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SHRUB AND TREE DATA FOR PLANT ASSOCIATIONS ACROSS THE MOJAVE/GREAT BASIN DESERT TRANSITION OF THE NEVADA TEST SITE, 1963-1975

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ABSTRACT

The shrub, tree, and cactus vegetation of 59 selected study sites in eight drainage basins of the Nevada Test Site was documented in 1963, and again in 1975, by 1100 ft of modified line interception data on each site, each year. Vegetation of the sites, which span the range of 3076 to 7425 ft elevation, is assigned to five plant associations, and intergrades, on the 25 Mojave Desert sites; eight associations on the 10 Great Basin Desert sites; and six associations, and ecotonal types, on the 24 sites of the desert transition. All of the sampled vegetation is considered to be climax.

The data presented are for numbers of plants crossing the lines, mean height of plants, and calculated percentage cover of the ground. All data are summarized by site, species, and year for each of the vegetation categories, and for living and dead plants combined and dead plants only. The data are recorded in 36 tables. Methods and procedures used are described in detail.

Apparent from the data are increases in the numbers, height, and percentage cover on nearly all sites, and in essentially all species, during the 12-year period, and a decrease in the proportions of dead plants. Species composition or relative proportions of the species did not change. The increases appear to be directly related to rainfall during the time interval, especially the heavy rains of 1965 and 1969, and probably also 1973. It is concluded that in desert vegetation numbers and size of shrubs vary significantly with climatic fluctuations through time, and reflect especially the rainfall history of a given site at any point in time.

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INTRODUCTION

As part of a program designed to assess the effects of test activities at the Nevada Test Site on the native plant and animal assemblages, all components of the vegetation of selected sites were documented through the period 1962-1975. Segments of the data have been presented in usually summary form in past publications, to the extent and at the level needed to meet the objectives of each publication. It is the objective of this report to present in their entirety the data for the woody components of the 59 undisturbed communities; shrub vegetation of sites disturbed by nuclear detonations, fire, or blading will be dealt with, along with the herbaceous vegetation, in a later report.

The vegetation mosaic of central-southern Nevada has been described in Beatley (1976) in relation to physiographic, geologic, climatic, and edaphic features of the region and as background information to accompany the geographic distributions of the vascular flora. The present report is an elaboration of the quantitative bases for the description of the shrub (and tree) plant associations, as they occur in the Nevada Test Site part of the region. Interpretative matters, not dealt with previously, will be considered here to the extent necessary to complete the overall definition of the vegetation mosaic of the Nevada Test Site. Refinements yet to be made in this description will include considerations of the herbaceous species of these same communities, analyses of species diversity (in total, over 300 plant species occur on the study sites), ordination of the communities, species association, and other treatments of the data. The considerations here are those for which the shrub data were collected primarily, viz., to document quantitatively certain shrub parameters for use with physical and other biological parameters measured on the same sites toward an understanding of the ecosystem of each site, and in relation to the systems of all other sites, both in space and through time.

THE VEGETATION MOSAIC

The Nevada Test Site lies within the area of transition from the Mojave Desert to the south and the Great Basin Desert to the north. Across this region of transition there are large incremental increases in elevation of the floors of the eight drainage basins that are wholly or partially included within the Test Site boundaries. Each basin is circumscribed by hills and mountains, below which are the coalesced alluvial fans (bajadas); there are, therefore, also large increases in elevation from the lower bajadas to the crests of the mountains.

These latitudinal and altitudinal increases in elevation, and the accompanying environmental changes, are reflected in the kinds of vegetation that occur along environmental gradients from south to north, and in each drainage basin from the lowest to the highest elevations. Vegetation of the southern part of the Test Site, coincidentally an area of limestone-

dolomite mountains, is that of the Mojave Desert extending to the south across much of southern California, including Death Valley. Vegetation of the volcanic mountains and mesas of the northern part of the area, and in certain parts of the basin floors, is that of the Great Basin Desert extending to the north across central and northern Nevada. In general, the Mojave Desert vegetation occurs below 4000 ft, the Great Basin Desert is above 5000 ft, and between 4000 and 5000 ft the vegetation types are transitional between the two large deserts.

The vegetation pattern is associated with the higher temperatures and lower rainfalls of the lower-elevation Mojave Desert, the lower temperatures and usually higher rainfalls of the Great Basin Desert, and the climatic fluctuations and extremes of both deserts which characterize the transition desert areas. Frenchman and Yucca Flats are closed drainage basins with playas, in which the vegetation pattern includes Mojave, Great Basin, and transition desert communities (Frenchman Flat) or Great Basin and transitional communities (Yucca Flat) according to patterns of year-round nocturnal cold air accumulations in the lowlands of these basins (Beatley 1974, 1975).

The overall vegetation pattern in relation to physiographic features is shown in Figure 1. The Mojave Desert includes all areas designated as "Larrea" in the figure legend, except those in Yucca Flat. The "Atriplex", "Artemisia", and "mountains, hills and mesas" north of the Mojave Desert limits, are interpreted as Great Basin Desert, and all others are here considered to characterize and belong to the desert transition.. In the present treatment, the sampled vegetation includes five Mojave Desert plant associations (and intergrades), eight belonging to the Great Basin Desert, and six (plus ecotonal types) that are identified with and restricted to the desert transition. All are viewed as climax vegetation in the sense that they are all self-perpetuating and stable assemblages in equilibrium with the present climate and soils.

Site Selection. Most of the total 68 study sites were selected from the vegetation mosaic in 1962, after there was adequate familiarity with what there was to choose from, and what would potentially meet the requirements of a program designed ultimately to evaluate the effects on Test Site ecosystems of ionizing radiation from nuclear detonations and other test activities. Sites were chosen on the basis of a combination of judgments, needs, and ecological interest: (1) The general kind of system represented, and a number of other floristic considerations beyond the shrub type; (2) location with respect to particular topographic and edaphic features; (3) history with regard to disturbance; (4) the site's having served previously as a source of biological materials; (5) the potential for future irradiation or no irradiation; and (6) for most, a remote or out-of-the-way location in an effort to insure survival of a site, once selected. Where possible, the former sampling sites of William H. Rickard (Rickard and Beatley, 1965) were incorporated into the network.

At the time of selection (spring, 1962), a study plot sample of a usually much larger stand of the vegetation type of interest was delineated on each site. Each plot became the part of the site where many kinds of data collections were thereafter made, and once biological and physical measurements began, was considered irreplaceable in the network.

In Mercury Valley there were two contrasting systems, one (Site 1) characterized by the conspicuous Mojave Yucca (Yucca schidigera), and the other (Site 2) was obviously closely related to transition desert systems of Yucca Flat, 40 miles to the north.

In Rock Valley, one site was below the limestone Specter Range (Site 3), and the other (Site 4) below volcanic Skull Mtn. Site 3 was within the radiation field of a caesium source (French, 1964) and adjacent to plots B and D of that study; this site later was near the IBP Rock Valley Validation Site.

In Jackass Flats, the four sites (Sites 11-14) on the north slope were selected for their location to the north of Test Cell A, and hence their potential for radiation effects studies following nuclear reactor tests. Extreme west Jackass Flats was judged to have the simplest systems in the Mojave Desert part of the region (Sites 7-10).

The 10 plots (Sites 28-37) on the east side of Frenchman Flat (plus two additional sites on NRDL Arcs 2 and 5) were selected as sampling sites for a Larrea radiation effects study to be conducted in connection with the Small Boy event on the playa in July 1962. Most of these sites were beyond the east boundary of the Test Site.

Sites in Yucca Flat (Sites 43-60) were chosen for use in test effects studies around ground zeros, or their remoteness from ground zeros, as well as to serve as samples of the different kinds of vegetation in this drainage basin. Three sites were differentially affected by the Sedan thermonuclear detonation in July 1962. Plot 57 was relocated (as 57N) upslope in 1966, after the original plot was destroyed by nearby drill-hole construction.

The Forty-Mile Canyon series (Sites 61, 62, 63, and 65) at the time of site selection were in a remote area along an unimproved road (Back Rainier Mesa Road), and included a sand-dune site (Site 65) traversed by the road. In the spring of 1964, construction of a new paved road system to Pahute Mesa resulted in near destruction of Sites 61 and 62, leaving the study plot of Site 62 as an island in the bottomland after removal of a foot or more of the alluvium for fill along the nearby roadbed. Site 68 was selected as a possible replacement for Site 62. Location of the Rainier Mesa site (Site 64), at the highest elevation of the site network, was selected for use in a radiation effects study following a forthcoming nuclear test in Tunnel B located almost directly under the mesa-top site.

Most other sites were chosen to complete the geographic and ecologic coverage of the Test Site within its 1962 boundaries.

After the network was established in 1962, in anticipation that a number of the sites would be exposed to significant dosages of ionizing radiation from atmospheric testing in progress at that time, the 1963 moratorium on above-ground testing was declared. With the opening up in 1964 of Pahute Mesa for the high-yield underground tests of the next decade, the area of the Test Site was increased by around one-half its 1962 area, and no additional sites were added to the already established network of 68 sites.

Because the sites were chosen largely for particular needs, especially for use in radiation effects studies, and except for the tunnel area of Rainier Mesa the original Test Site itself was located in the transition

and Mojave areas, the higher elevation Great Basin communities are under-represented among the total study sites. The numbers of Mojave, transition, and Great Basin sites remain in about the same proportion as the desert regions are represented in the present land area of the Test Site, exclusive of Pahute Mesa.

METHODS AND PROCEDURES

Study plots, 100 x 100 ft, were delimited by 4 steel or wooden posts in the spring of 1962. Each plot was a sample of a selected site where the vegetation was a recognizable type occurring over a few to usually many acres, and usually of a type recurring over the region. Sides of the plot were parallel and perpendicular to the slope gradient, and drainage courses were excluded wherever possible. Following damage to the shrubs by off-road vehicles on about a third of the study plots, plots were relocated where necessary and a low, single-strand wire fence erected around all plots, and a metal sign installed identifying the project. From autumn 1962 until early January 1973, the plots were the sites of year-round measurements of rainfall, air temperature, soil moisture, and ionizing radiation, and seasonal documentation of the vegetation and rodent components of the systems.

Vegetation measurements. From August 1 through mid-September 1963, shrub data were collected on all but 6 sites (late November on Sites 61, 62, 63, 65, and June 1964 on Sites 64 and 68), at a season when most species are leafless. Permanent steel pins (or wooden stakes on some plots) were placed in the ground at measured 10-ft intervals on opposite sides of the plot, so that the tape connecting opposing pins 100 ft apart would subsequently be at right angles to the slope gradient, i. e., parallel with the slope contours. There were thus 11 100-ft long parallel lines on each plot (including two sides of the plot), spaced at 10-ft intervals, or a total of 1100 feet of line along which the systematic sampling was done. A few plots of necessity were rectangular, and the lines were set up so that the pattern of sampling remained the same, with a total of 1100 feet of line consisting of more numerous but shorter parallel line segments 10 ft apart.

Beginning with Line 1 on the downslope side of the plot, a K & E steel surveyor's tape, marked in feet and tenths of feet, was pulled as taut as possible between two steel posts set back of the pin markers, so that 0 to 100 ft on the 100-ft tape extended between opposing pins and the tape was close to the height of the shrub matrix; the 0-ft mark on the tape was placed directly over one of the steel pins. Sometimes the tape was entirely above the shrub matrix, but usually it also passed through a few of the taller shrubs touching the line. A meter stick, 1-inch wide, was held vertically from the ground to above the tape, and was moved along the length of the tape (and against the side of the tape), consistently on the same side of the tape, to define the area of sampling. Every shrub (and herbaceous perennial) plant that touched upon this 1-inch wide strip was included in the sampling. Recorded were the beginning and ending points of interception along the line (feet, and tenths of feet), the measured height (in inches) of the plant at the point of maximum height, whether the plant was living or apparently dead, or if living, its phenological condition (vegetative, flowering, or fruiting). Species were separated at the time of recording.

Where there were two or more plants in a clump with overlapping intercepts, the intercept points of each plant were recorded. Two or more meter-stick lengths were used to measure height of trees.

The two steel posts, with the tape attached at each end, were pulled out of the ground, carried to the next pair of opposing markers upslope, pounded in the ground again so that the tape was taut, and data for the 100-ft line collected in the same way and in the same direction across the plot. The procedures were repeated between each pair of opposing steel pins until the 11th line (upper side of plot) completed the plot sampling. Recorded with the line data were the date, location of Line 1 and direction of the lines, initials of the two individuals who collected the data, and other information as appropriate. Plants growing in each clump were so indicated in the data, and clump numbers (consecutive from Lines 1 through 11) were assigned where there was interception by two or more plants of a clump that was crossed by the line.

In 1967 all data were key-punched on IBM cards according to the format below. For each plant touching or crossing the line:

Cols. 1-2	-	Plot number (01 through 68)
4-9	-	Date (month, day, year)
11-45	-	Scientific name (genus, species, variety or subspecies)
46-47	-	Line number (01 through 11)
51-54	-	Beginning intercept point along line, feet and tenths of feet
57-60	-	Ending intercept point along line, feet and tenths of feet
63-64	-	Height in inches
68	-	Number of plants between intercept points (usually 1)
70	-	Whether plant living (L) or dead (D), vegetative (in leaf) (V), flowering or fruiting (F), or no notation (N)
72	-	For Larrea branches reaching or crossing the line, living (L) or dead (D)
blank	-	All other columns

The data were processed on the IBM 370 at the University of California, Los Angeles, using a program that calculated the following parameters for the plants of each plot.

For each species, and for all species:

(1) Number of plants (living and dead) intercepting the line
(2) Average height (inches)
(3) Total length of intercepts (feet and tenths of feet)
(4) Percentage cover (total length of intercept divided by 1100, X 100)

From April 1 through early June 1975, the shrub data were collected again on all sites except one (Site 64, previously collected in August 1974). The collections were made in exactly the same way on each site, along the same lines

extending between the permanently-set steel pins, with procedures and methods identical to those used 12 years earlier. The work was supervised and the data recorded in the field and later key-punched by the same person for all data collections of both periods.

Following the 1975 data collections, all shrub data (and all other plant data), as punched on around 24,000 cards, were intensively reviewed for key-punch or other errors, and for changes in scientific names, so that the 1963 and 1975 data decks might be in as nearly perfect and up-to-date form as possible. The corrected decks were reproduced on tape, and a new program was written to recalculate the shrub parameters previously calculated, but with plant height in centimeters and the addition of separate calculations for living plants only, dead plants only, and both living and dead combined. Data appearing in the tables of this report are the final values for these parameters, and where at variance with previously published names or numerical values, those appearing in this report supercede the earlier names and numbers.

Excluding the nine disturbed sites not being considered here (for all of which there are several years of comparable shrub data through the 12-yr period), for the 59 undisturbed sites of this report there are in total about 25 linear miles of shrub and tree interception data: 10.4 mi. in the Mojave Desert, 4.2 mi. in the Great Basin Desert, and 10.0 mi. in the desert transition. A little more than two months' time was required for the two observers to collect the data each of the two collecting periods.

Shrub Data Utilization. The modified line interception method used is in reality an 1100-ft long, 1-inch wide transect. It was used to obtain cover values for the species; since there were many overlapping intercept lengths, the sum of the species cover values, that is, the total percentage cover of the ground on a plot, is often greater by this method than would be the case if cover were determined by certain other methods, as for example, from aerial photographs. Differences would be greatest where the plants are strongly clumped, as in many Larrea and Grayia-Lycium communities, and least, if at all, where the plants do not occur ordinarily in clumps, as in Coleogyne and Artemisia vegetation. The data are not directly usable for comparisons with other Test Site data (e.g., Wallace and Romney (1972) and Romney, et al. (1973)) or with data for desert vegetation elsewhere without critical evaluation and comparisons of the methods used. All data are strictly comparable between and among the sites of this study.

The method used does not enable density (number of plants/unit area) to be calculated. Numbers of plants intercepting the 1-inch wide line are given in the tables, and these numbers are comparable between and among the sites in as much as they indicate relative plant density among the sites. They may, however, be a useful estimate of density (or basis for density estimates): Where the absolute number of plants of a species was determined (for Larrea on all plots of its occurrence), there was overall high correlation between the absolute densities and numbers of plants intercepting the line ($r = 0.751$) (Beatley, 1974), but with large variation in the reliability of the estimate from site to site.

Rainfall measurements. Since it has been shown that percentage shrub cover (and hence numbers and size of plants) is highly correlated with rainfall pattern in this desert region (Beatley, 1974), the mean annual rainfall, as measured through the 10-year period 1963-1972, and the highest and lowest annual rainfalls of this period, are included in the tabular material for each site.

Measurements employed an 8-inch diameter polyethylene funnel feeding into a 2- or 4-liter polyethylene bottle buried in the ground to the bottle neck. The bottle was protected against removal by especially foxes and coyotes by a heavy lead washer resting on the shoulders of the bottle. The excavation into which the bottle fitted was lined with a waxed cardboard liner. Rain water was measured with a graduate cylinder, in milliliters, and snow and ice were melted for their water content. Gauges were read year-round on a regular basis (weekly or biweekly, with additional readings as necessary) at the time of collection of other environmental measurements data. The data were recorded on IBM cards, milliliters of water converted to inches of rainfall, and the annual rainfalls and mean for the 10-yr period computed from the record for each site.

THE SHRUB VEGETATION

All of the measurements data for woody plants (and cacti) of the 59 undisturbed shrub (or shrub and tree) communities of the Nevada Test Site are included in the tables following the text. These include the data for the two periods of data collection (1963 and 1975) and for living and dead plants. Where communities are grouped under the same plant association, there are both site and species summary data. Site location, elevation, and a rainfall summary are recorded for each site; location of sites, in relation to major physiographic features and the generalized pattern of vegetation, is shown in Figure 1.

Of the 19 plant associations recognized, most constitute the major vegetation types of the region and, except for those of the desert transition, the Mojave and Great Basin deserts, as well. Vegetation of nearly a third of the sites (17 sites) is interpreted as variously intergrading between two of the major associations (Larrea-Ambrosia/Larrea-Grayia-Lycium), or consisting of two of the associations which occur more or less discretely in intricate mosaic (Coleogyne/Larrea-Grayia-Lycium; Coleogyne/Grayia-Lycium; Larrea-Atriplex/Coleogyne; and Coleogyne-Grayia/Artemisia). Data for the two Atriplex canescens sites, and two Artemisia nova-Pinyon-Juniper sites, are presented separately because the communities are obviously different and contrasting expressions of the two plant associations.

The assigning of a community to an abstract kind of vegetation (plant association) is an interpretative processs involving considerations beyond the quantitative data. The communities of no two sites are ever the same, and the local variations must be viewed in relation to regional understandings. The interpretations appearing here represent the judgments of the author, with the knowledge that other vegetation categories might also be recognized. This pertains especially to the communities where a single species, prominent either because of the size of plants or their numbers, is superimposed on one of the basic vegetation types.

An example of this in the Test Site vegetation, and in the site data, is the superposition of the Yuccas -- Y. schidigera in certain Mojave Desert

communities (Site 1), and Y. brevifolia in communities of higher elevation Mojave and transition deserts (appearing in the data for Sites 14, 32, 35, 43, 47, and 57N, but also occurring on Sites 13, 66, 25, 27, 36, 44, 45, 56, and 60). Where these tree species occur they are the most conspicuous component of the vegetation, but the trees are merely superimposed on one of the basic vegetation types and seldom have more than low cover values or low numbers of individuals in sampled vegetation. Wherever they occur they could be considered one of the dominants on the basis of size of plants (but rarely on the basis of numbers of plants), and Yucca could be included in the association designation.

Likewise, Menodora spinescens, which grows in profusion on the middle and upper bajada below the south face of Shoshone Mtn. in western and northern Jackass Flats, is superimposed on what are basically Larrea-Ambrosia (Site 7) or Coleogyne/Grayia-Lycium (Site 14) communities. As the Larrea-Ambrosia drops out rather sharply upslope (at an elevation well below that of its usual upper limits), there is a broad band across the bajada where the elevation is yet too low for Coleogyne, and much of the vegetation is Menodora-Ephedra (Site 9). There is the possibility that this broad band of unusual vegetation is related to aerial bombing by the Air Force in the past. Supporting site disturbance of the original communities is the prominence of Ephedra nevadensis, which predictably always increases by sprouting following destruction of the shrub vegetation, but supporting the natural occurrence of Menodora-Ephedra as a climax vegetation type is the large confluent area it covers. Scattered over this bajada are a number of large circular areas denuded of shrubs, inferred to be the result of past aerial bombing. Whether or not Menodora-Ephedra has its origin in past site disturbance, clearly there are edaphic conditions on this upper bajada, associated with the alluvial materials from parts of Shoshone Mtn., which modify the usual pattern of vegetation and enable Menodora to dominate the vegetation.

Similarly, materials from the limestone-dolomite Ranger Mtns. in southeastern Frenchman Flat are restrictive to the distribution of Lycium shockleyi (a southern Nevada endemic), and enable this species to be a dominant in what would otherwise be Atriplex confertifolia or Larrea-Atriplex communities. The Yucca and Menodora variations have not been accorded association status here, but the Lycium shockleyi communities are so recognized.

In addition to the plant associations of widespread occurrence in the region, and the variations in expression of these associations due to the addition of single species with the status of dominant, there are many local variations in shrub dominants that make recognizable plant associations of restricted occurrence. These are usually associated with soils from a particular mountain range, or part of the range, and are not interpreted as a variation of one of the basic types. Such a community, and plant association, is the Larrea-Psorothamnus (Site 33) on the east slope of Frenchman Flat, where the soil materials are probably derived from the limestone-dolomite Spotted Range several miles due east. This is a well-defined kind of vegetation on this part of the slope, and throughout the region there are many other combinations of dominants that occur locally and would be worthy of recognition if the vegetation of the region were considered in its entirety.

Living vs. Dead Plants. Numbers of plants, mean height, and percentage cover of living and dead plants combined and dead plants only, are recorded in the tables for each site and by species for each plant association, for both periods of data collection. The parameters for living plants may be obtained by subtraction. Percentages of dead plants in the communities of the three desert areas are as follows:

	1963	1975
Mojave Desert (25 sites)	11.3	9.9
Transition desert (24 sites)	15.1	5.6
Great Basin Desert (10 sites)	16.1	9.6
Mean, 59 sites	14.2	7.7

Designations of "living" or "dead" refer in the data to the plant itself, whether or not the branches touching upon the line were living or dead. If any part of the plant was living, the plant was recorded as living. Not shown by the data, therefore, is the proportion of dead branches. All dead plants, regardless of how long they had been dead, were included if still intact at the soil surface. Most of the "undetermined" dead plants were plants beyond recognition to species because they had been dead for apparently many years.

From the dead plant summary above, it is apparent that generally in the region there was a significant decrease in numbers and proportion of dead plants in the plant communities during the 12-year period. This is inferred to be the result of environmental conditions, especially rainfall, during a period which enabled greater survival than had occurred in the period preceding the 1963 record (see Discussion and Conclusions), but also resulted in more rapid decomposition of shrubs than had occurred prior to 1963. The higher percentages in 1963 may also be due, in part, to occasional errors in judgment of whether or not a plant was living, since the data collections were made in late summer when most of the intricately-branched shrubs were leafless and dormant.

Among the Mojave Desert sites one site contributes heavily to the total dead plant percentages both years: Site 29, on the north slope of Frenchman Flat where the Larrea-Atriplex has been largely replaced by Ephedra nevadensis following death of most Larrea and Atriplex confertifolia plants. In this sample of the vegetation that occurs over a large and prominent area of the bajada north of Frenchman Flat playa, there is an apparently large pocket gopher (Thomomys umbrinus centralis) population that has brought about the decimation of the shrub vegetation; only Ephedra, because of its extraordinary sprouting behavior, is able to survive the underground and soil surface disturbances of the gopher activity here. To a lesser extent these influences extend downslope to Site 31 (Atriplex confertifolia in the Great Basin Desert vegetation), adjacent to the playa. Whether gopher invasion of this area was related to loosening of the soil by aerial bombing in the 1940s and 1950s is not known. If Site 29 is excluded in the table above from the percentage of dead plants in the Mojave Desert, the percentages become 9.6% in 1963 and 9.2% in 1975.

Inferable from the table above is that in the drier and warmer environments of the Mojave Desert part of the region, the ratio of living to dead plants may generally be more nearly constant through time than in the wetter and/or colder environments of the Great Basin Desert. Overall, it is in the desert transition areas where there are the greatest climatic fluctuations and extremes from year to year, and it is in the transition communities where numbers and percentage of dead plants appear to be the most variable through time.

Numbers of Plants. Apparent from the data is the increase during the 12-year period in numbers of plants that were crossed by the sampling lines. Although the magnitude of increase varies, the pattern of increase is consistent among the Mojave, transition, and Great Basin sites, and also among the species.

Increased numbers of plants in the sampling data may be the result of (1) increased size of plants near the sampling line, and hence the branches of more plants touching upon the line, or (2) a real increase in numbers of individuals in the population, related to germination and seedling survival during the time interval. Both have contributed to the increases in numbers of plants shown in the tables, but an evaluation of the relative contributions is not possible without the data necessary to establish which plants were, in fact, new plants added to the population between 1963 and 1975. Many small plants (as indicated by height) appear in the original field data, most of which probably represent plants that survived the seedling stage following seed germinations in recent years. This would not hold, however, for all small plants, and interpretations would necessarily have to be on a species basis, since germination, survival, and growth rate characteristics vary among the species and in the differing site environments.

Germination is most often a mass and fairly frequent event, with dozens of seedlings over an area the size of the 100 x 100 ft study plots. Mass germination happens periodically in Larrea tridentata, Ambrosia dumosa, Coleogyne ramosissima, Artemisia spinescens, Atriplex canescens, and others, when a particular set of environmental conditions obtains, especially in the spring and autumn. In others, germination appears to be a rare mass event, or an event occurring only occasionally in usually scattered seeds through time as appears to be the case with Grayia spinosa and the Lycium species. Of those that arrive in a mass germination, only a very few, or perhaps none, ordinarily survive longer than a year or so, depending on many factors, but especially rainfall during the first critical years of seedling establishment. Long-term field studies of germination and survival of shrub seedlings are a need of high prioity for understandings of the structure, processes, and stability of desert ecosystems.

Size of Plants. Also apparent from the data is an overall increase in size of plants, as indicated by height, on both site and species bases. Slight decreases in mean height in most cases reflect the contribution of young plants added to the population during the 12-year period.

Mean increases in plant height, while on the average of only a few centimeters and representing growth imperceptible to one viewing the vegetation, are nevertheless indicative of changes of large significance to the structure and biomass of the communities. Increased height of plants is a measure of increased length of one or more branches at the top of the plant, a growth increment that may be assumed to have occurred to a greater or lesser extent on all of the other, usually many living branches, thus resulting in increase in diameter and circumference of the canopy, and an overall larger plant in all dimensions. For many species, conditions inducing stem elongation also induce the growth of new branches, which further contributes to the intricacy of branching and to the biomass of the plant as a whole.

Percentage Cover. This parameter combines numbers of plants and their size into an estimate of the percentage of the ground covered by the plant canopies. As pointed out in the Methods section, the data were collected as though the canopy of each plant was separate from the canopy of any other plant, i. e., without overlapping or intermingling of branches. The site cover values in the tables, which are the sum of the cover values for the individuals of each species, are more or less greater than the actual percentage of the ground covered by shrub vegetation, depending largely on the degree to which the plants grew in the close association of shrub-clumps.

Percentage cover by the shrub canopies increased on nearly all sites during the 12-year period, reflecting the increase in numbers of plants along the sampling lines, in turn the result of increased size of plants and the addition of new plants to the sampled populations.

DISCUSSION AND CONCLUSIONS

On nearly all of the 59 undisturbed sites where measurements were made in 1963 and again in 1975, there was an increase in numbers of shrubs in the sampling data, size of plants, and percentage cover of the ground, and a decrease in the percentage of dead plants in the communities. Species composition did not change, nor did the relative proportions of the species in the communities.

It was previously shown (Beatley, 1974) that percentage shrub cover on this network of study sites (excluding the three Artemisia-Pinyon-Juniper of the high elevations) was highly correlated ($r = 0.829$) with the mean rainfall for each site. Site cover values were for the 1963 measurements, and the rainfall means were for 9 years (1963-1971). This established that the pattern of numbers and size of plants, and hence percentage cover, in shrub vegetation over the region is closely related to the regional rainfall patterns over the land surface.

The present study deals with these same shrub communities through time. The 1963 data collections were made during a period of low rainfall, and the 1975 data were collected after two extraordinary years of heavy rainfall

(1965 and 1969) during the period of rainfall measurements (1963-1972) and an additional heavy rain period in 1973 after the period of rainfall measurement but prior to the 1975 shrub data collections. In all of these years the shrubs exhibited extraordinary vegetative (and reproductive) growth with regard to numbers and size of leaves, and presumably also in elongation and growth in diameter of the stems.

Site increases in numbers of plants or percentage cover during the 12-year period are not correlatable with either of the two heavy rain periods of 1965, or the even heavier rains of the winter of 1969. But, using the site rainfall for 1963 and 1964 to characterize the dry period of the 1963 data collections, and the site rainfalls of the 5-year period 1965-1969 to characterize the period of wetter years prior to the 1975 data collections, there is a close relationship between numbers and size of plants and rainfall on the sites of measurement. For numbers of plants in 1963 times the mean site rainfall for 1963-1964, and numbers of plants in 1975 times the mean site rainfall for 1965-1969, the correlation coefficient is 0.959.

It is concluded that the parameters used in this study — numbers of plants crossing the line, height, percentage cover, and ratio of living to dead plants — are all under the primary control of rainfall and at any given time closely reflect the rainfall history of several to perhaps many years prior to that time. It is also evident that to be meaningful in quantifying the components and processes of desert ecosystems, data for the shrub component require interpretation in relation to (1) where on the landscape the system is in relation to regional and local rainfall patterns, and (2) when the data were collected in relation to recognizable periods of rainfall fluctuation. Changes in size and numbers of plants characterize all of the desert plant communities through time, and although extreme and prolonged fluctuations in climate should result in changes in composition with regard to the species and the proportions in which they are represented, there is no suggestion of compositional changes in the data for the 12-year period from 1963 to 1975.

ACKNOWLEDGMENTS

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The early data collections and computer work were done on AEC Contract (AT(04-1)-Gen 12 with the Laboratory of Nuclear Medicine and Radiation Biology, University of California, Los Angeles. Processing of the final data, computer work, and report preparation were done on ERDA/DOE Contract E(11-1)-2307 with the University of Cincinnati. The field studies were supported during both periods by the Civil Effects Test Organization, Nevada Test Site, and accomplished as a part of the field program of CETO Project 61.5.4.

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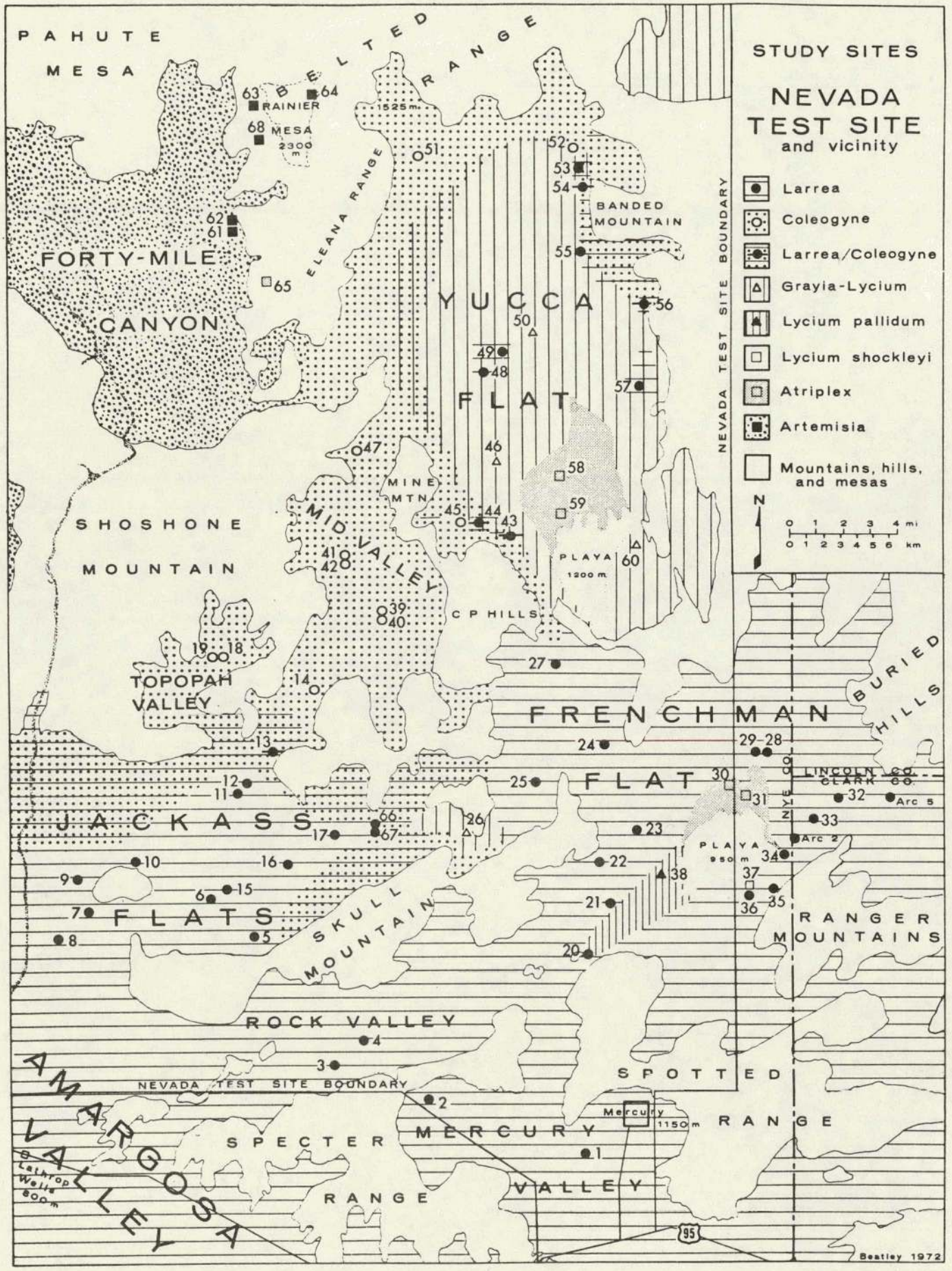
Fig. 1. Location of study sites in relation to physiographic features and generalized vegetation pattern, Nevada Test Site, central-southern Nevada. Numbers are site numbers used in text and tables. Reproduced from Beatley (1974).


STUDY SITES
NEVADA TEST SITE and vicinity
Larrea
Coleogyne
Larrea/Coleogyne
Grayia-Lycium
Lycium pallidum
Lycium shockleyi
Atriplex
Artemisia
Mountains, hills, and mesas
N
0 1 2 3 4 mi
0 1 2 3 4 5 6 km
NEVADA TEST SITE BOUNDARY
PAHUTE MESA
BELTED RANGE
ELEANA RANGE
RAINIER MESA
2300 m
1525 m
FORTY-MILE CANYON
YUCCA FLAT
BANDED MOUNTAIN
MINE MTN
MID VALLEY
SHOSHONE MOUNTAIN
PLAYA 1200 m
C P HILLS
TOPOPAH VALLEY
FRENCHMAN FLAT
BURIED HILLS
LINCOLN CO.
CLARK CO.
NYE CO.
Arc 5
Arc 2
PLAYA 950 m
JACKASS FLATS
SKULL MOUNTAIN
RANGER MOUNTAINS
ROCK VALLEY
AMARGOSA VALLEY
Lathrop Wells 800 m
NEVADA TEST SITE BOUNDARY
SPECTER RANGE
MERCURY
Mercury 1150 m
SPOTTED RANGE
VALLEY
95
Beatley 1972

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SUMMARY SHRUB AND TREE DATA for plant associations, 59 sites across the Mojave/Great Basin desert transition of the Nevada Test Site, central-southern Nevada, 3076 - 7425 ft elev., 1963-1975. Data are for living and dead plants combined.

Plant Association	No. Sites	No. Spp.	1963 Mean No. Pls. /Site	1963 Mean Ht. (cm)	1963 Mean Cover /Site (%)	1975 Mean No. Pls. /Site	1975 Mean Ht. (cm)	1975 Mean Cover /Site (%)
MOJAVE Desert (3076 - 4065 ft elev.)								
Larrea-Ambrosia	6	18	140	34	18.6	170	37	19.9
Larrea-Lycium-Grayia	7	15	91	51	14.9	106	52	16.6
Larrea-Ambrosia/Larrea-Grayia-Lycium	9	17	134	47	18.9	173	48	22.0
Larrea-Atriplex	1	5	206	27	21.3	187	29	19.0
Larrea-Psorothamnus	1	6	57	41	7.2	69	43	10.0
Menodora-Ephedra	1	8	128	25	21.1	161	27	22.3
All sites	25	24	124	41	17.4	149	44	19.4
TRANSITION Desert (3080 - 4950 ft elev.)								
Larrea-Grayia-Lycium	4	21	177	47	24.9	204	50	28.2
Grayia-Lycium	4	15	238	38	26.5	306	44	34.7
Coleogyne	3	9	350	39	46.7	423	38	47.9
Coleogyne/Larrea-Grayia-Lycium	3	14	194	46	26.7	215	48	28.9
Coleogyne/Grayia-Lycium	3	11	289	39	38.5	324	40	43.3
Larrea-Atriplex/Coleogyne	1	10	217	35	20.5	213	49	28.3
Coleogyne-Grayia/Artemisia	1	9	269	47	37.7	255	53	40.5
Larrea-Lycium shockleyi-Atriplex	3	17	123	22	11.0	150	26	15.0
Lycium shockleyi-Atriplex	1	4	102	25	11.9	137	31	17.3
Lycium pallidum-Grayia	1	6	82	59	14.3	95	65	18.5
All sites	24	33	217	40	27.4	253	43	31.7
GREAT BASIN Desert (3085 - 3960 ft elev.)								
Atriplex confertifolia	1	1	87	29	8.6	75	32	8.4
Atriplex-Kochia	1	2	186	21	14.9	228	28	19.8
Atriplex-Ceratoides	1	6	172	30	17.5	271	32	25.6
Atriplex canescens (1)	1	3	45	36	5.4	61	36	6.9
All sites	4	8	123	27	11.6	159	31	15.2
(5500 - 7425 ft elev.)								
Atriplex canescens (2)	1	5	99	44	16.0	94	43	14.4
Artemisia tridentata	1	5	193	58	32.6	225	60	38.4
Artemisia tridentata-Pinyon-Juniper	1	5	264	67	40.8	273	64	43.9
Artemisia nova	1	4	332	35	37.3	337	38	41.8
Artemisia nova-Pinyon-Juniper (1)	1	7	403	30	37.0	516	26	42.5
Artemisia nova-Pinyon-Juniper (2)	1	14	212	74	34.8	231	76	36.2
All sites	6	21	250	48	33.1	279	47	36.2
TOTAL sites	59	51	175	40	22.6	205	43	25.8

LARREA-AMBROSIA

6 Sites: MOJAVE Desert

Site 1. E. Mercury Valley, below S side of west Spotted Range (Red Mtn). 3370 ft elev.
Annual rainfall 2.47 to 9.89 in., mean 5.57 in.

Site 7. W. Jackass Flats, below S side of Shoshone Mtn. 3160 ft elev.
Annual rainfall 2.56 to 9.13 in., mean 4.79 in.

Site 8. Sw. Jackass Flats, below S side of Shoshone Mtn. 3076 ft elev.
Annual rainfall 2.45 to 8.93 in., mean 4.61 in.

Site 22. Sw. Frenchman Flat, below SE end of Skull Mtn. 3270 ft elev.
Annual rainfall 2.83 to 11.18 in., mean 5.15 in.

Site 28. Ne. Frenchman Flat, below s. Halfpint Range. 3235 ft elev.
Annual rainfall 2.01 to 9.08 in., mean 4.77 in.

Site 32. E. Frenchman Flat, below sw. Buried Hills. 3420 ft elev.
Annual rainfall 2.39 to 8.74 in., mean 4.82 in.

SHRUBS AND TREES, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 1	9	139*	51	19.1	9	138	52	18.7
Site 7	7	167	27	22.1	6	197	28	22.7
Site 8	5	148	30	17.7	5	194	32	19.4
Site 22	9	105	47	18.0	8	157	44	19.6
Site 28	9	142*	38	16.8	9	182*	36	19.5
Site 32	7	140*	37	18.0	7	150*	36	19.5
Mean, all sites	8	140	34	18.6	7	170	37	19.9
Dead								
Site 1	4	21*	33	1.8	5	13	43	1.1
Site 7	4	10	25	1.1	4	22	15	2.2
Site 8	2	9	23	0.8	2	14	23	1.4
Site 22	5	16	37	2.8	6	21	29	2.2
Site 28	6	19*	26	2.0	4	20*	19	2.0
Site 32	4	20*	31	2.2	4	15*	18	1.4
Mean, all sites	4	16	30	1.8	4	18	24	1.7

* Includes 1 or more dead plants undetermined to species

(Larrea-Ambrosia)

SHRUB AND TREE SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls./ Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls./ Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Larrea tridentata	6	23	73	5.2	6	25	77	5.2
Ambrosia dumosa	6	45	30	5.4	6	57	29	5.5
Grayia spinosa	2	10	48	1.2	2	22	46	2.0
Lycium andersonii	2	9	44	1.4	2	9	51	1.6
Lycium pallidum	1	1	84	0.4	1	1	97	0.4
Ephedra nevadensis	4	5	49	0.5	3	5	47	0.8
Ceratoides lanata	3	3	37	0.2	3	6	37	0.5
Krameria parvifolia	4	10	23	1.2	4	12	22	1.2
Psorothamnus fremontii	2	16	39	1.9	2	18	40	2.3
Menodora spinescens	3	25	17	3.5	3	31	17	3.6
Acamptopappus shockleyi	4	40	20	3.4	4	57	19	3.8
Atriplex confertifolia	2	6	32	0.8	2	5	44	0.6
Atriplex canescens	2	4	42	0.6	2	4	58	0.6
Yucca schidigera	1	25	98	4.0	1	21	115	3.1
Yucca brevifolia	1	2	251	0.3	1	2	368	1.0
Echinocactus polycephalus	1	1	25	0.1	1	1	36	0.2
Opuntia echinocarpa	1	2	25	0.1	0			
Opuntia ramosissima	1	2	10	0.1	1	1	36	0.1
Undetermined	3	6	19	0.3	2	1	23	0.2
All species, all sites	6	140	34	18.6	6	170	37	19.9
Dead								
Larrea tridentata	3	4	48	0.5	4	2	38	0.2
Ambrosia dumosa	6	5	27	0.6	5	7	21	0.6
Grayia spinosa	1	2	50	0.4	2	4	32	0.5
Lycium andersonii	1	1	36	0.2	2	1	27	0.2
Ephedra nevadensis	1	2	36	0.2	1	3	21	0.1
Krameria parvifolia	1	1	13	0.1	1	2	14	0.2
Psorothamnus fremontii	2	3	43	0.5	1	1	30	0.0
Menodora spinescens	1	2	15	0.1	2	5	14	0.7
Acamptopappus shockleyi	3	4	21	0.3	4	8	17	0.5
Atriplex confertifolia	2	4	30	0.5	2	1	25	0.2
Atriplex canescens	2	1	40	0.2	0			
Yucca schidigera	1	4	62	0.3	1	5	66	0.5
Opuntia echinocarpa	1	1	25	0.0	0			
Undetermined	3	6	19	0.3	2	1	23	0.2
All species, all sites	6	16	30	1.8	6	18	24	1.7

LARREA-LYCIUM-GRAYIA

7 Sites: MOJAVE Desert

Site 5. S. Jackass Flats, below NW end of Skull Mtn. 3675 ft elev.
Annual rainfall 2.14 to 10.91 in., mean 5.59 in.

Site 11. N. Jackass Flats, below S side of Shoshone Mtn and unnamed hills to the E. 3900 ft elev.
Annual rainfall 2.56 to 10.77 in., mean 5.57 in.

Site 12. N. Jackass Flats, below S side of Shoshone Mtn and unnamed hills to the E. 3965 ft elev.
Annual rainfall 2.51 to 11.72 in., mean 5.85 in.

Site 16. E. Jackass Flats, below N slope of Skull Mtn. 3800 ft elev.
Annual rainfall 2.30 to 12.23 in., mean 5.78 in.

Site 17. E. Jackass Flats, below unnamed hills to the N of Skull Mtn. 4065 ft elev.
Annual rainfall 2.80 to 11.38 in., mean 5.54 in.

Site 21. Sw. Frenchman Flat, below SE end of Skull Mtn. 3205 ft elev.
Annual rainfall 3.12 to 10.91 in., mean 5.22 in.

Site 27. N. Frenchman Flat, below CP Hills. 3710 ft elev.
Annual rainfall 2.29 to 12.76 in., mean 6.06 in.

SHRUBS, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 5	8	62*	48	9.6	10	60	46	10.2
Site 11	7	135	34	16.4	10	161	38	19.5
Site 12	8	148	40	18.9	7	168	43	22.2
Site 16	5	38	90	9.3	4	47	87	9.5
Site 17	8	106	63	23.1	10	122	58	22.7
Site 21	5	52	66	10.0	5	68	65	12.9
Site 27	5	94*	59	16.8	5	113	58	18.9
Mean, all sites	7	91	51	14.9	7	106	52	16.6
Dead								
Site 5	2	10*	27	0.8	4	12	33	1.5
Site 11	2	9	15	0.5	1	6	13	0.3
Site 12	3	5	28	0.4	4	5	25	0.5
Site 16	2	3	25	0.4	1	3	30	0.4
Site 17	4	6	38	1.0	2	16	34	3.7
Site 21	4	10*	42	1.5	4	11	56	1.9
Mean, all sites	3	7	31	0.7	3	8	35	1.2

* Includes 1 or more dead plants undetermined to species

(Larrea-Lycium-Grayia)

SHRUB SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Larrea tridentata	7	35	79	7.6	7	40	78	8.3
Ambrosia dumosa	5	2	23	0.2	5	3	29	0.5
Grayia spinosa	6	10	51	1.4	7	9	53	1.0
Lycium andersonii	7	14	48	3.0	7	17	45	3.2
Lycium pallidum	1	16	59	2.8	1	16	56	3.0
Ephedra nevadensis	4	11	33	0.9	3	17	42	1.7
Ceratoides lanata	2	5	32	0.1	4	5	38	0.3
Krameria parvifolia	5	20	18	2.2	5	22	20	2.8
Menodora spinescens	1	6	9	0.3	1	11	14	0.9
Acamptopappus shockleyi	5	7	15	0.4	6	8	17	0.4
Coleogyne ramosissima	1	1	53	0.2	1	1	48	0.2
Atriplex canescens	0				1	1	91	0.2
Thamnosma montana	1	2	22	0.2	1	2	25	0.2
Hymenoclea salsola	0				1	1	51	0.1
Opuntia basilaris	1	1	13	0.0	1	1	5	0.1
Undetermined	2	5	28	0.4	0			
All species, all sites	7	91	51	14.9	7	106	52	16.6
Dead								
Larrea tridentata	3	2	44	0.3	4	2	54	0.2
Ambrosia dumosa	2	2	23	0.2	1	1	20	0.0
Grayia spinosa	3	2	54	0.4	2	1	51	0.1
Lycium andersonii	2	2	40	0.4	4	7	34	1.3
Lycium pallidum	0				1	4	45	0.5
Ephedra nevadensis	4	2	26	0.2	2	2	28	0.2
Krameria parvifolia	1	1	15	0.1	0			
Acamptopappus shockleyi	3	3	15	0.1	3	3	14	0.2
Thamnosma montana	1	1	18	0.1	0			
Opuntia basilaris	1	1	5	0.1	0			
Undetermined	2	5	28	0.4	0			
All species, all sites	7	7	31	0.7	7	8	35	1.2

LARREA-AMBROSIA/LARREA-GRAYIA-LYCIUM

9 Sites: MOJAVE Desert

Site 3. E. Rock Valley, below N side of Specter Range. 3405 ft elev.
Annual rainfall 3.42 to 11.50 in., mean 6.87 in.

Site 4. E. Rock Valley, below S side of Skull Mtn. 3460 ft elev.
Annual rainfall 2.86 to 10.67 in., mean 5.94 in.

Site 6. S-cent. Jackass Flats, below N side of Little Skull Mtn.
3490 ft elev.
Annual rainfall 2.80 to 11.64 in., mean 5.46 in.

Site 10. Nw. Jackass Flats, below N side of Little Skull Mtn hill outlier.
3410 ft elev.
Annual rainfall 2.25 to 9.62 in., mean 4.93 in.

Site 15. S-cent. Jackass Flats, below NW end of Skull Mtn. 3550 ft elev.
Annual rainfall 2.35 to 10.56 in., mean 5.20 in.

Site 20. Sw. Frenchman Flat, below west Spotted Range (Red Mtn).
3260 ft elev.
Annual rainfall 3.21 to 11.21 in., mean 5.47 in.

Site 23. Cent. Frenchman Flat, below E end of Skull Mtn. 3190 ft elev.
Annual rainfall 2.62 to 9.45 in., mean 4.85 in.

Site 24. N-cent. Frenchman Flat, below s. Halfpint Range/CP Hills.
3370 ft elev.
Annual rainfall 2.67 to 10.53 in., mean 5.55 in.

Site 25. W. Frenchman Flat, below NE side of Skull Mtn. 3620 ft elev.
Annual rainfall 3.69 to 12.40 in., mean 6.34 in.

(Larrea-Ambrosia/Larrea-Grayia-Lycium)

SHRUBS, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 3	11	198	50	30.4	11	210	50	30.7
Site 4	9	190	36	22.7	9	263	38	25.3
Site 6	6	128	46	18.7	7	160	43	22.1
Site 10	8	149	41	19.1	8	186	45	21.8
Site 15	4	49	82	13.5	6	63	74	14.6
Site 20	7	142	55	20.6	7	201	56	27.0
Site 23	9	125*	37	12.0	9	142*	40	14.9
Site 24	6	126*	52	19.0	6	156	51	20.2
Site 25	8	98*	49	13.8	8	177	53	21.4
Mean, all sites	8	134	47	18.9	8	173	48	22.0
Dead								
Site 3	6	15	42	2.2	7	23	35	3.1
Site 4	4	15	35	1.7	6	32	35	3.3
Site 6	4	11	60	2.4	3	10	35	1.0
Site 10	1	1	38	0.2	4	8	26	0.9
Site 15	1	1	30	0.1	1	1	28	0.1
Site 20	4	10	52	2.2	5	19	37	2.1
Site 23	4	27*	28	2.3	3	11*	24	0.8
Site 24	6	26*	38	2.8	6	18	31	1.6
Site 25	4	12*	40	1.6	3	18	33	2.2
Mean, all sites	4	13	39	1.7	4	16	33	1.7

* Includes 1 or more dead plants undetermined to species

(Larrea-Ambrosia/Larrea-Grayia-Lycium)

SHRUB SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Larrea tridentata	9	26	83	6.1	9	31	84	6.6
Ambrosia dumosa	9	31	30	3.0	9	43	33	4.0
Grayia spinosa	8	22	52	3.2	9	27	53	3.4
Lycium andersonii	8	11	53	2.1	8	15	49	2.3
Lycium pallidum	3	20	57	3.0	3	21	58	2.9
Ephedra nevadensis	6	12	40	1.2	6	15	44	1.6
Ceratoides lanata	5	21	38	1.8	5	34	40	2.8
Krameria parvifolia	3	19	15	1.9	3	15	17	1.6
Psorothamnus fremontii	3	1	25	0.1	3	2	29	0.3
Menodora spinescens	1	2	18	0.2	1	1	28	0.1
Acamptopappus shockleyi	7	9	26	0.8	7	14	26	1.2
Coleogyne ramosissima	1	8	63	1.9	1	8	63	1.6
Haplopappus cooperi	2	2	28	0.2	2	4	39	0.4
Atriplex canescens	0				1	2	86	0.2
Hymenoclea salsola	2	13	38	1.4	2	26	45	2.8
Tetradymia axillaris	1	1	36	0.1	0			
Opuntia echinocarpa	0				1	1	23	0.1
Undetermined	3	6	23	0.5	1	1	15	0.0
All species, all sites	9	134	47	18.9	9	173	48	22.0
Dead								
Larrea tridentata	6	2	54	0.4	6	2	45	0.3
Ambrosia dumosa	4	3	33	0.4	8	3	29	0.3
Grayia spinosa	6	5	49	0.7	6	5	41	0.9
Lycium andersonii	3	2	54	0.5	4	3	35	0.5
Lycium pallidum	2	2	45	0.2	2	2	34	0.1
Ephedra nevadensis	4	4	34	0.3	3	3	25	0.1
Ceratoides lanata	3	3	38	0.4	3	9	30	0.8
Psorothamnus fremontii	1	1	41	0.1	0			
Acamptopappus shockleyi	4	2	26	0.2	4	3	21	0.2
Hymenoclea salsola	1	5	38	0.7	1	8	30	0.8
Undetermined	3	6	23	0.5	1	1	15	0.0
All species, all sites	9	13	39	1.7	9	16	33	1.7

LARREA-ATRIPLEX

1 Site: MOJAVE Desert

Site 29. N. Frenchman Flat, below s. Halfpint Range, in large area N of playa with an apparent high-density gopher population.
3235 ft elev.
Annual rainfall 1.86 to 8.28 in., mean 4.95 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Larrea tridentata	15	39	1.8	4	45	0.4
Atriplex confertifolia	64	26	6.1	55	22	4.3
Ephedra nevadensis	52	39	6.8	79	40	9.5
Ambrosia dumosa	3	14	0.2	3	16	0.2
Krameria parvifolia	62	19	6.1	46	19	4.5
Undetermined	10	13	0.4	0		
All species (5)	206	27	21.3	187	29	19.0
Dead						
Larrea tridentata	11	40	1.2	3	53	0.4
Atriplex confertifolia	45	23	4.1	37	18	2.4
Ephedra nevadensis	2	19	0.1	4	28	0.1
Krameria parvifolia	3	16	0.1	1	18	0.0
Undetermined	10	13	0.4	0		
All species (4)	71	24	6.0	45	21	2.9

LARREA-PSOROTHAMNUS

1 Site: MOJAVE Desert

Site 33. E. Frenchman Flat, below north Spotted Range. 3260 ft elev. Annual rainfall 2.53 to 8.34 in., mean 4.69 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Larrea tridentata	18	63	3.3	22	58	4.2
Ambrosia dumosa	0			2	15	0.1
Ephedra nevadensis	1	46	0.2	2	63	0.6
Psorothamnus fremontii	24	36	2.5	27	42	3.2
Krameria parvifolia	12	19	1.2	13	26	1.7
Opuntia ramosissima	1	36	0.1	2	22	0.2
Undetermined	1	25	0.0	1	25	0.1
All species (6)	57	41	7.2	69	43	10.0
Dead						
Larrea tridentata	7	54	1.2	8	38	0.9
Psorothamnus fremontii	0			1	43	0.1
Undetermined	1	25	0.0	1	25	0.1
All species (2)	8	50	1.2	10	37	1.0

MENODORA-EPHEDRA

1 Site: MOJAVE Desert

Site 9. Nw. Jackass Flats, below S side of Shoshone Mtn. 3245 ft elev. Annual rainfall 2.82 to 10.14 in., mean 5.13 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Larrea tridentata	2	67	0.2	4	57	0.4
Ambrosia dumosa	1	20	0.0	1	20	0.1
Ephedra nevadensis	33	41	6.6	50	46	8.2
Ceratoides lanata	1	36	0.1	1	41	0.1
Krameria parvifolia	26	21	3.6	26	20	3.1
Coleogyne ramosissima	1	51	0.1	1	66	0.1
Menodora spinescens	63	17	10.3	77	15	10.2
Opuntia echinocarpa	1	30	0.2	1	36	0.1
All species (8)	128	25	21.1	161	27	22.3
Dead						
Larrea tridentata				1	66	0.1
Ambrosia dumosa				1	20	0.1
Ephedra nevadensis	2	41	0.1	9	27	1.3
Krameria parvifolia	4	22	0.5	1	10	0.1
Menodora spinescens	2	17	0.2	2	14	0.2
Opuntia echinocarpa				1	36	0.1
All species (6)	8	25	0.8	15	27	1.9

LARREA-GRAYIA-LYCIUM

4 Sites: TRANSITION Desert

Site 2. W. Mercury Valley, below N side of Specter Range. 3570 ft elev. Annual rainfall 2.79 to 13.5 in., mean 7.04 in.

Site 66. E. Jackass Flats, old Wahmonie townsite below unnamed hills N of Skull Mtn, at saddle between Jackass and Frenchman Flats. 4330 ft elev.
Annual rainfall 3.20 to 14.09 in., mean 6.96 in.

Site 49. W-cent. Yucca Flat, below NE side of Shoshone Mtn. 4160 ft elev. Annual rainfall 1.91 to 14.00 in., mean 6.53 in.

Site 57N. E. Yucca Flat, below W side of Halfpint Range. 4160 ft elev. Annual rainfall 2.17 to 15.53 in., mean 6.98 in.

SHRUBS AND TREES, ALL SPECIES:

	1963[a]				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 2	8	166	52	27.4	10	229	50	29.3
Site 66	10	138	65	29.9	10	153	67	33.0
Site 49	7	117*	53	17.4	9	138	58	23.6
Site 57N	11	286	33	25.0	13	294	37	26.8
Mean, all sites	9	177	47	24.9	11	204	50	28.2
Dead								
Site 2	3	18	50	4.1	5	38	33	4.3
Site 66	4	10	50	1.7	5	13	47	2.8
Site 49	4	15*	34	1.9	2	11	41	1.6
Site 57N	8	92	22	6.6	6	37	26	2.8
Mean, all sites	5	36	29	3.6	5	25	33	2.9

[a] Data collected in 1966 on new Site 57 (57N) following destruction of original Site 57

* Includes 1 or more dead plants undetermined to species

(Larrea-Grayia-Lycium)

SHRUB AND TREE SPECIES, ALL SITES:

	1963[a]				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Larrea tridentata	4	16	115	4.7	4	20	124	6.3
Grayia spinosa	4	42	57	7.8	4	57	55	8.7
Lycium andersonii	4	24	48	4.2	4	29	45	4.6
Ephedra nevadensis	4	14	40	2.0	4	17	48	2.4
Ceratoides lanata	3	25	34	2.1	3	31	36	2.1
Tetradymia axillaris	3	2	48	0.2	3	2	58	0.4
Tetradymia glabrata	1	6	45	0.7	1	4	46	0.5
Acamptopappus shockleyi	3	44	20	2.5	3	40	19	1.9
Coleogyne ramosissima	1	1	81	0.2	1	1	71	0.3
Artemisia spinescens	1	10	19	0.7	1	8	24	0.3
Haplopappus cooperi	1	1	30	0.2	1	1	38	0.2
Atriplex confertifolia	1	38	35	3.7	1	38	34	3.9
Atriplex canescens	0				1	2	63	0.4
Ambrosia dumosa	1	17	36	1.6	1	18	37	1.7
Menodora spinescens	1	2	17	0.2	1	2	11	0.1
Chrysothamnus viscidiflorus ssp. stenophyllus	0				1	1	10	0.1
Hymenoclea salsola	1	23	39	2.7	2	11	49	1.3
Salazaria mexicana	1	3	29	0.2	1	5	40	0.7
Thamnosma montana	1	3	26	0.2	1	3	38	0.5
Yucca brevifolia	1	1	282	0.5	2	2	159	0.5
Opuntia basilaris	0				1	1	15	0.4
Undetermined	1	5	27	0.4	0			
All species, all sites	4	177	47	24.9	4	204	50	28.2
Dead								
Larrea tridentata	1	1	91	0.2	1	2	74	0.5
Grayia spinosa	4	5	50	1.1	4	9	39	1.3
Lycium andersonii	3	3	47	0.7	2	6	37	0.7
Ephedra nevadensis	3	4	37	0.5	3	3	40	0.4
Ceratoides lanata	2	3	23	0.3	1	9	35	0.9
Tetradymia glabrata	1	3	39	0.3	1	1	23	0.1
Acamptopappus shockleyi	2	31	18	1.8	2	11	14	0.5
Artemisia spinescens	1	7	16	0.5	0			
Atriplex confertifolia	1	6	24	0.5	1	7	33	0.7
Ambrosia dumosa	0				1	2	18	0.1
Hymenoclea salsola	1	4	37	0.5	0			
Salazaria mexicana	0				1	1	38	0.1
Yucca brevifolia	0				1	1	66	0.5
Undetermined	1	5	27	0.4	0			
All species, all sites	4	36	29	3.6	4	25	33	2.9

GRAYIA-LYCIUM

4 Sites: TRANSITION Desert

Site 26. W. Frenchman Flat, below N side of Skull Mtn and S side of unnamed hills to the N, along Cane Spg Wash. 3995 ft elev. Annual rainfall 3.36 to 16.42 in., mean 7.30 in.

Site 46. Sw. Yucca Flat, below E side of Mine Mtn. 4025 ft elev. Annual rainfall 1.69 to 16.08 in., mean 7.06 in.

Site 50. W-cent. Yucca Flat, below E side of Shoshone Mtn-Eleana Range. 4130 ft elev. Annual rainfall 2.03 to 13.76 in., mean 6.50 in.

Site 60. Se. Yucca Flat, E of playa and below W side of Halfpint Range. 3950 ft elev. Annual rainfall 2.13 to 14.70 in., mean 6.45 in.

SHRUBS, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 26	6	163	49	21.7	8	245	49	35.1
Site 46	9	335*	32	31.3	12	392	38	37.0
Site 50	6	218	42	25.0	6	295	50	34.9
Site 60	9	237*	34	27.8	10	290*	40	31.7
Mean, all sites	8	238	38	26.5	9	306	44	34.7
Dead								
Site 26	5	21	42	2.7	3	19	33	3.0
Site 46	7	46*	27	3.5	5	18	28	1.4
Site 50	5	16	33	1.4	4	9	42	1.0
Site 60	5	12*	20	1.1	5	20*	20	1.5
Mean, all sites	6	24	30	2.2	4	17	29	1.7

* Includes 1 or more dead plants undetermined to species

(Grayia-Lycium)

SHRUB SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Grayia spinosa	4	66	50	10.1	4	85	51	10.9
Lycium andersonii	4	30	40	3.8	4	43	46	5.2
Ephedra nevadensis	3	17	42	1.8	3	28	55	4.7
Ceratoides lanata	3	54	31	4.3	3	66	37	4.7
Tetradymia axillaris	2	4	64	0.6	2	3	56	0.3
Tetradymia glabrata	2	25	43	3.6	2	30	56	4.8
Acamptopappus shockleyi	1	66	18	4.3	1	70	19	4.1
Artemisia spinescens	3	26	20	1.7	3	24	19	1.4
Haplopappus cooperi	1	1	13	0.1	1	1	13	0.1
Atriplex confertifolia	1	9	29	0.6	1	7	38	0.9
Atriplex canescens	2	12	41	1.1	4	12	65	1.9
Chrysothamnus viscidiflorus ssp. stenophyllus	1	40	25	3.4	2	22	29	1.7
Hymenoclea salsola	1	41	46	4.1	2	43	49	5.6
Thamnosma montana	1	20	40	2.6	1	32	44	4.8
Psorothamnus fremontii	1	2	17	0.1	1	6	28	0.4
Undetermined	3	6	21	0.4	1	2	27	0.0
All species, all sites	4	238	38	26.5	4	306	44	34.7
Dead								
Grayia spinosa	4	6	47	0.9	4	7	37	0.9
Lycium andersonii	2	2	40	0.2	2	2	37	0.2
Ephedra nevadensis	2	2	32	0.2	1	1	25	0.1
Ceratoides lanata	2	5	23	0.4	2	4	28	0.4
Tetradymia axillaris	1	3	69	0.3	0			
Tetradymia glabrata	1	1	5	0.1	0			
Acamptopappus shockleyi	1	1	15	0.0	1	4	15	0.3
Artemisia spinescens	3	7	18	0.4	2	6	14	0.4
Haplopappus cooperi	0				1	1	13	0.0
Atriplex confertifolia	1	1	15	0.1	1	2	33	0.2
Atriplex canescens	1	2	36	0.1	1	1	69	0.1
Chrysothamnus viscidiflorus ssp. stenophyllus	1	1	28	0.1	1	4	20	0.3
Hymenoclea salsola	1	1	41	0.1	1	2	34	0.3
Thamnosma montana	1	3	36	0.3	0			
Psorothamnus fremontii	1	2	17	0.1	0			
Undetermined	3	6	21	0.4	1	2	27	0.0
All species, all sites	4	24	30	2.2	4	17	29	1.7

COLEOGYNE

3 Sites: TRANSITION Desert

Site 18. N. Topopah Valley, below S side of Shoshone Mtn. 4880 ft elev. Annual rainfall 3.70 to 18.95 in., mean 8.99 in.

Site 41. N. Mid Valley, below E side of Shoshone Mtn. 4755 ft elev. Annual rainfall 3.95 to 19.96 in., mean 9.47 in.

Site 51. Nw. Yucca Flat, below E side of Eleana Range. 4950 ft elev. Annual rainfall 3.47 to 18.41 in., mean 8.85 in.

SHRUBS, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 18	3	295	38	45.1	3	417	37	46.6
Site 41	4	409	41	50.0	5	422	38	49.7
Site 51	4	345	37	45.1	4	429	38	47.3
Mean, all sites	4	350	39	46.7	4	423	38	47.9
Dead								
Site 18	1	1	48	0.1	2	7	26	0.8
Site 41	3	26	34	2.4	3	9	29	0.8
Site 51	2	27	26	2.8	2	14	20	1.4
Mean, all sites	2	18	30	1.8	2	10	24	1.0

(Coleogyne)

SHRUB SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Coleogyne ramosissima	3	317	40	43.4	3	391	38	44.4
Grayia spinosa	1	1	46	0.2	0			
Ephedra nevadensis	3	31	32	2.9	3	30	41	3.3
Artemisia tridentata	1	1	48	0.3	1	1	36	0.2
Chrysothamnus viscidiflorus ssp. stenophyllus	1	1	38	0.1	1	1	41	0.1
Yucca baccata	1	3	56	0.6	1	3	75	0.6
Coryphantha vivipara var. rosea	0				1	1	13	0.1
Echinocereus engelmannii var. chrysocentrus	0				1	1	10	0.1
Opuntia echinocarpa	1	1	48	0.1	1	1	18	0.4
All species, all sites	3	350	39	46.7	3	423	38	47.9
Dead								
Coleogyne ramosissima	2	9	34	1.1	3	5	24	0.7
Ephedra nevadensis	2	18	27	1.4	3	5	23	0.3
Artemisia tridentata	1	1	48	0.3	1	1	36	0.2
Opuntia echinocarpa	1	1	48	0.1	0			
All species, all sites	3	18	30	1.8	3	10	24	1.0

COLEOGYNE/LARREA-GRAYIA-LYCIUM

3 Sites: TRANSITION Desert

Site 13. N. Jackass Flats, below S side of Shoshone Mtn and unnamed hills to the E. 4220 ft elev.
Annual rainfall 2.68 to 13.12 in., mean 6.57 in.

Site 44. Sw. Yucca Flat, below N side of CP Hills. 4130 ft. elev.
Annual rainfall 1.70 to 18.06 in., mean 7.18 in.

Site 56. E. Yucca Flat, below W side of Halfpint Range. 4320 ft elev.
Annual rainfall 2.72 to 13.37 in., mean 6.51 in.

SHRUBS, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 13	8	182*	43	26.0	8	227*	42	29.1
Site 44	10	194*	46	26.3	12	191*	51	28.2
Site 56	6	206*	49	27.7	6	227	51	29.4
Mean, all sites	8	194	46	26.7	9	215	48	28.9
Dead								
Site 13	4	17*	33	2.2	4	27*	27	2.8
Site 44	7	39*	35	4.3	4	7*	38	1.1
Site 56	5	18*	38	2.2	3	4	35	0.4
Mean, all sites	5	28	35	2.9	4	12	32	1.4

*Includes 1 or more dead plants undetermined to species

(Coleogyne/Larrea-Grayia-Lycium)

SHRUB SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Coleogyne ramosissima	3	90	45	11.8	3	102	43	12.9
Larrea tridentata	3	9	115	2.6	3	10	129	2.9
Grayia spinosa	3	30	48	4.0	3	32	48	3.9
Lycium andersonii	3	28	40	4.7	3	36	47	5.9
Ephedra nevadensis	3	17	42	1.9	3	16	50	2.2
Ceratoides lanata	1	1	25	0.1	1	1	41	0.0
Tetradymia axillaris	2	2	63	0.2	1	1	94	0.3
Artemisia spinescens	1	20	27	1.4	1	6	22	0.4
Haplopappus cooperi	2	5	31	0.4	2	12	20	0.8
Menodora spinescens	1	3	19	0.1	1	2	14	0.1
Hymenoclea salsola	0				1	1	66	0.0
Ambrosia dumosa	1	6	28	0.7	1	6	29	0.5
Acamptopappus shockleyi	0				1	1	28	0.0
Echinocereus engelmannii var. chrysocentrus	1	1	13	0.0	1	1	25	0.1
Undetermined	3	5	30	0.6	2	2	21	0.1
All species, all sites	3	194	46	26.7	3	215	48	28.9
Dead								
Coleogyne ramosissima	3	2	30	0.3	3	6	25	0.6
Larrea tridentata	1	1	36	0.2	0			
Grayia spinosa	3	6	44	0.8	3	3	36	0.4
Lycium andersonii	2	3	33	0.6	2	2	41	0.3
Ephedra nevadensis	3	5	36	0.5	3	2	33	0.3
Tetradymia axillaris	1	1	63	0.1	0			
Artemisia spinescens	1	10	26	0.6	0			
Menodora spinescens	1	1	25	0.1	0			
Ambrosia dumosa	1	1	28	0.1	0			
Undetermined	3	5	30	0.6	2	2	21	0.1
All species, all sites	3	28	35	2.9	3	12	32	1.4

COLEOGYNE/GRAYIA-LYCIUM

3 Sites: TRANSITION Desert

Site 14. N. Jackass Flats, below S side of Shoshone Mtn and unnamed hills to the E. 4750 ft elev.
Annual rainfall 4.32 to 15.32 in., mean 7.44 in.

Site 39. S. Mid Valley, below W side of CP Hills and N side of unnamed hills N of Cane Spg. 4515 ft elev.
Annual rainfall 3.25 to 14.50 in., mean 8.03 in.

Site 45. Sw. Yucca Flat, below N side of CP Hills. 4205 ft elev.
Annual rainfall 1.66 to 19.34 in., mean 7.34 in.

SHRUBS AND TREES, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 14	7	309	31	42.5	7	385	33	49.8
Site 39	9	306*	39	35.6	9	306	40	39.3
Site 45	6	251*	47	37.5	6	280	51	40.8
Mean, all sites	7	289	39	38.5	7	324	40	43.3
Dead								
Site 14	5	17	35	2.3	4	9	32	1.5
Site 39	6	33*	34	3.8	3	10	32	1.3
Site 45	5	33*	35	3.5	5	16	36	1.6
Mean, all sites	5	28	35	3.2	4	12	34	1.5

*Includes 1 or more dead plants undetermined to species

SHRUB AND TREE SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Coleogyne ramosissima	3	109	43	15.2	3	117	40	15.3
Grayia spinosa	3	44	48	6.7	3	49	57	7.1
Lycium andersonii	3	36	39	5.2	3	39	44	6.2
Ephedra nevadensis	3	23	42	3.0	3	23	49	3.4
Ceratoides lanata	3	11	39	0.7	3	22	42	1.6
Tetradymia axillaris	2	3	47	0.3	2	2	68	0.2
Tetradymia glabrata	1	2	43	0.1	1	1	33	0.0
Artemisia spinescens	1	17	17	1.1	1	7	16	0.4
Haplopappus cooperi	1	10	23	0.7	1	9	28	1.2
Menodora spinescens	1	143	18	18.4	1	201	20	25.7
Yucca brevifolia	1	3	173	0.6	1	3	179	1.2
Undetermined	2	8	30	0.8	0			
All species, all sites	3	289	39	38.5	3	324	40	43.3
Dead								
Coleogyne ramosissima	2	8	36	1.1	3	6	28	0.6
Grayia spinosa	3	5	41	0.9	2	2	43	0.2
Lycium andersonii	3	2	41	0.3	1	2	37	0.3
Ephedra nevadensis	3	6	37	0.5	3	2	42	0.4
Ceratoides lanata	1	2	33	0.1	1	2	36	0.2
Tetradymia glabrata	1	1	33	0.0	0			
Artemisia spinescens	1	7	16	0.4	0			
Menodora spinescens	1	4	16	0.4	1	3	11	0.3
Yucca brevifolia	1	1	114	0.0	1	1	114	0.4
Undetermined	2	8	30	0.8	0			
All species, all sites	3	28	35	3.2	3	12	34	1.5

LARREA-ATRIPLEX/COLEOGYNE

1 Site: TRANSITION Desert

Site 43. S. Yucca Flat, below N side of CP Hills. 4185 ft elev. Annual rainfall 2.01 to 17.55 in., mean 7.09 in.

SHRUB AND TREE SPECIES:

	1963			1975		
Living and Dead	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Larrea tridentata	13	90	2.2	17	122	3.7
Atriplex confertifolia	71	35	8.3	84	42	14.1
Coleogyne ramosissima	24	41	2.2	28	43	3.0
Grayia spinosa	1	53	0.1	1	43	0.1
Lycium andersonii	1	30	0.1	3	31	0.2
Ephedra nevadensis	25	34	2.6	36	45	4.2
Acamptopappus shockleyi	47	16	2.9	27	20	1.3
Menodora spinescens	5	11	0.2	6	15	0.3
Artemisia spinescens	9	20	0.6	6	23	0.4
Yucca brevifolia	4	229	0.4	4	271	1.0
Undetermined	17	16	0.8	0		
All species (11)	217	35	20.5	213	49	28.3
Dead						
Atriplex confertifolia	7	29	0.9	10	27	1.2
Coleogyne ramosissima	0			2	38	0.3
Grayia spinosa	0			1	43	0.1
Ephedra nevadensis	8	34	0.6	3	29	0.4
Acamptopappus shockleyi	5	16	0.3	1	18	0.1
Menodora spinescens	1	15	0.1	1	13	0.1
Artemisia spinescens	2	18	0.1	0		
Undetermined	17	16	0.8	0		
All species (8)	40	22	2.7	18	28	2.2

COLEOGYNE-GRAYIA/ARTEMISIA

1 Site: TRANSITION Desert

Site 47. W. Yucca Flat, below NE side of Shoshone Mtn. 4840 ft. elev. Annual rainfall 3.17 to 20.78 in., mean 9.13 in.

SHRUB AND TREE SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Coleogyne ramosissima	64	52	9.8	65	50	10.1
Grayia spinosa	53	60	9.3	57	65	12.0
Lycium andersonii	5	56	1.2	5	56	1.1
Artemisia tridentata	43	55	6.7	38	60	7.0
Ephedra nevadensis	31	38	4.0	32	48	3.3
Tetradymia glabrata	4	67	1.0	6	68	1.3
Haplopappus cooperi	46	31	4.2	44	34	4.8
Hymenoclea salsola	5	40	0.4	7	48	0.8
Yucca brevifolia	1	155	0.1	1	239	0.2
Undetermined	17	16	0.9	0		
All species (9)	269	47	37.7	255	53	40.5
Dead						
Coleogyne ramosissima	0			2	43	0.2
Grayia spinosa	4	35	0.9	1	43	0.2
Artemisia tridentata	27	46	3.3	19	46	3.2
Ephedra nevadensis	6	39	0.7	0		
Haplopappus cooperi	1	33	0.1	0		
Undetermined	17	16	0.9	0		
All species (5)	55	35	6.0	22	46	3.6

LARREA-LYCIUM SHOCKLEYI-ATRIPLEX

3 Sites: TRANSITION Desert

Site 34. Se. Frenchman Flat, below NW Ranger Mtns, at E margin of playa.
3120 ft elev.
Annual rainfall 2.62 to 9.25 in., mean 4.89 in.

Site 35. Se. Frenchman Flat, upper bajada below NW Ranger Mtns.
3300 ft elev.
Annual rainfall 2.28 to 10.00 in., mean 5.36 in.

Site 36. Se. Frenchman Flat, below NW Ranger Mtns near SE margin of playa.
3085 ft elev.
Annual rainfall 2.30 to 10.02 in., mean 4.95 in.

SHRUBS, ALL SPECIES:

	1963				1975			
	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)	No. Spp.	Tot. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead								
Site 34	5	112	22	10.7	7	134	29	17.2
Site 35	8	130*	19	10.7	7	155	21	12.6
Site 36	10	127*	24	11.7	10	162	29	15.2
Mean, all sites	8	123	22	11.0	8	150	26	15.0
Dead								
Site 34	0				1	1	23	0.1
Site 35	1	10*	19	0.8	4	12	21	0.7
Site 36	2	4*	16	0.3	2	7	18	0.5
Mean, all sites	2	7	18	0.6	2	7	20	0.4

* Includes 1 or more dead plants undetermined to species

(Larrea-Lycium shockleyi-Atriplex)

SHRUB SPECIES, ALL SITES:

	1963				1975			
	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)	No. Sites	Mean No. Pls. /Site	Mean Ht. (cm)	Mean Cover /Site (%)
Living and Dead								
Larrea tridentata	3	9	62	1.7	3	12	77	2.4
Lycium shockleyi	3	60	18	5.5	3	67	22	7.2
Atriplex confertifolia	3	17	22	1.2	3	19	27	1.7
Atriplex canescens	0				1	2	33	0.1
Ambrosia dumosa	2	7	20	0.6	2	13	21	0.9
Ceratoides lanata	1	1	28	0.0	1	4	27	0.2
Psorothamnus fremontii	2	2	26	0.2	1	3	36	0.4
Krameria parvifolia	1	15	16	1.3	2	8	19	0.6
Acamptopappus shockleyi	1	28	15	1.9	1	44	16	2.4
Ephedra torreyana	1	3	40	0.3	1	5	35	0.3
Menodora spinescens	1	33	13	2.0	1	46	13	3.8
Hymenoclea salsola	1	1	28	0.1	1	1	30	0.1
Thamnosma montana	1	4	23	0.4	1	7	29	0.6
Yucca brevifolia	0				1	2	136	0.1
Opuntia basilaris	1	1	5	0.0	0			
Opuntia echinocarpa	1	1	13	0.0	1	1	13	0.0
Opuntia ramosissima	1	1	13	0.0	1	1	15	0.0
Undetermined	2	2	16	0.1	0			
All species, all sites	3	123	22	11.0	3	150	26	15.0
Dead								
Lycium shockleyi	1	1	15	0.2	1	1	10	0.0
Atriplex confertifolia	1	8	20	0.7	1	8	24	0.6
Ambrosia dumosa	0				2	1	20	0.1
Acamptopappus shockleyi	1	1	13	0.1	1	6	18	0.4
Menodora spinescens	0				1	2	10	0.1
Yucca brevifolia	0				1	1	25	0.0
Undetermined	2	2	16	0.1	0			
All species, all sites	2	7	18	0.6	3	7	20	0.4

LYCIUM SHOCKLEYI-ATRIPLEX

1 Site: TRANSITION Desert

Site 37. Se. Frenchman Flat, below Ranger Mtns, at SE margin of playa. 3080 ft elev.
Annual rainfall 2.39 to 10.06 in., mean 5.06 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Lycium shockleyi	79	24	10.1	99	31	14.1
Atriplex confertifolia	20	28	1.6	32	30	2.8
Ceratoides lanata	3	33	0.3	4	42	0.3
Acamptopappus shockleyi	0			2	11	0.0
All species (4)	102	25	11.9	137	31	17.3
Dead						
Lycium shockleyi	0			2	14	0.1
Atriplex confertifolia	0			2	30	0.3
Ceratoides lanata	0			1	13	0.1
All species (3)	0			5	20	0.5

LYCIUM PALLIDUM-GRAYIA

1 Site: TRANSITION Desert

Site 38. Cent. Frenchman Flat, below N side of west Spotted Range (Red Mtn). 3115 ft elev.
Annual rainfall 2.54 to 10.05 in., mean 4.77 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Lycium pallidum	49	66	10.5	50	73	13.5
Lycium andersonii	2	58	0.3	0		
Grayia spinosa	23	52	2.7	27	58	3.1
Ceratoides lanata	1	36	0.1	0		
Atriplex canescens	4	60	0.5	16	55	1.5
Psorothamnus polydenius	3	27	0.3	2	39	0.3
All species (6)	82	59	14.3	95	65	18.5
Dead						
Lycium pallidum	1	20	0.0	2	61	0.3
Grayia spinosa	3	36	0.3	5	43	0.6
Atriplex canescens	0			2	24	0.2
All species (3)	4	32	0.3	9	43	1.1

ATRIPLEX CONFERTIFOLIA

1 Site: GREAT BASIN Desert

Site 31. N. Frenchman Flat, near playa margin, below s. Halfpint Range. 3085 ft elev.
Annual rainfall 3.11 to 7.99 in., mean 5.12 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Atriplex confertifolia	87	29	8.6	75	32	8.4
Dead						
Atriplex confertifolia	30	19	2.5	10	27	1.0

ATRIPLEX-KOCHIA

1 Site: GREAT BASIN Desert

Site 59. S. Yucca Flat, near N margin of playa. 3930 ft elev.
Annual rainfall 1.66 to 17.05 in., mean 6.95 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Atriplex confertifolia	64	26	6.9	92	27	11.2
Kochia americana	122	19	8.0	136	29	8.6
All species (2)	186	21	14.9	228	28	19.8
Dead						
Atriplex confertifolia	14	23	1.6	8	26	1.3
Kochia americana	2	15	0.2	5	16	0.3
All species (2)	16	22	1.7	13	22	1.6

ATRIPLEX-CERATOIDES

1 Site: GREAT BASIN Desert

Site 58. S. Yucca Flat, N of playa. 3960 ft elev.
Annual rainfall 1.91 to 16.74 in., mean 7.00 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Atriplex confertifolia	64	33	7.8	83	36	10.8
Ceratoides lanata	61	30	5.2	90	39	7.9
Artemisia spinescens	35	24	2.9	88	19	4.8
Grayia spinosa	2	52	0.3	4	59	0.7
Lycium andersonii	5	49	0.9	5	52	1.1
Tetradymia axillaris	1	48	0.1	1	63	0.1
Undetermined	4	18	0.3	0		
All species (6)	172	30	17.5	271	32	25.6
Dead						
Atriplex confertifolia	6	18	0.5	17	31	2.3
Ceratoides lanata	4	26	0.3	2	28	0.1
Artemisia spinescens	2	33	0.2	0		
Undetermined	4	18	0.3	0		
All species (3)	16	22	1.3	19	31	2.3

ATRIPLEX CANESCENS (1)

1 Site: GREAT BASIN Desert

Site 30. N. Frenchman Flat, near playa margin, below s. Halfpint Range. 3095 ft elev.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Atriplex canescens	42	36	5.0	57	37	6.4
Atriplex confertifolia	2	37	0.3	3	29	0.4
Ambrosia dumosa	1	23	0.1	1	23	0.1
All species (3)	45	36	5.4	61	36	6.9
Dead						
Atriplex canescens	4	28	0.5	5	34	0.2

OMISSION: P. 46, for Site 30

Annual rainfall 2.86 to 7.77 in., mean 4.97 in.

ATRIPLEX CANESCENS (2)

1 Site: GREAT BASIN Desert

Site 65. E. Forty-Mile Canyon, below W slope of Eleana Range (Sugar Loaves), on sand dune. 5500 ft elev.
Annual rainfall 3.27 to 14.52 in., mean 7.18 in.

SHRUB SPECIES:

	1963			1975		
Living and Dead	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Atriplex canescens	3	73	0.4	4	84	0.6
Chrysothamnus viscidiflorus ssp. viscidiflorus	17	49	3.2	13	45	2.3
Ephedra viridis	2	71	0.4	2	71	0.3
Psorothamnus polydenius	16	44	1.3	9	39	1.0
Eriogonum kearneyi*	59	41	10.5	65	40	10.1
Undetermined	2	25	0.3	1	33	0.1
All species (5)	99	44	16.0	94	43	14.4
Dead						
Chrysothamnus viscidiflorus ssp. viscidiflorus	2	42	0.1	5	29	0.6
Psorothamnus polydenius	1	28	0.1	0		
Eriogonum kearneyi	1	15	0.1	3	33	0.1
Undetermined	2	25	0.3	1	33	0.1
All species (3)	6	30	0.5	9	29	1.1

* Suffrutescent, perennial and woody at and near base of branches

ARTEMISIA TRIDENTATA

1 Site: GREAT BASIN Desert

Site 62. E. Forty-Mile Canyon, below W slope of Eleana Range.
5740 ft elev.
Annual rainfall 4.78 to 17.00 in., mean 7.98 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Artemisia tridentata	180	59	31.0	211	61	37.2
Ephedra nevadensis	3	67	0.7	2	69	0.4
Atriplex canescens	2	62	0.3	3	63	0.4
Chrysothamnus viscidiflorus ssp. puberulus	1	18	0.0	1	25	0.0
Eriogonum kearneyi*	7	38	0.5	8	27	0.4
All species (5)	193	58	32.6	225	60	38.4
Dead						
Artemisia tridentata	22	54	3.5	32	41	4.4
Ephedra nevadensis	2	60	0.4	0		
Eriogonum kearneyi	2	22	0.1	0		
All species (3)	26	52	4.0	32	41	4.4

* Suffrutescent, perennial and woody at and near base of branches

ARTEMISIA TRIDENTATA-PINYON-JUNIPER

1 Site: GREAT BASIN Desert

Site 68. E. Forty-Mile Canyon, below W face of Rainier Mesa (sw. Belted Range). 6060 ft.
Annual rainfall 5.72 to 21.06 in., mean 10.28 in.

SHRUB AND TREE SPECIES:

	1964			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Artemisia tridentata	243	67	37.3	234	63	36.9
Juniperus osteosperma	1	157	0.2	1	218	0.6
Atriplex canescens	8	76	1.6	14	87	3.4
Chrysothamnus viscidiflorus ssp. puberulus	1	38	0.1	2	43	0.2
Chrysothamnus viscidiflorus ssp. viscidiflorus	11	47	1.6	22	48	2.7
All species (5)	264	67	40.8	273	64	43.9
Dead						
Artemisia tridentata	90	60	13.1	80	51	11.9
Chrysothamnus viscidiflorus ssp. viscidiflorus	1	23	0.0	1	23	0.3
All species (2)	91	59	13.2	81	51	12.1

ARTEMISIA NOVA

1 Site: GREAT BASIN Desert

Site 61. E. Forty-Mile Canyon, below W slope of Eleana Range.
5760 ft elev.
Annual rainfall 5.28 to 17.90 in., mean 8.04 in.

SHRUB SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Artemisia nova	294	34	32.9	305	38	38.1
Grayia spinosa	20	40	1.9	16	40	1.9
Lycium andersonii	1	38	0.0	0		
Ephedra nevadensis	17	43	2.5	16	45	1.8
All species (4)	332	35	37.3	337	38	41.8
Dead						
Artemisia nova	58	26	5.5	25	27	2.0
Grayia spinosa	6	32	0.6	1	46	0.1
Ephedra nevadensis	4	34	0.4	3	40	0.1
All species (3)	68	27	6.5	29	29	2.2

ARTEMISIA NOVA-PINYON-JUNIPER (1)

1 Site: GREAT BASIN Desert

Site 63. E. Forty-Mile Canyon, below W face of Rainier Mesa (sw. Belted Range). 6420 ft elev.
Annual rainfall 5.94 to 21.68 in., mean 10.62 in.

SHRUB AND TREE SPECIES:

	1963			1975		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Artemisia nova	193	35	21.0	202	33	21.7
Pinus monophylla	26	78	5.2	35	79	7.8
Juniperus osteosperma	14	122	4.9	14	138	5.5
Chrysothamnus viscidiflorus ssp. puberulus	17	26	1.1	18	25	1.1
Ephedra viridis	5	66	0.9	6	52	0.6
Purshia tridentata	2	47	0.5	3	51	0.8
Eriogonum caespitosum	146	5	3.3	238	6	4.9
All species (7)	403	30	37.0	516	26	42.5
Dead						
Artemisia nova	30	27	2.8	11	25	1.3
Juniperus osteosperma	1	211	0.5	1	198	0.4
Chrysothamnus viscidiflorus ssp. puberulus	1	15	0.0	0		
Ephedra viridis	1	89	0.2	0		
Purshia tridentata	0			1	28	0.1
Eriogonum caespitosum	9	6	0.2	0		
All species (6)	42	28	3.6	13	39	1.8

ARTEMISIA NOVA-PINYON-JUNIPER (2)

1 Site: GREAT BASIN Desert

Site 64. N. end of Rainier Mesa (sw. Belted Range), s. Kawich Valley drainage. 7425 ft elev.
Annual rainfall 5.06 to 26.05 in., mean 10.64 in.

SHRUB AND TREE SPECIES:

	1964			1974		
	No. Pls.	Mean Ht. (cm)	Cover (%)	No. Pls.	Mean Ht. (cm)	Cover (%)
Living and Dead						
Artemisia nova	68	41	8.2	76	49	9.8
Pinus monophylla	32	268	15.5	36	256	16.9
Juniperus osteosperma	1	330	0.4	1	366	0.4
Quercus gambelii	13	107	3.4	14	112	2.0
Chrysothamnus viscidiflorus ssp. puberulus	1	28	0.1	4	23	0.3
Chrysothamnus viscidiflorus ssp. viscidiflorus	1	38	0.1	0		
Ephedra viridis	1	18	0.0	0		
Purshia tridentata	28	47	3.2	31	51	3.7
Ribes velutinum	4	100	0.9	3	105	0.3
Haplopappus nanus	12	27	1.0	9	23	0.7
Eriogonum caespitosum	2	8	0.1	3	4	0.0
Eriogonum microthecum var. lapidicola	29	5	0.6	32	6	0.7
Eriogonum umbellatum var. subaridum	5	7	0.1	5	16	0.2
Opuntia erinacea var. erinacea	15	19	1.4	17	16	1.2
All species (14)	212	74	34.8	231	76	36.2
Dead						
Artemisia nova	9	33	1.1	1	36	0.2
Pinus monophylla	1	394	0.8	1	396	0.6
Quercus gambelii	2	74	0.3	2	88	0.5
Purshia tridentata	8	26	0.9	4	46	0.4
Ribes velutinum	1	71	0.1	0		
Opuntia erinacea var. erinacea	0			2	6	0.1
All species (6)	21	53	3.1	10	81	1.7