Vegetation and Land Use in Nevada

Paul T. Tueller

NEVADA IS RANGELAND. All of the land area in the state not built-up, covered with water, used for transportation and other rights-of-way, or used for intensive agriculture is rangeland, constituting some 80 to 90 thousand square miles or over 85 percent of the land area. The vegetation may appear to be monotonous, but in reality there is considerable variety ranging from salt desert shrub vegetation which provides rich winter forage for sheep and cattle, to high elevation mountain mahogany and quaking aspen stands which harbor mule deer in the heat of summer. Bristlecone and limber pine at the highest elevations act as sentinels over the thousand of acres of salt desert shrub, sagebrush and pinyon-juniper dominated vegetation below. Interspersed throughout, and giving even more variety and continuity, are riparian and wetland vegetation types.

Nevada falls almost entirely within the Great Basin, a part of the Basin and Range physiographic province. From the Sierra Nevada extending outward across the Great Basin to the Utah border, we find a continuous pattern of valley, mountain range, valley and mountain range again. In his book, *Silent Cordilleras: the Mountain Ranges of Nevada*, Alvin McLane (1978) has annotated 314 separate and distinct mountain ranges within the state. These mountain ranges are highly dissected with varying directions of slopes and associated foothills, canyons, buttes, ridges and arroyos. Geological and erosional processes have created innumerable distinct environments with different plant communities, each with distinct but often repeatable species compositions. It is mostly a cold desert with relatively high elevations, ranging from 500 feet to over 13,000 feet with many of the valley bottoms having elevations between 3,500 and 6,500 feet.

The Soil Conservation Service, USDA has described some 453 ecological sites or unique soil-vegetation-landform units that form the basis for management recommendations. These sites are found mostly in areas of average and higher forage productivity. Many more ecological sites and their plant communities have yet to be described, particularly at the highest elevations and some of the lower salt desert or Mojave desert sites. Areas dominated by sagebrush or salt desert shrubs constitute the two most common kinds of vegetation.

Southern Desert Shrub Vegetation

In the southern part of the state, where the valleys have both a lower latitude and lower elevation, the vegetation is typically Mojave Desert. The characteristic species are cresote bush, bur sage, blackbrush (Fig. 1) and the Joshua tree *(Yucca brevifolia)*. Two additional showy species of yucca are found in southern Nevada, the Mojave yucca or spanish bayonet *(Yucca schidigera)* and the fleshy fruit yucca *(Yucca baccata)*.

When compared with the cold deserts in the northern Great Basin, the Southern Desert Shrub or Mojave Desert plant communities are floristically much more diverse, exhibiting considerably more speciation. For example, in a typical cold desert shrub/grass plant community, one may be hard pressed to list 4 woody species; whereas in many Mojave desert plant communities, one may commonly list 15 to 20 or more shrub species. This vegetation is sparse, and in many ways much more fragile and slow to heal if overgrazed or disturbed; therefore the ecosystems here, and in the cold desert, are very slow to undergo successional changes.

Mojave Desert plant communities are extremely susceptible to drought and produce good forage for livestock only every 7 or 8 years. They are usually grazed as ephemeral ranges and reliance on the ephemeral vegetation makes their carrying capacity very erratic. Few ranches exist. During very good years it would be possible to move most of the livestock from the rest of the state southward to feed on this resource. For example, one year I clipped red-stemmed filaree *(Erodium cicutarium)* in a Mojave desert valley in southern Nevada in an ecosystem that usually produced almost no usable forage, and recorded 8 tons per acre of high quality air dry forage.

Salt Desert Vegetation

In many of the lower valleys, internal drainage coupled with high summer temperatures, high evaporation rates, and low rainfall has created a salt desert vegetation (Fig. 2). The harshness of the salt deserts has led to subtle vegetation differences over relatively short changes in elevation and substrate or drainage (Roundy and Young 1985). Dominant species in the upland salt desert on alluvial fans with well-drained soils and low alkalinity include Bailey's greasewood *(Sarcobatus baileyi)*, shadscale, and associated species.

A lowland salt desert shrub vegetation is found on saline riparian areas where many plants tap shallow ground water. Black greasewood, four-wing saltbush, bluejoint *(Elymus triticoides)*, saltgrass *(Distichlis stricta)* and Great Basin wildrye are characteristically dominant species. This valley-bottom, playa-edge, salt desert shrub vegetation might best be described as salt marsh vegetation (Branson et al. 1967). Other characteristic species include the grass, alkali sacaton *(Sporobolus airoides)* along with salt tolerant species such as pickelweed *(Allenrolfea occidentalis)*, *Sueda*

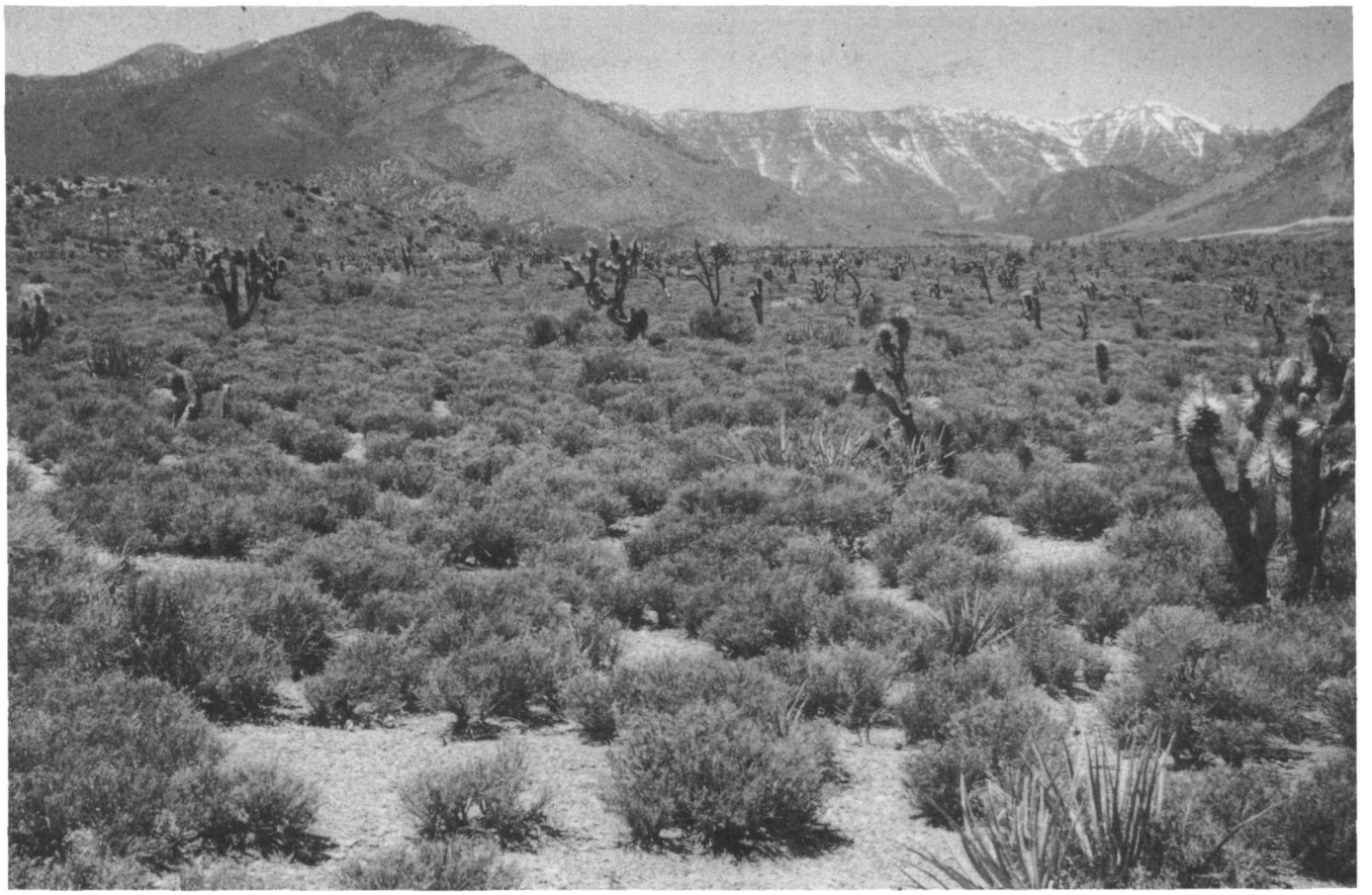

Fig. 1. *Blackbrush* (Coleogyne ramossissima) *in the Mojave Desert with scattered Joshua tree* (Yucca brevifolia), *fleshy fruit yucca* (Yucca baccata) *and Mormon tea* (Ephedra nevadensis).

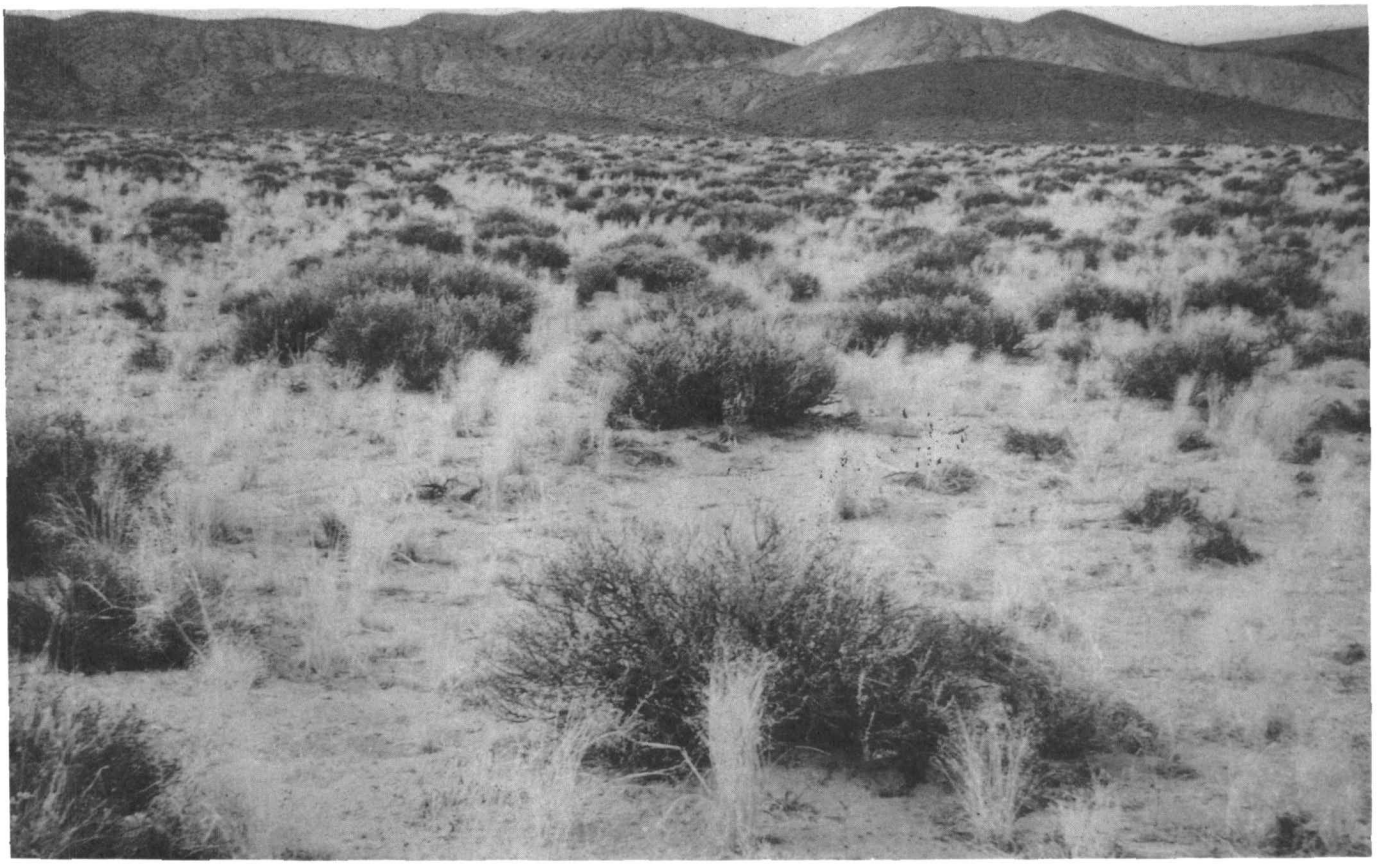

Fig. 2. *A salt desert shrub plant community dominated by Bailey's greasewood* (Sarcobatus baileyi) *with Indian Ricegrass as the dominant understory species.*

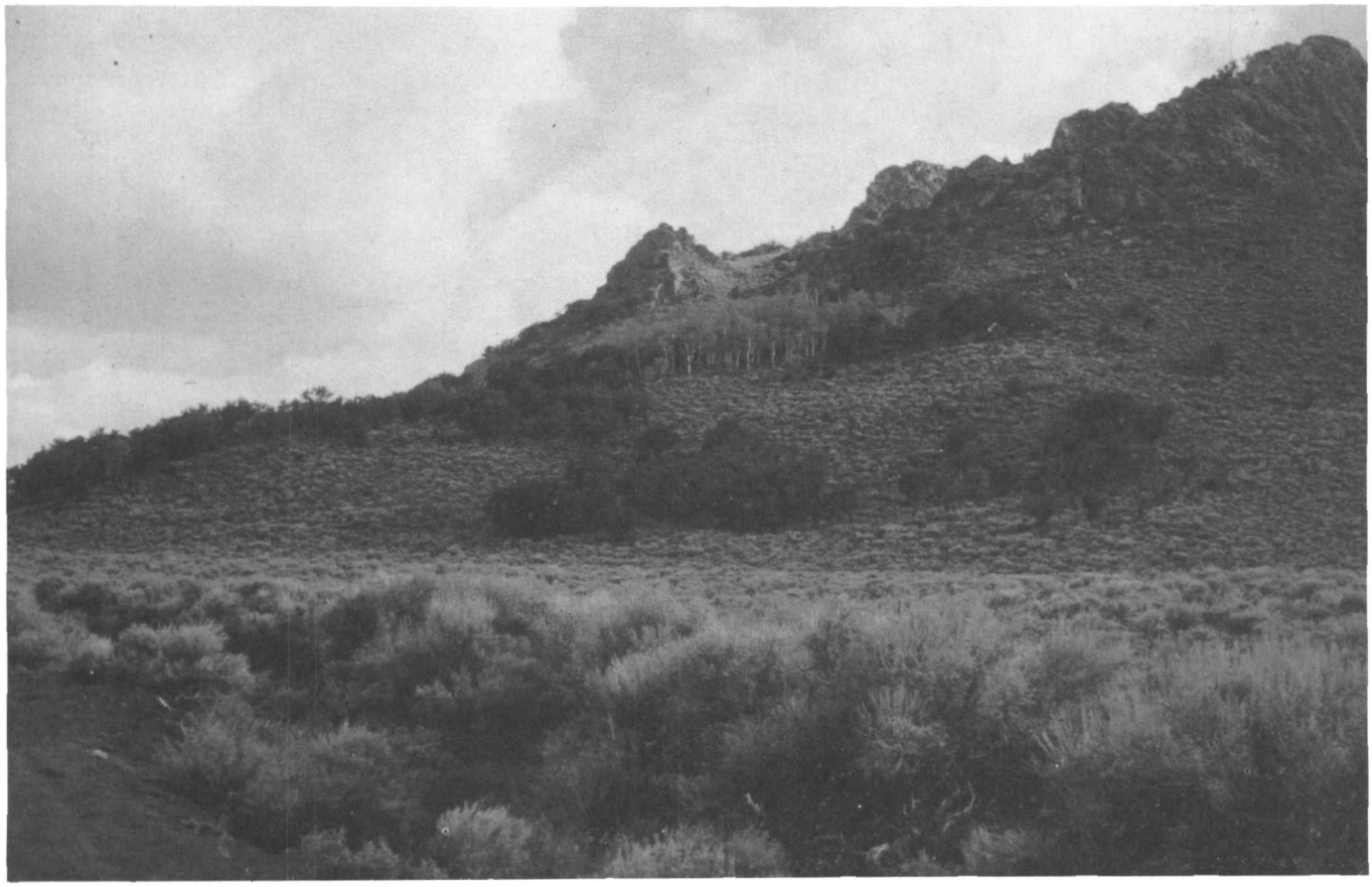

Fig. 3. *High elevation mountain big sagebrush with associated curlleaf mountain mahogany and quaking aspen.*

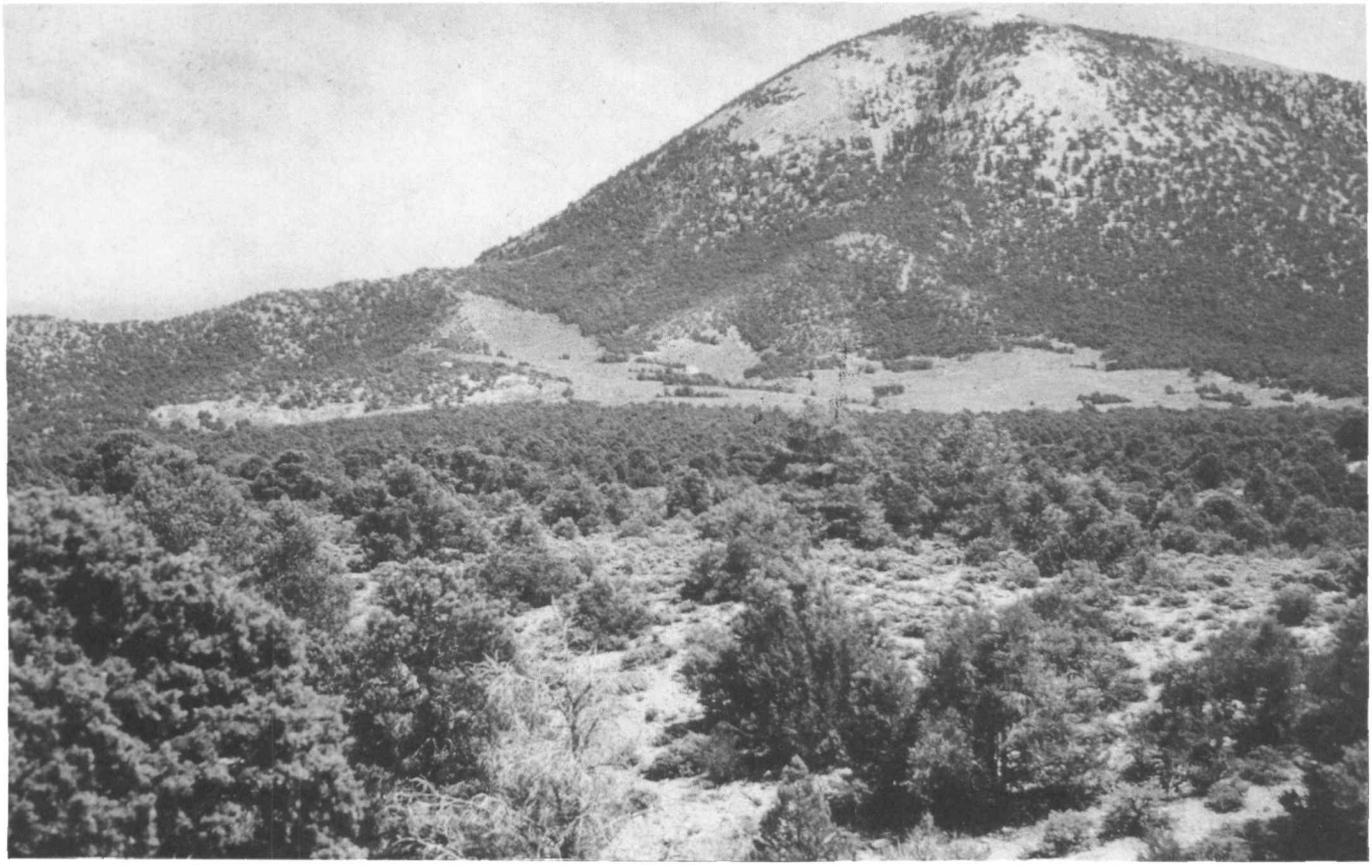

Fig. 4. *Single needle pinyon and Utah juniper.*

sp. and *Salicornia* sp.

There are many other characteristic species that are not dominant but are important species in the salt desert shrub vegetation based on either their constancy or uniqueness. Among these might be listed dalea *(Dalea polyadenia),* globemallow *(Sphaeralcea ambigua),* Nuttal's saltbush *(Atriplex nuttallii),* spiny hopsage, bud sage, green rabbitbrush, Kochia *(Kochia americana),* black sagebrush, and pygmy sagebrush *(Artemisia pygmeae).* Although grasses are sparse in the salt desert shrub vegetation, the most common ones would be Indian ricegrass, squirreltail, alkali sacaton, salt grass, blue joint, and Great Basin wildrye.

Carrying capacity for livestock in the salt desert is generally very low, nearing 25-35 acres/AUM. While this vegetation will often not support livestock, one commonly sees livestock grazing in these communities. This is the result of having pockets of higher producing vegetation, often with a grass understory, in depressions with deeper soils. For example, areas of winterfat, a desirable shrub, are found interspersed in the salt desert. There is also pygmy sagebrush which is a palatable salt desert shrub species with very limited distribution on rather barren, open sites.

Sagebrush/Grass Vegetation

Over 200 ecological sites, dominated by one or more of 15 taxa of the genus *Artemisia,* are found within the Great Basin (Tueller 1985) and support carrying capacity values falling between 5 and 20 acres per AUM. Sagebrush is found in valley bottoms of the higher valleys and spreads upward to some of the highest elevations, interfingering into the mountain brush vegetation (Fig. 3) and the pinyon/juniper woodland. These plant communities are referred to as the western intermountain sagebrush steppe, Great Basin-Colorado plateau sagebrush (West 1983), northern desert shrub vegetation (Tueller 1975), or simply sagebrush/grass. Most widespread would be Wyoming big sagebrush, basin big sagebrush, mountain big sagebrush, low sagebrush, black sagebrush and early sagebrush *(A. arbuscula longiloba).*

It is commonly conceded that this vegetation has been significantly altered from what was found by the first Europeans. The sagebrush vegetation of the Great Basin foothills and valley have been particularly impacted. These areas, often the drier part of the sagebrush vegetation zone, were where the towns were built and exotic species were introduced. Many of these areas commonly had early spring grazing and, because of the settlements, fire became a much more significant factor.

Many ecologists believe that the sagebrush/grass plant communities once had considerably more palatable perennial grass species in the understory of the more mesic sites. Now many of these grasses have been replaced with less desirable species and the more zeric sites likely never contained abundant perennial grasses. Fire and the introduction of cheat or bronco grass *(Bromus tectorum)* resulted in permanent floristic changes on most of these foothill ranges.

The perennial grasses in the sagebrush/grass vegetation include such species as bluebunch wheatgrass, Idaho fescue, Thurber's needle grass, needle-and-thread grass, Great Basin wildrye, Indian ricegrass, and galleta. Now these grasses have given way in large measure to increasing species such as squirreltail, Sandberg's bluegrass, rabbitbrush and other shrubs and annuals such as cheatgrass. Important understory perennial and annual forbs are too numerous to mention.

Pinyon/Juniper Woodlands

The 11.5 million acres of pinyon-juniper woodlands in Nevada are highly variable with respect to the proportions of pinyon to juniper and to the presence or absence of certain understory plant species (Tueller et al. 1978 and Everitt 1985). The primary species are the single-needle pinyon and the Utah juniper of which some stands are apparently climax, fire-safe sites (Fig. 3). On other sites, there are seral stands where pinyon and juniper have invaded various sagebrush sites as a result of fire, heavy grazing or other factors (Blackburn and Tueller 1970). Other woodland species include the Rocky Mountain juniper, the western juniper, and in one eastern Nevada valley the water-loving juniper *(Juniperus osteosperma holmgrenii).* Scattered across the Great Basin are populations in mesic sites with two-needled fasciles. It is thought that these specimens are *P. monophylla/P. edulis* hybrids.

Intermixed throughout the woodland are plant communities dominated with one or more of the sagebrush species. The pinyon/juniper woodland constitutes a valuable resource with wood products (posts, firewood, etc.), livestock forage, pine nuts, wildlife habitat, and water yield as some of the important uses. Livestock carrying capacity is highly variable depending upon understory characteristics and may vary from 10 to 30 acres per AUM.

Grassland Vegetation

Grasslands are almost nonexistent in Nevada although one can find small, pure stands of grasses such as Indian ricegrass, Nevada blue grass *(Poa nevadensis),* Great Basin, wildrye and galleta. Numerous small and an occasional large meadow support pure stands of grasses and grasslike plants. In the past, some stands of Indian ricegrass and great basin wildrye have been harvested for seed. Over a million acres of sagebrush/grass vegetation have been ploughed and seeded to introduce perennial grasses. For many years, these seedings have produced a good spring and fall feed where livestock can usually be seasonally grazed at 3 to 10 acres per AUM. These seedings are not without criticism, however. Many have been concerned with the idea of creating man-made monocultures, and grass tetany and increased fire have also been problems.

The rather intense speciation of the genus *Artemisia* suggests that this genus has been evolving in the Great Basin for thousands of years and was always an important part of all cold desert plant communities between the pinyon-juniper woodland and the salt desert vegetation.

This was even true for the more mesic environments at higher elevations where one might expect to find more grasses. Additions of both temporary and permanent annual grasslands created by fire in the sagebrush vegetation zone constitute on exception to this rule. These stands, where recurring fire is not a factor, are reverting back to sagebrush/grass vegetation.

Mountain Brush Vegetation

At elevations slightly higher than the pinyon-juniper woodland much of the non-sagebrush/grass vegetation is characterized as mountain brush vegetation (Tueller 1975). Important dominant shrubs include snowberry *(Symphoricorpus orbiculatus),* bitterbrush *(Purshia tridentata* and *P. glandulosa),* cliffrose *(Cowainia mexicana),* mountain mahogany, Gambels oak, service berry *(Amelanchier pallida),* squaw apple *(Peraphyllum ramosissima),* and bitter or choke cherry *(Prunus demissa* and *Prunus virginiana).* These sites often produce considerable forage (3 to 15 acres per AUM) and are important grazing and water-yielding areas in the mountain ranges of the Great Basin.

Intermixed among the mountain brush vegetation are several endemic species. Many are of interest to the plant ecologist. An example of one such species is fern bush *(Chamaebatiaria millefolium)* which is found on xeric sites at intermediate elevations on rocky areas usually with limestone parent material in eastern Nevada. A fine-leaved mountain mahogany *(Cercocarpus intricatus)* also occurs on limestone sites in eastern Nevada and green ephedra *(Ephedra viridis)* is sometimes found as a dominant shrub on south-facing slopes in southern, central, and western Nevada.

Somewhat related to the mountain brush, but confined to the east side of the Sierra Nevada, we find fire-formed stands of eastside chapparal with three important species: buckbrush *(Ceanothus velutinus),* manzanita *(Arctostaphylos patula)* and squaw carpet *(Ceanothus prostratus).* Anderson's peach brush *(Prunus andersonii)* is a mountain brush species common along the eastern front of the Sierra Nevada and mule's ear is a common forb.

Forest Vegetation

At higher elevations, there are a few dominant forest species. In the southeastern part of the state, stands of yellow pine *(Pinus ponderosa)* may be mixed with the pinyon/juniper woodland. On the east side of the Sierra Nevada there are extensive stands of yellow or Jeffery pine *(Pinus jeffreyi).* At elevations above 10,000 feet, there can usually be found stands of white fir *(Abies concolor),* limber pine *(Pinus flexis),* whitebark pine *(Pinus albicaulis),* and the often studied bristlecone pine *(Pinus longaeva).* Subalpine fir and Douglas fir are also found in limited stands. These high elevations forest types are of great interest to wilderness advocates and botanists but provide little to the Great Basin forage resource.

Alpine Vegetation

Alpine tundra is found above 11,000 feet where the species composition changes away from typical cold desert and intermountain species to an alpine tundra flora. Bell and Johnson (1980) defined the alpine zone as those areas above the highest areas dominated by shrubby *Artemisia* species. They include low sagebrush *(Artemisia arbuscula arbuscula)* fellfields as subalpine. These sites are not very important for livestock grazing but do provide summer browse and forage for certain wildlife species such as mule deer and big horn sheep. Great Basin alpine vegetation has been studied by plant geographers and ecologists interested in endemism and mountain island biogeography (Billings 1978).

Riparian Vegetation

Intermingled throughout the cold desert are the water-loving vegetation communities. Riparian vegetation is found along the streams, near springs and seeps in the mountain ranges, and along the edges of the many playas or dry lake beds. Freshwater wetlands are associated with many of the large valleys in the Great Basin. These riparian or water-loving vegetation types provide considerable grazing and are a strong attraction to livestock. Carrying capacity here may be the highest of any of the Great Basin vegetation types and subsequently these areas have often been overgrazed. Presently there is considerable concern, research, and a renewed effort toward the management of this valuable vegetation resource but its future for livestock grazing is not clear.

Protected Areas.

The vegetation of much of the Great Basin has been impacted and influenced by numerous perturbations such as grazing, fire, lack of fire, land disturbance for roadways, rights-of-way, mining, flooding, and military activities. The vegetation on long protected military and energy land withdrawals gives us a glimpse of the vegetation composition and productivity without heavy grazing. At the Nevada Test Site (A facility of the Department of Energy) in southern Nevada, one plant community is dominated by black brush in the overstory and desert needlegrass *(Stipa speciosa)* in the understory, each exhibiting dominance in their respective layers. With protection from grazing for some 30 years, this almost extinct plant community is flourishing. Outside the test site, where desert grazing has been practiced for many years, the desert needlegrass is essentially missing.

Throughout the state there are numerous study exclosures, research natural areas, and other sites set aside for future reference and a new national park has been established. One can hope that these areas will allow ecologists to study and understand the limits of perturbations, e.g., wildfire, and their influences on the vegetation over the long term, as well as to maintain genetic diversity. Increased understanding will lead to better management of the state's vegetation resources.

Discussion and Conclusions

There seems to be great contemporary interest in Great Basin ecosystems and plant communities. This is related to the increases in our urban populations and to a latent

interest in the Great Basin by conservationist/preservationist groups and scientists.

THE VEGETATION OF NEVADA is perceived differently by various individuals and publics. For example, the perception of the vegetation by a rancher, a miner, a wildlife biologist, a member of a preservationist group, or a member of the general public, if the latter person really exists, will all be different. Some feel that man has been uncaring and that overgrazing and land degradation have been the result (Reveal 1979). Others see that Great Basin as a significant rangeland resource with many different uses and numerous resources.

Ranchers are often faced with the harsh realities of modern day economic situations. Yet they still love and appreciate the value of rangeland resources and the need to maintain the vegetation at a good ecologically productive level.

Mining tends to alter the range landscapes. To some it constitutes a rape of the land, to others it is a matter of man being clever enough to wrestle great wealth from the earth, the scars themselves representing this endeavor. Many mining companies within the Great Basin are, on their own, now healing and revegetating these altered landscapes. Most appreciate the needs of wildlife and livestock and the general need to maintain their ecosystems.

With all this in mind, what can we say about the contemporary status of the vegetation? The vegetation must primarily be considered as being low seral or disturbed. The succession is almost exclusively secondary with the possible exception of primary succesion sites along the edges of playa lakes. Many land uses have had strong influence on species composition. Range managers working with various agencies strive to understand these secondary successional stages and use the knowledge to manage the rangeland vegetation resource.

Many thousands of acres once covered by big sagebrush and associated species are now dominated by the annual cheatgrass. Cheatgrass is eminently pre-adapted to the dryer sagebrush sites and its infusion into the vegetation represents a permanent floral change. In some areas cheatgrass has dominated the vegetation for over 30 years. Just when one thinks that perennials are gaining a foothold, another fire spreads across the landscape perpetuating this vegetation (at least on the dry end of the sagebrush zone). On the more mesic end of the sagebrush/precipitation gradient, cheatgrass is found only s the result of disturbance and is a temporary species.

Species of certain habitats have now become endangered. In 1979 Monzingo and Williams listed 170 plants in Nevada that were either threatened, endangered, possibly extinct or on a watch list. There are no grasses and no important shrubs on the list. The majority are forbs and most have very restricted ranges in very narrow habitats. It is unclear how influential grazing has been to the fate of threatened or endangered species. It is important, however, to keep in mind the fact that many species have survived 120 years of livestock grazing and much of that time there was far more intensive grazing than currently occurs. While these species do not constitute an important component of the vegetation based on abundance, they are nevertheless an important component in the total vegetation picture of the state.

We are often our worst enemy when it comes to the management of vegetation on public lands. For example, we have passed the Wildhorse and Burro Act which requires the BLM to manage wild horses in a "thriving ecologic balance." However, political interference has precluded that directive and essentially decreed that there will be, at least on many rangelands, intense overgrazing by wild horses. Until we pass new laws allowing the management of these animals, many areas of Great Basin vegetation will suffer. It is ironic that with the authority vested in the Nevada Department of Wildlife to manage resident populations of big game they have the responsibility of managing the numbers of mule deer, antelope and bighorn sheep so that they will not overbrowse the rangeland vegetation. However, no one has expressed the initiative to do the same with the wild horses because of their special classification and because of the political rhetoric involved.

It appears that man is in the Great Basin to stay and that our rangeland vegetation resources will continue to be used for various benefits for all. One can wonder what these vegetation resources will be like in 100 years. It will benefit mankind as a whole if we can, in the future, develop management approaches that will allow the management of these vegetation resources in perpetuity.

Literature Cited

Bell, K.L., and Johnson, R.E. 1980. Alpine flora of the Wassuk Range, Mineral County, Nevada. Madrono, 27:25-35.

Billings, W.D. 1978. Alpine phytogeography across the Great Basin. Great Basin Naturalist Memoirs, Intermountain Biogeography: a symposium. 2:105-117.

Blackburn, W.H., and P.T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in east central Nevada. Ecology 51(5):841-848.

Branson, F.A., R.F. Miller, and I.S. McQueen. 1967. Geographic distribution and factors affecting the distribution of salt desert shrubs in the United States. J. Range Manage. 20:287-296.

Everitt, R.L. 1985. Great Basin pinyon and juniper communities and their response to management. *In:* Proceedings-selected papers presented at the 38th annual meeting of the Society of Range Management at Salt Lake City, Utah, February 11-15, 1985, p. 53-61.

McLane, A.R. 1978. Silent cordilleros; the mountain ranges of Nevada. Camp Nevada, Reno, Nevada, 118p.

Mozingo, H.N., and M. Williams. 1980. Threatened and endangered plants of Nevada. U.S. Dept. of the Interior Fish and Wildlife Service and Bureau of Land Management, 268p.

Reveal, J.L. 1979. Biogeography of the intermountain region. Mentzelia, No. 4, 92p.

Roundy, B.A., and J.A. Young. 1985. Salt deserts of the Great Basin. p. 39-49 *In:* Proceedings-selected papers presented at the 38th annual meeting of the Society of Range Management at Salt Lake City, Utah, February 11-15.

Tueller, P.T. 1985. Sagebrush dominated vegetation of the Great Basin. p. 24-30. *In:* Proceedings-selected papers presented at the 38th annual meeting of the Society of Range Management at Salt Lake City, Utah, February 11-15.

Tueller, P.T., C.D. Beeson, R.B. Tausch, N.E. West, and K.H. 1979. Pinyon-juniper woodlands of the Great Basin: distribution of flora, vegetal cover. USDA Forest Service Research Paper INT 229, U.S. Dept. of Agr., Ogden, Utah. 23p.

Tueller, P.T. 1975. The Natural Vegetation of Nevada. Mentzelia 1:3-28.

U.S.D.A. Soil Conservation Service. 1977. General vegetative map of White Pine County, Nevada. Soil Conservation Service, U.S. Dept. of Agriculture, L/MLRA D-28 3/77 HGA, 12p.

West, N.E. 1983. Temperate Deserts and Semi-Deserts. Edited by N.E. West, Elsevier Scientific Publishing Co., Amsterdam, Netherlands.

Joseph H. Robertson—Range Scientist Pioneer

Barry Davis

Dr. Joseph H. Robertson, or "Dr. Joe", as his former students call him, is a teacher, a scholar, researcher, and humanitarian. He was born in Carrington, North Dakota, on January 10, 1906, to Mabel M. and William Robertson. In 1914, Joe's father died, leaving Mabel with Joe, age eight, and Gertrude, age two, to rear on her own. The family moved to Beaver Crossing, Nebraska, and then on to Oak, Nebraska, as Joe's mother struggled to raise her family. The difficulties she had to overcome as a woman and a single parent left Joe committed to fair play.

When Joe was 14, his mother, with Gertrude in tow, left for a job as a housekeeper. Joe remained in Oak with his aunt. When his mother returned six months later, Joe had finished the nine dollar Farmer Burn's correspondence course in wrestling and could throw every boy within two years of his age. He had also taught himself several other masculine skills such as smoking, swearing, and squandering money. He had earned more money than his mother while she was away, yet it was all gone.

The Oak school had only ten grades. When Joe was half-way through the tenth grade, his mother advertised for work in an area with a full-term high school. The family moved to a vacant farm four miles from Alexandria, Nebraska, where Joe jogged to school the remainder of the school year. In his junior year, his landlord supplied a retired saddle horse. When the landlord decided that Joe should quit school and work the farm full-time with a view to partnership, Mable found another vacant "fixer-upper" home two miles from Alexandria, without cows, chickens, or horses.

Joe grew quickly and by age 16 he weighed 162 pounds. He loved sports and was caught up in the mid-western basketball mania. He excelled in both football and basketball. Having no money for football shoes, Joe nailed cleats onto a pair of button shoes.

Early in his senior year of high school, Joe played a basektball game while ill with the flu and subsequently was sick in bed for several weeks. Then against his doctor's orders, he played in three games during the state basketball tournament. He left the last game extremely sick with numbness in his legs. He developed a heart murmur and never fully recovered from this episode. It changed his entire lifestyle. Gone were the days of boisterous and rowdy behavior. Joe then concentrated on his studies and graduated as salutatorian of his class.

Due to Joe's interest in agriculture and his need for a relatively sedentary lifestyle, he entered the University of Nebraska to study agricultural engineering. A bank failure wiped out his savings and he had to return home to earn money to attend school.

After failing to earn sufficient money to return to the university at Lincoln, he registered at Peru State Teacher's College to obtain a teaching certificate. Teaching seemed the most direct route to earn money to return to engineering school. After receiving his certification, Joe taught a year at a rural school two miles from Oak, with 19 students in grades one through eight. Because the students had to pass a series of difficult tests to enter the ninth grade, there was a backlog of older students in the eighth grade. The teacher previous to Joe had not been much of a disciplinarian. As vouched for by his college students forty years later, Joe had little difficulty in solving the discipline problems and eliminating the backlong. Now, with fewer students to teach, the school refused to raise his salary.

The following fall Joe found a new job as principal, custodian, and teacher of a three-teacher school at Cadams, Nebraska. Joe taught grades 7 through 10 to allow the regular principal to run for county office. When the principal lost the election, Joe returned to Peru to complete his A.B. in education and science in August 1928.

Three themes were to characterize Joe's teaching throughout his career. First, as a teacher, Joe never failed to take advantage of a student's inquisitiveness or to teach lessons from real situations as they were discovered.

Secondly, Joe did not stress rote memorization. He wanted students to think and reason and he often asked questions that had no single right answer to see what a student would do with it. Joe would teach lifelong processing skills such as creativity and problem solving in a way in which few other instructors were able to do.

Thirdly, Joe has a tremendous sense of "fair play" which influences everything he does both privately and as a teacher.