A study of the plant ecology of Salt Lake and Utah valleys before the Mormon immigration

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A STUDY OF THE PLANT ECOLOGY OF SALT LAKE AND
UTAH VALLEYS BEFORE THE MORMON IMMIGRATION

A THESIS SUBMITTED TO
THE DEPARTMENT OF BOTANY
OF
BRIGHAM YOUNG UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF
MASTER OF SCIENCE

BY
JOHN HOMER WAKEFIELD
1933
This Thesis by John Homer Wakefield
is accepted in its present form by the Department
of Botany as satisfying the Thesis
requirement for the degree of Master of Science.

May 22, 1933          Signed
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A STUDY OF THE PLANT ECOLOGY OF SALT LAKE AND UTAH VALLEYS BEFORE THE MORON IMMIGRATION

INTRODUCTION

In recent years the stockman and forester, the farmer and urbanite have become awakened to the need of conservation of forests, water sheds, and grazing lands. As they become conscious of over-grazing, overcutting, or burning, they see the results in floods, poor cattle, and water shortage. In correcting this situation, grazing permits are reduced, cutting is restricted, and fire prevention methods are adopted with the view of allowing the ranges and forests to come back to their former condition. Many times it is desirable to know just what the former vegetation was.

In the study of the Davis County flood districts of 1930, (45) the Governor's committee made up of qualified engineers, geologists, foresters, and stockmen, concluded that there were three principal causes of the floods. The first being uncommonly heavy rainfall, the second geological conditions and steep topography and the third scant vegetation.

A study of the deposits at the mouths of canyons in Davis County show the rate and amount of erosion and deposition from floods in past ages. The texture, structure, and form of these deposits, show that the 1923 and 1930 floods mark a distinct increase from the normal rate of erosion since Lake Bonneville. In other words there have been abnormal conditions of late years, and these abnormalities can be looked for in the plant covering of the watersheds.

The committee in its report says that "Plant cover is the only one of the three major factors in relation to floods that is subject to
human influence, except as dams and basins can be used to control run-off." This would indicate that due to man, the vegetation is not the same as it was before the coming of the pioneers.

In recent years there have been a few attempts to reconstruct the probable original plant covering of the state as an aid to present studies in plant succession. Evans (17) in 1925 listed plants found in fence corners and other places protected from fire and grazing. The plants found in these protected areas were listed as the probably original floral covering of that area. This procedure was not entirely satisfactory as often wrong conclusions are arrived at due to the presence of introduced species, for instance Bromus tectorum.

Pickford (32) has made an attempt to determine the natural vegetation of the foothills in Salt Lake Valley in order to ascertain the changes that have taken place due to grazing, fire, and other human factors. This was accomplished by the study of a large number of protected areas. Areas that had been protected from fire, from grazing or from both.

In Tidestrom's Flora of Utah and Nevada, there is a chapter on "Plant Communities in Utah and Nevada" by H. L. Shantz, and one on "The Foothill-Montane-Alpine Flora and Its Environment" by Arthur W. Sampson.

Cottam (15) indicates changes that have taken place in Utah Valley and Utah Lake, basing his comparison on some historical evidence and some verbal description.

In every study of plant succession, whether it be for pure science or for economic purposes, it is highly desirable to know what the plant associations were before the factors that man controls, entered
There are two methods by which this information may be acquired; one by experiment, the other by studying historical data.

Of the many methods of studying vegetation, the permanent quadrat (fenced in) would be the most useful in attempting to determine the natural vegetation of a district. To wait for a study plot to come back to its original condition would be a long process as succession in arid or desert regions is very slow and it is hard to bring back.

Another method is to locate such protected areas as old neglected cemeteries and other enclosures that have been protected from grazing, fire and other disturbing factors; but then, as before mentioned, there is the introduced species that will migrate in and often disturb the original balance.

In contrast to the experimental, the historical method depends on the collecting of data, statements and descriptions, from journals of pioneers, of explorers, and of any reliable source, also from verbal descriptions by living witnesses.

This study is an attempt to bring together such available material, heretofore not collected, into a single compilation pertaining to the plant associations of Utah and Salt Lake Valleys. An endeavor is made to build a picture of the vegetation as it was before the pioneers entered these valleys as compared with what it is today.

The material compiled here is the result of searching through all available sources such as government reports of geological explorations, private diaries of explorers and pioneers, contemporary magazines, books and newspapers. This study was started during the summer of 1932 and was undertaken at the suggestion of Dr. Walter P. Cottam, and to him the writer expresses his appreciation for the council and encourage-
ment he has given, also for the loan of photographs and other material. Acknowledgements are also due Dr. T. L. Martin and Mr. Bertrand Harrison of the B. Y. U. department of Botany, and to Dr. William J. Snow of the department of history for their interest and council.
PRESENT STATUS

Physiography

The Salt Lake and Utah valleys lie in the north-central part of the state of Utah and entirely within the Great Basin. The dominant features of this region are the lofty Wasatch Mountains which form the eastern rim of the two valleys, as well as that of the Great Basin. The two lakes, Great Salt Lake and Utah, lie in the western extremities of these valleys. Between these lakes and the mountains on the east is a varying strip of fertile land now cultivated and supporting considerable of the population of the state.

The average altitude of this section is from 4,255 feet above sea level at the shore of Great Salt Lake to an average of 4,500 feet on the floor of Utah Valley.

The western limits of Salt Lake Valley are formed by desert mountains rising like islands from the old floor of the ancient Lake Bonneville the geological predecessor of Great Salt Lake. To the east there are the lofty peaks of the Wasatch Range while on the south lie the Oquirrh Range.

Utah Valley is flanked on the west by Lake Mountains which slopes rather gradually from the western shores of Utah Lake to a height of 3,000 feet above them. This mountain is some fifteen miles long and is connected by low hills with the East Tintic Mountains on the south, and the Oquirrh Mountains on the north. The gentle slope of the Utah Valley east of the lake is suddenly terminated by the abrupt slopes of the "Wasatch Mountains, a magnificent range of partially wooded slopes and snowy peaks, from 9,000 to 12,000 feet above sea level." (2)
Great Salt Lake is about thirty miles wide by eighty miles long, with an average depth of twenty to thirty-five feet, and an area of about 1,500,000 acres. The water level fluctuates about twenty-two inches annually on the average. The level is controlled by the precipitation on the water-sheds and the evaporation from the surface of the lake. Due to this oscillation the surface area varies and the salinity varies considerably. Its percentage by weight in the high water of August 1873 was 13.42 while in the low water stage of October 1903, it was 21.72 percent. (2)

Utah Lake is a large body of fresh water which freezes over practically every winter. It is about twenty-two miles long and ten miles wide, and covers approximately 93,000 acres and has an average depth of only eight feet. It is crescent in shape which corresponds in general to the crescent of the South Wasatch Range.

Utah Valley is about thirty-eight miles long and averages fifteen miles in width and occupies about 560 square miles including the lake. With the exception of the ten mile strip west of Goshen Bay that slopes some five miles to the East Tintic Mountains, there is but a narrow barren strip of foothills of little agricultural value. In contrast the west shores of Great Salt Lake are much more barren; a great part of it being a salt desert. The lands immediately to the east of the lake are also somewhat salt saturated which farther on gives way to alkali, but continuing towards the mountains the uplands and benches are fertile. These benches, or deltas, are found all along the eastern side of the valley and have been cut through by streams from the mountains.

A similar delta formation is found along the eastern boundary of Utah Valley. The most prominent formation being Mapleton Bench at
the mouth of Spanish Fork Canyon, and Provo Bench at the mouth of Provo River.

The water in Utah Lake is derived from several sources; streams, seepage, springs in and near the lakes, and precipitation. Most of the water comes from streams from the mountains, but the underground source is considerable. Utah Lake drains an area of about 3,600 square miles, all of which is in the Wasatch Mountains, except some of which is in the Uintas at the head of Provo River. There are no streams from the mountains on the west. By far the largest tributary of Utah Lake is Provo River. Its source lies in some small glacial lakes in the Uinta Mountains seventy-five miles north east of its mouth. It drains an area of more than 600 square miles in the Wasatch and Uinta Mountains (38). Spanish Fork River is the next largest with a drainage area almost as large as Provo. There are ten streams entering the Lake and only one, the Jordan, flowing from it.

The Bear River enters Great Salt Lake at the north east after a circuitous journey through three states, having risen in the north side of the Uintas. The Ogden River, Weber River, and a number of lesser streams flow from the east side and all but the Weber and Bear rise in the Wasatch Mountains. The Weber has its beginning near the head of the Provo River in the Uinta Mountains.

The Jordan, rising in Utah Lake, is the only stream that traverses for any distance on the valley floor. It flows forty miles through Utah and Salt Lake valleys before emptying into the Great Salt Lake. Its course is slow and winding except where it passes through the narrows at the point of the mountain.
Climate

The general climate of Western Utah is arid with an average annual precipitation of 13.0 inches. The average for the principal settled regions along the east side of the lakes and west of the Wasatch Mountains is over fifteen inches. The flat lands to the west have a much lower annual precipitation, while higher up the mountain the precipitation is more, altitude and distance from the mountain being the chief governing factors.

March, April, and May are normally the wet months in this section, the May and most of the April precipitation being in the form of rain. June, July, August and September are the dry months. There are an average of four stormy days per month in summer and ten per month in spring (with 0.01 inches or more of precipitation). The yearly average for the section is sixty-two stormy days, ranging from thirty in the more arid western part to eighty-five or ninety in the mountains. (2)

The Pacific ocean is the principal moisture source. Much of this moisture is intercepted by the Sierra and Cascade ranges. The Wasatch mountains form the principal topographic control of precipitation within the state as they intercept the winds from the west and therefore, the state's heaviest precipitations are found on the west slopes of these mountains and the north of the Uintas. The area in the depression to the west of the Wasatch is the state's most arid region. Alter sayd (1, p.633) "The precipitation increase with altitude begins at a considerable distance to windward of the mountain base, and is progressive at a fairly regular rate on the long gradual uninterrupted slopes, until near the summit where it decreases slightly. The geographical area of diminished precipitation on the western slope of the Wasatch Mountains at from 7,500 to 8,750 feet altitude is about ten times
the amount over the salt deserts 60 to 75 miles to windward."

The mean annual temperature of the section is about 47.5, though the regions through the cities may average a little higher.

This section has a frost-free season of about 125 days, though on the bench lands, where fruit is grown, the season is 150 days. Extreme temperatures are rare in these districts. The lakes have a slight influence on both uniformity of temperature and on the humidity of the air.

The average total hours of sunshine per hear is 2,905 with an average percent of 63. July furnishes the most hours of sunshine with an average of 362 and is followed by June with a 353 hour average. December has the fewest hours with an average 128. May followed by March are the windiest months with an average hourly velocity of 8.8 and 8.7. December has a velocity of 6.5 and the yearly average is 7.8. The prevailing direction for March, April, May and June is north west, and for the remaining months is south east. (2)

The summer months are characterized by high temperatures and low rainfall and high evaporation. Therefore, the soil moisture used by the plants is largely furnished by the precipitation of the first five months of the year. This has a definite bearing on the character of vegetation in these valleys.
10.

Ecology

The climate of the regions here discussed, is uniform, except for a slightly lower precipitation in the extreme west portion of Salt Lake Valley. The differences of vegetation in the various parts of the valleys are due to differences in topography and soil, therefore the largest ecological division used by Cottam (15) in Utah valley was the physiographic formation, the term being used in a physiographic sense. He also recognized the "association" which is a unit of vegetation essentially similar throughout in regard to its physiognomy and floristic composition. The term "society" designates plant communities of lesser rank occurring in the association and characterized by species that have only local dominance.

Merriam's zone classification for this region would include the Upper Sonoran over the major parts of the valleys with some of the Transition zone reaching down the mountains sides into the foothills, or using Tidestrom's nomenclature (4) the sagebrush belt and the Yellow Pine belt.

Shants (40) lists the following plant formations in Utah and Nevada; alpine grassland, spruce fir forest, western yellow pine forest, pinyon juniper woodland, northern desert shrub, salt desert shrub, and southern desert shrub. Of these only pinyon juniper, northern desert shrub and salt desert shrub would occur in the area under discussion.

Cottam (15) lists the following formation and associations for Utah Valley:

The marsh formation
Pondweed association
Bulrush--cat-tail--reed association
Sedge association
Willow association
The peat bog formation
The sedge-Helanium association

The stream side formation
Willow association
Cottonwood association

The Salt marsh formation
Salicornia-Allenrolfia association
Salt-grass association
Bunch-grass association

The alkali upland formation

The bench-1 and formation
Sage association
Scrub oak association
Juniper association

The sand dune formation
Herb association
Scrub association

The lake cliff formation
The shingle beach formation
The rock island formation
The sandy beach formation
The marginal lake beach
The middle beach
The heliotropium association

The marginal swamp beach.

Swamps and bogs are frequent and sometimes extensive about the shores of Utah Lake. In the fresh water marshes the dominant plants are Potamogetons, Lemnas, and Chara, in the Pondweed association. Scirpus validus vahl, is the most conspicuous species in the bulrush--cat-tail--reed association. The sedge association includes many meadow plants and is the last successional state preceding the willow association. It contains many societies.

The peat bog formation on Utah Lake is very limited in area, and contains no Sphagnum nor is it acid. Absence of decay of vegetation may be due to cold artesian water and exclusion of oxygen.

A conspicuous feature of the natural vegetation of Utah valley is the stream side formation. It varies from the salt grass banks of the Jordan river to the heavy groves found along the Provo River. The principal dominants include willows and cottonwoods.
More than half of the 23,360 acres of alkali land surrounding Utah Lake is south and west of Goshen Bay. This land is worthless and supports only extreme halophytes.

The Salicornia-Allenrolfia association in the salt marsh formation supports the three alkali resistant plants, Salicornia utahensis, S. rubra and Allenrolfia occidentalis.

The salt flat meadow is intensively distributed about the shores of Utah Lake on poorly drained lowlands. It consists of the salt grass association, dominated in the wetter places by Distichlis spicata and sometimes Sporobolus airoides in higher drier parts of the meadow. This latter also is found in the bunch grass association which is really a transition between the salt grass and scrub.

The alkali upland formation includes the level alkali scrub land and includes the Sarcobatus, Kochia and Atriplex associations.

Most of the cultivated land in both valleys is on the Maricopa loams of the bench lands and this formation, for that reason, shows a probably greater change than any other formation. Cottam listed a sage brush association, a scrub oak and a juniper association. He no longer considers the sage brush as a climax however. The sage brush is now found in all areas of good soil and drainage. It is the dominant feature and is accompanied by an abundance of spring annuals.

Scrub oak belongs more to the mountains, but in places such as north slopes, it extends down into the foot hills. This association is rich in species.

The juniper association has but a few remnant areas as on Mapleton bench. There are also stands on Lake and West mountains and a few at the point of the mountain.
Salt Lake valley shows a similar succession from lake to foothills. At Saltair is found a salt flat extending from the lake to the Jordan River east and south to about the Garfield road. Evans (17) lists no places except algae on the miry salt flats near the shore. Back a little, where the substratum becomes firmer, is found a scant stand of Allenrolfia occidentalis, Salicornia utahensis, and S. rubra, the most salt tolerant plants of the region. Next to the east of this area is a less alkaline zone of sparse vegetation. The dominants here being Atriplex confertifolia, Distichlis spicata, Chenopodium salinum, C. rubrum Sarcobatus vermiculatus, Salsola pestifer and Kochia vestita. This is typical of most of this region except on high places where Kochia and Grazia spinosa, Poa Sandbergii and Sphaerostigma pubens, are found. On the highest parts of these raised areas are Artemisia tridentata, Guterrozia Sarothri, Erodium cicutarium and Bromus tectorum.

Between the Jordan and Oquirrh mountains the alkali is fairly well leached out, here is a good growth of Artemisia, Chrysothamnus, and various annuals and grasses. Much of this area is now cultivated. Considerable alkali is present near the shores of the lakes and a successional series is found leading from the salt flat to the sage brush association on the benchlands. The salt flats occupy the low undrained section south of Utah Lake and around a considerable portion of Great Salt Lake. The salicornia-Allenrolfia association (15) will probably remain an edaphic climax.

The sage brush association is a questionable climax of the higher, well drained lands and under protected conditions is associated with considerable bunch grass.
EXPLORATION

On July 29, 1776, the same year that marked the birth of a new republic on the far eastern borders of this wild unexplored continent, two Franciscan priests, Silvestre Velez de Escalante and Atanasio Dominguez, left Santa Fe, New Mexico on a trip of exploration with the purpose of finding a new route to Monterey in California. In the course of their journey they passed through Spanish Fork Canyon and probably became the first white men to enter beautiful Utah Valley. During the short time they camped on the south east shores of Utah Lake, the Indians told them of the large body of salt water to the north. In giving Escalante credit for first discovery, due account is taken of the published descriptions of the Baron La Honton who told about such a body of water in 1699. However, there is no evidence that he ever visited the shores of the Great Salt Lake.

After Escalante's arduous journey, it seems that the Spaniards were rather familiar with Utah territory as far north and west as Utah Lake. There is an account of Manuel Mestas in 1805, who at that time had been a guide and interpreter for fifty years. He was familiar with the Yuta language and had visited Utah Valley on several occasions.

The next account of Spaniards trading with the Yutas in the Utah Valley is found in a manuscript at Santa Fe. Snow says (41) "The company consisted of seven men under direct command of Manrico Arze and Logos Garcia. They were gone some four months, leaving Abiquin March 10, 1813 and returning on the 12th of July."

From then on the Spaniards were frequent visitors by way of the Spanish trail, which led from Santa Fe to Central Utah, for the purpose of trading for furs and for Indian women and children for slaves.
Probably the first Americans to enter the present boundaries of Utah were some of the Astorians in 1811, but they didn't get as far south as Great Salt Lake. Also, in 1819, McKenzie of the Northwest Company led a large crew to Bear Lake and the Bear River Valley, but so far none of them had seen the Great Salt Lake.

For the first discovery of this inland sea, credit must go to James Bridger. Bridger was with Ashley's men in Cache valley in the winter of 1824-25, when the question came up as to where the Bear River discharges its waters. He followed it down to where it emptied into Great Salt Lake, tasted its waters and found them salty. Soon after this, in 1836, four men circumnavigated the lake in a skin boat. Recently the journal of James Clyman has been published substantiating this in a brief way and identifying Clyman as one of the four trappers.

On page 45 of Clyman's biography is the following: (10)

"Clyman evidently stayed in the mountains with Sublette's party during the time that Ashley returned to St. Louis. He next appears as one of the four men who circumnavigated the Great Salt Lake in the fall of 1825, or, as Robert Campbell said, in the spring of 1826. Clyman's entry in his diary, June 1, 1846, gives the date as 1825, and identifies himself for the first time as one of those who made the voyage. The names of the others are not known. Letters, written to Lyman C. Draper by John Hustis and Hiram Ross, Wisconsin friends of Clyman, mention the Salt Lake voyage."

An article in Niles Register, December 9, 1836 gives the following:

It was coasted last spring by a party of Gen. Ashley's men in canoes, who were occupied four and twenty days, in making its circuit. They did not exactly ascertain its outlet but passed a place where they supposed it must have been.

Unfortunately Clyman did not start his journal until some time later.

From this time on the trappers were frequently in the mountains and on the streams leading into the Salt Lake and Utah Valleys;
some left accounts of their findings. Ashley was there in 1826.

During the few years after 1825 Beckworth, Mose Harris, Provot (who was never in Utah valley), William L. and Milton Sublett and Pegleg Smith, were all in Great Salt Lake Valley. Jedediah S. Smith, the intelligent partner of Ashley, started from Salt Lake on his adventurous trip to California and return.

In the early forties, emigrants to California had started passing through the valley in small numbers. Many of these have left some little information about the vegetation as they saw it, but Fremont in 1843-4 furnishes the first scientific data. Jones (29) says of his trip "This was the most wonderful trip ever taken of which we have any record." He collected plants on the whole trip, but much of his material was lost in the hard return trip over the Sierras in the snow. As he traveled by navigation he was never lost, though he may have been months from any familiar landmark.

Stansbury's survey was made in 1852 (42) five years after Salt Lake City was founded and a year after Provo in Utah valley was established. Gunnison acted as botanist and contributed much data.

In 1862 King made his survey of the fortieth parallel. The botanist of this expedition was Serano Watson (46). His report was a large volume of which Jones says "It was a monumental work and laid the foundation for all modern ecological botany."

The last of the early botanists to do work in these valleys was Dr. John M. Coulter, who started as assistant geologist with Hayden Survey of the Territories in 1872, but while outfitting at Ogden he spent some spare time collecting plants, and was thereupon appointed botanist.
17.

It is from these explorers, pioneers, trappers, emigrants and scientists, that the material for this study is obtained.
HISTORICAL DATA

Ecology is a comparatively recent science, in fact many of its first workers are still alive, therefore it is evident that no study of plant communities was undertaken by the early explorers and botanists who visited the Great Basin. Added to this first handicap in a study of this kind, the pioneers who first settled these valleys were interested in establishing homes and in religious ideas and were concerned with plants only to the extent that the latter helped them in their purpose.

Many of the early trappers were illiterate, were after adventure or gain for themselves or employers, and were given to fanciful tales of their adventures, so but little information for this study could be salvaged from their reports.

Of the colonizers and gold seekers who passed through Utah, a little indirect information is available.

As many of these references are short and incidental portions of journals, documents and other early writings, cards indexes and catalogues were of little value in locating material. It therefore became necessary to examine thousands of pages in likely old books, documents and manuscripts noting every mention of grasses, sage brush and other plants and especially looking for statements as to where the vegetation grew and in what quantities and to what size.

These were mostly obtained in the B.Y.U. library, the Salt Lake and Church Historians libraries and the Provo library.

As this paper is a study of the extent to which man has been a biotic factor in ecological change, it is obvious that any observation after the sixties would very likely fail to show all the characteristics of the original condition, therefore, an attempt has been made
to include no description or observation made after the sixties. All material used is from original sources.

Probably Escalante was not a botanist, he certainly was not an ecologist, but he was a careful observer, and he had the honesty that should accompany a clergyman and must be an integral part of a scientist. To him goes the credit for giving us the first written account of Utah valley. As Escalante's party approached this valley through Spanish Fork Canyon, long before they reached the mouth of the canyon, they noticed clouds of smoke arising. Following Escalante's Journal (18:pl75) from this point he says:

"We found the grass of the plains where we came recently burned over and others burning, from which we inferred that these Indians had thought us to be Comanches, or other enemies; and as they had probably seen that we were bringing animals, it had been their intention to destroy the pasturage along our way, so that because of the lack of this we would be obliged to leave the valley sooner. But as it is so large and broad, we could not do it in so short a time, even though they had put fires everywhere. For this reason our small party remaining in this location, as soon as we had halted, Father Francisco Alanasio, with the guide Silvestre, his companion Joaquin and the interpreter Muniz, left for the first of the settlements, and going as rapidly as possible, though the horses were so fatigued, in order to arrive this afternoon, they went six leagues and a half to the north-north-west. They arrived, and were received by some of the men with their weapons ready to defend their families and homes. But as soon as Silvestre had spoken to them they changed their warlike appearance to the most courteous and simple expressions of peace and affection."

Under September 25, 1776 (18:pl80) he writes:

"...North of the river of San Buenaventura, as we have shown before, there is a range of mountains that, so far as we could learn, extends from the northeast to the southwest more than seventy leagues, and in width more than forty, and where we crossed it is more than thirty leagues. In the western part of these mountains, in latitude 49° 49', and in a direction a quarter northwest of north of the town of Santa Fe, is the 'Valley of Our Lady of Mercy of the Timpanogotsis,' surrounded by the peaks of the Sierra; from which flow rivers which flow through and water it, until they enter the lake in the middle of it. The plain of the valley extends from southeast to northwest, sixteen Spanish leagues (such as are used in this diary-footnote, the old Spanish leagues is equal to 2.41 U.S. miles), and from northeast to southwest ten or twelve leagues it is all clean land, and with the exception of the marshy places along the shores of the lake, very good for planting. From the four rivers that water it the first flows from the south, and is the Aguas Calientes, in
whose broad plains is sufficient cultivable land for two large villages. The second following the first, three leagues to the north, and with more water than the first, could maintain one large and two small villages. This river, before entering the lake, is divided into two branches, on whose banks are poplars and large alder-trees. We named this river the San Nicholas. Three leagues and a half from this to the northwest is a river which runs through large plains of good land for planting. It had more water than the two preceding ones; it has larger groves and plenty of good land if irrigated, for two and even three large villages. We were near this river the 24th and the 25th, and we named it the Rio de San Antonio de Padua (Saint Anthony of Padua.) To the fourth river we did not go, although we saw its groves. It is to the northwest of San Antonio, and as we saw it, has on each side of it much level ground. They told us that it had as much water as the others, and so I am satisfied we could establish there some ranches and towns. We named it the river of Santa Ana.

"Aside from these rivers, there are in the plain many pools of good water, and several fountains which flow down from the mountains. From what we have just said about the settlements, let it be understood that we wish to give to each one more land than he really needs, but if each settlement took only one league for cultivation, there would be room in the valley for as many villages of Indians as there are in New Mexico; because although in the northerly direction we gave to it the above dimensions (though it has more), on the south it also has large spaces of good ground. There is everywhere good and abundant pasturage, and in some parts flax and hemp grow in such abundance that it seems to have been planted."

After Escalante's account of his visit to the valley of the "Timpanogotsis", there was some lapse of time before another record was made of exploration in the valleys. Perhaps it will be more convenient to follow the exploration of Salt Lake Valley first as it was first settled by the white man.

Bridger was the first white man known to have seen the Great Salt Lake, but he didn't write, and his observations, like most of his kind, were likely to be fabulous. (A description of his will follow in order.)

Jedediah S. Smith leaves a letter to General William Clark, probably written where Lake Town, Utah on Bear Lake now is, in which he describes his trip from Great Salt Lake in 1826, to California and back. His description of the vegetation through southern Utah and Nevada is of some value, but does not add to this study.
Beginning with the Lewis and Clarke expedition the Government sent a series of explorers to the west equipped to make scientific collections and observations. Colonel Fremont made three such explorations for the government. His second, third and fifth trips took him through Utah, but only the second furnishes material for this problem.

On September 6, 1843 they had been following a comparatively well-timbered stream called Weber's Fork. He says: (22:p263)

Leaving encampment early, we again directed our course for the peninsular butte across a low shrubby plain, crossing in the way a shough-like creek with miry banks, and wooded with thickets of thorn (crataegus) which were loaded with berries. This time we reached the butte without any difficulty, and ascending to the summit, immediately at our feet beheld the object of our anxious search—the waters of the Inland Sea, stretching in still and solitary grandeur far beyond the limit of our vision. It was one of the great points of the exploration; and as we looked eagerly over the lake in the first emotions excited pleasure, I am doubtful if the followers of Balboa felt more enthusiasm when, from the heights of the Andes, they saw for the first time the great western ocean. It was certainly a magnificent object, and a noble terminus to this part of our expedition. Several large islands raised their high rocky heads out of the waves; but whether or not they were timbered, was still left to our imagination, as the distance was too great to determine if the dark hues upon them were woodland or naked rock. So far as we could see, along the shores there was not a solitary tree, and but little appearance of grass.

September 8.

"A calm, clear day, with a sunrise temperature of 41 degrees. We left the camp at sunrise, and had a very pleasant voyage down the river, in which there was generally eight or ten feet of water, deepening as we neared the mouth in the latter part of the day. The river divided into several branches, filled with fluvials, and so very shallow that it was with difficulty we could get the boat along, being obliged to get out and wade. We encamped on a low point among rushes and young willows, where was a quantity of drift-wood, which served for our fires. The evening was mild and clear; we made a pleasant bed of young willows; and geese and ducks enough had been killed for an abundant supper at night, and for breakfast the next morning. The stillness of the night was enlivened by millions of waterfowl. Latitude (by observation) 41 degrees 11' 26" and longitude 112° 11' 30". September 9.

"The channel in a short distance became so shallow that our navigation was at an end, being merely a sheet of soft mud, with a few inches of water, and sometimes none at all, forming the low water shore of the lake. All this place was absolutely covered with flocks of screaming plover. We took off our clothes and, getting overboard, commenced dragging the boat—making, by this operation, a very curious trail, and a very
disagreeable smell in stirring up the mud, as we sank above the knee at every step. The water here was still fresh, with only an insipid and disagreeable taste, probably derived from the bed of fetid mud. After proceeding in this way about a mile, we came to a small black ridge on the bottom, beyond which the water became suddenly salty, beginning gradually to deepen, and the bottom was sandy and firm. It was a remarkable division, separating the fresh waters of the rivers from the briny water of the lake, which was entirely saturated with common salt."

(p.271) "From the point (on island) where we were standing, the ground fell off on every side to the water giving us a perfect view of the island, which is twelve or thirteen miles in circumference, being simply a rocky hill, on which there is neither water nor trees of any kind; although the Fremontia vernicularis, which was in great abundance, might easily be taken for timber at a distance. The plant seemed here to delight in a congenial air, growing in extraordinary luxuriance seven to eight feet high, and was very abundant on the upper parts of the island, where it was almost the only plant. This is conveniently a sail shrub; its leaves have a salty taste and it luxuriates in saline soils, where it is usually a characteristic. It is widely diffused over all this country. A chenopodiaceous shrub, which is a new species of obione (O. rigida, Torr, and Form) was equally characteristic of the lower parts of the island. These two are the striking plants on the island, and belong to a class of plants which form a prominent feature in the vegetation of this country. On the lower parts of the island, also, a prickly pear of very large size was frequent. On the shore, near the water, was a woolly species of phaca; and a new species of umbelliferous plant (leptotaemia) was scattered about in very considerable abundance. These constituted all the vegetation that now appeared upon the island."

"In our excursions about the island we did not meet with any kind of animals; a magpie, and another larger bird, probably attracted by the smoke of our fire, paid us a visit from the shore, and were the only living things seen during our stay. The rock constituting the cliffs along the shore, where we encamped, is a talcous rock or steatite, with brown spar....On the shores of the lake we adopted for its elevation 4,200 feet above the Gulf of Mexico.....I called it Disappointment Island."

Between 1843 and 1847 there were a number of emigrants that passed through Salt Lake Valley including the Donner party in 1846, but they left very little in the way of written description of the section here studied.

As the real problem in this paper arises with the settlement of the valley, the first impressions and descriptions by the pioneers of 1847 should prove most valuable. Fortunately there are several of these descriptions written when seen during or soon after 1847.
Orson Pratt, being somewhat of a scientist, should be reliable and his descriptions prove of some value. He says (33):

"July 21...After issuing from the mountains among which we had been shut up for 178 days, and beholding a moment such an extensive scenery open before us, we would not refrain from a shout of joy, which almost involuntarily escaped from our lips the moment this grand and lovely scenery was within our view. We immediately descended very gradually into the lower parts of the valley, and although we had but one horse between us, yet we traversed a circuit of about 12 miles before we left the valley to return to our camp, which we found encamped 1 3/8 miles up the ravine from the valley, and 3 miles in advance of their noon halt...June 22nd. This morning George A. Smith and myself, accompanied by seven other, rode into the valley to explore, leaving the camp to follow on and work the road, which here required considerable labour, for we found that the kanyon at the entrance of the valley, by cutting out the thick timber and underbrush, connected with some spading and diffing, could be made far more preferable than the route over the steep hill mentioned above. We accordingly left a written note to that effect, and passed on. After going down into the valley about 5 miles, we turned our course to the north, down towards the Salt Lake. For 3 or 4 miles north we found the soil of a most excellent quality. Streams from the mountains and springs were very abundant, the water excellent, and generally with gravel bottoms. A great variety of green grass, and very luxuriant, covered the bottoms for miles where the soil was sufficiently damp, but in other places, although the soil was good, yet the grass had nearly dried up for want of moisture. We found the drier places swarming with very large crickets, about the size of a man's thumb. This valley is surrounded with mountains, except on the north: the tops of some of the highest being covered with snow.

July 28...Considerable good timber is discovered up the ravines which put down from the mountains, such as sugar maple, ash, oak, fir, and pine."

William Clayton made an extensive journal of the first pioneer trail to Salt Lake Valley. He records the only available account or description by James Bridger of the valleys toward which they were slowly making their way. In his journal (11,p273) under date of Monday 28th (June 1847) he says:"

...We then proceeded on, expecting to go about eight miles farther, but after traveling a little over a mile we were met by Elder G. A. Smith who introduced us to Mr. Bridger of Bridger's Fort on his way to Fort John in company with two of his men. Mr. Bridger being informed that we had designed to call at his place to make some inquiries about the country, etc., he said if we would turn off the road here and camp, he would stay with us till morning. A camping place being selected we turned off from the road about a quarter of a mile and formed our encampment near the Sandy at six o'clock, having traveled this afternoon one and three-quarters miles, exclusive of allowance for leaving the road, and during the day fifteen and a quarter miles. We have pretty good feed
here, enough to fill the teams well. A while after we camped, the twelve and several others went to Mr. Bridger to make some inquiries concerning our future route, the country, etc. It was impossible to form a correct idea of either from the very imperfect and irregular way he gave his descriptions, but the general items are in substance as follows:

We will find better grass as we proceed farther on. His business is to Fort Laramie. His traders have gone there with robes, skins, etc., to fill a contract, but having started later than they intended the men at Laramie have taken advantage of the delay and he is going to see the business himself. There is no blacksmith shop at his fort at present. There was one, but it was destroyed. There have been nearly a hundred wagons gone on the Hastings route through N ev er's Fork. They cross the Blacks Fork and go a little south of west from his place and pass below the mountains which cross Green river. The Green river runs over an extent of country of 400 miles. It is impossible for wagons to follow down Green river, neither can it be followed with boats. Some have gone down with canoes, but had great difficulty getting back on account of the rapid current and rough channel. Cannot pass the mountains close to the river even with horses. For some distance beyond that it is hard black rock which looks as if it were glazed when the sun shines on it, and so hard and sharp it will cut a horse's feet to pieces. When we got below the mountains, the Green River Falls into a level country for some distance after which it winds through a mountainous country perfectly barren to the Gulf of California. From Bridger's fort to the Salt Lake, Hastings said was about one hundred miles. He has been through fifty times but can form no correct idea of the distance. Mr. Hastings' route leaves the Oregon route at his place. We can pass the mountains farther south, but in some places we would meet with heavy bodies of timber and would have to cut our way through. In the Bear River valley there is oak timber, sugar trees, cottonwood, pine and maple. There is not an abundance of sugar maple but plenty of as splendid pine as he ever saw. There is no timber on the Utah Lake only on the streams which empty into it. In the outlet of the Utah Lake which runs into the salt Lake there is an abundance of blue grass and red and white clover. The outlet of the Utah Lake does not form a large river, neither a rapid current but the water is muddy and low banks. Some of his men have been around the salt lake in canoes. They went out hunting and had their horses stolen by the Indians. They then went around the lake in canoes hunting beaver and were three months going around it. They said it was 550 miles around it. The Utah tribe of Indians inhabit the region around the Utah Lake and are a bad people. If they catch a man alone they are sure to rob and abuse him if they don't kill him, but parties of men are in no danger. They are mostly armed with guns./ There was a man opened a farm in the Bear River valley. The soil is good and likely to produce corn were it not for the excessive cold nights which he thinks would prevent the growth of corn. There is a good country south of the Utah Lake, or southeast of the great basin...He never saw any grapes on the Utah Lake and the country is still better the farther south we go until we meet the desert which is upwards of 200 miles south from the Utah Lake. There is plenty of timber on all the streams and mountains and abundance of fish in the streams. There is timber all around the Utah Lake and plenty of good grass; not much of the wild sage only in small patches. Wild flax grows in most of the valleys and they are the richest lands. He
passed through that country a year ago last summer in the month of July, and they generally had one or two showers every day sometimes a very heavy thunder shower but not accompanied by strong wind."

Later after leaving Weber he writes:

"Thursday, 22nd (July 1847) (p.308)......While the brethren were cutting the road, I followed the old one to the top of the hill and one arriving there, was much cheered by a handsome view of the Great Salt Lake lying, as I should judge, from twenty-five to thirty miles to the west of us; and at eleven o'clock I sat down to contemplate and view the surrounding scenery. There is an extensive, beautiful, level looking valley from here to the lake which I should judge from the numerous deep green patches must be fertile and rich. The valley extends to the south probably fifty miles where it is again surrounded by high mountains. To the southwest across the valley at about twenty to twenty-five miles distance is a high mountain, extending from the south end of the valley to about opposite this place where it ceases abruptly leaving a pleasant view of the dark waters of the lake. Standing on the lake and about due west there are two mountains and far in the distance another one which I suppose is on the other side of the lake, probably from sixty to eighty miles distance. To the northwest is another mountain at the base of which is a lone ridge of what I should consider to be rock salt from its white and shining appearance. The lake does not show at this distance a very extensive surface, but its dark blue shade resembling the calm sea looks very handsome. The intervening valley appears to be well supplied with streams, creeks and lakes, some of the latter are evidently salt. 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. There may be timber on the mountains which the long distance would render impossible to be seen with the naked eye, but the mountains through which we have passed have very little on them. In some places may be seen a grove of small fir or cedar or pine and in the valleys some cottonwood and other small timber. There is doubtless timber in all passes and ravines where streams descend from the mountains....From this hill I passed down the creek, which we named the Last Creek, about a mile and there saw a bed of bulrushes of the largest kind I ever saw, some of them being fifteen feet high and an inch and a half in diameter at the bottom. The grass on this creek grows from six to twelve feet high and appears very rank. There are some ducks around and sand hill cranes. Many signs of deer, antelope, and bears, but not many have been seen here. There have been fresh buffalo signs seen a few days' travel back, but those animals evidently do not stay in this region unless some come to winter. The ground seems literally alive with the very large black crickets crawling around up grass and bushes. They look loathsome but are said to be excellent for fattening hogs......We are now five and a quarter miles from the mouth of this canyon....At this place, the land is black and looks rich, sandy enough to make it good and the water is also good. There are many rattlesnakes of a large size in this valley...The land looks dry and lacks rain, but the numerous creeks and springs must necessarily tend to moisten it much. The grass looks
rich and good.... Approaching near the lake, the land is mostly sunken and small lakes in it. A few miles north of this, is a good spot to break up and plant potatoes, sew our seeds, etc. There is a little timber on the creek. From twelve to fifteen miles north at the foot of the mountain they saw many hot sulphur springs... Friday, 23rd. This morning Elders Pack and Mathews started to meet the President and at the same time the camp moved on to the final location. We traveled two miles and then formed our encampment on the banks of the creek in an oblong circle. The grass here appears even richer and thicker on the ground than where we left this morning. The soil looks indeed rich, black and a little sandy. The grass is about four feet high and very thick on the ground and well mixed with rushes.

26th. (p. 230) In the meantime Elders Smith, Carrington and myself went lower down towards the lake in search of some fresh water to quench our thirst. We found a nice clear stream of cold water but a little way from the sulphur spring and having drunk of it, we concluded to go on and see the river which he had noticed from the mountains. We took nearly a west course and soon struck the old road made by emigrants last year. We found many wet places but no signs of swamps, nor danger of miring. After traveling about two miles, we arrived at the river having followed the road to the ford. This river is about five rods wide on an average, three and a half feet deep at the ford but in other places much deeper. The current is slow and the water of a dark lead color. The banks are about five feet high and the soil to the water level of a rich, black alluvial. There is no timber on the banks here and not many willow bushes. We went over the river and found the soil equally good on the other side....We could but remark all along, the richness of the soil and the abundance of high, good looking grass.... This morning Joseph Mathews and John Brown started west to go to the mountain. They returned this evening and report that they have been at the foot of the mountain and judge it to be about sixteen miles distance. They say the wild sage is very plentiful on the other side of the valley, showing that the land is not so rich there as here....

27th... A company of brethren have been to the mountains to get more lumber to build a skiff. They returned this evening bring a very handsome pine log about twenty inches through and which, probably, when whole, would measure sixty feet long. The day has been fine and warm. The horses and cattle seem in good spirits and are getting fat.

28th. Wed.... Joseph Hancock and Lewis Barney have been off hunting in the mountains two days. They state there is abundance of good timber for building in the mountains but difficult to get at it. The timber is mostly balsam fir and poplar and many sticks will make two good logs...

Clayton's description of the whole trip would prove of value to a study of the plains region. He write an emigration guide (12) in which he says of Salt Lake Valley:

"The city is located within three miles of the mountains... The land is gradually sloping from the mountains to within a mile of the Cut-
let, and is of a black, loose, sandy nature. A stream of water rushes from the mountain east of the city, and at the upper part it divides into two branches, both of which pass through the city to the outlet. The water is good and very cold, and abundance for mill purposes, or for irrigation. The air is good and pure, sweetened by the healthy breezes from the Salt Lake. The grass is rich and plentiful and well filled with rushes, and the passes in the mountains afford abundance of good timber, mostly balsam fir.

Major Howard Egan accompanied the Brigham Young party, into Salt Lake Valley in 1847. In his journal (17,104-105) he writes:

"...We then left the ravine and turned to the right and ascended a very steep pitch where we beheld the great valley of Salt Lake spreading out before us....I rejoiced at having the privilege of beholding this extensive and beautiful valley, that may yet become a home for the Saints. From this point, we could see the blue waters of the Salt Lake. By ascending one of the ridges at the mouth of this canyon, the view over the valley is at once pleasing and interesting. These high mountains on the east side, extending to the head of the valley, about fifty miles to the south, many of them white on the tops and crevices with snow. At the south end is another mountain, which bounds the valley in that direction, and at its western extremity, it is joined by another range, forming its western boundary to the valley and extending in a northerly direction until it ceases abruptly nearly west of this place. The valley between these mountains is judged to be twenty-five to thirty-miles wide at the north end of the last mentioned mountain. The level valley extends to the Salt Lake, which is plainly visible for many miles in a western direction from this place....In the lake, and many miles beyond this valley, are two mountains projecting high in the air, forming a solemn but pleasing contrast with the dark blue waters of the lake. Beyond these two mountains and in the distance, in a direction between them, is another high dark mountain; supposed to be on the western boundary of the lake, and judged to be eighty to one hundred miles from here. At this distance we can see apparently, but a small surface of the water, extending between this valley and the mountains referred to, but that surface is probably thirty miles wide. Looking to the northwest, another mountain appears, extending to the north till hidden by the eastern range. At the base of this mountain is a long ridge of white substance, which from its bright shining appearance is doubtless salt, and was probably caused by the dashing of the waves, and then hardened by the sun. The whole surface of the valley appears, from here, to be level and beautiful. The distance from here (mouth of Echo Canyon) to the lake is judged to be forty to fifty miles. Throughout the whole extent of the valley can be seen very many green patches of rich looking grass, which no doubt lays on the banks of creeks and streams. There is some little timber also on the streams, and in the direction of the great lake many small lakes appear upon the surface, the waters of which are doubtless salty. From a careful view of the appearance of the valley from this place, it cannot be concluded to be otherwise than rich and very fertile....This valley is bounded by high mountains, some of them covered with snow, and from what knowledge we have of it at present, this is the most safe and secure place the Saints could possible locate themselves....The scarcity of timber has probably been the reason that this beautiful
valley has not been settled long since by the Gentiles. But I think we can find sufficient timber up the creeks for present purposes, and also coal in the mountains.

Most of the pioneer journals after the first migration lack informative descriptions of the vegetation as they entered the valley. Some of the "forty-niners" however, leave some desired information. Charles D. Ferguson passed through Salt Lake Valley in the spring of 1850 and writes in his "A Third of a Century in the Gold Fields" (20) the following:

"•••••••This Herculean labor lasted five days, when finally we reached the summit to find our ample reward in the most beautiful prospect on this earth. Seventeen miles away down the gentle western slope lay the beautiful, but then little, village of Salt Lake, as plain to the naked eye as if only half a mile away. Beyond the village, Salt Lake, eighty miles long, glistened in the sun, its remotest shore as distinctly visible as the village itself. Away to the south, as far as the eye could reach, was one broad, beautiful, level plain, covered already with a carpet of deepest green. All this loveliness of lake and landscape was bordered and framed by snow-capped mountains whose silver summits seemed to touch the blue vault of heaven. Such were my impressions of Salt Lake City and valley then, and never since, in all my travels, has that picture faded from my memory or been surpassed by any other."

In the Millenial Star for March, 1850, is a letter from John Taylor (43) to Orson Hyde in which he describes Salt Lake Valley. He says:

"It is an excellent grazing country the grass is very rich and nutritious, cattle and stock of all kinds will become as fat as the best stall fed in the east."

The following are some extracts from letters written by John R. Young to his grandson, John A. Young and published in The Utah Historical Quarterly (50) under "Early recollections of the Salt Lake Valley":

"My father harvested the first acre of wheat raised in Utah. It grew about on the lot where the Salt Lake Theater stands. It grew about twelve inches high, short straw but good heads. My brother Franklin and I pulled every spear of that wheat, laid it in piles, then went to the creek and cut willow switches with which my brother William bound it. It yielded about eighteen bushels to the acre.

"From our cabin in the mouth of City Creek Canyon, in 1847, one could see a lone cedar tree on the plain southeast of us, and on the south fork of the creek, about where Main and Third South Street intersect, stood seven wind-swept, scraggy cottonwood trees. On the north side of City Creek stood a large oak tree. No other trees were visible in the valley."
"The plain was covered with scattering bunch grass eight or ten inches high and occasional patches of low flat prickly pears. We bare-footed lads had to be careful where we stepped. Along the banks of the creek were thin strips of willows, rose briars, and squaw bush. In the swamps were patches of coarse wire grass, bull rushes, and cat tails. If ever lawyer Baskin wet his moccasins while riding through the valley on horseback it would be because he rode across the sloughs. For several years, in the early days of Salt Lake, people went to Tooele, American Fork, or Ogden to get hay.

"Looking toward the Great Salt Lake the view was more desolate and discouraging. Scarcely a summer day passed but one would see whirling clouds of alkali dust sweeping southward, covering with poisonous substance the short prickly brush that tried to grow on the sand dunes of that vicinity."

In the first general epistle found in the Millenial Star (49) from Great Salt Lake Valley, the first Presidency write:

"... The winter of 1847-8 was very mild, grass abundant, flocks and herds thriving thereon, and the earth tillable most of the time during each month; but the winter of 1848-9 has been very different, more like a severe New England winter.

Also in the Millenial Star (34) is an item from P. P. Pratt:

Salt Lake July 8, 1849

"... As a grazing country there is / scarce its equal on the globe. Milk, cheese, butter, beef, etc., are very fine and abundant.... Our cattle climb the highest hills, and delight to graze on the sides of the steepest declivities where it is possible for them to climb. ... Timber here is abundant, and inexhaustible in the mountains."

James Clyman's probable first voyage around Great Salt Lake has been referred to earlier in this paper, and it was stated there that he left no written account of these early travels. Later as a guide to California he was returning with a party including Hastings over the so-called Hastings cut-off south of Great Salt Lake when he write the following in his journal: (14, p221)

"Proceeded nearly east to the point of a high mountain (Oquirrh Mountains) that Bounds the Southern part of the great Salt Lake. I observed that this lake like all the rest of this wide spread Sterility has nearly wasted away one-half of its surface since 1825 when I floated around it in my Bull Boate and we crossed a large Bay of this Lake with our horses which is now dry and continued up the South side of the Lake to the valley (salt Lake Valley) near the outlet of the Eutaw Lake and encamped at a fine large spring of Brackish water 20 miles to day."
After unpacking several Indians were seen around us, after considerable signing and exertion, we got them to camp and they appeared to be friendly.

In this valley contrary to anything we had yet seen lately the grass is full grown and some early kinds are ripe and now full grown and still the mountains nearly all around are yet covered with snow.

These Ewtaws as well as we could understand informed us that the snakes and whites were now at war and that the snakes had killed two white men. This news was not the most pleasant as we have to pass through a portion of the snake country.

According to promise our Eutaw guide came this morning and conducted us to ford on the Eutaw river which we found quite full and wetting several packs in our low mules but we all got safely over and out to the rising ground where we found a fine spring brook and unpacked to dry our wet baggage.

This stream (Jordan River) is about 40 yards wide running in a deep channel of clay banks and through a wide valley in some places well set in an excellent kind of grass, but I should think that it would not be moist enough for grain, the mountains that surround this valley are picturesque and many places beautiful being high and near the base smooth and well set in a short nutritious grass especially those to the west.

Afternoon took our course E into the Eutaw (Wasatch) mountains and near night we found we had mistaken the Trail and taken one that bore too much to the South camped in a cove of the mountain making 25 miles the ravines and some of the side hills have groves of oak and sugar maple on them all of a short shrubby description and many of the hill sides are well clothed in a good bunch grass and would if not too cold bear some cultivation."

Late in 1849, Captain Howard Stansbury reached Salt Lake Valley for the purpose of surveying Great Salt Lake. His only scientific aid was Lieutenant J. W. Gunnison who besides other duties, acted as botanist. Besides his contributions to Stansbury's report, he wrote a book on the Mormons. In this book (26, pl4) he makes the following comments on the valley:

"The valleys afford perennial pasturage, but the hillsides furnish the bunch grass only during the warm months of the year. It seeds in summer, and is germinated by the autumnal rains, and grows under the snowy covering of winter. In the spring, as the snow-line retreats up the slope, under the melting influence of the approaching sun, the cattle and wild grazing animals follow it to the mountain peaks until mid-summer, to be driven down again as the accumulating snow, beginning on the summits about the equinox, descends in a few weeks to the base. When it rains on the valleys, the snow falls on the mountains, and, during winter, an immense quantity is drifted into the canyon and passes, to the depth sometimes of hundred of feet, blocking up the roads, and making prisoners at home, those who sojourn in those solitudes.

Salt Lake Valley lowlands:
"Along the brackish streams, from the saline springs, grows a thick tangled grass, and the marshy flats are covered with fine reeds or dense festucas. In early summer the shepherd lads fill their baskets with the eggs deposited in that cover by the goose, the duck, the curlew, and plover; or taking a skiff, they can row to the Salt Lake islands, and freight to the water's edge with those laid for successive broods by the gull, the pelican, the blue heron, and the crane, and the brandt."

"Hidden away in the profound chasms and along the streams whose beds are deeply worn in the mountain sides are the cedar, pine, dwarf-maple, and occasionally oak, where the inhabitants of the vale seek their fuel and building timber, making journeys to obtain these necessaries from twenty to forty miles from their abodes."

Extracts from Stansbury's report (42, p78) follow:

"Wednesday, August 22, 1849 . . . We were forced still farther to the south, and struck upon the heads of Pumbart's Creek, a tributary of the Wever River, which later discharges its waters into the Great Salt Lake. . . . We continued down this valley until the middle of the following day, when, instead of the broad open appearance which it had at first presented, it soon began to contract, until it formed a canon, with sides so steep that it was scarcely passable for mules. . . . After following the canon some ten miles, we came to a broad valley coming into it from the left, which the guide declared headed in the ridge from which we had descended yesterday, and to the eastward of the route we had taken. As all prospect of a road by the valley of Pumbart's Creek was now out of the question, I determined to follow up this valley and ascertain whether a route could not be obtained in that direction. This was accordingly done, and we found it to be as the guide had stated. This branch of Pumbart's Creek, which we called Red Chimney Fork, from the remarkable resemblance of one of the projections of the cliffs to that object, we found to have a very moderate descent from the ridge to its mouth, with plenty of room for a road, requiring but little labour to render it a good one. The timber is small and consists of oak, black-jack, aspen, wild-cherry, service-berry, and box-elder of large size. In many places it is quite abundant."

"There we encamped for the remainder of the day, with abundance of excellent grass, wood, and water. . . . Wild cherries were found in tolerable abundance, and the trail was strewn over with their smaller branches, thrown away by the Indians."

"Monday, August 27 . . . We followed down Ogden's Creek about a mile, when we found that the broad valley was shut up between two ranges of hills, or rather mountains leaving a flat, low, level bottom, densely covered in places by willows, through which the stream meanders from side to side, for three miles, washing alternately the base of either range. After passing through this canon, the ridge separated, and before us lay a most lovely, broad, open valley, somewhat in the shape of a crescent, about fifteen miles long, and from five to seven miles in width, hemmed in on all sides, especially on the south and west, by lofty hills and rocky mountains, upon the tops and sides of which the snow glistened in the rays of the morning sun. The scene was cheering in the highest degree. The valley, rich and level, was covered with grass; springs broke out from the mountains in every direction. . . ."
"Descending the pass through dense thickets of small oak-trees, we caught the first glimpse of the Great Salt Lake, the long desired object in our search, and which it had cost us so many weary steps to reach. A gleam of sunlight, reflected by the water, and a few floating, misty clouds, were all, however, that we could see of this famous spot, and we had to repress our enthusiasm for some more favourable moment.

Consequently, after following the eastern base of the ridge about six miles to the south, we began gradually to diverge from it to the eastward, and at dark encamped in the prairie, near a noble spring of fresh, cold water, with abundance of excellent grass, and an extensive grove of large willows for fuel.... This valley is called "Tuilla Valley" by the Mormons, and forms an excellent pasturage for numerous herds of cattle, wintered here by them under the charge of keepers. The grass is very abundant, and numerous springs are found on both sides of it." - (As he was completing his survey around the lake.)

"Wednesday, November 7... Ther. at sunrise, 47. Starting early in the morning, we crossed to the eastern side of the valley, followed the base of the mountain to its northern extremity, and reached the shores of the Great Salt Lake near Black Rock, where we crossed the valley of the Jordan, over sterile artemisia plains, and reached the city in the afternoon - being the first party of white men that ever succeeded in making the entire circuit of the lake by land.

"Discussing Lieutenant Gunnison's operations making survey of Salt Lake and Utah valleys... But the principal difficulty was the scarcity of timber. Wood grows nowhere on the plains; all the wood used for cooking in camp, and all the timber, both for posts on the base line and for construction of the stations, had to be hauled from the mountains, in many cases fifteen or twenty miles distant, over a rough country without roads. Almost every stick used for this purpose cost from twenty to thirty miles' travel of a six-mule team. This, together with the delays of getting into the canons, where alone the timber can be procured, cutting down the trees and hauling them down the gorges by hand to the nearest spots accessible to the teams, involved an amount of time and labour which must be experienced before it can be appreciated. All this had to be done, however, or the prosecution of the work would have been impracticable.

"Beyond the Jordan, on the west, the dry and otherwise barren plains support a hardy grass, (called bunch-grass,) which is peculiar to these regions, requiring but little moisture, very nitritious, and in sufficient quantities to afford excellent pasturage to numerous herds of cattle. To the northward, in the low grounds bordering the river, hay in abundance can be procured, although it is rather coarse and of an inferior quality.

"On the eastern side of the Salt Lake Valley the land susceptible of irrigation stretches along the western base of the Wasatch Mountains, from about eighty miles north of Salt Lake City to about sixty south of it, the latter portion embracing, toward its terminus, the fertile valley of Lake Utah. This is a beautiful sheet of pure fresh water, thirty miles in length, and about ten in breadth, surrounded on three sides by rugged mountains and lofty hills, with a broad grassy valley sloping to the water's edge, opening to the northward. Through this opening flows the river Jordan, by which its waters are discharged into the Great Salt Lake. The lake abounds in fine fish, principally speckled trout, of great size and exquisite flavour, which afford sustenance to numerous small bands of Utahns."
"Concerning Fremont's Island. The island is fourteen miles in circumference; has neither timber nor water upon it, but its sides are covered with luxuriant grass, and about in prodigious quantities of the wild onion, wild parsnip, and sego. (Calochortus luteus.) The latter is a small bulbous root, about the size of a walnut, very palatable and nutritious, and is much used by the Indian tribes as an article of food. It abounds on hillsides and in stony ground in great quantities. Near the summit of the island, the sage (Sarcobatus vermicularis, nees) grew in great profusion, and to an extraordinary size, being frequently eight feet high and six or eight inches in diameter. Could fresh water be obtained by boring, (and it is worth experiment,) a more admirable range than this for sheep and goats could not be desired. Being surrounded by deep water, the protection from wild beasts is absolute; an object in this country of no small importance, where wolves abound in great numbers. The wild parsnip is already up several inches, and its vivid green presents a cheerful contrast on the sunny slopes with the snow-clad mountains which surround us. A single ground squirrel was seen; but how he got here, and where he obtained water to sustain life, is somewhat of a mystery. In all our subsequent examinations not the least indication of a spring was discovered. Our men picked up quite a number of the eggs of the blue heron, now just beginning to lay, in the tall grass along the shore.

"Tuesday, April 9. Morning very cool. Heavy blow all last night from the north. Sent a team to the city for an additional supply of provisions and equipage ..."

"Rounding the northern point of Antelope Island, we came to a small rocky inlet, about a mile west of it, which was destitute of vegetation of any kind, not even a blade of grass being found upon it. It was literally covered with wild waterfowl; ducks, white brandt, blue herons, cormorants, and innumerable flocks of gulls, which had congregated here to build their nests. We found great numbers of these built of sticks and rushes, in the crevices of the rock, and supplied ourselves without scruple, with as many eggs as we needed, principally those of the herons, it being too early in the season for most of the other waterfowl.

"Wednesday, April 10. Up by sunrise. Breakfast, cold fried bacon, roasted herons' eggs, and cold water. Morning cool—wind from east; afterward shifted to northeast and north. Started for a small island lying about five miles to the northward, to erect a station upon it. We found it to be a mere islet, one hundred feet in height, and about a mile in circumference, having a long, narrow sand-slip running off from it in a southeast direction for a mile and a-half. It is merely a pile of granitic conglomerate, with tufa in large masses. Grease-wood seems to be the principal growth, and the whole island abounds in the wild onion, now vividly green, filling the air with its odor. Two species of cactus were also seen...." (p-163. South side of island) "...The vegetation on this side of the island was similar to that on the other; the bunch-grass was especially fine and abundant...."

"On Carrington's Island. It abounds in the sego (Calochortus luteus,) which is beginning to seed, and, with its beautiful white, lily-like flowers, whitens and enlivens the gentle slopes of the island. A large number of other plants was also collected here, among which Cleome lutea, Sidalcia neo mexicana, Malvastrum coccineum, Stephanomeria minor, a new species of Malacothix and Gravia spinosa, were the most prominent."
The eastern shore, in many parts, affords springs of excellent water, and the numerous tracks of wolves, deer, and antelope, added to the frequent remains of Indian fires, indicate these spots have long been the favorite haunts of both man and beast. In the vicinity of these springs, the grasses are rich and abundant, and the range for cattle the best I have seen in the country. Both this and Antelope Island have been reserved by the sagacious Mormon authorities for grazing purposes.

"In skirting the shores, several plants were collected for preservation; among which were the Comandra umbellata, a new genus of Elymus, Stipa, juncea, and the Elymus Striatus. Various seeds were also gathered."

After a severe climb of some three hours, through rich bunch grass near the base, artemisia and grease-wood higher up, and, still higher, over rocky projections covered with stunted cedar, we at length reached the summit of the "dome". From this point, the highest within the circuit of the lake, we had expected to enjoy a noble view of both it and the surrounding islands and mountains; but, unfortunately, the atmosphere was filled with so thick a haze that our hopes were wholly disappointed. In our ascent, quite a variety of plants were collected and carefully preserved. Among these, several have been ascertained by Professor Torry, to whom the whole collection has been submitted for examination, to be new species; among others, a Heuchera, Peretyle, Cowania, and Chenactie.

"After resting under the shadow of some wide-spreading cedar trees, (the first shade we had enjoyed for months,) the summit of the peak cleared, and a circular wall built, . . .

"As we descended, the gorge, which had at first been almost shut up between perpendicular cliffs of white sandstone, opened out into a superb, wide, and gently sloping valley, sheltered on each side by besting cliffs to the very water's edge, effectually protected from all winds except the east, and covered with a most luxuriant growth of rich and nutritious bunch-grass.

"Near the shore of the lake, abundant springs of pure, soft water gush forth, amply sufficient for the consumption of all the stock the valley could supply with food. As a range for cattle, it was all that could be desired; and is superior to either Tuilla Valley or Antelope Island, on account of the complete protection it affords from the storms of winter here both long and severe."

R. F. Burton was in Salt Lake City in 1863 and made a stay there of some time. From his travels and observations he wrote his book "The City of The Saints". Quoting from that book: (8, p-194)

"In some parts the valley was green, in others, where the sun shot its oblique beams, it was of a tawney yellowish-red, like the sands of the Arabian desert, with scatters of trees, where the Jordan of the West rolls its opaline wave through pasture-lands of dried grass dotted with flocks and herds, and fields of ripening yellow corn. Everything bears the impress of handiwork, from the bleak benches behind to what was once a barren valley in front. . . .

. . . . . . . . . . .
The bench-land then attracted our attention. The soil is poor, sprinkled with thin grass, in places showing a suspicious whiteness, with few flowers, and chiefly producing a salsolaceous plant like the English samphire. In many places lay long rows of bare circles, like deserted tent-floors; they proved to be ant-hills, on which light ginger-colored swarms were working hard to throw up the sand and gravel that everywhere in this valley underlie the surface.

We then struck into the "City", usually known as "Brigham's" Kanyon, the prophet having a saw-mill upon the upper course. It is the normal deep narrow gorge, with a beautiful little stream, which is drawn off by raised water-courses at different altitudes to supply the settlement. The banks are margined with dwarf oaks and willows; limestone, sandstone, and granite, all of fine building quality, lie scattered about in profusion, while high above rise the acclivities of the gash, thinly sprinkled with sage and sunflower. Artemisia in this part improves like the population in appearance, nor is it always a sign of sterility; in parts wheat grows well where the shrub has been uprooted.

On July 18, 1855, Jules Reny, a French naturalist left San Francisco for Salt Lake City. Between Carson City and Haw's Ranch he describes sagebrush as follows: (37, Vol. 1, p-113)

"... We lit a large fire of sagebrush. Some of the stems of this plant were enormous. I counted fifty rings in one, which indicated an age of half a century."

He also continuously mentioned sagebrush and juniperus. Writing of the lake: (37, p-180)

"... The vegetable kingdom is only represented by an alga of the family Nostaceae."

(Vol. 1, p-121)

"There are not trees on the borders of the lake, (S. L.) nor on any of the adjacent plains. It is necessary to ascend almost to the summit of the surrounding mountains to procure fire-wood, composed of green trees, some maples, willow, poplar, and oak. Nothing is to be seen near the shore but a few withered plants, such as yellow composites, a yellow Oenothera, and especially a large Cleome with roseate flowers......"We left the lake on our left, and followed a sandy road in the middle of a vast plain perfectly level and uncultivated, where nothing grew but sagebrush and grease-wood."

He writes the following regarding the south part of the valley: (37, Vol. II, p-316)

After leaving Cottonwood, we crossed a little river, on the banks of which, in spite of the lateness of the seasons there were to be seen willows in leaf, a Hydicityle, a convolvulus, some common Synantherae, and a little rush similar to the Juncus bufonius."
Utah Valley

So far most of the material quoted has been with reference to Salt Lake Valley. On turning to Utah Valley it will be necessary to again refer to Fremont. On his return from California, near the finish of his second western journey; and some months after being at Great Salt Lake he again entered what is now Utah by way of its southwest corner. He had endured terrible hardships on the journey, crossing the Sierras in heavy snow, but he went on with his observations and collecting. Taking up his journal (22) as he enters Utah Valley from the south he writes:

May 23. "Crossing the next day a slight ridge along the river, we entered a handsome mountain valley covered with fine grass, and directed our course towards a high snowy peak, at the foot of which lay the Utah Lake. On our right was a bed of high mountains, their summits covered with snow, constituting the dividing ridge between the Basin waters and those of the Colorado. At noon we fell in with a party of Utah Indians coming out of the mountain, and in the afternoon encamped on a tributary to the lake, which is separated from the waters of the Sevier by very slight dividing grounds."

"Early the next day we came in sight of the lake; and, as we descended to the broad bottoms of the Spanish Fork, three horsemen were seen galloping towards us, who proved to be Utah Indians—scouts from a village. Farther down the lake we encamped on a fertile bottom near the foot of the same mountain ridge, which borders Great Salt Lake, and along which we had journeyed the previous September. Here the principal plants in bloom were two, which were remarkable as affording to the Snake Indians—the one an abundant supply of food, and the other the most useful among the applications which they use for wounds. These were the kooyah plant, growing in fields of extraordinary luxuriance, and convallaria stellata, which, from the experience of Mr. Walker, is the best remedial plant known among these Indians.

"Utah is a lake of note in this country, under the domination of the Utahs, who resort to it for fish. Its greatest breadth is about fifteen miles, stretching far to the north, narrowing as it goes, and connecting with the Great Salt Lake."

(p-465) "At the time of our visit, there was only one place in the lake valley at which the Spanish Fork was fordable. In the cove of the mountains, along its eastern shore, the lake is bordered by a plain, where the soil is generally good, and in greater part fertile; watered by a delta of prettily timbered streams. This would be an excellent locality for stock farm; it is generally covered with good bunch grass, and would abundantly produce the ordinary grains. In arriving at the Utah Lake, we had completed an immense circuit."
"The contents of this great Basin are yet to be examined. That it is peopled, we know; but miserably and sparsely. From all that I heard and saw, I should say that humanity here appeared in its lowest form, and in its most elementary state. Dispersed in single families; without firearms; eating seeds and insects; digging roots, (and hence their name)—such is the condition of the greater part. Others are a degree higher, and live in communities upon some lake or river that supplies fish, and from which they repulse the miserable Digger. The rabbit is the largest animal known in this desert; its flesh affords a little meat; and their bag-like covering is made of its skins. The wild sage is their only wood, and here it is of extraordinary size—sometimes a foot in diameter and six or eight feet high. It serves for fuel, for building material for shelter to the rabbits, and for some sort of covering for the feet and legs in cold weather. Such are the accounts of the inhabitants and productions of the Great Basin; and which, though imperfect, must have some foundation, and excite our desire to know the whole."

"Turning our faces once more eastward, on the morning of the 27th we left the Utah Lake, and continued for two days to ascent the Spanish Fork, which is dispersed in numerous branches among very rugged mountains, which afford few passes, but a good trail facilitated our traveling, and there were frequent bottoms covered with excellent grass. The streams are prettily and variously wooded; and everywhere the mountain shows grass and timber."

Brigham Young made one of his trips to Fort Utah starting September 14, 1859. (6)

"The following day, September 15, the President and his party continued the journey, traveling through a hot spring of pure water, about a foot wide at the top. West of this spring they found several other springs, which ran into a lake surrounded by tall grass. Some portions of the road were very steep and very difficult to ascend, but they all got up on the tableland in safety. 'Here,' writes Elder Bullock, 'We had a splendid view of the Great Salt Lake Valley, and Utah County on the south, Utah Valley, with its timber and beautiful lake. We descended into the Utah Valley in a diagonal line and soon reached Dry Creek, the present site of Lehi, which was fringed with willows and small trees.'"

"We continued on to the American Creek. We traveled over a very dusty road, through small cottonwood brush, passed through an extensive swale, and came in sight of the grove, in which lies the Fort.... On crossing the island we saw some very beautiful timber. We then crossed the Provo River, a fine stream, five rods wide and from sixteen to twenty inches deep."

In Journal History of Utah Stake (30) these comments are made:

"During the early months this spring, the cowherds went to graze on the East bench and Union bench, now Mapleton.... The herd, with eight or ten boys, and as many dogs, in charge would meet at the East gate, with the "lowing" herds at sunrise, and drive the cows to graze on the luxuriant bunch grass, which abounded on every hand as soon as the end of the land was reached."
Again quoting from Lieutenant Gunnison's book (26):

"Ascending the Traverse range, a beautiful panorama of lake, plain, and river embosomed with lofty and romantic mountains, bursts upon the view. Here is the lovely Utah Lake and its winding outlet; and the Timpanogas, with four other rivers, fringed with cottonwoods, a sight so seldom seen in these regions, and by contrast, enchanting. All the valley on the east side of the lake is fertile, and the waters throughout fresh and sparkling, as they rapidly descend to the quiet reservoir."

Then from Burton again (8):

(p-333) The steep descent on the counterslope of Traverse Mountain disclosed to us the first sight of Utah Lake, which is to its sister what Carmel is to Lebanon. It was a soft, sunny, a placid and beautiful landscape, highly refreshing after the arid lands on the other side. A panorama of lake, plain, and river lay before us. On the east, south, and west were rugged walls and peaks of mountain and hill; and northward a broad, grassy slope rose to the divide between the valleys of the Fresh and of the Salt Lake. From afar the binding of plain round the basin appeared so narrow that the mountains seemed to dip their feet into the quiet reservoir; and behind the southern point the lone peak of lofty Nebo stood, to adopt the Koranic comparison, like one of the pins which fasten down the plains of earth. A nearer approach discovers a broad belt of meadow, rich alluvial soil, in parts marshy, and in others arable, wheat and rootcrop flourishing in the bottom, and bunch-grass upon the acclivities. The breadth is greater to the west and south of the lake than in other parts. It is cut by many a poplar-fringed stream that issues from the tremendous gorges around the American Fork, the Timpanogas or Provo River, and the Spanish Fork. . .

(Jordan) The bed, where it shows, is pebbly; a white, chalky incrustation covers the shallower bottom; shells, especially the fresh-water clam, are numerous upon the watery margin; the flaggy "Deseret weed" in the tules is ten feet high. (Tulare is a marsh or bulrush (Scirpus lacustris), which is found extending over immense tracts of river valley in Western America. "Tooly" water, as it is pronounced, is that which is flavored or tainted by it) and thicket is dense in places where rock does not occupy the soil. The western side is arid for want of influents; there is a "lone tree," a solitary cottonwood, conspicuous amid the grazing-ground of bunch-grass, sage, and grease-wood, and the only inhabitants, excepting a single ranch - Evan's - are, apparently, the Phrynosoma and the lizard, the raven and the jackass-rabbit.

". . . We forded the Jordan, at that point 100 feet broad, and deep to the wagon-hubs. The current was not too swift to prevent the growth of weeds."

While Stansbury was surveying the islands of Great Salt Lake, Gunnison surveyed the east side of the lake and Utah Lake. Gunnison's report to Stansbury was inserted in the latter's Government report. From it (42) the following is taken:
"From the Jordan to Dry Cottonwood is a grazing range. At the outlet of the lake there is a reed marsh from which, by early cutting the dense growth, a pretty hay can be made. It will be difficult to obtain irrigatable land until we reach the Spring Creek and we have to rely on the American Fork for water to irrigate with. A beautiful and wide bottom land lies along the lake shore, for some miles under control of this stream; and from the crossing to the heads of Pomont-quint is a rich alluvial soil mixed with vegetable mould. A series of rolling, round hills now occur between the Pomont Creek and Timpanogas, well grassed for cattle ranges. On the Timpanogas bottoms wheat grows most luxuriantly, and rootcrops are seldom excelled. A continuous field can be made thence to the wa-ke-te-ke creek, and the lovely Utah Valley made to sustain a population of more than a hundred thousand inhabitants. The west of the lake is grazing land ..."

There are a number of quotations from various volumes of the Millenial Star, concerning the beauty and fertility of Utah Valley: (Kane, 31)

"The territory of the Mormons is unequalled as a stock-raising country. The finest pastures of Lombardy are not more estimable than those on the east side of the Utah Lake and Jordan River. We find here that cereal anomaly, the bunch grass. In May, when the other grasses push, this fine plant dried upon its stalk, and becomes a light yellow straw, full of flavour and nourishment. It continues thus through what are the dry months of the climate, till January, and then starts with a vigorous growth, like that of our own winter wheat in April, which keeps on till the return of another May. Whether as straw or grass, the cattle fatten on it the year round."
(6, p-615)

"... the company started to explore a new route to this city, west of Utah Lake, as you will see by the following extract from Elder Bullock's Journal:

"At 9:10 a.m., the camp started on their back track, and went 1 3/4 miles, then took a westerly course, passing over three ridges of mountains, and came to a halt for the night on Kimball's Creek, having traveled 20 2/3 miles, being decidedly the roughest part of the journey.

"May 28. Camp started at 7 a.m., taking a northerly course, travelled along the western side of the Utah Lake for several miles before we could find a suitable place for a noon halt, the banks of the Lake being fringed several rods wide with cane and tall grass. After staying a couple of hours, resumed journey by the side of the Lake, and came to a halt opposite Pelican point at 6:30 p.m., having travelled 34 1/2 miles. Saw many pelicans, swans, blue cranes, geese, and other water fowls. Some parts of the road very rocky and rough...."

Again quoting from volumes of the Millenial Star, are more references to the abundant fish in Utah Lake: (48, p-117)

"Brother Whipple, who left the valley late in the fall, informed me that the Utah Lake is abundantly supplied with the mountain trout, of a very large size, and all trout from a quarter up to three and four pounds. He watered his land from Mill Creek, and when shutting off the water, could go into the field and pick up any quantity he wished of very fine trout."
From P. P. Pratt. (34):

"... I was at the Utah Lake last week, and of all the fisheries I ever saw, that exceeds all. I saw thousands caught by hand, both by Indians and whites. I could buy a hundred which would each weigh a pound, for a piece of tobacco as large as my finger. They simply put their hand into the stream, and threw them out as fast as they can pick them up. Five thousand barrels of fish might be secured there annually, just as well as less."

Lieutenant E. G. Beckwith was with Gunnison on a railroad survey when Gunnison was killed near Sevier Lake. Beckwith then completed the work. Gunnison had made a plant collection and it was his plan to survey Timpanogas Canyon the next spring. (4, p-77)

November 4, 1853. ... The road then followed close along the base of the mountains for 6.37 miles, to the settlement of Provo, on the Timpanogas River". ... (Concerning the inland along west of Wasatch, east of lake). ... "The grass of this district and of the higher mountain valleys is excellent; and potatoes and other roots are produced in abundance, and of superior quality."

"November 5. Leaving the Timpanogas River, we ascended a high bluff to a table extending along the base of the mountains. The road for eight miles was very fine and the view of Utah Lake the best we had had, reminding us of those of western New York. It is twenty-five miles in length, north and south, by twelve in width, with fine, irrigable lands on the east and pasture lands on the west. ..."

"On the eighth of November our party arrived in Great Salt Lake City, and on the 12th the animals were sent to graze for the winter, in charge of a strong guard, in Cedar Valley, a few miles south of Utah Lake."

Remy made a few more brief notes on Utah Valley. (37. Vol 1, p-322)

"We soon came upon a small water-course called American Fork, which spreading over the country, inundates it and forms a sort of marsh in which, together with cosmopolite nettles, are found stunted oaks, consumptive-looking maple-trees, and large-sized worm-wood. A little farther on, we crossed another rivulet, Spanish Fork on the borders of which were to be seen, in the midst of swamps, some Lemna, Chara, and Fisaria. We then went twelve miles, without finding a drop of water, through a country which seemed to be neglected, and where we saw nothing but grease-wood."

(p-323) (Off Provo Bench) "A few miles from there (Battle Creek), we descended into a valley forming a basin, through which we rode some time, in the midst of willows, oaks, and dogberry, all of low size."

(Pratt, 35)

"The company camped Thursday night, November 27, for the night on Hobble Creek, which was twenty-eight feet wide and two feet
deep with clear water. Here was cottonwood for fuel and plenty of feed, and a good place for a settlement.

"Wednesday, November 28. The same exploring company started from Hobble Creek to make other explorations.

"The brethren saw a long level prairie ahead and soon crossed Spanish Fork River, which was fourteen yards wide and fourteen inches deep with rocky bottom and steep banks. The bottom land here was 250 yards wide with steep ascent and descent to and from the bench. Cottonwood timber and willows abounded and greasewood and sage were plentiful all along the prairie; the canyon to the east was very open. The company passed low swamp land for three-fourths of a mile, and also noticed rich black soil. They camped at three p.m. on Peteetnee Creek, which was fourteen feet wide and seventeen inches deep with swift current and like City Creek running on the highest levels of lands. Here the explorers found fine soil and beautiful grass and the present site of Payson is mentioned as a desirable place for a settlement.

"Thursday, November 29. The exploring expedition started at 9 a.m., the morning being clear and frosty. They found plenty of dry feed and the soil dry and sandy with sage and greasewood abundant, and the mountains covered with cedar and fir. They crossed a branch of Summit Creek, which was thirty feet wide, one foot deep with cottonwood in abundance on the banks. They found the stream to flow on the summit or ridge between Utah and Juab valleys with gently undulating land for four or five miles from the foot of the mountains."

O. B. Huntington was one of the first to settle at Springville.

From the several volumes of his journal the following is taken (27,p.59)

"Besides the Salt Lake Valley are several smaller valleys, the largest of which is the Ewtah, which would be the end of my searches to find a pleasant and delightful home. About 60 miles in length and 30 in width with the Ewtah Lake in the center stretching about 40 miles north and south, 20 miles east and west laying in an irregular triangular form, well filled with excellent fish as also all its large tributaries. From almost any point the whole valley and lake is in full view, surrounded with very high, bold mountains, more so than the other valley described. The most of the western side of the valley is sandy and covered with juniper trees. There are 5 or 6 small rivers and numerous little creeks emptying into this lake, and the borders of these are creeks and rivers are well stocked with wood, and up these streams into the mountains the wood is easier of access than in Salt Lake Valley, also there is always less snow in this valley, and good salt spring in the south end. This valley will probably hold and sustain about 59,000.

From P.P.Pratt's Autobiography (36,p.463) is the following:

"Monday, March 24, 1851. We commenced our journey from Peteetnee organized in companies of tens, fifties and one hundred—fifty journeying together.

"Our fifty, commanded by Captain Seely, travelled six miles to Summit Creek. Tuesday 15th.—I took a walk in the morning about three miles and ascended a beautiful height, which afforded a fair view (with
a telescope) of the head of Utah Lake and the valley of Salt Creek, which enters the lake through an extensive meadow at the head of the lake, forming at its junction a beautiful harbor and a convenient beach of sand. The depth of water not known, but its deep blue color intimated sufficient depth for small crafts....We journeyed eleven miles to Willow Creek, the country being rich in grass, and watered by Salt Creek, a stream of one and a half rods wide, and several large springs running north into Utah Lake."

In a brief history of Springville by Don Carols Johnson (28,p.1)

he has written:

"Coming to our own citizens. Oliver B. Huntington came to this locality with Barney Ward upon a trading expedition in February, 1849. Being young, ardent and filled with the spirit of adventure, he was easily persuaded by the old trapper that there was money in it, and he concluded to do some trading with the natives for peltries. Accordingly several pack animals were loaded with such gew-gaws as would delight the dusky denizens of the valley; notably red flannel, gaudy bandanas, paints brass rings, powder and shot, beads, etc.--and started for the valley of the Utah Lake. At this time the snow lay a foot deep all over the Utah valley. The dry bunch grass protruded from the white crust six inches in many places and afforded excellent feed for their horses. The adventurers only went as far as the Spanish Fork River...."

"The trading party returned at the end of the week, and made their camp about the center of Fourth street, near the site of the present residence of William Giles. The horses were hobbled and turned out to feed upon the ripened grasses that grew abundantly in that locality. In the morning the bell-horse had become unhobbled and led the band astray out across the valley toward the mouth of Maple canyon. Mr. Huntington easily followed the trail out through the cedars which grew on what is now known as Mapleton Bench, and soon returned to camp with the runaways...."

"We now come to the real locator of Springville as a town-site--William Miller. He came to Salt Lake City in September, 1848, and built a home....James Mendenhall was also one of those volunteers, and he in connection with Mr. Miller took a trip down through the valley as far as Payson, they called Peteetneet, but found no place that delighted them as did the site on Hobble Creek. Here they resolved to come with their friends and make a settlement....It was then arranged that as soon as Aaron Johnson and his company came to Utah they would be assigned to Hobble Creek to make a permanent settlement. In the summer of 1850, while Johnson's company was on the Plains, Mr. Miller brought his wife, Phoebe, down to inspect the proposed home-site. They came, they saw, and were conquered.

"Never had their eyes beheld a more eligible site on which to make a home. The season was early June, and the scorching rays of the sun had not yet parched the landscape; acres of waving grass, studded with bright colored flowers, beautified the broad expanse from the lake to the snow line on the mountains, and loaded the pure air with their fragrance and bloom."
"Bright and early on the morning of the 19th the hardy pioneers were up and doing. While the mothers and daughters prepared the first meal of the day, the male portion hung grind-stones and sharpened scythes, preparatory to the haymaking from the wild grasses which grew luxuriantly in every direction. Axes were prepared and wagons were selected to go into the canyons for logs with which to build a fort to protect themselves, not only from the wintry snows which would soon cover the valley but from the wild natives who then roved unmolested in the land....The logs for the houses were procured up the creek bottom and at the forks of Hobble creek canyon, where there grew a beautiful grove of cedars and cottonwoods. The cottonwood entered largely into the construction of the walls of the houses, while the cedar, which grew tall and straight and would "split like an acorn," was used for ridge poles, joists and rafters....one load of which entered into the construction of Mr. Smith's house, which stood in the southeast corner of the fort. These logs grew upon the flat at the Forks, were of balsam, the same timber.

"...This season in May the creek (1855) showed a rising spirit. For the first time the narrow channel was full and foaming, and at some places over-running its banks. It then ran in its natural channel, crossing State street where it now does, then turning a square corner ran north just in front of the Dinwoody building to the point where the old cottonwood tree stands; then turned west.

"In the summer of 1854 the first ditch was made from Hobble Creek upon the Union Bench and farms were taken up and worked for a few years, and were then abandoned in consequence of the scarcity of water. At this period the Union bench was covered with luxuriant bunch grass upon which the cattle would soon fatten, and caused the cows to give the richest milk in abundance."
Interviews

Mr. W. B. Emnis born at Draper in 1857 was asked to describe the early vegetation of that part of the valley as he remembered it. He said that cottonwoods grew along the streams and low down in the valley, box elders, service berries, and choke-cherries, a little higher up and along the foothills. Sagebrush grew everywhere on good soil.

There were many grasses; buffalo grass on lower benches (richest feed in intermountain district) wheat grass in the meadows, (Still common at Lehi). Wire grass grew in damp soil, salt grass on mineral lands, blue grass, segoes, poison sago, and matchweed. On the dry sandy soil were prickly pears and on the dry flats shadscale. Oak and maple grew along the foothills, willows, white shile or basket, and black along the streams. Wild currants also grew along the streams.

On low alkali lands in general, the grease wood grew, but a very large thrifty variety was found south of little Cottonwood Creek. But brush was on the flats, a good sheep feed, hardy and dry. Rabbit brush was scarce, and only on the richest, damper soil; very little was among the sage.

The mahogany in the foothills was used extensively for fuel. There were very few cedars in Salt Lake Valley, but quite a grove along each side of the road at the point of the mountain.

Elderberry grew down in the valley and kinnikinnick along the streams.

On the west side of the valley at Riverton grew the little sage. Farther west were prickly pears, shadscale, and greasewood. In the foothills was vegetation similar to that on the east side, and west of the Jordan River grass grew abundantly.
At Bluff Dale, Mr. Wm. Turner was interviewed. Though he was born there in 1868, he could remember an abundance of blue grass along the lower east side of the flat (west of Jordan) which was annually cut for hay. The sagebrush was thin, more at the extreme west side of the valley about the same distance as at present. Also there were sagoes, prickley pears, bunch grass, wild onions, ground cherries, and fox tail. There were only a few cedars at the point of the mountain and no pinion pine in the valley.

Sagebrush grew on the rich dryer flats. Rabbit brush along gullies and disturbed places. Grass and flowers were found among the sagebrush, while higher up on the mountain sides and tops an abundance of grass and pea vines grew. He agreed with Mr. Ennes in practically everything except the number of cedars at the point of the mountain.

Speaking of Springville, Mr. J. F. Wakefield Sr. said that north and west clear to Provo, was a church pasture with all kinds of grass which they mowed for hay.

Referring to the old tree on Main street he said, "I remember when we first came in there, that tree looked like it was pretty near as big as it is now, and the creek went right next to it. After high water changed the course of the creek south and west, they build the school house near the tree."

Cedars came right down to the main highway and there was bunch grass through the cedars. There was not much grazing among them, but there was a great deal between the town and the cedars on the bench.

Provo bench had some sage and lots of grass though the sage was not very high. When we moved south from Salt Lake Valley, we camped on the bench. There was lots of grass for stock, but no water."
Near Spanish Fork it was greasewood, clay beds, and willows. Mr. Wakefield was born in 1847, so was in a position to know considerable about early Springville and he remembered things very clearly.

Mr. Andrew Jensen, Church Historian, said that the west part of the bench (Salt Lake Valley) was mostly grass, with bulrushes in swamps toward the lake. Segoes grew in highlands, in the upper lands grew sage and meadow lands which furnished some hay. "Would divide land from meadow and farm land."

Many others were interviewed but most of the interviews hardly proved satisfactory. Some individuals were too old to remember clearly, others were not old enough to have seen things in their original state.

**Relict Areas**

In a study of the influence of heavy grazing and of promiscuous burning on ranges in Utah, Pickford (32) found eighteen areas in the Great Salt Lake district that had been free from grazing for from five to sixty-five years. Nine of these had been neither grazed nor burned. Nine had been burned but not grazed, and seventeen that had been both grazed and burned were studied. These plots were from one to two and a half acres in size. In each case grazed referred to an overgrazed condition. These plots were located in cemeteries and other fenced and protected areas.

It was assumed that the unburned, ungrazed areas represented, approximately, the original natural vegetation of the bench lands. "Perennial grasses, including blue bunch, wheat (Agropyron spicatum) beardless wheat (A. inerme) slender wheat (A. tenerum), Sandberg's blue (Poa sandbergii), and Nevada blue (P. nevadensis), with an average density of 0.26, constitute approximately 68 percent of the total plant cover."
Downy brome (*Bromus tectorum*) good perennial weeds and shrubs were unimportant on the protected areas. The sagebrush made but eleven percent of the total vegetative cover and has a density of 0.04.

On the plots that had been burned but not grazed, the total cover was slightly more dense but the density of the perennial grasses was thirty-two percent less. Downy brome became twenty-two percent of the vegetation on these areas. Sagebrush was practically eliminated by fire.

Grazing alone reduced the density of the perennial grasses to where it was only thirty-eight percent as great as on the protected plots. Sagebrush was more prevalent and on the grazed areas reached a place of dominance with a density of 0.09 forming twenty-four percent of the total vegetation. Unpalatable perennial and annual weeds had a forty-three percent greater density on the grazed than on the protected plots.

Burning and grazing combined reduced the average density of the vegetation to only seventy-six percent of that on the protected areas. Downy brome was the dominant species and made up thirty-eight percent of the total plant density. Poor perennial weeds occupied about twice as much space on the burned grazed plots as on the protected areas. Sagebrush was practically destroyed, occupying but three percent of the total as compared with ten percent on the unburned protected plots. The annual weeds were about the same on burned and grazed areas.

**Discussion**

The principal changes that have occurred in the Salt Lake and Utah valleys since 1847 are found on the well drained bench lands and foothills. The alkali areas in the lowlands do not show much change from
the original, probably because the flora found there is an edaphic climax. This makes it impossible for the invasion of any less alkali tolerant plants. It is true, however, that the native grasses have been reduced by overgrazing on these salt areas as well as on other areas in the valleys.

The present growth of oak on the foothills is probably recent since the annual fires that prevented its growth in former times have been eliminated. Gunnison mentioned "and occasionally oaks", giving the idea that these chaparrel formations were limited at that time. The annual fires certainly could be a limiting factor to their growth. The lack of prominence of the sagebrush in the valleys might also be attributed to these fires.

The Indians started fires for the purpose of roasting crickets. Gunnison describes these fires (25):

"The more exposed parts of the country are annually run over by the fires set by the Indians to kill and roast the crickets which they gather in summer for winter food. These fires ascend the furzy hillsides and penetrate the forest canyons—and it is a beautiful, but melancholy sight to see the withered vegetation swept away by the curling flames as they leap up the cliffs, lighting up at night the surrounding country with fitful splendours. . . ."

Escalante thought these Indians were burning the grass to keep his party out of the valley. It is possible that it was their annual fall harvest of crickets.

The evidence seems to show that there was a much larger proportion of grasses on the bench lands than sagebrush or oak.

Referring to Clements (13, p. 153) he writes:

"The general rainfall limits (in the Basin) are from 5-15 inches in the interior, though to the eastward sagebrush mixes with or yields to grasses the rainfall rises above 12 inches.

It actually averages from fifteen to sixteen inches in the eastern parts of the two valleys in question."
Because of winter precipitation and a predominance of *Agropyron spicatum* and other perennial grasses in the Palouse prairie, there is a similarity between that formation and the probably original benchland formation of Salt Lake and Utah Valleys. Weaver and Clements (47, p. 468) place this formation on the "rugged hills of the great wheat-producing region known as the Palouse but is characteristic, in general of eastern Washington and Oregon, southern Idaho and northern Utah. Quoting further from the same authors they say:

"Over most of its area, this prairie has been replaced by two communities that owe their advantage to overgrazing and, in the case of the annuals, to fire also. So abundant is the sagebrush throughout the major portion that this whole region has been assigned to the sagebrush climax, but the study of relict and protected areas, especially experimental exclosures, proves that the grasses are climax and that they again assume dominance when grazing is much reduced or eliminated."

Sampson (37) shows that the native wheat-grass consociation on the forest ranges have similar factors to those of the valleys, except that the growing season is later on the mountains.

The growing season on the Manti Forest begins about the first of June. The average June precipitation is 1.86 while July is 2.08 inches. The growing season in the valleys would be March, April, and May, and the average precipitation for these months at Salt Lake City is 2.07, 2.01 and 2.00 inches. The predominant species of the bunch wheat grass on the Manti Forest are, as those found by Pickford, to be native in the valleys, the blue bunch wheat (*Agropyron spicatum*) and slender wheat (*A. tenerum*).

The fact that so many of the early travelers and explorers in this region mentioned grass in their accounts, might be thought to be due to an interest in grass for their animals. However, such men as Gunnison and others who write of the grass and pasturage in these val-
leys, make note of sagebrush where it did occur in quantities. The last entry in Gunnison's journal before his death as given in Beckwith's report (4,p.72). On October 25, 1853, the following is found in the journal:

"... I came down the river southwest for nine miles ... The route was through heavy artemisia for five miles. ..."

This was near Sevier Lake. Several of the pioneer's journals show the same lack of description of sagebrush in the valleys while mention is made of it elsewhere. Bullock (5,p.274) writes:

"Leaving Salt Creek party went into Sanpete, which is full of sagebrush, and rabbit weed ... The valley is generally level, filled with sage and rabbit weed, except a strip on the immediate banks of the creek, and a few marshy places. The hills are low and are well studded with cedars and other timber. ..."

The introduction of downy brome and Russian thistle, two very hardy and prolific plants, has brought about a considerable change in the present vegetative covering. Fire and overgrazing aids rather than hinders these species.

According to Watson (46,p.xlii) the following plants had been introduced into the Basin as early as 1868.

"The first eight seemed to make themselves perfectly at home in the sagebrush. ... The rest were found only near old fields or fences or in catual cultivation excepting the last four, which were collected on stream-banks in canyons near roads traveled only by the teams of woodmen. Their introduction is perhaps questionable."

Introduced species.

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<tr>
<th>Brassica nigra</th>
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<tr>
<td>Brassica campestris</td>
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<td>Saponaria Vaccumia</td>
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<td>Capsella Bursa-pastoris</td>
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<td>Naruta Cotula</td>
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<td>Marrubium vulgare</td>
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<td>Chenopodium album</td>
<td>Polygonum Convolvulus</td>
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Chenopodium Botrys.  
- - -  
Nasturtium officinale.  
Portulaca oleracea.  
Medicago sativa.  
Melilotus parviflora.  
Melilotus alba  
Peucedanum sativum.  
Verbascum Thapsus.  
Satureia hortensis.  

Phleum pratense.  
Eragrostis poaeoides.  
Hordeum Himalayense.  
Avena fatua.  
Avena sativa.  
- - -  
Taraxacum Dens-leonis.  
Polypogon Monspeliensis.  
Poa annua.  
Setaria viridis.  

Garrett (23, 24) lists 102 introduced species of Salt Lake Valley.

It is evident that changes had started to take place even before Watson did collecting in the valleys in 1868. Gilbert made his geological studies in the late seventies and soon after. He notes (25, p.248):

"In the virgin condition most lowland valleys and all of the upland valleys were covered by grass and other herbaceous vegetation. These have been eaten off by the herds of the white man and in their place has sprung up a sparse growth of low bushes between which the ground is bare."
SUMMARY AND CONCLUSIONS

In making studies of plant succession it is very desirable or even necessary to know the original plant covering of the region studied. Man is considered a biotic factor in vegetative changes, but it is necessary to know the previous condition of an area before the extent of his influence can be estimated.

Since the settling of the Great Salt Lake and Utah Lake Valleys by the pioneers of 1847, there has been in that region a change in the plant communities, both floristically and ecologically.

A comparison of the present status with that of the former shows that the principal changes have not been in the marsh grass or salt weed associations so much as in the better drained, less alkaline bench lands.

These changes are shown in the prevalence of many introduced species such as Bromus tectorum, Salsola pestifer, and others that on overgrazed and burned areas have replaced, to some extent, the original flora. There is an increased alkalinity in many of the lowland soils due to leaching from irrigated upper lands. In overgrazed areas there is an increase of annuals such as Bromus tectorum and a decrease in woody perennials as sagebrush. The results of both overgrazing and burning have reduced the total density of the plant cover, leaving poor annual and perennial weeds and annual grasses in predominance.

The written historical evidence, the interviews with pioneers, and observations of protected areas seem to indicate a grass rather than a sagebrush climax for this region.

This paper presents a collection of historical data concerning the vegetative covering of the Salt Lake and Utah Valleys before or at
the time the valleys were settled by the white people. It attempts to compare these data with observations made by a few of the remaining pioneers and with a study of relict areas.

This paper might prove of value in its providing basic material for future ecological and successional studies in the region studied.

This study has been handicapped by the scarcity of material in general and especially by the lack of very extensive scientific evidence. Many of the observers quoted were only casually interested in the vegetation, and only occasional reference to it is found in their writings. It is possible that as more of the early diaries, letters, and other writings come to light, some slight additional evidence may be brought forward.

Had this study been projected a few years earlier much valuable information might have been derived from pioneers still living, but at this time there are very few early settlers left.

Several problems for future study have arise during the preparation of this thesis. Ample historical data was found to make a similar study of the original ecology of the plains region and also of some sections in Utah; such as Sanpete, Sevier, and other valleys. From Stansbury's report of his survey of the islands in Great Salt Lake, an interesting study might be made of the effects of grazing and plant succession there. Data can also be collected from these same sources for zoological studies of a similar nature.
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