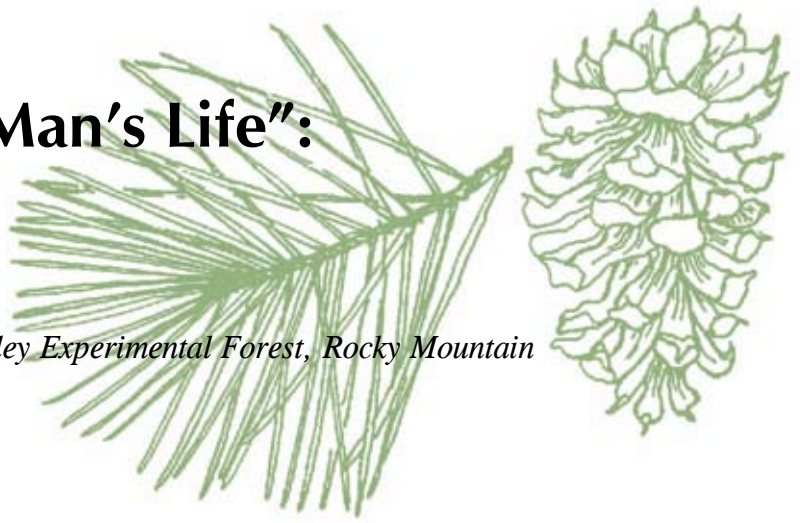


“It Was a Young Man’s Life”: G.A. Pearson

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Abstract—The nation’s initial USFS research site commenced in a rustic cabin in the midst of northern Arizona’s expansive ponderosa pine forest. Gustaf A. Pearson was the first in a distinguished line of USFS scientists to live and study there. A visitor to Fort Valley today often wishes he could have stood in Pearson’s large boots (he was said to have enormous feet) as he and his early compatriots were true pioneers on a journey toward understanding nature’s methods of ponderosa pine regeneration. Over the past century, their efforts have been honed into an extensive foundation of silviculture, range and watershed research that benefits current and future researchers. The pioneering seeds of techniques they sowed and carefully nurtured have grown into *modus operandi* for scientists. The tree Raphael Zon planted is now a towering, stately ponderosa pine that proffers progress in science, knowledge, and preservation. This historic spot and its scientific yields have earned celebration and acknowledgment. This paper looks at the cultural history of FVEF and provides introduction to the subsequent papers in these proceedings.

Introduction

Nine miles separate Flagstaff from Fort Valley over a meandering road that skirts the base of the San Francisco Peaks climbing from 6900 feet to 7300 feet in elevation. The road weaves through a stunning forest interspersed with small meadows, or parks. The journey provides glimpses of a splendid ponderosa pine with a 36-inch diameter and fire scars towering above smaller trees. The final mile opens into Fort Valley, an expansive meadow with abundant grass and water and a settlement history defined by people who enjoyed the beauty and resources but not the extreme weather conditions (Figure 1, Olberding 2002).

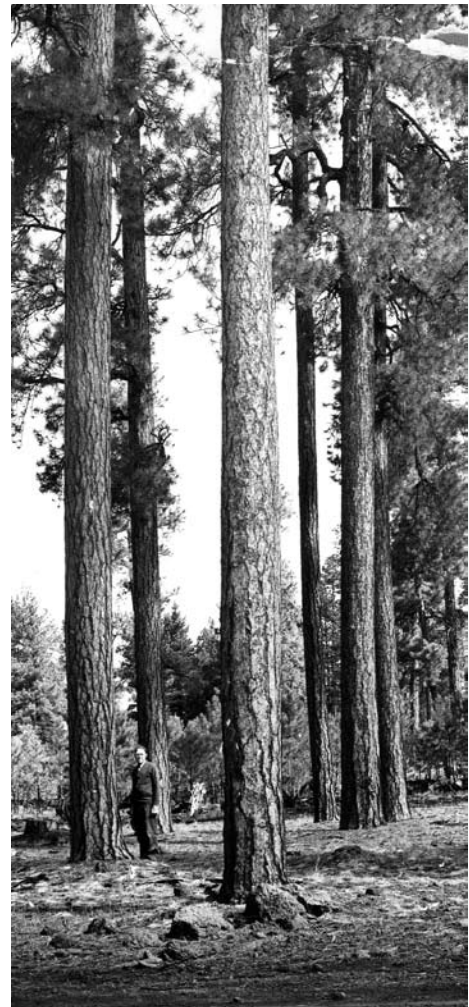
Protection of these resources was the reason Raphael Zon, Gustaf A. Pearson, and the others considered Fort Valley as a research site with a mission to study and perpetuate the predominant tree of the Southwest—the ponderosa pine (Figure 2). The forests were threatened by extensive logging and grazing and were not regenerating. T.A. and M.J. Riordan, owners of Flagstaff’s Arizona Lumber and Timber

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Figure 1. Fort Valley park area in 1918 with the San Francisco Peaks in the background. The FVEF headquarters are to the left center in the trees. This view is looking north. USFS photo 89769 by G.A. Pearson.

Figure 2. G.A. Pearson in 1944 just prior to his retirement. This photo is taken on permanent sample plot 10, near FVEF headquarters. USFS photo 433053.



Directors of Fort Valley Experimental Forest

1908-1935 - Gustaf A. Pearson

1935-1942 - Arthur Upson (then the SWFRES)

1942-1953 - Raymond Price

(In 1953, the SWFRES merged with the RMFRES and Project Directors have since been in charge of Fort Valley/Flagstaff RMRS)

Company sawmill, foresaw trouble as they faced a fast-depleting resource. Upon the advice of USFS inspector Frederick E. Olmsted, the Riordans sent a letter in 1903 to their friend Gifford Pinchot, Forester of the U.S.D.A. Bureau of Forestry (later to be the U.S. Forest Service), suggesting that they “...do some experimenting in forestry work.” Pinchot didn’t need any encouragement and directed Chief of Silvics Raphael Zon to create an outline for experiment stations (Zon 1908).

Zon met young forester Gustaf A. Pearson in Flagstaff in August 1908 to explore several sites recommended by Zon’s assistant, Samuel Trask Dana, for the first experiment station (Fry 1967). Pearson, originally hired by the USFS in 1907 to work on the Wallowa National Forest, was already in northern Arizona studying reproduction of western yellow pine. Zon and Pearson most likely encountered USFS Associate Forester Albert F. Potter, once an Arizona livestock operator, who had arrived in Flagstaff in late July (*Coconino Sun* July 31, 1908). The *Coconino Sun* of August 7, 1908 noted:

Mr. Zon will establish temporary headquarters at Fort Valley for the purpose of making extensive investigations concerning the growth of pines, and endeavor to ascertain what causes most affect the growth of seedlings. The reason for non-growth in localities and other interesting and valuable information will be gathered by an exhausting study of conditions here. Mr. Pearson will have direct charge of the work.

Fort Valley was the first of nine USFS forest experiment stations that opened between 1908 and 1914 to study American silviculture through ongoing research working cooperatively with a forest’s natural cycle, yet seeking optimal growth for timber harvesting. Objectives were to gain knowledge of timber, range, and water resources management and to furnish answers to technical and practical issues for both public and private lands administrators (Dana 1909). Silviculturists and other forest investigators were to appraise the relationship of the entire forest biological unit and then furnish scientific data to National Forest management (Pearson 1914).

The Work Begins

Fort Valley provided an ideal research locale as the forest had not been decimated by logging because of its distance from the railroad. Water was readily available, and an existing cabin gave Pearson a home/office (Figure 3). That first autumn he planted a nursery, established meteorological sites, and designed experiments. When winter came, he relocated to the “Hotel de Flag,” a large house in Flagstaff rented by bachelor USFS employees and used also by visiting USFS scientists (Maunder 1958). He returned to the uninsulated and fireplace-less cabin once official word arrived that the Experiment Station was to permanently open on January 1, 1909 (Arizona Farmer 1946). He chinked the walls with whatever he could find and buried his canned food in the ground to keep it from freezing, but it still froze and the labels came off. He never knew what his meal would consist of until he had opened a few cans (Schubert 1965). Pearson, accompanied by his two mules, Pat and Mike, conducted research within walking, snowshoeing, or riding distance from the cabin. Those mules could travel the nine miles into Flagstaff in

Figure 3. The ranger cabin that Pearson used as quarters when the FVEF first opened during the winter of 1908-09. USFS photo 89799.



Figure 3a. The ranger cabin as it appeared in August 1909. Screened planting beds and shade frames appear in the foreground. USFS photo 83522.

one hour and forty minutes, when encouraged with a whip. Later, when more staff was on site, the mules escorted the young men into town for Saturday night entertainment. Pearson valued the mules, but one staff member considered them grumpy, independent and more trouble than they were worth (Fritz 1964, Pearson 1936).

The official opening was a brief mention in the local newspaper stating that Ranger William W. Wilson was assigned to assist Pearson at the Experiment Station (*Coconino Sun* January 9, 1909). Townspeople generally regarded the new facility with passing interest as most were not concerned about a small research lab in distant, cold Fort Valley. Foresters and lumbermen, and later, stock raisers, were cognizant of the Station's work, but its remote location limited visitors and curiosity seekers.

The Fort Valley Experimental Forest

Initially called the Coconino Experiment Station, the name changed in 1911 to the Fort Valley Experiment Station to avoid confusion with the Coconino National Forest. The area is named Fort Valley because of a stockade built in the area in the 1870s by John Willard Young, a son of LDS President Brigham Young (Olberding 2002). Today, Fort Valley Experimental Forest (FVEF) headquarters is commonly used.

An April 7, 1909, agreement between the Coconino National Forest and Coconino Experiment Station exempted the lands near the Fort Valley headquarters from hunting, logging, fuelwood cutting, or homesteading. The only exceptions to these protections were to occur as part of the research plan. The District 3 Investigative Committee Report of December 1915 stated that progress on designation as an experimental forest would not proceed until funds were allocated for this work. \$1,000 was estimated as needed for examinations and mapping and an annual \$5,000 sum was requested "...to place the Forest under the form of management required to make it serve the ends for which it is created" (USFS 1915). Finally, in 1931, this agreement was made into a Forester's Order that permanently withdrew 2,420 acres as the Fort Valley Experimental Forest. Amendments in 1935 and 1941 brought the total to 4,950 acres.

The five separate units of the Fort Valley Experimental Forest originally included: (1) the headquarters, (2) on U.S. Highway 180 between Snowbowl Road and Hidden Hollow area, (3) Wing Mountain, (4) Hwy 89 North Cinder Pits area, and (5) Coulter Ranch, south of Mormon Lake. The Cinder Pits area was returned to the Coconino National Forest in 1975. The current total acreage for the Fort Valley Experimental Forest is 5,270 acres. The 154-acre G.A. Pearson Natural Area of old-growth ponderosa pine was established in 1951 and is included in Unit 1.

"... if regeneration worked here ... it could be done anywhere else more easily." (Fritz 1964)

Forest Assistant Harrison D. Burrall, Student Assistant Harold H. Greenamyre, and a clerk joined Pearson as staff in the spring of 1909. Their ideas and experiments were restricted only by human limitations and budget restraints. They studied regeneration, impact of weather on seedlings, seed sprouting, uses of forest products, disease and insect control, harvesting methods, and livestock effects. Research locales expanded around the Southwest as roads and vehicles improved. Several permanent technical men and ten to twelve temporary summer workers were assigned to Fort Valley as years passed. A cook/janitor was hired at \$60 plus board per month since Pearson felt scientists were hired to do research, not cook. His salary was paid by both the Forest Service and staff; prorated to about \$1/day/man (Figure 4, Pearson 1914).

Fort Valley evolved into a well-respected scientific site where researchers fostered innovative silviculture work. USFS pioneering scientists overlooked marginal living and working situations and without their spirit and dedication, the Forest Service Research program would not have progressed as rapidly as it did. Fort Valley scientists relished walking out their front doors into their workplace, moonlight



Figure 4. The water tank and bath house at FVEF. The mess house is to the left. USFS photo 92583 by G.A. Pearson in 1911.

snowshoeing, and taking long walks. Work in the forest was done from sunup to sundown, six days a week, for about \$3.00 per day. Reports were written beside dim lantern light in drafty tents or while sitting by the fireplace. Early scientists who worked at Fort Valley include Clarence F. Korstian, Alexander J. Jaenicke, Jack Boyce, Ferdinand S. Haasis, Max H. Foerster, Wilbur R. Mattoon, Robert R. Hill, Harold S. Betts, E.M. Hornibrook, and Enoch W. Nelson, to name just a few (Figure 5, Gaines and Shaw 1958). Some researchers were assigned to specific experiments and left after a short stint, others stayed for years. Families were often in residence. In 1921, Ferdinand Haasis' wife, when eight months pregnant, traveled to Albuquerque to give birth as Flagstaff did not have a hospital (Bean 1999). Visitors, usually USFS related, included Zon, and a rumor persists that Gifford Pinchot tore his pants on the barbed wire fence at the Wing Mountain permanent sample plot. Pearson noted that in those early days, guests could stay for awhile and not have to leave right away for another appointment (Pearson 1936).



Figure 5. 3 USFS scientists prepare for work in 1913. From left: Hermann Krauch, M.W. Talbot, and Reginald Forbes. USFS photo F16929A.

Pearson wanted the headquarters to blend in with the forest as if the structures magically appeared. After five years as FVEF Director, he wrote that construction of facilities should be accomplished prior to beginning scientific work, although Fort Valley did not occur that way (Pearson 1914). A total of \$500 was allotted for construction during 1909, and a combined home/office (today's Pearson House) that Pearson made sure was insulated was built. Improvements in the initial years were a greenhouse/laboratory, store house, water plant that included a well, windmill and elevated tank, and root cellar (rare in the Southwest) to store perishables, as electricity did not reach the site until 1936. Pearson encouraged a neat and orderly appearance of an experiment station, and believed facilities should be available to the public for educational purposes so people could view forestry science in action (Figure 6, Pearson 1914). He hoped that experiment stations would be permanent with ongoing facilities, staff and organization to carry on long-term work. Pearson noted this was most important in the southwestern forests because 200-300 years is required to mature a forest and twenty years to restock it after harvesting (*Coconino Sun* September 3, 1920). Fort Valley claims the construction of the first bathroom in Region 3, built in 1918. It actually was a bath house, built inches away from the Pearson House since there were cost limitations on existing buildings (Pearson 1936).

By 1927, after nineteen years, Fort Valley consisted of only four structures. Additional funding from the McSweeney-McNary Act enabled increases in construction and research projects. The Southwestern Forest and Range Experiment Station (SWFRES) was created as the administrative umbrella over all USFS Research occurring in Arizona and New Mexico. Pearson was named Director and headquarters were established in Tucson. Staff moved seasonally between Tucson to the various field sites, including Fort Valley, which then focused on forest and range investigations.



Figure 6. The FVEF headquarters as viewed from the nursery site about 1912. Note the windmill. Tents are used by temporary employees. USFS photo 449257 by G.A. Pearson.

To house the extra scientists, the Civilian Conservation Corps built structures and worked on various projects related to silviculture research. More construction occurred during the 1930s than during the previous two decades of Fort Valley's existence and most of the extant residences are CCC-built. All the commotion caused Pearson to comment that the garage built for sixteen vehicles still left some out in the rain (Figure 7, Pearson 1936). The CCC installed a two and one-half mile underground pipeline between Little Leroux Springs and the FVEF. Later, Big Leroux Springs water came through the same pipeline.

The FVEF complex consisted of a two-story office building with a built-in safe, a laboratory, garage, workshop, water plant, schoolhouse, mess hall, dormitory, and seven furnished residences by the end of the 1930s. It was a bustling community with activities like square dances, group waffle breakfasts and Thanksgiving dinners, and volleyball games with twenty people on each side of the court. The social activity was short-lived as staff dwindled during World War II. A brief occupancy surge occurred prior to the merging of the SWFRES into the Rocky Mountain Forest and Range Experiment Station (now RMRS) in 1953. But, in 1958, at Fort Valley's fiftieth anniversary, the Arizona State College in Flagstaff (now Northern Arizona University) opened a forestry school in which USFS researchers worked in conjunction with faculty from an office building constructed next to the forestry school. Foresters then worked and lived in town and visited Fort Valley.

Other agencies rented many of the Fort Valley structures from the 1970s-1990s that kept the facility mostly intact. Residents have been sporadic since. The site was listed on the National Register of Historic Places in 2001. The historic headquarters has had minimal occupancy and upkeep until 2005 when USFS deferred maintenance funds enabled some sorely-needed repairs to occur on four of the twelve buildings.



Figure 7. CCC workers sit atop Juniper posts at the FVEF headquarters. The schoolhouse shows to the right. USFS photo 330506 by G.A. Pearson in September 1936.

The Science of Silviculture

Restocking the Southwest forest was a key element in District 3's research agenda. The scientists' task was to replant the forest so the trees could again be harvested, thereby supporting local economy yet also perpetuating the resource. Over 85 percent of the timber cut in 1908 in Arizona and New Mexico was ponderosa pine, unquestionably the most valuable marketable tree (Pearson 1942). Studies were initiated on every factor that might influence a tree's life: livestock grazing, weather, disease, and rodents. Silviculture science is the cultivation and care of forest trees. "Cultivation" refers to ridding the forest of inferior products and improving quality and growth and "care" refers to encouragement of natural regeneration and maintenance of all age classes. A balanced program between fundamental and applied research contained the following objectives: cutting methods, perpetuating the forest crop, and fostering natural regeneration. One approach sometimes took precedence to respond to immediate demands. Every FVEF project fit into one or both of these categories, i.e., pruning ill-formed stems, keeping livestock away from the seedlings, selective cutting, or thinning of stands. Through these tests, defined by Pearson in 1944 as a form of agriculture, scientists endeavored to learn methods of tending the ponderosa pine forests when Nature was discouraged from using her preferred managerial style (Pearson 1944).

The science was new and challenging. Every factor that might influence a tree's life was analyzed. Plots were established to study how to thin, prune, burn, plant, harvest, or control disease and pests. They were fenced and then re-fenced higher to exclude elk. Trees were planted, nurtured, abused, or left alone, but never forgotten. Research plans were continually adapted to fit current conditions or to follow a surprise discovery. The main research topics focused around ponderosa pine: 1) ecology of forest types; 2) growth, reproduction, and mortality; 3) artificial

TURPENTINE

In April 1908, just prior to Fort Valley's establishment, Royal S. Kellogg of the Department of Forestry called upon Flagstaff lumberman Michael J. Riordan to discuss his idea of developing a pulp wood operation on the Coconino National Forest and using the waste for turpentine and other byproducts. Kellogg was anticipating a shortage of turpentine due to exhaustion of the southern trees' supply of resin. Riordan's reply is lost to history, but perhaps this inquiry led to the 1910 and 1911 turpentine experiments near Fort Valley.

Harold S. Betts, Forest Service engineer for timber tests, first began a turpentine experiment at Fort Valley in Fall 1910. He brought laborers from the southeastern forests to tap yellow pines within walking distance of FVEF. Ninety trees were notched and hung with cups to collect the dripping resin. To tap a tree, the outer bark is removed from one side near the base. An incision is made and an "apron" is inserted, with a cup placed below the apron. The apron collects the gum that drips into the cup. A new chip is made into the tree each week above the previous one. Two collections of resin during a two-month period showed that the ponderosa pine produces an average of 23 barrels of resin per dipping. The southwestern trees average 25-30 barrels per dipping. These results were promising enough to cause Betts to plan more extensive experiments the following year, especially as demand for turpentine was increasing.

In April 1911, a second season of turpentine was established near FVEF in four different areas over 28 acres of black and yellow pine that involved 600 trees. Betts described the area as having little undergrowth and only a few trees less than 12 inches in diameter. Resin was collected every three weeks after the initial tap. The collected gum was put in buckets and then weighed to determine how much dip was gathered. In 1911, an average flow of 0.217 lbs/cup/week compared to a Florida average of 0.263 lbs/cup/week. The dip was comprised of 77.9% rosin and 22.1% turpentine, both of which are satisfactory for commercial use.

On two of the four areas, the blackjacks produced more resin than the yellow pine; while on the third area the opposite happened. In the fourth area, fifty trees larger than 15 inches in diameter were tapped with two cups—one on the north side and one on the south—to test the difference of production between cups. Twenty-seven south cups yielded more than the north while 17 north cups produced more than the south, and six trees had the same flow on each side. One occurrence unfamiliar to the southerners was the diurnal temperature ranges of at least 40 degrees which caused the gum to harden overnight. After a few hours in the morning sun, the gum would melt and drip again. Such temperature fluctuations are rare in the hot and humid south.

Ponderosa pine produces about 4/5 the quantity of southeastern trees when factors such as length of season are the same. The southern season lasts for 35 weeks while northern Arizona lasts 26 weeks at best since flow corresponds to temperature changes. But for whatever reasons, the turpentine project did not continue and the market never developed.



Turpentine work on a ponderosa pine in northern Arizona in August 1910. USFS photo 93752, photographer unknown.



Figure 8. A wintry field camp. Photo by C.M. Linthicum ca.1918.

reforestation; 4) stand improvement; 5) control of damage; 6) sale and logging of timber; and 7) management of the forests (Pearson 1942, Ronco 1998).

Researchers explored unencumbered space to really see what was affecting a tree's life. They could find where: a porcupine had enjoyed a tasty meal of pine needles, an elk had bedded down, mistletoe had taken hold, a lightning-struck tree had fallen onto a neighbor, or snow pack had bent a tree over. This intense, on-the-ground time helped scientists plan their experiments and course of action. Data recording was meticulously scrutinized and redone when necessary. Publications documenting research work received similar inspection (Figure 8).

Communicating research findings to District 3 National Forest managers was accomplished through a quarterly "Fort Valley Bulletin," first published on May 1, 1917, in efforts to provide the scientific results to the foresters. The introductory issue mentioned the research analysis determined that 15-30 years or more is needed to restock cutover yellow pine stands. Studies of forest types, tip moths, brush disposal, and Douglas-fir were also addressed.

Permanent Sample Plots

District (now Region) 3 Chief of Silviculture Theodore S. Woolsey, Jr. aspired to mark 50,000 acres of logged-over southwestern National Forest lands as permanent sample plots, but compromised on 2,000 acres, which still made District 3 one of the National Forest Regions with the highest number of research lands set aside. Woolsey, Pearson, and Wilbur R. Mattoon developed the methods and ideas used on the sample plots; Harrison D. Burrall did much of the establishment work. The initial plots were on the Coconino National Forest, and by 1912, 25 plots around the Southwest had been established. Lengthy instructions on how to establish a sample

Edward C. Martin and Florence Cary Martin

Edward C. Martin (1902-1972), considered by his peers as the “world’s strongest mortal,” was hired by Pearson to build fence in 1932. He later supervised the Fort Valley CCC camps and eventually was named Station Superintendent. Ed’s formal schooling ended at the sixth grade as his father wanted him to take over the family farm, but Ed’s ambitions led elsewhere. He pitched baseball for a Chicago Cubs farm team but declined a spot on the major league roster because of no money. He ended up in Arizona where he and a partner kept mustangs in Sycamore Canyon one winter and sold them the next spring. He then accepted a position at FVEF. For the next 40 years, Ed worked either at Fort Valley or Tucson. He was amiable, proficient with tools, and well-respected as a firefighter (it is said he worked two shifts to everyone else’s one during a fire).

Florence Cary (1904-2001) arrived at FVEF in May, 1933 to work as G.A. Pearson’s secretary. She recalled driving from Tucson on that spring morning wearing sandals and stepping out into snow at FVEF. Her coworkers, including her future husband, chuckled at her. Florence worked in the office building on the Silvics side while the other side held the staff of the Range Division.

Single women lived in the apartment (known as the penthouse) above the office. After a several year courtship, Florence Cary and Edward C. Martin married in 1938 and soon moved into the Krauch residence. She went into Flagstaff about every three weeks for supplies on the very rocky and unpaved road which would later become Highway 180. Their daughter, Maybelle, aka Marty, was born in 1940 and raised at FVEF. Marty enjoyed an idyllic childhood with pet Abert squirrels and forts built amongst the rocks. She recalled swinging in a tree swing built by her father and hearing a mountain lion scream. She bolted to the ground and ran home with her feet barely touching the ground.

The Martin family were the only people living all year at Fort Valley during World War II. Florence planted a Victory garden and grew carrots, turnips, potatoes, lettuce, and beans in a flat area east of the nursery and stored the produce in the root cellar. She eventually had to quit her gardening because of rules regarding such activities on federal property. At one point during the War, she and Ed drove to the Coulter Sample Plot cabin where she knew some sugar was kept. With sugar being in short supply then, she didn’t want it to go to waste.

The family moved in between Fort Valley and Tucson and retired in Flagstaff. In 1995, a birthday lunch for Florence was held in her work space at the FVEF office building. She entertained her hosts with stories of the past. Florence turned 91 years young that day.

plot were written and revised several times (Mattoon 1909, Woolsey 1912).

Permanent sample plots maintained ongoing experiments that attempted to understand a forest’s natural growth cycle. “Extensive” plots of 72 to 480 acres contained trees that were not tagged and measured. Smaller plots, known as “Intensive,” ranged from 3 to 14 acres. On the Intensive plots, each tree was tagged with a number and then monitored over its lifetime. Maps of the plots show exact locations of every thing on it, for example downed logs, stumps, plants, rocks. Usually a tree was measured every five years, sometimes more often, and checked for disease infestation or damage from rodents or a number of other factors that affected growth. Pearson ideally wanted a 200-year record of measurement for a complete life history; however, the majority of the trees were not recorded after a twenty-year span because of changes in

investigative emphasis. Most of the plots were remeasured in the 1990s.

Everything needed to be invented—choosing the site and marking it off, forms used in recording data, best use of photographs, how often to examine, and what to examine. Pearson was a stickler for detail and documenting every particular element. This frustrated some co-workers, but for historical records, the attention to specifics is very helpful in allowing the research to continue today. Letters between Pearson and Regional staff on what paper to use for forms are indicators of his exactness. The original measurements of 1909 were amended by the 1914

(five-year increment) measurements to include factors missed in the initial record. Tin tree tags were replaced by galvanized tags and placed four and one-half feet above ground level, a point that was determined by actual measurement, not merely guessed at. Initial methods were altered when a newer one presented itself to be more accurate, as in the 1912 change from using calipers for diameter measurements to using a steel diameter tape (Scherer 1914). All trees were then remeasured with the steel tape. Instructions were prepared for newcomers who practiced on an already-measured plot before going out on their own. These forms and reports are housed in the FVEF archives.

Critical to the work was the accurate measurement of trees. Initially, the method of measuring a tree's diameter at breast height (dbh) was to be taken at the level of a man's chest. Chest heights vary, so the dbh of a tree could also fluctuate depending upon who did the measuring. FVEF scientists redefined the proper way of determining a tree's dbh: it is to be taken four feet above a nail driven into the south-facing base of a tree at ground level with all litter (fallen pine needles and grass) cleared away. Two to two-and-a-half inches of the nail was to be exposed so the nail wouldn't be overgrown before the next measurement (Pearson 1915).

Natural Regeneration

The Riordans had grumbled at leaving two to four trees per acre, and science showed four to six seed trees above 20 inches dbh were needed to restock a logged area. Seedlings became established only under favorable conditions of seed, moisture, loose soil in the seed ground, protection, and weather and only one to two percent of germinated seeds survive. Pearson's prediction that less than five percent of germinated seedlings survive caused Zon to caution that Pearson may be "digging a grave for himself instead of a monument" (Myers and Martin 1963, Pearson 1936, Ronco 1998).

Nature blessed scientific study in 1919-1920 when abundant precipitation in 1918 produced an exceptional ponderosa pine seed crop. An unusual rainfall of three and one-half inches in late May 1919 allowed germination of the 1918 seed crop to take root. Cloudy skies also kept the nighttime temperatures higher. These new seedlings could sink good roots before the fall drought time and resist frost-heave. Scientists were delighted with this unique opportunity to study tree survival under superb conditions with this introduction of a new age class. But, the overstocking created new problems and foresters were soon lamenting the small-diametered, dense areas of spindly trees. The term "doghair thicket," or trees as thick as the hair on a dog's back, was heard. Arid conditions over the next decade caused high mortality rates of this crop, but the problem of overcrowded trees still exists (Gaines and Shaw 1958, Myers and Martin 1963).

Artificial Regeneration/Nurseries

One of the first projects at Fort Valley was to establish a nursery. Opportunities existed for experimental work to find what methods of planting, gathering seeds, mulch, transplanting, etc. proved successful and what failed. Nurseries opened around the Southwest during the 1910s and grew thousands of seedlings that were later transplanted. As usual, these efforts were sparsely staffed. Expensive attempts



Figure 9. Transpiration pots at FVEF in 1920. USFS photo 49175 by F.W. Haasis.

at artificial restoration failed except for the knowledge gained. By 1927, science indicated artificial planting was most successful when a small plot was completely cleared of herbaceous vegetation and the soil raked, seeds planted in gravelly soil, and the area screened against rodents. But a transplanting continues to have mortality rates for fifteen years (Figure 9, Pearson 1950).

Meteorological Studies

Studying climatological effects on ponderosa pine regeneration was an early Fort Valley priority. Three (later increased to six) meteorological observation stations were established in a chain across the open park of Fort Valley in 1909. The stations contained equipment to monitor temperature, precipitation, relative humidity, wind movement, measurement of melting, soil moisture and temperature, frost, and snow accumulation. Stations were placed in various locales—near the trees or in the open, and all were subject to different wind directions (Figure 10, Jaenicke and Foerster 1911, Pearson 1913).

The data collected for this experiment indicated small, but important, differences in climactic variations. Additional research on forest cover in relation to temperature needed to be conducted and it was determined that the park area would not be a prime location for forest nursery development. A more extensive weather study from November 1916 to January 1, 1920, provided data for the purpose of identifying ecological differences in changes of vegetation as an aid to fire protection. Scientists believed that forest types varied depending on when fire was most likely to occur because they dried out at different times. With the data, fire look-outs could then watch for indicators that a particular area was dry and susceptible to fire. A component of this project was to determine the point at which litter and ground cover will ignite and the effect of brush in various conditions as a fire hazard (Zon and Pearson 1915).

Instruments placed at various locations and altitudes recorded physical conditions that measured air temperature, soil temperature and moisture, precipitation, and wind. This project amplified C. Hart Merriam's earlier work in 1889 that identified lifezones. Stations were set from the woodland range of 5,100 feet to timberline at 11,500 feet in elevation. Forest rangers at Ash Fork and Walnut Canyon kept data for their locales. The weather stations placed at points up the San Francisco Peaks in the zones of yellow pine, Douglas-fir, Limber pine-Bristlecone pine, Engelmann spruce, and timberline were monitored by FVEF scientists. Young silviculturist Emanuel Fritz was involved in this project as he and co-workers installed the spruce location at 10,500 feet in mid-November when the ground was already frozen solid and they had to chip out ice and dirt to create a support hole for the station. They gathered data weekly from the stations, regardless of the weather. Departing from FVEF on foot at 5 a.m. with snowshoes, lunch, dog, and a snow measuring tube, they climbed 3,000 feet in elevation before they reached the first station. They had

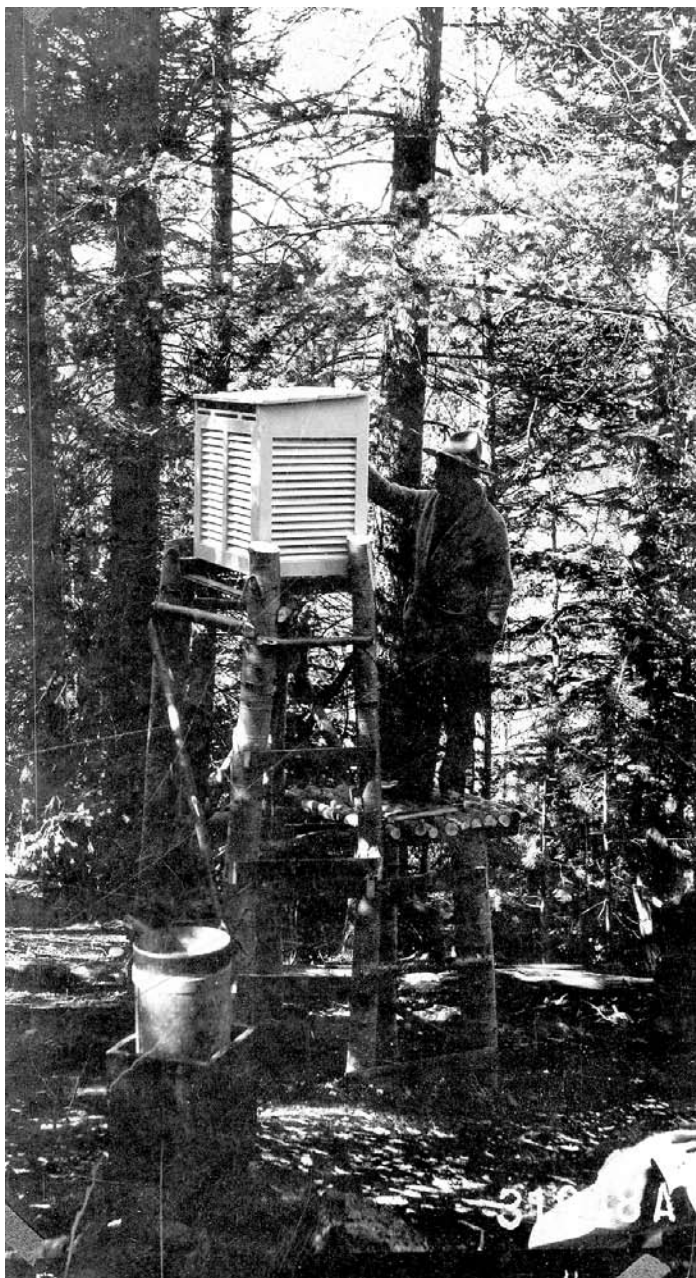


Figure 10. A USFS scientist gathers weather recording from the Campbell's Camp area during the San Francisco Peaks study, 1917-20. USFS photo 31948A taken in February 1917.

to brush snow away from the instruments, take the measurements with half-frozen fingers and then hike up to the next sites. When they finished they ran back down the mountain via moonlight (Fritz 1964).

Publications written about Fort Valley weather always noted the importance of climatic factors in relation to ponderosa pine regeneration. Lack of heat in the higher altitudes affects pines where spruce and fir dominate, and water was the limiting factor toward growth in the desert regions.

The Science of Range Research

The southwestern range was as jeopardized as the forest when scientists began studying its perpetuation. Enormous numbers of grazing sheep, cattle, horses, and goats mowed down the native grasses in the late 1800s. The establishment of Forest Reserves initially prohibited access to public lands grazing, but ranchers objected and lobbied Washington officials for a policy change. Finally, the Arizona Woolgrowers Association (AWGA) invited Gifford Pinchot to see first hand the effects of livestock grazing on public lands in northern Arizona. In June 1900, Pinchot and USDA botanist Frederick J. Coville were met in Winslow by local hosts that included popular Holbrook rancher Albert F. (Bert) Potter, then an AWGA officer. They journeyed south to Show Low during the typical dry and dusty June and noted the few water holes were polluted and noted erosion on excessively overgrazed areas. Ponderosa pine seedlings had been eaten and trampled. By the end of the trip, Pinchot realized the need for livestock operators to have access to the public lands grass to stay in business. He next formed the USFS Branch of Grazing and, knowing he needed a man who knew his way around both the rangelands and the halls of Congress, asked Potter to head the new division. Potter crafted a grazing policy that protected the local stockmen as well as the forage, and implemented range research on specific sites (Pinchot 1947). But it was 1928 before adequate structure and funding was in place for a solid Range Research program.

Southwestern scientists had to keep in mind that by the time research plots were established, the range was so severely overgrazed that, in many areas, the grasses would never recover to pre-European conditions. This must be remembered when interpreting data from protected plots. Range studies were first directed from District 3 headquarters in New Mexico where they had been a part of the curriculum since the beginning of the Forest Reserves. General administration for the range studies came from the Washington D.C. Office of Grazing Studies and then later the Division of Range Research.

Grazing Effects on Tree Regeneration

In Fort Valley, Pearson opposed any livestock grazing on the forests, but discerned he was fighting a losing battle, and proceeded with studies to best determine how young seedlings could be protected from domestic graziers. In 1910, range research began in two areas near the FVEF, both upon the Tusayan (later the Kaibab) National Forest (Figure 11). One range, known as the Wild Bill (also called the Fort Valley Experimental Range), included 24,000 acres and was grazed by cattle. The other was 8,000 acres known as the Willaha sheep range near Kendrick Peak. Both



Figure 11. Steers at the edge of Deer Mountain tank on the Tusayan National Forest, AZ (now part of the Coconino National Forest). Note the browse line on the aspens. USFS photo 269371 by C.K. Cooperrider in 1929.

ranges are of woodland and ponderosa pine forest types, which comprise 88 percent of the southwestern forest types. Studies have once again begun on these areas.

The five Hill Plots, named for District 3 Chief of Grazing Studies Robert R. Hill, were established on the Coconino National Forest in 1910 to study the effects of intense livestock grazing on tree regeneration (Hill 1911). In 1912, a secondary study of the recovery of understory vegetation when protected from livestock grazing began. These areas were examined until 1947, then not again until 2002.

Initial evidence showed that grazing impacted tree regeneration and stockmen, especially sheep raisers, naturally resented hearing that overgrazing was hazardous to range health. Efforts to discredit the scientists and their work and suppress the findings led to political pressure to close FVEF. During a joint meeting of the AWGA and the Arizona Cattle Growers Association (ACGA) in July 1920, a Resolution passed by the conference members said the Fort Valley Experiment Station was considered worthless because "...the work has been an entire failure and a use-less expense to the amount of approximately \$20,000 per annum," and recommended that it be abandoned and that the lands occupied by it be restored to entry..." as reported in the *Coconino Sun* of July 9, 1920. A letter from Secretary of Agriculture Edwin T. Meredith to ACGA president Charles Mullen asked for specifics as to where FVEF had failed. An apologetic response blamed the Resolution on "some sheepmen" that was approved by weary, uninterested cattlemen who passed it without realizing what they were saying. FVEF remained open.

In 1927, with the creation of the SWFRES, range research was added to Fort Valley's scope. Scientists, led by Charles K. "Coop" Cooperrider, conducted studies of range resources, domestic livestock, wildlife, and forest and range influences. Their purpose was to develop methods to ensure sustained yield of forage, develop livestock management policies to stabilize range industry, and to modify these methods to serve the maximum proper use.

Major findings of Fort Valley range research was noted by Tucker (1989): "Coop and other Research men found that in several plots that had been under fence for a good many years, death from drouth, mice and other rodents was almost equal to the damage outside of the plots."

Edward Clayton Crafts began his USFS career at Fort Valley in 1932 on both timber and range studies and eventually became USFS Associate Chief. He said a definite decision was never reached about grazing's impact on regeneration and wildlife grazing had more effect on timber management than domestic grazing (Figure 12, Crafts and Schrepfer 1972).

Conflict

"Full crops of timber and forage can not grow on the same ground at the same time. The two may thrive side by side for a few years, but sooner or later one or the other must decline" (Pearson 1927).

By 1937, an irreparable breach between senior scientist Pearson and range staff caused administration to separate silvicultural and range. Mudslinging, accusations, suppression of scientific facts, and other harmful acts were occurring from both sides. By 1941, Pearson was instructed to limit his work to only pine reproduction before his 1945 retirement and to summarize his three decades of research into a manuscript that was published posthumously in 1950 as "Management of Ponderosa Pine in the Southwest."

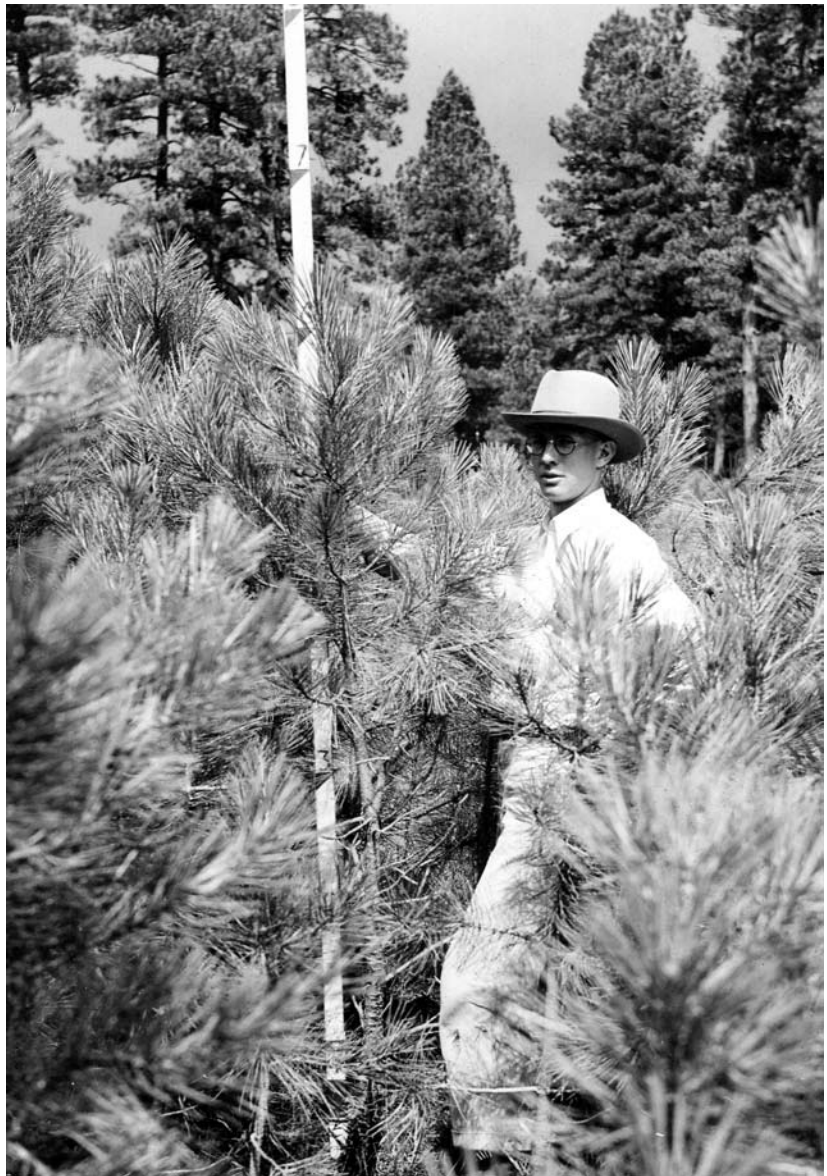


Figure 12. USFS scientist Edward C. Crafts holds a measuring stick as part of the Cooperrider/Cassidy grazing study at FVEF. USFS photo 319004 by W.J. Cribbs in 1935.

The Science of Watershed Studies

Fort Valley research concentrated on regeneration; however, part of the SWFRES mandate was to study watersheds at sites like the Sierra Ancha Experimental Forest in eastern Arizona and later, Beaver Creek in central Arizona. In 1925, Pearson and “Coop” corresponded with Washington office staff Earle H. Clapp, formerly of District 3, and W.R. Chapline on wording for an appropriation for watershed research. A watershed is an upstream drainage area that feeds a larger river basin. Scientists began watershed management investigations on the importance and effect of vegetative cover to the quantity and quality of stream flow, along with the indirect studies of reforestation that affect watersheds.

Summary

Even after a century, efforts toward the goal of 200 years worth of tree records are only half attained. The lands and resources of the twelve USFS Region 3 National Forests still have much of their research value. Ecological distinctions or lifezones, initially described by C. Hart Merriam, and developed further by FVEF scientists, contain numerous study projects. The papers and poster papers included in these Proceedings contain more information on many of the components to Fort Valley-based research over the past century.

Edward C. Crafts, among others, believed that researchers should live in the forest instead of in town and that researchers were hampered and frustrated because their projects were planned by administrators subject to political whims far from sample plots (Crafts and Schrepfer 1972). Methods of conducting research changed when a scientist would drive to the office in a personal vehicle, then drive to the forest in a government vehicle, gather data, and return to the office to compile results while looking at a computer screen. Originally, researchers would walk from home to the office, then walk into the forest and gather data, return to the office and ponder the data while looking at the forest outside the window, and then walk home in the evening. A forester should instinctively consider all options—altitude, exposure, wildlife, flora, water table, and understory—in an attempt to determine tree growth success or failure (Figure 13). They should also research and analyze experiments on a given study in more than one area before making blanket recommendations, especially in the diverse Southwest where climate, soil types, and conditions change so rapidly.

Cooperrider, Krauch, Pearson, Zon, and the Riordans believed the use/abuse of the Southwest forests and ranges detrimental to future generations. They saw beyond immediate greed and wastefulness and on to the importance of conservation and fought for it. Their efforts continue today by scientists and students with the same vision: perpetuation of the magnificent ponderosa pine forest and expansive range lands of the Southwest. Fort Valley’s scope of work for its second century has a strong, firm foundation from which to build upon because of the pioneering scientists of yesterday, today, and those yet to come.



Figure 13. A portion of the FVEF headquarters as it appears today. Photo by S.D. Olberding.

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