

THE ARIZONA STRIP

Report of Reconnoissance of the Country
North of the Grand Canyon

By

PROF. A. M. McOMIE
Arizona Agricultural Experiment Station

C. C. JACOBS
District Engineer U. S. Geological Survey

DR. O. C. BARTLETT
Assistant State Entomologist



Published by
Board of Control, by authority of Chapter XXVIII, Title 1
Revised Statutes of Arizona 1913, Civil Code

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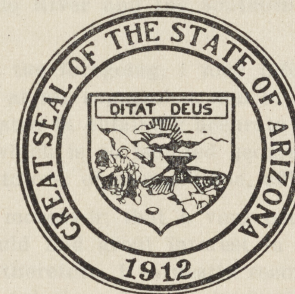
Arizona Agricultural Experiment Station

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PREFACE

The Arizona Strip is that portion of Arizona which lies between the Colorado River and the Southern boundary of the State of Utah. Concerning this isolated but productive area, very meager information has been available heretofore. With a view, accordingly, of bringing the facts regarding this comparatively unknown region and its highly enterprising and industrious inhabitants within the realm of current knowledge, Honorable Geo. W. P. Hunt, Governor of Arizona, early in the summer of 1914, authorized and directed the organization of a reconnoissance party consisting of Prof. A. M. McOmie, of the Arizona Agricultural Experiment Station, Mr. C. C. Jacob, District Engineer of the U. S. Geological Survey, and Dr. O. C. Bartlett, Assistant State Entomologist of Arizona. The report on the population and natural resources of the Arizona Strip, as presented in this booklet, is the result of the reconnoissance so ordered, and on March 1st, 1915, was transmitted in typewritten form to both houses of the Second State Legislature of Arizona. The Governor's letter of transmittal addressed to the Legislature, reads as follows:

March 1st, 1915.

To the Senate and House of Representatives,
Second State Legislature of Arizona.

Gentlemen:

I have the honor to transmit to you herewith copies of reports rendered by Mr. C. C. Jacob, District Engineer, United States Geological Survey; Dr. O. C. Bartlett, Assistant State Entomologist, and Prof. A. M. McOmie, respectively, relating to that region of Arizona which lies between the Grand Canyon of the Colorado River and the southern boundary of the State of Utah.

With reference to the foregoing, I may inform you that the attached reports were rendered at my suggestion, and in the belief that the Arizona public would be interested in obtaining accurate information regarding that portion of the State which is so isolated geographically that it has never been the subject, heretofore, of any reliable, official account.

I feel quite sure, moreover, that a very considerable number of the people of Arizona would find great interest in reading the reports transmitted herewith, and, therefore, I earnestly recommend to you that legislative authority for the printing of these interesting, official descriptions of the "Arizona Strip" be extended during the present session.

Very respectfully,

GEO. W. P. HUNT,
Governor of Arizona.

After giving consideration to the Governor's recommendations, as set forth in the foregoing letter, the State Senate adopted a resolution authorizing the Board of Control to have the reconnoissance report printed, and thus made available for distribution. The Board accordingly presents to the people of Arizona the interesting and authentic report comprised by this pamphlet, a copy of which will be sent on request to any citizen until the supply is exhausted.

CHAS. R. OSBURN,
Secretary, State Board of Control.

Phoenix, June 30, 1915.

THE ARIZONA STRIP

Report of Reconnaissance from Flagstaff, Arizona, to Hurricane, Utah, across Kaibab and Kanab Plateaus, Arizona

The purpose of this reconnaissance was to examine that part of Arizona between the Colorado River and the Utah line, with particular reference to the agricultural possibilities and water resources of the so-called Arizona strip. The reconnaissance was made under the authority of the Director of the Arizona Agricultural Experiment Station and the District Engineer of the Santa Fe District, United States Geological Survey.

On July 10, 1914, our party consisting of A. M. McOmie, Agriculturist, Arizona Agricultural Experiment Station, Dr. Bartlett, Assistant State Entomologist, and C. C. Jacobs, Assistant Engineer, United States Geological Survey, and driver, left Flagstaff in a Ford automobile, intending to reach Fredonia, Arizona, by this means of transportation, at which point arrangements had been made for a wagon and horses to continue the reconnaissance. The road followed is the main highway to Tuba City, of the Navajo Indian Reservation, which skirts around the base of the San Francisco mountains, across the lava flows and down over a rolling grass covered country which slopes uniformly to the northeast towards the Little Colorado basin. The Little Colorado River was crossed at the new suspension bridge. The stream was at flood stage, carrying about 5,000 sec. ft. of muddy water. This locality was examined for a gaging station site but conditions were found to be very unfavorable on account of the shifting character of the stream bed. The stream is well confined here by vertical cliffs about 75 feet high of soft sand-stone of the "Moencopie" formation. The geology of this locality has been covered by Mr. N. D. Darton, and others of the Geological Survey and need not be referred to in detail. The many brilliant colored clays and sandstones absolutely devoid of vegetation that characterize this area, constitute the so-called

"Painted Desert." The Moencopie wash, which drains a considerable area east of Tuba City, but is normally dry, was found to be carrying a flood of approximately 2,000 sec. ft. and was impassable. Flood waters from the Moencopie wash are used by the Navajo Indians to irrigate their farms near Tuba City. Crops of corn and vegetables and some fruit trees were observed along this wash. Tuba City lies on top of the mesa from which several small springs issued from the sandstone. The quality of this water, which is doubtless of local origin, was not determined, but alkali signs were observed at several points along the road from the wash up to the top of the mesa. In general, the water seeping from these red sandstone strata is soft and otherwise of excellent quality.

The road from Tuba City to Lee's Ferry follows up a shallow draw for about thirty miles at the base of the red sandstone escarpment, forming the Echo Cliffs. The Buckskin Mountains strike the Echo Cliffs nearly at right angles and are composed of gray limestone strata, possibly belonging to the Aubrey group (Dutton) of the carboniferous system. These mountains are doubtless a local uplift and the strata dip to the north. The Buckskin Mountains are covered by a growth of cedars, but there is no evidence of springs or running water, at least in the vicinity traversed by the road, although several "tanks" and local seeps were noted. After crossing these mountains, the road still follows the Echo Cliffs, but the slope of country is here to the north and aside from the crossing of numerous intersecting side washes, a highway of nearly uniform grade could be easily constructed down across the slope to the Colorado River. Paria River, which joins the Colorado at Lee's Ferry, is in a deep canyon cut through the red sandstone of the Vermilion cliffs. There is only a very limited area of irrigable land near the mouth of this stream—possibly 100 acres—the company which owns the land at the Ferry has approximately 30 acres under cultivation, irrigated from Paria River. No storage possibilities were noted on this stream, though a limited power development is possible, providing there were a market for the energy. There had been a heavy flood in this stream previous to our arrival, which had nearly subsided to the normal stage. The stream was carrying approximately 15 sec. ft. of muddy water. The low stage flow is probably much smaller than this.

The Paria Plateau northwest of the Vermillion Cliffs is rough

and of no value except for grazing for sheep and goats. There is no water on this plateau, which in itself prohibits any development.

The old Utah road passes around the southern side of the Vermillion Cliffs, intersecting numerous side washes running south from the Cliffs to the Grand Canyon, the formation consisting of brown shale and red sandstone with bright colored clays exposed in the washes. There were several water seeps, doubtless of local origin, in the little canyons south of Lee's Ferry. A small spring at Jacob's Pools has been developed by a cattle company and the water piped down into the House Rock Valley for stock purposes. This water is free from mineral salts and otherwise of excellent quality. It seeps out from the red sandstone of the Vermillion Cliffs. These red sandstones of this area doubtless belong to the Shinarump group (carboniferous or lower triassic).

House Rock Valley is a series of white rolling plains and sand hills extending from the Grand Canyon to the Utah line. It obviously follows an extensive fault line, since the Kaibab plateau, consisting of a block of carboniferous limestone, confines it on the west and the Paria plateau of red sandstone on the east. Thus we found on the east side of the valley a series of red sand knolls and ridges and on the west, level rolling plains built up on the waste from the limestone plateau, mixing with sand carried over by the wind. The central part of the valley is the result of a blending of the two distinct types of rock waste. On account of the obviously shattered condition of the formations underlying the valley, together with the general porosity of this strata, chances for developing ground water are not very good, but dry farming can be carried on by utilizing the small springs or seeps from the upper sandstone strata for domestic and stock purposes. By this means this valley could possibly sustain a number of profitable ranches. There are no running streams in this valley, although the central wash evidently carries considerable flood water at times. The greater part of the rainfall, however, enters the loose soil cover and either sinks through the porous strata or is evaporated from the surface. The Kaibab plateau, varying in altitude from 7,000 to 9,000 feet, is covered by a heavy growth of timber, predominantly the different varieties of pine, with cedar and oak on the foot hills. There are no running streams on this plateau, but it is reported that there is water in most of the canyons near its southern end.

At various points the rain water collects in shallow sinks from small lakes that usually contain water. The Kaibab plateau breaks off to the northwest in a series of rolling foot hills covered with cedar and lower down with sage brush. The rolling valley, through which runs Kanab Creek, is covered by a heavy growth of sage brush, shad scale, and other semi-desert plants and the soil appears to be very fertile. There are several dry farms in this valley near Fredonia, where, in spite of the crude and unscientific methods used, field crops of corn, barley, sweet clover and other forage plants are grown. Kanab Creek is little more than a dry wash, though most of the year it carries a stream of two or three sec. ft. at Fredonia, which is all diverted for irrigation in the immediate vicinity. It is evident, however, that a number of floods come down each year which, if they could be stored, would irrigate several times the area now being cultivated. It is reported that there is at least one excellent reservoir site on this stream about 25 miles north of the Utah line. No feasible power possibilities were noted on this stream and no additional irrigational possibilities aside from that just mentioned. The stream is not of sufficient importance to justify the heavy expense of maintaining a gaging station on it and no favorable and accessible site for such a station was found. There are no other running streams of importance in the Strip. Several reservoir sites were examined where considerable flood water drained from the rolling plateau by large central washes could be stored each year, but in general they are too extensive and too shallow to warrant development.

There is a small stream, which is almost wholly in Utah but enters Arizona for a short distance, called Short Creek, where indications are good for shallow wells and limited pumping. Also, the creek water, amounting to one or two sec. ft., would permit extensive dry farming development of the adjacent lands. There are a number of homesteaders now located near the mouth of this creek. Short Creek is a permanent stream up in the Canyon and sinks into the sand before it enters the valley. There is a shallow reservoir about three miles below its mouth which receives the flood water and which might be greatly improved by dykes and a dam at its outlet. There are several small springs seeping out from the sandstone strata of the Vermilion Cliffs. Pipe Springs has a constant

flow of about forty gallons per minute and is the largest of these springs. This water is soft and otherwise of the highest quality.

CONCLUSION.

The surface water resources of this area are of very little importance for power or irrigation purposes and can be developed for very little more than municipal, domestic and stock uses. However, from a dry farming standpoint, the area studied is very promising and undoubtedly holds great possibilities. The most efficient means of settling these lands would seem to be the careful and complete development of all seeps and springs and piping them to central localities where small towns could be built and the adjacent lands farmed by dry farming methods for a radius of five or six miles. The entire area could thus be made to support easily from 5,000 to 10,000 people. There is no rainfall data for this area except the data obtained from one isolated station near the Utah line, which can hardly be taken as representative for the whole area. The altitude is about 5,000 feet and the vegetation and other features indicate a mean annual precipitation of at least fourteen inches. This is known to be ample for dry farming, especially since its distribution is very favorable and a crop each year would be practically assured.

Respectfully submitted,

C. C. JACOB,

District Engineer,
U. S. Geological Survey.

Phoenix, Arizona, Sept. 12, 1914.

CONSIDERING PART OF THE COUNTRY IN ARIZONA NORTH OF THE GRAND CANYON OF THE COLORADO RIVER.

The writer wishes that those interested in this account give appropriate weight to the fact that only twelve days were spent in a very large territory. Insufficient time and insufficient funds were granted this work, making it impossible to thoroughly investigate a territory heretofore considered inaccessible. With these facts in view, the writer will present an account of a trip covering ground traveled over in the so-called Arizona Strip. Recourse to the government maps will make this narrative much clearer.

During the month of July the writer, with two other men, A. M. McOmie, Assistant Agriculturist of Arizona, C. C. Jacob of the U. S. Geological Survey, spent twelve days making a trip from Flagstaff to Lee's Ferry and thence through part of the country in Arizona north of the Grand Canyon of the Colorado River into the Virgin River country of lower Utah. The expedition was planned and organized by A. M. McOmie, dry farm expert for Arizona. Of several objects in view, some may be enumerated.

- (1) Agricultural land, amount, value, condition, etc.
- (2) Mineral, timber, water, climate, etc.
- (3) To carry Farmers' Institute work to this distant part of the state.

(4) The important reason for the Assistant Entomologist's making the trip was to find how much danger there was of introducing the Utah alfalfa weevil into the state of Arizona by carrying it across the Arizona Strip, principally through Lee's Ferry as a point of entry.

The trip from Flagstaff to House Rock Valley was made in a Ford automobile. Some difficulty was experienced but none that could not be overcome. The rest of the trip was made either on foot, horseback or by wagon. With but little exception there is no land of agricultural interest between Flagstaff and House Rock Valley. The country is too broken, or if not, there is no water available for irrigation. Except in the forest, there seems to be not enough rainfall for dry farming. From Flagstaff north

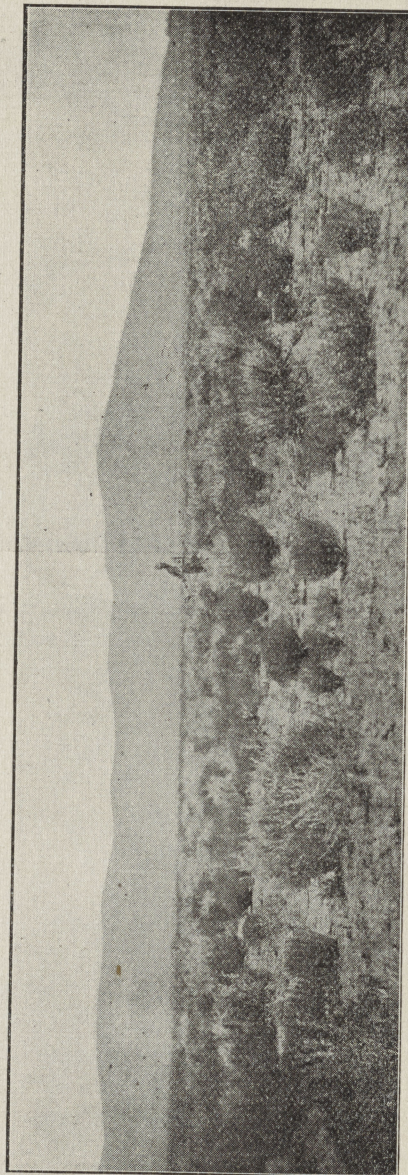
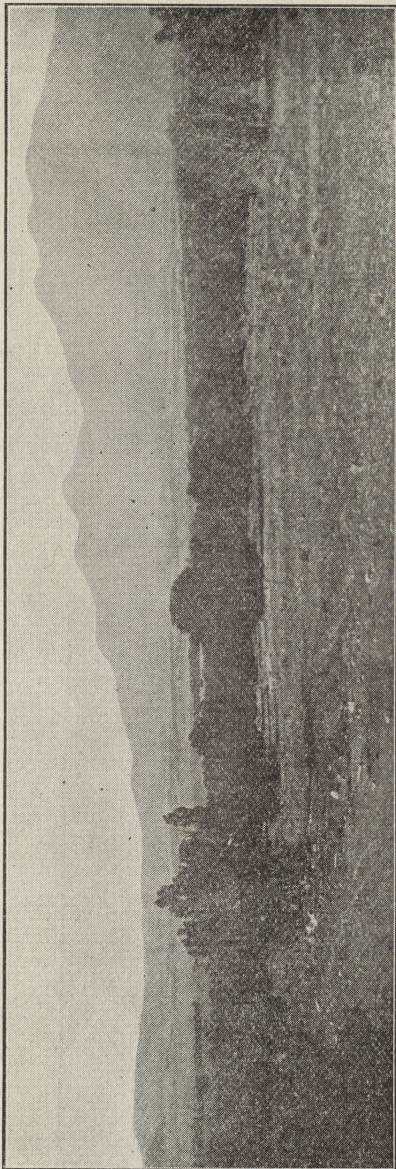


1. Moencopie Wash at Time of Flood.
2. A View of Moencopie Wash, Showing Adjacent Flood Ravages.

to the edge of the forest the land is excellent for dry farming and we know from records at Flagstaff that there is enough rainfall. From the edge of the forest the road rapidly descends through Dead Man's Flat to the Little Colorado River. Dead Man's Flat is good land. Rainfall a question. Crossing the Little Colorado by the government bridge, the road continues over the famous Painted Desert to Tuba City. Here the Indians have a large tract along the Moencopie Wash under cultivation. Some irrigation water is taken from the wash at high water. Corn, vegetables, beans and quite large fruit orchards are being grown. The interesting agricultural methods used by the Indian in desert regions can be studied at Tuba City. The road from Tuba City to Lee's Ferry follows close to the Echo Cliffs. Between the so-called Cedar Ridge and Navajo Springs on the Indian Reservation there is a strip of agricultural land, otherwise the country is too broken to be of agricultural value. At the point called the Cedar Ridge there is a grade very near straight up. Our Ford made it with difficulty. Through this section there is no available water except at two or three springs along the cliffs. A very little improvement would make the road from Flagstaff to Lee's Ferry nicely passable for automobiles.

At Lee's Ferry there are about thirty acres under cultivation, water being taken from the Paria River. There are grown six tons of alfalfa to the acre, five cuttings per year. Of greater interest to the writer was a thrifty orchard of apple, peach, plum, pear and some small fruits.

From Lee's Ferry the road runs southwest along the foot of the Vermillion Cliffs nearly parallel with the river, in and out of deep canyons, over broken mesa country of no agricultural value, to House Rock Valley. This valley extends about 35 miles north and south between the Buckskin Mountains on the west and the Vermillion Cliffs on the east into Utah. It is on an average about six miles wide. It has excellent winter range of white sage, black gramma grass and blue stem grass. At least three springs have been developed by the Grand Canyon Cattle Company and piped into the valley where the water is fenced in. The land is of good agricultural value, being decomposed limestone on the west side and decomposed sandstone on the east. The washes indicate that there might be a danger of a layer of the so-called caliche—a lime formation which if too near the surface destroys the agricultural value



3. Dead Man's Flat, North of San Francisco Peaks, Where Many Travelers have died in Search of Water.
4. View of Portion of Pipe Springs Valley, Showing General Topography and Vegetation.

of the land. It is the opinion of the writer that much of this land can be successfully cultivated. Use of a land auger would quickly prove or disapprove the above statement. The amount of rainfall is a question but the character of the flora indicates enough for dry farming.

At House Rock the road leaves the valley and climbs the Kaibab Plateau, running about twenty miles to Jacob's Lake. Here the Grand Canyon Cattle Company has summer headquarters. There is also a ranger station connected with Fredonia by telephone. Jacob's Lake is a shallow basin of perhaps two acres in extent where seepage water gathers. The water is good for stock purposes only. It is estimated that there are several billion feet of the finest timber in Arizona on the Kaibab Plateau. The plateau is also a fine summer range. Present indications are that there are valuable copper deposits near Jacob's Lake. One prospect was being worked. A small sawmill near Jacob's Lake supplies timber to Fredonia and Kanab. Trees growing on the plateau are mostly Arizona White and Yellow pine, some Douglas fir. A few Quaking asp were seen. There is an excellent summer range of the gramma grasses. The elevation is about 9,000 feet and heavy snow in winter causes cattle to seek range at lower levels.

Leaving Jacob's Lake westward, the road descends very fast and enters the white Sage Flat country, where there are a number of acres of valuable dry farming land. The flora here indicates the character of the soil. White sage grows on good land. Proof of the value of this land is to be seen at the ranch of Frank S. and Rex R. Brown. These men are dry farming here and are successfully growing potatoes, corn, beans, grain, etc. Turkey red wheat planted September, 1913, harvested July 3, yielded twenty bushels to the acre, rye 25 bushels, corn, 50 bushels of shelled corn to the acre. They get water for ordinary purposes and stock in a peculiar manner. Their houses have corrugated roofs drained to a cement tank in which rain-water is stored. They get enough water to supply two houses, water six horses and two cows in this manner. This indicates the rainfall. Information from the Browns indicated other land of like value northward and close to the plateau.

From here the road runs northwest to Fredonia, a small Mormon settlement on Kanab Creek and about seven miles from the town of Kanab, which is located just over the state line in Utah. The

land about these towns is very rich, loam in character and although there is irrigation water, the people are taking up dry farm land and succeeding in growing larger and better crops than with the water. About Fredonia there is some indication of alkali on the surface. It may be gypsum deposit. The people there have about 1000 acres irrigated. Amount of water for irrigation about one acre foot. There are about 200 acres in alfalfa and the rest in grain, corn, rye, wheat, oats, etc. Rye seems to be the favorite grain crop. There are a few small orchards, but the codling moth or wormy apple pest, is very bad. The town is a relief after the desert, for it has fine large shade trees of poplar, honey locust, catalpa, elm and balm of Gilead. Fruit grown is apple, pear, peach, plum, apricot, grape, etc. The rancher makes three cuttings of alfalfa. The population of the town is about 150. Littlefield has about 100, Lee's Ferry 10, Short Creek 50 and Moccasin 10. It was estimated that there were about 16,000 head of cattle grazing along Kanab Creek.

It is significant that at Kanab the ranchers are now taking up dry farm land in preference to that under irrigation. They use the town water supply for culinary purposes, etc., living in the town and going out to farm. This is possible under the Utah homestead law, for in that state a farmer may homestead without living on the said land. This makes the farming of a great deal more land possible. The present Arizona homestead law makes this impossible. Leaving Fredonia, the road turned southwestward into a cedar ridge territory. Here there is a very fine grazing tract covered with a fine growth of the best native grasses and some cedar. A large flock of about 5,000 Persian-Rambouillette sheep owned by Wooly and McCormick of Kanab was seen. These sheep appear superior to the Tunis. Meat from a young wether killed while the party was at the sheep camp was sampled and found of excellent quality. The Persian sheep is characterized by a large fat tail.

From this region the party turned northward, crossing the lower part of Antelope Valley to Pipe Springs where there is a large natural spring of excellent quality. It is fenced by a cattle company. Traveling westward the road went through Pipe Springs Valley and on through the Short Creek country to the Hurricane Ledges. Here, as far as the eye can reach, there stretches a wonderful tract of excellent agricultural land, the best north of the Canyon. It has a gentle slope, deep, decomposed sandstone soil

and evidently enough rainfall, as indicated by a gauge at Kanab which for three years registered an average of 15 inches annually. These valleys running from Pipe Springs by the Short Creek country to Hurricane Ledge and thence southward through Antelope Valley must contain close to three-fourths of a million of acres of fine agricultural land. There are several springs which, if accessible, towns could be built around and the land farmed from these as centers. At Short Creek about 50 families are operating farms. There are a few squatters in Pipe Springs Valley. The character of the crops is indicated by excellent corn, vegetables, etc., which were growing at Short Creek.

Following the Hurricane Ledge formation into the town of Hurricane, Utah, we attended a good-roads meeting, to which Arizona officials had been invited but none had taken the trouble to attend. Object of road meeting to complete a good automobile road to Grand Canyon from Salt Lake City. A short distance taken care of by the State of Arizona assured the whole road to a point opposite El Tovar, for other parts in Arizona had been completed by U. S. Indian and Forest Service.

(1) AGRICULTURAL LAND, AMOUNT, VALUE, CONDITION, ETC.

There is no land of agricultural value east of the House Rock Valley in the Arizona Strip except the few acres at Lee's Ferry. House Rock Valley contains about two hundred and ten square miles of land, part decomposed limestone and part decomposed sandstone. These kinds of soil are recognized as the finest of agricultural soils. This land can easily be put under cultivation.

Land on the Kaibab Plateau is of limestone origin, but for farming the elevation is too much and the soil is shallow. There is a fine summer range for cattle and sheep.

Along the western edge of the plateau lies a few hundred acres of extremely good dry farming land. Part of it lies in the White Sage Flats. Here, as has already been described, the Brown brothers are doing successful dry farming.

At Fredonia there are one thousand acres under irrigation and several hundred being farmed as indicated above. There are about the town a great many acres of good dry farm land.

The country through the Pipe Springs Valley on over the Short Creek section and thence southward through the great Antelope Valley is an extensive stretch of very valuable agricultural land. The soil is decomposed sandstone from the Vermillion Cliffs and very deep. In some places the washes showed forty feet of exposed soil. There must be well over one-half million acres of fine dry farm lands in this section. Crops seen growing at Short Creek prove its value.

South of the lower Antelope Valley lies a great tract of fine grazing land. Cattle and sheep seen upon it were in prime condition. Elevation ranges from four thousand to five thousand five hundred feet. The enterprising cattlemen in this country west of the Kaibab Plateau have established a fine method of improving the stock on the range of the Strip. They have agreed among themselves to round up all the mavericks on the range and sell them at public auction. The money thus acquired is used to buy the best bulls that can be obtained. These bulls are turned loose on the range. Thus every one gets the benefit of better blood. The result is easily seen, for the increased quality of the stock is very evident.

We were told that there was a very large tract of land of the same character as that in Pipe Springs Valley west of the Hurricane Ledge, down toward the Virgin River country. This land we did not see.

The land spoken of east of the Hurricane Ledges could be put under cultivation easily and at small cost.

In all, there must be north of the Canyon in Arizona good agricultural land to the extent of well over the three-quarter million mark, perhaps approaching one million acres.

(2) MINERAL, TIMBER, WATER, CLIMATE, ETC.

There are several copper prospects being worked. They were reported of good value. Other mineral prospects were told of.

The only timber the writer saw was that on the Kaibab Plateau. Its value and character have already been indicated. It was understood that the U. S. Forestry Service was offering several million feet of this fine timber for sale. Timber of fine quality was reported on the Dixie Reserve and the Unkaret Mountains.

The water proposition was to be covered by C. C. Jacob. It

is enough to say that the great source of water supply is from living springs of excellent quality, coming mostly from the Vermilion Cliffs. These springs are now mostly controlled by fences. There were two or three dam sites for impounding irrigation water being talked of in the section.

(3) FARMERS' INSTITUTE WORK.

The first farmers' institute ever held north of the Grand Canyon in Arizona was held at Fredonia, July 16, 1914, at 7:30 in the evening. There were present sixty-five interested farmers. The speakers were Dr. O. C. Bartlett, Assistant State Entomologist; topic, Fruit Growing and Insect Pests. Prof. A. M. McOmie—Dry Farming. C. C. Jacob—Water Resources. It was very noticeable that the people in this region appreciated very much the effort to get in touch with them. They wanted to become more intimately in touch with our state and county government. They are fine people, industrious farmers and stock breeders and not outlaws, as is indicated by prevalent stories abroad in this state.

(4) DANGER FROM THE ALFALFA WEEVIL.

As to the insect question, at the same elevations approximately the same climatic conditions exist north of the Colorado River as south of it. This is strongly intimated by the kinds of insects found in the Arizona Strip. Some classes of insects are fair indicators of the range of climate. It was noticeable that the same kinds of insect pests were found on the Arizona Strip that are found in other parts of the state at the same elevations—grasshoppers, locusts including a species much resembling the famous Rocky Mountain locust, plant lice, corn earworm, codling moth, et cetera.

The worst pest called to the writer's attention was a large plant bug which attacked the grain in the milk stage and sucked the grain heads dry. This the farmers called the "chinch-bug," a local name used because of the character of the damage done. It is not the chinch bug, but one of the large plant bugs which have done serious

damage to grain in other parts of our state as in the Sulphur Springs Valley.

The Utah alfalfa weevil question should be one of great interest to the people and officials of this great alfalfa producing state. Alfalfa is our staple crop and always will be. Its protection from an invasion of the above scourge is a question of immense importance to the continued prosperity of our state. As an expert on insect questions, the writer considers there is extreme danger that the alfalfa weevil will make its way into Arizona across the Arizona Strip, and considers Lee's Ferry the most dangerous point where it might gain access. With all the precaution now taken to prevent its spread to Lower Utah, it is steadily making its way south. It becomes the writer's duty to say that it would seem immediate steps should be taken to safeguard the above point. In talking with J. Edward Taylor, the Secretary of the Utah Horticultural Commission, at the Hurricane road-meeting, the writer gained the idea that the Utah official considered it impossible to prevent the invasion of the alfalfa weevil into Southern Utah because of the prevalence of immigrant movement. He considered this and other sources of like character the chief means by which the weevil becomes disseminated. There is too much movement of this character through Lee's Ferry into lower Arizona to be safe. It must be only a question of time before the alfalfa weevil gets to Salt River Valley. Every step should be taken to prevent its coming. It is the usual thing that a state acts too late. This state should be beforehand. A study of the conditions in Utah and modern methods used there to control the pest is recommended. A short time used by an expert would glean valuable information that has cost Utah thousands of dollars.

In conclusion it is easy to say there is a wonderful country in this part of our great state yet undeveloped. The expenditure of a small amount of money towards good roads, certain modifications of the present unfavorable laws in this state governing the homesteading of dry farm lands, the establishment of a rational water policy would do much toward opening to the public a fine region. The natural scenery is very attractive. Every step is very interesting to the traveler. The far-famed Painted Desert with its mysterious coloring, the historic Lee's Ferry with the picturesque Colorado Canyon, the Vermilion Cliffs talked of by the poet, the Kaibab Forest with its great trees and wild animals, and the immense

stretches of grazing land demand the attention of the most indifferent, while to one fond of nature it opens a prospect which cannot be duplicated anywhere in the world.

Respectfully submitted,

O. C. BARTLETT,
Assistant State Entomologist.

Farmers of Fredonia, Arizona.

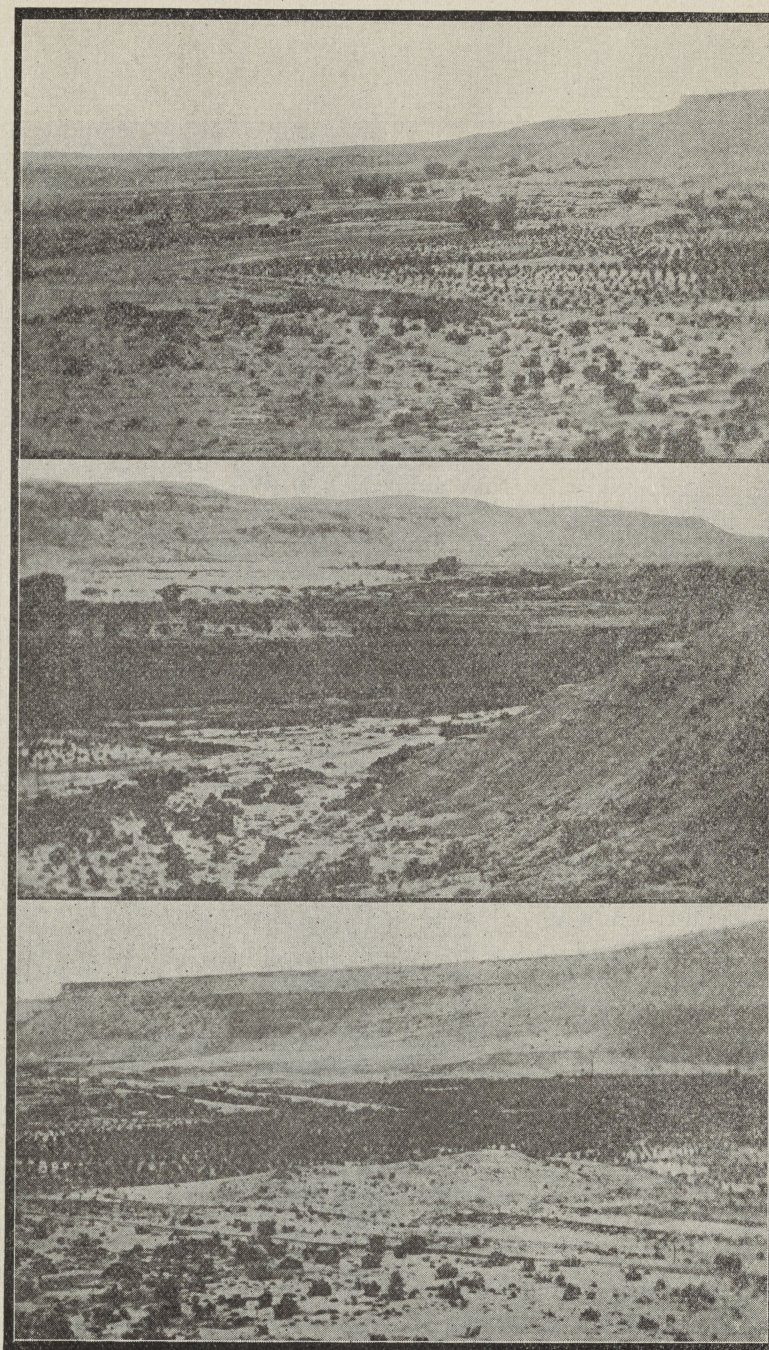
H. E. Judd, D. V. Lawson, B. K. Judd, Thos. Jensen, A. E. Lewis, J. R. Button, Thos. P. Jensen, L. Pratt, Sr., S. R. Dunham, Lorin Pratt, Jr., Orin Judd, Hyrum Judd, W. J. Brooksby, H. P. Cram, E. S. Brown, Rebecca Church, Nancy Judd, A. W. Brown, J. O. Lamb, W. M. Judd, J. H. Hortt, Lee Brown, A. W. Judd, Reese B. Griffith, Thos. Dobson, Jas. T. Owens, Walter Haycock, Ralph Button, R. A. Jackson, Earl Jackson, Nathanea Young, W. M. Brooksby, Jos. Brooksby, Alfred Brooksby, Ira Judd.

Farmers at Short Creek. Postoffice Moccasin.

W. S. Rust, O. F. Colvin, Iasic Carling, Frank, Johnson, Price Johnson, Lorin Covington, Henry Covington, Mrs. May Covington, J. H. Gallighan, J. W. Lavritzen, Knute Palmer, John Dennett, Dave Dennett, Dan Dennett, Mr. Cougill, Mr. Straton, Mr. Wormly, Mr. Marshall, Freborn Gifford, Oscar Stephens, Artimus Denuell.

Farmers at Moccasin.

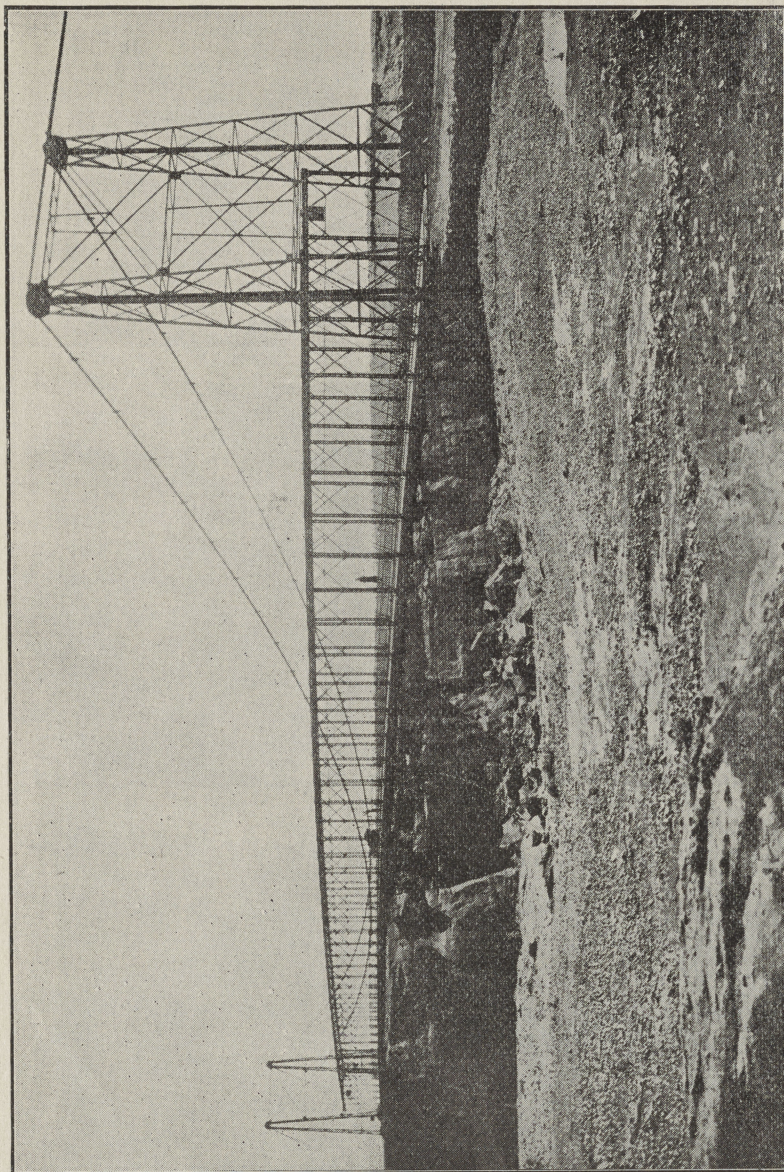
Jonathan Heaton, Chas. C. Heaton, Fred C. Heaton, Christopher Heaton, Edward Heaton, J. W. Maxwell, Supt. Schools, John Caswell.



5-6-7. Illustrations of Indian Farming near Tuba City, on Moencopie Wash.

RECONNOISSANCE OF THE COUNTRY NORTH OF THE GRAND CANYON, ARIZONA, KNOWN AS THE "ARIZONA STRIP."

By Prof. A. M. McOmie.



8. Suspension Bridge Constructed by U. S. Indian Service across Little Colorado River at Tuba City—This Structure is 800 ft. Long and Cost \$30,000.

The purpose of the reconnoissance of the "Arizona Strip" was to get at first hand information concerning the possibilities of this section of the state. Up to this time, no officials of any institutions or departments of the state had made even a cursory survey of that country. There is meager literature on certain aspects of the section, such as forester reports, reconnoissance maps, etc., but these present only partially the real worth of this area to Arizona. Vague rumors as to its character and possibilities and people have been abroad over the state for many years. Some of these depicted a marvelously rich country; others a barren waste, and many described the inhabitants as being outlaws of the most desperate character. Furthermore, the writer in compiling data on dry farming in Arizona, felt that this country might possess some possibilities for this class of farming which would be overlooked if a trip were not made into it.

Accordingly, the writer organized a party consisting of C. C. Jacob, District Engineer for Arizona of the United States Geological Survey, and Dr. O. C. Bartlett, Assistant State Entomologist of the Arizona Commission of Agriculture and Horticulture.

On the 10th day of July, we left Flagstaff in a Ford automobile and traveled in a northeasterly direction over the main thoroughfare to Tuba City, crossing the Little Colorado on the newly built suspension bridge. Thence, we took a northwesterly course, following a tributary of the Moencopie Wash, along the escarpment of a fault called Echo Cliffs, to Lee's Ferry on the Big Colorado River. The first day's travel was somewhat impaired by having encountered, by trying to make a short cut, Moencopie Wash in flood; and although Lee's Ferry was our objective point for the night, we were compelled to stop on account of darkness and a second swollen wash, about twenty-five miles out from the Ferry, on the Navajo Indian

Reservation. The road up to this point was passable, and with small expense could be made very pleasant going. A few bridges would be necessary, and at a point near Cottonwood Tank, going over Cedar Ridge, the grade would have to be very much reduced. Here we had to unload our luggage, and after a dozen attempts, were finally successful in getting on top. The grade at present must be twenty-five per cent.

The second day, we started early after a refreshing sleep on the grass-covered desert, and encountered serious difficulty in going down the dug-way into Lee's Ferry. Heavy storms had washed the road considerably, requiring much work to make it passable. The most serious setback was a large boulder, weighing a couple of tons, that had been dropped in the middle of the ten foot dug-way. It was necessary to blast this in order to get past.

This portion of the road is very picturesque, being cut in a reddish sandstone shale elevated above the river some fifteen hundred feet in many places, and below the top of the mesa some two thousand feet, with nearly perpendicular walls either up or down. The second night was spent at the ranch situated at Lee's Ferry.

Lee's Ferry crosses the river just above the junction of the Colorado proper, and a tributary, the Paria. The ranch is located below the junction of these two streams. A very excellent and most picturesque crossing suitable for auto travel, could be made out of the present site.

The third day we followed on a badly broken mesa, gradually flattening and widening from Lee's Ferry as we proceeded westward. This is formed from the disintegrated and erratically transported sandstone of the Vermillion Cliffs, which are the escarpment of a fault on the north side of the Grand Canyon. The Paria Plateau extends north and westward from Lee's Ferry, and according to information gathered from cattlemen, it is of little value except for grazing, and the scarcity of water even prevents extensive flocks subsisting there. This mesa road is very heavy in places, being inremittently covered with drifting sand, and having a fairly constant grade of considerable pitch. Naturally this wore severely on the machine, which was shown about twenty-eight miles out when the Wyott bearing gave way and compelled us to walk five miles to an old deserted stock ranch at Jacob's Pool. Here we found excellent water that had been piped down four miles from Jacob's

Pool to a winter headquarters ranch of the Grand Canyon Cattle Company. After a night at this place, we walked some fifteen miles to House Rock, where the fourth night was spent.

The next day, up until two o'clock, was occupied by walking from House Rock to Jacob's Lake, some sixteen miles, across the lower or northern end of the Kaibab plateau and forest. From here horses were provided by Mr. Mansfield of the Grand Canyon Cattle Company, on which we were carried to Fredonia.

Here we left the chauffeur, and arranged with Mr. Dunham of Fredonia to transport us over the Kanab Plateau, through Antelope Valley, over the Uinkaret Plateau to Mount Trumbull, over Hurricane Ledge to St. George, Utah. The trip as planned, was completed in the twelve days following.

SCENERY.

From the time we left the San Francisco peaks until we arrived at St. George, the trip was enlivened by endless scenic beauty. The weather was cool, and refreshing showers fell around us every day. A more wonderful road could not be planned than the course over which we traveled, fitted for auto travel in a north and south highway. The calm rolling desert, the rugged, awe-inspiring canyons, the wonderful forests, and with all the vastness of the country, adds variety that makes the entire trip a pleasure. Such a road could be built from all Arizona points to Salt Lake City, and the Yellowstone Park, with comparatively slight cost.

CLIMATE.

The country east from Hurricane Ledge to Lee's Ferry varies in elevation for the most part from forty-five hundred feet in the low valleys to nine thousand feet in the Buckskin Mountains. The highest temperature for June at Moccasin was 97 degrees; for July, 97 degrees, and for August, 102 degrees, with a mean for the month of June of 66.4 degrees, and a minimum of 39 degrees. The maximum for January was 56 degrees, the minimum 6 above zero, and the mean 35.4 degrees. This would indicate that the climate so far as temperature is concerned, is excellent. Moccasin is 4,500 feet elevation, and would not represent the conditions in the Kaibab For-

est farther east, nor along the Virgin in the extreme west, but it is characteristic of the main agricultural areas of the Strip. The precipitation for 1913 is 12.12 inches. Up to August 1, 1914, 11.31. At Short Creek, some thirty miles west from Moccasin, the 1913 records show 14.27 inches. It may be safely concluded, therefore, that the average annual precipitation over the agricultural areas would range from 12 to 15 inches.

On the high plateaus and in the mountains, the snowfall is heavy, which compels the stock to seek lower levels during the winter months. There is not a great difference, from available information, between the climate on the north and the south side of the Grand Canyon in Arizona at the same elevation.

GEOLOGY.

The geology of the locality between Flagstaff and the Colorado River has been covered by Mr. N. D. Darton, as well as others of the Geological Survey. The multi-colored clays and sandstones over a portion of the road between the Little Colorado and Tuba City, are devoid of vegetation and constitute the widely famed "Painted Desert." A similar formation, but smaller in extent, was observed on the Virgin River near Hurricane, Utah. The Vermillion Cliffs are composed of red sandstone, which doubtless belong to the Shinarump group (carboniferous or lower Triassic). These strike nearly at right angles the limestones of the Aubrey group, composing the Buckskin Mountains. These gray limestones of the Buckskin are of the carboniferous system, and form a sharp contrast to the Vermilion sandstones, which are characteristics of this section. Many washes running south from the Vermilion Cliffs to the Grand Canyon expose brown shale, red sandstone, and brightly colored clays. The escarpment of a fault extending from Lee's Ferry to St. George, forms the Vermilion Cliffs, which extend westward in a more or less receding, broken line from the Grand Canyon. The Uinkaret Mountains on the west are also carboniferous limestone, being like the Kaibab plateau, an intrusion of local origin.

SOILS, FLORA, ETC.

It was observed that the soils formed from the red sandstones were of greater depth and uniformity than those formed from the

limestone. East of the Buckskin Mountains, House Rock Valley possesses distinct limestone soils on the west and sandstone soils on its east slopes, with a mixture in the middle. This valley extends in a northerly direction between the Vermilion Cliffs and the Buckskins. It supports a fine growth of grass composed of the various gramas, and giletta seem to be the predominating species. There was also a slight growth of yellow sage on the knolls in the valley proper. Slight indications of alkali were observed at House Rock in a depression, but the valley, on the whole, is strikingly free from these salts. The depth of the soil will not recommend it highly for agricultural purposes. It is partly underlain with caliche about four feet below the surface. The surface soil is very fine sandy loam, easy of cultivation. There is a distinct slope from either side to the center. The valley is about twelve miles long by five miles wide, and is at present used almost exclusively as a winter range by the Grand Canyon Cattle Company, who have piped water from the Vermilion Cliffs to House Rock, a distance of some four miles. The water is of excellent quality, and is developed from seeps which occur at various intervals along the Vermilion Cliffs. This is the only agricultural valley of any promise east of the Kaibab Plateau.

Rising abruptly on the west of House Rock Valley, is the Kaibab Reserve. This plateau is fringed with cedar, juniper and pinyon trees of fair size, and also supports a good growth of gramas. The soil is generally very shallow, being underlain with gray limestone. As higher elevations are reached, the soil improves in character and depth, and the timber changes to yellow and white pine, with a little Douglas fir. We also observed some quaking asp, wild currants, sarvis berries, etc. The chief grasses are the gramas and some pine grass.

At Jacob's Lake, there is a forest ranger's station and summer headquarters of the Grand Canyon Cattle Company, and a few miles distant a sawmill. There is also some copper mining here of a superficial character. Considerable money, however, has been spent in following the indications in this section. Jacob's Lake has an area of about one acre, and is formed by a natural depression into which water is diverted from two directions. This water is good for stock, but not for human consumption.

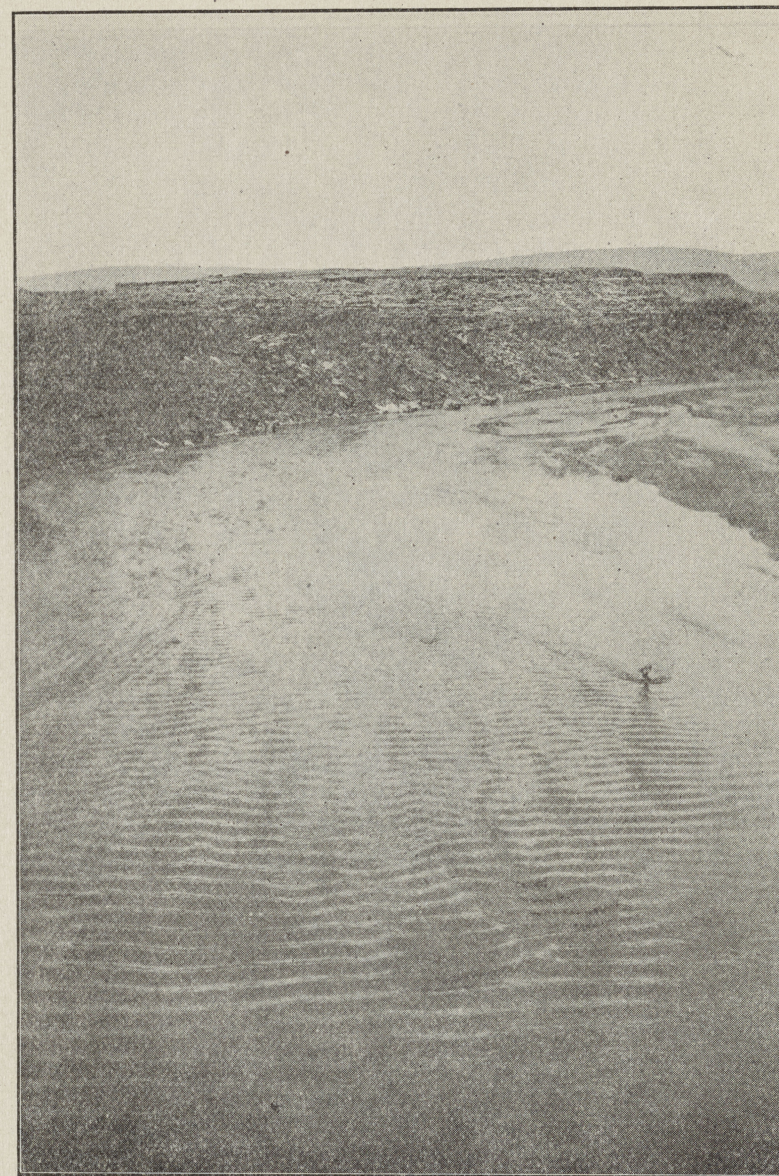
Coming west, the Kaibab Plateau is broken up, with numerous very picturesque canyons, which finally open into the drainage of

Kanab Creek. About midway between Jacob's Lake and Fredonia, we found white sage flat, a very small section of a few thousand acres of extremely desirable land. Here the Brown boys of Fredonia are successfully growing grain, corn, pumpkins, potatoes, beans, etc. This is their third trial, and they report good crops each year. One of the most interesting features here was the way in which they supplied themselves with water. They had a large shed with a roof 32x60 feet, covered with corrugated roofing. A pipe catches all the water that falls on this shed, and conducts it into a cement cistern 17x8½x9 feet. They state one inch of rain will put one foot of water into the tank. In this way they accumulate sufficient water to supply six horses, one cow and two families.

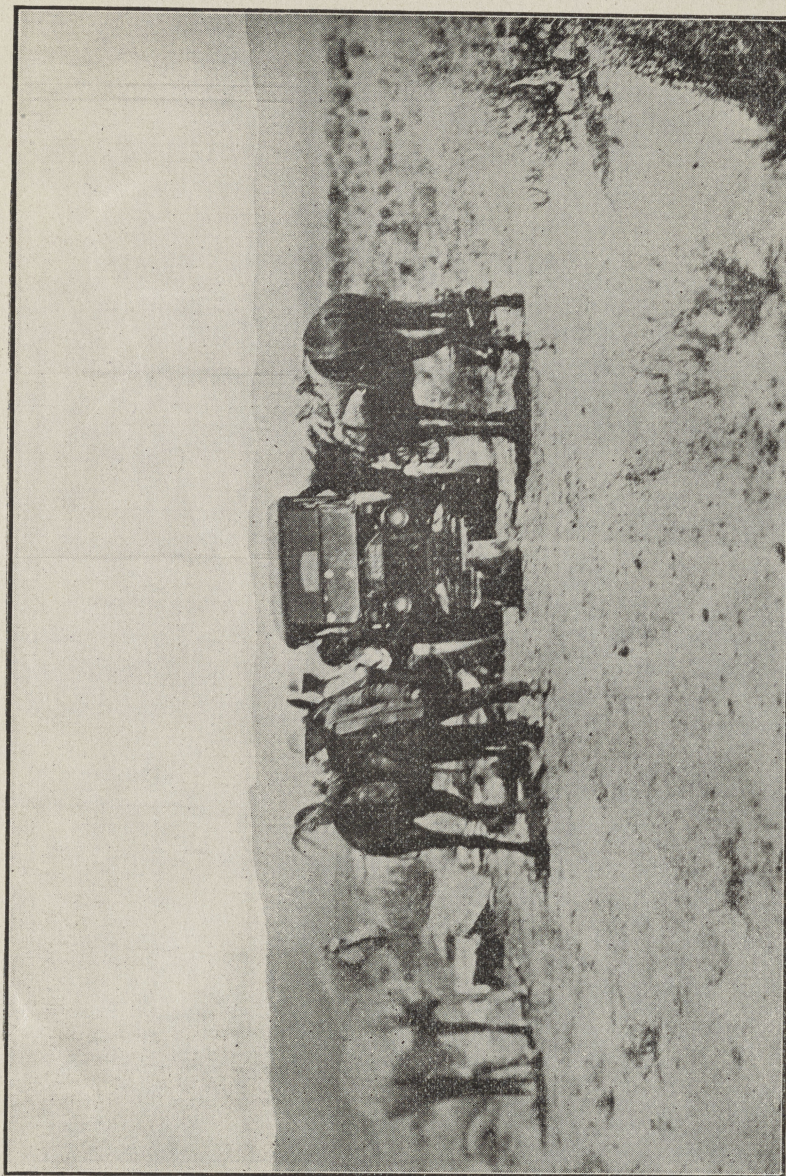
Mr. Frank S. Brown claims to be the original dry farmer of the Strip. He and his brother have 320 acres each, with some hundred acres under cultivation. Their records show Turkey red wheat planted September, 1913, and harvested July 3, 1914, with an estimated yield of twenty bushels per acre. The yield of shelled corn in 1913 averaged 32½ bushels, and six hundred pounds of pink beans. Mr. Brown began farming here February 19, 1911.

Proceeding in a northwesterly direction, we passed over a more or less broken country well covered with white sage and sage brush. Occasionally small patches of cedar would show, but here the character of the vegetation is not like any other section of Arizona, but resembles more distinctly, sections of the Great Basin area. The soil is of limestone origin, and occurs only in small patches suitable for dry farming, due altogether to the gravel and generally broken up condition of the soil mass.

Around Fredonia, which is located on Kanab Creek, we found a thousand acres of irrigated land. The soil here is of sandstone origin, but would be classed as a heavy loam type. Indications of alkali occur in some of the depressions and low lying flats in this vicinity. It is covered with a thick growth of shad scale and rabbit brush, with a few greasewoods in the depressions. There are one thousand acres of irrigated land, served with about one second foot of water. Two hundred acres are in alfalfa and the rest in corn, rye, wheat and potatoes. The water supply is intermittent, and here they have been practicing supplemental irrigation for thirty-five years. They report never having had crop failures. The town site covers one hundred acres, each lot having shade and fruit trees.



9. Little Colorado River after the subsidence of Flood—Sand Ripples in Foreground.



10. Cowboys Assisting Reconnoissance Party over Difficult Strip of Highway.

Of the former we observed poplar, black locust, honey locust, two species of ash, and elm. Of the latter, we observed pears, apples, peaches, plums, apricots, grapes, etc. They harvest three cuttings of alfalfa, about one and one-half tons per cutting. Mr. Jensen, in 1900, reports having grown 25 tons of alfalfa on three acres. The land having been measured, and the hay weighed and sold. Both white and yellow flowered sweet clover were observed growing with great vigor. The chief corn is white flint, which yields from 25 bushels upward.

They commenced dry farming around Fredonia four years ago, and there are now over five hundred acres of corn, rye and wheat in this section. Rye is the most popular crop, yielding from 15 to 20 bushels per acre. The country around Fredonia is occasionally flooded by the turbulent waters of Kanab Creek, one of the most important occurring in 1911. The substance of a narrative relating thereto, by Mr. A. W. Brown, is given below.

On August 31, 1911, a great flood occurred, which covered 100 acres from zero to six inches deep in five hours, depositing silt from zero to four inches in depth over the area. It carried great quantities of mud, which was forced mostly in front of the main water sheet, and formed great clayballs, one of which measured 28 feet long by 16 feet wide, and stuck out of the moving sheet of mud 8 feet. This was brought from 30 to 40 miles distant. Some lie now southwest of Fredonia and although breaking down rapidly, they are in a comparatively high state of preservation. These balls are of red, blue and yellow clay, usually round or oblong in shape and have no coarse material whatever in them. The manner in which they are formed, and the persistency exhibited in withstanding weathering is very striking and interesting. So far as known, no such phenomena have been observed elsewhere.

While at Fredonia, a visit was made to Kanab. Here we found a live agricultural community. Kanab is six miles from Fredonia, due north, being three miles north of the Utah line. Twenty-five thousand acres of land have been sold by the State of Utah since 1912, and have been cultivated by dry farming, chiefly into wheat, the average yield ranging from 15 to 25 bushels. The Utah Agricultural College has located an Experiment Station one and one-half miles north of the Arizona line, consisting of forty acres. This was located June 20, 1913, and had not grown any crops, but was being

broken and prepared for planting this fall. The man in charge at present is I. H. Chamberlain, Kanab, Utah. Growing season here is from April 25 to October 10. Farmers grow Turkey red wheat, barley, rye, corn, potatoes, alfalfa, etc. Milo was tried this year, and the field of Mr. Wooley examined was about three feet high. Last year it did not mature. It is stated there are still 25,000 acres that have been set aside as available under the Smoot Act in and around Kanab. The contrast between Arizona and Utah farming at this place was especially noticeable, as nothing but the boundary line separates the two sections. Yet the Utah side is flourishing with yellow fields and thrifty homes, while the Arizona side is still in sage brush. The soils in this vicinity are all made from the Vermilion Cliff sandstone.

East of Fredonia is Telegraph Valley, where are several thousand acres of excellent land which skirt the northern slopes of the Kaibab forest and reserve. These are covered with sage brush and white sage. The soil is of carboniferous limestone origin.

On the 19th of July, we left Fredonia for the western trip via St. George. Directly west of Fredonia is the Moccasin Indian Reservation, the soil over which is very desirable, having been derived from the red sandstone of the Vermilion Cliffs, and being for the most part deep and uniform in texture. The entire reservation is well grassed with grama and giletta, and carries a heavy growth of shad scale with some rabbit brush.

The Reservation is 18 miles long and 12 miles wide, and supports eighty Indians. Allotments have not been made to these as yet. Fourteen miles out is Bullrush Wash, made by President Taft a public watering place. The soil in this vicinity is underlain near the surface with a shale which makes it undesirable for farming. Going southwest, toward Mount Trumbull on the Sunshine road, the country is somewhat broken, and nearly all underlain near the surface with the red sandstone shale. Occasionally, small valleys varying in size from one-half to one mile wide, and one to four miles long, occur with sufficient soil depth to warrant farming.

All of the section is excellent grazing land, being heavily grassed with giletta, six weeks, grama, as well as some buffalo grass. As higher elevations are reached going toward Mount Trumbull, the rise being very gradual, other species come in, such as white greasewoods, occasionally white cedar, yellow sage, etc. The soil condi-

tions are not suitable for farming, but the range conditions improve as the elevation is increased. Twenty-six miles out, we stopped for the night at the Wooley-McCormich sheep camp.

We were near Mount Trumbull, and found the soil of limestone origin, but badly broken up and unfit for agricultural purposes. Range conditions, however, were exceedingly favorable. They were running some 5,000 head of grade Persian-Rambouillette sheep in one band. The elevation here is about 5,500 feet. The thrifty condition of the sheep would indicate that they were well adapted to their environment.

We continued in a southeast direction toward Mount Trumbull, and passed over a country which is much broken by intruding ridges from the Uinkaret Mountains, one of the most conspicuous of which is known as Cedar Ridge. We found gramas and giletta grass knee high, with an abundance of sage browse. The cattle were all very fat. It is evident the precipitation is greater here, as all vegetation looked more luxuriant. West and north of the Cedar Ridge is a conspicuous range of hills, with a receding limestone plateau extending and sloping mainly to the north, which finally opens into a very superior valley with soil exposed in washes six to ten feet deep, and of uniform texture. This soil is probably of carboniferous limestone origin, and is very fertile. A hole dug on the west slopes revealed a slight sub-surface crust at about 12 inches. It was not impervious to water nor plant roots. This is only one of many similar small valleys in this section.

Water here for culinary and stock purposes would have to be impounded in tanks and cisterns. The multitudinous small canyons and draws, however, furnish excellent facilities for such storage.

Pipe Springs Valley represents the best type of soil and general conditions for dry farming that we found anywhere on the strip (Soil sample sent in for complete analysis).

This valley extends in a general north and south direction, and has a uniform slope from each side towards the center, where water is carried in considerable amount into Kanab Creek drainage. The soil exposed in many places is as much as forty feet, and is of the same character to this depth. It is the decomposed red sandstone of the Vermilion Cliffs, and supports a luxuriant growth of grama grass and browse of white sage on the more elevated slopes, and greasewood in the lowest flats. With little or no interruption, Pipe

Springs Valley opens into the Short Creek country, which extends southwestward and joins Antelope Valley. The soils over these last two are identical with that of Pipe Springs, and support the same class of flora.

Hurricane Valley also offers an excellent opportunity for dry farming as far as the soil is concerned, it being of a heavy sandy loam type, easy to work and to conserve moisture. West from Hurricane, the country drops into the Virgin River watershed, and becomes precarious for dry farming, although excellent range is furnished over most of this district.

The soils of the Strip in general examined seem to have been derived either from the Vermilion Cliff sandstone, or from the gray carboniferous limestones. Wherever the mechanical composition is favorable, it supports a thrifty growth of grass and browse, and no doubt would support a profitable growth of agricultural crops. There is no strong evidence of the soil shifting to any serious degree. Certain small patches, however, showed sand dunes. Of the area in the Pipe Springs, Antelope, Short Creek and Hurricane Valleys, there are fully one million acres with excellent soil for agricultural purposes.

WATER.

The occurrence of living water over the area is confined to a series of seeps or springs, which show themselves at Jacob's Pool, Two Mile Spring, Pipe Springs, Short Creek, Antelope Springs, Bullrush Wash, Kane Beds, and one or two in Hurricane Valley. There are a few seeps on the Kaibab Forest, but the indications for water there are generally rather adverse. This is shown by the water that forms Bright Angel Creek as it comes out some two thousand feet below the rim, which would indicate that the main subterranean water supply is carried to that depth before finding an impervious stratum. Two or three of the stockmen with large holdings in this section have attempted at various times to corral various springs for their own operations. The country not having been surveyed, however, has with two or three exceptions left them public. President Taft also made public watering holes of Bullrush, Antelope, Kane Beds and other springs in the Hurricane Valley, which has prevented for all time the monopoly of any one individual over these

waters. Sufficient water could be developed at the different points indicated along the Vermilion Cliffs, such as Pipe Springs, Short Creek, Two Mile Spring, etc., to supply cities of five to ten thousand inhabitants at each place. These would be the nucleus for agricultural development for a radius of some ten miles from each town. The quality of the living water coming from the Vermilion Cliffs is very good, while that at Bullrush is brackish, and suitable only for stock.

Storage possibilities occur in a small way from various canyons and draws, coming from the Buckskins on the east, and Uinkaret on the west. These are very small, however, and would be developed by individual or a small group of individual farmers. The storage possibilities on Kanab Creek, into which the waters of Duck Lake, Utah, could be diverted, are sufficient to irrigate some twelve or fifteen thousand acres of land in Arizona. The dam site is in Utah, and most of the water rises in Utah. If suitable arrangements could be made between the two states, the area of irrigated land around Kanab could be brought up to 2,500 acres, and that around Fredonia to 10,000 acres. Short Creek also offers possibilities in the way of a submerged dam and a storage dam for an acreage of perhaps 5,000. Numerous smaller projects were examined, but are of little or no significance.

The subterranean water, as it occurs around Kanab and Fredonia, is slightly brackish and not used extensively by the people in these towns. It is suitable for stock water, and occurs as near as 20 feet from the surface. There are a few or no wells outside of the Fredonia section from which data could be gathered.

There is a great possibility for an economic use of flood water in this district, which, judging from the numerous washes and draws, is considerable. We were stopped by a heavy storm between Pipe Springs and Short Creek, which had swollen a wash that we estimated discharged 1,000 acre feet of water in about one hour. The flood waters are all heavily laden with sediment.

TIMBER.

The timber over the Strip is found in the Kaibab National Forest, the Dixie Reserve, and the Uinkaret Mountains. That of the first mentioned area is the best forest in the state. The government

foresters have put up for sale, three billion feet from this reserve, with a hope of fostering a railroad through this section. The timber is generally yellow and white pine, with some Douglas fir on the Kaibab Reserve. There is also a small amount of timber not included in the reserves between the Arizona-Nevada line. There is a sawmill operated here by John Pulsiafer of St. George. The timber is scattering and not very large. One sawmill is at present operating near Jacob's Lake on the Kaibab Reserve. There is also one operating in the Dixie Forest.

MINERAL.

The chief mineral observed is copper. There is a mine at Ryan called Coconino, on which \$500,000 has been expended in development work. They put up a small smelter and lesher at this place. The mine at Jacob's Lake is called the Potaska, at which they have also a small lesher. Here the indications are good, but the amount of work done is not extensive as yet. Around Moccasin, Mr. Jonathan Heaton reports immense deposits of low grade copper. Samples showed amounts from one and one-half to three per cent.

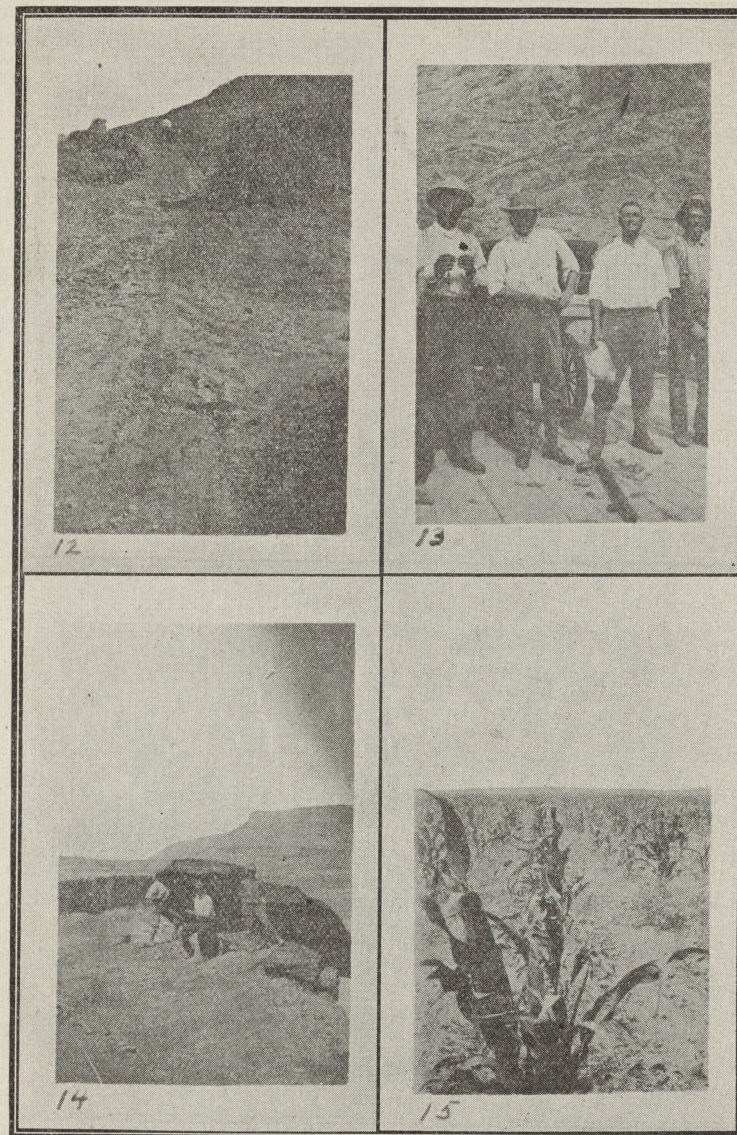
POWER.

One of the best opportunities for development of power is on Bright Angel Creek. Although more or less isolated, the creek flows some 12 or 15 second feet of water, and has a drop of 2,000 feet, in a distance of about three miles. There would also be about 1,000 horsepower developed along with the irrigation project mentioned above, on Kanab Creek.

INHABITANTS, INDUSTRIES, ETC.

We found some eighty Indians located at Moccasin, who occupy themselves with farming in a small way and raising stock. They have an Indian school at this point, at present in charge of J. W. Maxwell. They belong to the Piute tribe.

The white people of the Strip are found at Fredonia, Littlefield, Lee's Ferry, Short Creek, Moccasin, and on the various cattle ranches. The population of Fredonia is estimated at 150, Littlefield 100, Lee's Ferry 10, Short Creek 50, Moccasin 10, cattle ranches 25.



12. Approach to Lee's Ferry.
13. An Auto Crossing Lee's Ferry Set a Precedent.
14. On Dugway near Lee's Ferry.
15. Growing Corn on Arizona Strip.

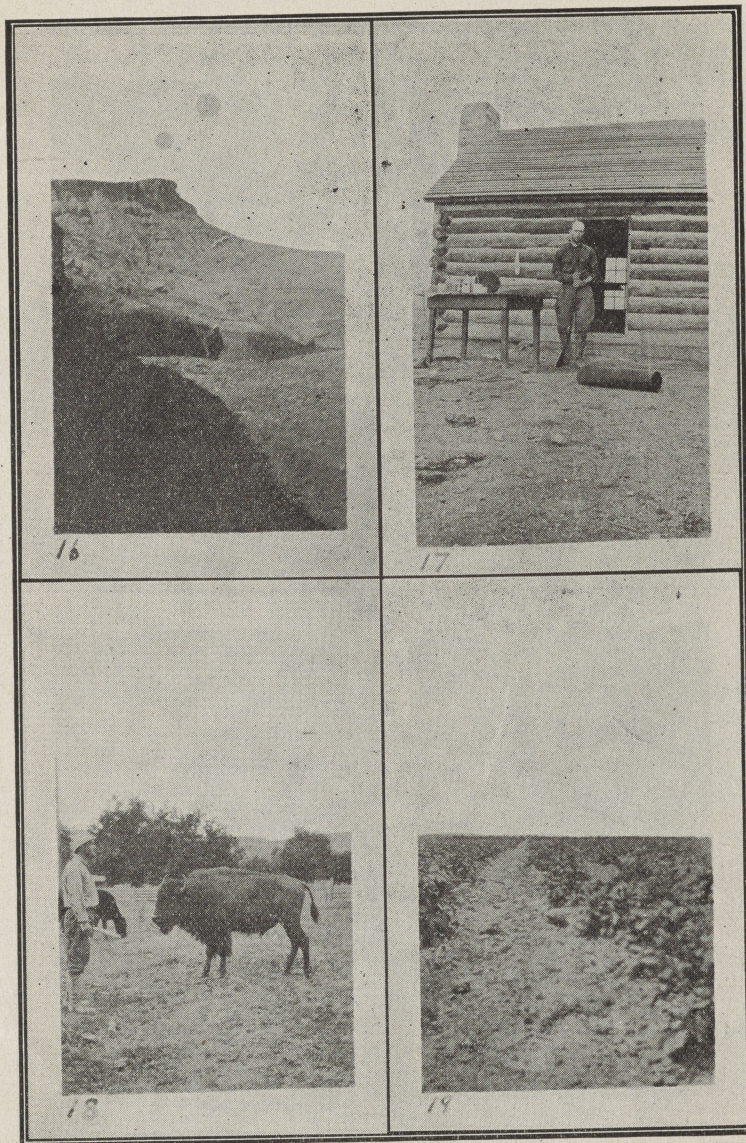
The principal occupation of the white people is stock raising. Practically all possess cattle and sheep and some supplement live stock with farming.

The general standard of the people in Fredonia was shown in a Farmers' Institute which we held on July 16. There were 65 present, and they were apparently very much alive to their agricultural and social problems. The program consisted of a lecture on dry farming by A. M. McOmie, Insect Pests by O. C. Bartlett, and Water Resources by C. C. Jacob.

Some of the best cattle breeders of this section are Jonathan Heaton of the Grand Canyon Cattle Company, Alex Finley, and Mr. D. Wooley of Kanab, Utah, and "Buffalo" Jones.

"Buffalo" Jones, or Colonel Jones, associated with Mr. Wooley, have at present four buffalo bulls and 48 hybrids. The hybrids have the following breeding:

One bull, one-sixteenth buffalo. Two cows, one-fourth buffalo (these looked like cows, except a little heavier in the shoulders). The rest are less than half cow, but all looked like buffalo; 23 head of these are on the range around Jacob's Pool, and the rest were shipped to Las Vegas, New Mexico, last spring. The Grand Canyon Cattle Company get seven grade calves this year. They have only two pure bred bulls. Mr. Owens is also interested in buffalo. They are chiefly valuable for their pelt, which is reputed to bring as much as two and three hundred dollars from a full grown animal. They say the meat is very similar to first class beef, but no better. These animals cross with difficulty on the common cow, the great trouble being that the shoulders of the calf are so heavy that many cows are killed in giving birth to the calf. It is also necessary in order to get a buffalo male to serve a cow, to bring the buffalo from a calf in constant contact with domesticated cows. The buffalo on the range do not mix much with the other cattle, and seem to select their own range very distinctly. One breeder states that he took a young buffalo calf from its mother from the range, and the whole herd, consisting of ten head, immediately left that portion of the range. It seems also that they are not very prolific breeders. Mr. Jones and others making a study of their habits and wants, state that this section of the country where the buffalo can have the high plateaus for the summer and the lower mild valleys for the winter,



16. Arrival at Damsite near Fredonia.
 17. Cabin Belonging to Grand Canyon Cattle Company.
 18. Looking over Buffalo in Pasture at Kanab.
 19. Potatoes Grown by Dry Farm near Fredonia.

thrive better than in any other portion of the United States, especially better than those being tried on open range in Wyoming.

Other live stock of interest are the Persian sheep, owned by the Wooley-McCormick Persian Sheep Company of Kanab. They are a desert sheep, kept on this range the entire year, and are characterized by fat tails or rumps, which in many cases weight from 30 to 40 pounds. This is very much reduced, however, by first one cross on the Rambouillette, or other similar breeds of sheep. The tail coming out from the fat rump, is small and short, and curls up like that of a goat. The wool is long and of fairly good quality (samples taken). We sampled the meat also of a young wether, and found it to be of first grade quality.

As near as I could ascertain, the Strip supports 50,000 head of cattle and 200,000 head of sheep most of the year. These flocks are owned by Utah growers as far north as Parowan. The old system of providing water tanks by building small dams across washes, and of running the cattle on the high plateaus in the summer and the lower valleys in the winter, prevails in this section. The cattle consist of grade Shorthorns and Herefords. The sheep are principally grade Rambouillette.

We found a thriving school at Fredonia. There is also one at Littlefield. They have no school at Lee's Ferry, Moccasin nor Short Creek, although in the last named place, they stated they would have one this year. The people of Short Creek are mostly squatters located along the line, and share the accommodations furnished the people directly across the line in Utah, at Short Creek and Big plains.

AGRICULTURAL DEVELOPMENT.

Agricultural development at present consists of about 30 acres of irrigated land at Lee's Ferry, cropped to fruit and alfalfa. One thousand acres of irrigated land at Fredonia, and about 600 acres at Littlefield. The dry farming development consists of 500 acres at Fredonia, 200 acres at White Sage Flat, and about 2,000 acres at Short Creek, with five or six squatters in Hurricane Valley. The country generally is suited to the production of grains, corn, sorghum, potatoes, alfalfa, and all classes of deciduous fruits. The prices of some of the more staple products at Fredonia are as follows:

Alfalfa—\$25 per ton.

Corn—3 cents per pound.

Rye—3 cents per pound.

Wheat—3 cents per pound.

Potatoes—2 cents per pound.

The agricultural possibilities here are very promising for combined stock raising and farming operations. There are at least a million acres of excellent dry farming lands with many more acres of excellent adjacent grazing lands. The irrigated area may be increased several times by the construction of storage dams; by the state taking some of the land, and by putting the rest under the non-residence clause of the Smoot Act, the people may settle around the living water mentioned above in communities, and build permanent homes. The water conditions, however, will make it imperative for some such arrangement as indicated, if the country is fully developed. The future prospects for the Strip under these conditions are very bright, and the resources are ample to support a population of 20,000 people, which is ample to form a thriving county.

The construction of a good road from the Arizona line through the heart of the Strip to the head of Bright Angel Canyon, opposite El Tovar, would be a great step towards bringing this section before the public. The canyon from the north side is quite as attractive as it is from the south side, and thousands of tourists would be induced to make this trip from the north, who are now compelled to forego it on account of its inaccessibility.

It was the fortune of our party to attend a good roads meeting at Hurricane, Utah, in which such a road was discussed. The Utah people now have a good automobile road from Salt Lake City to Hurricane, and propose to build it from Hurricane to the Arizona line. The Salt Lake Chamber of Commerce is spending its energies to inducing tourists to see the Grand Canyon from that side, and the officials of Arizona should not be found wanting in keeping up their end of the road development work.

(Signed) A. M. McOMIE.