been undertaken in major irrigated regions of the Rocky Mountains to determine, first hand, present irrigation techniques and practices. Areas in Utah, Idaho, Colorado, Wyoming and New Mexico, have been visited and such field work carried out. Government and local authoritative sources have been investigated, and local archives examined for information on irrigation, source areas, and diffusion.

From this research design a great amount of information has been obtained, and is presented in this study in a historical-geographical context.
CHAPTER II

THE EARLY BEGINNINGS OF IRRIGATION IN THE
WESTERN STATES PRIOR TO THE
MORMON EXPERIENCE

It has been estimated that 138,240,000 acres of land had been
reclaimed in various countries of the world when the Latter-Day Saints
first arrived in the Salt Lake Valley in 1847. Of this amount only a
very small percentage existed in what is today the continental United
States. In 1825 the total acreage being irrigated in the Western States
did not exceed 35,000 acres, primarily in the Spanish settlements of the
Southwest. When the Latter-Day Saints arrived in Utah in 1847 this
total could not have been much greater. Nevertheless, irrigation was
being practiced. Although the scale was relatively small, the soil of
nearly every Western State was irrigated at one time or another before
the Mormon arrival in the Great Basin.

Prehistoric Irrigation

There is no record of the very first attempts at irrigation in
what is now the United States. So great is the antiquity of irrigation
in the United States that the only accounts are vague Indian myths and

---

1 Charles Hillman Brough, Irrigation in Utah (Baltimore: The
John Hopkins Press, 1898), p. 3.

2 George Thomas, Early Irrigation in the Western States (Salt
Lake City: University of Utah, 1948), p. 43.
legends. However, it is clear that the first irrigators were the native inhabitants of the land.

Perhaps the first irrigators were the Hohokam, an Indian culture group which lived in the deserts of Arizona two thousand years ago. Scholars have divided Hohokam culture into four time periods—the Pioneer, the Colonial, the Sedentary, and the Classic. During the Pioneer period the Hohokam were only floodwater irrigators, but during the Colonial period a canal system was developed. Between 600 and 900 A.D. a large and well-built canal system was established.

The Hohokam culture eventually faded. It is very likely that the Pima and Papago Indians are descendants of the Hohokams. These Indian peoples were extensive irrigators and were the first Arizona Indians the white man met. Centuries ago these Indians established an elaborate irrigation system on the Gila and Salt Rivers. Canals twenty to thirty feet across, four feet deep, and up to twenty miles in length were built. Such works were well engineered. Near present day Phoenix is an Indian tunnel several hundred feet long which diverted water to a canal some twenty miles in length. Not only were the Indian irrigation systems well built, they were also extensive. In the Salt River Valley alone more than 250,000 acres were irrigated by one thousand miles of

1 Ibid., p. 1.
3 Ibid., p. 90, 547.
4 Thomas, pp. 3-4.
canal and ditch. On the Verde an additional 250,000 acres were irrigated. On the Gila it is not known how much land was irrigated. However, at least 150 miles of canal can still be traced. More canals have probably been filled with sand and are unrecognizable.

Eventually irrigation among the Pima and Papago Indians declined and many canal systems fell into disuse. However, irrigation was still being used by these tribes, as well as by other Indian peoples in the Southwest, when the Spanish explorers arrived on the scene. The writings of Coronado and his men indicate some Indians were still irrigating the land. In the Rio Grande Valley of New Mexico as much as thirty thousand acres may have been irrigated when the Spanish came. However, there is some disagreement as to how much acreage was being irrigated by these Pueblos.

Other areas of the Western United States were also irrigated anciently. For instance, prehistoric irrigation in Nevada was practiced by people living in caves in present day Clark County. They left behind remnants of canals and ditches. Cliff dwellers who occupied Montezuma

---


2 Thomas, pp. 4-6.

3 Hess, p. 809.

4 Thomas, p. 9.

5 Marc Simmons, "Spanish Irrigation in New Mexico," New Mexico Historical Review, 47 (April, 1972): 137.

Valley in southwestern Colorado also irrigated anciently. It is obvious then, that long ago, irrigation was not an uncommon practice in the western portion of the United States.

It should also be noted that much of the irrigation done by the Pueblo builders, especially in New Mexico and Texas, was relatively efficient. Canals thirty feet across and seven feet deep were engineered and even plastered with clay to prevent seepage. Near El Paso, efficient irrigation systems built by the Pueblo people long ago are still in use today.

The Spanish and Irrigation

Following the irrigation developments made by the native Indian peoples came the Spanish attempts at irrigation. Irrigation had been practiced for centuries in Spain. Thus the Spanish were well equipped to extend and improve the Indian systems.

The Spanish were particularly careful to establish themselves in areas where they knew water was available for irrigation.

The most important physical factor in the selection of a mission site was the availability of water. It mattered little that soil was fertile and level land abundant unless sufficient water could be provided.

---


2Thomas, p. 10.


The importance of water to the Spanish attempts can also be seen in the cultural landscapes of southwestern settlements. The community "acequia" or ditch is an institution which can immediately be attributed to the Spanish influence.\(^1\) Laws and principles governing water use can also be traced to the early Spanish habitation.\(^2\)

The distribution of Spanish irrigation eventually covered a wide area of the southwestern United States and California. In Texas San Antonio, El Paso, and the southern Rio Grade Valley were all areas of important Spanish irrigation. In New Mexico the Spanish settled and irrigated the Santa Fe region, and extended irrigation down the Rio Grande Valley and northward to the Colorado border. Spanish irrigation was also practiced in southern Arizona, but was of less importance. In California irrigation accompanied the Spanish settlements as they moved up the coastal regions from San Diego to San Francisco.

The above is a very brief account of the location and extent of the Spanish irrigation attempts. A more detailed discussion of Spanish irrigation, state by state, is included in the following section.

**Irrigation Beginnings State by State**

The brief outline of the early beginnings of irrigation in the Western United States presented above indicates the existence of irrigation in the West prior to the Mormon settlement of the Great Basin. The following pages will elaborate on the extent of irrigation agriculture found in the present states of the Western United States prior to 1847.

---

\(^1\) Hutchings, p. 261.

\(^2\) Simmons, pp. 139-140.
New Mexico, Texas, Arizona, and California

For purposes of analysis it is convenient to examine the four states of New Mexico, Texas, Arizona, and California together. All were subject to early attempts by the Spanish or Indian peoples to irrigate territory within the states' present day boundaries. These states also contained the bulk of irrigated acreage in the West prior to 1847.

The area around Santa Fe was the most important region of early irrigation in New Mexico. In 1598 Juan de Onate and 1,250 people came to New Mexico to explore and colonize. They settled at San Gabriel, the present day town of Chamita near Santa Fe, and immediately began to irrigate the land. Santa Fe was founded shortly thereafter.\(^1\) Pueblo Indians were conscripted, canals and ditches dug, and the area irrigated.\(^2\)

Irrigation in the vicinity of Santa Fe and Albuquerque continued into the 1800's, and was noted by Zebulon Pike in 1807 during his stay in the Southwest:

Both above and below Albuquerque the citizens were beginning to open the canals, to let in the water of the river to fertilize the plains and fields which border its banks on both sides: We saw men, women, and children of all ages and both sexes, at the joyful labour, which was to crown with rich abundance their future harvest, and ensure [sic] them plenty for the ensuing year. These scenes brought to my recollection the bright descriptions by Savary, of the opening of the canals of Egypt.\(^3\)

Before the American Army came in 1846, irrigation near and around Santa Fe was still the most important in New Mexico. However, in the

\(^1\) Thomas, p. 35.

\(^2\) Simmons, pp. 138-139.

early 1800's another important irrigated area was settled in northern New Mexico around Taos. In 1815 settlements were also made at Arroyo Seco and Arroyo Hondo each ten miles from Taos.¹

Further down the Rio Grande in Texas, irrigation farming and settlement were also taking place. Perhaps the earliest irrigation in Texas took place near El Paso. Ditches were dug by the Indians under the direction of the Spanish Padres in the latter half of the seventeenth century. During the 1700's, other irrigation took place at missions located on the Nueces River, Guadalupe River, San Saba River, San Gabriel River, and also near present day Goliad. However, probably the most efficient Spanish irrigation in Texas was established at San Antonio and vicinity.²

In Arizona, as before mentioned, the Pima and Papago Indians built tremendous prehistoric irrigation works. They continued to irrigate on a reduced scale through the centuries, and the white man found them still irrigating. The Spanish established themselves at Tubac and Tuson,³ but other than this, irrigation in Arizona was not important until after 1857.

The first irrigators in California were the Spanish Padres. Around 1770 the first irrigation ditch was utilized near the San Diego

---


²Arneson, pp. 121-123.

Mission. Other missions were established and irrigation begun at San Gabriel in 1771; San Luis Obispo in 1772; San Bernadino in 1776; San Juan Capistrano in 1776; and Santa Barbara in 1787. Besides these missions, towns were also established and land irrigated at San Jose in 1777 and at Los Angeles in 1781.

Irrigation continued and expanded in California, and by 1844 others besides the Spanish were irrigating the land. Fremont reported in 1844 that John A. Sutter was irrigating California soil. He mentions, "The ditches around his extensive wheat field" and Indian girls, "busily engaged in constantly watering the gardens." Fremont also wrote that, "Mr. Sutter was about making arrangements to irrigate his lands by means of the Rio de los Americanos." Other American were also irrigating in California before the Mormons arrived in the Great Salt Lake Valley. Alvin T. Steinel indicates in his book, History of Agriculture in Colorado, that American settlers were a growing population in California, and that they were irrigating before the Mormon arrival in Utah.

Not only had the Spanish and various American settlers irrigated in California before the arrival of the Mormons in Utah, but it would also appear that even Mormons irrigated in California before they did so

---

1 Hess, p. 810.
2 Thomas, p. 17.
3 Ibid., p. 25.
4 Bevet Captain John C. Fremont, Report of the Exploring Expedition to the Rocky Mountains in the Year 1842 and to Oregon and North California in the years 1843-44 (Washington: Gales and Seaton, 1845), 246.
in the Salt Lake Valley. On July 31, 1846 the ship, Brooklyn, arrived at Yerba Buena, present day San Francisco, with nearly 240 Mormon passengers. This group had left New York in February of the same year under the leadership of Samuel Brannan, hoping eventually to join the major body of Saints who were moving west. Since the main contingent of Saints did not arrive at the Salt Lake Valley until July 1847, the Brooklyn Saints remained in California for the intervening year. During this time twenty of their number established the town of New Hope on the Stanislaus River in the San Joaquin Valley. Here they put in crops, and irrigated by means of ditches and buckets. This was the first Mormon irrigation practiced in the Western States. 1

Colorado

As mentioned before the first irrigation attempts made in Colorado date back to prehistoric times. However, it is clear that irrigation was also practiced by various people living within the boundaries of Colorado prior to the Mormon attempts in Utah. As early as 1832 the Bent brothers irrigated at Bent's Fort midway between the towns of La Junta and Las Animas. They built a ditch which took water from the nearby river to forty acres of land which had been planted to corn, beans, squash, and melons. 2 Smiley in the Semi-Centennial History of the State of Colorado suggest that other early trading posts on the Arkansas River


probably irrigated small gardens between 1825 and 1840. He also men-
tions that some irrigation was done at Fort Lupton and Fort St. Vrain
on the South Platte prior to 1840.¹ When Fremont passed through the
area in July of 1843, he made several observations about Fort Lupton or
Fort Lancaster as he called it:

Passing on the way the remains of two abandoned forts, (one of which,
however was still in good condition), we reached, in 10 miles, Fort
Lancaster, the trading establishment of Mr. Lupton. His post was
beginning to assume the appearance of a comfortable farm; stock,
hogs, and cattle were [sic] ranging about on the prairie; there were
different kinds of poultry; and there was the wreck of a promising
garden, in which a considerable variety of vegetables had been in a
flourishing condition, but it had been almost entirely ruined by the
recent high waters.²

If Mr. Lupton was raising vegetables and probably feed for his stock and
poultry it would be logical to assume he was also irrigating, since the
climate of the area would demand it.

Other areas of Colorado were also irrigated during the early and mid-
dle 1840's. In 1840 fifty Mexican families from the Santa Fe region
established themselves in southern Colorado on the Costilla, Culebra, and
Conejos—all tributary streams of the Rio Grande.³ By 1842 others from
New Mexico including some mountain men and their Spanish wives had estab-
lished themselves on the Arkansas near present day Pueblo.⁴ In that year
some of the first white men to settle in Colorado cultivated an area near
the Pueblo site. This group of men, Fisher, Sloan, Spaulding, Kinkaid,
and Simpson, raised a crop of corn there in 1842. A year later in the

¹Smiley, Semi-Centennial History, 1: 551, 571.
²Fremont, p. 111.
³Wilbur Fisk Stone, ed., History of Colorado 4 vols. (Chicago:
⁴Smiley, Semi-Centennial History, 1: 571.
Hardscrabble Valley thirty miles from Pueblo a crop of corn was raised by George S. Simpson. ¹ When Fremont passed through the region in 1843 he found some of these settlers still engaged in farming:

A short distance above our encampment on the left bank of the Arkansas, is a pueblo, (as the Mexicans call their civilized Indian villages) where a number of mountaineers, who had married Spanish women in the valley of Taos, had collected together, and occupied themselves in farming, carrying on at the same time a desultory Indian trade.²

In 1846, Francis Parkmen noted crops growing around Pueblo, and received corn and vegetables from the settlers of the area.³ He also had occasion to visit a group of Mormons who were wintering at Pueblo.⁴ It is possible that the settlers of Pueblo and vicinity irrigated since it is unlikely that sufficient rain fell to raise vegetables and corn over a period of successive years.

As was mentioned before, there is proof that irrigation was carried out at Bent's Fort in Colorado as early as 1832. Some years later the founder of the Fort, William Bent, and another man named John L. Hatcher conceived the idea of farming the Purgatoire River area some

¹Stone, History of Colorado, 1: 478.
²Fremont, p. 116.
⁴The Mormons Francis Parkmen mentions in The Oregon Trail (p. 263) were a group composed of Mormon Battalion members and converts from Mississippi who had expected to meet the main body of Saints moving westward. However, the main contingent of Saints did not come west until the next year. For this reason the group took up quarters in Pueblo for the winter, joining the Saints the next spring for the westward trek.
miles from Bent's Fort. It is well documented that irrigation was used by these men on the bottom land of the Purgatoire River. John L. Hatcher left Taos in September 1846, with three wagons, sixteen oxen, and fifteen to sixteen men. They located on bottom land along the Purgatoire River about eighteen miles northeast of present day Trinidad. Some forty acres were planted to corn, and an irrigation ditch one to two miles long was constructed.

John Hatcher, trapper, Indian fighter, trader, mountaineer, and plainsman, had knowledge of irrigation having seen it practiced in the Southwest. As a result it was a simple matter for him to construct a ditch and small dam. Lewis H. Garrard was present when the first irrigation water flowed into Hatcher's ditch, and gave the following account:

William Bent's party consisted of himself, Long Lade, and two others. They had plows, and the acequia, by which the land would be irrigated, was nearly finished; the dam, to elevate the water in this, was yet to be constructed; so the following morning we went hard to work. For two days we labored as though the embryo[sic] crop depended upon our finishing within a specified time. When the water flowed in the acequia, we watched bits of wood and scum floating with the first tide, with intense interest and satisfaction.

Despite Hatcher's efforts the experiment failed as a result of Indian attacks just as the crop matured.

---


2. Cheetham, p. 5.

3. Smiley, Semi-Centennial History, 1:571


5. Ibid., p. 281.

Washington and Oregon

It is probable that the first irrigation practiced in Washington and Oregon was by white men rather than the Indians. Unlike the Southwest it seems that the Indians of these states did not practice irrigation.

In 1825 Doctor John McLoughlin was farming at Fort Vancouver. This was perhaps, the first agriculture practiced west of the Cascades, but it is unclear whether irrigation was used. No doubt McLoughlin had knowledge of irrigation since he was familiar with the missionaries in the region who did irrigate. Fort Vancouver was also far enough inland to warrant irrigation. As a result it is possible that Dr. McLoughlin may have been the area's first irrigator.

The Hudson Bay Company established Fort Walla Walla in 1819, and irrigation was practiced there at least by the 1830's on a garden basis. In 1836 irrigation at the fort was seen and noted by Mrs. Marcus Whitman.

Near Fort Walla Walla, Marcus Whitman also pioneered in irrigation. At his mission Whitman irrigated his crops, and induced the Indians of the area to also farm and irrigate the land. Charles Wilkes visited the area in 1841, and found Whitman and the Indians successfully rose.


3Thomas, p. 50.


5Boening, p. 261.
practicing irrigation: "The Indians have learned the necessity of irrigating their crops, by finding that Dr. Whitman's succeeded better than their own."¹

Irrigation was also practiced at other missions in the Oregon-Washington region. Near what is now the border of these two states, at Wascopam (The Dalles) a mission farm was established, and irrigation practiced.² Wheat, potatoes, and garden vegetables did well under irrigation, and supplied the missionary families with much of their needs.³ Thomas Farnham visited the mission in 1839 and found one acre planted and irrigated with plans for four hundred to five hundred more acres to be farmed and irrigated.⁴

Irrigation was also practiced by Mr. Elkanah Walker in 1841 at Tshimakain. He was another missionary, and the site was near Fort Colville in Washington.⁵ Irrigation was likely practiced at Fort Colville as well since 340 acres were plowed, and wheat, potatoes, and garden produce were raised around the Fort.⁶


⁶Barry, p. 163.
Idaho

The first attempt at irrigation in Idaho was in 1837 by Henry Spaulding. His missionary establishment at the mouth of Lapwai Creek on the Clearwater had sixty to seventy Indian families cultivating the soil in 1838. In 1840 one hundred Indian and missionary families were farming and irrigating the area. By 1843 the Lapwai Mission was self-sufficient with the Indian families cultivating four to five acres each.¹ Charles Wilkes in 1841 noted that Spaulding himself was growing twenty acres of wheat and a field of vegetables:

His efforts in agriculture are not less exemplary, for he has twenty acres of fine wheat, and a large field in which were potatoes, corn, melons, pumpkins, peas, beans, etc., the whole of which were in fine order.²

Wilkes further wrote that irrigation was needed: "In their cultivation, irrigation is necessary; and the wheat fields as well as those of vegetables, etc., were treated in this way."³

Besides Spaulding's efforts at Lapwai it is probable that irrigation also occurred at Fort Hall and Fort Boise. Ephraim Tucker writing in 1838 noted that agriculture was practiced on a small scale at Fort Hall:

In the Eastern Section, or upper country, Fort Hall is the only place where any attempts at agriculture have been made. Vegetables and the small grains are produced here in tolerable abundance,—but the soil of this section, as well as the climate, is better adapted to pasturage than cultivation.⁴

¹Meinig, p. 137.
²Wilkes, 4:460.
³Ibid., p. 461.
Fremont recorded in 1843 that minor attempts at raising vegetables were also made at Fort Boise:

Mr. Payette had made but slight attempts at cultivation, his efforts being limited to raising a few vegetables, in which he succeeded tolerably well; the post being principally supported by salmon.¹ Since climatic conditions at Fort Hall and Fort Boise were relatively dry it is probable that irrigation by some method was practiced at both locations.

**Montana**

There is only one recorded instance of agriculture and probable irrigation which took place in Montana prior to the Mormon experience in Utah. In 1841 Father De Smet, a Catholic missionary, founded St. Mary's Mission in the Bitter Root Valley of Montana. James Hamilton in his book, *From Wilderness to Statehood: A History of Montana*, says that irrigation was used at this mission, but gives no source as to his information.² However, as a general rule neither farming nor gardening would likely have succeeded in the area without irrigation of some sort. Support of this idea was given by Father De Smet himself when he wrote:

St. Mary's, or Bitter-Root valley, is one of the finest in the mountains, presenting, throughout its whole extent of about two hundred miles, numerous grazing, but few arable tracts of land. Irrigation, either by natural or artificial means, is absolutely necessary to the cultivation of the soil, in consequence of the long summer drought that prevails in this region, commencing in April and ending only in October.³

---

¹Fremont, p. 174.


Utah

Prior to the coming of the Mormons to Utah irrigation was extremely limited within what are now the state boundaries. Evidently the Indians of southern Utah did practice some irrigation. Parley P. Pratt found them irrigating on the Santa Clara River in January of 1850. Addison Pratt also wrote that travelers bound for California found Indians irrigating on the Virgin River. No doubt these Indian groups irrigated long before the arrival of the Mormons into the area.

Prior to 1847 Miles Goodyear had established a ranch on the Weber River in northern Utah. On July 22, 1847 a Mormon delegation visited the ranch, and found radishes, cabbage, corn, carrots, and beans growing. These crops may have been irrigated by nothing more than a bucket. However, the ranch at that time was not being looked after by Goodyear but by an Englishman named Kells. Kells had previously lived in Mexico, and was no doubt familiar with irrigation. It may have been that the Goodyear garden was watered not by a bucket but by an irrigation ditch, but this is conjecture at best.

Nevada

The first agriculture and irrigation in Nevada was carried on by prehistoric cave dwellers in present day Clark County. They left behind remnants of ditches and canals. However, irrigation was also being practiced by the Indians when the first white settlers arrived. When settlers arrived in Walker Valley they found portions of the valley

\[1\] Thomas, p. 11.

\[2\] Thomas, p. 47.

\[3\] Mack and Sawyer, pp. 108-109.
already being irrigated.\textsuperscript{1} As far as is known this irrigation was taking place prior to the Mormon arrival in Utah and was the only irrigation practiced in the state until the Mormons themselves settled in the region in the 1850's.

\textbf{Wyoming}

No irrigation took place in Wyoming prior to the Mormons coming to Utah. As will be discussed later in this study, irrigation in this state was initiated by the Mormons themselves in the 1850's.

\textbf{South Carolina}

Although South Carolina is not included in the study area of this thesis it is interesting to briefly note that irrigation also occurred in this state long before the Mormons came to Utah. Before and after 1800 rice, indigo, and cotton were grown by flood irrigation in the swamp-lands of South Carolina. Fields were diked and generally flooded three times from April to August of each year by openings in the dikes referred to as "trunks".\textsuperscript{2} Thus even in the eastern United States, a form of irrigation had been used long before the first Mormon irrigation occurred in the Great Basin.


Summary

It is obvious that irrigation had its inception in what is now the United States many years before the Mormon experience in Utah. Although irrigation was discontinued in many of the areas spoken of in this study before the arrival of the Mormons in the Great Basin, in others it was still of considerable importance, particularly in the Southwest and California.

The map on page 24 best summarizes the spatial extent of irrigation attempts in the Western United States prior to the Mormon arrival in Utah. It represents as accurately as possible the attempts made at irrigation from prehistoric times up to 1847. From the map it may be noted that irrigation at some time or another was practiced in nearly every Western State before the earliest Mormon attempts in 1847. Only the soil of Wyoming was not irrigated. The map also points out the greater influence of early irrigation in the Southwest especially around the Santa Fe region. Except for the prehistoric Indian attempts, irrigation in the Southwest was primarily done by the Spanish. In California the distribution of irrigated land between San Francisco and San Diego was also a result of Spanish settlement, but some Anglo-American irrigation also occurred there. In the remaining Western States irrigation attempts were fewer and more widespread, a greater number occurring in Colorado.
Spatial Extent of Irrigation in the Western States: Prehistoric - 1847

- Regions of Prehistoric Irrigation
- Regions of Spanish and Indian Irrigation
- Sites of Anglo-American Irrigation
CHAPTER III

MORMON AWARENESS OF: THE GREAT BASIN;
THE REGION'S ENVIRONMENT;
AND IRRIGATION

Early writers give little support to the idea that the Mormon people and their leaders knew of irrigation before their arrival in the Salt Lake Valley. For instance, Smythe in his book, The Conquest of Arid America, wrote:

Brigham Young had lived in Vermont, Ohio, Missouri, and Illinois. Neither he nor any of his followers had ever seen a country where the rainfall did not suffice for agriculture, nor ever read of one save in the Bible. But they quickly learned that they had staked their whole future upon a region which could not produce a spear of tame grass, an ear of corn, nor a kernel of wheat without skillful irrigation. Of the art of irrigation they were utterly ignorant. But the need of beginning a planting was urgent and pressing, for their slender stock of provisions would not long protect them from starvation.

It was this emergency which produced the first irrigation canal ever built by white men in the United States.¹

Brough also included a similar statement in his book, Irrigation in Utah:

There is little reason to believe that Brigham Young had any previous knowledge of irrigation when he entered Salt Lake Valley. The region around Nauvoo, Illinois, from which the Mormons were driven by the United States authorities, typified the agriculture of the humid region.²

Other authors of early studies of irrigation such as Widtsoe, Mead, and


²Brough, p. 3.
Hess made similar assertions. Thus it was assumed that the Mormons had no previous knowledge or contact with the art of irrigation prior to their arrival in Utah.

In summary, it has often been suggested that the Latter-Day Saint leaders were unaware of their destination until reaching the Salt Lake Valley; that they had little or no understanding of the area's environment; and that they were ignorant of irrigation methods. This chapter examines these suggestions, and shows that they are not true. The Church leaders knew where they were going before they left Nauvoo, and had studied the then current information concerning the Great Basin region. They also were aware of irrigation methods recognizing that irrigation would likely be a necessity in the area they intended settling.

The Great Basin Destination

The Mormon leaders knew their destination before leaving Nauvoo, Illinois. Joseph Smith, even before Brigham Young, had planned to settle the Saints in the Rocky Mountains. On August 6, 1842, he made the following prophecy:

I prophesied that the Saints would continue to suffer much affliction and would be driven to the Rocky Mountains, many would apostatize, others would be put to death by our persecutors or lose their lives in consequence of exposure or disease, and some of you will live to go and assist in making settlements and build cities and see the Saints become a mighty people in the midst of the Rocky Mountains.

---


2 Joseph Smith, "Manuscript History of the Church, 1805-1879," August 6, 1842, MS, L.D.S. Church Historian's Office, Salt Lake City.
Stephen H. Goddard recollected that Joseph said the Latter-Day Saints would go to the Great Basin area:

Prophet Joseph mapped out on the floor with a piece of chalk a diagram of what he called the Great Salt Lake Basin or Valley, and said that the Latter-Day Saints would go there.¹

There has been some doubt cast on this recollection made by Goddard, and some do not accept it as accurate. However, there are other instances when it appears that Joseph Smith had in mind settling the Saints in the Rocky Mountains. On February 20, 1844 he instructed that an exploration party be sent to find a location in the Rockies where a city could be built:

I instructed the Twelve Apostles to send out a delegation and investigate the locations of California and Oregon, and hunt out a good location, where we can remove to after the temple is completed, and where we can build a city in a day, and have a government of our own, get up into the mountains, where the devil cannot dig us out, and live in a healthful climate, where we can live as old as we have a mind to.²

On February 25, 1844 Joseph Smith also made the following prophecy:

I gave some important instructions, and prophesied that within five years we should be out of the power of our old enemies, whether they were apostates or of the world; and told the brethren to record it, that when it comes to pass they need not say they had forgotten the saying.³

Referring to this prophecy Henry W. Bigler wrote in his diary the following:

In the spring of 1844 the Prophet Joseph had prophesied [sic] that within five years the church would be located in the Rocky Mountains

²Joseph Smith, "Manuscript History of the Church, 1805-1879," February 20, 1844, MS, L.D.S. Church Historian's Office, Salt Lake City, Utah.
³Ibid., February 25, 1844.
beyond the influence of mobs requesting it to be remembered for persecution had followed the church ever since its organization.  

Finally, just prior to his martyrdom, Joseph Smith crossed the Mississippi River, and prepared to start for the Great Basin:

At daybreak arrived on the Iowa side of the river. Sent Orin P. Rockwell back to Nauvoo with instructions to return the next night with horses for Joseph and Hyrum, pass them over the river in the night secretly and be ready to start for the Great Basin in the Rocky Mountains. 

It is apparant that Joseph Smith had intentions of seeing the Saints settle in the Great Basin region long before Brigham Young led them there.  

As far as Brigham Young was concerned it is the conclusion of Jackson that by 1845 President Young had decided the Salt Lake Valley would be the best location for settlement. Brigham Young wrote September 8, 1845 that it was his intention to send 1,500 men to the Salt Lake Valley: 

Forenoon unwell. Two p.m. General Council met. Resolved that a company of 1500 men be selected to go to Great Salt Lake Valley and that a committee of five be appointed to gather information relative to emigration, and report the same to the council. 

Concerning the deliberations made by President Young and the Church leaders Jules Remy offers a possible insight: 

At the conference which was held the 6th of October 1845 under the unfinished roof of the temple, the principal [sic] part of the preachers spoke of the means of effecting the projected emigration. The new patriarch, Joseph's uncle, had a vision, wherein it was revealed to him that they should go and seek for peace in the deserts of the west. Before this Lyman Wight had proposed Texas, where,

---


2 Joseph Smith, "Manuscript History of the Church, 1805-1879, June 22, 1844, MS, L.D.S. Church Historian's Office, Salt Lake City, Utah. 


4 Brigham Young, "Manuscript History of the Church, 1805-1879," September 9, 1845, MS, L.D.S. Church Historian's Office, Salt Lake City, Utah.
in fact, he had himself gone after his excommunication; John Taylor had indicated Vancouver's Island; others were in favor of California. After a long but calm debate, wherein they carefully weighed the advantages and disadvantages of each of the proposed places, it was resolved that they should go and settle in some valley in the Rocky Mountains.¹

Remy gives no source for his information, and he himself was not present at this meeting. He probably was given this story while in Salt Lake City in 1855. The account, therefore, may be somewhat unreliable but it points out that it was the common view of the Mormons in 1855 that they had decided on the Rocky Mountains as a destination before they set out.

As Remy mentioned, a number of places were considered as possible areas for settlement. However, Texas, California, and Oregon as they are now constituted were not looked upon as good possibilities by the Church leaders because it was so difficult to live with gentile neighbors.² Only the Rockies seemed like a feasible choice.

We again find Brigham Young making reference to the Rockies as his choice of settlement on December 31, 1845:

Elder Heber C. Kimball and I superintended the operations in the Temple, examined maps with reference to selecting a location for the saints west of the Rocky Mountains, and reading various works written by travelers in those regions.³

A few months later in March of 1846 President Young also proposed that three hundred men cross the mountains and begin planting wheat in the Great Basin.⁴ However, this expedition did not take place.


²Jackson, p. 60.

³Brigham Young, "Manuscript History of the Church, 1805-1879," December 31, 1845, MS, L.D.S. Church Historian's Office, Salt Lake City, Utah.

⁴John D. Lee, "Diaries and Official Records of John D. Lee," March 8, 1846, MS, Brigham Young University Library, Provo, Utah.
It also appears that Brigham Young spoke or wrote to several individuals of his intention to settle in the Great Basin. For instance, on August 7, 1846 President Young told Colonel Thomas L. Kane of his intention to settle the Great Basin area:

Pres. Young said to Col Kane with reference to our settlements in the California's we do not intend going & settling the majority of our people on the course or near the bay of San Francisco—but intend settling the greater part of our people in the great Basin between the Mountains near the Bear river valley & we will likely make a settlement on Vancouver Island that is such Emigrants that as will Emigrate by water.¹

Only two days later on August 9, 1846 President Young also wrote President James K. Polk, and expressed the same intention:

The cause of exile we need no repeat; it is already with you, suffice it to say that a combination of fortuitous, illegal, and unconstitutional circumstances have placed us in our present situation on a journey which we design shall end in a location west of the Rocky Mountains, and within the basin of the Great Salt Lake or Bear River valley, as soon as circumstances shall permit, believing that to be a point where a good living will require hard labor, and consequently will be coveted by no other people, while it is surrounded by so unpopulous but fertile country.²

It would appear that President Young was very much aware of his destination. However, many ordinary members of the Church were probably not aware of his decision to settle in the Salt Lake Valley. Some probably knew of his decision, and others may have only suspected this was to be the case.³ Whatever the extent of awareness among the Church members, it is clear that settlement in the Great Basin was a premeditated

¹Ibid., August 7, 1846.
²Brigham Young to President James K. Polk, August 9, 1846, Photocopy of original in Washington, D. C., Church Historian's Office, Salt Lake City, Utah.
³Jackson, p. 122.
decision made by Church leaders, and one that was probably made as early as 1845.

Mormon Study and Knowledge of the Great Basin Environment

Before and after the Church leaders had decided upon settling in the Great Basin they had studied the information available about the region, and had formed a reasonably accurate perception of the environment. A number of sources of information were available to them. They had ready access to the reports of Fremont, Wilkes, Bonneville, and others who had traveled extensively through the Western United States. Reports of the West and Rocky Mountain area often differed greatly. Some described the region as fertile, others as being a wasteland. However, it was generally felt that there were areas suitable for settlement, and nearly all travellers and explorers spoke favorably of the scenery and the climate.

Perhaps the most accessible sources of information were Hasting's publication, The Emigrants' Guide to Oregon and California, and Fremont's published reports. Hastings referred to the Bear River Valley and the Great Basin area in generally favorable terms, and spoke of good vegetation in many of the valley areas. Fremont also spoke reasonably well

---


2 Jackson, p. 83.

of the West. Church leaders studied these reports, and talked of the western region among themselves. As already mentioned Brigham Young and Heber C. Kimball examined maps and reports of travellers in the western area. Brigham Young wrote that he and members of the Twelve studied Fremont's Journal:

Saturday 20.--Beautiful morning. I dictated the arrangements for the day. Afterwards, with a few of the Twelve and others heard F. D. Richards read Fremont's Journal giving an account of his travels to California.¹

On December 25, 1845 President Young and the Twelve discussed the western region:

The Twelve met in my room for council and Prayer. After considerable conversation about the Western Country we united in prayer; George Smith was mouth.²

Again on December 29, 1845 President Young noted that, "Elder Parley P. Pratt read Fremont's Journal to Brother Kimball and me."³

Ordinary members of the Church also had access to western reports. Newspapers and other periodicals such as the Niles Weekly Register, Sangamo Journal, The American Review, The North American Review, and others were widely read, and published much information about the western regions.⁴ The Church periodicals also published information about the West. For instance, The Evening and Morning Star published information about Bonneville, Sublette, and Fremont. The Nauvoo Neighbor, between May 3, 1843 and October 29, 1845 published fifty articles dealing with

¹Brigham Young, "Manuscript History of the Church, 1805-1879," December 20, 1845, L.D.S. Church Historians Office, Salt Lake City, Utah.
²Ibid., December 25, 1845.
³Ibid., December 29, 1845.
⁴Christian, pp. 37-41.
the western country. Of this available information it has been said:

The significance of the foregoing references consists in the fact that when condition made a removal from Illinois inevitable those Mormons who had read the church periodicals possessed valuable information relative to the land they were going to whether it be the California coast, Oregon, or the Great Basin.

It is obvious the information concerning the West was readily available, and that it could be obtained by both Church leaders and members.

During the migration of the pioneer company to the Salt Lake Valley the Saints also gained further information from travellers they had already studied. William Clayton noted that personalities such as Jim Bridger and Miles Goodyear were encountered on the trail. These men spoke favorably of the Great Basin region, and helped the Saints clarify their perception of the area.

When the Saints arrived in the Salt Lake Valley they found few environmental conditions that they did not expect. William Clayton indicated in his journal that the Saints knew before their arrival what the Great Basin environment would and would not offer them:

There is but little timber in sight anywhere, and that is mostly on the banks of creeks and streams of water which is about the only objection which could be raised in my estimation to this being one of the most beautiful valleys and pleasant places for a home for the Saints which could be found. Timber is evidently lacking but we have not expected to find a timbered country.

---

1 Andrew Love Neff, *History of Utah 1847 to 1869* (Salt Lake City; The Deseret News Press, 1940), pp. 33-35.
2 Ibid., p. 37.
4 Ibid., p. 309.
The Church leaders and members must have understood the environment of the region to a fair degree not to expect a well timbered country.

The Mormon Knowledge of Irrigation

Knowing their destination and the environment of that destination, Church leaders were undoubtedly aware that irrigation would be required to raise crops. Thomas F. O'Dea in the, The Mormons, noted that Church leaders discussed the problem of irrigation while in Nauvoo and at Winter Quarters:

Moreover, before migration the Mormons had suspected that irrigation might be necessary in their new location and had discussed the problem in Nauvoo and at Winter Quarters.¹

Leonard J. Arrington in the Great Basin Kingdom also indicates that the Church leaders discussed irrigation techniques, but like O'Dea gives no source for his information.² No doubt Church leaders were aware irrigation would be necessary from reading Fremont's Journal. As noted earlier in this study Fremont spoke of irrigation while he was at Sutter's Fort in California. The other information studied by the Church leaders would also indicate the rainfall was not sufficient for cultivation and that irrigation would likely be necessary for successful agriculture. That Church leaders did realize this is evident from an important entry made by Brigham Young on February 26, 1847:

Conversations ensued relative to the journey westward, the construction of boats, pioneer traveling, location, seeds, irrigation science, etc.³

³Brigham Young, "Manuscript History of the Church," February 26, 1847, MS, L.D.S. Church Historian's Office, Salt Lake City, Utah.
This statement refers to a discussion among Church leaders, and is a specific reference to irrigation made by the presiding elders of the Church before their arrival in the Salt Lake Valley. Only a few days later another reference to irrigation was made by a Church leader. While speaking to the Saints Willard Richards reasoned against moving the entire body of Church members West all at one time.

If we go 5 or 600 ms [miles] to put in a crop this spring we shall probably be too late as the drought comes on much sooner in that region of the country than it does here, thus you see we will have to be careful and select a location where we can irrigate everything that we put into the ground, which will doubtless require considerable of labour to build a dam, cut races or make troughs sufficient to water a farm of that size.¹

These statements of Brigham Young and Willard Richards may be the only recorded references to irrigation made by Church leaders before their arrival in Utah. The lack of additional references may or may not be due to the fact that the subject had become common place. Whatever the case the passages above indicate a measure of awareness of irrigation among the Church leaders.

As final evidence it should be noted that upon entering the Salt Lake Valley, the pioneers immediately began to irrigate. They did not deliberate or wait for crops to fail, but immediately dammed City Creek. This would indicate that they knew irrigation would be needed. William Clayton recorded the event on July 23, 1847:

The brethren immediately rigged three plows and went to plowing a little northeast of camp; another party went with spades, etc., to make a dam on one of the creeks so as to throw the water at pleasure on the field, designing to irrigate the land in case rain should not come sufficiently.²

¹Ibid., March 6, 1847.
²Clayton, p. 313.
Clayton also wrote more concerning irrigation in the Salt Lake Valley:

This land is beautifully situated for irrigation, many nice streams descending from the mountains which can be turned in every direction so as to water any portion of the lands at pleasure.¹

From this statement and the success of the Saints at irrigation it would appear that they not only realized irrigation would be necessary, but also had sufficient knowledge and skill to apply it.

Summary

The Church leaders were well aware of their destination before leaving Nauvoo. In fact, by 1845 they had determined to settle in the Great Basin. They had studied and examined maps and reports of the region, and felt it offered them the best location for settlement. Through their study they had developed a reasonably accurate perception of the Great Basin environment and knew essentially what to expect upon their arrival. Knowing their destination and its environment, the Saints also realized that the region would require irrigation and were sufficiently aware of irrigation techniques to apply them.

¹Ibid.
CHAPTER IV

DIFFUSION OF IRRIGATION TO THE MORMONS:

A HYPOTHESIS

Although it has been shown that the Latter-Day Saints and their leaders were aware of the principle of irrigation, the question of the origin of their information remains unanswered. Although it is impossible to state categorically where the Mormons obtained their knowledge, a reasonable hypothesis can be inferred, if not entirely proven. A number of possible sources and routes of diffusion may be examined, some of which are more important than others.

Diffusion from the Spanish

It is hypothesized that the diffusion of irrigation knowledge to the Mormons came primarily from the Spanish, particularly from the Santa Fe region and vicinity. This diffusion occurred primarily by way of the Santa Fe trade and the Mormon Battalion.

The Santa Fe trade

The Santa Fe trade may have been the single most important medium along which irrigation knowledge diffused to the Mormons. After 1822 a flourishing trade developed between Santa Fe and Independence, Missouri. Somewhere between 70 and 320 men a year made the trip between these cities until 1846.\(^1\) The following description of Independence gives an

\(^1\)Thomas, p. 54.
indication of the magnitude of the trade:

By 1842 Independence had become second only to St. Louis as a river port, for it was the starting point of both the Santa Fe and Oregon trails. Each spring greater numbers of emigrants were setting out for the Northwest, and each year the traffic over the Santa Fe trail was expanding. At the height of the spring season the town was overrun with emigrants, river men, trappers, buffalo hunters, traders and teamsters, fighting over the scant grazing for their thousands of horses, mules, and oxen.¹

The traders, explorers, and frontiersmen who made the journey to Santa Fe saw and noted the irrigated fields of the area. William Becknell conducted the first trading expedition to Santa Fe in the early 1820's.² He noted in his journal the following:

Corn, rice and wheat are their principal productions; they have very few garden vegetables except the onion; which grows large and abundantly; the seeds are planted nearly a foot apart, and produce onions from four to six inches in diameter. Their atmosphere is remarkably dry, and rain is uncommon except in the months of July and August. To remedy this inconvenience, they substitute with tolerable advantage, the numerous streams which descend from the mountains by daming them up, and conveying the water over their farms in ditches.³

In 1825 another traveller on the Santa Fe Trail, M. M. Marmaduke, noted in his journal the use of irrigation at Santa Fe.

As regards the face of the country, it is in general remarkably poor and sterile, as not any kind of grain or vegetable can at any season of the year be raised without being watered by water from


³Thomas Becknell, "The Journals of Capt. Thomas Becknell from Boone's Lick to Santa Fe, and From Santa Cruz to Green River," Missouri Historical Review, Francis A. Sampson ed., 4 (January, 1910); 78.
canals taken from springs or the rivers which run through the country.¹

Perhaps the best known traveller and trader on the Santa Fe Trail was Josiah Gregg. Between 1831 and 1840 he traveled the Santa Fe Trail four times. Later he also wrote a book about his experiences which was published in 1844.² In his book he noted the use of irrigation at Santa Fe.

The necessity of irrigation has confined, and no doubt will continue to confine agriculture principally to the valleys of the constant flowing streams.³

He also noted the use of the Spanish acequia.

One acequia madre (mother ditch) suffices generally to convey water for the irrigation of an entire valley, or at least for all the fields of one town or settlement.⁴

Gregg goes on in his discussion of irrigation to give a brief but detailed account of the acequia, its repair and use, and other Spanish techniques of irrigation.⁵

No doubt the explorers and traders who returned to the western frontier of the United States spoke of their observations, and explained the use of irrigation to others. Such information would have been of great interest, and also would have widely diffused along the frontier region by word of mouth.

³Ibid. p. 107.
⁴Ibid., pp. 107-108.
⁵Ibid.
That there was great interest in the Santa Fe area is evident from the attention given the subject by both city and frontier periodicals. These newspapers and magazines further helped to diffuse information about Santa Fe. For instance, the Nile's Weekly Register published many articles dealing with Santa Fe. Neil N. Luxon in his analysis of the Register found this to be the case:

The Santa Fe traders furnished many news items in the twenties, and again in the forties. Most of them were factual ones about the goods traded or were descriptive of the Southwest.¹

The North American Review also published articles dealing with the Santa Fe area. For instance, an article in 1845 specifically points out the use and need of irrigation at Santa Fe.

Agriculture, owing to the necessity of frequent irrigation, is principally confined to the borders of the few streams where water can be found throughout the year; nor can it be expected to flourish, in the absence of the means of transportation.²

Other periodicals also carried reports and descriptions of irrigation at Santa Fe. Becknell's and Marmaduke's accounts of irrigation as quoted in this study were also published by the Missouri Intelligence.³

It would appear that information about Santa Fe including details about irrigation, was available on the frontier. Traders and explorers


brought back the information, and it was diffused by periodical and by word of mouth.

For twenty years the Latter-Day Saints had been on the frontier. The Saints had even lived in Independence for a short time. After establishing Nauvoo they were still only a short distance from this terminal of the Santa Fe trade. This provided the Church leaders and members an ideal location to acquire information relative to irrigation as it took place in the Spanish Southwest. Even if the information were not purposely sought it would be difficult not to hear or read of the Santa Fe area, its people and customs.

Not only were the Saints near the Santa Fe trade, but they may have also taken part in it. Some Church members may have been teamsters, and some evidently went to Santa Fe to trade for the Church. Henry W. Bigler recorded in his journal a meeting with such a trader:

This afternoon we met a Brother Mckinzy returning from Santa Fee [sic] he had left Nauvoo sometime last spring as I understood to go on a mission to trade for the Church and is now on his way to Council Bluffs.¹

This passage would indicate that direct contact with Santa Fe did exist, and no doubt knowledge of irrigation techniques diffused to Church leaders and members by way of the Santa Fe Trail.

The Mormon Battalion

Other contact between the Church leaders and Santa Fe was established by the Mormon Battalion. These five hundred volunteers were mustered into the Army of the West to defend Santa Fe during the Mexican War of 1846. They traveled extensively through the Southwest, and

several made notes in personal diaries of irrigation methods being carried on at Santa Fe and the vicinity. One of these soldiers, Henry G. Boyle, wrote the following:

There are considerable many Spaniards or rather I may say Mexicans living on this River, Thier [sic] mode of living & farming is Singular enough to me but they Seem to get along, & Seem to be happy enough. Thier [sic] land for cultivation [sic] is enclosed by ditches, hedges, & adoba [sic] Walls. On acount [sic] of the dry Seasons in this country, they have to irrigate all this farming land thier [sic] vineyards & orchards which is done by leading the water from the River through ditches through all their grain & every thing else that is raised or produced.¹

Samuel H. Rogers also noted in his journal the irrigation methods being used in the Santa Fe vicinity:

In this country the settlers occupy the vallies sic near the streams, so that they can lead the water upon their fields and gardens, thus irrigating the land.²

Members of the Battalion saw first hand the irrigation practices of the Santa Fe area. This knowledge could easily have been diffused to family, friends, and Church leaders by letter or word of mouth. However, a more direct means of diffusion probably occurred. Before and after reaching Santa Fe, detachments of sick and disable men left the battalion, to proceed to Pueblo for the winter. A few individuals were instructed to continue on to Council Bluffs carrying dispatches. Certainly then, Church leaders were able to receive news and information about the brethren in the Battalion. Perhaps they were even made aware of irrigation methods used in the Santa Fe vicinity. Later twelve of the


²Samuel Holister Rogers, "Journal of Samuel Holister Rogers 1840-1886," October 12, 1846, MS, Brigham Young University Library, Provo, Utah.
Battalion overtook the pioneer vanguard on July 4, 1847, several weeks before their arrival at the Salt Lake Valley. Again information about irrigation may have been diffused to the Church leaders.

Other direct communication with the Battalion at Santa Fe also occurred. Mail, money, etc. was sent by Mormon soldiers by way of individuals acting as messengers. For instance, John D. Lee was sent by Church leaders to Santa Fe to collect the pay of the Battalion members. He spent ten days in Santa Fe and noted in his journal that irrigation was practiced:

They raise some wheat squaw corn onions red peppers squashed & c... they cultivate the valley only and are under the necessity of watering all the stuff they raise.2

Later after returning to Winter Quarters he reported to President Young:

At 7 I met in council at Pres. Young's, Presant: [sic] B. Young, H. C. Kimble, G. A. Smith, W. Woodruff, A. Lyman, O. Pratt, Egan and myself...Pres. Young requested me to give a history of my journey to Santa Fe [sic] which I did. They appeared much interested at the history of the country, manners and customs of the Mexicans our own prosperity, deliverance and protection.3

Lee probably also described the irrigation methods he saw being practiced at Santa Fe.

Regarding the Mormon Battalion several things may thus be inferred. Members of the Battalion saw, first hand, irrigation methods being applied around Santa Fe. There was contact between these brethren and Church leaders at Council Bluffs and later on the Mormon Trail. Therefore, it is very likely that additional irrigation knowledge diffused

---

1 Clayton, p. 282.

2 John D. Lee, "Diaries and Official Records of John D. Lee," October 5, 1846, MS, Brigham Young University, Provo, Utah.

The Mississippi Saints

The Mississippi Saints were one source of diffusion which followed essentially the same route as the Mormon Battalion. These Church members were led by John Brown from Mississippi to Fort Laramie in 1846 in hopes of intercepting the main body of the Saints moving west. Since the main body of the Church did not move west until 1847, the Mississippi group went south and spent the winter at Pueblo. It is likely that this group of Saints saw irrigation being practiced along their way.

Other Sources of Diffusion

Other sources of information about irrigation were also available to the Church leaders. These were of less importance than those already discussed, but were no doubt additional sources of knowledge.

The Mississippi Saints arrived at the Salt Lake Valley from Santa Fe by way of the Battalion to the Church leaders before the

Other Sources of Diffusion

Several men soon came down from the fort which is about two miles from here and made themselves known as a part of the Mississippi Saints who joined them. They have been here two weeks. It caused us much joy to meet with brethren in this wild region of country and also because we should have some news from brethren in the army.
This again was an opportunity for the Church leaders to gain additional insight into irrigation procedures from men who had probably seen irrigation practiced first hand.

General knowledge

Another source of information about irrigation that is usually overlooked may be labeled "general knowledge." As pointed out in the introduction of this paper, irrigation has been practiced for hundreds of years in many parts of the world. It is unreasonable to think that members of the Church had never heard of such a widely used and ancient art as irrigation. Certainly there were learned and educated men in those days who at least had a general understanding of irrigation. This should particularly have been true in a church which highly regarded learning, and was so interested in the Bible lands and missionary work. Therefore, it is felt that some general knowledge of irrigation was had by individual members of the Church. This is evidenced by the use of the term "irrigation" by Church leaders and members. Several passages already cited indicate that the presiding elders of the Church and members of the Mormon Battalion were familiar with the term, and used it in their writings. How widespread such knowledge was is impossible to estimate. The diffusion of this information to individuals is difficult to trace. Nevertheless, it seems to have existed.
Another source of information about irrigation was Orson Hyde, an apostle of the Church. In fact, he was undoubtedly one of the first Mormons to come into direct contact with irrigation. Elder Hyde was called as a missionary in 1840 to:

...visit the cities of London, Amsterdam, Constantinople, and Jerusalem, and also other places which they may deem expedient; to converse with the priests, rulers, and elders of the Jews, and obtain from them all information possible.\(^1\)

He visited Egypt, Syria, and Lebanon, and had opportunity to see irrigation being practiced in several locations. While in Jerusalem he observed and noted the use of irrigation:

I found plenty of water there for baptizing, besides a surplus quantity sent off in a limpid stream as a grateful tribute to the thirsty plants of the garden in the valley.\(^2\)

It is possible that Elder Hyde gave a more detailed description of irrigation techniques when he returned home in 1842.

Another early source of information may have been the western Indians. It is possible that some knowledge of the Spanish Southwest settlements and irrigation may have diffused from the Indians to the Church. There is no way of confirming this hypothesis, but it can be noted that one missionary, Oliver Cowdery, learned of a tribe of Navajo Indians living only three hundred miles west of Santa Fe.\(^3\) Perhaps

\(^1\) *Times and Seasons* (Commerce, Illinois), April, 1840, p. 86.


missionaries also gained information concerning Santa Fe itself.

Samuel Brannan

One other minor source of information may be considered. Samuel Brannan conducted a group of Latter-Day Saints by sea from New York to San Francisco, had opportunity to see irrigation being practiced in the vicinity and later at Sutter's Fort. As already pointed out the Saints themselves practiced some minor irrigation in California. As a result Brannan should have been well acquainted with irrigation. In 1847 he left San Francisco, and intercepted Frigham Young at the Green River:

After dinner the brethren commenced making two rafts, one for each division, and while afterwards Elder Samuel Brannan arrived, having come from the Pacific to meet us, obtain council, etc.1

His main purpose was to convince President Young to continue to California. He did not succeed and later returned to San Francisco. It is feasible that he may have provided additional information concerning irrigation having seen it practiced in the San Francisco area. However, it is not possible to confirm this idea.

Summary

Several possible sources of information concerning irrigation were available to the Church leaders and members. Knowledge of irrigation likely diffused from the Santa Fe area to the frontier and thus to the Mormons. It also appears that some knowledge of irrigation was part of the general milieu of the day. It would be very surprising if the Mormons hadn't utilized it.

The maps on pages 49 and 50 show possible routes of diffusion.

1Clayton, p. 281
Map 2 shows the major source of irrigation information to be the Santa Fe Area. The route of diffusion from this region centers around the Santa Fe Trail which was used by both the Mormon Battalion and the Santa Fe traders. Map 3 shows the minor routes of irrigation diffusion. These routes were of less importance, and some as illustrated by the map are difficult if not impossible to trace in detail.
CHAPTER V

DIFFUSION OF IRRIGATION FROM THE MORMONS

"Whatever Brigham Young's contribution, if he made any, to irrigation farming, it was confined to his own state and people."¹ Such a statement could not be further from the truth. The contributions of Brigham Young and the Latter-Day Saints to irrigation farming cannot be denied, nor can it be said that the great effect and influence of these contributions has been confined to Utah alone. Once firmly established in the Rocky Mountains the Latter-Day Saints became the primary source from which irrigation diffused to other areas of the Western States. Through cooperative effort, for which they became well known; canals, ditches, and dams were built, and the valleys in the immediate vicinity of the Great Salt Lake were irrigated. As early as 1850 more than 16,000 acres were being artificially watered.² The rapid development of irrigation in Utah gave the Saints a greater and more practical knowledge of irrigation methods. In the next fifty years this knowledge and its practical application spread as far north and south as Canada and Mexico and as far east and west as California and Colorado.

Diffusion of irrigation was of two basic types—direct and indirect. Direct diffusion of irrigation principles was accomplished by the Mormons themselves as they personally took the practice of irrigation

¹Steinel, p. 184.
directly to areas outside of Utah. It is the most significant and easily traced diffusion. Indirect diffusion of irrigation principles occurred as non-Mormons came into contact with Mormon irrigation, and then spread the practices they saw to other regions of the West. This diffusion followed many variable routes, and is more difficult to trace.

**Direct Diffusion**

Essentially what is termed direct diffusion in the study refers to the colonization program that was so energetically pursued by Brigham Young and his predecessors. By the turn of the last century, valleys of many Western States had been colonized and irrigated by Mormon pioneers, and even areas of Mexico and Canada had received Mormon settlers. Eventually the Saints applied for statehood, and proposed state boundaries which would have included nearly all of their settlement area. As can be seen from map four the new state would have encompassed much of the Intermountain region. Settlement was even made as far east as Texas,\(^1\) and the Great Plains.\(^2\) It was also once rumored that Mormons were going to colonize Alaska.\(^3\) Today the Mormon cultural region in the western United States can still be traced by its distinctive landscape features.\(^4\)

---


Four periods of Mormon colonization may be recognized. Three of these periods occurred under Brigham Young and the fourth after his death. The first period of colonization encompassed the years from 1847 to 1857. During this time one hundred towns were established. Most of these were in Utah but settlement was also made in the outlying areas of Fort Bridger, Fort Supply, the Salmon River, Carson Valley, Las Vegas, and San Bernardino. However, in 1857 an event of considerable geographical significance occurred as these outlying settlements were abandoned due to the expected arrival of Johnston's Army. This contraction of the Mormon colonization pattern is especially important when considering the fact that several of these outlying settlements were never re-established. During the second period of colonization from 1858 to 1867, 135 towns were established. Again most of these settlements were in Utah, but a number were also established in Nevada and Arizona. The third period of settlement, from 1868 to 1877, saw the establishment of 127 new settlements, a great number of which were outside of Utah. In 1877 Brigham Young died having directed a total settlement of 360 towns. After his death new settlements continued to be established up to approximately 1912. The total number of colonies founded during all four periods was well over four hundred.

1Milton R. Hunter, Utah in Her Western Setting (Salt Lake City; The Deseret News Press, 1943), pp. 359-360.

2Johnston's Army or the so-called "Utah Expedition" refers to United States troops sent to Utah by President Buchanan to put down a supposed Mormon rebellion. The expedition was led by General Albert Johnston in 1857 to 1858. The revolt was shown to be non-existent and no blood was shed.


4Hunter, pp. 362-363.
The significance of the Mormon colonization effort lies in the fact that the Mormon settlers took with them knowledge and experience in irrigation to the surrounding Western States. They were among the first irrigators in many areas, and contributed greatly to the irrigation knowledge and experience of nearly every western state. It has been said of the Mormons:

Mormon cities and towns flourished throughout the area, and they are found today in Arizona, Idaho, Nevada, and California and to a lesser degree in other Western States. Their influence on the culture of the West is another story, but the experience with reclamation that was achieved at Salt Lake was put to good use through the Mormon settlements so that Western irrigation flourished and prospered under Mormon guidance.  

To examine the Mormon influence on irrigation in the West a systematic state by state approach is in order.

**Arizona**

The first Mormon contact with the Arizona region was through the Mormon Battalion. Most of the Battalion members made the trek across Arizona to California in 1846 before joining the main body of Saints in the Salt Lake Valley. No doubt they later provided a wealth of information concerning the Arizona region and its possible colonization and irrigation. Thirty-three members of the Battalion, either on their own initiative or upon request of Church authorities, eventually made their homes in Arizona, and applied their knowledge of the area first hand.

Mormon irrigation in Arizona began as early as 1851 at Tubac. However, this was only a temporary settlement. Permanent settlement

---

1 Golz'e, p. 9.
3 Ibid., 56.
did not begin until later, and did not reach a peak until the late 1870's and early 1880's.

Generally speaking, the Mormon irrigation of Arizona began in the north and gradually moved south. The first agriculture practiced in northern Arizona was that done by the Mormons at Beaver Dams, now Littlefield, on the Virgin River in 1864.\(^1\) Irrigation later spread through northern Arizona and then south to the Little Colorado area. From here settlement expanded to the Salt and Gila rivers and later near the Mexican border. Eventually Arizona became one of the more heavily colonized states that Mormon settlers entered.

In all of the Arizona settlements irrigation was of primary importance. Canals, ditches, and dams were all used to reclaim the Arizona soil. While Indian and Spanish methods and systems of irrigation had dominated the limited agriculture of Arizona for many years, Mormon-American techniques eventually overtook these older systems.\(^2\) These newer irrigation economics greatly aided the development of Arizona, particularly central Arizona. In this area the Mormons have been given a great deal of credit for the area's prosperity.\(^3\)

In summary Mormon reclamation in Arizona was widespread and important. Irrigated acreage was extended and older Spanish irrigation systems improved or overshadowed by Mormon cooperative efforts. The following passage best describes the Mormon contribution:

---

\(^1\)Ibid., p. 117.  
\(^2\)Hutchins, p. 279.  
The agricultural growth of Arizona was given great impetus by the Mormon settlements which began about 1876, and which introduced a new set of irrigation institutions into the Territory.  

Colorado

The diffusion of Mormon irrigation to Colorado occurred in two general areas—the San Luis Valley and southwestern Colorado. In the San Luis Valley the Mormons were not the first to irrigate. As before mentioned, a number of Mexican families had first begun irrigation there in 1840. Though not the first irrigators, the Mormons were more extensive in their efforts, and eventually the Spanish and Mexican influence was considerably lessened. Seventy-two Mormon settlers arrived in the San Luis Valley in 1878 from Pueblo. These settlers were not from Utah but rather from Georgia and Alabama. They were led by Elder John Morgan, and had been at Pueblo since 1877. Brigham Young had advised Elder Morgan to settle these southern Saints at a site where abundant water could be obtained for cheap irrigation. After locating in the San Luis Valley the southern Saints were strengthened by the arrival of ninety more settlers from Manti, Utah, sent by President Young. Since the southern Saints had little or no knowledge of irrigation, the arrival of the Manti Saints was of special importance.

1 Hutchins, p. 278.


3 Hutchins, p. 281.


5 Flower, p. 23.

6 Lantis, p. 206.
By 1881 the landscape of the San Luis Valley had been altered considerably with forty thousand acres of land under cultivation and six towns settled.¹ Eventually nine Mormon communities were established and a considerably greater acreage irrigated. Some Mormon settlers also had dispersed throughout the valley settling individual sites without definite community structure.²

Many canals and ditches were constructed and irrigation carried out on a respectable scale. The main problem encountered was lack of money. Had sufficient funds been available to finance additional irrigation works, Mormon expansion in the valley would have been much greater. The Mormons were also the first to see the need for reservoirs in the nearby mountains, but again money for such projects was not available.³ Despite these restrictions the Mormon settlers contributed greatly to the irrigation development of the valley.

Other Mormon irrigation development occurred in the Mancos and Weber Valleys of southwestern Colorado in the San Juan River drainage. The first Mormon settler to come to the area was Joseph S. Smith. He was able to rent a farm in the Mancos Valley because of his irrigation knowledge and experience. He farmed there in 1880 and moved to the Weber Valley in 1881. As more settlers came, canals and ditches gradually extended, and a reservoir was built. The Weber Valley was especially suited for irrigation and extensive farming of which the Mormon settlers took advantage. Settlement continued past 1901 when the town of Kline was established. Still later in 1905 the Red Mesa area was also settled

by Mormon families who recognized the irrigation possibilities there. Eventually a reservoir was also built in this area.¹

The Mormon influence on irrigation in Colorado was probably less important than in many other Western States, being basically confined to the southern part of the state. Nevertheless, Mormon irrigation did occur, and was of considerable importance on a local basis.

Idaho

The diffusion of Mormon irrigation experience to Idaho began on June 18, 1855 with the establishment of the Salmon River Mission or Fort Lemhi. Almost immediately after their arrival the Mormon settlers proceeded to build an irrigation ditch, and plant peas, potatoes, turnips, and corn. On June 27 the Pattee Creek was diverted into the ditch, and the first crop was watered. This same ditch was still in use as late as 1942² and may still be in use at the present time. During that first year at Lemhi extensive acreage was not irrigated due to the lateness of the season,³ but in the following years Fort Lemhi became the first area of substantial irrigation enterprise in Idaho. Another fort was also established two miles south of Fort Lemhi, and both were strengthened by new colonists sent by Brigham Young in 1857. Unfortunately, Lemhi was abandoned in 1858 due to the approach of Johnston's Army, and severe Indian attacks.⁴


⁴Beal, pp. 142-144.
Mormon irrigation in Idaho was re-established April 14, 1860 when a small group of Mormon settlers founded the town of Franklin, and quickly put into use canal and ditch systems.¹ The importance of Franklin lies in the fact that it was the first permanent settlement made in Idaho and thus the first to develop a complete irrigation system. Only temporary irrigation and settlement had previously been made at Lapwai and Lemhi.²

The following years in Idaho saw the expansion of Mormon settlements northward. During the 1860's, the Bear River Valley and Bear Lake Valley were settled and irrigated. During the same time period, the Malad Valley came under colonization, and its streams were tapped for irrigation purposes.³ In fact, irrigation in this valley was so extensive that all available water in the area was used to irrigate, and as a result dry farming eventually became important.⁴ Mormon settlement gradually spread northward during the 1870's and 1880's. Eagle Rock (present day Idaho Falls), and the surrounding area came under Mormon irrigation during the 1870's while the Snake Fork area experienced an influx of settlers during the years 1883 to 1884 with Rexburg serving as

¹Ibid., pp. 152, 320.

²C. J. Brosnan, History of the State of Idaho (New York, Chicago and Boston: Charles Scribner's Sons, 1918), pp. 82-83.


the center of development.  

Speaking of Idaho as part of the Northwest, Oscar O. Winther said:

This pattern established by the Mormons was of far-reaching significance to the Pacific Northwest inasmuch as the Saints migrated into the Snake River region, to which place they brought with them and made use of the irrigation codes and methods of operation successfully devised in the Great Salt Lake region.  

The Mormons then brought to Idaho the first permanent irrigation and settlement. In the years that followed they contributed in many ways to irrigation, and expanded their influence northward. By 1914 Idaho was one of the most extensively irrigated states in America, and at least partial credit for that achievement belongs to the early Mormon settlers.

Nevada

Although there was some settlement eventually made by Latter-Day Saints in eastern Nevada, the initial and most important diffusion of Mormon irrigation was to Nevada's western and southern valleys. Western Nevada, or the Carson Valley area, was settled first.

In 1850 Captain Joseph DeMont and Hampton S. Beatie arrived from Salt Lake City at a site overlooking the Carson Valley, and founded a trading post which became known as the Mormon Station. A year later in

---


1851 John Reese came from Salt Lake with supplies, bought the station, and began planting and irrigating. ¹ Eventually he was successful in raising wheat, barley, corn, watermelons, turnips, and other vegetables. ² His efforts at farming, the first by a white man in Nevada, resulted in others coming from Utah to settle the area. After 1855 a number of Mormon families established themselves in Washoe Valley, Jacks' Valley, Eagle Valley, and Carson Valley, and built irrigation works to sustain their agricultural economy. ³ Brigham Young sent Orson Hyde to the region, and he established Church organization and effective control of the area. ⁴ The settlers were well on the way to having a substantial and successful agricultural economy when the outer settlements were recalled in 1857. ⁵ Despite the removal of the Mormons, their irrigation work and influence remained for others to use and copy.

In southern Nevada, Mormon colonization and irrigation began at Las Vegas in 1855. ⁶ In 1864 Mormon colonization also took place on the Muddy River. It was here in southern Nevada where the Mormon influence was most pronounced. As each new community was surveyed and settled along the Muddy River, one of the first considerations was the placement and construction of ditches and canals. At times considerable work and money were expended in surveying and constructing the irrigation systems. This was especially true of the lower valley as opposed to the upper valley which did not require construction of dams and large canals.

¹ Thompson and West, p. 31.
³ Elliott, pp. 115-116; and Brooks, pp. 19-20.
⁴ Brooks, p. 18. ⁵ Elliott, pp. 115-116. ⁶ Ibid., p. 54.
However, the Mormon's foresight enabled them to grow grain, cotton, alfalfa, corn, orchards, vineyards, and even sugar cane. The irrigation systems proved to be adequate except in times of severe drought such as in 1869. Even then, the settlers helped alleviate the problem by building a new canal three miles long and six feet deep in only five days.1

By 1895 enough settlers had come to the Muddy Valley to warrant the formation of an irrigation company to protect water rights and insure proper water distribution. Today, thanks to the foresight of the early settlers, the irrigation system remains adequate and irrigation a success.2

New Mexico

There are three broad irrigation regions in the State of New Mexico--the Eastern Plains; the Central Valley of the Rio Grande; and the Western Plateaus.3 Spanish and Mexican irrigation greatly affected the irrigation development of the first two regions, but never affected the Western Plateaus to any great extent due to their remoteness and hostile Indians.4 It remained for Mormon settlers to influence the irrigation development of this region.

It is likely that Mormon interest in New Mexico as a region for settlement and missionary activity dates back to the experience of the

---

4 Palmer, p. 7.
Mormon Battalion. Sites for settlement and opportunities for missionary work were noted by Battalion members, and their knowledge and experience were a source of information to other members of the Church.¹

The main region of New Mexico colonized by Mormon settlers was the San Juan Valley. The Western edge of New Mexico was also settled,² but was of less importance. The San Juan settlements were established during the 1880's and eventually numbered six.³

The Mormon settlers were not the first to irrigate the land of the San Juan Basin. Prehistoric Indians in the San Juan region were the first. Anglo-American settlers who arrived before the Mormons also had irrigated the San Juan area to some extent. However it was the Mormons who gave experience and greater impetus to irrigation. They used their knowledge and past experience to establish canals, ditches, and even a dam.⁴

Fortunately Mormon irrigation was aided by an adequate water supply. The San Juan River and its tributaries constitute the greatest water source available in New Mexico, with five-eighths of all the surface water in the state passing through this River Basin.⁵

As a result of abundant water and Mormon irrigation technique,

²Ibid., pp. 66-83.
³History of New Mexico, pp. 864-865; and Palmer, p. 29, 75.
⁴Palmer, pp. 7, 52.
this part of New Mexico was stabilized and increased in value. Thus
the Mormon contribution was an important one in this area of New Mexico.

Wyoming

In Wyoming, Mormon irrigation occurred in three main regions--
the Bridger Valley, the Star Valley, and the Big Horn Basin. The first
area settled was the Bridger Valley in the early 1850's. Next came the
Star Valley area and finally the Big Horn Basin was settled. During this
process of settlement the Mormons brought to these three separate areas
of Wyoming their irrigation knowledge and abilities.

Having passed through Fort Bridger on the way to the Great Salt
Lake Valley, Brigham Young later tried to purchase the Fort. Initially
the purchase attempts were unsuccessful. Unable to buy Fort Bridger the
Mormons established Fort Supply only twelve miles away.¹ Near this Fort
a two hundred acre field was planted and irrigated. This was the first
agriculture and irrigation of any consequence carried out in the State
of Wyoming.² In 1857 settlement of Bridger Valley was abandoned with
the coming of Johnston's Army. When the army withdrew a few of the
Saints returned to the area.³ More substantial settlement of Bridger
Valley occurred later in the 1890's. Eventually three Mormon settle-
ments were established. Canal and ditch irrigation was very important

¹Velma Linford, Wyoming: Frontier State (Denver: The Old West
²Jackie Newton Crawford, "Wyoming: First Agricultural Settle-
³Linford, p. 330.
to these settlements since the Bridger Valley is of little use agricul-
turally without irrigation, except as pasture.¹

Mormon colonization and irrigation of the Star Valley occurred
between 1879 and 1891. During this period eleven communities were
established, six in the upper portion of the valley and five in the
lower.² Canals, ditches, and dams were used almost immediately upon
the arrival of the Mormons in the valley and as each new town was set-
tled. Fortunately nine principle streams provided an abundant water
supply, and assured eventual prosperity.³

In 1893, Mormon irrigation in the Big Horn Basin began on the
Greybull River.⁴ In fact, it was the irrigation features and opportun-
ities which attracted the Mormons to this region. In the beginning
migration to the area was not sponsored by the Church leaders, but by
1900 the Church had given its sanction to the colonization of the Basin.⁵
In that same year additional settlements were opened, and construction
on the Sidon Canal begun. The canal was dug even before homes were
built.⁶ Soon the land around several Mormon settlements in the Big

¹Jerry F. Twitchell, "History of Latter-Day Saints in Bridger
51-58, 71-72, 98-103.

²Linford, pp. 330-331.

³Ray M. Hall, "A History of the Latter-Day Saint Settlement of
Star Valley, Wyoming" (Master's Thesis, Brigham Young University, 1962),
pp. 128-131.

⁴Charles A. Welch, History of Big Horn Basin (Salt Lake City:
Deseret News Press, 1940), p. 49.

⁵Charles Lindsay, "The Big Horn Basin" (Ph.D. Dissertation,
University of Nebraska, 1930), pp. 164, 191-192.

⁶Welch, p. 84.
Horn Basin was being irrigated three to five miles in every direction.¹

The Mormon impetus to irrigation in Wyoming has been substantial. Three times, in three separate areas, a direct diffusion of experience and ability occurred. Mormons were the first to irrigate Wyoming soil, and continued to contribute to irrigation expertise right up to the turn of the last century.

Washington, Oregon, Montana, Texas, and California

Diffusion of Mormon irrigation to Washington, Oregon, and Montana by the direct means of colonization did not occur. It is possible that individual Mormon families settled in these areas, and in a small way aided to diffusion of irrigation principles. However, no colonies were established in these three states.

There was a minor Mormon influence in Texas. In 1901 the town of Kelsey was officially organized as a Mormon settlement. Irrigation was carried on,² but just how much this influenced others in the area is not known. Mormon irrigation in the whole of Texas was very small, and direct diffusion of irrigation knowledge and methods by colonization almost nil.

In California, as has already been mentioned, a small group of Mormons irrigated in the San Joaquin Valley before the main body of Saints arrived in Utah. Only one other major Mormon attempt at irrigation

---


²Hearne, pp. 11-51.
in California took place. This was at San Bernardino. Here a colony was established and irrigation practiced:

When the Mormons arrived they almost immediately began the construction of ditches to water their garden spots and grain fields. While they made no concerted effort at irrigation, they dug a number of open ditches and brought considerable area under irrigation.¹

San Bernardino was later abandoned when the outpost settlements were recalled due to the approach of Johnston's Army. After the Mormons had left, other settlers used the irrigation works they had constructed.² This was the extent of direct diffusion or colonization in California since San Bernardino was never re-established by the Mormons.

Canada and Mexico

The north and south extent of Mormon influence is well illustrated by the diffusion of Mormon irrigation to Canada and Mexico. In both countries the Latter-Day Saints were able to make a contribution to irrigation development.

The first Mormons to settle in Alberta, Canada, arrived in April of 1887 at a place called Lee's Creek, later known as Cardston.³ This was the beginning of Mormon colonization and irrigation in Alberta which was to last past the turn of the century, and result in the establishment of a number of Mormon communities. The Mormon colonization also repre-

²Ibid.
sents the first construction and use of irrigation works in Alberta.  

The early irrigation done by the Mormons was similar to that done in Utah, and was very successful. In 1898 recognition of their irrigation abilities was given them. Farsighted officials of an Alberta railroad company offered them a contract to construct a ninety-mile-long canal designed to irrigate an extensive acreage. One reason cited why the Mormons were given this contract was the fifty years of irrigation experience they brought with them from Utah. The canal was successfully built with the Mormon people providing the main impetus.

Other contributions were also made by the Mormons in Canada. Using their knowledge and experience in irrigation they helped to build the agricultural economy of Alberta. Partly because of their own initiative, Canadian Mormons today are located in the heart of the most productive irrigation projects in Canada, and have helped bring irrigation to other regions by pressing for irrigation legislation. In summary, "Irrigation was unquestionably the most important contribution of the Mormons to western Canadian agricultural development."  

Mormon irrigation in Mexico was the direct result of Church missionary activity in that country. Brigham Young instructed missionaries sent to Mexico to report any areas suitable for settlement. As a result

---


2Tagg, p. 179.


4Tagg, p. 197.  

5Lee, p. 20.  

6Ibid.

ten colonies were eventually established between the years 1885 and 1912.\(^1\) So important was irrigation during the founding of these colonies that plans for irrigation sometimes pre-empted actual settlement.\(^2\) With their experience and industry, the Mormons soon established good irrigating systems that were an example to the native people of what could be done. So successful were the Mormon agricultural pursuits that they often entered their produce in exhibitions in Mexico City, and usually won the grand prizes.\(^3\)

As in many Western States, the Mormons brought to Mexico a greater understanding and experience in irrigation which led to what has been called an efficient and economical system of irrigation.\(^4\)

**Indirect Diffusion**

Diffusion of Mormon irrigation knowledge and experience was not limited to the direct means of colonization. Although somewhat isolated at first from the rest of the United States, the isolation did not last. Soon other avenues were open for the flow of knowledge from Utah to the surrounding areas and states. Freighting companies, overland mail, pony express, telegraph, newspapers, and railroad were all eventual strands and routes of diffusion. Communication and transportation ties revealed the progress which had been made in Utah.\(^1\) Visitors could see and study, first hand, the Mormon success with irrigation, and it was not long before irrigation knowledge was commonplace throughout the West and the rest of the United States. To trace all the possible diffusions and their routes would be impossible. Instead it is the purpose of this

\(^1\) Foster, pp. 37-65. \(^2\) Romney, pp. 121-122.

\(^3\) Foster, pp. 56-58. \(^4\) Romney, pp. 96-97.
section to point out the many possibilities for diffusion of Mormon irrigation, and to give two examples of what has been labeled indirect diffusion. These examples are the diffusion of irrigation knowledge from Utah to California as a result of the gold rush and the diffusion of knowledge from Utah to Colorado as a result of Horace Greeley and the Union Colony.

The Gold Rush and Irrigation Diffusion

As was mentioned before, a direct diffusion of irrigation knowledge from Utah to California through colonization was very limited. Perhaps more important was the flow of irrigation knowledge over the California Trail during the days of the Gold Rush. Widtsoe gives the following description:

Soon after the founding of irrigation in the Great Salt Lake Valley, gold was discovered in California. Most of the tens of thousands who flocked to the gold-fields passed through Utah and Salt Lake City, and thus became in a measure acquainted with irrigation. Many of these emigrants upon their arrival in California, found irrigation agriculture more profitable than gold-hunting. Others, rich or discouraged, returned to their homes in the East, and told not only of the gold-fields, but of the conversion of the heartless desert into a fruitful garden by the intelligent will of a courageous people. The stories of the travelers gained currency until the whole country knew a little of the practice and possibilities of irrigation in the Great West.

Other authors have also acknowledged this flow and spread of irrigation knowledge due to the California gold rush.²

---


As national attention was focused on California and the West, irrigation also began to receive widespread publicity. Not only did the 49er's help diffuse Mormon irrigation practices to California, but they also helped introduce the entire nation to the practice of irrigation.

The Union Colony and Irrigation Diffusion

Mormon colonization was not the only type of colonization to operate in the Western States:

After the Utah demonstration of the feasibility and profitable results of irrigation, projects were launched in all parts of Western America, independently or based on the Utah or the early Spanish experience. 1

Of these other colonization attempts which were based on the Mormon experience the most well known was the Union Colony at Greeley, Colorado. This successful colony eventually proved the soundness and correctness of Mormon methods. 2

The development of the Union Colony began with Horace Greeley:

The decade of the sixties saw the development of an enthusiastic movement in behalf of irrigation. This movement apparently received its main impetus as a result of a trip made by Horace Greeley across the continent in 1858. On this trip Greeley had come into contact and was much impressed with the Mormon irrigation system. Shortly after his return, he printed several articles in the New York Tribune on irrigation farming. In 1869, M. C. Meeker, the agricultural editor of the Tribune, proposed to establish a colony in Colorado which would be based upon irrigation.3

Here again is an indirect source of diffusion, the newspaper.

---


2 Widtsoe, Principles, p. 460.

Eventually Greeley's experience and writings led to the planning of the Union Colony. However, it should be noted that it was M. C. Meeker who became the real driving force behind the founding of Union Colony. He himself set out in 1869 to visit Utah, and study the Mormon irrigation system. Meeker never made it to Utah on this particular journey as he was stopped by snow in Cheyenne, Wyoming. However, after the initial stages of planning, a location committee was sent west to investigate possible locations for the colony. The committee consisted of M. C. Meeker, General R. A. Cameron, and a Mr. Fisk of Toledo. They were also joined by H. T. West. Meeker and the location committee did visit Utah:

They all went on from here to Utah, and Mr. West, who had been there before and had relatives and acquaintances, made the rest acquainted, and the leading Mormon dignitaries of church and state treated them with much consideration and gave them all the information they could about crops, fruit culture, irrigation, etc.

In Utah they gained a great deal of information including valuable understanding of irrigation procedures. Later, Union Colony at Greeley was founded, and in many ways imitated the Mormon systems of cooperation and irrigation.

Further diffusion of Mormon irrigation knowledge and methods occurred later when several other colonies were founded copying the Union Colony methods:

The success ultimately attained by the Greeley colony and the wonderful results shown by the Mormon communities, which have spread from Utah north into Idaho and Wyoming and south into Arizona, have attracted public attention and have greatly stimulated the colony idea. As a consequence, many organizations have been formed for the

1David Boyd, A History: Greeley and the Union Colony of Colorado (Greeley, Colorado: The Greeley Tribune Press, 1890), 16, 39.

2Ibid., p. 41.
purpose of bringing people in large bodies from the Eastern states, and even from Europe, and placing them upon small farms located near each other and supplied with water from a common ditch.¹

Some of these colonies were the Chicago Colony at Longmount, Fountain Colony at Colorado Springs, Agricultural Colony at Fort Collins, and Southwestern Colony at Green City.²

As can be reasoned, Mormon irrigation diffused to the Union Colony at Greeley and from here to a number of other colonies. In the process the public attention was drawn to the study of irrigation, spreading the principle widely through the United States.

Summary

The diffusion of Mormon irrigation in the Western States occurred by means of direct and indirect methods. Of the two, direct diffusion was the most important in spreading irrigation. Map five best summarizes this diffusion by showing the extent of Mormon colonization and irrigation during the sixty-five year period from 1847 to 1912. Since the purpose of the map is to show the fullest extent of colonization and irrigation, both successful and unsuccessful attempts are shown. It is evident that Mormon irrigation was diffused to a great part of the Western States by direct colonization.

Although not as important as direct diffusion, indirect diffusion of Mormon irrigation did affect practices in the Western States. Many different indirect routes of diffusion developed as transportation and communication links were established with Utah. It is impossible to


²Widtsoe, Principles, p. 461.
trace all such diffusions, but the two examples offered illustrate the far-reaching effect of Mormon irrigation.
Sites of Mormon Colonization and Irrigation: 1847 – 1912
CHAPTER VI

INFLUENCE AND STATUS OF PRESENT DAY MORMON IRRIGATION

Indications of past diffusion of Mormon irrigation in the West may still be noted in western irrigation systems. However, much of the early day technology and custom has been replaced by better, more efficient methods which are not Mormon in their origin. Thus, the dominance of Mormon irrigation in the West has long since passed, and much of the Latter-Day Saint development has been pre-empted. Nevertheless, Mormon irrigation was the first large scale reclamation done by Americans, and as a result their developments and contributions, to a degree, are still with us. For instance, the Mormons were first to develop water codes, and their influence in this aspect of irrigation remains a part of western water law. Irrigation developments that were typically Mormon also may still be observed in the landscapes of some western areas.

Water Law as an Indication of Diffusion

Although some Western States officially adopted water codes before Utah, the first development of American water law occurred in the Mormon settlements. Often principles of water law were recognized and used among the Mormons by custom before becoming law. The passage of

water law was therefore not necessary until a later date.

Since the Mormons developed water codes based upon an arid region, the Eastern doctrine of riparian rights,\(^1\) based upon a humid region, was not acceptable. As a result, the Mormons developed the basic principle of prior appropriation.\(^2\) Widtsoe notes the importance of this development:

The Utah pioneers laid down the fundamental principle that since, in an arid country, the use of water for irrigation is the most important concern of the people, the doctrine of riparian rights must be abrogated, and the proper use of water in irrigation must constitute the fundamental claim of the individual upon the use of the freely flowing waters of the State. This doctrine, which now seems axiomatic, represents a great contribution to the conquest of the arid West by irrigation.\(^3\)

The principle of prior appropriation diffused widely in the West. Today, nine of the eleven Western States, incorporate this doctrine into their laws. Two states, California and Arizona, use both the doctrine of riparian rights and the doctrine of appropriation in their systems.\(^4\)

Since early times, the water laws of these states have become very complex and have been developed to meet the needs of each particular state. However, the principle of appropriation is the prevailing Western doctrine.

Partial credit may be given to the Mormons for helping establish prior appropriation as the basis of water law in many Western States.

---

\(^1\)Riparian rights refers to the right of a land owner to use the water on and under the surface of his property. However, the owner may only use the water and not deplete it to the extent that other right owners would be injured.

\(^2\)Prior Appropriation assumes that surface and underground water belongs to the public, but that individuals may establish prior claim to the use of the water. Prior claims may deplete the water source even to the detriment of later claims.

\(^3\)Widtsoe, *Success*, pp. 2-3.

\(^4\)West, pp. 24-33.
However, the California gold miners played even a greater role in establishing this doctrine. The miner's version of prior appropriation spread more quickly to areas of the Northwest, Montana, Wyoming, and other western regions because of mining activities in these states.\(^1\)

Nevertheless, the Mormons were the first to apply the principle of prior appropriation to agriculture. As a result they also contributed to establishment of this doctrine in the Western States, especially as it applies to agriculture.

**Mormon Methods as an Indication of Diffusion**

Irrigation characteristics which are typically Mormon are still faintly recognizable in several states bordering Utah. These methods and irrigation features were part of the cultural landscape associated with the Mormons, and some irrigation features were particularly common in early Mormon reclamation.

The early Mormon irrigation systems as characterized by the small towns of Utah typically began with one or two major canals leading from a stream in a canyon or further up the valley. The canal or canals were subdivided into ditches serving different areas of the valley which were further subdivided to serve individual farms. Laterals took the water to the fields where furrow or flood irrigation was practiced. Characteristically, the ditches in Mormon towns were small and of dirt construction. Roadside ditches used to flood lawns or water gardens were, and still are, very typical of Mormon irrigation. Other Mormon cultural

\(^1\)Hutchins, pp. 160-165, 287.
landscape features such as early housing, hay derricks, poplar trees, etc., were also part of the early Mormon landscape. ¹

The same cultural landscape elements including irrigation features which characterized early Mormon settlements in Utah may also be observed outside of the State. Many of the small communities of the Star Valley of Wyoming, the San Luis Valley of Colorado, the San Juan Basin of New Mexico, southern Nevada, and southern Idaho show many elements of the Mormon cultural landscape including similar irrigation features. In some areas the original irrigation system constructed by early Mormon settlers has not been greatly altered.²

Present-day Status of Mormon Irrigation

In the early years of Mormon settlement irrigation was a premier accomplishment for which the Mormons had no equal. As irrigation diffused, however, other areas of the West experienced more rapid irrigation development and soon Utah was overtaken in amount of irrigated acreage and in technological development.

Statistics of irrigated acreage in the West before 1889 are very scarce and at best only approximations. However, it would appear that in the spring of 1848, less than one year after the arrival of the first Mormon settlers, that five thousand acres were under irrigation in Utah. By 1850 this figure had increased to 16,000 acres.³ Irrigated acreage


²Observation in the field, San Juan Basin of New Mexico, May 13-16, 1974; southern Idaho, May 22-24, 1974; and San Luis Valley, Colorado, June 4-6, 1974.

³Golz'e, p. 6.
in Utah steadily increased and by 1865 153,949 acres were being irrigated by 277 major canals, a total of 1044 miles in length.\footnote{Widtsoe, \textit{Success}, p. 4.} This represents a significant achievement and substantial irrigation development. By 1870, the total acreage estimated to be irrigated in the entire area of the Western States ranged from only 250,000 to 300,000 acres.\footnote{Golz'\'e, p. 11.} Irrigated acreage in Utah accounted for more than half the total irrigated acreage in the Western States in that year.

There had been little irrigation development outside Utah up to 1870.\footnote{Donald M. Baker and Harold Conkling, \textit{Water Supply and Utilization} (New York: John Wiley and Sons, Inc., 1930), p. 7.} This approximate date was perhaps the height of Mormon irrigation in the West. As the 1870's progressed, Utah continued to be the dominant irrigating region. However, by this time irrigation had widely diffused. In 1880, it is estimated that rapid irrigation development in the West had resulted in more than one million acres under irrigation.\footnote{Golz'\'e, p. 11.} In 1889, the first census of irrigation was conducted and it showed that a total of 3,631,381 acres were being irrigated in the Western States. Of this amount, only 263,473 acres were being irrigated in Utah. Three states, California, Colorado, and Montana, had surpassed Utah in total irrigated acreage. California alone irrigated more than one million acres in 1889.\footnote{U.S. Bureau of the Census, \textit{Eleventh Census of the United States: 1890 Agriculture by Irrigation} (Washington: Government Printing Office, 1894), pp. 1, 22, 33, 157, 218.} After the turn of the century, irrigation development continued at a rapid rate. The 1969 census showed that only
Nevada and New Mexico had not surpassed Utah in total irrigated acreage.\textsuperscript{1}

There are several geographic factors which likely contributed to Utah's loss of dominance. First of all, rapid population increases in states outside of Utah created a need for more irrigated land. Second, a number of states simply had more suitable farming area. Third and perhaps most critical was the availability of water. In this aspect many states fared better than Utah. As a result, by 1971 Utah irrigated only 1,349,000 acres of the fifty million irrigated in all of the United States.\textsuperscript{2}

Although the Mormons in Utah pioneered in irrigation engineering, they have been surpassed in modern irrigation technology. Perhaps the best index of each state's level of irrigation technology is the percentage of sprinkling irrigation in each state. Sprinkling systems are perhaps the most widely used modern irrigation development. This method of irrigation increases the yield per acre while using less water per acre, making it one of the most efficient means of irrigation. The map on page 83 shows the location of areas with the heaviest sprinkler use. The map also indicates that Utah ranks ninth of eleven states in this form of modern technology.

Other indexes may be used, but it is evident that Utah lags behind the other Western states in irrigation technology. As a general rule dirt ditches and canals, reliance on older methods of irrigation, and a lack of modern irrigation equipment characterize much of the


\textsuperscript{2}West, p. 9.
Sprinkler Irrigation as a % of Total Irrigation

- < 10%
- 10-20%
- 20%
- > 20%
irrigation farming done in Utah and also in areas of Mormon influence outside of the state. Small farms, lack of capital, marginal land, and a general inability to change older established irrigating rules and systems seem to be the reasons for Utah's lower status in irrigation technology and progressiveness. The situation contributes to the decline of small Mormon towns which in turn discourages capital investment needed to rectify the situation.

**Summary**

Present-day indications of diffusion do exist in the Western States. Remnants of early Mormon colonization and the impact of Mormon water law development are proof of past diffusion patterns. However, Mormon irrigation is no longer the dominant influence of western irrigation. It is instead of less importance in total acreage and in technological development.
CHAPTER VII

SUMMARY

Irrigation has played an important part in the development of the Western States. Its beginnings have often been associated with Mormon settlement in the Great Basin in 1847. However, irrigation had its inception in the West long before that date. Prehistoric Indian culture groups in the Southwest were the first irrigators in what is now the Western United States. Spanish irrigators followed and expanded the Indian attempts. Under the Spanish, areas of Texas, New Mexico, Arizona, and California were irrigated. A number of Anglo-American also practiced irrigation in isolated instances throughout the West. Missionaries, traders, and mountain men practiced irrigation on a small scale in areas of Washington, Oregon, Idaho, Colorado, and in other western regions. Eventually the soil of nearly every Western State was irrigated to some extent before the Mormons arrived in the Great Basin.

Before the Mormons came to the Rocky Mountains they had studied several possible sites for settlement. Before the exodus from Nauvoo, Illinois, began, Church leaders had decided to settle in the Great Basin region. They had studied the area and formed a reasonably accurate perception of its environment. Church leaders also realized that they would probably need to practice irrigation to sustain an agricultural economy.

While the Mormons understood the basics of irrigation agriculture, the origins of this knowledge are unclear. It is unlikely that
Irrigation knowledge diffused to them from the Spanish Southwest. It also appears some understanding of irrigation was part of the general milieu of the day. The circumstances of the time and the location of the Mormons made such irrigating information readily available and a diffusion of that knowledge probable.

Further diffusion, this time from the Mormons to areas of the Western United States, also occurred. After gaining some practical experience in irrigation, Mormon colonizers began to take the practice of irrigation to many areas in the Western States, Canada, and Mexico. Between 1847 and 1912 Mormon irrigation systems were built in hundreds of locations throughout the West. This direct Mormon influence in many states gave impetus to later irrigation developments. As the isolation of the Great Basin was broken down, further diffusion of Mormon irrigation took place by indirect means. Transportation lines, communication lines, periodicals, and individuals soon made the knowledge of Mormon irrigation available all over the United States.

The Mormon influence still lingers in the irrigation of the Western States, but the dominance of Utah in irrigation has passed. Today Mormon irrigation in Utah is of less importance in terms of total acreage and technological development. Nevertheless, remnants of past Mormon influence and diffusion may be faintly recognized.
BIBLIOGRAPHY
BIBLIOGRAPHY

Books


Fremont, Brevet Captain John C. Report of the Exploring Expedition to the Rocky Mountains in the Year 1842 and to Oregon and North California in the Years 1843-'44. Washington: Gales and Seaton, 1845.


Periodicals and Newspapers


Nile's [Baltimore] Weekly Register, 9 July 1825.


Simmons, Marc. "Spanish Irrigation in New Mexico," New Mexico Historical Review, 47 (April, 1972): 135-150.


Commerce [Illinois] Times and Seasons, April, 1840.

Unpublished Material


Journals and Manuscripts


Jensen, Andrew, ed. "Journal History of the Church." Latter-day Saint Church Historian's Office, Salt Lake City, Utah.
Lee, John D. "Diaries and Official Records of John D. Lee." MS, Brigham Young University, Provo, Utah.

Rogers, Samuel Holister. "Journal of Samuel Holister Rogers 1840-1886." MS, Brigham Young University, Provo, Utah.

Smith, Joseph. "Manuscript History of the Church, 1805-1879." MS, Latter-day Saint Church Historian's Office, Salt Lake City, Utah.

Young, Brigham. "Manuscript History of the Church, 1805-1879." MS, Latter-day Saint Church Historian's Office, Salt Lake City, Utah.


Public Documents


THE MORMON ROLE IN IRRIGATION BEGINNINGS AND DIFFUSIONS

IN THE WESTERN STATES: AN HISTORICAL GEOGRAPHY

Kelly C. Harper

Department of Geography

M.S. Degree, August 1974

ABSTRACT

Irrigation has played an important part in the development of the Western States. Its beginnings have often been associated with the Mormon settlement in Utah. However, irrigation had its inception in the West long before the Mormons came to the Great Basin in 1847. The spatial extent of irrigation before this date included limited acreage in nearly every Western State.

Before their arrival in the Great Basin the Mormons had become acquainted with irrigation methods. Knowledge of irrigation had diffused to them primarily from the Spanish in the Southwest. Thus, they were well prepared to begin their irrigation enterprises in the West. After establishing the practice of irrigation securely in Utah, this region then served as a source area from which irrigation methods then diffused to other Western areas.

Eventually, the status and influence of Mormon irrigation waned. In more recent years Utah has fallen behind other Western States in total irrigated acreage and in the application of new irrigation technology.

COMMITTEE APPROVAL:

Richard H. Jackson, Committee Chairman

Alan H. Grey, Committee Member

Robert L. Layton, Department Chairman