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**An Analysis of the Flora of the Canadian River Canyon  
Mills Canyon Section**

by

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*(Note: This article was originally written in 1981. Since 1981 there have been a number of taxonomic revisions which have resulted in name changes and combinations of species. This article, although not previously published, has been cited in other studies. In order to maintain the integrity of the data as originally collected, there has been no attempt to update the taxonomic revisions which have occurred since the original data collection in 1981.)*

Within the grasslands of northeastern New Mexico, the Canadian River has carved out an enormous canyon known as the Canadian River Canyon, exposing a variety of sandstone strata and supporting extensive stands of both riparian and woodland vegetation. A portion of the Canadian River Canyon occurs within the Kiowa National Grassland (Panhandle National Grasslands). The Canadian River Canyon-(Mills Canyon Section) area is located in Harding and Mora counties, northeastern New Mexico, about 30 miles east-northeast of Wagon Mound. In 1981, a detailed floristic survey of the Mills Canyon section of the Canadian River Canyon was undertaken. This report is a summary of the findings of the 1981 study which covered approximately 50 sections of rangeland, canyonland, and floodplain west of State Highway 39.

The study area was restricted to those portions of the Kiowa National Grassland along the Canadian River that were contained within a rectangular area approximately 6 miles wide and extending from the vicinity of Roy, New Mexico, northward for approximately 14 miles.

### Geology of the Study Area

The Canadian River Canyon study area encompasses large expanses of flat upland habitat as well as numerous steep rocky slopes and canyon bottoms. There are also a number of precipitous side canyons, many of which are several hundred feet deep. This variation in habitats makes the Canadian River Canyon study area ideally situated to provide an interesting mixture of prairie and montane species.

Most of the Mills Canyon section of the Canadian River Canyon consists of what, at first glance, appears to be relatively homogenous sandstone overlaid by a thin band of limestone. However, between the village of Mills and the bottom of the Canadian River to the west, there is a drop of nearly 1000 feet in elevation. Throughout this 1000-foot drop, there are numerous geologic strata representing the Cretaceous, Jurassic, and Triassic ages. The following are the more prominent formations arranged stratigraphically from the top of the canyon to the bottom.

The first strata encountered at the top of the canyon is Greenhorn limestone, which occurs on knolls, hills, and breaks on top of the canyon. Beneath the Greenhorn limestone lies Graneros shale, a dark gray shale interbedded with thin layers of limestone. Both the Greenhorn limestone and Graneros shale underlie the grasslands which stretch outward from the lip of the canyon.

Beneath the Graneros shale lies Dakota sandstone. Within the Canadian River Canyon the Dakota sandstone can vary from lenticular to parallel-bedded gray shale, shaley sandstone, and sandstone layers. The basal unit of this member is composed of an uninterrupted band of massive sandstone. Dakota sandstone outcrops near the rim of the canyon.

The Morrison formation occurs beneath the Dakota sandstone. It consists of gray-green and reddish-brown sandy clays intermixed with local beds of white to brown sandstone, siltstones, and occasional limestones. These beds mark the transition from the Cretaceous to the Jurassic age. Outcrops of the Morrison

formation are often found in the middle slopes of the canyon. Beneath the Morrison formation occur the massive white to pink, fine-grained sandstones of the San Rafael group, layers that often occur near the bottom of the canyon. The light brown sandstones and reddish-brown to purple mudstones of the Dockum group also occur near the bottom of the canyon. The Dockum group represents the transition into rocks of the Triassic age and is composed of the oldest rocks exposed in the Mills section of the Canadian River Canyon.

### History of the Study Area

Human use of the Canadian River Canyon extends far back into prehistory. Archaeological sites occur throughout the canyon. The Canadian River Canyon, however, is also of great historic significance. Wagons following the Santa Fe Trail often crossed the canyon in the areas of Mills. Perhaps the most significant cultural resource in the area is the remains of a large orchard and stone house located on the floodplain of the Canadian River near the Mills Forest Camp. The stone house was built in 1881 by Melvin Whitson Mills on land which his father, Daniel Mills, had homesteaded in 1870. The house served as headquarters for managing the large orchard which contained some 14,000 trees, including peaches, apples, pears, cherries, apricots, plums, mulberries, quinces, nectarines, grapes, walnuts, chestnuts, pecans, and almonds. The house was also a stagecoach stop for Mills' Concord Coach line, a line which originated in Kansas and ran from Clayton through the Canadian River Canyon to Fort Union. The old stagecoach road still exists and is the primary access to the Canadian River Canyon. In October of 1904, a large flood occurred in the Canadian River Drainage. This flood severely damaged the orchard. The orchard never fully recovered, and the last reported harvest occurred in 1912. Surprisingly, during the 1981 survey, a few scattered trees were encountered, still persisting along the canyon bottom. These included pear, apple, apricot, mulberry, walnut, pecan, plum, and osage orange.

### Survey Strategy

The analysis of the Mills Canyon Section of the Canadian River Canyon involved two periods of collection and observation. The first week in July was selected as the prime time for the first field session after checking historical rainfall patterns for the grasslands. It was felt that if investigations had to be confined to a one-time effort, this time period would allow for the inclusion of some of the holdovers from the spring flora as well as some of the early fall-

flowering species. The first field period actually occurred between June 30 and July 4, 1981, and was staffed by a volunteer field crew composed mostly of experienced field botanists. These personnel represented the University of New Mexico, New Mexico State University, the U. S. Forest Service, the New Mexico State Heritage Program, and the Los Angeles County Museum of Natural History and included William Martin, Reggie Fletcher, Paul Knight, Richard Spellenberg, Robert Soreng, Darell Ward, Beth Schmidt, Ann Cully, Mollie Toll, Sandra Limerick, Tim Fischer, Robert Gustafson, Pamela Fletcher, Gwendolyn Fletcher, Christina Allen, Rex Wahl, and Elizabeth McClellan.

The second field period of this study occurred on September 17 and 18, 1981. At this time a floristic survey was completed by William Martin and Reggie Fletcher. The second survey period was necessary because of the drought conditions which prevailed in the area until midsummer of 1981. The flora was relatively sparse during the early part of the growing season in late June and July. During that time the greatest variety of species occurred in protected habitats, such as in canyons and along watercourses. Abundant mid- and late summer rains (more than 20 inches in less than two months) resulted in an explosive growth of vegetation late in the growing season. This development made necessary the second survey in September to make additional collections from selected parts of the study area.

In all, more than 1000 collections of vascular plants from numerous habitats were made during the summer and fall surveys. These collections represented 493 taxa arranged in 73 families of ferns, fern allies, gymnosperms, and angiosperms. The severe drought in 1981 affected the number of taxa present and their flowering times. During a more mesic year, the number and diversity of vascular species within the study area would undoubtedly increase.

Our initial survey plan was to implement a series of transects through the canyon to gather species and distribution data. After the second field day of the first field session, it was agreed that it would be more efficient to concentrate on a general survey of the area that would be as complete as possible and to reduce emphasis on transect data and other numerical values for use in comparative studies.

The results of this survey include an annotated checklist of plant taxa and a vegetation map of the area. General descriptions of various small side canyons

and other areas collected are provided to further familiarize the reader with the study area. The following are descriptions of each of the canyons.

### Field Notes on the Canadian River Canyon Study Area

During this study, field notes on the ecology of the Canadian River Canyon and its tributaries were compiled and distribution data were gathered on all vascular plant species encountered. Due to the drought, these data are probably incomplete. In spite of intensive field searches, the drought undoubtedly detracted from the completeness of our distribution data. The following are the field notes and observations of habitats within the various canyons and collection locations within the study area.

#### Vercere Canyon

Vercere Canyon is a small tributary (Sections 21 and 22, T21N, R24E). The canyon is oriented from east to west and empties into the Canadian River about 1/4 mile below Mills Forest Camp. The mouth of the canyon lies at approximately 5200 feet. Physiographically, Vercere Canyon is composed of steep hillsides of reddish sandstone, with sandstone scarps of various sizes lining the rim of the canyon. This canyon was sampled from its mouth to a point near its head at approximately 5900 feet.

The mouth of Vercere Canyon was dominated by *Pinus edulis* and *Juniperus monosperma* in an approximate 1:1 ratio. The piñon trees in the canyon produced a moderate fall crop of nuts despite the severe drought. *Ipomoea leptophylla*, which was common in the sandy areas along the river, occurred infrequently above the floodplain near the mouth of the canyon. More common taxa in the canyon included *Bouteloua gracilis*, *B. curtipendula*, *Hilaria jamesii*, *Andropogon scoparius*, *A. saccharoides*, *Gutierrezia sarothrae*, *Rhus trilobata*, *Quercus undulata*, *Quercus grisea*, and *Opuntia imbricata*. In addition, *Artemisia filifolia* was occasionally present, as were *Eurotia lanata* and *Artemisia frigida*, which were both uncommon.

The floor of the lower Vercere canyon contained *Tamarix pentandra*, *Salix exigua*, *Fallugia paradoxa*, and *Melilotus albus*. *Rhus radicans* and *Parthenocissus inserta*, common in the narrow rugged tributaries of the Canadian River drainage, were rare near the mouth of Vercere Canyon. These species, however, became increasingly common as one proceeded farther into

the canyon.

The exposed south-facing slope of Vercere Canyon had few *Pinus edulis* compared with the dominant *Juniperus monosperma*. An abundance of *Dalea formosa*, *Echinocereus triglochidiatus*, *Fallugia paradoxa*, *Rhus trilobata*, and *Cercocarpus montanus* was found on these slopes. The north-facing slope was dominated by stands of *Quercus undulata*. Some 600 yards up the canyon, beyond the mouth, there were stands of *Juniperus scopulorum* and *Pinus ponderosa*. Beyond that point, the canyon floor steepened to an approximate 10° slope with an average of 30° slopes for the canyon walls. *Quercus undulata* grew on both the north and south canyon walls. *Juniperus scopulorum* also increased in abundance in the upper portions of the canyon.

*Populus acuminata* occurred along the canyon bottom, with *Amorpha canescens* and *Verbascum thapsus* at the border of Sections 21 and 22. Ponderosa pine was also found but was uncommon. This portion of the canyon floor was strewn with large boulders, some of them several feet in diameter. Oaks dominated the south-facing slope, but *Bouteloua eriopoda* and *Prosopis glandulosa* were also encountered.

In general, the woodland area on the east side of the Canadian River Canyon was more or less confined to the vicinity of the canyon rim. In contrast, the west side of the canyon was dominated by a wide border more typical of a piñon-juniper community type. The rim on the west side was, however, slightly higher than the rim of the east side. The rim above Vercere Canyon was bordered by an often bare sandstone cap, with scattered scrubby ponderosa pine growing out of the shallow soils on top of the sandstone. These trees owed their existence to moisture accumulating in the cracks in this sandstone. As one proceeded in all directions away from the rim, the soil depth increased and the ponderosa pine diminished in importance, eventually sharing dominance with piñon-juniper vegetation. The more common grasses at these locations included *Bouteloua gracilis*, which dominated along with *Buchloe dactyloides*, *Muhlenbergia torreyi*, and *Hilaria jamesii*, the later varying in amounts according to intensity of pasturage.

### Biscante Canyon

Biscante Canyon is located in Sections 21 and 22, T22N, R24E, and is oriented from northeast to southwest. The head of this canyon diverges into a multitude

of tiny fingerlike canyons that disappear into the dry plains. The surrounding plains were represented by open grasslands characterized by scattered *Yucca glauca* and *J. monosperma*. The grassland was interspersed with stands of *Gutierrezia*.

A shallow depression occurred at the head of the canyon, marked by concentrations of *Pinus edulis*. The soil was compact and sandy, derived from a white, fractured, erodible sandstone. The most common species were *Chenopodium album*, *Melampodium leucanthum*, *Hymenoxys acaulis*, *Gaura coccinea*, *Portulaca oleracea*, *Solanum rostratum*, *Pinus edulis*, and *Gutierrezia sarothrae*. Continuing down into the canyon, the walls steepened to form a narrow, gently sloping gorge which cut through the sandstone at a 4-6° dip. At this point, bedrock lined the canyon bottom, with permanent pools of water and marshes nestled in sandstone basins in the bedrock. These basins appeared to have been formed by storm waters that carved into the floor of the canyon. The abundance of water within these pools suggested that they were spring fed. One large pool of approximately 20 feet by 40 feet was at least 10 feet deep and populated by sunfish. The shallower portions of the pools supported extensive populations of *Sagittaria cuneata*. The pools were often rimmed by dense stands of *Juncus*, *Carex*, and *Oxalis*. Ferns were very common on the sandstone ledges above the pools. The dominant vegetation of the surrounding upland habitats included *Rhus trilobata*, *Quercus undulata*, *Opuntia imbricata*, *Juniperus monosperma*, and *Brickellia californica*.

Within the middle portions of the canyon, alluvium began to cover the sandstone bedrock on the canyon floor. The water, which was so prevalent in the upper canyon, disappeared beneath the sandy soils which covered the canyon bottom. Willows and canyon grape (*Vitis arizonica*) were abundant. The adjacent hillsides were dominated by stands of *Rhus trilobata*, *Pinus ponderosa*, *Pinus edulis*, *Juniperus monosperma*, *J. scopulorum*, *Vitis arizonica*, and occasionally *Cucurbita foetidissima*. Dense stands of cacti abounded (especially *Echinocereus triglochidiatus*) on the drier slopes of the canyon. Forest elements became more prevalent on the lower canyon slopes. Huge ponderosa pines and spreading piñon pines formed a canopy. At a point about 3/4 mile down the canyon, abundant stands of *Tradescantia*, *Melilotus*, *Amorpha*, *Tragopogon*, and *Verbascum* grew in the deeper soils along the bottom. At that point, the forests which were common on the upper canyon slopes retreated to the canyon bottom. Sandstone parapets dominated the upper slopes as the canyon widened and became drier. The canyon bottom still

barriers existing between the white oak and black oak sub genera.

Approximately 1.5 miles down the canyon a decided change was noticed in the relative humidity level of the canyon. As the canyon broadened, the ponderosa pine phased out and species of juniper began to appear. At this point, the study team travelled diagonally to the north and cut across the south-facing slope of the canyon. The only plant of interest encountered in this side trip was a small truncate *Mammillaria* with the apex only slightly above ground level. The team's initial reaction was that this was probably a species called *M. gummifera* or perhaps a variety of *M. heyderi*. Without flowers and/or fruit, definite identification was not possible. The team then angled back to the northeast and skirted the top of the canyon. Vegetation of significance included grassland dominated by a carpet of snakeweed and dotted with patches of *Yucca*.

### Mestenito Canyon

Mestenito Canyon (Sections 2, 11, 35, T21N, R24E) is roughly T-shaped, with the top of the 'T' longer than the stem and running from north to south. The stem of the 'T' is not only shorter but also drier and runs from east to west. Mestenito Canyon is visually impressive, with the upper area composed of red sandstone and the lower slopes composed of sculptured white sandstone. The top of the canyon was dominated by *Juniperus monosperma*, *Rhus trilobata*, *Quercus undulata*, and *Cercocarpus montanus*.

The study team began the exploration Mestenito Canyon by walking from west to east from the mouth of the main canyon toward its head. A torrent of water rushing down the canyon was soon encountered. The lower canyon was very mesic and supported large stands of *Pinus ponderosa*. Here, the slopes were strewn with boulders covered with numerous lichens. Many of these boulders provided suitable habitat for an extensive population of *Cheilanthes villosa*. The secondary dominants at this location were *Quercus gambelli*, *Ptelea trifoliata*, *Pinus edulis*, *Juniperus scopulorum*, and *Rhus trilobata*. Adjacent to the stream were significant stands of *Urtica*, *Vicia*, and *Helianthus*.

The upper slopes of this canyon were more xeric and were dominated by *Quercus*, *Cercocarpus*, *Echinocereus viridiflorus*, *E. triglochidiatus* var. *melanocanthus*, *Opuntia imbricata*, and *Coryphantha vivipara*. Further up the canyon, numerous boulders and ledges were encountered. Plant life there included *Hilaria jamesii*, *Bouteloua curtipendula*, *Brickellia californica*,

*Cheilanthes villosa*, *Woodsia* spp., and *Solidago wrightii*. The mid-slopes at that point were characterized by ponderosa and piñon pines, *Ribes* spp., *Rhus toxicodendron*, *Bromus*, *Andropogon*, *Quercus*, and *Parthenocissus insertus*. The north-facing slope below the rim featured stands of grapes, including the genera *Andropogon*, *Sporobolus*, *Hilaria*, and *Aristida*.

The upper reaches of the canyon were definitely drier than the lower canyon. These xeric conditions may be attributed to the fact that the upper canyon was relatively shallow, no longer providing the sheltered effect typically afforded by a deep narrow canyon. The north-facing slope was vegetated by *Pinus ponderosa*, *Rhus trilobata*, *Pinus edulis*, scattered *Penstemon barbatus*, and species of *Quercus*. The streamside habitat was occupied by *Vitis arizonica*, *Brickellia californica*, *Melilotus alba*, *Rumex* spp., *Verbascum thapsus*, *Bouteloua curtipendula*, *Equisetum*, *Cyperus*, *Juncus*, and an occasional *Tamarix*. The south-facing slope of the canyon was dominated by *Pinus edulis*, *Opuntia imbricata*, *Yucca baccata*, and species of *Quercus*.

At this point, the team left the east-west dogleg of Mestenito Canyon and proceeded northwest to intersect with the head of the main canyon which runs approximately north to south. The interceding area between the two canyons was heavily grazed open grassland. At this juncture, a wild burro was encountered moving off into the canyon. The surveyors also noted numerous plants of *Mammillaria* at the margins of the grassland. The head of the north-south drainage of Mestenito Canyon was densely populated by *Prunus virginiana*, *Pinus edulis*, *Rhus trilobata*, *Cercocarpus montanus*, *Bouteloua gracilis*, *Hilaria jamesii*, *Brickellia californica*, *Portulaca oleracea*, and *Chenopodium album*. Scattered stands of *Opuntia phaeacantha*, *O. Polyacantha*, *Guierrezia sarothrae*, *Buchloe dactyloides*, and *Artemisia frigida* also occurred in the area.

Proceeding southward into the canyon proper, the team began to encounter mesic areas dominated by *Verbascum thapsus*, *Bouteloua curtipendula*, *Rhus toxicodendron*, *Melilotus alba*, *Scirpus* spp., *Juncus* spp., *Phragmites communis*, *Woodsia* spp., *Vitis arizonica*, *Sagittaria cuneata*, *Taraxacum officinale*, and *Equisetum*.

Approximately 1/3 mile farther down the canyon, a large spring emerged from the east-facing canyon wall. Although the spring surfaced from a sandstone substrate, the water was highly calcareous, suggesting that the water may have

passed through a limestone deposit previous to its emergence from the sandstone. The rate of flow at this spring was approximately 1/2 gallon per minute. A large population of the orchid *Epipactis giganteus* was growing in a small wetland located in the overflow of the spring. There were between 50 and 100 plants in this population. Most of them were in flower, but some were fruiting. This same species of orchid was also located approximately 200 yards farther down the canyon, growing beneath a shaded ledge.

The upper portions of Mestenito Canyon are fairly mesic. The main channel of the canyon is cut through a layer of white sandstone. The surrounding hillsides were primarily parkland with slopes dotted by scattered *Pinus ponderosa* and *Juniperus scopulorum*. Also found were stands of *Pinus edulis*, *Cercocarpus montanus*, *Rhus trilobata*, *Vitis arizonica*, *Parthenocissus inserta*, and *Quercus undulata*. The areas along the stream in the bottom of the canyon supported an abundance of *Salix* and *Franseria acanthicarpa* along with *Acer negundo*, *Ptelea trifoliata*, and *Equisetum*.

About 1/2 to 2/3 mile down Mestenito Canyon, the sandstone cliffs that line the upper canyon become dissected to form numerous broken ledges and rock shelters. At one point there is a sharp drop of at least 25 feet in the floor of the canyon, resulting in a waterfall and a large natural amphitheater cut in the sandstone bedrock. Here a herd of approximately 40 Barbary sheep was noted. The sheep were resting in rockshelters and on ledges along the eastern slope of the canyon. Two large males had horns which extended backward to the flanks of their shoulders, and upon noticing the team, they led the herd in a wild scurry up the broken sandstone slopes. Below this point the canyon dropped steeply and was littered with massive boulders, often 20 feet in diameter, which obstructed easy passage through the canyon bottom. At this point the flowing stream disappeared below the surface into the numerous cracks and fissures afforded in the spaces between the rocks and boulders strewn on the canyon bottom. The lower canyon below the field of rocks and boulders leveled out and had intermittent pools of water surfacing in low spots of the canyon bottom. Here the team encountered extensive stands of *Acer negundo*, *Salix exigua* and *Populus angustifolia*.

#### Spring and Small Unnamed Tributary Canyon Due East of Mills Canyon Campground

The upper, more rugged portion, of this unnamed south-southeast flowing

canyon lies primarily in Section 14, T21N, R24E. This area was surveyed by Reggie Fletcher and crew on Tuesday, June 30, 1981.

The head of this small canyon receives storm water runoff and the overflow from a small spring. In combination, these two water sources form pools and seeps along the canyon bottom that provide habitat for a large variety of riparian species. Most of the species noted in this canyon were restricted to mesic zone in the upper 1/4 mile of the canyon.

Except for a small outcrop of shale, the canyon is composed entirely of sandstone. The canyon sides and floor are steep. The east-facing slope averages some 30°, the west slope approximately 20°, and the bottom approximately 10°, with some spots declining as much as 20°. The canyon floor is strewn with car- and room-sized boulders. At the border of Sections 14 and 23, the canyon rim opens to the main Canadian River Canyon, and the small tributary drops sharply to the floodplain below.

The dominant plant on the steep east slopes of the canyon was *Juniperus monosperma*. *Pinus ponderosa* was occasional and scattered. *Yucca baccata*, *Nolina microcaropa*, and *Quercus undulata* were also scattered throughout the east slope of the canyon. The more shaded western slope was mostly occupied by *Juniperus scopulorum* and *Pinus ponderosa*. The overstory on the rim above the box was a mixture of *J. monosperma*, *Q. undulata*, and *Pinus edulis*.

The upper portion of the canyon just below the spring was dominated by an overstory of *Pinus ponderosa*, *Salix exigua*, *Salix amygdaloides*, *Populus fremontii*, *Populus x acuminata*, and *Juniperus scopulorum*. *Forestiera neomexicana* was common along the canyon floor. The rugged nature of this small canyon has protected it from livestock use, and while stock use a dozen trails into the water at the head of this canyon, the remainder of the boulder-strewn floor of the canyon provides only a small amount of level area. Nonetheless, the variety of taxa occupying the multitude of microhabitats in the canyon was surprising.

The complexity of hybridization of the oaks within the study area was difficult to decipher. In this canyon alone, specimens showing traits of possible crossing with *Quercus rugosa*, *Q. havardii*, *Q. gambelii*, *Q. undulata*, *Q. Grisea*, and *Q. pungens* were noted.

East Rim (W 1/2 Section 23, E 1/2 Section 24, T 21N, R24E)

After collecting the spring and canyon area in Section 14, Fletcher and his crew crossed up and out of the canyon to the east rim of the Canadian River Canyon. From this location they proceeded southward to a small rugged canyon located in the eastern half of Section 25. The rim portion of this canyon was dominated by *Bouteloua gracilis* with some *Hilaria jamesii* and occasional *Aristida* spp., *Pinus edulis*, and *Opuntia imbricata*. There were also patches of *Quercus undulata* and *Juniperus monosperma*. This area was composed mostly of open grassland except adjacent to the canyon rim where an oak-woodland association was more typical.

As one proceeded eastward along the main rim of the Canadian River Canyon, the prairie influences increased and woodland components decreased. *Bouteloua gracilis* dominated, with *Opuntia imbricata*, *Muhlenbergia torreyi*, and *Buchloe dactyloides* increasing according to the intensity of past use. *Buchloe dactyloides* was the last grass to disappear and the first grass to reappear in areas such as cattle trails that were heavily impacted. Local diversity included such species as *Eriogonum jamesii*, *Cryptantha jamesii*, *Haplopappus spinulosus*, *Solanum eleagnifolium*, *Thelesperma megapotamicum*, *Artemisia frigida*, *Gutierrezia sarothrae* (most of which appeared dead due to drought stress), *Opuntia polyacantha*, *Engelmannia pinnatifida*, and *Psoralea tenuiflora*.

A dry stock pond was encountered in the bottom-center of Section 24. Common weedy species such as *Euphorbia marginata*, *Solanum rostratum*, *Verbena plicata*, *Helianthus annuus*, and *Xanthium strumarium* dominated this site. Even considering the drought conditions, this pasture was in poor condition. In other pastures along the east rim, grasses showed a mixture of *Bouteloua hirsuta*, *B. gracilis*, *Andropogon saccharoides*, *Hilaria jamesii*, *Agropyron smithii*, and several others. *Suckleya suckleyana* (poison suckeya) was abundant in the bottom of the dry tank. This plant is poisonous to livestock by reason of its potential for producing hydrocyanic acid. At times cattle losses in Colorado and New Mexico have been heavy due to this plant. Poison suckleya is found in moist sink holes, around the drying borders of lakes and ponds, and in tanks such as the one in which it was found. Because this species is an annual, it is difficult to control, except by complete removal of the seed source. It is one of the few undesirable plants localized enough in occurrence to merit attention in this report.

Small Unnamed Canyon Flowing South through the East 1/2 of Section 25,  
NE Corner of Section 35, T21N, R24E

The upper reaches of this canyon were gently sloping (approximately 2-3°) and were dominated by sandstone bedrock. *Bouteloua curtipendula*, *Andropogon scoparius*, and *Amorpha canescens* were common throughout this portion of the canyon. *Pinus ponderosa* was established on scabrock on both sides of the canyon bottom, but *Juniperus monosperma* was the dominant conifer. About 1/2 mile below the head of the canyon, the drainage deepened. Conditions become mesic enough to support scattered *Elymus canadensis*, and *Pinus ponderosa* increased in density. The dominant conifer, however, was still *Juniperus monosperma*. The open and shallow nature of the canyon, combined with southerly aspect, has prevented the steeper, lower portions of the canyon from supporting many of the more mesic species found elsewhere in the study area. For example, within the lower portions of the canyon, *Pinus ponderosa* was absent. *Juniperus scopulorum* was present with the relatively common *Forestiera neomexicana* and widely scattered *Populus fremontii*.

A primitive road, probably used for oxcarts, paralleled the canyon above the canyon rim on the east side. Apparently the larger trees in the lower canyon were cut for use along the road and stumps of these trees were still in evidence. In most places this road was not discernable for any distance as ruts in the road had eroded to depths of more than 6 feet. *Quercus grisea* was common on the open south-facing slopes in the area, having, in large measure, replaced *Q. undulata* which was more typical of those environments.

The floodplain of the Canadian River near the mouth of the canyon was heavily disturbed. Rehabilitation problems at this location are exacerbated by periodic flooding. Approximately 4 miles below the Mills Canyon Campground, a site some 50 feet above the canyon floor contained flood debris piled among the *Juniperus monosperma*. These high watermarks were at points some 500 yards between the banks of the river. Even without the effects of periodic flooding, utilization levels exceeded that which most perennial forage could withstand.

Canyon de la Cueva Drainage (Sections 7 and 12, T20N, R25E)

The Canyon de la Cueva drainage was surveyed by Reggie Fletcher and Richard Spellenberg on July 1, 1981. Beginning along the north fork of the canyon,

the surveyers proceeded to a spring located on the rim of the north fork. This spring is located due north of the confluence of the two forks of the canyon. From the spring, Fletcher and Spellenberg traveled down the north fork to the main channel of Canyon de la Cueva and up the main canyon drainage to the rim in the southeast 1/4 of Section 6.

The north rim of Canyon de la Cueva forms a narrow cobbly bench that gently slopes to the west. The vegetation along this bench consisted primarily of a mixture of *Juniperus monosperma* and *Bouteloua gracilis*. *Pinus edulis* occurred occasionally at the site, and *Quercus undulata* was abundant in local patches. *Opuntia imbricata* and a number of prickly pear cacti were also common.

Below the spring, near the confluence of the north fork and main channel of Canyon de la Cueva, an earthen dam creates a small impoundment of water. *Pinus ponderosa* was widely scattered around this tank, anchored in cracks of the sandstone bedrock. An old abandoned rock house (15 x20 feet) lies above the tank. The presence of this house emphasizes the importance of the spring. A prehistoric chert scraper was also found below the tank, indicating prehistoric use of the spring.

In the defile below the tank, there were several small potholes which provided suitable habitat for a variety of grasses and grasslike species. *Populus tremuloides*, *Rosa woodsii*, and other mesic species whose presence is dependant upon a moisture-enhanced condition also occurred at this location.

At midslope of the canyon above the spring there was a terrace containing *Prosopis glandulosa*, *Baccharis wrightii*, *B. pteronioides*, and *Ephedera torreyana*. This south facing aspect averaged about 30° in slope.

The canyon floor of the north fork was boulder strewn but relatively mesic. The main canyon lacked the diversity of its more rugged counterparts. The main canyon also runs almost due east-west, allowing for desiccation in most of the canyon. The south-facing slope of the canyon was the most xeric habitat seen during the course of the study. This exposed slope contained the largest populations of the relatively rare species *Yucca neomexicana*. These south slopes often supported extensive stands of *Nolina microcarpa*, *Prosopis glandulosa*, *Opuntia imbricata*, *Opuntia phaeacantha*, and *Juniperus monosperma*. *Pinus edulis* was almost absent from the steeper slopes but did

become more prominent as the slopes decreased.

*Fallugia paradoxa* occurred at its highest stage of development in the study area within this canyon. *Populus x acuminata* and *P. fremontii* were also present, but the hardier *Salix exigua* was more common than either of these species.

Approximately 300 yards up the main canyon from its junction with the north fork is a permanent natural water hole. This pothole provided habitat for *Typha angustissima*, *Alisma trivale*, and *Tamisk pentandra*.

### SUMMARY

This portion of the Canadian River report contains the field notes and observations of the surveyors who participated in the study. These notes provide an overview of the setting and conditions within the canyon in 1981. During the course of this study, more than 1000 plant specimens were collected, representing 493 taxa arranged in 73 families of ferns, fern allies, gymnosperms, and angiosperms. In addition, a vegetation map of the entire study area by sections was compiled. This mapping will appear in subsequent issues of the journal.

### **Annotated Checklist of the Flora of the Canadian River Canyon and Surrounding Areas**

The following is a checklist of the 493 taxa arranged in 73 vascular plant families. These taxa are listed by family, genus, specific epithet, and subspecific epithet if applicable. Families are listed alphabetically, including both flowering and nonflowering plants. Genera and species are also listed in alphabetical order. Where possible, common names are also given. References to the areas where these species were noted within the study area are presented as a letter code (surrounded by parentheses) following the common name of the species. The following is a description of each of the general collection areas represented by the letter reference code. In all, specimens were collected in 28 different areas within and around the Canadian River Canyon. These collection areas are represented by the letters A-Z as well as AA and BB.

### Reference Code for Collection Areas

(All locations are approximate based on the best judgement of the recorder)

- A. Vercere Canyon, lower section, Sec. 22, T21N, R24E, 5150–5300 ft.
- B. Vercere Canyon, upper section, Sec. 21, T21N, R24E, 5300–5900 ft.
- C. Rim Area, west side of Canadian River, SW 1/4 Sec. 22, 5900 ft.
- D. Along Canadian River, vicinity of Mills Forest Camp, Sec. 10, 15, 5150–5200 ft.
- E. East side of Canadian River, spring and small canyon, Sec. 14, 5200–5750 ft.
- F. Tank and surrounding prairie, NE 1/4 Sec. 23, W 1/2 Sec. 24, 5800–5850 ft.
- G. East side of Canadian River, small canyon below tank, W 1/2 Sec. 25, NE 1/4 Sec. 35, 5050–5850 ft.
- H. Canadian River area below Mills Forest Camp, Sec. 35, 26, 23, 5050–5150 ft.
- I. Spring, north fork of Canyon de la Cueva, NE 1/4 Sec. 12, T20N, R25E, 5050–5550 ft.
- J. Canyon de la Cueva, EC 1/4 Sec. 12, N 1/2 Sec. 7, T20N, R25E, 5050–5700 ft.
- K. Limestone hills between Hwy 39 west of Mills 6000 ft
- L. From 1/2 mile to 1 mile northeast of Abbott Lake, 18, 19, T23N, R25E, 5800–6000 ft.
- M. Plains along Mills Canyon Road, Sec. 12, T21N, R24E, 5700–5850 ft.
- N. Upper slopes and rim, Biscante Canyon, SW 1/4 Sec. 22, NE 1/4 Sec. 28, T22N, R24E, 5800 ft.
- O. From 1 mile north of Mills to 6 miles north of Mills, 5900–6150 ft.
- P. Canyon along Route 600, N 1/2 Sec. 11, T21N, R24E, 5500–5700 ft.
- Q. Canyon Colorado, Sec. 8, 9, 10, T21N, R24E, 5800–5900 ft.
- R. Marshy area and slopes, upper Biscante Canyon, Sec. 22, T22N, R24E, 5600–5800 ft.
- S. Lower Biscante Canyon to the Canadian River, Sec. 21, T22N, R24E, 5300–5600 ft.
- T. Upper Blanco Canyon, SE 1/4 Sec. 1, NE 1/4 Sec. 22, T20N, R25E, 5600–5700 ft.
- U. Lower Blanco Canyon, Sec. 28, 29, T20N, R26E, 5300–5500 ft.
- V. Rim top and grassland above Blanco Canyon, NW 1/4 Sec. 22, T20N, R25E, 5700 ft.
- W. East-west arm of Mestenito Canyon, NE 1/4 Sec. 2, T21N, R24E,

- 5400-5700 ft.
- X. Upper north-south arm of Mestenito Canyon, SW 1/4 Sec. 35, T22N, R24E, NW 1/4 Sec. 11, T21N, R24E, 5400-5700 ft.
- Y. Lower north-south arm of Mestenito Canyon, SW 1/4 Sec. 2, NE 1/4 Sec. 11, T21N, R24E, 5100-5400 ft.
- Z. Grassland and rimrock above Mestenito Canyon, SE 1/4 Sec. 2, NE 1.4 Sec. 11, T21N, R24E, 5700 ft.
- AA. Casa Chiquita Canyon, S 1/2 Sec. 28, T22N, R24E, 5300-5700 ft.
- BB. Emplazado Canyon, spring, walls, and rim, Sec. 9, T20N, R25E, 5500-5800 ft.

### Annotated Check List of the Flora of the Canadian River Canyon

#### Aceraceae. Maple Family.

*Acer negundo* L. var. *interius* Western box elder. (D,E,H,R,Y)

#### Alismaceae. Water-plantain Family.

*Alisma subcordatum* Raf. American water-plantain. (BB,R)

*Alisma trivale* Pursh. Common water-plantain. (J)

*Sagittaria cuneata* Sheld. Wapato. (E,M,R)

*Sagittaria latifolia* Willd. Duck-potato. (L)

#### Amaranthaceae. Amaranth Family.

*Amaranthus palmeri* Wats. Careless-weed. (D)

*Amaranthus powellii* Wats. Powell pigweed. (D)

*Froelichia gracilis* (Hook.) Moq. (M,E)

#### Anacardiaceae. Sumac Family.

*Rhus radicans* L. Poison ivy. (A,B,E,I,P,Q,R,T,W,X)

*Rhus trilobata* Nutt. var. *trilobata*. Skunkbush. (B,D,N,O, P,Q,R,S,Y)

*Rhus trilobata* Nutt. var. *pilosissima* Engler. Hairy skunkbush.

(A,B,D,E,I,K,M,P,R)

#### Apocynaceae. Dogbane Family.

*Apocynum cannabinum* L. var. *glaberrimum* A. DC. Smoot dogbane (D)

*Apocynum sibiricum* Jacq. var. *salignum* (Greene) Fern. Northern dogbane.

(P,R,T)

*Apocynum suksdorfii* Greene var. *suksdorfii*. Dogbane. (R,S,T,U,W,X)

*Apocynum suksdorfii* var. *anquistifolia* (Woot.) Woodson. Narrowleaf dogbane.

(A,I,K)

**Asclepiadaceae. Milkweed Family.**

*Asclepias arenaria* Torr. Sand milkweed. (K,X)

*Asclepias engelmanniana* Woodson. Engelmenn milkweed (D)

*Asclepias latifolia* (Torr.) Raf. broadleaf milkweed. (F,M,R)

*Asclepias macrotis* Torr. Shrubby milkweed. (D,F,M,P)

*Asclepias speciosa* Torr. Showy milkweed. (D)

*Asclepias subverticillata* (Gray) Vail. Poison milkweed. (A,D,I,J,O,R)

*Asclepias verticillata* L. whorl-leaf milkweed. (D,T)

*Asclepias viridiflora* Raf. Greenflower milkweed. (X)

*Funastrum* spp. Vining milkweed. (D)

**Asteraceae. Aster Family.**

*Ambrosia artemisiifolia* L. Common ragweed. (D)

*Antennaria* spp. Pussytoes. (P)

*Arnica latifolia* Bong. Groatleaf arnica. (L, D)

*Artemisia bigelovii* Gray. Bigelow sagebrush. (K,L,O)

*A. carruthii* Wood. Flat sagebrush. (F)

*A. dracunculoides* Pursh. False tarragon. (Q,P)

*A. filifolia* Torr. Sand sagebrush. (A,D, H,Q)

*A. frigida* Willd. Estafiata. (A,D, F,K,X)

*A. ludoviciana* Nutt. Wormwood. (D,D,E,I,Q,R,X)

*Aster ericoides* L. White-rayed aster. (P)

*Aster fendleri* Gray. Fendler aster. (L,K)

*Aster horridus* (Woot. & Standl.) Blake. Spiny-toothed aster. (E,J,P,R,S,W)

*Aster porteri* Gray. Porter aster. (J,P,E,G,I)

*Baccharis glutinosa* Pers. Sticky baccharis. (E)

*Baccharis pteronioides* DC. Yerba-de-pasmo. (C,E,G,I)

*Bahia neomexicana* Gray. New Mexico bahia. (C,D,E,P)

*Bahia oppositifolia* (Nutt.) DC. Plains bahia. (K)

*Bahia woodhousei* Gray. Wood's bahia. (C,F)

*Baileya multiradiata* Harv. & Gray. Desert marigold. (P)

*Berlandiera lyrata* Benth. Lyreleaf berlandiera. (K,F,X)

*Brickellia brachyphylla* Gray. Lanceleaf bricklebrush. (K,P)

*Brickellia californica* (Torr. & Gray) Gray. Californica bricklebrush.

(A,B,D,E,H,Q,R,W,BB)

*Chrysopsis canescens* (DC.) Torr. & Gray. Silvery goldenaster

*Chrysopsis villosa* (Pursh) Nutt. Ex. DC. Hairy goldenaster. (B,D,Q,R,S)

- Chrysopsis viscida* (Gray) Cronquist. Vigid golden aster (A,B,D,E,G,I)  
*Chrysothamnus nauseosus* (Pallas) Britt. subsp. *graveolens* (Nutt.) H.&C.  
 Rubber rabbitbrush. (D,E.)  
*Chicorium intybus* L. Chicory. (T)  
*Cirsium ochrocentrum* Gray. Santa Fe thistle. (K,L)  
*Cirsium undulatum* (Nutt.) Spreng. Wavyleaf thistle. (B,C,D,E,J,M,R)  
*Conyza canadensis* (L.) Cronq. Canada conyza. (I,J,R,S,T,U)  
*Dyssodia papposa* (Vent.) Hitch. Fetid maridold. (E,F,J,K)  
*Engelmannia pinnatifida* Torr. & Gray. Engelmann daisy.  
 (A,C,D,F,J,K,S,U,Y)  
*Erigeron canus* Gray. Hoary fleabane. (F,K,L)  
*Erigeron divergens* Torr. & Gray. Spreading fleabane. (G)  
*Erigeron neomexicanus* Gray. New Mexico fleabane. (G)  
*Erigeron nudiflorus* Buckl. Sprawling fleabane. (L)  
*Eupatorium herbaceum* (Gray) Greene. Desert thoroughwort. (P,E)  
*Eupatorium wrightii* Gray. Spreading thoroughwort. (Q)  
*Franseria acanthicarpa* Hook. & Cov. Burweed. (D,R,W)  
*Franseria confertiflora* (DC.) Rydb. Slimleaf burweed. (A,K)  
*Gnaphalium* spp. Everlasting. (B,E,I)  
*Grindelia aphanactis* Rydb. Plains gumweed. (B)  
*Grindelia squarrosa* (Pursh) Dunal. Curlycup. (F)  
*Gutierrezia sarothrae* (Pursh) Britt. & Rusby. Plains snakeweed.  
 (A,C,E,F,J,K,O,P,V,Z)  
*Haplopappus spinulosus* (Pursh) DC. Subsp. *Spinulosus*. Spinyleaf goldenweed.  
 (D,U)  
*Haplopappus spinulosus* subsp. *australis* (Greene) Hall. Southern  
 spinyleaf goldenweed. (D,U)  
*Helianthus annuus* L. Annual sunflower. (A,D,F,R,T)  
*Helianthus ciliaris* L. Blueweed. (T)  
*Helianthus nuttallii* Torr. & Gray. Nuttall sunflower. (W)  
*Helianthus petiolaris* Nutt. Prairie sunflower. (D,R,S,U,W)  
*Heterosperma pinnatum* Cav. (P)  
*Heterotheca horrida* (Rydb.) Harms. Rough golden-aster. (Q)  
*Hieracium* spp. Hawkweed. (P)  
*Hymenopappus filifolius* Hook. var. *cinereus* (Rydb.) Johnst. Threadleaf  
 ragweed. (K)  
*Hymenopappus flavescens* Gray. var. *cano-tomentosus* Gray. Silvery ragweed.  
 (C,K,Q,V)  
*Hymenopappus tenuifolia* Pursh. Plains white ragweed. (C,F,P)  
*Hymenoxys acaulis* (Pursh) Parker var. *arizonica* (Greene) Parker.  
 Rubberweed. (D,J,K,L,O,Z)  
*Hymenoxys scaposa* (DC.) Parker var. *scaposa* Rubberweed (A,O)

- Hymenoxys scaposa* var. *lineris* (Nutt.) Parker. Narrowleaf rubberweed. (K)  
*Iva axillaris* Pursh. Poverty sumpweed. (G,J)  
*Iva xanthifolia* Nutt. Clotbur. (D)  
*Kuhnia chlorolepus* Woot. & Standl. False boneset. (I,D)  
*Lactuca serriola* L. Wild lettuce. (B,D,H,J)  
*Leucelene ericoides* (Torr.) Greene. Dwarf aster. (K)  
*Liatris punctata* Hook. Gayfeather. (D,K,M,P)  
*Lygodesmia juncea* (Pursh) D. Don. Rushstem skeltonplant. (D)  
*Machaeranthera tanacetifolia* (H.B.K.) Ness. Tansyleaf aster. (D)  
*Melampodium leucanthum* Torr. & Gray. Blackfoot. (C,D,I,K,L,Z)  
*Parthenium incanum* H.B.K. Mariola. (D)  
*Pericome caudata* Gray. Arrowleaf. (B,D,E,Q,R)  
*Psilostrophe sparsiflora* (Gray) A.Nels. Greenstem paperflower. (D)  
*Psilostrophe tagetina* (Nutt.) Greene var. *grandiflora* (Rydb.) Heiser.  
 Paperflower. (A,D,O)  
*Ratibida columnifera* (Nutt.) Woot. & Standl. Prairie coneflower  
 (A,B,D,J,R,T)  
*Ratibida tagetes* (Jones) Barnh. Globehead coneflower. (B,D,F,J,R)  
*Senecio canus* Hook. Silvery groundsel. (K)  
*Senecio douglasii* DC. var. *longilobus* (Benth.) L. Bensen. Threadleaf groundsel.  
 (C,D,F,H,J,P)  
*Senecio fendleri* Gray. Notchleaf groundsel. (K)  
*Senecio* spp. Groundsel. (P)  
*Solidago missouriensis* Nutt. Missouri goldenrod. (P)  
*Solidago sparsiflora* Gray. Goldenrod. (E,P,Q,W)  
*Solidago wrightii* Gray. Wright goldenrod. (E,G,I,P,W)  
*Sonchus asper* (L.) Hill. Prickly sow thistle (E)  
*Stephanomeria pauciflora* (Torr.) A. Nels. Wire-lettuce.  
*Tagetes micrantha* Cav. Wild marigold. (E)  
*Taraxacum officinale* Weber. Common dandelion. (E,I,P,R,W)  
*Thelesperma longipes* Gray. Cota. (T)  
*Thelesperma megapoticum* (Spreng.) O. Ktze. Navaho tea. (B,C,D,E,F,K)  
*Thelesperma subnudum* Gray. Navaho tea. (K)  
*Townsendia exscapa* (Richards.) Porter. Dwarf Townsend aster. (K,L,O)  
*Tragopogon pratensis* L. Salsify. (D,E,I)  
*Verbesina encelioides* (Cav.) Benth. & Hook. (D,K)  
*Xanthium strumarium* L. var. *canadense* (Mill.) Torr. & Gray. (D,F,I,J)  
*Xanthium* spp. (D)  
*Zinnia grandiflora* Nutt. (F,H,J,K,L,Z)

#### Boraginaceae Borage Family.

- Cryptantha jamesii* (Torr.) Payson. James hiddenflower. (F)