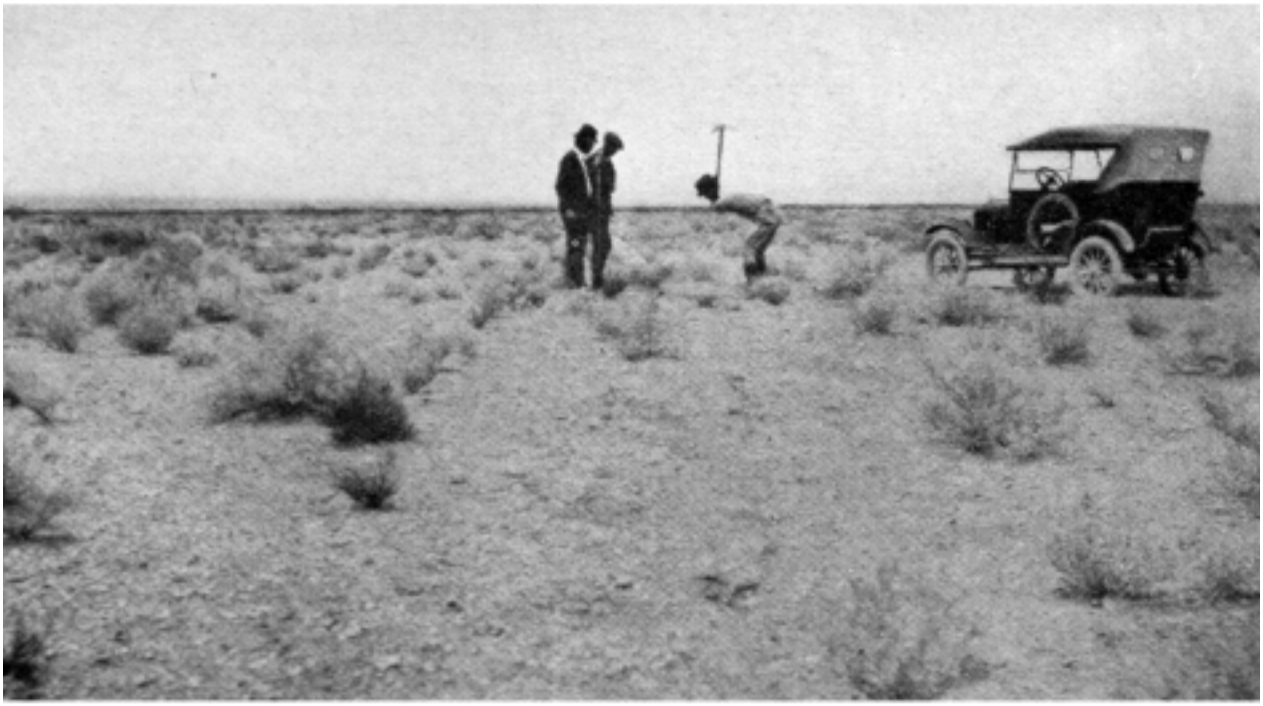
A History of Soil Survey in Nevada

United States Department of Agriculture

Natural Resources Conservation Service

Reno, Nevada



— from a Report of Bureau of Soils, U.S. Department of Agriculture, 1923

A History of Soil Survey in Nevada

A Compilation of Short Stories Commemorating the 100th Anniversary of the Soil Survey Program

Compiled by
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Publication available on the Internet
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Preface

Welcome to the first edition of *A History of Soil Survey in Nevada*. In developing this *History*, we have tried to capture a picture of what it was—and is—like to work hard and love it, to get your hands dirty and your back sweaty analyzing soils in the most remote areas of this great state, and to describe those soils and their respective vegetative communities, so that current and future generations can benefit from this knowledge.

We have attempted to recognize all of the people who have contributed to the soil survey program in Nevada since it began in 1909. However, historical records are scarce or nonexistent, so we relied on the memories of those contacted. We know that many people were missed, and there are many more stories that could be shared. If you have worked on the soil survey in Nevada, if you know of someone we've missed, you find an error, or if you'd like to contribute to this *History*, please let us know so that we can maintain a current, historical record of the efforts and accomplishments of so many hardworking individuals over the past 100 years.

We have divided this document into 5 eras. We began with the first soil survey of the Fallon Area published in 1909, when the first work was done with a plane table and a compass. Work during the second era, 1938 to 1950, started with the plane table, then evolved with the initial use of aerial photos. These surveys were recognized as Physical Surveys and Surveys for Better Land Use.

The third era, 1950 to 1970, had better photography and more effort was focused on interpretations. Mapping was initiated with connotative symbols and reflected the development of soil taxonomy. These surveys were mostly in key agricultural areas and intended for agronomic uses. However, we made our first efforts to meet urban needs with the Soil Survey for the Las Vegas and Eldorado Valleys Area.

The fourth era, 1970 to 1978, was a brief transitional period of time, which saw the completion of the soil surveys of key agricultural areas and those intended for urban uses. During this brief era a new relationship was forged between the U.S. Department of Interior's Bureau of Land Management and the Soil Conservation Service. This relationship paved the way for the rapid acceleration of the soil survey program in the fifth era.

The fifth era, 1978 to 2000, saw the rapid acceleration of the soil survey with major input of both time and money by the U.S. Department of Interior's Bureau of Land Management. During this period, we needed to cover large amounts of country in a short period of time but still provide the quality of range interpretations needed to protect the resources. The

information was being used as fast as it was generated and, using the feedback received, Order 3 surveys, with soil/site/landscape relationships, developed.

Presently, we are working to make the data more user-friendly and accessible. We are doing this by Major Land Resource Area (MLRA) so that the information provides continuous coverage that is uniform for the entire area. We are making a major effort to get our data into the National Soils Information System and to make all of the data available to our customers in digital form.

Because no documents on soil surveys have been found prior to 1909 or from 1923 to 1938, the early eras of soil survey discussed in this *History* are estimates. The dates and the range of time exist as a result of actual dates on soil survey publications. Some surveys and efforts, including the Reconnaissance Soil Survey, do not fit exactly into the eras identified in this *History* and were included where we felt most appropriate. Also, certain individuals assisted with mapping portions of a progressive soil survey many years before the survey was completed. As a result, these surveys overlap the eras identified in this document. A complete list of soil surveys produced in Nevada and their date of publication is included in the appendix.

If you wish to contribute to this *History*, please contact Paul W. Blackburn, USDA Natural Resources Conservation Service, Elko Field Office, 2002 Idaho St., Elko, NV 89801; phone (775) 738-8431, Ext. 18; or send an e-mail message to Paul.Blackburn@nv.usda.gov.

William E. Dollarhide
MLRA Leader/State Soil Scientist

Paul W. Blackburn
Resource Soil Scientist

Dedication

We dedicate the first edition of *A History of Soil Survey in Nevada* to Edmund (Ed) A. Naphan, former state soil scientist. Ed mapped soils in Nevada in the 1940's and served as state soil scientist for the U.S. Department of Agriculture, Soil Conservation Service, in Nevada from 1950 to 1984. He provided active direction during more than one third of the soil survey history in the state. As we look at the soil surveys around the state, at the soil survey areas to see the contributions of the project leader, and within us all, we can still see Ed's mark and feel his presence.

To list the contributions Ed made to soil survey work would be a history book by itself. His involvement and guidance in the development of soil taxonomy, to assure the soils in Nevada could be grouped to meet the interpretative needs of the state, has had monumental significance. Ed was instrumental in defining the different orders of survey to meet the different intensities of management needs. He recognized the need to place all components on the landscape at the higher orders of survey. He encouraged Dr. Fred Peterson to write *Landforms of the Basin and Range Province Defined for Soil Survey*, which served as a backbone during the accelerated soil survey in Nevada. Ed's foresight to have two of Nevada's soil surveys included in a digitizing pilot in the 70's, and to start compiling on orthophotography, has put Nevada in a position to have all of the published, and soon to be published, soil surveys digitized, Soil Survey Geographical Database (SSURGO) Certified, and available to the public by 2001.

With his vast technical knowledge of the soils in the state, and after running the program for more than 30 years, it would have been easy to follow a pattern or get in a rut. I assure you, this was not the case with Ed. The day he retired, he was still suggesting new things to try. When computer-assisted writing (CAW) was being developed, we quickly started using it. However, after the first few drafts of manuscripts came in, Ed suggested we stop using CAW. When I asked why, his explanation was simple, "It allows soil scientists not to think, and we can't have soil scientists doing anything without thinking."

Ed always empowered soil scientists to do their job and somewhat insisted they accept this empowerment. As a result, we were all willing to take risks. Whether our decision was right or wrong, Ed would be behind us and support us. Ed liked to push all people to their potential or limit, and he

dearly loved to tease. When he was teasing, there was no difference in his voice tone or his eyes. Only when you saw his left hand go up to scratch his head and a smile, ever so slight, cross his face, did you know you had been had.

Ed, when we are digging a pit in the shadscale overlooking the playa and the temperature is in the 100's, or walking down a ridge line with the north wind pelting snow on our ears, we can all hear you say, "That's just the way I like it."

And, as we proudly look over the first 100 years of the soil survey program in Nevada, we say, "Thank you, Ed."

William E. Dollarhide
MLRA Leader/State Soil Scientist

Acknowledgments

In this document, we have attempted to capture the history of soil survey efforts and accomplishments in Nevada during the past 100 years, to identify the projects and the people who worked on them. We want to acknowledge the assistance and support of others who have contributed to this success. The regional correlators from Berkeley, Calif., the Soils Section at the West National Technical Service Center, the National Cartographic Center, the National Soil Survey Center, the Director of Soil Survey, and all of their staff members, have had a profound effect on the program, providing technical guidance and support. We acknowledge and appreciate the managerial support we have received from state conservationists, state directors, district managers, and other line officers who have supported the soil survey program in Nevada, as well as the administrative support we have received.

We want to acknowledge every soil scientist who turned over a sharpshooter of soil, range scientist who identified a plant or plant community, engineer who assisted with an interpretation, and all the users who provided feedback so we could create a better product. Lastly, I would like to acknowledge the effort made by Paul Blackburn who chaired this project, by Rose Santos for getting this on the web, and by Liz Warner for a fine job of editing.

William E. Dollarhide
MLRA Leader/State Soil Scientist

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The First Era, 1909 to 1923

Letter of Transmittal [1/]

U. S. Department of Agriculture
Bureau of Soils
Washington, D. C.

February 9, 1911

SIR: An important project of this Bureau carried to completion during the field season of 1909 was the survey, on a scale of 2 inches to the mile, of the first unit (Fallon Area) of the Truckee-Carson irrigation district in Nevada. This work was undertaken at the request of the U. S. Reclamation Service, which cooperated with the Bureau to the extent of supplying an accurate and detailed base map.

The results of this work should be of great service to settlers in this part of Nevada, which is as yet practically undeveloped agriculturally, and I have the honor to recommend that this be published as advance sheets of the Field Operations of the Bureau of Soils for 1909, as authorized by law.

Very respectively,

Milton Whitney
Chief of Bureau

Hon. James Wilson
Secretary of Agriculture

[1/] Soil Survey of the Fallon Area, Nevada: United States Department of Agriculture, Bureau of Soils, Washington Government Printing Office, 1911

Soil survey in Nevada had begun! (Report of Bureau of Soils. U. S. Department of Agriculture, 1923)

Individuals Involved in the Nevada Soil Survey Program from 1909 to 1923

Bureau of Soils

Carpenter, E. J.
Soil Survey of Las Vegas Area, Nevada
Soil Survey of Moapa Valley Area, Nevada

Strahorn, A. T.
Soil Survey of the Fallon Area, Nevada

Van Duyne, Cornelius
Soil Survey of the Fallon Area, Nevada

Youngs, F. O.
Soil Survey of Las Vegas Area, Nevada
Soil Survey of Moapa Valley Area, Nevada

The Second Era, 1938 to 1950

> *If there were some standardized, simple remedy for the ills of the land that could be applied indiscriminately, the job of soil conservation would be comparatively easy. But there is about as much variety in soil, in erosion, and in the performance of water and wind and plants, as in the landscape of the country.* — H. H. Bennett [2/]

In 1938, many of the conservation districts in Nevada were organized at the request of local ranchers and farmers. Supervisors of these conservation districts requested that the Soil Conservation Service (SCS), now the Natural Resources Conservation Service (NRCS), make a physical survey because they recognized the need to procure soil, vegetative, and land use capability data that would be applicable to district planning and detailed farm planning.[3/] Ten of these physical surveys were completed in Nevada by 1940, most of which were in the western and southern parts of the state. Aerial photography was available for some of these surveys.

In 1940, the regional office of the SCS was located in Berkeley, Calif. Stan Cosby was the regional soil scientist and Henry Fox was Nevada's state soil scientist. Ed Naphan, who would become state soil scientist for Nevada in 1950, left a position with the SCS in California prior to joining the service in World War II. George Borst filled the position vacated by Ed. George would have lost his position if Ed had decided to return to California after World War II. Ed decided instead to take a position as a soil scientist in Elko, Nevada, in 1946.

In 1948, Lou Langan began work for SCS in Nevada as a student-trainee at the state office in Reno. Henry Fox was his boss. Lou related that mobile soil survey crews headquartered in Elko during the summer would head south during the winter to Overton and Mesquite and then back to Elko during the summer.

John Swenson was part of the mobile survey in 1943. Swenson's duty station was Yerington where John McCormick was party leader. Swenson was sent to Ely during the summer of 1943 where he completed mapping on ranches in the Ely area and in the Ruby Valley of Elko County.

The soil mapping during this time consisted of conservation planning surveys of individual farms and ranches. Langan and Swenson related that, when surveying in remote locations, they would stay in the bunkhouse on the farm or ranch they were surveying. The ranch also provided meals. Both men commented on the quantity and quality of the meals they were fed on the ranches. Farms and ranches that were close to their duty station were driven to on a daily basis. While mapping the Cleveland Ranch in Spring Valley, Swenson said fishing was excellent in the creek that ran through the ranch. The ranch manager told him that no one had fished that stream for many years during World War II.

[2/] Better Land Use in the Meadow Valley Soil Conservation District, U. S. Department of Agriculture, Soil Conservation Service, Region 7, Caliente, Nevada, 1946.

[3/] Report of the Physical Survey of the Mason Valley Soil Conservation District, Nevada; U. S. Department of Agriculture, Soil Conservation Service, Pacific Southwest Region, August, 1940.

According to John, being precise and accurate in the field using a plane table was a challenge. However, John McCormick, Swenson's boss, was very talented at using the plane table and his work was precise. Mr. McCormick provided critical training to John on establishing a starting point on the plane table. This training consisted of using a 100-foot tape and laying out a distance of 1,320 feet usually along a fence line. Once the starting point was established, all other points on the map were located accurately by triangulation. A stadis rod was used to obtain distance.

John Swenson and John McCormick dry camped in tents while mapping near Baker, Nevada. Each had a truck assigned to them for fieldwork. On the morning of their last day at camp, Swenson had his truck warming up and pointed downhill. Both men finished loading their trucks with their gear and McCormick left first for Ely. When Swenson was ready to leave, he killed the engine when he tried to back up. His battery was dead and he had a long walk to get help. When he finally made it back to Ely, he gave McCormick a piece of his mind for not waiting for him.

Lou said that the Elko office had the first Jeep in the state. The lowest hanging part on this Jeep was the brake master cylinder. The surveyors went to the field daily with brakes and returned home in the afternoon with no brakes. This problem was eventually solved after a skid plate was installed to protect the master cylinder. The Elko Field Office has on file most, if not all, of the original work that was completed during this period. Fieldwork was done by plane table until 1949, which is the date of the first aerial photography for Elko County. These aerial photos were strip photos that were taken in flight lines but only of individual farms and ranches.

Field mapping techniques included general observations of surface and subsurface texture, restrictive layers or bedrock, slope, and, to some extent, percent of soil lost to erosion which, unless obvious according to George Borst, was impossible to predict. Detailed descriptions of soil profiles were nonexistent. Connotative map unit symbols were used for these surveys. These symbols were not always consistent in their use from field office to field office.

George Borst relates that the conservation planning surveys were very detailed and considered excellent work. However, in the early 1950's, Charlie Kellogg "deemed the conservation surveys unsuitable" and they were subsequently replaced by popular surveys that used taxonomy. These conservation planning surveys remained an actively used product in this state until the mid-1960's and even into the late 1970's in those areas that had not been mapped as part of modern surveys.

The Way It Was

Grant Kennedy

During the fall of 1937, I was back in Reno for my senior year at the University and graduated in May of 1938. I had some good professors and, looking back, wished I had taken more advantage of the fine opportunities that were offered, but such is the way with youth.

My botany professor, Dr. Lehenbauer, mentioned a job opening starting early in May. It was a position with the Department of Interior under the Taylor Grazing Act—today this would be with the Bureau of Land Management, U. S. Department of the Interior. He must have put in a good word for several out of his class were immediately hired when we applied. The job entailed working as a member of one of several survey parties making a soil and vegetation reconnaissance survey of Elko County, Nevada. This was to be a cooperative survey. Other government agencies involved included the Department of Interior, the Forest Service, the Soil Conservation Service, and several other Federal departments.

The job entailed working as a member of one of several survey parties making a soil and vegetation reconnaissance survey of Elko County, Nevada.

Mr. Martineau, who apparently was in charge of the project with headquarters in Reno, picked up some of us graduates and took us to Wells, Nevada. It was early in May and before graduation services were to be held at the University. The work was to get off to an early start to maximize the number of favorable field days before cold weather set in come fall. We were introduced to “Speed” Agee who was in charge of our party of seven, including him. The pay was to be $105 per month with $1.60 per diem. There were also several other crews that would be working in other parts of Elko County.

Speed drove a government station wagon—a Ford V8 of the woody variety—and hauled our gear and us to a campsite south of Wells. The exact location escapes me, but when I found an old photo, I see it was Warm Springs. Our “home” was to consist of two large wall tents. One was for sleeping where we rolled out our sleeping bags on folding camp cots. The second was the cook tent and “office.” It held a long table with two benches placed on one side and at the opposite end was the cook stove—a rectangular piece of metal covering a trench in the ground fueled by the nearest source of wood, which was often sagebrush. The

Coleman gas lantern was the source of light. We had a camp cook and members of the crew chipped in to pay his wages and the cost of groceries. Our crew at this time consisted of Charlie York, Chester Jacobsen, Fred Galloway, and myself from the University of Nevada; Otis Orton and Mark Shipley from Idaho and Utah, respectively; Speed, the party chief; and Harrison, the camp cook.

The next day, we were driven out to a corral, which contained some saddle horses. Speed assigned numbers to each horse, and we drew lots to see which one we would be assigned. We each took our horse and saddled up to try out our new companion. The saddles were strictly GI (Government Issue)—they were McClellan saddles such as the Cavalry used during Civil War times and thereafter. We were to ride off some distance and get the feel of riding this particular horse, dismounting several times in the process. My horse seemed a bit spooky at first but reasonably manageable. Now, although I was raised on a ranch, I was never aboard a saddle horse but only a few times. Finally, I pulled up on the reins and dismounted. I walked a short distance and decided to get back in the saddle. As I was almost in the saddle, the horse made a fast movement to his right dumping me off to land in a thorny greasewood (*Sarcobatus*) bush. I held on to the reins and he dragged me several feet and stopped. Then I stood up and dusted myself off and got back on, this time being more prepared for any sudden action by the horse. I had no trouble thereafter with this horse, which I called Sarcobatus. He would sometimes be a little spirited when out in flat country, but when the going was tough, he would rub his nose on my shoulder and want to be my best buddy.

The soil was identified in broad terms, such as landforms, and changes in vegetation and soil boundaries along the transect were to be shown on a small-scale base map.

The method used in making this survey was to run transects along section lines, traversing in either an east-west or north-south direction. At set intervals, the people running transects would scribe a circle having an area of one hundred square feet. Then, they would identify and record the vegetation and its percentage of cover in relation to the plot. The soil was identified in broad terms, such as landforms, and changes in vegetation and soil boundaries along the transect were to be shown on a small-scale base map. In some places, there was reasonably good correlation between the vegetation and the soils. For example, uniform stands of low sage on alluvial fans seemed to have soils underlain with a caliche layer (hardpan) usually overlain with clay subsoil. Badger holes, although a hazard for your mount's legs, were welcome as inspection of the mounds around the hole gave some insight into underlying soil properties. We were given a forester's compass and

Jacob Staff (pole about the size of a broom handle), the latter used for sticking the point in the ground and mounting the compass for sighting. For outlining our plots of 100 square feet that we were to take at set intervals, we had a chain and pin set, the chain being about 5 1/2 feet in length attached to two metal stakes about two feet in length. A device about the size of a stop watch, which we called "tally whacker," was used to record the number of paces taken as distances were estimated by paces taken by either horse or man. At the offset, we traversed known distances by foot and horseback to determine the average length of paces. A small short-handled pick was issued to examine some soil properties. A 10- by 12-inch aluminum binder for maps and vegetation write-ups completed our list of equipment. Section corners that could be located were used to lay out transects. The best corner locations were the iron pipe variety, but they were found mostly when encountering rangeland owned by the Utah Construction Company, such lands having, at the time, been recently surveyed. The others were post markers from the original land survey and they weren't very plentiful. The original survey may have been the contract type where they used a horse and buggy, with the revolutions of the buggy's wheel to measure distances. I suppose it was an extreme case but one of the fellows asked a sheepherder if he knew of any section markers. He replied that he knew of some—usually when he found one he moved the post to higher ground if possible so it was easy to see.

This job only lasted a few months but it still fills my mind with so many unusual experiences, more than which can be recalled from later years in my career. About the first of June, we arose one morning to find about a foot of snow on the ground. For several weeks after, I was wishing I had some long underwear like several other fellows wore, as it was bitter cold and my heavy wool coat was inadequate. But, it finally warmed up before I could obtain more clothing. Early on, we visited the camp of another crew working nearest us. Some had left school before graduation also and were having an impressive ceremony receiving a symbolic diploma while standing in a pile of horse manure. This wasn't the usual 9 to 5 job and we didn't expect it to be so. We arose early, had breakfast, and headed out in the station wagon, oft times down some dusty or graveled washboard road leaving camp about seven in the morning. Our horses were usually situated near a portable manger near some road where we all had assembled at the end of the previous day. The horses were watered and grain fed. We saddled up and were each on

We saddled up and were each on our way to our starting point from where we were to proceed as closely as was possible along section lines in the same direction spaced a mile apart.

our way to our starting point from where we were to proceed as closely as was possible along section lines in the same direction spaced a mile apart. At some place, usually within 10 to 15 miles in distance, we would assemble again at a given place accessible by road and Speed would bring feed and water for the horses. Then, we would go back to camp. By the time we got there and ate, it was usually quite late because of distances and difficulties encountered in our daily travels. Oft times we arrived in camp looking almost ghostlike from a generous covering of silty road dust. On one of these particularly dusty rides, someone remarked, "Your eyes look like a couple of holes burnt in a blanket." We had ravenous appetites, as all we carried for lunch in our saddlebags was a can of tomato or fruit juice.

Rocky Mountain Fever was a concern in those days and we all got our first shot for our protection when we went to work. Ticks were plentiful. I was up in some mountainous area in early June. Light flurries of snow were falling and I stopped and sat under a Juniper tree for shelter as I worked on my map and write-ups. That evening, I pulled about 14 ticks off my woolen coat. Before turning in, we always held tick inspection examining each other's backs looking for any undetected creatures.

When ticks were dug into our skin, we would place a burning cigarette near the tick and most of the time they would back out. Otherwise, if one pulled them off, they left part of their anatomy buried in your skin, which could cause a sore spot. During the day's ride, I would look under the horse's belly and scrape bloated ticks off with a stick.

We came to a steep downward slope....After that experience, I learned to take a few tips from my horse.

As we started to work, we set up our compass and picked out a distant prominent object in our direct line of site. Then we went in that direction and extended the line of sight as needed during the day. This worked well where we could see long distances as in a valley but was difficult in some rough terrain. It was often most difficult to follow a straight-line direction because of downed timber, thick patches of brush, cliffs, rim rock, beaver ponds, and other obstacles. When these were encountered, one detoured to the left or right and then hoped to get on line after the obstacle was bypassed. One time, toward the end of the day, I was riding through an open stand of juniper and happened to look to my left. There in an open area was Lew Leifer (a fellow crew member at that time) riding parallel to me about a third of a mile away. He rode over to meet me and we figured we should be close to the point where we all would meet Speed. It started to rain and we couldn't see any sign of the road near our spot to be picked up or the station wagon or anyone else. We rode

together another quarter of a mile and suddenly my horse began to whinny. About 100 feet ahead, we came to a steep downward slope. There, way below us, was the station wagon, several of our horses, and part of our crew around a blazing fire. After that experience, I learned to take a few tips from my horse.

For a time, our transects had us crossing the Pequop range west of Wendover. Some of us had come in unusually late and related that it was because of the difficult terrain. Speed decided to try it himself to see why we were having difficulties. He had one of the crew take his place and took this person's horse and started out on one of the lines. My transect was several miles from his. I had no difficulty ascending the east slope. Then, as I started down the west slope, I ran into a sizable dense growth of mountain mahogany. In detouring around it, I found myself in the streambed of a boxlike canyon. For some reason, I had switched horses and was riding a gray mare. Ahead of me, the streambed sloped sharply downward and was quite stony.

The mare stopped even though I urged her forward. I decided to get off and lead her. She wouldn't budge, no matter how hard I pulled on the reins. I decided to try to get back on and give it another try urging her in a more forceful fashion. When I did so, she started forward but fell about half way down the obstacle course. She was on her side and my left leg was pinned beneath her. I thought I could visualize the buzzards circling—here I am miles from anywhere and would be hard to find. Somehow, I managed to remove enough loose stones to free my leg. I got up and then the horse was able to stand. Neither of us was hurt and she let me lead her to a spot where the route ahead seemed to offer fewer hazards. I was a little late to finish at day's end but not the last to show up. Speed was the last and latest. He told how, while on a narrow trail, his horse slipped and then fell about ten feet into a small pine tree. His shirt was torn and the horse had a deep scratch on his flank. The upshot of this was that Speed decided we should finish the remainder of the Pequop crossings on foot. We made several crossings that way and I still remember the first.

I started fresh, going eastward, and, by eleven, I thought the crest lie ahead and finished the last of my meager water supply from an army canteen. When I reached what I earlier thought was the summit, I discovered a lot more uphill work ahead of me. I later passed a pool of water and, though extremely thirsty, chose not to drink from it. With all the various animal tracks around, I could see it was well used. Around four-thirty, I struggled to the top and could look down on a long valley. I could see a road in the valley below me and in the far distance, the dust

from a car on the road. I got renewed strength and headed downhill as fast as my weary legs could travel. The car was Speed coming to pick us up. In a while, I came to the road. I would guess we hiked some 10 to 12 miles but it felt like more. Needless to say, we were glad to get the horses back.

We moved camp in June to a place called Jasper Well. To get there, we left the highway and traveled eastward crossing an old lakebed (playa) somewhat paralleling a railroad. The camp was situated at the site of a well and corral at the foot slope of some adjacent hills. There had to be a den of rattlesnakes nearby as we killed something like twenty in and near our camp. We always hung our boots up at night in case we had to go out suddenly. We got the Fourth of July off and I went home to Lovelock. But I came down sick—possibly with the flu. I probably went back to work too soon but I thought I was okay. It had rained hard in the area where we were working. The dry lakebed where the road crossed to our camp at Jasper Well was under several inches of water. We met Speed in Wells and, as we went back, he drove into a sea of water and we wondered if a long detour that was possible by another road would be a better option to get to camp. Speed had inquired and found out the other road had some almost impassable stretches. But the surface of many lakebeds in Nevada is almost like concrete. We crossed at a slow speed and only got stopped once, so the passengers got out, gave a push, and we were on our way again.

We were working north and west of this camp on the day the Joe Louis—Max Schmelling fight was to be broadcast. Speed had a good radio in his personal car and his wife was to drive out to camp. We planned to start work early and get done in time to get back and hear the broadcast. Interest was high because Schmelling was a German and Hitler was flaunting his power and, also, because of his snub of Jesse Owens, the great sprinter, during the 1936 Olympics held in Berlin. We got done as planned and Speed was driving us back. We were on the opposite side of the railroad some three miles from camp. The nearest crossing was possibly six miles to the west and to go there and then double back would make us late for the broadcast. It was decided that the station wagon could cross the tracks if it was driven at an angle. It worked, but, in the process, there was a loud noise. When Speed was across and on the road leading to camp, he stopped and shut the motor off to examine the car. The problem was soon obvious. Cars in those days had the battery mounted under the floorboards. The battery had struck one of the rails and was broken. Speed's wife must have seen our dust as we approached the railroad as she was soon driving out to meet

us. However, by the time she arrived, the fight had just ended and Louis won in the second round.

Saturday was a workday. We worked all through one weekend and on the following went in to Wells. Everyone checked in at the McDonald Hotel and got a bath the first thing. Then, we headed to the barbershop for a shave and haircut. There wasn't much to do in Wells but we enjoyed eating at the hotel for a change. One time, one of the fellows from another crew had a car and took several of us to a country-dance at Lamoille, some 30 miles distant, that was held in an old school- house. The only other country-dance that I ever went to was back in Lovelock about the summer of 1934. It also was held in a schoolhouse. No one dare bring liquor into the schoolhouse so some would hide their bottle outside nearby. I discovered that a thirsty drinking man found his bottle by grabbing a handful of small gravel, tossing it in the air and listening for the tinkle of glass. These dances would go till dawn so we wound up back in Wells about the time that we would get ready to leave for camp.

I was in Elko several times. It was the county seat and, of course, Speed and other supervisory people went there on business. Elko, at the time, had a population of four thousand—there must be seven or eight times more people at present—the increase fueled in part by gold mining. In June, I went there to take a Civil Service exam for a Junior Soil Surveyor. The reason I did was because my brother was then working on a similar job in New Mexico with the recently formed Soil Conservation Service. At that time, he was working on the Navajo Indian Reservation. He had informed me that this test was being held. As I was going up the steps of the Post Office, where the test was to be given, Speed introduced me to two people from the Soil Conservation Service Regional Office which was in Berkeley at the time. The two were Stan Cosby and Leonard Wohletz, both whom later would play an important part in my career. They wished me "good luck"—little did I know that I would run into them later.

Our second tick shot was due soon after the Fourth of July. When we were getting our shots, the doctor examined me and put me in the hospital in Elko. Evidently my flu, or whatever it might have been that I had over the Fourth of July, was flaring up again and the doctor didn't think camp life would furnish the proper environment for recovery.

Speed was a good person to have for Party Chief. He was raised on a ranch in the county, knew the area well, and was acquainted with some of the ranchers and people in Wells. Therefore, things went more smoothly for us. He was always there to pick us up at night and seemed

to have a good game plan for the day's transect. Other crews reported having members lost or out overnight. There was only one time we had a problem and it wasn't Speed's fault. He had to be gone on business and Harrison, the cook, offered to go to town and pick up the groceries and then come pick us up in late afternoon. We all reached the pick-up spot on time and had our horses unsaddled. We were not too far from a road and were standing around a fire since we were damp from a recent rain shower. Soon we saw a car coming and it was the station wagon. Everyone thought Harrison could see us but he drove on and disappeared over the hill. We waited some time until it was apparent he wasn't coming back. At that time we were closer to camp than usual—about 7 miles. There was nothing else we could do but saddle up and ride back to camp. Cooks in those days took those camp jobs in order to "dry out" because of a drinking problem. Harrison must have quenched his thirst while getting the groceries. Anyway, we soon had a new cook who turned out to be much better although, except for this incident, Harrison had done a reasonably good job.

One day, near dark, we were some 15 miles south of Oasis. It was time to head back to camp and we were crossing an old playa with only very sparse vegetation, when one of the rear wheels hit an unseen pot hole and a rear spring was broken in the process. The fender rested on the rear tire and the vehicle was disabled. Someone suggested we could jack the car up and place something underneath to keep the fender off the tire. There was nothing we could use on this barren stretch. Then, one of the fellows remembered passing a lone post about a half-mile away. Two fellows hiked back and got the post and put it in place under the car fastened with baling wire. By then, darkness had set in and Speed discovered the lights wouldn't work. There was some moonlight and we all looked out the windows helping the driver find the road. Fortunately the terrain was flat and the road reasonably straight. We made it to Oasis and had the lights fixed at the service station. Then, we drove down the highway into Wells with the post still wired to the frame. It demonstrated something I was to use throughout my career—try every option possible before you start walking.

Another time, we were miles from anywhere and were using Henry Fox's SCS Chevrolet sedan to locate section corners. The car was boiling and we had no spare water. Nearby was a "charco"—a small depression constructed on rangeland to collect runoff. The water was muddy—too thick to drink and too thin to plow. We found a container in the trunk and debated momentarily about putting this liquid in the radiator. Then we thought of the alternative and went ahead and filled the radiator. We got the car back to Henry. The next time he saw us, he

wanted to know what we did to his car, but finally dropped the subject knowing full well that he would have had to do the same thing.

We were making an inventory of the flora but I might mention a little about the fauna. In our travels, we would run into mustangs or wild horses. There was one band we encountered a few times that ranged south of Wells. When we were fortunate to get close to them, our horses would seem excited and, when given a free rein, would take off on a gallop after them. Someone said that some of our horses had been used to round up mustangs. The herd would take off, their tails flying in the wind, and soon you could see their dust cloud as they sped down the valley in the direction of Spruce Mountain. Now and then, we would come upon a coyote. Several times I chased them on horseback. A horse could catch up with them, but they didn't get the name "wily" for nothing. You soon found the coyotes picking a route of their choice, such as sand dunes or rock outcrops where it was rough going for your horse, or, if the sun was low on the horizon, they would run into the sun so you were half blinded and then suddenly disappear, ducking behind some clump of brush. I saw what I thought were mountain lion tracks but never spotted one. Deer sightings were frequent in some areas. More than once, I came upon a big muletail buck and both of us were startled. We spotted sagehen near some springs we drove by regularly for a time.

The only fishing I ever did was on a trip into some "badlands"—a series of volcanic breaks—lava beds—through which the "Little Salmon" flows toward Idaho. The stream was somewhat entrenched where we came to it, and to get down into a boxlike canyon, my fellow crew member Charlie York and I took a steep trail where our horses had their front feet forward and their rear next to the ground as we slid downwards. We camped there overnight. My partner had brought string and fish hooks. We each cut a willow for a pole. Using bacon for bait, we soon had six big trout and quit, as that was enough for supper. Never again did I see such good fishing.

A day's ride covered enough territory so one saw or heard a number of rattlers. Often it was your horse that would suddenly detour to one side or halt quickly and there was a rattler ahead. In some lava bed areas, a series of flows formed stair steps with rimrock 10 to 15 feet in height. When riding close to these, sometimes you could hear rattling but never see the snakes in the rocky crevices.

Beaver ponds were common on some streams where there were quaking aspen groves growing along the watercourse. Sometimes you had to ford the stream and, because of the beaver dam, the water would be up to your stirrups.

This particular summer, Elko and the adjacent Humboldt County were plagued with Mormon crickets. They descended in droves like the biblical locust and devastated all within their path. I never was caught in such a position but observed the slippery mess where they crossed a highway and were a hazard to traffic. One of our crews had them come through their camp ruining most everything they had. Effective pesticides were not developed yet. The only means of trying to eliminate them was to dig a long trench across the path they might come and erect a corrugated tin barrier on the far side. When the crickets fell in the trench they were sprayed with oil and then set on fire.

It seemed that summer there were more thunderstorms in late June and July than usual. Some occurred on our day's ride. We would run into a shower, get wet, and usually dry off as the day wore on. These showers always brought out the almost pungent odor of sagebrush. A few times the lightning was menacing. I was on top of a mountain range when a storm struck. It began to rain and, out of the corner of my eye, I could see several bolts of lightning strike nearby prominent rocky points. I headed the horse downhill as he walked sideways with his rear to the driving rain. I pulled my hat down, almost over my eyes, and hoped for the best. Another time we had moved our camp, and the tents were situated between a large corral and a large outcropping of rocks. I was the only one in camp and was left to tend the horses. I was sitting on my bunk looking out when I saw a bolt of lightning split overhead, one part hitting the rocks and the other striking a 15-foot-high pole in the corral. I reached up and closed the tent flap and made no other observations until the storm passed.

By mid-July, I felt comfortable in the saddle—didn't have any more saddle sores, at least. I even rode 50 miles in one day—taking my horse back to a ranch and returning with another. Late in August we moved camp again, and I think it was in the vicinity of O'Neil. It was a nice spot with a creek nearby. The night temperatures were fairly cold. I believe we were at about 6,000 feet in elevation. We got up in the mornings always finding a skiff of ice on the wash basin water. We began working in an area between the road to Jarbridge and the highway to Idaho that passes through Contact. I have several vivid recollections of this period. One afternoon my progress had been slowed and darkness descended before I got back to the road where we were to meet. I was coming down what appeared to be a stock trail along side of a creek and could scarcely see anything. Finally, I lay low in the saddle to avoid tree branches and let my horse go forward as he chose. He was old, reliable, and followed the path until we came out at the road I was seeking. The other time, it was about dusk when I was heading to the road to find the

station wagon. Suddenly, I came to a barbed wire fence and could see no gate anywhere in sight. I got off my horse and managed to pry the staples loose that were holding the wire at the nearest post. I managed to get the wire down to the ground; then, I held the wire down with one foot while trying to lead my horse across. Things were going well but, as his last hind foot crossed, one strand of wire caught on his shoe. At first, he started to pull the wire and I was afraid we were in for a real mess. Somehow, I managed to calm him and was able to free the wire. It was now very dark but I could see what appeared to be headlights about a half-mile in the distance and rode in that direction. It proved to be our station wagon and I was "home free."

It was the middle of October when everyone took several days off and two of us were left in camp on the weekend to tend to the horses. We drove out to the area where the horses were grazing. The horses were hobbled and it was decided that they had moved a considerable distance and we would move them down to a corral and feed them some grain. I volunteered to herd them as soon as we took off the hobbles. There were no saddles or bridles in the station wagon so I just put a halter rope on the nearest horse and got on bareback. I got the other horses where we wanted them and then tried to get this horse to go in the opposite direction to the station wagon. He started that way and suddenly decided to turn abruptly to follow the others. I lost my balance and slid off, landing on my feet, but the horse was moving at a gallop and the momentum caused me to fall. Somehow, I hit my left elbow on some stones. It hurt and I thought it was sprained. When we got back to camp I put my arm in a sling rigged from a flour sack. When Speed came back the next morning, he looked at my arm. By now it was badly swollen. He thought I should see a doctor and get x-rays. So, it was back to Elko about 90 miles in distance. The arm was broken but in such a way that by holding my left hand under my chin, the doctor could tape it up and, this way, with a sling, the arm would heal in a month. Thus ended my horseback days in Elko County.

Soil Surveys at Walker and Pyramid Lake Indian Reservations

Grant Kennedy

The SCS transferred me from Georgia to Berkeley, California. About February 15, 1940, I reported to the Regional Office for California and Nevada, then located on Fulton Ave. close to the University of California campus. The building had the appearance of having been a bank building, the front having several large columns as in Greek architecture. I was ushered into Stan Cosby's office and met him and his assistant, Leonard Wohletz. I was informed that I was to report to the area office in Yerington, Nevada, and would be making a soil survey on the Walker Lake Indian Reservation. I was given a brief orientation and one of the secretaries assisted me with completing the necessary paperwork. I left Berkeley after lunch and drove to Yerington, Nevada.

Yerington lies southeast of Reno about 90 miles. It was a small town much like Lovelock and, besides being the county seat of Lyon County, was the nearest shopping center for the ranches and others nearby. I checked in at the area office and was turned over to Clarence Olds, a soil surveyor formerly from Oregon, with whom I would be working. My immediate need was some kind of housing. Since these forays were of short duration, I always had to look for a furnished place and I almost had to take the first thing available, not having time to shop around. The big copper deposit at Weed Heights nearby hadn't yet been discovered or, at least, there was no mining activity there at the time, so there was little demand for rentals and what I wanted was hard to come by. Finally, there was a fellow at the office who said he had a place with a spare bedroom and he would be willing to let me stay there and we could share the kitchen and bathroom. "It isn't much," he said, "but it might get you settled until you find something better." He had come down from Alaska and this was a temporary assignment. His wife was already somewhere in California where he expected to go soon. His appraisal of the place was accurate. It was a small place upstairs over a service station and garage close to downtown.

I went to work then after getting settled. I believe Ralph Smith was the equivalent of an area soil scientist and had some input as I got started. Some soil series were being mapped and had some descriptions that were somewhat brief as compared to later standards. Clarence met me at the office the next morning and we went to Schurz, about 25 miles east of Yerington. Schurz is the headquarters for the Walker Lake Indian Reservation. The reservation is located just north of Walker Lake close to where the Walker River empties into the lake. Walker Lake is one of those slowly declining remnant lakes in the Great Basin formed after the Ice Age.

At one time, this lake contained numerous cutthroat trout unique to parts of Nevada. Many were large for trout and often were of trophy size. In 1940, this lake was a popular spot for sport fishing.

Clarence and another person had been making a soil survey of parts of the reservation before I came aboard. They had already mapped the better land around Schurz and now were mapping some of the rangeland. A plane table was used to make the base map and to delineate the soil boundaries. It was the last of February so the weather wasn't the best. It would snow but never enough to hardly cover the ground. We would get the plane table out, do our procedures, and, before long, our fingers were blue and our feet were icy. We had a telescopic alidade and I was the rod man when we measured distances. Clarence drove a pickup, which, thankfully, had a heater—not all government cars were so equipped at that time. It also was equipped with a big spare gas tank. He would leave the truck idling and, when it got too uncomfortable outside, we got in the cab to thaw out. On one of these days, about noon, a few flakes were falling and we heard the weirdest sound. It came from some coyotes howling their best from the ridge of a nearby sand dune. I had heard coyotes howling before but never out in broad daylight.

Things were winding up at Walker Lake so I was to be sent to work on the Pyramid Lake Indian Reservation some 50 miles from Reno by road and situated north east of Reno. About the same time, my wife had to have an appendix operation and, upon her release from the hospital in Reno, I took her to Lovelock to stay with my parents until such time as we could get situated at Pyramid Lake. The reservation headquarters was at Nixon. Paul (Pat) Pattengale, a range surveyor, was in charge and I was to work with him. We left Yerington with a GMC pickup that had come from South Dakota. It had about 15,000 miles on the odometer, came equipped with large tires, a spare gas and water tank, and had a governor that limited our speed to 45 miles per hour. We both brought sleeping bags as we knew we would have to spend a number of days out on the job. The first place we picked for temporary quarters was at Sutcliffe, the location of a dude ranch. It was a place where we could park our personal cars or the government car when necessary. We could get a meal at Sutcliffe and make a phone call in an emergency. Our assignment was to make a range and soil survey on the reservation. Our mapping was to be done using a plane table to make a small scale base map. This was sure an abrupt turnabout for me after delineating soils on aerial photos in Louisiana and Georgia.

Some of the roads were graveled but were so rough that they felt like the washboard surface would quickly tear a car apart. My Oldsmobile was relatively new, so, rather than subject it to this treatment, I bought a Model A Ford sedan for this duty. I purchased it in Lovelock for $65 and it served me well traveling back and forth on some weekends. I even towed a relatively new car that was stranded on the highway some 15 miles into

Lovelock with this vehicle. When I left later for California, I told my father to sell it and he did—for the $65 I originally paid.

At the start of what was to be our soil and range survey on the reservation, the SCS conducted what we later would call an Initial Field Review. Leonard Wohletz represented the Berkeley office, Ray Roberts was the soil correlator out of Berkeley, and Ralph Smith came out from Yerington. Together we examined parts of the area looking at the soils and vegetation and deciding what features should be mapped. We examined some of the soils and Ray came up with several established series names for observed soils and assigned tentative names for some others. My main recollection of that week in the field was that it was bitter cold and the troops on Friday night welcomed the warm confines of Reno and the Golden Hotel. On Saturday morning, we had a brief meeting in the hotel lobby and the people from Berkeley walked the half block to the Reno Depot and caught a train back home.

We started out working areas accessible from the road to get started. Then we would drive cross-country on some stretches using the pickup like a four-wheel-drive vehicle of today. Of course, we got stuck a lot where we would hit small sand dunes and even the big tires, although helpful, couldn't prevent our problem. Finally, we got several jacks and a long tarp. When stuck, we would jack up the rear wheels, pull the tarp underneath, and tie the end to the tailgate. This would give us enough traction to get started. Generally we would hit a hard surface in a short distance. We dragged the tarp behind us until such a spot was reached. Once we had more difficulty than usual, as the governor on the pickup restricted the power necessary to move forward. That's when we broke the seal and deactivated it so we could rev up the motor. Somebody behind a desk thought this speed deterrent was a good thing but he never was faced with the specter of a long hike or being "hung out to dry" when passing another vehicle.

Our pickup was equipped with boxes for our equipment and we always carried some food items. When the day's work ended, we found some spot to spread our sleeping bags out and fix something to eat. We had to stick to canned goods and things like ham and salami. I particularly liked salami but, after this job, it was a long time before I could eat it again. The Trading Post was at Nixon and was run by "Snuffy" Smith. Prices were reasonable, particularly for meat. All cuts were $.20 a pound be it the best steak, stew meat, center cut of ham, salami, or whatever you wanted.

We started in the southwest part of the reservation and worked our way northward. We got up to Sand Pass and out onto the Smoke Creek Desert. The desert part did not require much time to map where we were, as it was one big playa almost devoid of any vegetation. We camped briefly at the lower reaches of a canyon to the east. The road approaching this place was

just a couple of ruts and consequently, the sidewalls of our big tires took a beating. While we were working in this location, our supervisors drove up from Berkeley to spend time with us but never did find us nor did we know they were coming. Somewhere north of the lake, there was a range rider's cabin, which we had permission to use. It wasn't fabulous but at least it was a roof overhead. We found a couple of old tired bedsteads on which to roll out our sleeping bags. There was a watering trough nearby fed by a windmill. We had a tank for water on the truck but we saved that for drinking and emergencies.

I remember two things about this place. Pat had to go to Reno and, for some reason, I stayed there. He left on Saturday morning supposedly to return that night. He didn't show up until Monday morning. It was solitude for sure—I could hear the coyotes at night, the footsteps of a pack rat, and the constant tapping of something dangling in the breeze on the outside cabin wall. I had two *Time* magazines and I had almost memorized every article before Pat showed up. *Time* magazine was filled with happenings related to the start of World War II.

The other incident occurred a few days later. I was driving and came to a spot where there was a dip in the road and a rock near the center of the road that stuck up some and might cause us a problem. Pat got out to give me guidance, and I steered the pickup according to his directions. Having eased the vehicle to a certain point, he called out, "Give her hell." I stepped on the gas and, as the car moved forward, heard a loud crunch. We crossed the dip but, in doing so, had bent the tie rods so that one wheel appeared to be at about thirty degrees out of line. It wasn't too far to the cabin and we managed to drive there. Pat had some mechanical ability and we had a few basic tools. We jacked the front end up and he took off the tie rod and straightened it as best he could, pounding out the bend with the rod lying on an old railroad tie. It wasn't exactly "Mr. Goodwrench's Wheel Alignment" but it got us back to civilization.

Pat was an outgoing person and a good man for the job. He had fudged his age and joined the army before he finished high school and, no doubt, some of his army experience rubbed off on him. He didn't have a high school diploma but applied for entrance to U.C. Berkeley. They let him take a test for entrance and he passed and went on to get his degree. Soon after the "high center" incident, we got the pickup into Reno for repairs on a Saturday. It was late afternoon before we got everything in order. We were walking by the Palace on the corner of Commercial Row and Center Street in the downtown area. Pat had a little loose change that was burning a hole in his pocket. He went in and put it in slot machine and won about $15. He said to me, "I'll tell you what, Grant. I will buy your dinner. We will go to the Columbo Hotel to eat." Then he went to the nearest phone and I could hear him making reservations for two, sounding like we were two important

people. The Columbo was only a block away. We appeared before the maitre d' at the appointed time, dressed in our field clothes because that's all we had, and were escorted to a nice table. In those days, $15 would cover a good dinner for two, assuming that was all you had. Pat seemed knowledgeable about wine and had the waiter bring a special vintage he named. We had a leisurely dinner, and then the dance band began to play. It was about a five-piece orchestra with a vocalist. Pretty soon, Pat was up chatting with the leader and making several requests. The music was good and, I guess, we were an appreciative audience. Finally, intermission came and Pat went up and invited the whole group down to our table for drinks. We had cashed our paychecks earlier and the $15 was long gone and I was adding some of my money along with his. As soon as the group finished the intermission and started to play once more, I told Pat to stay if he so desired but I was going to get us a hotel room. I went to the Golden Hotel and registered for both of us. Several hours later he came dragging in, poorer but, perhaps, wiser.

A few roads were on the east side of the lake so we opted to use horses. Pat managed to rent some, and we each had a packhorse. I had never used a pack animal, but Pat seemed to know how to make a proper hitch on the horse and secure all our gear. He even showed up with a young fellow who was to be our wrangler but that only lasted overnight. He showed up dressed for the job along with a big guitar. Finally, Pat decided he wanted a working cowboy, not someone to croon "Back In the Saddle Again," as Pat could see it wasn't going to work out. One day, we met one of the Indian range riders. He invited us to come up to what was known as Hell's Kitchen. They had some wild horses they had rounded up in a corral and were going to do some roping. We could leave the packhorses at a nearby corral. We agreed to follow him, as we wanted to look at the area ourselves. Off we went, up this steep mountain trail rising high above the lake. Once over the crest, the terrain was less sloping and we soon arrived at the destination where three other Indians were at work. Inside the corral they would rope the wild horses and manage to get them down and "short hobble them," that is, tie a rope from one hind leg to the opposite front leg. Tied in this manner, the horse could walk but couldn't run, and they would be able to lead them down to their headquarters. The four of them were doing real well and finally roped the last one—a big buckskin stallion. They managed to get him roped and hobbled and were starting out the gate with him when he broke loose somehow. Several of the riders were already on their horses. "After him, after him!" they shouted as the stallion neared our position. We just froze in our saddles as it would mean taking off on a downhill slope among a bunch of rock outcrops —pure suicide for the amateur—so all we could do was wanly wave an arm. But those two Indians took off in a gallop and roped that horse out there in the open. It exceeded any exhibition you could see in a rodeo.

We left the northern part of the lake heading along the east side edge of the lake, eventually working our way to Nixon. There was one place where the only trail was a narrow path along what was almost a cliff and it seemed like several hundred feet almost straight down to the lake shore. I was hoping my horse was surefooted, which he was, but the pack animal I was leading had one hind foot slipping over the edge and, if I had not pulled hard on the lead rope, I think we would have lost him. Fortunately, this hazardous section was only over a short distance. That afternoon, we stopped to spend the night where the Indians had another corral and a small stack of hay. When we got ready to put our sleeping bags on the ground for the night, Pat had the bright idea to get some of the hay and put it under our bed to make it more comfortable. It sounded good to me so we did that and turned in. In the morning as we got up, both of us were itching something fierce and soon discovered the cause. There were little minute critters crawling everywhere—chicken mites! A bunch of chickens had nested in the hay before it was hauled to the site. We went down to the lake and jumped in, clothes and all, and then took off the duds and hung them over the brush to dry. I wore a Stetson western hat, which I liked. Taking it off, I could see those minute forms racing around inside my hat. I tried to rid them by holding the hat over the flames of our campfire. I killed the mites but, sadly, ruined my hat.

Later, down near the lakeshore, we ran into some very young coyote pups. I thought I would try to catch one. I had my jacket off and ready to put over the pup, but that little fellow could just keep out of my reach and, finally, I gave up the chase. I don't really know what I was doing this for other than the challenge.

Finally, we managed to get the pickup out to our work location. We tied the horses up to the pickup and one horse managed to kick out a headlight. Then, one horse got loose and stole away in the night. Fortunately for us, the horse headed straight for home and was there when we checked with the owner. It was unusual though since he had to cross two cattle guards in the process.

It was now about the first of June and we found quarters in Nixon. We had an old house, a two-story affair, which had been made into several apartments. At one time, it served as the residence of the Bureau of Indian Affairs administrator for the reservation. I was able to bring my wife down from Lovelock as we were done with our campouts. She had never been around any Native Americans so it was a novelty to her. She noticed, particularly, the babies in their traditional "Papoose Carrier." Pat even bought one to take home to his wife. I often wondered if they ever used it. Every year there was a big rodeo in Winnemucca around the Fourth of July and the local tribe was practicing their ceremonial dance during some of the

evenings. It sounded so strange at first but we got used to the sounds. There was a cemetery about a half block back of the house and some of the headstones dated back to the Civil War period. It was odd that I was to read in the *Sacramento Bee* newspaper around 1985 that, in doing some excavation work around this cemetery, they uncovered some gold coins dating back to the 1860's.

Now that we had a kitchen, we took advantage of the Trading Post offerings and had a number of good steaks and other good cuts of meat. Pat had checked a book out of the University of Nevada Library regarding Pyramid Lake. It was about the findings of an Army group sent out to make a reconnaissance survey and search for an outlet from what is now the Great Basin to the Pacific Ocean. This was done around 1860 or so, I think. Anyway, it had good sketches of the so-called "pyramids" and other prominent features, descriptions of vegetation, locations of water sources, and an analysis of some of the water from springs. It mentioned that Fremont had passed by the lake at an earlier date and the lake level at that time. We thought we passed near the same spot but the lake level was many feet lower than when Fremont made his observations.

It must have been the year of the rabbit. Traveling from Wadsworth to Nixon after dark was almost sickening. So many rabbits raced across the road under the glare of your headlights only to hit the bumper and wind up as "road kill." This abundance of rabbits no doubt increased the coyote population and probably was followed by a disease, which decimated the rabbit world.

We were busy trying to catch up with some map compilation in the "office" at Nixon. It was almost the last of June. Suddenly, Pat got a telegram telling us to take all of our equipment and leave the reservation and come to Berkeley immediately. We had to be off of the reservation before the first of July. We didn't know the reason for the sudden exodus but orders were orders. We took the pickup back to Yerington and got an earful about the condition of the vehicle but those in the know realized that this was to be expected if you were to do much fieldwork. They wanted me to take another vehicle to Berkeley, so Judy and I went in it and I reported to Stan Cosby at the Regional Office. He explained the reason for our quick getaway from the reservation. Harold Ickes was then the Secretary of Interior and, of course, Indian lands were under the Department of Interior. He could be a feisty person at times and he must have gotten into a squabble with someone in the Department of Agriculture of which the SCS was a part. Perhaps it was with Henry Wallace, the Secretary of the Department of Agriculture. Anyway, he told the SCS head to get its men and equipment off of Interior lands before July 1 or he would see that men and equipment were transferred to the Interior.

We stayed in Berkeley a few days and then found out I was to be transferred to Escondido, Calif. Judy and I caught the train at the Berkeley Depot and went back to Nevada to get our automobile and then would drive to Southern California.

Detail to Elko, Nevada

Grant Kennedy

During World War II, they discontinued Mobile Soil Surveys; at least they didn't have them in the Region where I was working. The Regional Office had been moved to Portland and served California, Nevada, Oregon, Washington, Idaho, and Utah. Then, State Offices came into being and we got most of our orders from this office. Someone, however, thought up the idea of a detail, which in itself was a temporary assignment. In about May of 1947, I was asked to go to Alaska. I balked a bit because I had recently spent a year overseas in the Army and did not want to be away from my family so soon. Then, in 1948, I was asked to go on a detail to Nevada to which I agreed as it was to be of short duration. I was living at Escondido, California at the time, making Conservation Soil Surveys for farms and ranches in San Diego County.

I left Escondido in my government pickup on the 13th of July, 1948. I drove via Hwy. 395, which crossed the Mojave Desert, to Bishop and into Reno, Nevada. I was driving a Chevrolet pickup equipped with a spare gas tank and another tank for water. This vehicle also had boxes on either side of the bed where we could store some equipment and food items. On the 14th, I reported for duty at the State Office in Reno. George Hardman was the state conservationist at the time and Henry Fox was the state soil scientist. I was sent to Elko to report to Royce Hermanson, then the area conservationist, and was told that I would be working under the guidance of Ed Naphan, soil scientist working out of Elko at the time. I knew Ed as we worked on a soil survey together at Julian, California, in 1942. Lou Langan had recently come to work with the SCS and he would be working with me during this short assignment.

At this time, the SCS soils personnel were making Conservation Surveys. I suppose this was to be a method of speeding up the process of getting soils information for planning on individual farms at a time when the number of Soil Conservation Districts was rapidly expanding. Farms and ranches were done as needed for planning and these were usually mostly scattered rather than in blocks resulting in what we used to call "spot surveys." A National and Regional Soil Survey Guide was issued indicating the procedures to be followed. Soil differences were delineated and soil legends had provisions for a code symbol that indicated the depth, texture, permeability, and other features of each soil delineated. The soil symbol itself supposedly described most of the information for the planner's needs. Soil series were not mapped and there was no correlation between soils with like symbols. These surveys served an immediate need but, after a few years, they went by the wayside as legends were lost and, in most cases, it would be hard to determine some properties of delineated soils. It seemed to be the best step at the time, since they were used in "uncharted waters," where nothing had been done previously in the way of soil surveys.

We were using a plane table to make the base map and delineate the soils. Aerial photos were not available at the time, which was understandable. Ranches were widely scattered and interspersed with rangeland. The cost of flying the area was then beyond budget allocations. Photos would have been nice where soil boundaries were intricate or not obvious at ground level. Lou Langan and I alternated at operating the plane table and being the rodman or flagging needed points on the landscape. We carried our sleeping bags and some food, mostly canned items, and stayed out in the field all week sometimes, staying in a bunkhouse and taking meals at the ranch where we were working.

We surveyed several ranches that were a reasonable distance of Mountain City, north of Elko near the Idaho line. We stayed in Mountain City at the hotel when doing this work. Neither of us was acquainted with the hotel when we first registered at the desk. We climbed the stairs and found our room. It was a bare bones situation of an aging hotel. There sat an ancient double bed with those fine woven springs of yesteryear that, when occupied, sagged and assumed the shape of a hammock. Somehow, we hadn't asked anything about the room and I guess we expected to find two bunks in the room. We decided that our camp cots would be better, providing the stern landlady at the desk would permit us to use them in the room. Down to the desk we went, and Lou, carefully selecting his words, asked if we could use our camp cots in the room. We thought we might offend her and she would give us the old heave-ho. It was the only place around and we could get meals there. Besides, down the hall were facilities that included a shower, a highly desirable item after tramping around in the sagebrush all day. Perhaps customers weren't too plentiful and she agreed to our proposal, so we lugged our things upstairs.

The weekends were spent in Elko. We felt luxurious in our modest motel—our employers at that time weren't overly generous with per diem and some even seemed to feel that since you were roughing it, you didn't need much. This was to change for the better, probably, in the sixties. So we cut a few corners to make out. Lou and I got together with Ed and laid out our strategy for the week ahead. On Sunday morning, we always went to a cafe near downtown and had steak and eggs for our breakfast. Sometimes we made a safari to the Commercial or the Stockman's Hotel. We liked the fare at the Star Hotel that served the Basque meals and had some of our meals at this establishment when we were in town. Bing Crosby owned a ranch in Elko County at the time, and he and his sons were supposedly in and out of town that particular summer. The weekends seemed all too short, and, on Monday mornings, we headed out for the week. We were usually faced with the 90-mile drive to Mountain City, with the Dinner Station being the only potential stop along the route.

The time flew, and soon the 60-day detail came to an end. I drove to Reno, leaving there on the 13th of September and arrived in Escondido on the 14th.

Individuals Involved in the Nevada Soil Survey Program from 1938 to 1950

USDA Soil Conservation Service

Barber, H. N.
Better Land Use in the White Pine Soil Conservation District, Nevada

Eckholm, Oke
Soil Survey of the South Fork Purchase Tract, Lee, Nevada

Goff, Arthur M.
Soil Survey of the South Fork Purchase Tract, Lee, Nevada

Graham, Fred U.
Soil Survey of the Walker Indian Reservation, Schurz, Nevada

Holmgren, George
Conservation Planning Surveys, Washoe County, Nevada

Houghton, Haley F.
Soil Survey of the South Fork Purchase Tract, Lee, Nevada

Johnson, Cale C.
Soil Survey of the Virgin Valley Conservation District, Nevada
Soil Survey of the Moapa Valley Conservation District, Nevada

Koch, Edward C.
Soil Survey of the Mason Valley Conservation District, Nevada
Soil Survey of the Carson Valley Conservation District, Nevada
Soil Survey of the Smith Valley Conservation District, Nevada

Langan, Lou N.
Conservation Planning Surveys, Elko County, Nevada

Leifer, Lewis G.
Soil Survey of Bottom Lands of the Meadow Valley Conservation District, Lincoln County, Nevada

McCormick, John A.
Soil Survey of the Mason Valley Conservation District, Nevada
Soil Survey of the Carson Valley Conservation District, Nevada
Soil Survey of the Smith Valley Conservation District, Nevada
Better Land Use in the Moapa Valley, Nevada
Better Land Use, Fernley, Nevada

Naphan, Ed
Humboldt East (Paradise Valley), Nevada
Conservation Planning Surveys, Elko County, Nevada

Olds, Clarence R.
Soil Survey of Walker River Indian Reservation, Schurz, Nevada

Pattengale, Paul S.
Soil Survey of Pyramid Lake Indian Reservation, Nixon, Washoe County, Nevada
Soil Survey of Walker River Indian Reservation, Schurz, Nevada

Reveal, Jack L.
Soil Survey of the South Fork Purchase Tract, Lee, Nevada

Smith, Ralph T.
Soil Survey of the Mason Valley Conservation District, Nevada
Soil Survey of the Carson Valley Conservation District, Nevada
Soil Survey of the Smith Valley Conservation District, Nevada

Swenson, John
Conservation Planning Surveys, White Pine and Elko Counties, Nevada

Taylor, William D.
Soil Survey of the Virgin Valley Conservation District, Nevada
Soil Survey of the Moapa Valley Conservation District, Nevada
Soil Survey of the Pahranagat Valley Conservation District, Nevada

Wallace, Atwell M.
Soil Survey of Pyramid Lake Indian Reservation, Nixon, Washoe County, Nevada
Soil Survey of Walker River Indian Reservation, Schurz, Nevada

Soil Survey Technical Support

USDA Soil Conservation Service

Cosby, Stan
Regional Soil Scientist
Berkeley, California

Fox, Henry
State Soil Scientist
Nevada State Office

Roberts, Ray
Soil Correlator
Berkeley, Calif.

Wohletz, Leonard
Berkeley, Calif.

U. S. Department of the Interior

Galloway, Fred
Northeastern Nevada Cooperative Land Use Study

Jacobsen, Chester
Northeastern Nevada Cooperative Land Use Study

Kennedy, Grant M.
Soil Survey of Pyramid Lake Indian Reservation, Nixon, Washoe County, Nevada
Soil Survey of Walker River Indian Reservation, Schurz, Nevada
Conservation Planning Surveys, Elko County, Nevada
Northeastern Nevada Cooperative Land Use Study, Nevada

Orton, Otis L.
Better Land Use in the White Pine Soil Conservation District, Nevada
Northeastern Nevada Cooperative Land Use Study, Nevada

Shipley, Mark
Northeastern Nevada Cooperative Land Use Study

York, Charlie
Northeastern Nevada Cooperative Land Use Study

The Third Era, 1950 to 1970

Field parties produced many Order 2 soil surveys during this time period. The first of these detailed surveys was the Las Vegas and Eldorado Valleys Area, which was completed in 1957. The possibility of developing land for agricultural uses was the driving force behind starting this survey.

According to Lou Langan, this soil survey had as much utility, if not more, for engineering potential interpretations as for agricultural land potential. Urban development placed increased importance on identifying soils with petrocalcic horizons so that excavation contractors would not lose their shirt planning and installing pipelines across soils with these hardpans.

Jackhammers were first used in 1955 to dig through the extremely hard, indurated petrocalcic and duripan horizons. A backhoe was first used in Nevada a year later to accurately describe soil profiles of soil pits. Ed Naphan and Lou Langan were instrumental in showing the genetic relationships of petrocalcic horizons, and of duripans and their separation. Before using this equipment, these layers were considered equivalent to bedrock. Prior to the late 1970's, Nevada owned and operated its own backhoe. After that time, ownership policy changed and backhoes were rented from that time forward.

The Las Vegas and Eldorado Valleys Area Survey explained why homes had been destroyed because of swelling soils. Salts in the soil became deliquescent at air temperatures of 41 to 45 degrees F. Upon becoming deliquescent, the salts (sodium sulfate) in the soils took on 10 molecules of water in the atmosphere. In so doing, the soil would swell, resulting in a maximum displacement of the house roof as much as 18 inches, and concrete slab floors rose as much as 3 feet. These swelling salts were found in the Land Series. The definition of the Salic horizon in taxonomy started with the Land Series.

Lou Langan was the soil correlator in the Nevada State Office during the latter 1950's. During this time, the third and fourth approximation definitions of soil taxonomy were being tested. Once or twice a year, Lou would travel to the regional office in Berkeley, California, as Lou says "fully prepared," and meet with Guy Smith and representatives of other western states to discuss needed criteria for taxonomic separations. Taxonomic placement problems derived from field mapping in Nevada, such as soil horizons with high temporary water tables and high in salt, were proposed and discussed resulting in a salic horizon. A major accomplishment took place during testing of the third approximation in Berkeley when it was decided that there would be ten Soil Orders. These defined clear-cut separations between soils in the eastern part of the country from soils in the western part. A major accomplishment of the fourth approximation was defining soil families. Soil temperature regimes were also discussed and defined. Spit and polish of the aquic soil moisture regime were applied at these sessions, as well. This provided better representation of the wet soils in Nevada, which are on the "dry end of the aquic spectrum."

The need to recognize very fine and fine textural families came as a result of the final field review for the Lovelock Area. Guy Smith, Lou Langan, Ed Naphan, Bill Johnson, Jack McClelland, and George Harper attended this final field review. Separation of the Humboldt Series and the Ryepatch Series was based on percent clay in the control section. The Ryepatch Series has in excess of 60 percent clay and is placed in a very fine family; the Humboldt Series has 40 to 60 percent clay and is placed in a fine family. Lou is thankful for a molybdenum study conducted by Joe Kubota. The Lovelock Series, which had been determined by field textural analysis to be a silt loam, actually had 70 percent clay, much of which was diatomaceous earth and volcanic ash.

During this time, Ed Naphan was offered a job in Washington, D.C., but declined and stayed in Nevada as state soil scientist. Lou Langan relates that Ed Naphan did more for the soil survey program in Nevada than anyone else did. Lou is thankful for his association with Ed. However, Lou says that when camped in the field, you did not let Ed cook because, if he did, he would fry garlic and that is what you would eat. Also, when Ed chose the campsite, he found the highest, rockiest, driest, windiest place he could find. According to Les McKenzie, Ed said you needed to do that to keep the mosquitoes away.

Conservation planning surveys were still actively being done until the mid-1950's. Les McKenzie was involved with this mapping in Elko County. As range conservationist, Les completed conservation surveys on ranch areas that were dominated by native range. Les indicates that he mapped at a rate of about 1,500 to 2,000 acres per day. Range condition was established by whether the plant community was dominated by increasers or decreasers. Some clipping work was completed to verify range production estimates. It was generally assumed that there were 4 acres per cow per month (AUM) on a typical sagebrush-grass plant community. It wasn't until the mid-1950's before range conservationists in Nevada started to develop range sites.

Les McKenzie remembers, "We started identifying range sites and writing up some kind of description for them in the early 1950's. They had names like Upland Loam, Stony Claypan, Steep South Facing Slopes, etc., that kind of generally described their position and maybe the textures of soil they might occur on. The early site guides were loosely tied to the fractional soil symbols and each had a list of species we thought might occur in them, together with about how much of each would be counted toward the condition rating score. It was more of a consensus thing, developed in a meeting of all the soil scientists, range conservationists, soil conservationists, work unit conservationists, and others that were working with them. Later, we started doing clippings to more closely tie them down. The real "scientific" approach wasn't started until "modern" soil surveys, such as Tuscarora Mountain, were begun."

"In the 1960's, water use-planning money became available and Ed Naphan pursued reconnaissance soil surveys, as the amount of money available was insufficient to conduct Order 2 soil surveys," said Dr. Fred Peterson. "The funds

that were available for these water-use planning surveys were required to go through the University of Nevada, and this is the reason I was hired at UNR."

Major field work for the Tuscarora Mountain Soil Survey was completed from 1960 to 1966. According to Eddie Spencer, this survey was one of three pilot surveys in the United States that was a cooperative effort with the Bureau of Land Management (BLM). The BLM began evaluating the utility of soil surveys for its programs in Nevada in 1961. In that year, the Elko District assigned a range conservationist to work with the SCS soil survey party in the Tuscarora Mountains to evaluate the correlation of soils with potential vegetation relationships, and to determine if soil surveys would facilitate the BLM range inventories. The pilot survey led to the Bureau's policy, issued in November 1964, that soil surveys were not needed for the Bureau's resource management programs. This policy lasted until 1973 when cooperation with the SCS resumed with an interagency agreement for a soil survey of part of the Ely District. [4/]

[4/] Pemerening, James A.; The Soil Survey Program of the Bureau of Land Management Past, Present and Future; United States Department of the Interior, Bureau of Land Management; October, 1980.

Individuals Involved in the Nevada Soil Survey Program from 1950 to 1970

USDA Soil Conservation Service

Alexander, Earl
Reconnaissance Surveys of Railroad and Dixie Valleys, Nevada

Archer, Warren M.
Soil Survey of Diamond Valley Area, Nevada
Soil Survey of Tuscarora Mountain Area, Nevada
Soil Survey of Churchill County Area, Nevada
Fort McDermitt, Part of Soil Survey of Humboldt County, Nevada, East Part

Badura, George
Soil Survey of Surprise Valley-Home Camp Area, California and Nevada

Bagley, Donald G.
Conservation Planning Surveys, Elko County, Nevada
Soil Survey of Virgin River Area, Nevada and Arizona
Soil Survey of Meadow Valley Area, Nevada and Utah
Soil Survey of Surprise Valley-Home Camp Area, California and Nevada

Borup, Harry J.
Soil Survey of Meadow Valley Area, Nevada and Utah
Soil Survey of Carson Valley Area, Nevada
Soil Survey of Pahranagat-Penoyer Areas, Nevada

Candland, David M.
Soil Survey of Tuscarora Mountain Area, Nevada

Cole, E.
Soil Survey of Lovelock Area, Nevada

Davis, Elmer
Conservation Planning Surveys, Eureka and White Pine Counties, Nevada

Dimick, Edwin G.
Soil Survey of Tuscarora Mountain Area, Nevada

Dollarhide, William E.
Soil Survey of Fallon-Fernley Area, Nevada

Downs, Joseph
Soil Survey of Las Vegas Valley Area, Nevada

Endo, A.
Soil Survey of Carson Valley Area, Nevada

Garlick, Glen W.
Soil Survey of Carson Valley Area, Nevada
Soil Survey of Tahoe Basin Area, California and Nevada
Soil Survey of Big Smoky Valley Area, Nevada
Soil Survey of Virgin River, Area, Nevada and Arizona
Conservation Planning Surveys, White Pine County, Nevada

George, C. J.
Soil Survey of Las Vegas and Eldorado Valleys Area, Nevada

Harper, W. G.
Soil Survey of the University of Nevada Valley Road Farm, Nevada

Kennedy, Grant M.
Soil Survey of Tahoe Basin Area, California and Nevada

Langan, Lou N.
Soil Survey of Las Vegas and Eldorado Valleys Area, Nevada
Soil Survey of Pahranagat-Penoyer Areas, Nevada
Soil Survey of Carson Valley Area, Nevada
Soil Survey of the University of Nevada Valley Road Farm, Nevada
Soil Survey of Lovelock Area, Nevada
Soil Survey of Humboldt County, Nevada, East Part
Soil Survey of Lincoln County, Nevada, South Part
Soil Survey of Fallon-Fernley Area, Nevada
Hawthorne Naval Ammunition Depot, Nevada
Fallon Naval Auxiliary Air Station, Nevada
Conservation Planning Surveys, Mason Valley, Smith Valley, and Truckee Meadows, Nevada

Larsen, Leland I.
Soil Survey of Las Vegas and Eldorado Valleys Area, Nevada
Soil Survey of Tahoe Basin Area, California and Nevada
Conservation Planning Surveys, Elko, White Pine, and Humboldt Counties, Nevada

Levitt, Dee
Conservation Planning Surveys, Eureka County

Link, Victor
Conservation Planning Surveys, Elko County

Malchow, R.
Soil Survey of Surprise Valley-Home Camp Area, California and Nevada

Mayhugh, R.
Soil Survey of Lovelock Area, Nevada

Porter, M. K.
Conservation Planning Surveys, Elko and Humboldt Counties, Nevada

Rogers, John H.
Soil Survey of Carson Valley Area, Nevada
Soil Survey of Tahoe Basin Area, California and Nevada

Rooke, Lloyd
Soil Survey of Pahranagat-Penoyer Areas, Nevada
Soil Survey of Diamond Valley Area, Nevada
Soil Survey of Las Vegas and Eldorado Valleys Area, Nevada
Soil Survey of Meadow Valley Area, Nevada and Utah

Spencer, Eddie L.
Soil Survey of Tuscarora Mountain Area, Nevada
Soil Survey of Elko County, Nevada, Southeast Part

Strong, Richard D.
Soil Survey of Tuscarora Mountain Area, Nevada

Summerfield, Harry B.
Soil Survey of Surprise Valley–Home Camp Area, Nevada
Railroad Valley Area, Nevada
Toiyabe National Forest, Nevada, Central Parts of Eureka, Lander, and Nye Counties

Townsend, M.
Soil Survey of Carson Valley Area, Nevada
Soil Survey of the University of Nevada Valley Road Farm, Nevada
Railroad Valley Area, Nevada
Soil Survey of Fallon–Fernley Area, Nevada

Wilde, Russel
Soil Survey of Surprise Valley–Home Camp Area, California and Nevada
Soil Survey of Lyon County Area, Nevada

Williams, Les
Soil Survey of Surprise Valley–Home Camp Area, California and Nevada

Yamamoto, Leo
Soil Survey of Lander County, Nevada, North Part

University of Nevada, Reno

Peterson, Frederick F.
Program Leader, Agricultural Experiment Station
Railroad Valley Area, Nevada
Author, *Landforms of the Basin and Range Province Defined for Soil Survey*

USDI Bureau of Land Management

Luscher, Charles W.
Soil Survey of Tuscarora Mountain Area, Nevada

Soil Survey Technical Support

USDA Soil Conservation Service

Campsey, Leland, Range Conservationist
Dimick, Ed, Range Conservationist
Halliday, Blaine, Range Conservationist
Harmer, Renee, Secretary (~1956-1985)
Hatch, Sumner, Area Conservationist, Reno
Hugie, Vern, Soil Scientist
Kimsey, Dwight, Range Conservationist
Langan, L. N., Soil Correlator (1950-1969)
Lysne, Luella, Secretary (1956-1986)
McKenzie, Les, Range Conservationist
Mullins, Gene, Range Conservationist
Palmquist, Dale, Backhoe Operator
Passey, Howard, Range Conservationist
Summerfield, Nancy (Harris), Cartographic Technician (1966-1977)

USDI Geological Survey

Morrison, Roger, Geologist

Soil Survey Program Direction and Management

USDA Soil Conservation Service

Naphan, Ed, State Soil Scientist, Nevada State Office

The Fourth Era, 1970 to 1978

Lasting Friendships

Carole Jett

I will never forget when I first met Lou Langan. It was at Soil Mechanics in Portland, Oregon, where he was one of the instructors. It was about 1976 and I was a newly promoted GS-7. I was arrogant as hell. Lou really kept riding me about Nevada and asking me questions in detail about the textural triangle and aerial photos and blisters and going to the bathroom in the field. I was, of course, irritated at this. I kept answering his questions and he kept pressing me until I blew up. When I tore into him, he started laughing like only Lou could do and said to me, "That's the exact same look you gave me when I fouled you out of your basketball games at Swope Junior High School!!!" It all came flooding into my memory. When I was in the 8th-12th grades in Reno, I played basketball. Lou was a very picky referee and I fouled out more than once. What a surprise to discover this former acquaintance. We became friends and I never blew up at him again, no matter how he pressed. What a guy. So I came into the soil survey with a friend.

Individuals Involved in the Nevada Soil Survey Program from 1970 to 1978

USDA Soil Conservation Service

Anderson, Jon (USDA, Student Trainee)
Soil Survey of Washoe County, Nevada, South Part

Archer, Warren
Soil Survey of Storey County Area, Nevada
Soil Survey of Lyon County Area, Nevada

Baumer, Otto W.
Soil Survey of Washoe County, Nevada, South Part
Soil Survey of Washoe County, Nevada, North Part

Blackburn, Paul W.
Soil Survey of Washoe County, Nevada, Central Part
Soil Survey of Douglas County Area, Nevada
Soil Survey of Humboldt County, Nevada, West Part

Blake, Edward W.
Soil Survey of Washoe County, Nevada, South Part

Candland, David M.
Soil Survey of Carson City Area, Nevada
Soil Survey of Douglas County Area, Nevada
Soil Survey of Big Smoky Valley Area, Nevada

Chadek, Ronald (USDA, Student)
Soil Survey of Washoe County, Nevada, South Part

Dollarhide, William E.
Soil Survey of Washoe County, Nevada, South Part
Soil Survey of Fallon-Fernley Area, Nevada

Dougherty, Brian
Soil Survey of Elko County, Nevada, Central Part

Duckworth, William
Soil Survey of Lyon County Area, Nevada

DuRousseau, Joseph
Soil Survey of Lyon County Area, Nevada

Fisher, John B.
Soil Survey of Washoe County, Nevada, South Part

Gorham, John (USDA, Student Trainee)
Soil Survey of Washoe County, Nevada, South Part

Jett, Carole E.
Soil Survey of Washoe County, Nevada, South Part

Larsen, Leland I.
Soil Survey of Washoe County, Nevada, South Part
Soil Survey of Humboldt County, Nevada, East Part

Leavett, Verr Dee
Soil Survey of Virgin River Area, Nevada

Lunden, Eugene
Soil Survey of Western White Pine County Area, Nevada
Soil Survey of Lyon County, Nevada

Mayfield, George
Soil Survey of Washoe County, Nevada, South Part

McKay, Thomas R.
Soil Survey of Las Valley Area, Nevada

Mitchell, James
Soil Survey of Lyon County Area, Nevada
Soil Survey of Carson City Area, Nevada

Slusser, Steve
Soil Survey of Elko County, Nevada, Central Part
Soil Survey of Humboldt County, Nevada, West Part
Soil Survey of Humboldt County, Nevada, East Part

Smith, Robert
Soil Survey of Elko County, Nevada, Central Part
Soil Survey of Elko County, Nevada, Northwest Part

Staidl, George J.
Soil Survey of Lander County, Nevada, North Part
Soil Survey of Tuscarora Mountain Area, Nevada
Soil Survey of Elko County, Nevada, Central Part
Soil Survey of Eureka County, Area, Nevada

Summerfield, Harry
Soil Survey of Surprise Valley–Home Camp Area, California and Nevada
Soil Survey of Humboldt County, Nevada, East Part
Humboldt National Forest Area, Nevada, Parts of Elko and White Pine
Toiyabe National Forest, Nevada, Central Parts of Lincoln, Nye and White Pine
Soil Survey of Mineral County Area, Nevada
Soil Survey of Esmeralda County Area, Nevada

Woodruff, G.
Soil Survey of Virgin River Area, Nevada

USDA Forest Service

Bare, Norm
River Basin Survey

Private

Cox, Dellon N.
Soil Inventory of Tonopah Range Environmental Impact Statement Area, Nye County, Nevada

Gibson, T. Scott
Soil Inventory of Tonopah Range Environmental Impact Statement Area, Nye County, Nevada

Knecht, Arnold
Sevenmile Wash Area, Nye County, Nevada
Monitor Area, Nye County, Nevada

Soil Survey Technical Support

USDA Soil Conservation Service

Arnold, Harlan, Range Conservationist, Eastern and Southern Nevada

Campsey, Leland, Range Conservationist, Northern Nevada

Chamrad, Dean, State Range Conservationist, Nevada State Office

Fitzjames, Barry, Cartographic Technician, Nevada State Office (1977-1979)

Harmer, Renee, Secretary, Elko Field Office (1956-1985)

Kimsey, Dwight, Range Conservationist, Northwestern Nevada (1969-1972)

Lysne, Luella, Secretary, Nevada State Office (1956-1986)

McLain, John, Range Conservationist, Western Nevada

Mullins, Gene, State Range Conservationist, Nevada State Office

Palmquist, Dale, Backhoe Operator

Reil, John, Range Conservationist, Northern Nevada (1967-1978)

Spencer, Eddie L., Soil Correlator, Nevada State Office (1969-1976)

Staidl, George, Soil Correlator, Nevada State Office (1976-1988)

Sterns, *(first name unknown)* Range Conservationist, Winnemucca Field Office (1973-1975)

Summerfield, Nancy (Harris), Cartographic Technician, Nevada State Office (1966-1977)
Yeager, Bob, Range Conservationist, Western Nevada (1972-1975)

Soil Survey Program Direction and Management

USDA Soil Conservation Service

Bagley, Don, Assistant State Soil Scientist, Nevada State Office (1950-1976)
Dollarhide, William E., Assistant State Soil Scientist, Nevada State Office (1976-1990)
Naphan, Ed, State Soil Scientist, Nevada State Office (1950-1984)
Price, Boyd, State Range Conservationist, Nevada State Office

USDI Bureau of Land Management

Evatz, Ed, Chief of Resources, Nevada State Office
Linnel, Lyle, State Soil Scientist, Nevada State Office
Spang, Ed, State Director, Nevada State Office (1975-1986)

USDA Agriculture Research Service

Evans, Ray, State Director, Reno
Young, James, Nevada Range Research, Reno (1970-present)

University of Nevada, Reno

Dunn, Larry, Research
Peterson, F. F., Research
Young, Ralph (1969-1975)

The Fifth Era, 1978 to 2000

Working Together

William E. Dollarhide

The 1978 to 2000 era of soil survey in Nevada began with a 1977 court ruling. The National Cooperative Soil Survey in Nevada was about to make a drastic shift. The Bureau of Land Management (BLM) was faced with gathering soils information on more than 50 million acres in a relatively short period. This was a major dilemma with many debates as to how to accomplish this task. At that time, the BLM had no field soil scientists, relatively few private consultants available, and lots of questions about bringing in crews for only short periods who were not familiar with the area, but still requiring quality work from them. The SCS had a history and a reputation for the quality needed, but there was no history of mapping at a rate that could get the job done. The initial attempt was through contract, however, in new country, with new soils, new range sites, and no real provisions for quality control, things were difficult.

With the next attempts, BLM solicited SCS for the quality control. This again was difficult, costly, and a learning curve for all, but a glimmer of hope prevailed. In 1977, Chet Connard, district manager at Winnemucca, hired the first BLM field soil scientist with the intent of mapping soils. The negotiations with SCS had been ongoing. If SCS were to do the job, it would require a great increase in personnel, more vehicles, and equipment. To do this would require a long-term (10-year) commitment. There was still doubt: Could SCS map at the rate needed?

Informally, the agencies agreed to use the Lahontan Environmental Statement Area as a test. It consisted of 2.2 million acres and the data was needed in 2 years. SCS assigned a range conservationist and two project leaders to the task, placing three soil scientists on each of their staffs. The BLM provided a soil survey office, hired a clerk, provided a soil scientist to work on the crew, and assigned a range conservationist to assist. A new chapter in cooperation of the National Cooperative Soil Survey had begun.

The Winnemucca BLM District had a crew of soil scientists and a range conservationist with a project leader working in the Owyhee Desert area. Crews consisting of various combinations of SCS and BLM soil scientists and range conservationists were scattered around the state. At a peak point,

SCS had 31 field soil scientists and BLM had 13 soil scientists, supported by 10 range conservationists between the two agencies, all mapping soils.

With major participation from two disciplines from two agencies, and without an exact pattern to follow, there were many debates. Sometimes, the tension was great, but professionalism prevailed, and we all learned from each other.

During this same period, the Order 3 soil survey was being defined and tested. The previous "low intensity" surveys were not meeting management needs, and soil/site correlations were not consistent. There was a need to delineate relatively broad landscapes so the survey could be completed in an economical and rapid fashion. There was a need to have a hierarchy of landscapes with major physiographic parts and major landforms to relate and distinguish map units with each other throughout a survey area. Component landforms, landform elements, and slope components were needed to place each soil component and inclusion within each map unit and to do it in a consistent manner. In 1981, Dr. Frederick F. Peterson published *Landforms of the Basin and Range Province Defined for Soil Survey*. This publication provided a communication link and allowed range specialists to see the landscapes in a similar manner as soil scientists. It also provided the means for soil scientists and range specialists to begin to see the relationships of landforms/soils/plant communities.

There was a need to have a hierarchy of landscapes with major physiographic parts and major landforms to relate and distinguish map units with each other throughout a survey area.

To meet the customer needs, it took effort and learning from everyone involved in the process, and his or her efforts are truly appreciated. However, without the publication from Dr. Peterson, and the special effort by Gary Brackley, state range conservationist, NRCS, to learn the soil-plant (site) relationship and provide the technical leadership to other range conservationists, the quality of the product would not be what it is today.

Kamikaze Cow

Warren Archer

One day, as I was driving up a dry wash in the Pine Grove Hills, a cow fell from the sky, missing my truck by just a few inches. I thought this was rather strange so I investigated to see if I could find out where the critter came from. Apparently what had happened was the hapless cow had been grazing too close to the edge of a very steep slope. Presumably, the cow got nervous or excited because it hadn't seen a truck before, lost its footing, rolled to the edge of the cliff, and fell over. What an interesting accident report that would have made had the cow's aim been a little better. When I came back down later on, it was still twitching so I put it out of its misery with a pick handle. It belonged to Baron Hilton of the Hilton Hotels. Its loss didn't cause the collapse of his hotel empire.

. . . a cow fell from the sky, missing my truck by just a few inches.

The Twilight Zone

Warren Archer

Some days you seem to pass into another dimension. Up until noon, all had been routine while working on the Conservation Needs Inventory. I had finished the job I had to do on the Quinn Canyon Range in east central Nevada and stopped to eat lunch on one of the peaks. I wanted to get back to Tonopah as quickly as possible to work on the report.

The trip was well over a hundred miles of poor roads to go back the way I came. Having no map of the area, I decided to navigate by dead reckoning, taking a road that headed in the right general direction. The road looked good starting out, but as most unimproved tracks seem to do, it began to get narrower and less traveled. Ahead of me, there was a steep gravely down grade that I wouldn't be able to climb out of even with four-wheel-drive truck. Over I went, committed to whatever lay before me. It wasn't too bad for the first mile or two, and then the road began to disappear. I had to build the road as I went, filling gullies, moving rocks, etc. The road finally started getting better and it eventually broke out of the canyon onto an alluvial fan in a large valley. Where on Earth was I? The road began veering in the wrong direction; having no choice I had to follow it. Off in the distance, I could see a cloud of dust from another vehicle. Good, I thought. I'll soon be able to ask someone how to get back to Tonopah. When I finally got to the vehicle, it was a pickup driven by a woman, with six or so dogs in the cab with her and at least twice that many in back. She stopped and began frantically chasing the dogs, trying to keep them from running away. She said she was in a hurry, she had to fix a water trough so her cattle could get a drink. I asked her how to get back to Tonopah. She asked if I wanted to go the long way or the short way. The short way would be best, of course, or so I thought.

So, following her directions, another part of this debacle began. It wasn't long before I noticed some A-6 attack planes flying maneuvers off to the left. Suddenly, they came right at me and began buzzing the truck, one right after the other. After awhile, they tired of their little game and flew away. A short time later, an F-16 came straight for me about 10 feet off the ground. It about blew my ears off when it went over! Then, the A-6's were back with their antics along with some more F-16's. It seems the "dog lady" neglected to tell me that the short cut went across the Air Force's Nellis Bombing and Gunnery Range. They probably thought, "Here's a live one. Let's have some fun."

. . . they came right at me and began buzzing the truck, one right after the other.

The "dog lady" is probably still chuckling.

Stuck in the Mud

Warren Archer

One of the hazards associated with this job is getting one's vehicle stuck in the mud, sand, snow, or having a mechanical failure. Since we had to drive off of the road much of the time, dealing with these problems added a little color to our lives. Many times we would have to walk many miles to get help if we couldn't extract the truck or fix the problem.

One scenario, in particular, remains in my mind. It happened first thing one morning in Steptoe Valley, about 30 miles north of Ely. It seems that a layer of stable soil overlaid a thick layer of saturated lacustrine sediments with no bearing strength. Without my realizing it, the stable surface soil got progressively thinner as I traveled down the slope. Suddenly, all four wheels of the truck broke through the thin surface at the same time.

After a couple of hours of cutting brush to put under the wheels, shoveling, and trying to lift the truck with a jack to no avail, I decided to seek help.

After a couple of hours of cutting brush to put under the wheels, shoveling, and trying to lift the truck with a jack to no avail, I decided to seek help. I walked to a ranch 4 or 5 miles away and asked to get pulled out. They agreed and took their truck to the rescue. They didn't get within 200 yards of my truck before they were in the same predicament. Off we went back to the ranch for the tractor. The same process was repeated with it. Again we returned to the ranch to get the Caterpillar tractor this time. Yes, we got it stuck, too! Finally, we walked back again, got a flat bed truck, loaded it with chains and railroad ties, and then returned to the scene of our tribulation. After carrying the ties to the Cat and chaining them to the tracks, we were able to get it up out of the mud. By laying the ties in front of the Cat, we were able to pull the other vehicles to solid ground. Upon leaving the unhappy ranchers with my profuse apologies, I finally returned to Ely at about 9:00 p.m.

Lessons Learned the Hard Way

Paul W. Blackburn

My first experience with government vehicles was at the Winnemucca Field Office when I started as a student trainee. Lee Larsen, the party leader, and I were going to make a long day trip to the east side of the Bilk Creek Mountains. The vehicle of the day was an International 4X4 pickup with a Giddings Augar mounted in the bed. This truck was a gas hog. Lee and I left Winnemucca with a full tank of gas and two full five gallon gas cans, thinking this would be plenty of gas to complete our planned trip. The gas gauge of the truck was on empty while still in the Bilk Creek Mountains so we emptied the gas cans, completed our day's mapping and headed home. About 3 miles from Winnemucca, the International coasted to a stop. Lee and I hitched a ride into town where we filled one can and returned with a friend of Lee's to the International. A long day had finally ended.

. . . one of the cardinal rules of back road travel: Never go down a road you can't get back up!

While scouting areas to be mapped during the spring of 1980, Terry Bowerman and I learned one of the cardinal rules of back road travel: Never go down a road you can't get back up! Terry and I were traveling roads in the Tuscarora Mountains which were very passable except for the occasional residual snow drift that covered some of the trails on north or east slopes. I was driving down a road that was adjacent to a small stream that was full with spring runoff. The stream, for some reason, had left its natural channel and had captured the right wheel rut for its new streambed. As this diversion was only for what appeared to be a short distance, I attempted to straddle the right wheel rut that contained the stream. This attempt eventually failed as I became mired in the mud on the right side. As the vehicle was pointed downhill and the distance left to go before the stream left the road and went back to its natural channel was not far, neither Terry nor I were too concerned. We went through the usual inconvenience of digging the vehicle out and were soon back on dry ground. Our real trouble lay ahead as we could not get back up the short distance to where we had come from. All roads that were available to travel from this point on were either washed out or were covered with a snowdrift. Terry and I finally had no choice but to exit the mountains cross-country and traverse the flooded meadows at the south end of Independence Valley. Our mistake had cost us an extra 3 or 4 hours. One other cardinal rule was learned this day: Never take unnecessary chances late in the day.

Fire was always a problem to be dealt with while in the field. The source of the fire was the catalytic converter on the field rigs. Each vehicle had its own level of fire hazard depending on the make of the vehicle, ground clearance, and location of converter in relation to skid plates protecting the

transfer case. Other variables consisted of the type of country you were mapping; whether there was access to roads with no brush or brush with limited height; whether or not it had been a wet year with good herbaceous growth; or simply the time of day or year. There were days that would get bad enough that we had to clean the glowing embers from the area adjacent to the converter many times a day. Without this diligence, I'm sure we would have started a few range fires.

Twice I have had a nice blazing fire underneath my vehicle while in the field. The first time I had pulled my vehicle into the wind and stopped to discuss a mapping concept. Smelling smoke, I made the usual check and discovered the fire. Informing the passengers that the vehicle was on fire, they immediately bailed out. Adding to the urgency of the fire was that the fire had melted the fuel line, which was plastic, and we had dripping gas adding to the flames. I learned proper use of a fire extinguisher this day, also. Holding the extinguisher in my left hand I could not pull the pin from the handle to activate the spray mechanism. I handed the inoperable extinguisher to Roy Kaiser, the range conservationist and also a volunteer fireman. Roy quickly pulled the pin and put out the fire. In my excitement, I had squeezed the handle so tightly that I could not remove the pin. Needless to say, I felt pretty stupid!

The other fire I extinguished under my field rig was on Connors Pass in White Pine County. The vehicle I was using this day was notorious for smelling of smoke due to the muffler that would get coated with oils from sagebrush and these oils would slowly smoke off. On this particular occasion, when I smelled smoke, I thought this was just going to be another smoke-off, but I decided I better stop just as always and make sure. Fortunately I did, as there was quite a fire going. Most of what was on fire was very difficult to get at as it was trapped in tight areas adjacent to the frame. I lay under the vehicle for about an hour and a half digging out the embers until I was satisfied I would not leave a burning trail the rest of the way to Ely.

Stranded

Alan Wasner

The summer of 1980 was very hot. Terry Bowerman and I were staying alone at the camp, but one evening, Terry had not returned. He had spent that day in the field with Range Conservationist Gary Brackley. Since it was around 7:30 p.m., I drove out to where they were working as fast as I could to beat the encroaching darkness. As I drove down one of the large roads near Tuscarora, I saw a lone figure up ahead in the road. As I approached, the figure dropped to his knees in the roadway! It was Gary! This did not bode well and many thoughts went through my mind like, "What has happened?" "Where is Terry?" "Are they injured?" It turned out that Gary was fine, just very thirsty. The walk out was longer and hotter than it appeared, and he had graciously left most of the water with Terry, who had decided to stay with the truck, knowing I would come to get them. Gary led me to where Terry was and we all made it back to camp by midnight.

Later one evening, after Soil Scientist Rod Douglass had joined the crew, both Terry and Rod failed to return to camp. I raced out to where I knew Terry was working, as he was closest. There was Terry's Jeep standing on its nose at about a 75-degree angle with its rear wheels five feet off the ground right in the middle of the road. The road was a typical flat dirt road that appeared totally dry. But Terry had driven into a spot, where, just below the dry surface of the soil, a spring had opened up, saturating the substratum. Terry had driven over this spot many times before. It had come as a rather abrupt shock when the road had opened up and the truck had plunged straight down. Terry told me, "Put a chain on this and pull me out." I said, "We can't! We have to find Rod before it gets dark!" (He was amazed that two of us would become stuck on the same day.) So, we raced out to where Rod was - a full hour away in the darkening desert. As we came around a bend, there was Rod's truck with the hood up. The Jeep J-10 he had was notorious for breaking rotors and Rod had already used the only spare. We could see where he had attempted to tape together a replacement. But there was no sign of Rod. We started driving slowly back the way we had come, honking the horn, and after about 8 miles, there was Rod in the road. He said, "Hey, you guys drove right by me." I said, "How could we do that?" He said, "Well, that was because I was so tired, I laid down beside the road to rest and fell asleep." Fortunately, both of my searches were successful and no one was hurt.

We realized the "blue box" was the bed of his truck standing perfectly straight up in the field.

Another time when Rod did not show up at the designated meeting place, Terry and I went looking for him. We found him out in the middle of the

Mary's River floodplain standing next to a large blue box. We could not figure out what this odd box was standing up in the middle of the field until we got closer. We realized the "blue box" was the bed of his truck standing perfectly straight up in the field. Rod had accidentally driven it into a huge gully that had been camouflaged by tall grass. He wasn't injured but was very embarrassed.

The only time I really got badly stuck was trying to get into the extreme northeastern part of Elko County where it meets Idaho and Utah. This area is very rugged with a lot of streams. The only way I could get into this area was across a very muddy creek that had very eroded banks. I had to go in there to map this area so I spent several hours with a shovel working on the banks so I could get across. But my best-laid plans failed me because when I tried to cross the stream, I became stuck in the middle with water up to the windows all the way around the rear half of the truck. The front end was part way up the far embankment but I could not get enough traction to get up, and it was just far enough out of the water to not stall. What I had to do to get out of this was jack the rear of the vehicle up and put stones and boards under the rear wheels. This meant, standing in chest deep mucky water, I had to reach down and place a large flat piece of plywood under the handyman jack. We carried wood just for such emergencies. Then I was able to jack the rear of the vehicle up enough to get stuff under the rear wheels. It was really hard because the jack was all wet and muddy and kept slipping while I was behind the truck in the stream, and I had to put the jack at an angle. I had to be careful. It took almost all day to find and put enough rocks under the rear wheels to finally get out. But then, of course, I was inside this hard-to-get-to area, completely covered with mud from head to toe. I'm glad no one saw me. I ended up spending another day working on the mud hole crossing, diverting water, and draining it. I also spent time trying to find another way out of there but the two other roads were even worse. To walk out of this place would have been over a 50-mile trek. I should have waited a few weeks until things dried out more, but we were so gung-ho in those days, with large acreage goals, that usually we didn't let ANYTHING stop us. I ended up spending several workweeks in this area mapping.

. . . you just had to take it slow so as not to damage the truck.

While trying to find another way out of this area, I had to skirt around a large mud hole in the middle of the road by slowly driving through the basin big sagebrush. I had done this many times and never had a problem; you just had to take it slow so as not to damage the truck. Well, I hit a stump of sagebrush just right and it pulled off the right front brake line. I immediately realized what had happened, as the brakes became mushy. I found a flat rock and pounded about 6 inches of the brake line flat and then folded it back on itself to stop the flow of leaking fluid. Then, I put the can of brake

fluid I carried into the system, but it still was not full as I had lost a lot of fluid. This was not as bad as it sounds as I was in a very powerful truck with a manual transmission so I could use engine braking. But some of the mountains were very steep and coming out of there, I had some very tense moments with mushy brakes. By the time I got back to the office, a 5-hour drive, the brakes were pretty much gone. When I reached the GSA shop, I had to stop by just dropping the clutch while in second gear, which made the GSA mechanic come out and ask if I needed lessons in how to drive a manual transmission. He calmed down when I explained what had happened.

Another time, while straddling a deep gully in the middle of the road, I slid into it with the right side of the vehicle. With a handyman jack, this was usually a simple problem to fix. However, in this predicament, I had to jack the vehicle up almost to the top notch on the jack. While I was carefully putting stones under the jacked up wheel, the truck suddenly fell off the jack. I was fine, as I always stayed clear of the vehicle in case it fell, but the jack was gone! It was not under the vehicle. I looked around and, to my amazement, it was about 12 feet behind me in the road. It had come off the truck with such force that it had flown right past me and landed in the road.

Once during the monsoon season, we actually had flash floods in Elko County. Roy Kaiser, Dennis Worrel, and I went out to the main road to find it missing. A flood had come down a canyon and completely washed the road away, leaving a gully about 30 feet deep and 100 yards across. Luckily, the banks were gentle enough and the material solid enough that we just drove right across this devastated area. But, we did have to chain up all four wheels and we had Roy drive as he had the most experience driving under such extreme conditions.

The Wrong Stuff

Warren Archer

We were working on a survey of the mountain range east of Pyramid Lake, using a helicopter to get around. We came in for a refueling stop, then as we took off and got up a couple of hundred feet or so, the engine began popping and the helicopter began shaking violently. The pilot was able to make a successful forced landing, but the repairs that had to be made came to about $40,000. It seems that the fuel truck had been given a load of jet fuel instead of av-gas. Normally we used the Bell Jet Ranger, but we happened to be using the old model 47 Bell on this particular job, and the fuel person at Reno Flying Service made a mistake. Bill Dollarhide and his partner had been stranded up on the hill overnight that night. We found them the next morning, cold and in bad spirits, but otherwise OK.

Quick Thinking

John L. Swenson

One time we were working up north of the Petan Ranch nearly to the Idaho border. The pilot of the helicopter picked me up about 3:30 p.m. urging me to hurry. We flew back to where we had parked the supply truck. It seems that the pilot had forgotten to bring his pump to refuel the helicopter from his gasoline barrel. Richard Trenholme, a member of the party, was still out a considerable distance and the pilot did not have enough fuel in the helicopter tank to go get him. We were concerned because Richard was faced with the prospect of spending the night out in the desert. It was early October and the nights were cold, near freezing. There were three of us at the helicopter: the pilot, Les Beardall; another crew member; and me. Fortunately there was a siphon hose in the truck, which we decided we could use if we could get the truck on high ground with the helicopter below it. We remembered a road cut down the road a short distance. The pilot flew to the cut, which fortunately was wide enough to accommodate the rotors. Then, we got the truck up on the bank above it. We had to waste some gasoline, as we could not lift the barrel up on the cab of the truck when it was full. We were all overjoyed when we finally got the siphon going. The sun was just touching the western horizon when the pilot concluded that he had enough fuel to go get Richard and still get to our camp at the VN Ranch.

Helicopters—An Indispensable Tool

Paul W. Blackburn

In 1978, Dave Candland, the party leader for the Douglas County soil survey, contracted with Pine Belt Helicopters to complete mapping in areas of the Pinenut Mountains. To effectively use the helicopter, Dave established several teams composed of both a range conservationist and a soil scientist that would be moved from place to place in a leapfrog fashion. This was my first experience with helicopter soil survey but was definitely not the last. We also used helicopters to lift us to inaccessible areas of the Pinenut Mountains and Wellington Hills. The helicopter available for this was the B1 with the large bubble windshield. This helicopter could only carry one of us at a time. To gain enough lift to carry us to the top of the steep east face of the Pinenut's, the pilot would make a series of loops in a cork screw fashion flying close to the mountain accessing up-slope drafts. On one occasion, the preselected landing site was heavy with basin big sagebrush in a small intermountain valley surrounded by Pinyon-Juniper woodland. To land safely, the pilot directed me to hang my head out the door and ensure that the tail rotor was clear of the sagebrush as he carefully landed. Once we were dropped off, we would map our way off of the mountain winding up at our vehicles that we had spotted earlier in the day.

Since 1980, all surveys in Elko and White Pine Counties at some time used helicopters to complete mapping in mountainous areas. In northeast Nevada, September was the month of choice to do helicopter survey, as the helicopter was finished with the BLM fire contract and the weather in September is usually clear and calm. Not only was it considered undesirable to fly in stormy weather, but also, it was rather uncomfortable to wait at a drop site, which was usually on a ridge top, while a thunderstorm developed overhead.

When working in Lander County, we engaged in a helicopter survey in November. While in the field, the weather had changed and the afternoon was getting rather windy. The helicopter being used was a B1. Since it was cool, the machine could carry two of us. Karl Scheetz and I were dropped off on a ridge top where we were to descend a steep north slope and meet the helicopter at the bottom of a deep canyon. When we met the helicopter at the bottom, the pilot told us he didn't know if we were going to be able to get out of the canyon as the winds had picked up considerably. Fortunately, the pilot lifted off and managed to exit the canyon even though we were buffeted around quite a bit.

In the early 1980's, most of us either received formal or informal training in helicopter safety and etiquette, such as getting the nod from the pilot that it

was either OK to get out of the helicopter or to approach the helicopter at a drop site. Everyone took these issues seriously and no accidents ever occurred.

About this time, we were required to wear flight suits, helmets, lace-up leather boots and all cotton clothing during all flights. I do not always wear gloves because they inhibited the shuffle of aerial photos that were necessary to select the next drop site.

Since we were using helicopters to help map the most inaccessible and remote areas, we would do a lot of preliminary work in advance. Then the helicopters would get us into those difficult areas to verify what we predicted would be present. The two crews in Elko were commonly combined into teams, which maximized the area mapped as well as minimized downtime for the helicopter. The leapfrog manner of moving the teams was utilized as before in Douglas County, which proved to be very efficient.

Exciting times on helicopters for me have included flying in a “bird” with no doors; standing at a predetermined spot to guide the pilot back to the exact spot he had dropped us off so that the tail rotor would clear the basin big sagebrush found on the landing site; and, last, but not least, assisting with a power check. While doing helicopter work in White Pine County in 1987, Gary Brackley and I were picked up from the last drop site of the day. After we were airborne, the pilot handed me a small note pad and pencil and informed us that he was about to perform a power check. He brought the machine to a hover several thousand feet off of Steptoe Valley and brought the torque on the rotors to 100 percent. As he did this, I recorded the numbers he was reading from the gauges. The test was over quickly and I handed the note pad back to the pilot. However, it was now stained with mud from my hand, which was rather sweaty from the anxiety I felt during the power check.

In their successful attempt to obtain a representative description needed to establish the Eganroc Series in White Pine County, Ian Reid and Leon Lato had to exit the helicopter while it hovered over a narrow rock outcrop ridgetop that was not suitable for landing. I’m not sure how or where they were picked up.

Helicopters were an absolutely indispensable tool for the timely completion of soil survey mapping of the mountains of Nevada.

Backhoes

Paul W. Blackburn

Backhoes were as indispensable as helicopters to the timely completion of soil surveys in Nevada. Why? They can dig pits quite rapidly, exposing the soil profiles so that they can be accurately described to the prescribed depth. Backhoes were obtained from two sources. These sources were BLM and the private sector, which included local heavy equipment operators or local farmers or ranchers. When not tied up for fire season, the BLM Unimogs were available for our use in the field to dig pits. These machines had a backhoe attachment that was used to mount a backhoe. This arrangement was very cost effective as we were using government equipment supplied to us by BLM. An added benefit was that the machines, along with the operator who dug the pits, could go back to these holes and backfill them once we gave the OK to do so. The disadvantage to this arrangement was that the Unimogs were unavailable for the better part of the mapping season because of the fire season. When the Unimogs were unavailable, we resorted to contracting with the private sector, which usually was a local farmer or rancher who had a backhoe and the means and willingness to move it and operate it in remote areas.

Of all the operators we had, Marvin Jesson and Bob Burton were the most dependable and enjoyable to work with. They were very accommodating with our desires on pit placement, depth, and location even after they had bounced over miles of dusty road during very hot days or during some pretty intense thunderstorms. Like helicopters, we utilized backhoes to dig pits in soils that we already had a pretty good idea what they were from our small hand dug mapping holes. This maximized efficiency. Using the backhoe as a mapping tool was discouraged, as it was rather expensive. There was also the added hazard of muddling series concepts with an excessive amount of unnecessary detail from too many descriptions.

In about 1983, while working on the Elko Northeast Soil Survey, I arranged to meet a backhoe operator that we had contracted to do some work in an area of Shores Siding. I met the operator along Highway 93 where he had pulled his semi off of the highway. However, as it turns out, he was stuck and could not pull back onto the highway. It was during the spring and the shoulder of the highway was muddy. Without any discussion of how best to handle this situation, the operator climbed into the cab of the backhoe, started it up and proceeded to maneuver the backhoe sideways on the trailer. He extended the arm of the backhoe into the northbound lane of

Highway 93, which sent me scurrying to stop oncoming vehicles. Deftly using the arm and the front bucket, the operator lowered the backhoe to the pavement and we went to work.

As interesting as it was to watch this fellow unload the backhoe, he had an equally hazardous method of loading the backhoe that took place at another location. To get the backhoe up on the trailer of the semi, this man employed a ramp fashioned from two tree stumps and two railroad ties. The stumps were placed equidistant from the end of the trailer and the railroad ties were placed on top of the stumps and angled against the rear edge of the trailer. As he attempted the impossible, the backhoe rolled off of the ramp and landed on its side. This man was smart enough, or he had done it before, but he stayed in his seat and held onto the steering wheel as the backhoe hit the ground. This fellow had already lost one leg in some kind of prior accident.

The only real down side to using backhoes was the time necessary to accompany them for backfilling operations if you could not get the same guy who dug the pits. This was very frustrating and, indeed, there are pits still open today that were never backfilled.

Fearless

Alan Wasner

The crew at this time consisted of Paul Blackburn, Leon Lato, Dave Pickel, Ian Reid, and me. We were mapping near Currie, Nevada, and Paul got a backhoe contract with a local rancher. I soon got to meet the ranch's only hand, a young fellow who was in his twenties. My first experience with him was when he took the backhoe out to the work site on an ancient flatbed truck. He had no way to get it off the back of the truck, no ramps or boards, so he just drove it off the back of the truck promptly tipping it over on its side. To my surprise, he got it upright and we were able to do our job, for awhile. Then he ran out of gas and had no reserve. Several times during the work, he tipped the backhoe over or operated it in an unsafe manner. I chided him and tried to get him to be more careful, and he did try.

He was a very interesting person and friendly. I found out one time, when I had to have him sign a statement of the hours he had worked, that he could not read or write. He looked at the statement for the longest time, studying it intently. Then he asked me where he was to sign, and I showed him. He then, with the greatest deliberation, signed a great big "X". He had me come by and meet his girlfriend at the ranch one time. They lived together in a one-room house made out of railroad ties with a dirt floor and no windows. I found out that all they had to eat were fish from the alfalfa irrigation ditches and crab apples from an old tree. I started bringing them food each week after that. We worked on and off a lot that summer together. I heard he had later been killed in a train versus car accident in Oregon.

Field Living Accommodations

Paul W. Blackburn

Regardless of when you worked on soil surveys, 80 years ago or today, it becomes a way of life. Most of us involved in soils mapping in Nevada have spent the majority of time either camped out in the field or checked into some motel near the survey area. Camping out on surveys in Elko County consisted of pulling a BLM supplied travel trailer to some remote location centered within the area to be mapped. In this respect, life in the field had not changed that much from Grant Kennedy's accounts of field living arrangements in 1938. Camp trailers were placed in Midas, Currie, and a few other choice locations, some of which were quite beautiful. However, most of the time there was a motel, located in some small community that was not too far from the area to be mapped, for the whole survey crew. Motel accommodations were preferred as not only could one get reasonably cleaned up with a hot shower but also there was usually a restaurant somewhere close to the motel. Having someone cook your meals was a luxury that was not taken for granted, even when the food selection and variety were not that good.

Working out of a camp trailer also required an extra time commitment on weekends. Groceries had to be purchased on Sunday, properly packed and cooled for the upcoming week. All necessary camping gear, propane for the trailer, extra gasoline for the vehicle, etc., required a lot of extra time on Monday mornings. Having to face cooking your own meal after 10 hours in the field, day after day, week after week, was just not something I looked forward to doing.

In the summer of 1980, five of us on Terry Bowerman's crew dry camped at the "Falls" below the outlet of Wilson Reservoir. We were at this location while we were mapping the Elko County Northwest Soil Survey. We each used our own camping equipment, if we had any, or some of us, like myself, just unrolled a sleeping bag and slept in the back of a Jeep Wagoneer. Other than the good company of the party and the banter around the evening campfire, this was a miserable summer. Many days were very hot with temperatures hovering near the 100-degree mark. The ice that we brought with us to the field was usually melted by Tuesday night or, at best, Wednesday morning. The water in our canteens and coolers warmed by Wednesday afternoon. Hot showers were eagerly anticipated by Thursday morning, as we would head back to town on Thursday afternoon. It was an absolute treat to stop at Jack Creek Resort on the way home and purchase a real cup of brewed coffee.

A few people preferred to camp in the field where they ended the day mapping as they did not like to drive any distance at all back to the trailer or motel location. This was not an option for me. For the most part, variety and quality of food served in restaurants at field locations was fair, at best. An exception to this was summers that we stayed at Wendover while mapping either Elko Northeast or Elko Southeast. The casinos that provided our lodging had very good restaurants. Red's Café in Montello, without question, had the best and coldest beer of any place I have ever stayed.

Man Hunt

Alan Wasner

During the period that the soil survey crew was mapping the Owyhee Desert and adjacent areas, a large manhunt was in progress. Claude Dallas, a self-styled mountain man, had murdered two Idaho Fish and Game wardens who were trying to arrest him for poaching. Claude was well known in these areas of Nevada. He had vowed not to be taken alive. And here the soil survey crew was wandering around in the desert in very obvious government vehicles. Several times, Terry Bowerman and I would spend time in the evenings, after dark, looking out across the desert with binoculars, looking for campfires or other signs of Dallas' whereabouts. We were all relieved when he was finally captured. During this period, we spent time in the small Nevada town of Midas. The crew, Paul Blackburn, Terry Bowerman, Rod Douglass, and I, stayed behind the Midas bar (where there were snapshots of many people on the walls, including Claude Dallas) in a small camp trailer provide by BLM. The "town" had only one source of electrical power, an old one-stroke generator. This generator was noisy with a loud "boom" "boom" "boom" at each stroke of the engine. We'd lie there in the trailer trying to sleep, listening to that thing until about 10 p.m. when finally it would shut down for the night. That does not seem too late until you realize we had to get up at 5:30 or 6:00 a.m. and dig holes by hand all day in the heat.

The summer of 1980 was extremely hot. Paul, Terry, a person who is no longer in soils named Mike Richter, and I were staying in the Jack Creek campground of the USDA Forest Service along a perennial stream. We had a lot of concern about safety during this period of triple digit daytime temperatures in areas of rigid duripans, skeletal soils, and lots of clay. One evening, Terry and I became concerned when Paul did not return by 7 p.m. We were just mounting up to go find him when, thankfully, here he came. I watched with concern as Paul rolled into camp, got out of the vehicle, walked around to the back of his Jeep Cherokee, opened the back, pulled out most of the shovels and equipment, crawled in, and curled up in a ball, immediately falling fast asleep in the back of the dusty truck. He was obviously very tired. About 10 p.m., Terry and I were going to go to sleep, and I was concerned about Paul as he still had his boots on and no blanket or anything. So I went over and quietly said, "Paul? Are you OK?" at which point he woke up, said, "Yeah, I'm fine." I really didn't want to bother him so I left him alone. But I watched as he got out a tall cold drink, a can of corn which he ate, a bunch of Rolaids, took his boots off, and then went right back to sleep.

Personal Hygiene

Alan Wasner

While mapping Elko County Northwest, Central, Northeast, and Southeast, as well as White Pine West, I spent a lot of time camping out as did many of the other soil scientists. We had two crews in Elko during part of this time, one led by Terry Bowerman and one led by Dennis Worrel. Terry's crew was the one that camped out while Dennis' crew stayed in close enough to commute.

Camping out was, for the most part, a lot of fun and not a hardship at all. But cleanliness was difficult. There were so few places with water, and almost no streams or lakes where you could swim. Often we would swim in "cow ponds" of dubious water quality or even "take a dip" in a water trough. I only saw one hot spring the entire time I mapped in Elko County and it was at a rolling boil. We would spend all week working with a pick and shovel in holes in the ground so by Thursday night it was an understatement to say we smelled very bad and looked even worse.

During one period, we all had to park our vehicles away from the office due to lack of parking space, so we would car pool down and back to the trucks. One time, Terry's field crew just happened to be there at the same time as Dennis Worrel so we all piled into one truck to drive back to the office. Dennis started to get in the back and I said, "No, Dennis, you want to sit up front." He assumed I was just being nice because he was a project leader and I was a new employee. After he got into the vehicle, he turned around and started to say something like, "Gee, thanks Al . . ." but that was about as far as he got. He spent the rest of the trip back to the office hanging out the window saying, "You guys stink!"

Field Crews

John L. Swenson

The crew arrived at the campsite, about 80 miles north of Elko, Nevada, with their trailer houses ready for a summer of interesting work. Each of the men brought their wives, no one knowing just what the living conditions would be. Even though all the married people were past 60 years old, we all soon learned to cope without any of the modern facilities. Even though the Owyhee Desert Survey was made under contract with the BLM, the crew members doing the survey were mainly former Soil Conservation Service people.

During the final field review, I was given an opportunity to defend my classification of a soil. I had called it a Natrargid. It had good columnar or prismatic structure in the upper Argillic, with a pH of about 8.0, and 6 to 8 inches thick. Below this was what I was calling a B3ca horizon. It had clay films on the peds, a fairly strong blocky structure, very little decrease in clay, a pH of 9.0 or higher, and exchangeable sodium in excess of 30 percent. My argument was that this horizon was part of the Argillic and therefore qualified it as a Natric horizon. George Staidl would not have any part of it. He insisted that even though there were clay films and at least moderate structure, it was not a part of the Argillic. We had been discussing this for some time, when I looked around and most of the party was just standing around looking bored. I suggested that I would drop my claims so that we could get on with the review and not keep everyone waiting. Upon which George said, “Let them wait. We are going to settle this.” In the end, it went George’s way.

Trials, Tribulations, and Absolution

George Borst

My contribution to soil survey in Nevada was relatively modest, and was confined to mapping in North Smoky, Ione, and Upper Reese River Valley under BLM contract awarded to Woodward-Clyde Consultants of Denver. When I arrived in Eureka, I found Arnold Knecht working with four Woodward-Clyde laborers trying to develop a legend for the survey of BLM lands south of Eureka. None of these men had any previous experience in soil survey and were assigned simply to "dig holes" for Arnold. They had spent several months in the area with very little progress.

Rather than contribute further to the confusion, I decided to proceed with the work in the other three portions of the Woodward-Clyde contract. Initially, I established a base at Frontier, at the northern end of Smoky Valley. This was an area of Entisols and weakly developed Aridisols that formed in sandy alluvium on the valley floor and gently sloping fans of the Toiyabe Range. These included soil that had weak durinodes which, at that time, had recently stirred a flurry of excitement in the soil fraternity. Bob Zimmerman of the Reno SCS State Office was assigned to provide technical supervision for these surveys and was very helpful to me on many details. I recall, on one occasion, he showed me a strongly developed argillic horizon in an Aridisol under a desert pavement of gravels and cobbles that I had assumed to be no more than bedrock—a real surprise to me in central Nevada!

With the arrival of Thanksgiving and the first flurries of snow, I retreated to California for the winter, and then returned the following March. Woodward-Clyde then provided me with a small camper, which I located in a trailer park in Austin. This was a great improvement over the facilities at Frontier! John Asktin joined me soon after. John had mapped with me before and had a good knowledge of soil surveys and taxonomy. This was the time of the cold war and someone in the Defense Department had developed a scheme to mount a missile launching system on a large circular track in Reese Valley. This would extend under the mountains to the east of the valley that included reservation lands. The local Indians were highly suspicious of this scheme and had concluded that my soil mapping effort was involved with this plan. It was only after I had convinced the Chief that I was not involved in this scheme that the Indians in Reese Valley would communicate with me.

Shortly after meeting with the Chief, I had the misfortune of losing the coolant from the radiator of my pickup as I was coming in one evening.

After pulling off the road and contemplating my steaming radiator, an Indian woman and her young son stopped to offer me help. She had a jug of water in her car which she kindly poured in my radiator while her son protested, "Mommy, I'm thirsty!" After she poured in the last of the water, I knew the Indians had absolved me.

Those were the days of the "Sagebrush Rebellion" when many of the ranchers in Reese and Smoky Valley were resentful of the Federal bureaucracy efforts to control livestock numbers on public lands. It was therefore difficult to gain access to some private land, but I succeeded in convincing most of them that I was wholly disinterested in this problem and that it was in their interest to have good information on the nature and extent of their soils.

We ate breakfast and packed lunches in our trailer, but we ate most of our dinners at an eating place on a corner of what had been the leading general store in Austin, run by Carol Givens, wife of a retired rancher. She served magnificent meals of prime rib or steaks with a glass of burgundy to wash it down. We missed these dinners after we moved the trailer to a Forest Service ranger station in the southern end of Reese Valley, to be nearer to our survey areas. Mapping proceeded rapidly that spring. As I was about to wrap up the work and deliver the field sheets and mapping unit descriptions to Bob Zimmerman, we discovered to our horror that portions of an entire township included in the Woodward-Clyde contract had been omitted from the map of the survey furnished us by BLM. To resolve this dilemma, Bob worked with me over the weekend to extend the delineations into this area. We were careful not to recognize any additional mapping units in this township!

Contribution of the Laboratory to the Nevada Soil Survey Program

W. D. Nettleton

As far as this young man knows, the first sampling of Nevada soils was by C.F. Marbut, who sampled a Gray Desert soil about 12 miles south of Ely, Nevada. The USDA, Bureau of Chemistry and Soils Laboratory at Beltsville, Maryland, analyzed the samples. This was the only data reported for the Soils of Nevada in the Atlas of American Agriculture (Marbut, 1935). Nikiforoff included Nevada in his paper on the general trends of the desert type of soil formation published in 1937, but it was not supported by soil characterization data. Harper, in his paper on Calcisols in 1957, included Nevada soils in the field study, but did not include laboratory data on them.

Laboratory attention increased after the USDA Soil Conservation Service established the Riverside Soil Survey Laboratory in the early 1950's. By this time, Eddie Naphan was state soil scientist in Nevada. He saw to it that his surveyors had the data needed to guide interpretations for irrigation agriculture. They got the data from the Riverside Soil Survey Laboratory located on the U. S. Salinity Laboratory grounds at Riverside, California. George Harper, soil correlator for Nevada and Arizona; Rueben Nelson, head of the laboratory; and a staff of four were located in an old building at the foot of Mount Rubidoux.

The staff was small with Cliff Henry and Leo Klameth, who were chemists like Rueben. Lothair Grant guided sample preparation, did the particle size analysis, and analyzed for Wakley Black organic carbon and Kjeldahl nitrogen. George Holmgren, after a brief career as a soil surveyor in Nevada, joined the Riverside staff as a chemist before transferring to the Lincoln Soil Survey Laboratory. The laboratory staff all had graduate degrees and some analytical experience. They had the new laboratory up and running in a short time. The laboratory and soil survey in general benefited greatly from the salinity methods and experience gained from scientists next door at the U. S. Salinity Laboratory.

To sample, after correlation and Washington approval, a couple of members of the staff would drive out from Riverside. Many discoveries were made. For example, in analyzing the Fang Soils they had collected in Penoyer Valley in 1959, they found large quantities of nitrate. Dr. Nelson continued to search out the distribution of nitrate in Nevada soils throughout the rest of his career.

Speaking of experience, George Harper had a few. He may be one of the few soil scientists hired, fired, and later rehired by Charles E. Kellogg. Not

surprisingly, it was over a difference of opinion about soils. In the interim, George worked in Central America. George was the "Desert Fox." Water is the daytime drink in desert areas. George kept his supply in the car. Upon returning to the car for refreshment, he found to his dismay that the canteen had been contaminated by an oily sardine taste. It seems that no one was off limits for practical joking in Nevada.

Eddie Naphan was a Berkeley graduate and had a good understanding of the value of a balanced field and laboratory approach to soil survey. He was appreciative of the research of Max Springer on the desert pavement and the geomorphic studies of Roger Morrison on Lake Levels of Ancient Lake Lahontan and the relationship of these features to soils. The geomorphic-soils relationships were later extended by the thesis work of University of Illinois graduate students John Hawley and W. E. Wilson. Eddie Naphan involved Joe Kubota from the U. S. Plant, Soil and Nutrition Laboratory, Soil Survey Investigations, SCS, USDA at Cornell University, in a study of selenium and molybdenum toxicities. Eddie also supported study of mirabolite, the sodium sulfate mineral that was so destructive to some housing developments in Las Vegas.

The need for background soils data for the development of Soil Taxonomy sent the Riverside soil scientists to Nevada again and again. Ahead of that was one of Guy D. Smith's visits. The morning field trip grew long and noon approached with no restaurant in sight. The great man's comments grew short. One more stop had been planned. It was at a series of dunes. They all were relieved when the party leader dug steak and potatoes out of the sand. Nevada always prepared well!

Dr. Klaus Flach, Benny Brasher, and I were the ones making most of the trips as Soil Taxonomy developed. Although desert soils were intensively studied at the Desert Project in New Mexico by field scientists and by the Lincoln Laboratory, it became apparent that the project lacked examples of desert soils that were influenced by volcanic ash. Furthermore, though both states had deserts, the deserts in New Mexico received precipitation in the summer whereas those in Nevada more commonly received precipitation in the winter as snow. Klaus Flach and his staff, as a result, provided the data to characterize soils (xerollic subgroups) that were found suitable for increasing range production by replacement of sagebrush by crested wheatgrass. They also did the analysis of soils cemented by silica. This work was guided by the detailed descriptions of the soils by Lou Langan, Eddie Spencer, and Eddie Naphan. Eventually, criteria were written to differentiate between soils cemented by calcite and those cemented by silica.

The University of Nevada at Reno hired Fred Peterson in the late 1960's and, in so doing, greatly benefited soil research there. Fred had been part of the Desert Project in New Mexico and a professor at the University of California, Riverside, before coming to Reno. One of the first things he did was to define and illustrate *Landforms of the Basin and Range Province Defined for Soil Survey*. Soon, work to obtain moisture and temperature data on mountains, ranges, and the deserts was also underway. This was important in a state with few areas having a surplus of water and a great area of soils having a moisture deficit. Otto Baumer participated in these studies as he completed his master's degree there at Reno. Fred Peterson also intensively studied desert A horizon morphology, which in some of its forms has a very low water infiltration rate. He also brought to Nevada the orderly system he had helped develop for describing soils cemented by carbonate. He had a large part in defining orders for soil survey. Above all, he was a teacher that added much to our problem solving techniques.

I must also mention the impact of Harry Summerfield on the soils program of Nevada. He was Fred Peterson's graduate student and became one of the leading soil scientists in Nevada. He had a good understanding of plants and animals as well as of soils. He eventually became part of a team of scientists working in these three fields of science. It was through his help that Dewayne Mays and I got to Table Mountain. There the USDA Forest Service hoped to increase range production enough to support both the cowherds normally taken there and to also support the elk that hunters wanted to introduce there. Trouble struck upon our saddling up for the ride to the mountain. A group of ichthyologists was also leaving for the mountain. They had a fish shocker on a long pole and expected it to be carried up the mountain by one of the 'docile' pack mules. Well, that docile animal was spooked by the long contraption and began bucking and jumping. The packhorse Harry had loaded with the eggs packed for us then got involved. Soon the eggs were running down the sides of our packhorse. Harry was mad! Upon cooling down, he repacked all their train and we could see that here was a cowboy as well as a scientist.

On the mountain, each of us shared in the food preparation. My part was to get the fire going in the morning. Those were cold times; some snow fell while we were there. The tent and sleeping bag were tough to leave in the morning, but it had to be done. Impatience is dangerous when a fire is slow to catch. The gas can helped greatly, except for one time. That time, the stream of gas to the fire served as path for the fire to reach the can. Reacting to that, I threw the can far across the camp to the sagebrush beyond. Now that was a good toss, but it did not end the problem. As the can hit the ground, the fire carried to the bushes setting the can fire free. I quickly retrieved the can and began on the brush fire. But I was not the only one

now fighting the fire in the brush. The fiery comet across the opening of the tent had Harry and Dewayne on the scene now, too. Saddle sore, frightened, but well fed; camping with Harry was such fun! Down off the mountain with a little time left, I took Dewayne around to see the Sierras. Table Mountain, by the way, became part of Dewayne's thesis on Mollisols.

We helped with another thesis study encouraged by Eddie Naphan. This time it was for Oliver Chadwick from the University of Arizona. It was on duripans. Oliver's major professor was David Hendrix, a careful analyst with experience in chemistry and mineralogy. We characterized the soils; they did the mineralogy. They found the cement in duripans to be opal-A and opal-CT. The covalent nature of monosilicic acid drives it into the soil matrix where it bonds to soil particles as opal. This is in contrast to calcite, which as a result of its ionic nature, fills in the pores. Calcite is the more soluble of the two kinds of minerals, so redissolves and moves deeper in the soil tending, thus, to leave the opal higher in the profile. The tendency for opal to occur above carbonate makes recognition of duripans easier in soils that also contain carbonate.

We were involved with Oliver and George Staidl in a study of a transect of soils in Lamoille Canyon on the north side of the Ruby Mountains. Besides adding soil experience, George also identified the plants at the sites. The study used soil properties to show that over the 150,000 years of the history of the soils, effective moisture averaged 2 to 4 centimeters per year greater than at present. During glacial times, effective moisture was 7 to 9 centimeters per year greater. Over the long term, desert loess increased the water holding capacity of the soils by 25 percent. Drying at the end of the Pleistocene decreased the depth of leaching by 150 centimeters.

Accelerated Soil Surveys

Paul W. Blackburn

I was introduced to the soil survey party in the summer of 1976 as a student trainee in Winnemucca, Nevada. The party consisted of Lee Larsen, who was the party leader; Steve Slusser, who was on detail from his duty station in Elko; and Jim Mitchell, who was on detail from Yerington. I believe John Fisher also spent some time on this survey during this summer, as well as Bob Smith from Elko. It was a fantastic summer as I had the opportunity to work with several people on the party and learn the ways of a soil scientist in the field. The area being mapped was the Bilk Creek Mountains and we were staying at the motel in Denio. During this time, most field parties consisted of the party leader and maybe one additional soil scientist who may have been a trainee. This was the case for Dave Candland, in Douglas County, who was the party until I showed up in the summer of 1977 as a second year student trainee. In 1978, I began work in Minden for Dave as a GS-5 entry-level soil scientist. In 1979, we completed the mapping in Douglas County and I was informed I was going to be transferred to Battle Mountain, Nevada, because of a realignment of priorities. This realignment of priorities was fueled by the acceleration of mapping on BLM administered lands.

Many soil scientist and party leader positions were filled all across the state. This increase in manpower accelerated the rate of mapping production. I spent only three months in Battle Mountain and was transferred to one of the two soil parties located at the Elko Field Office. One of these parties had been in Elko for some time concentrating their work on the area that would become the Elko County, Nevada, Central Part Soil Survey. The other party was new and was assigned to complete mapping in the Elko County, Nevada, Northwest Part. I was assigned to this crew. There was also a party leader/quality control position established in Elko at this time to work with Goodson and Associates who had contracted with BLM to map the Owyhee Desert. Priorities established by BLM requested that our field mapping begin in the Wilson Reservoir area and in the Tuscarora Mountains. It was customary to check with the Bureau and, as much as possible, coordinate our area of mapping with their priority areas.

In the spring of 1980, the two parties, consisting of 10 soil scientists from both agencies, moved out of the field office and into BLM provided office space in the upstairs of the Vitality House, a drug and alcohol rehabilitation center. Entering this building on the main drag of Elko on Thursday afternoons, after spending the week dry-camped, created some interesting community reaction. Quite often, we had to straighten out misconceptions

of some people, who were unaware of the government office space upstairs and thought we were entering the building all grubby and dirty after a few too many drinks.

Approval was given at this time for a 10-hour workday, which everyone was excited about. The work schedule was from 0630 to 1700 Monday through Thursday. Being in the office during the winter and early spring made for some extremely long days, especially since we had to endure the cooking odors that permeated the building in the morning and midafternoon from the kitchen that fed the residents of the Vitality House.

Supervisory control of our soil survey office rested with the soil correlators in the state office as we were removed from local affiliation with the SCS field office. This management structure slowly eroded over time and we were eventually recombined and moved back to the field office in 1982.

Progress field reviews that took place during this time seemed to draw numerous people not only from our agency but also from the BLM. Everyone wanted a chance to go to the field and find out what the state of the art was relative to soil series concepts and interpretations as well as newly identified range sites. Most of the field reviews required long days, as there were many new series to be reviewed and long distances between pit locations. George Staidl, the correlator for this area, was extremely thorough in his examination of the draft field descriptions and took every opportunity possible to provide instruction on the fine points of soil genesis, formation, and classification. Most days, we did not arrive back until 8 or 9 p.m. These field reviews were critical, however, as they gave each of us a chance to observe what other party members had been mapping which enhanced the consistency of our soil-range correlations. By the spring of 1985, field operations in the Elko Central, Elko Northwest, and Elko Northeast Soil Survey areas had been completed. The summer of 1985 saw the initial field review for the last remaining survey area in Elko County. This survey required only one soil party leader and his party of five soil scientists. Soil survey work on this area was interrupted in 1987. We were reassigned to upgrade and remap 3.2 million acres of the Western White Pine County Soil Survey Area. Corrections to the original mapping of this survey centered on revisions to soil series and range site concepts and correlations. Work on the Elko Southeast Soil Survey was recommenced in the summer of 1988 with the winter of 87/88 and 88/89 utilized for completion of the Western White Pine draft manuscript.

Everyone wanted a chance to go to the field . . .

Field safety had always been a concern with many people scattered over the half million acres that was typical for a soil survey party to be working on in the summer. It was customary for each of us to inform others where we were working so if we did not show in the evening or by the next morning, someone could launch a search for us. One evening, Dave Pickel had not shown up at the trailer in Currie by 9:00 p.m. so a search was begun. We knew Dave was working in Goshute Valley so we divided up into two vehicles and started our search north from Alternate Highway 93. Thunderstorms that afternoon had centered on this area and the lakeplain soils were rather slick. Goshute Valley is a large valley but I never realized how large until I experienced it on a pitch-black night with a million stars overhead. We finally located Dave stuck in the mud resulting from a high intensity thunderstorm. We dug him out and were glad that we could find someone under these conditions.

By 1992, the soil survey party in Elko had dwindled to a party leader and a field soil scientist, as mapping in Elko Southeast ground to completion. By 1993, only the party leader left was in Elko completing the manuscript. In 1993, the BLM District Office in Ely decided it was time to recommence mapping in the White Pine County, Nevada, East Part, so a party leader was hired by the SCS headquartered in Ely. Gary Medlyn was party leader and was assigned a trainee field soil scientist. Progressive work was conducted in this survey area until 1995 when reimbursable funding for the survey area was terminated.

Making of a Soil Correlator

George J. Staidl

To do this justice, one has to look back over time. From my point of view, it then becomes an interesting review of the steps taken and events that transpired on the road toward a career as a soil scientist or, more notably, a soil correlator. To put it differently, "How does one ultimately become a soil correlator in the formerly called Soil Conservation Service (SCS), now the Natural Resource Conservation Service (NRCS)?" I can imagine it happens a number of different ways. Each individual's story is uniquely different. This is my tale.

The making of this soil correlator cannot be devoted entirely to my career in Nevada. It also involved a number of individuals and circumstances outside the state that influenced my direction. It started with my first soils course at the University of Wisconsin resulting in a change of majors from Forestry to Soils. At that point, interest in soils developed into a challenge and a career was launched.

Upon graduation in 1963, my first position with SCS was at Woodland, California, as a soil mapper in the Yolo County Soil Survey Area. This is where I was to first meet Grant Kennedy. (*Where did I hear that name before, Nevada?*) Grant was the area soil scientist at that time. He had a major influence in improving my technical expertise with the soils in the area. This was at a time when we were in transition from the 7th Approximation to Soil Taxonomy. The preliminary criteria to be incorporated into Soil Taxonomy were available to all soil scientists for testing. With Grant's guidance, identifying, describing, and placement of soils for the soil survey area was a challenge and unique experience.

To put things in perspective, the soil survey area was in the northern part of the Sacramento Valley. It encompassed part of the agricultural valley and annual range of the coast range. Interspersed with my duties were details to the adjoining Solano County SSA, Suisun Bay portion. This is a marshy wetland area that provided an opportunity to test proposed Soil Taxonomy criteria for identification and separation of organic soils. The experience gained in testing the proposed criteria provided me with ground floor learning and a challenge to work in new areas.

Transferring to Grass Valley, California, to work in the Nevada County Soil Survey Area in the Sierra Nevada Mountains, allowed me to broaden my soils background. This was an opportunity to gain experience in climate and elevation changes of soils and vegetation. The area ranged from the annual oak-grass zone to mature coniferous forests along with a multitude of

landscape and geologic changes. During my 5 years in California, I am indebted to the patient guidance provided by many well-qualified soil conservationists, engineers, range conservationists, and foresters. They influenced my development and appreciation for soil-plant-animal interrelationships.

The fall of 1968 found me in Battle Mountain, Nevada, as a soil survey party leader for the Lander County Area. By this time, I thought I knew it all, at least until I brought up the first bucket auger of soil in a greasewood flat. Not sure what I was looking at, I continued on to a shadscale community. Same problem, but a different soil. Frustration set in as I went back to the preliminary criteria for classifying soils. To make matters worse, I had no idea what the plants were in the area. I just knew they were different. E. A. (Ed) Naphan, state soil scientist, let me flounder around for a couple of months before he sent help. At the time, I did not appreciate his methods, but, in retrospect, it was one of the best things he ever did for me. Ed had a way of bringing the best out of you.

Ultimately, Eddie Spencer, state soil correlator, was sent to bring me around. Eddie went over and clarified a number of items dealing with Aridisols, Entisols, and Inceptisols. Then, it was off to the field. We first stopped at a borrow pit to examine a desert soil profile. Field examination revealed a number of cylindrical and round looking things. Eddie said, “The dog-dropping-looking things are durinodes.” On comes the light, a lesson never forgotten. This event was to follow me, as I was called “Mr. Durinode” by some colleagues for my ability to find durinodes in various soil profiles. Eddie also provided a lesson in determining the various degrees of silica pan cementation. It was a good week and finally set me on the right path.

Leland Campsey and John Riel, range conservationists, arrived shortly thereafter to help put me on track with desert plant identification and Nevada range site concepts. Great Basin Landforms was being developed by F. F. (Fred) Peterson, at the University of Nevada, Reno. I was fortunate to work with him a number of times over the years. This allowed me to incorporate his suggestions and concepts into the soil mapping process. These concepts were to be one of the final keys to consistency in mapping Nevada soils.

Transferring to Elko, Nevada, five years later brought on new challenges. The area was totally different. It is comprised mainly of various sagebrush and woodland plant communities along with different kinds of landforms. Trying to figure out the soils, vegetation, geomorphic, and climatic relationships was quite interesting.

During this time, Steve Slusser and I were detailed to the pine forest part of Humboldt County. This allowed the two of us to apply our knowledge to a mix of different landform and vegetative communities.

Not to be outdone by the old timers in soil survey, we would leave the office on Monday and return on Friday. We camped out at predetermined locations at the end of the day. One moonlit night, we were awakened by a flock of bats circling overhead. Fearing a potential rabid bat, we beat a hasty retreat to the trucks for the remainder of the night.

My promotion to soil correlator occurred in 1978 and I continued in that position until 1988 when I was assigned to the National Soil-Range Team. About this time, the Bureau of Land Management was gearing up for soil survey on public lands. The Nevada SCS Soil Survey Program was to play a lead role, in addition to our ongoing soil surveys. The workload increased, but the opportunity to work in almost all parts of the state was exciting.

During my tenure as soil correlator, the one feature I felt most positive about was the maintenance and refinement of our soil-vegetation-landform-climate concepts. These concepts brought consistency to the soil mapping process between individuals and across state or soil survey area boundaries.

There are a number of interesting experiences that I recall as a soil correlator and will share a few with you. One time on a field review in the Las Vegas area, we were field checking a soil type location. This soil had an extremely hard and thick petrocalcic horizon. The area was undergoing development for subdivision. A large crane was dropping a steel ball onto the petrocalcica horizon exposed in a trench. Continuous pounding was breaking the petrocalcic horizon into fragments. All I could think of was something an engineer once said, “Given enough time and money, you can manipulate a soil into anything you want. It is just a matter of economics.”

Another time, we were on a field review in northern Elko County. It was a long trip back to Elko and there was one more soil to examine, as it was a new soil series. Being late in the day and not wanting to make another the trip back, we decided to finish the job at hand before heading back. Everything went well until it was time to check soil colors. By this time, it was getting a little dark, so the only alternative was to use the truck headlights to check the colors. Needless to say, I know a soil correlator that was the butt of a joke for some time.

Helicopters were commonly used on BLM soil surveys and were a boom to a soil correlator. This is especially so during field reviews and spot checks of soil mapping. That is, it was fun until a two seat Bell B2 that was flying a couple of folks the day before I was to fly encountered a problem. It seems

the helicopter managed to lift about 25 feet when the supercharger quit, dropping passengers and machine back to the ground. No harm was done to man or machine, but hearing about the encounter, I was a little apprehensive after that.

Another time, on a field review in eastern Humboldt County, we stopped at a soil type location that was coarse-silty and contained durinodes. Everything was dry and dusty. It happened that there were two, new soil scientists in the soil pit with me. We were bent over looking at some durinodes when a clod of soil fell into the pit creating a cloud of dust. We came up choking and covered with dust.

Last, but not least, this tale probably sums up what it takes to make a soil correlator. We were completing some soil mapping spot checks in eastern Elko County. As we drove along the trail, I was holding the soil maps and the identification legend trying to keep track of mapping as we went. Finally I spotted something that did not look right and asked the driver to stop. This got the best of Al Wasner, one of the soil survey party members. He asked, "You have never been here before so how did you know when to stop and what soil should be here?" I replied, "If you have a strong interest and a good handle on soil, vegetation, climate, geomorphic, and landform concepts, everything comes together and it's easy to spot discrepancies. That means — learn all you can from each discipline and then it's just a matter of putting all the pieces together."

In retrospect, if one had to do it all over again, I would do it again with very few minor adjustments. This was an exciting time in my life, full of challenge, and a tremendous opportunity to make good friends and work with some of the best professional soil scientists available.

Discovery

Douglas J. Merkler

The slightest hint of a wind began to flow up the canyon as the cold morning air began to warm against the black rock in the late morning sunlight. Ed Naphan walked to the edge of the narrow canyon, breathed deeply, turned to me and said, "You can almost feel the primordial winds blowing through this canyon." And then he laughed, lit his cigarette, and walked with me the 40 or 50 feet back toward the others gathered around the shallow soil pit carefully dug on that cobbly basalt flow. It was 1979 and a preliminary review of the 2.2 million-acre Lahontan Environmental Statement area in the Sehoo Mountains southeast of Fallon, Nevada, was underway. I do not believe I understood then what Ed had intended with his comment. I do not believe any of us, except for Ed, understood the adventure we were about to embark on, discovering and describing soils and vegetation in Nevada.

Ed Naphan . . . said, "You can almost feel the primordial winds blowing through this canyon."

To meet the demanding objectives required in the newly contracted Order 3 soil surveys, a philosophy that soils should vary in association with landscapes, and that soil components could be distinguished in the same manner as climatic and vegetative components as they relate to the landscape, was promoted. Each region, valley, or mountain range contains a variety of soils, many of which are also encountered in other regions, but the distribution of soils will follow a definite repeatable pattern. This concept was important from both a theoretical and a practical point of view. Theoretically, soil distribution is often the key to answering many questions about soil formation. From a practical viewpoint, it is difficult and costly to prepare detailed maps of soil locations, which can vary in short distances; a practical tool was needed. Having studied under Dr. Fred Peterson in Reno, who had been working on his *Landforms of the Basin and Range Province Defined for Soil Survey*, it seemed hard to imagine one might take any other course of action. Fred's concepts were put into use even before his work was published in 1981. The seventh approximation of *Soil Taxonomy* had been published in a hardbound book and was in general use providing a solid taxonomic foundation. It was not until much later that I began to realize what a wonderful foundation this unique set of circumstances had provided all of us as we began what would become a career full of discovery in Nevada.

William Bryant Logan comments in his book, *Dirt, The Ecstatic Skin of the Earth*, "Horizons are what make some people become soil scientists. They are that lovely." To describe a variety of soils and their profiles is to begin a process of developing a vocabulary, not of words or taxonomic categories,

but of fundamental relationships in nature. Hans Jenny has been quoted as saying, “A soil is a body in nature.” The opportunity to describe ‘a new body’ in nature is not only a scientific privilege; in Nevada, it has been a requirement. Nevada has been, quite literally, the proving ground for many areas of soil classification. A flurry of new series concepts began to emerge, as the complexity of the Great Basin became apparent and observed. It must have been a similar situation for the biologists during the turn of the 20th century when C. Hart Merriam sent forth his army of biologists for a biogeographical reconnaissance of the western United States.

A certain amount of pride develops as one describes the horizons of a soil where the pebbles on the surface have been staring at the stars long enough to watch the cycles of precession pass like days, and realize that this is an undiscovered natural body that you will have to name. You can almost feel that primordial wind blowing.

Individuals Involved in the Nevada Soil Survey Program from 1978 to 2000

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Appreciation

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Selected References

Alexander, E. B. and W. D. Nettleton. 1977. Post-Mazama Natrargids in Dixie Valley, Nevada. Soil Sci. Soc. Am. J. 41: 1210-1212.

Chadwick, O. A., D. M. Hendricks, and W. D. Nettleton. 1987. Silica in Duric Soils: I. A Depositional Model; II. Mineralogy. Soil Sci. Soc. of Am. J. 51: 975-985.

Chadwick, O. A., W. D. Nettleton, and G. J. Staidl. 1995. Soil Polygenesis as A Function of Quaternary Climate Change, Northern Great Basin, USA. Geoderma 68:1-26.

Eckert, R. E., Jr., F. F. Peterson, M. K. Wood, and W. H. Blackburn. 1977. Properties, Occurrence, and Management of Soils with Vesicular Surface Horizons. Final Report, Contract No. 52500-Ct5 (N), USDI Bureau of Land Management and AES, Reno, Nevada. 116 pp.

Harper, W. G. 1957. Morphology and Genesis of Calcisols. Soil Sci. Soc. Am. Proc. 21: 420-424.

Hawley, J. W. and W. E. Wilson III. 1965. Quaternary Geology of the Winnemucca Area, Nevada. Technical Report No. 5, Desert Research Institute, University of Nevada. 66 pp. , 28 figures and 3 plates.

Kubota, J. 1972. Sampling of Soils for Trace Element Studies. Annals of the New York Academy of Sciences. 199: 105-117.

Marbut, C. F. 1935. Atlas of American Agriculture. Part 3. Soils of the United States. U. S. Government Printing Office, Washington, DC, 98 pp.

Morrison, R. B. 1961. Lake Lahontan Stratigraphy and History in the Carson Desert (Fallon) Area, Nevada. U. S. Geol. Survey Prof. Paper 424-D, 115-116.

Nettleton, W. D., B. R. Brasher, E. L. Spencer, L. N. Langan, and F. F. Peterson. 1986. Differentiation of Closely Related Xerolls That Support Different Sagebrush Plant Communities in Nevada. Soil Sci. Soc. Am. J. 50:1277-1280.

Nettleton, W. D., J. E. Witty, R. E. Nelson, and J. W. Hawley. 1975. Genesis of Argillic Horizons of Desert Areas. Soil Sci. Soc. Am. Proc. 39: 919-926.

Nikiforoff, C. C. 1937. General Trends of the Desert Type of Soil Formation. Soil Science 43: 105-131.

Peterson, F. F. 1981. Landforms of the Basin and Range Province Defined for Soil Survey. Technical Bulletin 28, Nevada AES, University of Nevada, Reno, Nevada, 52 pp.

Soil Conservation Service 1970. Soil Survey Laboratory Data and Descriptions for Some Soils of Nevada. Soil Survey Investigations Report No. 23. Soil Conservation Service, USDA. 219 pp.

Springer, M.E. 1958. Desert Pavement and Vesicular Layer of Some Soils of the Desert of the Lahontan Basin, Nevada. Soil Sci. Soc. Am. Proc. 22: 63-66.

Summerfield, H. B. and F. F. Peterson. 1971. Reconnaissance Soil Survey, Railroad Valley Area, Nevada. AES, University of Nevada, Reno, and the Soil Conservation Service, USDA. 49 pp.

Soil Survey Research

Alexander, Earl B. (University of Nevada, Reno, Reconnaissance Soil Survey; later USDA Forest Service Soil Scientist

- Research papers on (1) Formation of Bt in Dixie Valley in Less Than 6,600 Years, (2) Relation of Iron Oxides to Soil Age in Verdi Area, California.

Baumer, Otto W. (UNR Graduate Research)

- A Method for In Situ Measurement of Soil Profile Hydraulic Conductivity. 1975. Thesis (MS), University of Nevada, Reno.

Blackburn, Will (UNR Graduate and Program Research)

- Vegetation and Soils of the (Some 12 Different) Watershed. 1968-1972. Wilbert H. Blackburn, Paul T. Tueller, Richard E. Eckert, Jr., including Crowley Creek, Coils Creek, Pine Canyon and Mathews Canyon, and Rock Springs watersheds.
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- A Test of Soil-Suitability Guide for Rangeland Seedings: Crested Wheatgrass in Ruby Valley, Nevada. 1987. Thesis (MS), University of Nevada, Reno.

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- Molybdenum Toxicity in Livestock – Soil and Vegetative Sampling of Selected Soils in Nevada.

McLaughlin, Jim (UNR)

- The Survival of Ponderosa Pine Seedlings on the Eastern Sierra Nevada Under Moisture Stress Conditions. 1974. Thesis (MS), University of Nevada, Reno.

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- Research on Irrigation Water Use By Crop.

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- Master's Thesis Research on Mountain Big Sagebrush and Soils. Thesis reference not available.

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- Cooperative Studies of Rangeland Grass Seedling Emergence and Establishment on Crusting of Soils, with R. Eckert.
- Summary of Genesis and Properties of Aridisols. Nettleton, W. D., and F. F. Peterson. 1983 Aridisols. In Pedogenesis and Soil Taxonomy II. The Soil Orders, Chapter 5, pp. 165-215.
- Recruitment of Prospective Soil Scientists.
- Cooperative Soil Climate Studies with NRCS.

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- A Statistical Description of Nevada Soil Temperatures. 1981. Thesis (MS), University of Nevada, Reno.

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- Seedling Emergence on Vascular Crusted Surfaces as Affected By Artificial and Natural Cattle Trampling. 1980. Thesis (MS), University of Nevada, Reno.

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- Pedological Factors Related to the Occurrence of Big and Low Sagebrush in Northern Washoe County, Nevada. 1969. Thesis (MS), University of Nevada, Reno.

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Appendix

Nevada Soil Surveys

Published

Soil Survey of the Fallon Area, Nevada – 1909*
Soil Survey of Las Vegas Area, Nevada – 1923*
Soil Survey of the Moapa Valley Area, Nevada – 1923*

Better Land Use in the White Pine Soil Conservation District, Nevada – 1943*
Better Land Use in the Moapa Valley, Nevada – 1944*
Better Land Use, Fernley, Nevada – 1945*
Better Land Use in the Meadow Valley, Nevada – 1946*

Soil Survey of Las Vegas and Eldorado Valleys Area, Nevada – 1957*
Soil Survey of Lovelock Area, Nevada – 1958*

Soil Survey of Pahranagat-Penoyer Areas, Nevada – 1968*

Soil Survey of Carson Valley Area, Nevada-California – 1971*
Soil Survey of Surprise Valley–Home Camp Area, California–Nevada – 1974
Soil Survey of Tahoe Basin Area, California and Nevada – 1974
Soil Survey of Fallon-Fernley–Parts of Churchill, Lyon, Storey, and Washoe, Nevada – 1975
Soil Survey of Meadow Valley Area, Nevada-Utah – 1976
Soil Survey of Carson City Area, Nevada – 1979

Soil Survey of Big Smoky Valley Area, Nevada, Part of Nye County – 1980
Soil Survey of Diamond Valley, Parts of Elko, Eureka, and White Pine, Nevada – 1980
Soil Survey of Tuscarora Mountain Area, Nevada – 1980
Soil Survey of Virgin River Area, Nevada-Arizona, Parts of Clark and Lincoln Counties, Nevada, and Part of Mojave County, Arizona – 1980
Soil Survey of Washoe County, Nevada, South Part – 1983
Soil Survey of Douglas County Area, Nevada – 1984
Soil Survey of Lyon County Area, Nevada – 1984
Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County – 1985
Soil Survey of Eureka County Area, Nevada – 1989

Soil Survey of Storey County Area, Nevada – 1990
Soil Survey of Esmeralda County Area, Nevada – 1991
Soil Survey of Lander County, Nevada, South Part – 1991
Soil Survey of Mineral County Area, Nevada – 1991
Soil Survey of Lander County, Nevada, North Part – 1992
Soil Survey of Pershing County, Nevada, East Part – 1994
Soil Survey of Elko County, Central Part, Nevada – 1997
Soil Survey of Northwest Elko County Area, Nevada – 1997
Soil Survey of Washoe County, Nevada, Central Part – 1997
Soil Survey of Pershing County, Nevada, West Part – 1998
Soil Survey of Western White Pine County Area, Nevada – 1998
Soil Survey of Washoe County, Nevada, North Part – 1999

* Out of Print

Unpublished

Soil Survey of Churchill County Area, Nevada
Soil Survey of Elko County, Nevada, Southeast Part
Soil Survey of Energy and Defense Area, Nevada
Soil survey of Hawthorne Ammunition Plant, Nevada
Soil Survey of White Pine County, Nevada, East Part
Soil Survey of Humboldt County, Nevada, East Part
Soil Survey of Humboldt County, Nevada, West Part
Soil Survey of Humboldt National Forest Area, Nevada, Parts of Elko and White Pine Counties
Soil Survey of Humboldt National Forest Area, Nevada, Parts of Lincoln, Nye, and White Pine Counties
Soil Survey of Inyo National Forest, Nevada and California
Soil Survey of Lincoln County, Nevada, North Part
Soil Survey of Lincoln County, Nevada, South Part
Soil Survey of Nye County, Nevada, Northeast Part
Soil Survey of Nye County, Nevada, Northwest Part
Soil Survey of Sheldon Antelope Refuge, Nevada

Special Reports

Report of the Physical Survey of the Virgin Valley Soil Conservation District, Nevada – 1939

Report of the Physical Survey of the Carson Valley Soil Conservation District, Nevada – 1940
Report of the Physical Survey of the Mason Valley Soil Conservation District, Nevada – 1940
Report of the Physical Survey of the Moapa Valley Conservation District, Nevada – 1940
Report of the Physical Survey of the Pahranagat Valley Soil Conservation District, Nevada – 1940
Report of the Physical Survey of the Pyramid Lake Indian Reservation, Nevada – 1940
Report of the Physical Survey of the Smith Valley Soil Conservation District, Nevada – 1940
Report of the Physical Survey of the South Fork Purchase Tract Lee, Nevada – 1940
Report of the Physical Survey of the Walker River Indian Reservation, Nevada – 1940
Report of the Physical Survey of the Bottom Lands of Meadow Valley Soil Conservation District, Nevada – 1941

Soil Survey of the Pahrump-Amargosa Desert, Nevada – 1961
Soil Survey of the University of Nevada Newlands Station, Fallon, Nevada – 1961
Soil Survey of the University of Nevada Valley Road Farm, Nevada – 1961
Soil Survey of the Knoll Creek Field Station, Nevada, Advanced Copy – 1964
Interim Soil Survey Report, Fallon Indian Reservation, Churchill County, Nevada – 1968
Interim Soil Survey Report, Schroeder Reservoir Watershed, Nevada-Utah – 1968

Soils of the Battle Mountain Area, Nevada, Interim Soil Survey Report – 1970
Soil Survey of Eden Valley Unit, Humboldt County, Southeast Part, Nevada – 1978

Soil Survey of Ione Area, Nye County, Nevada – 1980
Soil Survey of Sevenmile Wash Area, Nye County, Nevada – 1980
Soil Survey of Upper Reese River Area, Nye County, Nevada – 1980
Soil Survey of Owyhee Desert Area, Nevada – 1981

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