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THE BIOTIC COMMUNITIES OF SOUTHERN NEVADA

by

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INTRODUCTION

A highly diversified biota exists in Southern Nevada. In this report the native and introduced vascular plants and vertebrate animals are assigned to biotic communities and their present distribution and relative abundance are discussed in the hope that the following three purposes will be served: (1) To provide a summary of the information now available about the community ecology of the area; (2) to provide a basis and framework for further studies; and (3) to provide a basis for comparison with paleoecological studies of the area. Photographs of many of the vegetation types discussed here also appear in Mehringer, Part 3, this report. Fossil vertebrates are discussed in Mawby, Part 2, this report, and late Pleistocene molluscan shells in Appendix A, this report.

The biota of Southern Nevada has not been extensively studied. Reports on the flora have been made by Rothrock (1878), Merriam (1893), Tidestrom (1925), Jaeger (1926), and Clokey (1951). Recent studies of the effects of nuclear tests on the vegetation of the Nevada Test Site, situated north and west of the area covered in this report, have been completed by Shields (1958, 1959a, 1959b), Shields and Rickard (1960), Shields, Rickard and Drouet (1959), Shields, Durrell and Sparrow (1961), Shields and Wells (1962, 1963), Rickard (1959, 19 61, 1963), Drouet (1959), Durrell and Shields (1960), Wells (1961), Beatley (1962) and Allred, Beck and Jorgensen (1963). A description of the vegetation of the Desert Game Range and a geographical analysis of the flora of Clark County, Nevada has been made by Bradley (1964, 1965, 1967).

Some information on the invertebrate fauna is found in Brues (1932), and La Rivers (1947, 1948a, 1948b, 1949a, 1949b, 1949c, 1950a, 1950b, 1951a, 1951b, 1953, 1954, 1956). Recent work on the distribution of invertebrates is reported by Allred, Beck and Jorgensen (1963) as well as numerous other papers by the Brigham Young University group working on the Nevada Test Site.

The systematics and zoogeography of the fishes of southern Nevada have been presented in the numerous studies on Great Basin fishes by Carl L. Hubbs and Robert R. Miller. This work, as well as that of other authors, is summarized in Hubbs and Miller (1948a, 1948b), Miller (1946a, 1948, 1959, 1961), Miller and Hubbs (1960) and Uyeno and Miller (1962). Studies of introduced fishes are reported by Miller and Alcorn (1946) and Miller (1952). Some data on man's influence on the native fauna are presented by Deacon et al. (1963), Hubbs and Deacon (1964), and Miller (1961, 1963). La Rivers (1962) has compiled and summarized much of the information available on the fishes of Nevada. Physiological studies on fishes in southern Nevada are reported by Sumner and Sargent (1940), Sumner and Lanham (1942) and Hubbs and Hettler (1964).

Early studies of reptiles were made by Yarrow (1875), Yarrow and Henshaw (1878), and Stejnegar (1893). More recent accounts have been published by Bentley (1919), Van Denburgh and Slevin (1921), Linsdale (1940), La Rivers (1942), Miller (1946b), Tanner and Jorgensen (1963), Deacon, Bradley and Moor (1966), Bradley and Deacon (in press), and Bradley and Deacon (19 66 ,a,b). Two authors, Klauber and Banta, have individually produced some of the most significant and numerous reports on the herptiles of southern Nevada. Most of their studies are cited in Banta and Tanner (1964).

Early reports on the birds of Nevada are Henshaw (1875) and Hoffman (1881). More recent reports on the birds of southern Nevada include Jaeger (1927), Van Rossem (1936), Linsdale (1936, 1951), Gullion, Pulich and Evenden (1959), Anon. (1961), Rickard (1961), Richards (1962), Austin and Bradley (1965, ms.) and Johnson (1965).

The distribution of mammals in southern Nevada was reported by Burt (1934) and Hall (1946). More recent reports are Deacon and Bradley (1962), Ryser (1964), Deacon, Bradley and Larsen (1964), Cockrum and Musgrove (1964), Bradley, Austin and O'Farrell (1965), Bradley (1966), Mauer and Bradley (ms.), and Bradley and Hansen (1965). Much work has been conducted on the Nevada Test Site and is reported by Allred and Beck (1963a,

1963b), Allred, Beck and Murdock (1960), Jorgensen (1962), White and Allred (1961), and Allred, Beck and Jorgensen (1963).

Papers giving descriptions of biotic communities in southern Nevada include Allred, Beck and Jorgensen (1963), Bradley, (1964, 1965), and Deacon, Bradley and Larsen (1964). The study of the flora and vertebrate biota of this are is greatly facilitated by a checklist compiled from the literature by Deming (ms.).

DESCRIPTION OP THE AREA

The area studied includes that portion of the Mohave Desert found in the State of Nevada, exclusive of the southern portion of the Nevada Test Site which has been reported on by Allred, Beck and Jorgensen (1963).

This area covers Clark County as well as small portions of southern Lincoln County and southeastern Nye County. In our considerations of aquatic habitats, these boundaries are extended to include the entire Nevada portion of the Colorado River drainage system as defined by Hubbs and Miller (1948a).

Physiographically, the area is a part of the Basin and Range Province. Elevations range from about 500 feet at the southern tip of the state near the Colorado River to 11,972 feet on Charleston Peak. The numerous isolated mountain ranges tend to be arranged in a north-south direction. With the exception of the Spring and Sheep Ranges, which have well-developed coniferous forests, most of the mountain ranges are covered by desert vegetation. Bajadas extend down to the valley floor where in many instances playas or dry lakes occur.

Few permanent streams occur in the area. Several small streams are found in the Spring Range. The Virgin and Moapa (Muddy) Rivers drain into Lake Mead, one of the largest man-made impoundments in the world. Meadow Valley Wash, an intermittent stream, drains into the Moapa River. The outflowing waters from most of the springs in the area sink into the beds of pluvial stream channels.

METHODS

The descriptions of biotic communities presented here are based primarily on field observations and collections made by the Biology Department, University of Nevada at Las Vegas, from 1959 to the present. In addition, the literature has been freely consulted.

The vegetation was sampled by random collecting, development of species lists for specific areas, line transect, quadrats and step-point (Levy and Madden, 1933; Phillips, 1959; Greig-Smith, 1964; and Bradley, 1964, 1965). Fish collections were made by use of seines, traps and a shocker. Amphibian, reptile and bird records were obtained by standard collecting techniques. Few quantitative records of abundance are available for plants, amphibians, reptiles and birds. Collections of fish and mammals have been more extensive, intensive and quantitative. Much of our mammal collecting has been done by using the technique described by Calhoun (1949), and further defined by Deacon, Bradley and Larsen (1964, pp. 397-398).

BIOGEOGRAPHICAL CONSIDERATIONS

The geographical position of southern Nevada is unique. Moving from Needles, California, north into southern Nevada, one can pass from the Sonoran through the Mohave, and into the Great Basin Desert to the north. (Munz, 1935; Clokey, 1951; Deming, 1946; Allred, Beck and Jorgensen, 1963; and Bradley, 1964, ms.).

Vascular flora: A summary of the geographical distribution of 887 vascular plants known from Clark County is presented in Table 1, and the ecological distribution of 704 species is given in Appendix I, p. 248. Approximately half of the native flora (Mohavian, Sonoran, Southwestern, Latin American, and Great Basin elements) covers most of southern Nevada and makes up the bulk of the desert vegetation at the lower and middle elevations. The Pacific, Rocky Mountain, Temperate North American, Holarctic,Endemic and Great Basin elements complete the flora and are found in the much smaller mountainous areas.

TABLE 1. Main Features of the Geographical Distribution of the Flora of Clark County, Nevada (from Bradley, ms.)

Geographical Elements	Main Distribution	Distribution in Clark County	Percentage composition in flora of Clark County
Endemic	Known distribution restricted to Clark County	Higher elevations in Spring Range	2.1
Mohavian	Mohave Desert at elevations below 5000 feet	Lower elevations in desert scrub communities	4.7
Sonoran	Sonoran Desert at elevations below 3000 feet	Lower elevations in desert scrub communities	19.1
Southwestern	Wide ranging at elevations below 5000 feet	Lower elevations in desert scrub communities	14.8
Great Basin	Great Basin at elevations between 4000 and 7000 feet	Middle elevations in woodland communities	10.2
Pacific	Pacific states excluding desert regions	Middle and higher elevations in woodland and forest communities	6.2
Rocky Mountain	Higher elevations in Rocky Mountain region	Higher elevations in forest communities	18.1
Temperate North American	Wide distribution in northern 13. S. and Canada	Forest communities and localized mesic situations	13.4
Holarctic	Circumpolar distribution	Forest communities and localized mesic situations	3.3
Latin America	Distribution extends to South America	Lower elevations in desert scrub communities	1.3
Introductions	Primarily from Eurasia	Widespread and localized	6.8

TABLE 2. The Geographical Analysis of the Amphibians, Reptiles, and Mammals of Southern Nevada

Geographical Regions	AMPHIBIANS		REPTILES			MAMMALS						
	Sala-manders	Frogs & Toads	Turtles	Lizards	Snakes	Insec-tivores	Bats	Rabbits	Rodents	Carni-vores	Ungu-lates	Totals for each region
Endemic	–	1	–	–	–				1			2
Mohavian	–	–	–	–	–							0
Sonoran	–	–	1	7	5	–	1	–	5			19
Southwestern	–	–	–	6	8	–	2	–	10	2	–	28
Great Basin				2					7			9
Pacific		1		1	1	1			2			6
Rocky Mountain	–	–	–	2	–	–	–	1	2	–	–	5
Western North American	–	6	–	–	1	–	9	2	–	1	1	20
Temperate North American		1			4		6		5	9	1	26
Introductions	1		1						1		4	7
Totals	1	9	2	18	19	1	18	3	33	12	6	122

Fish: Appendix II, p. 273, summarizes the community relationships of the 37 species of fish known to occur in southern Nevada. Two major drainage systems, the Colorado and the Death Valley, occur in this region. The native fish fauna includes an unusually high percentage of isolated, endemic species.

Of the 16 native species in the Nevada portion of the Colorado River drainage, 14 are endemic to the Colorado River system. Six of these species are restricted to southern Nevada. One sucker may be an undescribed form. One endemic species, Moapa coriacea, occurs in only the type locality. Two species (Salmo clarki and Ptychocheilus lucius) no longer maintain native populations in this part of their former range, and one species Lepidomeda altivelis) has become extinct.

The Death Valley Drainage system in Nevada includes Pahrump Valley and Ash Meadows. Of the five native species occurring here, four are endemic. Of these four, one (Empetrichthys merriami) is probably extinct, two are each restricted to single, isolated springs and the fourth is of restricted occurrence in the Amargosa Basin of eastern California and southwestern Nevada.

Amphibians, reptiles and mammals: Table 2 summarizes geographical affinities on the basis of presently known distribution of the 121 species of amphibians, reptiles and mammals known from southern Nevada. Distribution within the biotic communities is indicated for each species in Appendices III, IV and VI. In general, amphibians from western North America have a center of distribution from the central grasslands. Over 80 percent of the reptiles show southern affinities. The distribution patterns of mammals are more diverse. The larger mammals (carnivores and ungulates)are widely distributed but chiefly of northern affinities. Bats show primarily southern affinities superimposed on widespread distribution patterns resulting from excellent means of dispersal. Rodents are more restricted and show distinct regional patterns, with strong southern affinities and less marked northern affinities.

Birds: Approximately 290 species of birds which make up the highly-diversified avifauna of southern Nevada have been assigned to biotic communities in Appendix V. Van Rossem (1936) considers the avifauna of the Charleston Mountains (Spring Range) as depauperate, stating that of the 53 permanent residents or summer visitants in the upper Sonoran or higher zones (juniper-pinyon communities and above), 37 are of western or Great Basin distribution, 11 have affinities with the Rocky Mountains, and only three have affinities to the west. Johnson (1965) has re-examined the avifaunas of the Sheep and Spring Ranges and concluded that the breeding fauna is larger and endemism less marked than was indicated by Van Rossem (1936). Johnson (1965) concluded that the avifaunas of these ranges are most closely allied to those of the Great Basin Montane and Southern Rocky Mountain Montane faunas. The avifauna of the lower elevations, however, shows a majority of forms with distributions centered in the southwestern deserts. As a group, waterfowl and shore birds are distributed widely but with northern affinities.

Discussion and conclusions: The diversified biota of southern Nevada is largely made up of components having their main distributions in other regions. Endemism is found primarily in groups which are now isolated. There are about 40 endemic species of vascular plants and one endemic rodent, Eutamias palmeri, in the higher elevations of the Spring Range. Numerous isolated disjunct mammalian populations have developed endemic subspecies. Endemic species of fish occur in isolated desert springs and in the streams of the Colorado River system which is faunistically the most isolated river system in North America.

No terrestrial vertebrate, and only 4.7 percent of the vascular flora, has its main distribution within the Mohave Desert region at elevations below 5,000 feet.

Two main patterns of geographical distribution and dispersal are apparent. A biota with southern affinities has dispersed and entered southern Nevada along low elevations in the vicinity of the Colorado River or, to a lesser extent, from the Death Valley

region of California. There is now a continuous distribution of desert shrub communities in southern Nevada extending from southern regions. This pattern is shown by the flora, reptiles, rodents and some birds common to the lower shrub communities.

Another pattern of geographical distribution and dispersal is shown by a biota with northern affinities. This biota, composed of flora, rodents, carnivores, ungulates and some birds, is found in the woodland and forest communities at the middle and higher elevations. Dispersal occurred along the north-south oriented mountain ranges, or was general throughout the area during periods of cooler or more mesic climates. These communities are now isolated on the Spring and Sheep Ranges and are separated from similar communities to the north by desert shrub communities.

Many birds, due to their powers of dispersal and migratory habits, enter southern Nevada and select favorable habitats for various periods of time. Certain mammals, such as ungulates and carnivores, have wide ecological amplitudes.

Bradley (ms.) suggests that the plant communities now occupying the lower elevations in southern Nevada assumed their present position within the last 10,000 years. The lowering of vegetation zones by several thousand feet in various areas of the southwest has been reviewed by Martin (1963) and others. Pollen analysis by Mehringer (Part 3, this report) at the Tule Springs Site located near Las Vegas, Nevada, indicates major vegetational changes from pine parkland to desert shrub in the late Pleistocene. Fossil pollen spectra similar to modern pollen spectra first appeared about 7,000 - 7,500 years ago. Wells and Jorgensen (1964) in a study of the remains of fossilized packrat dens located in desert shrub communities on the Nevada Test Site, found an abundance of junipers and other plants suggestive of woodland communities.

Disjunct distribution patterns of much of the biota of northern affinities can best be explained as dispersal through continuous coniferous woodland and parkland communities which existed between the numerous mountain ranges of the Great Basin during the late Pleistocene.

Endemism is marked in the most isolated areas in southern Nevada. These include the higher elevations in the Spring Range and the isolated springs and streams which occur throughout this part of the state.

CLASSIFICATION AND DISCUSSION OF BIOTIC COMMUNITIES

A biotic community is a natural grouping of populations of plants and animals occupying a given area. Environmental phenomena usually exist as gradients which in areas of topographical diversity are quite steep. Therefore, vegetation "zones" are produced which can be recognized by even the casual observer. These vegetation zones form a basis for naming and recognizing natural communities.

Vegetation produces a micro-environment for animals, supplying food, shelter and other necessities of life. Many studies clearly show that animal distributions tend to correspond to definite vegetation types. Each population is distributed along environmental gradients according to its own limits of tolerance for various environmental phenomena. Each population acts as a separate entity in response to the total impact of the environment. A natural grouping of populations, the community, exists at a low degree of holistic integration (Gleason, 1926; Engler, 1951; Whittaker, 1951, 1953, 1956, 1960; Lowe, 1964; Bradley, 1964; and others). This is especially true in the more harsh environments such as deserts, where biotic modification of the environment is not as apparent as it is in areas where environmental extremes are less marked. Natural groupings are recognized as communities because of the overlapping ranges of tolerance

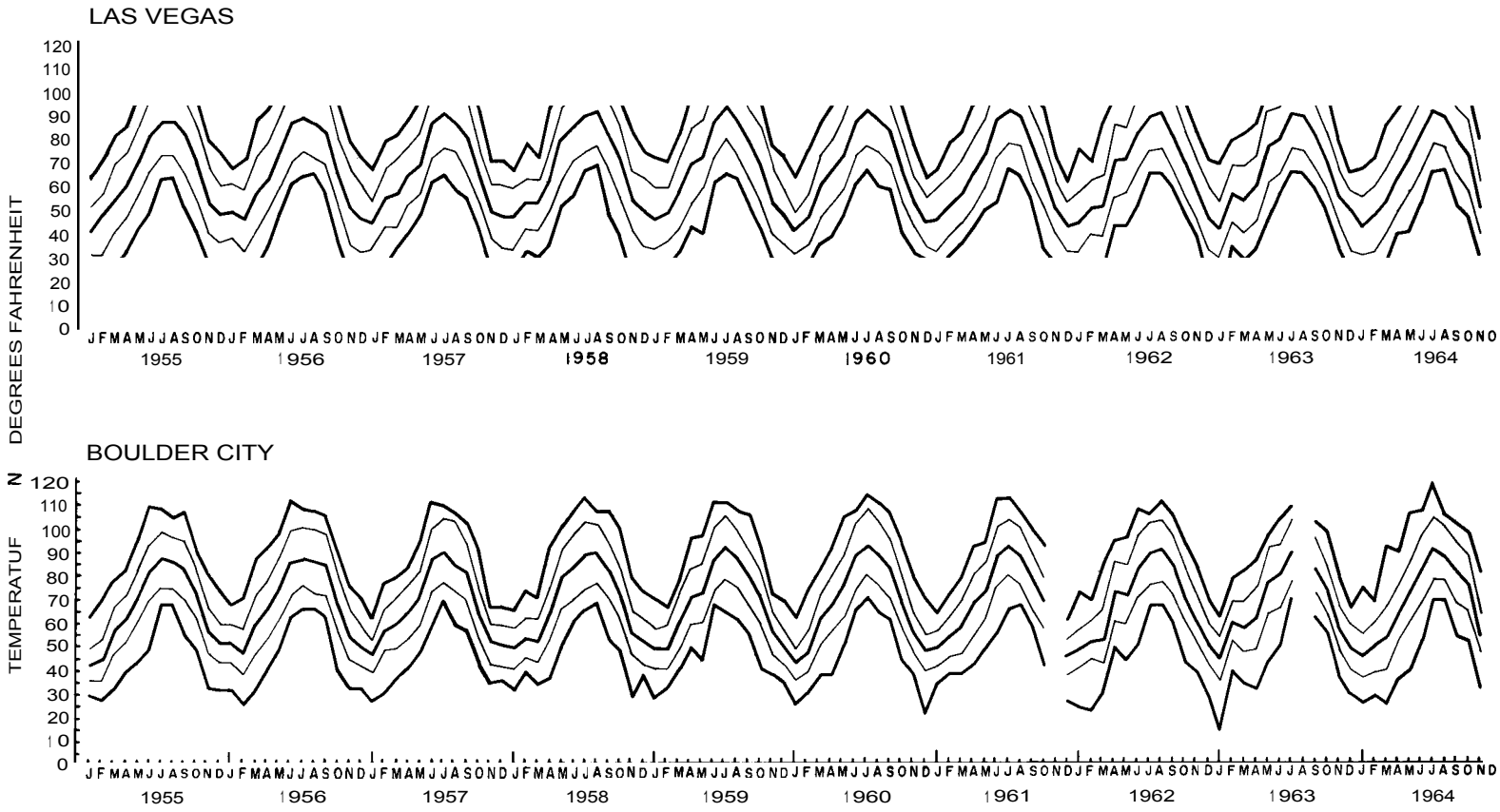

Fig. I. Temperature records at Las Vegas and Boulder City, in the creosote bush biotic community of southern Nevada, 1955—1964. The heavy lines indicate maximum, average and minimum monthly temperatures. The light lines represent average maximum and average minimum monthly temperatures.

of a significant portion of the biota. Species with wider limits of tolerance will have distributions along environmental gradients which pass through two or more communities.

The biotic community (community type) is recognized as an abstraction based on the sampling of several discrete areas (community) which are similar, yet different in varying degrees. By this abstraction, several distinct communities are grouped together and described as a unit. The major biotic communities used in this report are listed in Table 3.

TABLE 3. Classification of the Major Biotic Communities of Southern Nevada (modified from Bradley, 1964)

I. Terrestrial

Zonal Community Types

A. Desert shrub vegetation type
1. Creosote bush community
2. Blackbrush community

B. Woodland vegetation type
1. Juniper-pinyon community

C. Coniferous forest vegetation type
1. Fir-pine community
2. Bristlecone pine community

D. Alpine tundra vegetation type
1. Pseudo-alpine community

Transzonal Community Types

A. Shrub and woodland vegetation types
1. Desert riparian community
2. Saltbush community
3. Riparian and cliff community

II. Hydric and aquatic
1. Desert spring and marsh community
2. Stream riparian community
3. Stream community
4. Lake community

DESCRIPTION OF BIOTIC COMMUNITIES

A brief description of the location and characteristic features of each biotic community follows. The occurrence of each species in the various communities is presented in the appendices.

Creosote Bush Community: The creosote bush community is a widespread and prominent feature of the southern deserts (Sonoran, Chihuahuan, and Mohave) of North America (Shreve, 1951). In southern Nevada it is well developed on the valley floors and lower bajadas between 500 and 4,200 feet elevation, and extends up to 5,000 feet on arid south-facing slopes and small isolated mountains, and under exceptional conditions appears as small isolated stands as high as 6,000 feet.

The topography is typically flat valley floor to sloping bajada, occasionally interrupted by small hills and desert washes. The topography near the Colorado River is especially rocky and rugged.

The soil is commonly a gray, desert soil developed from alluvial deposits, and has a high content of calcium carbonate and other salts. In many areas a hard pan of caliche is present as a subsurface layer. Sizeable areas have a layer of "desert pavement" on the surface.

The climate of this community is extreme as shown by figures 1 and 2. Both daily and seasonal temperature fluctuations are marked (Figure 1). Weather bureau records for Boulder City and Las Vegas show temperature extremes for the past 10 years of 117° F. and 8° F. Maximum temperatures at ground surface greatly exceed the maximum recorded here. Average minimum temperatures, however, are relatively stable from one year to the next. For

instance, average minimum temperature at Boulder City for July, the hottest month of the year, varied only 7° F. (72-79°) over the ten year period. Similarly, records for January show only a 9° F. (35-44°) variation for the ten year period.

Precipitation is much less uniform than temperature. Rains in the desert are highly localized, therefore, the average monthly rainfall may vary considerably from year to year as is evident from an examination of Figure 2. This erratic rainfall pattern tends to reduce the general significance of any precipitation measurements taken at one specific locality. We know that precipitation is low; however, in order to assess the importance of precipitation to the community, it will be necessary to conduct long term ecological studies on specific sites.

The vegetation is dominated by creosote bush (Larrea divaricata) and Burro bush (Franseria dumosa) which are commonly found together. Occasionally, either may occur as almost a pure stand. Yuccas, especially the Mohave yucca (Yucca schidigera), are commonly found in this community. Cacti are common and include prickley pears and chollas (Opuntia sp.), barrel cactus (Ferocactus acanthodes), and others. Other common shrubs are Krameria parvifolia, Dalea sp., Atriplex Ephedra sp., Salvia carnosa, Encelia farnosa, Thamnosma montana, Mendora spinescens, Psilostrophe cooperi, Cassia ormata, Eriogonum and Lycium sp.

The herbaceous vegetation is composed of a large number of small desert annuals which are especially noticeable during years of higher precipitation when they cover the desert floor. The numbers and species composition vary greatly from year to year. Composites, mustards and legumes are most common.

Amphibians are found occasionally within this community, but are considered as belonging to more mesic adjacent communities. Reptiles are abundant and can in general be divided into the diurnal lizards, and the more secretive and largely nocturnal snakes. Lizards are commonly seen, easily collected, and therefore well-known inhabitants of this community. The more abundant species include Uta stansburiana, Cnemidophorus tigris, Callisaurus draconoides, Phyrnosoma platyrhinos, Dipsosaurus dorsalis, Sceloperus magister and Crotophytus wislizeni. The more common snakes include Pituophis catenifer, Masticophis flagellum, Arizona elegans, Crotalus cerastes, and Crotalus mitchelii. Two commonly known reptiles, the Gila monster (Heloderma suspectum) and the desert tortoise (Gopherus agassizi) are present but not abundant.

Thirty-three species of birds have been assigned to this community. Nine of these are permanent residents. The more important species are Gambel's quail, horned lark, raven, cactus wren, rock wren, Leconte's thrasher, and black throated sparrow. Resident populations are low. However, large populations of birds move through this community during spring and fall migrations.

The creosote bush community contains relatively large populations of several mammal species. Bats are commonly seen flying overhead at dusk. Our records, primarily based on collections from caves and mist nets over small bodies of water, show that Macrotis californicus, Myotis californicus, Pipistrellus hesperus, Corynorhinus townsendii, and Antrozous pallidus are common to abundant in this community. Common rodents include Citellus leucurus, Citellus tereticaudus, Dipodomys merriami Dipodomys deserti, Perognathus formo sus, Perognathus longimembris, and Peromyscus eremicus. Neotoma lepida and Onychomys torridus are widespread but never numerous in this community. The desert jackrabbit (Lepus californicus) and the desert cottontail (Sylvilagus audubonii) are widespread and sometimes locally abundant. Common carnivores are the coyote (Canis latrans), kit fox (Vulpes macrotis), badger (Taxidea taxus), and bobcat (Lynx rufus). Larger herbivores are rarely seen.

Blackbrush Community: The blackbrush community is also widespread and covers the upper bajadas, usually between elevations of 4,200 to 6,000 feet, extending down to about 3,900 feet on the north-facing slopes. On arid south-facing slopes and small isolated mountains, it is found up to and occasionally

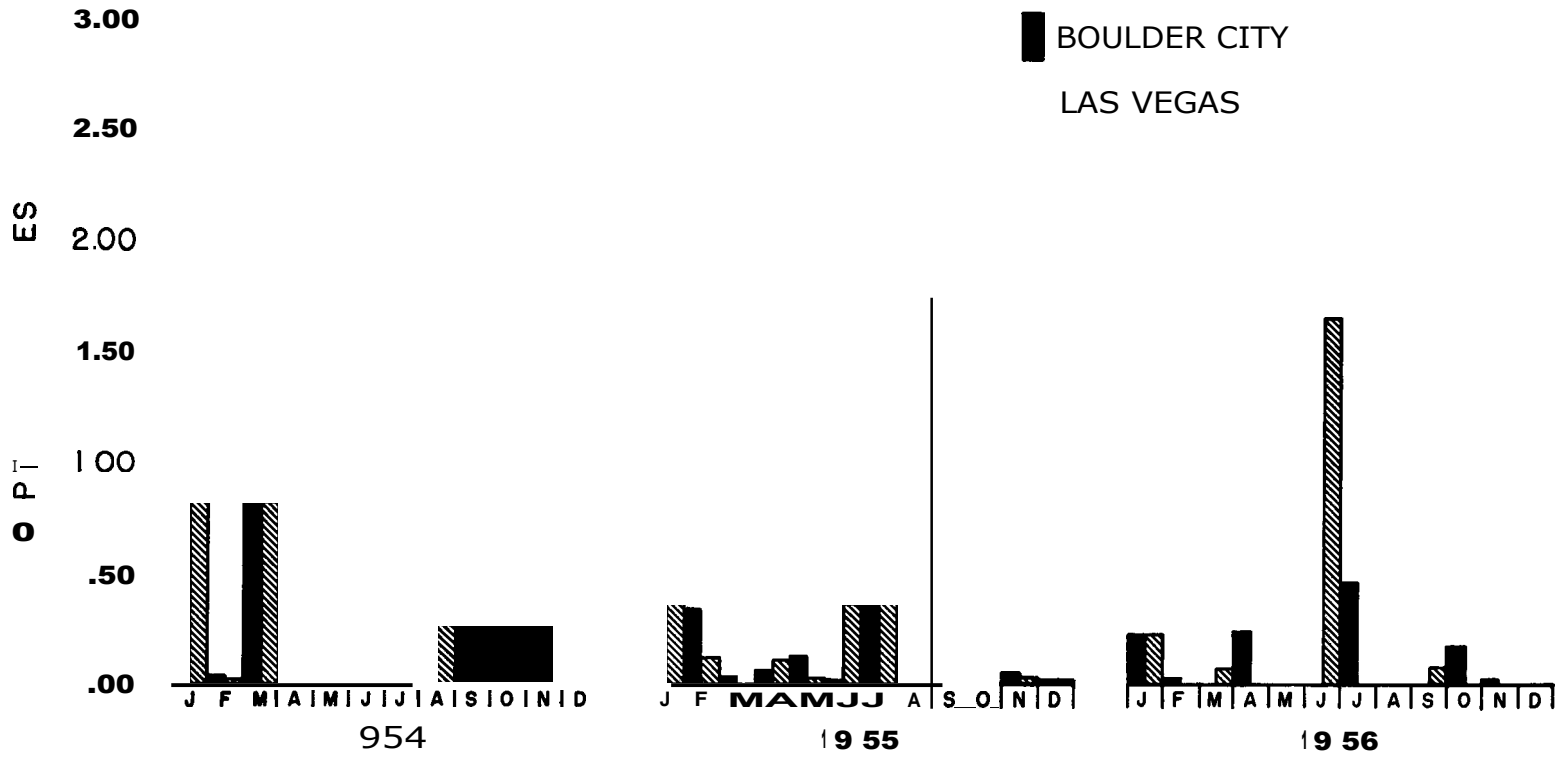

Fig. 2. **Precipitation records at Boulder City and Las Vegas in the creosote bush community of southern Nevada, 1954 —1964. Trace amounts are not recorded.**

(Continued on following page)

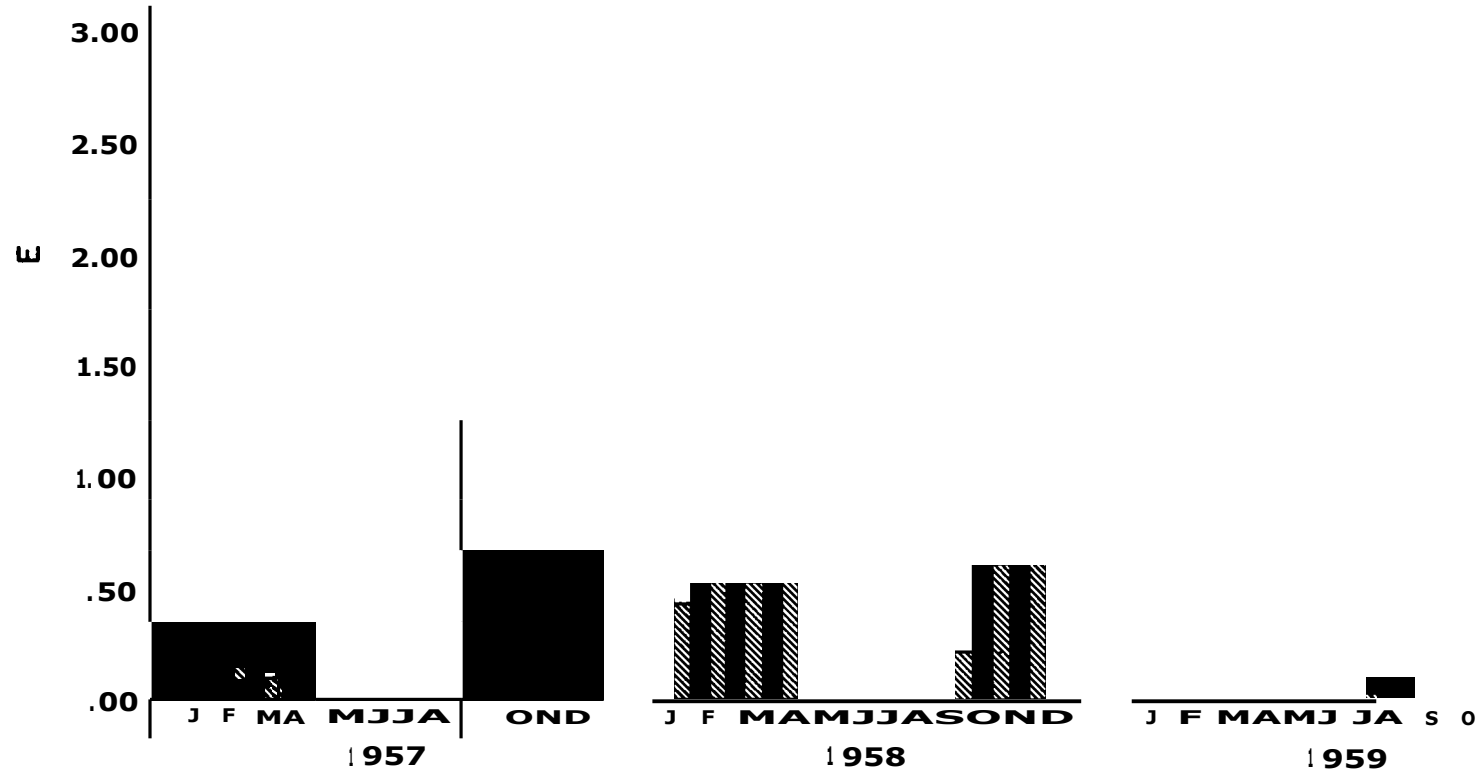

Fig. 2. Precipitation (Continued)

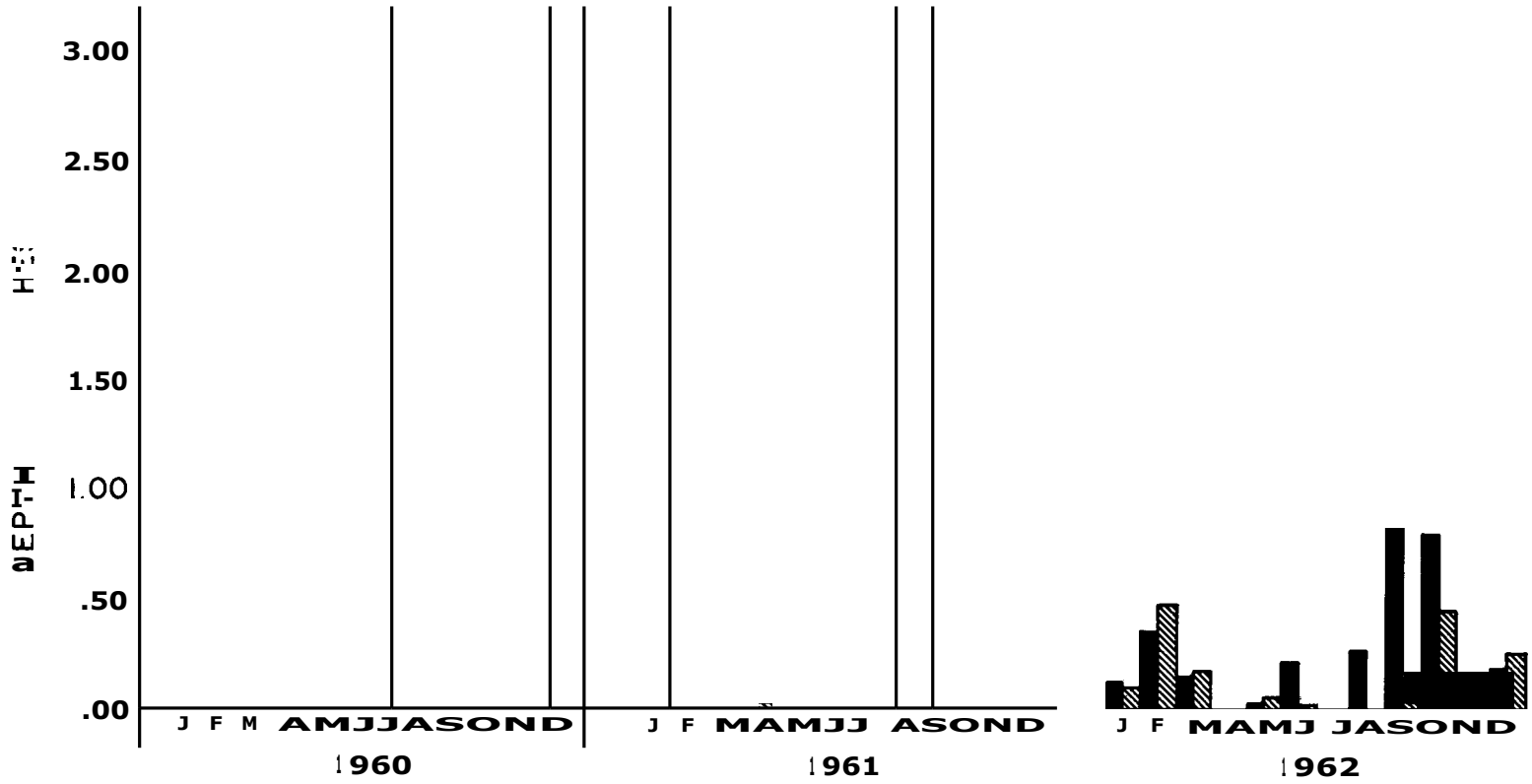

Fig. 2. Precipitation (Continued)

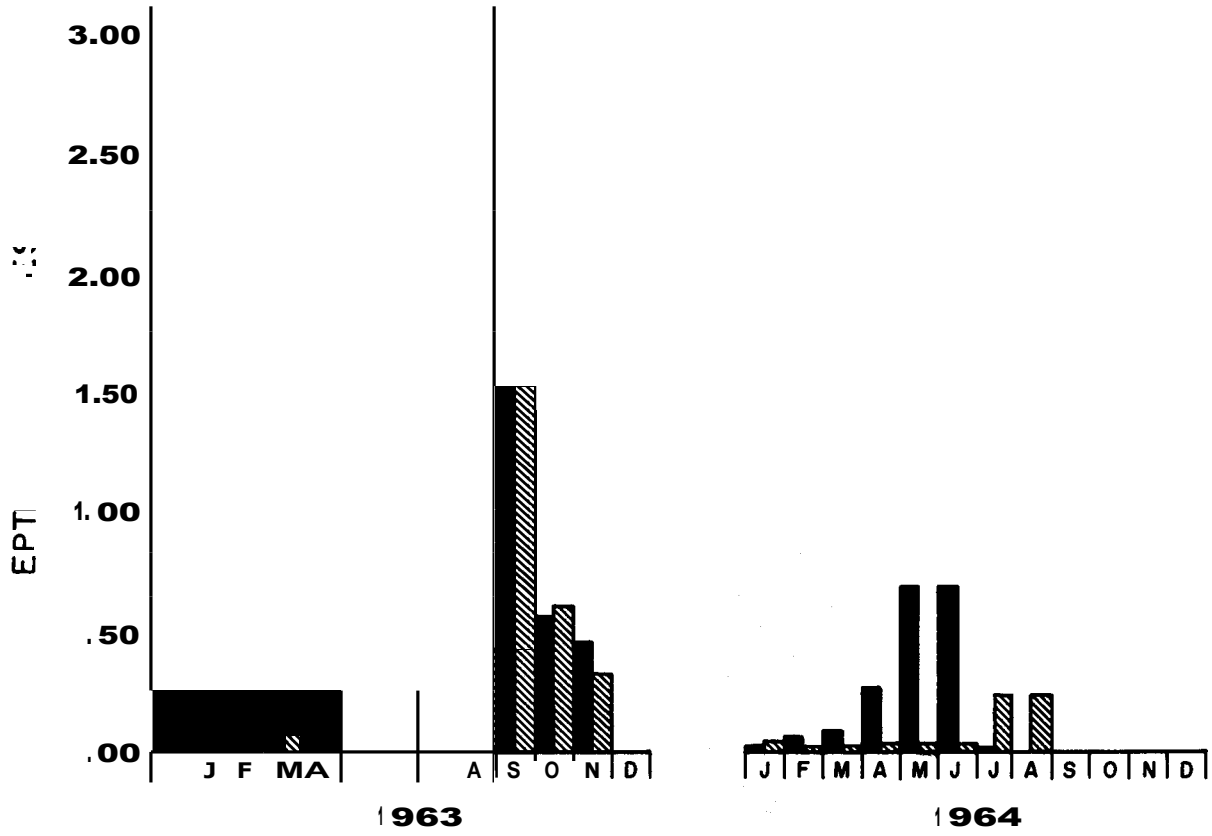

Fig. 2. Precipitation

I BOULDER CITY

LAS VEGAS

above 6,500 feet. It is best developed in the northern half of the area, but well-developed stands may be found in the south, especially near Searchlight, Nevada. Here the soil, developed from older alluvium, is overlain with small rocks, and is more permeable with lower salt concentrations than at lower elevations. The gray desert soil is slightly darker and contains more organic matter than does the soil in the creosote bush community.

The climate in this community is cooler than it is in the creosote bush community. Snow commonly falls during the winter, but does not remain on the ground for long periods.

The blackbrush community is dominated by a closely-spaced matrix of low, dark-gray blackbrush (Coleogyne ramosissima) interspersed with other desert shrubs. The spectacular joshua tree (Yucca brevifolia) is commonly found throughout this community and, as a result, Tidestrom (1925) and others have called this vegetation type a joshua tree association. In southern Nevada, blackbrush unquestionably dominates this vegetation type and may exist in association with few or no joshua trees. The banana yucca (Yucca baccata) is the most numerous yucca in this community. Other shrubs commonly found here include Ephedra sp., Dalea sp., Atriplex , Tetradymia , Thamnosma montana, Grayia spinosa, Eurotia lanata Artemesia spinescens, Agave utahensis, Eriogonum , Lycium sp., and Haplopapus sp. Cacti are not as abundant as in the creosote bush community.

The herbaceous vegetation is similar to the creosote bush community although grasses (Muhlenbergia Hilaria rigida, Bromus rubens, Tridens pulchellus, Sporobolus sp., and Oryzopsis hymenoides are more abundant.

Reptiles are well represented in this community, although not as numerous as in the creosote bush community. Common lizards include Uta stansburiana, Cnemidophorus tigris, Sceloporus magister, and Crotophytus collaris. The yucca night lizard (Xantusia vigilis) becomes abundant here under dead and decaying branches of yucca. The most common snakes are Masticophis flagellum and Crotalus mitchelli.

Many of the birds found in the creosote bush community are also present here. The more important permanent residents include the ladder-backed woodpecker, raven, cactus wren, rock wren, and sage sparrow.

Numerous mammals, many of which are found in the creosote bush community, are present here also. The more common bats include Myotis californicus, Pipistrellus hesperus, and Corynorhinus rafinesquii. Rodents which are common to abundant in the blackbrush community include Citellus leucurus, Perognathus formosus, Perognathus longimembris, Dipodomys merriami Onychomys torridus, Peromyscus eremicus Peromyscus crinitus, Peromyscus maniculatus, and Neotoma lepida. Both the desert jackrabbit and the desert cottontail are common here. The carnivores characteristic of the creosote bush community such as the coyote, kit fox, bobcat, and badger are also found here. The desert bighorn sheep (Ovis canadensis) utilizes the upper elevations of this community heavily (Bradley, 19 64) .

Saltbush Community: This community occurs as a mosiac within stands of the creosote bush and blackbrush communities where it occupies poorly drained soils in areas where standing water is present after rains. It covers large playas near the middle of mountain basins as well as small localized depressions. Billings (1949, 1951) studied the shadscale (Atriplex confertifolia) vegetation of Nevada and considered it a well-defined vegetation "zone" between creosote bush and sagebrush desert. Furthermore, he stated that this zone is replaced by blackbrush vegetation in southern Nevada. In the northern portion of the area covered in this report, these two vegetation types may exist near each other, at practically the same elevations. Here the shadscale vegetation is localized in small depressions (Bradley, 1964)

The soils of these playas and depressions may be several feet deep, are composed of a silty loam which is quite saline and, in some instances, a salt crust may develop on the surface.

The general climate is the same as that

found at comparable elevations in the creosote and blackbrush communities. An obvious difference, however, is the accumulation of water which drains from the surrounding communities into the basins or localized depressions.

This community is dominated by members of the Chenopodiaceae. On the more saline soils at the lower elevations the vegetation is made up of red molly (Kochia americana) and hop-sage (Grayia spinosa). Under extremely saline conditions large areas of a playa may be entirely devoid of vegetation. Thick stands of shadscale, accompanied occasionally with mounds of mesquite (Prosopis pubescens and Prosopis juliflora), may be present where some subsurface moisture is available. At the higher elevations, shadscale is associated with four-winged saltbush (Atriplex canescens) and winterfat (Eurotia lanata). Other common shrubs include Atriplex lentiformis, Atriplex polycarpa, Suaeda torreyana, Gutierrezia sarothrae, Artemesia spine scens, Pluchea sericea and Tetradymia axillaris.

The herbaceous vegetation is not as well known, but appears to be depauperate when compared with the other surrounding desert shrub communities. Grasses such as Distichlis stricta, Tridens pulchellus and Hilaria rigida are found in this community. Although the vertebrate biota of this community has not been investigated as thoroughly, preliminary findings indicate that a depauperate fauna representative of the surrounding communities is found here.

Desert Riparian Community: An arborescent community occuring along desert washes in the Sonoran Desert is well described by Shreve (1942, 1951). In the Mohave Desert similar wash communities occur, but the vegetation is not strikingly different in growth form from that of the surrounding shrub communities.

The desert riparian community occurs along washes from the lowest elevations of the creosote bush community to the middle elevations of the blackbrush community.

The soils are usually silty to sandy, but may be quite rocky at the higher elevations. The climate is similar to that of the surrounding communities except that increased subsurface water may be available from runoff which accumulates along the washes draining the surrounding desert landscapes.

The desert shrubs which commonly occur along these washes are largely absent or sparsely distributed in the surrounding communities. They include cheese weed (Hymenoclea salsola), snake weeds, (Gutierrizia sp.), bladder sage (Salazoria mexicana), and golden weeds (Haplopappus sp.). In the larger washes at lower elevations subsurface water is always available and such shrubs and small trees as mesquite (Prosopis juliflora and Prosopis pubescens), cat claw (Acacia greggii), desert willow (Chilopsis linearis), and the introduced salt cedar (Tamarix gallica) give the community a slightly arborescent appearance.

The herbaceous vegetation is quite similar to that found in the surrounding communities. Displays of desert wildflowers may be more prominent along these washes. This reflects a response to increased runoff, as well as flood disturbance and disruption of existing plant cover.

The vertebrate fauna is similar in composition to that of the surrounding communities. Certain species are more common along these washes, however, and several species find their greatest abundance here.

Lizards such as Callisaurus draconoides, Dipsosaurus dorsalis and Crotaphytus wislizeni are more abundant along the sandy desert washes than in the surrounding communities. The sidewinder (Crotalus cerastes), largely restricted to sandy areas, is common here.

Birds which frequent lower shrub communities tend to be found more frequently utilizing the more abundant cover and perhaps food in the desert riparian community.

Several small mammals reach their greatest abundance in this community. Perognathus spinatus is restricted to one particularly moist wash near the Colorado River (Ryser, 1964). Deer mice (Peromyscus eremicus) are more abundant along the washes, especially in the vicinity of small trees such as mesquite, cat claw and salt cedar. The canyon mouse (Peromyscus crinitus finds suitable shelter among the rocky outcrops, especially at the middle elevations. Desert wood rats (Neotoma lepida) are most

numerous in the shrub communities along the cracks and crevices of conglomerate cliffs which occur along the steep sides of many washes. Carnivores such as bobcats, coyotes, and foxes range freely throughout the desert communities. As they travel along the washes, they probably obtain much of their food supply from the rodent populations occurring there

Juniper-Pinyon Community: This community, widespread in the southwestern United States, is found at elevations above 6,000 feet on the Spring and Sheep Ranges and in the McCullough Range and the Virgin Mountains. In the Spring and Sheep Ranges, where coniferous forests are found above this community, the upper elevational limit is about 7,300 feet. In sheltered canyons on the east slope of the Spring Range the community may extend down to 4,000 feet. On south-facing slopes and on the more isolated mountain ranges it may occur as high as 8,500 feet or even rarely 9,000 feet due to the "Merriam effect" (Lowe, 1961; Bradley, 1964). For the same reason, many of the smaller isolated mountain ranges, with elevations to 6,000 feet or above do not have this community present, but instead are covered by desert shrub vegetation.

The topography varies from gentle rolling hills to steep mountain slopes, rocky canyons and narrow ridges. The soil is a sandy loam, with some development of distinct soil profiles. It is well drained and light brown in color, indicating a higher organic content than the soils found at lower elevations.

Measurements of the climate in this community are non-existant or unknown to us for southern Nevada. There is more rainfall and a cooler temperature than is found in the blackbrush community.

The vegetation consists of a coniferous woodland of juniper, pinyon pine and sagebrush, with other widely scattered shrubs and small trees. Juniper, especially Juniperus osteosperma, is more abundant at the lower elevations but is commonly associated with pinyon pine (Pinus monophylla) which becomes more numerous at the higher elevations. Sagebrush (Artemesia tridentata) commonly exists as an understory or, at the lower elevations of this community, in almost pure stands in depressions between rolling hills. The shrubs and small trees commonly found in this community include Juniperus scopulorum, Berberis fremontii, Philadelphys microphyllus, Ribes cereum, Rosa woodsii, Rhus trilobata, Rhamnus californica, Ceonothus greggi, Fraxinus anomala, and Symphoricarpos sp. Several species characteristic of the lower shrub communities such as Ephedra viridis, Yucca baccata, Agave utahensis, and Eriogonum sp.,are found sparsely distributed at the lower elevations. Other "chaparral-like" species characteristic of the adjacent riparian and cliff community also extend into this community, especially in response to disturbance by fire. These include Cowania mexicana, Falugia paradoxia, Quercus gambellii, Quercus turbinella, Cerocarpus ledifolius, Amelanchier utahensis, Prunus fasciculata, and Arctostaphylos pungens.

The herbaceous vegetation is largely made up of species restricted to the mountains with a few annuals found at the lower elevations extending into this community.

Reptiles are not as well represented here as in the lower desert shrub communities. Abundant and characteristic lizards are Sceloporus occidentalis and Sceloporus graciosus. Eumeces gilberti has been taken here but is nearly restricted to the adjacent riparian and cliff community. At least two species of snakes, Pituophis catenifer and Crotalus mitchelli, are found here but are not abundant.

The avifauna is composed of a number of permanent residents. The more important species include the red-tailed hawk, common bushtit, rock wren, and western bluebird. Summer residents make up a sizable portion of the avifauna and include the turkey vulture, nighthawk, white-throated swift, broad-tailed hummingbird, ash-throated flycatcher, scrub jay, black throated gray warbler, Scott's Oriole, rufous-sided towhee, and chipping sparrow. About one-third of the species recorded from this community are non-resident.

Mammals are well represented and abundant in this community. Common to abundant rodents characteristic of the community include Citellus variegatus, Peromyscus crinitus, Peromyscus truei, Peromys-

cus maniculatus, and Neotoma lepida. Perognathus parvus appears to be restricted to this community, but is not abundant in our collections. Peromyscus boylii is uncommon in our collections, but has been taken here. Eutamias panamintinus is abundant here in the Spring Range, while in the Sheep Range its niche is filled by E. dorsalis. Common carnivores include the bobcat, coyote, and gray fox. Deer and desert bighorn sheep are the only large native herbivores found here. Elk and antelope have been introduced in the Spring Range where they utilize this community most extensively.

Riparian and Cliff Community: This community occurs along the upper washes, canyons, cliffs and rimrock areas in the various mountain ranges. The lower limit is at about 5,000 feet along the washes which transect the blackbrush community. It extends through the juniper-pinyon community and into the fir-pine community to elevations of about 8,000 feet. The community also exists on many of the steep-walled, rugged canyons along cliff faces and rimrock areas to elevations above 8,000 feet and on extremely rocky and arid south-facing slopes to elevations above 9,000 feet. On the smaller isolated mountain ranges, disjunct stands are found along the steep rocky slopes and ridges.

The soils in the upper washes and lower canyons are relatively shallow and typically overlain with rocks of various sizes. There is some litter and accumulation of organic matter in the soil. On rimrocks and cliff faces, soil is deposited in cracks and shallow depressions among the rocks.

The climate is similar to that of the surrounding communities except that the more exposed cliff areas are more arid.

A number of shrubs and small trees grow in profusion, in marked contrast to the coniferous woodland and lower coniferous forest communities. At the lower elevations, desert shrubs are largely replaced by taller shrubs such as Cowania, Falugia, Chrysothamnus nauseosus, Rhus trilobata, Prunus fasciculata, and Berberis fremontii. Woody plants typical of the lower communities, such as Ephedra viridis, Yucca baccata, Agave nevadensis, and Atriplex canescens are also present. Small, low, woody plants prominent on the larger rocks at the lower and middle elevations include Polygala acanthodada, Peraphyllum ramosissimum, and Petrophytum caespitosum.

At the middle to higher elevations many of the above mentioned shrubs are still present and even more luxuriant and abundant. Other shrubs and small trees which are important here include Cercocarpus ledifolius, Amelanchier utahensis, Arctostaphylos punqens, Garrya flavescens, Fraxinus utahensis Fraxinus anomala Quercus qambelli, and Symphoricarpos longiflorus. On the south-facing ridges and cliff faces, the vegetation is dominated by Cowania and Cercocarpus intricatus.

This natural grouping of shrubs and small trees gives this community a "chaparral-like" appearance. Many of these are found in the more stabilized surrounding coniferous communities, especially in burn areas. This community appears to be best developed in areas where some disturbance occurs, such as floods along the washes and canyons, rock slides, and possible snow slides. These disturbed areas and extremely rocky areas do not provide ideal environments for the development of the more stable coniferous communities.

The reptiles found in the surrounding communities appear to be more abundant here. The extremely rocky areas provide shelter and basking sites for Sceloporus occidentalis and Sceloporus qraciosus, as well as Crotaphytus collaris at the lower elevations. Eumeces .qilberti and Eumeces skiltonianus are rare or seldom collected due to their secretive habits but appear to reach their peak of abundance in the accumulation of leaf litter found under some of the small trees of this community. Snakes are poorly represented.

Birds from surrounding communities utilize this community for shelter, food and nesting.

The mammals found here are those characteristic of the surrounding communities. Bats, such as Myotis volans, Eptisicus fuscus and Corynorhinus townsendii utilize the many caves as roosting and hibernation sites; Pipistrellus hesperus, a bat which

ranges widely through many communities, roosts among the crevices along the cliffs and canyon walls. Rodents including chipmunks (Eutamiasm.), the golden mantled ground squirrel (Citellus lateralis), rock squirrel (Citellus variegatus), pack rats (Neotoma lepida and Neotoma cinerea), and deer mice (Peromyscus crinitus, Peromyscus maniculatus, and Peromyscus truei) are common to abundant here, finding ideal shelter and nesting sites among the large rocks, crevices, and small caves. Peromyscus boylii, although uncommon, appears to reach its greatest abundance in this community. The large carnivores, coyote and gray fox (Urocyon cinereoargenteus), range through this community but are not common. The bobcat probably reaches its peak of abundance here, finding ideal shelter and abundant food. Mule deer and desert bighorn sheep commonly utilize these areas.

Fir-Pine Community: This community in southern Nevada is restricted to the Spring and Sheep Ranges and the highest elevations of the Virgin Mountains. It is characteristic of mountain slopes between elevations of 7,500 and 9,000 feet. On north-facing slopes and in protected canyons it extends down to and occasionally below 7,000 feet. Small isolated stands of yellow pine (Pinus ponderosa) are found in the bottom of protected canyons in the southeastern portion of the Spring Range at elevations as low as 4,000 feet. Since characteristic plant associates are not found here, these isolated stands are considered relicts, not properly belonging to the fir-pine community. On the south-facing slopes this community extends up to 9,500 feet, and dominants such as white fir (Abies concolor) may be found up to 10,000 feet. However, the upper elevational limit of a well-defined community is about 9,500 feet.

Soils are dark brown to blackish, showing a higher organic content than at lower elevations, have well-developed soil horizons, and are commonly covered by conifer needles and other ground litter. Topographic features include the less rocky canyon bottoms and slopes and ridges of the mountainous areas.

Climate is poorly recorded for this community, however, snow surveys have been conducted for several years. Figure 3 gives the water content of snow from 1954 to 1961 at 9,000 feet elevation in Clark Canyon on the western slope and at 8,300 feet in Lee Canyon and 7,800 feet in Rainbow Canyon on the east slope of the Spring Range. This figure shows a very erratic pattern of water content of snow on March 1, of each year. There is, however, some water available from this source every year.

The Spring Range receives more precipitation than other mountain ranges in southern Nevada. The second highest mountain range in the area, the Sheep Range, lies in the rain shadow of the Spring Range. Wind, although important as an ecological factor throughout southern Nevada, because of its tremendous influence on evaporation rates, probably plays a more direct physical effect at the upper elevations. Although we have no measurements of wind velocity, reliable verbal reports indicate a maximum measurement of 180 mph at 10,000 ft. elevation on Angels Peak in the Spring Range. A television relay tower at 8,400 ft. on Potosi Peak in the Spring Range is built to withstand winds of 150 mph. The effects of winds of this velocity on the vegetation is evident, especially on the more isolated and therefore less protected peaks. Persistent dry winds of high velocity may play an important part in producing what we have come to recognize as "Merriam's effect".

The vegetation is characterized as a white fir (Abies concolor), yellow pine (Pinus ponderosa) forest. Yellow pine is more abundant at the lower elevations with white fir becoming more numerous at the upper elevations. Quaking aspen (Populus tremuloides) is abundant on the more mesic or disturbed sites at the middle and higher elevations of this community in the Spring Range. Only a few small isolated stands may be found in sheltered canyons in the Sheep Range. At the lower elevations in the more arid sites, scattered conifers such as Juniperus osteosperma, Juniperus scopulorum, and Pinus monophylla may be found. At the higher elevations or more mesic sites, Juniperus

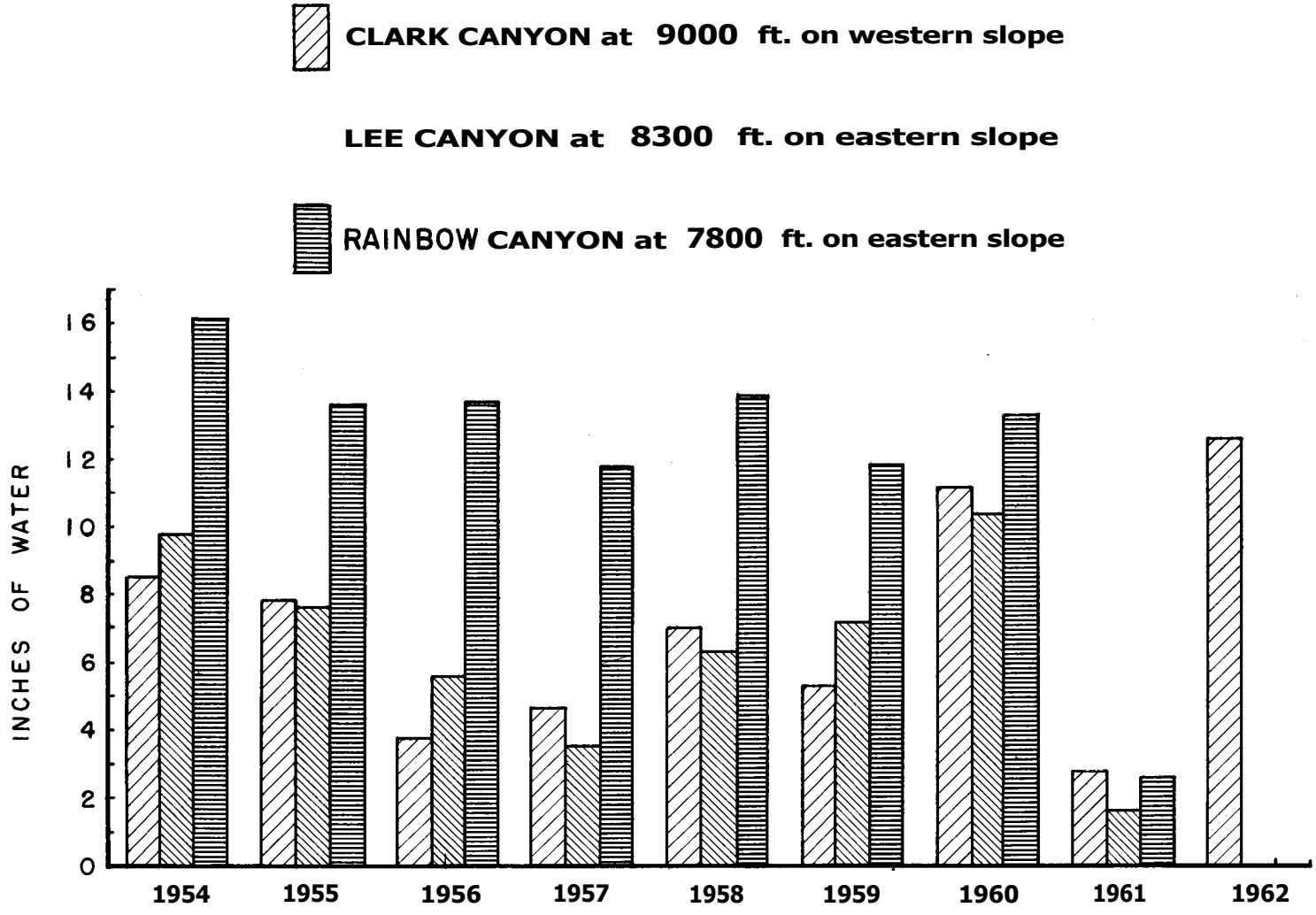

Fig. 3. Water content of snow on I March in Clark, Lee, and Rainbow Canyons, 1954 — 1962.

communis, Pinus flexilis, and Pinus aristata may be sparsely distributed in this community. Shrubs and small trees commonly found as an understory include Amelanchier utahensis Acer glabrum, Ribes sp., Holodiscus microphyllus, Cercocarpus ledifolius, Sambuccus coerulea, Rosa woodsii Rubus sp., and Berberis repens.

The herbaceous vegetation may be divided into two main components. One is made up of species having a distribution throughout the juniper-pinyon and fir-pine communities and the other of mesophytes found scattered throughout the fir-pine community, on the more mesic sites. This latter group is more common, or at least better known, from the Spring than the Sheep Range.

The only common lizard in this community is Sceloporus graciosus. Three other species, Sceloporus occidentalis, Eumeces gilberti, and Eumecus skiltonianus, are present, but not common. We have one record of a snake (Pituophis catenifer) from this community.

More birds are present here than in any other terrestrial community. Important permanent residents include golden eagle, Clark's nutcracker, white-breasted nuthatch, Pigmy nuthatch, common bushtit, canyon wren, and Cassin's finch. Important summer residents include the red-tailed hawk, white-throated swift, broad-tailed hummingbird, red-shafted flicker, hairy woodpecker, western wood pewee, violet-green swallow, western bluebird, Audubon's warbler, black-throated gray warbler, western tanager, green-tailed towhee, gray-headed junco, black-headed grosbeak, pine siskin, and chipping sparrow. Non-resident birds are the most important component of the avifauna of this community.

Mammals are well represented as at the lower elevations, with several species reaching their peak abundance here. Common bats ar Myotis evotis, Myotis volans and Eptesicus fuscus. Rodents, more abundant here than in neighboring communities are Citellus lateralis, Neotoma cinera and Peromyscus maniculatus. Other common rodents include Peromyscus crinitus, Peromyscus truei, Neotoma lepida, Citellus variegatus, and Erethizon dorsatum. In the Spring Range the endemic Eutamias palmeri is probably the most abundant rodent in this community, while in the Sheep Range E. dorsalis and E. umbrinus are common. The large carnivores, bobcat, gray fox, and coyote, range throughout this community. Mule deer and desert bighorn sheep are found here, but are more numerous at the lower mountainous elevations. Mountain lions are rare visitors, but do not appear to be resident.

Bristlecone Pine Community: This community, restricted to the Spring and Sheep Ranges in southern Nevada, is found from about 9,000 feet to timberline (about 11,500 feet on the Spring Range in the Charleston Peak area). On south-facing slopes this community may not be well developed below 9,300 or occasionally 9,600 feet elevations. However, at 9,000 feet the effects of slope exposure are not as evident, and on many south-facing slopes at 9,000 feet this community is present, although the individual trees are not as abundant as at higher elevations. At near timberline the trees are dwarfed and disfigured by the prevailing winds. The slopes and ridges are extremely steep and the shallow soil is covered with pine needles.

No records are available on climate from this community. Snow remains on the ground in the Spring Mountains well into July and occasionally into August in sheltered areas. The Sheep Range receives less snow and loses it sooner. Temperatures are cooler than at the lower elevations and wind is an important physical force in addition to its evaporative action. This community appears drier than the lower fir-pine community.

Limber pine (Pinus flexilus) is abundant at the lower elevations in association with scattered white fir (Abies concolor) and bristlecone pine (Pinus aristata). At the middle to higher elevations bristlecone pine becomes abundant and along the higher ridges at elevations of 10,000 feet or above it exists as almost a pure stand. A low juniper (Tuniperus communis) is found scattered throughout this community.

An understory of shrubs is almost absent and the herbaceous vegetation is not

as abundant here as in lower coniferous communities. A number of endemic plants are found on Charleston Peak, especially at the upper elevations near timberline.

Reptiles and amphibians are absent from this community.

The avifauna of this community is depauperate and made up of species found within the adjacent fir-pine community by having a large number of permanent and summer residents and few non-residents.

No mammal is restricted to this community which generally has a depauperate mammalian fauna both in number of individuals and in number of species. The bats found in the fir-pine community are present here also. Eutamias palmeri, and Peromyscus maniculatus are the only common rodents. Mule deer, desert bighorn sheep and larger carnivores usually found in the lower communities are found here, but are not common.

Pseudo-alpine Community: The pseudo-alpine community as described by Bradley (1964) occupies the area above timberline at elevations above 11,500 feet on Charleston Peak. Similar areas occupying a few acres are present on Hayford and Sheep Peaks in the Sheep Range at elevations below 10,000 feet. These latter areas are exposed to the prevailing winds. The more protected portions of these peaks are covered by bristlecone pines.

This community is localized, covers only about 1,000 acres, and lacks a distinctive alpine biota. The vegetation consists of a small number of low, sprawling shrubs and herbs. On Charleston Peak a large number of endemic plants are found.

Reptiles are not present. Birds are occasionally seen, but the small number of species are exclusively non-resident. The only mammal collected in this community is the deer mouse (Peromyscus maniculatus).

Desert Springs and Marshes: Springs and associated marshes are widely scattered in the lower desert areas of southern Nevada. Commonly, several localized springs form an associated group in the larger valleys. Systems of springs are found in Ash Meadows, Railroad, White River, Pahranagat, and Moapa Valleys. Other springs, now largely dried up or modified by man, formerly existed in Pahrump Valley and Las Vegas Valley. Indian Springs and Corn Creek Spring are located to the north of Las Vegas in the trough which drains into the Las Vegas Valley. Numerous springs are found in the vicinity of Lake Mead. Physiographic and zoogeographic evidence based on the distribution of the fish fauna shows that all of these springs east of the Spring Mountain Range, with the possible exception of Indian Springs, were previously connected to streams flowing into the Colorado River and therefore are considered as belonging to the Colorado River drainage system (Hubbs and Miller, 1948a).

The Spring Range, west of Las Vegas, separates the Colorado River drainage system from the Death Valley system. In Nevada, the Death Valley system includes the now isolated and modified desert springs located in Pahrump Valley as well as the slightly less modified and still integrated springs in Ash Meadows.

Most of these springs are thermal. The water temperature varies only a few degrees during the year. Some aquatic vegetation is usually present at varying distances from the spring source. Chara, Nasturtium, Naias, Potomogeton, Ruppia, algae and other aquatic plants may practically fill many of these springs. Small marshes commonly surrounding the periphery of these spring areas have a number of sedges (Carex, Scirpus), rushes (Juncus), spike rushes (Eleocharis), and cattails (Typha angustifolia). Associated trees growing in the vicinity of these springs include willows (Salix), mesquite (Prosopis juliflora and Prosopis pubescens), cottonwoods (Populus fremontii), and the introduced salt cedar (Tamarix gallica). Thick crusts of salts on the surface of the ground commonly surround these marshes. Where moisture is available, the ground may be thickly covered by salt grass Distichlis stricta). Also commonly found growing in these highly saline soils are such plants as iodine bush (Allenrolfea occidentalis), ink weed (Suaeda torreyana), and salt bushes (Atriplex sp.).

The native fish population in the thermal springs considered here commonly con-

sists of one species of cyprinid and one cyprinodontid. Rhinichtys osculus is represented in springs in Ash Meadows, White River Valley and Pahranagat Valley. It formerly occurred in Las Vegas Valley and Rogers Spring but is not represented in the thermal headwaters springs in Moapa Valley. Here the cyprinid is the endemic Moapa coriacea. Lepidomeda altivelis formerly occurred in the cooler outflow waters in Pahranagat Valley but is now extinct. In Ash Meadows, the cyprinodontid is represented by Cyprinodon nevadensis (C. diabolis in Devils Hole). Empetrichthys merriami formerly was rare in certain of the Ash Meadows springs. It was last collected by Ira La Rivers in 1957. The species is now probably extinct. In Moapa, Pahranagat and White River Valleys, Crenichthys baileyi represents the family Cyprinodontidae. Pahrump Valley has the endemic Empetrichthys latos but no cyprinid. Las Vegas Valley had a differentiated race of Rhinichthys osculus but no cyprinodontid. Fish populations in this community tend to become markedly reduced as its waters cool and flow into the marsh habitat. Cyprinodontids are almost non-existent in cooler flowing waters. Cyprinids always reach their greatest abundance in the flowing waters. However, the total fish population is not as high in flowing waters as it is in spring pools where cyprinodontids make up the major part of the fauna. Snails and aquatic insects are very abundant in this community.

Bullfrogs, Rana catesbeiana, have been introduced into most of these habitats. The Vegas Valley frog, Rana pipiens fisheri once common in Las Vegas Valley, is now extinct. Hyla regilla and Bufo punctatus occur in the cooler waters of this community.

Reptiles near these springs are all terrestrial and belong to the surrounding desert shrub communities.

Many birds found using these springs for watering, nesting and shelter are characteristic of the surrounding desert. However, these spring and marsh areas also serve as a resting place for many songbirds during spring and fall migrations. Many shore birds and waterfowl, mostly non-resident or winter residents, use these areas for varying periods of the year.

Many of the smaller mammals characteristic of the surrounding desert communities may be found here. Bats commonly found in the lower desert communities tend to concentrate around the desert springs at dusk and after dark, using these areas as feeding and watering sites. The deer mouse (Peromyscus maniculatus), rare in the creosote bush community, is common to abundant in many of the desert marshes. Harvest mice (Reithrodontomys megalotis) are rarely found in the other communities but are abundant around marshes with abundant cover. We have a record of the muskrat (Ondatra zibethica) from the marshes in Pahranagat Valley. Beaver (Castor canadensis) have been locally introduced into the streams in Moapa Valley where they are considered a nuisance by local ranchers. Isolated subspecies of the meadow mouse (Microtus montanus) are restricted to marshy areas in Pahranagat Valley and Ash Meadows. Marshes formerly occurring along the Colorado River below Davis Dam have been eliminated by channel stabilization work, completed since 1960. With them has gone the only Nevada population of the cotton rat, Sigmodon hispidis (Bradley, 1966).

Stream Riparian Community: This community is found along streams such as the Colorado River and its tributaries, the Moapa (Muddy) and Virgin Rivers, and the permanent section of the Meadow Valley Wash. A few small, permanent streams flowing for short distances in the Spring Range are not included. These streams do not have well-developed streamside vegetation, and lack native fish and other characteristic fauna. A few of these streams have abundant populations of Hyla regilla and Bufo punctatus.

The three permanent streams, and to a limited extent Meadow Valley Wash, have alluvial deposits of sand and silt in the river bed which is periodically inundated by water. An especially well-developed river bed covered by sand and silt, which in places is a mile or more across, is found along the Colorado River below Davis Dam.

A characteristic streams ide vegetation is found along the river banks. Trees, including willows (Salix sp.), cottonwoods,

(Populus fremontii), and salt cedars (Tamarix gallica) are usually found and often become numerous. Smaller shrubs such as arrowweed (Pluchea sericea), seep willow (Baccharis glutinosa), and small willows and salt cedars form thickets. Sedges (Carex sp.), rushes (Juncus sp.), cattails (Typha sp.), and various grasses are locally abundant forming small marshes. Large sandy areas, especially along the lower Colorado River, are largely bare or covered by desert vegetation, primarily mesquite. Here along the lower Colorado River are found relict populations of ocotillo (Fouquieria splendens) and smoke tree (Dalea spinosa) which are characteristic of the southern Mohave and Sonoran deserts, (Bradley, in press).

Amphibians are well represented. All of the frogs and toads are found here with the exception of the tree frog (Hyla regilla) This species has been reported from seepage pools on the Clark County side of the lower Colorado River opposite Fort Mojave by Banta (1961). His specimens were taken in 1950, 1953, 1954 and 1955. At that time he reported apparent extermination of some populations along Lake Mojave associated with the process of reservoir formation. Recent channel stabilization and associated draining and filling of seepage pools along the lower Colorado River has resulted in further, apparently complete elimination of Hyla populations in this community. We know of no place along the Colorado, Virgin or Moapa Rivers within the stream riparian community where Hyla can be found today. Common species are Bufo microscaphus, Bufo punctatus, Bufo woodhousei, Rana pipiens, and the introduced bullfrog (Rana catesbeiana).

Reptiles found here are those characteristic of the surrounding creosote bush community. The lizards (Callisaurus draconoides and Phrynosoma platyrhinos) and the sidewinder (Crotalus cerastes) are locally common to abundant in sandy areas. The long-tailed bush lizard (Uta graciosa) and the tree lizard (Uta ornata) are largely restricted to streamside habitats in southern Nevada. The latter reaches its greatest abundance in the high, rocky cliffs along the Colorado River. Another reptile commonly found here is the introduced soft-shelled turtle (Trionyx ferox).

The avifauna of this community is large and similar to that found in the desert springs and marshes.

Many mammals characteristic of the surrounding desert are found here. Pocket mice (Perognathus sp.) and kangaroo rats (Dipodomys sp.) are common to abundant. Dipodomys merriami reaches very high abundance in sandy areas along the lower Colorado River in the Fort Mojave area. Several species of deer mice (Peromyscus crinitus Peromyscus eremicus, and Peromyscus maniculatus) are locally abundant in the thick growths of arrowweed and salt cedar along the lower Colorado River. Rodents which are characteristic of this community and largely absent from the lower desert communities include Reithrodontomys megalotis, Peromyscus boylii, Peromyscus maniculatus, and the introduced house mouse (Mus musculus). Perognathus pencillatus is restricted to the alluvial soils along the Colorado and Virgin Rivers. Muskrats and beaver are still found in reduced numbers along the Colorado, Virgin and Moapa Rivers.

Bats are common along the borders of streams where they feed on the abundant insects. The species characteristic of the creosote bush community are well represented. Several species (Myotis velifer, Myotis yumanensis, and Macrotis californicus) are most abundant along the lower Colorado River where they utilize this community as a feeding area and find shelter in the nearby mine tunnels and caves situated in the creosote bush community.

Several species of small carnivores which are found along the streams range out into the surrounding desert. These include racoons (Procyon lotor), skunks (Spilogale gracilis) and (Mephitis mephitis), and ringtail cats (Bassariscus astutus). The now rare river otter (Lutra canadensis) has been seen along the Colorado and lower Virgin Rivers. Mule deer and desert bighorn are found in the vicinity of the Colorado River.

Stream Community: The stream com-

munity in southern Nevada is limited to the Colorado River and its tributaries, Virgin River, Moapa River and Meadow Valley Wash. A few small permanent streams exist in the Spring Mountains but are discussed elsewhere.

Moapa River heads in a series of warm springs at the head of Moapa Valley. These springs have their confluence on the Taylor (Home) Ranch. Here the stream is clear, 10 - 15 feet in width, to 3 feet in depth with a moderate current. A few shallow (2-6") rubble riffles occur here also. The streamside vegetation often makes a complete cover over the stream, and brush and snags frequently obstruct the entire channel. Farther downstream the width increases slightly to 20 - 25 feet, depths of 4 feet are common with pools 6 feet in depth occurring only rarely. Riffles are infrequent and vary from 4 inches to 2 feet in depth. Current over the riffles is swift, but moderate in the pools. The bottom is primarily a sandy silt with some areas of hard clay or mud bottom and a few areas of rock or sand bottom. Temperature in the headwaters stream is relatively constant at 85° F. A maximum temperature of 90° F. has been recorded in several spring sources in the headwaters. Temperature decreases rapidly downstream where the few shallow riffles serve to establish a fluctuating water temperature based on changes in air temperature. We recorded a low temperature of 57° F. in the lower Moapa River in March, 1964. The stream is used extensively for irrigation. Vegetation consisting of Chara, Naias and Hydrocotyle is dense in many of the headwaters springs and small streams. Marshy areas of Scirpus, Tuncus and Typha occur in the headwaters also. This dense vegetation disappears rapidly downstream but recurs occasionally in shallow pools. For the most part, however, the stream is devoid of significant areas of aquatic vegetation. Most of the cover is provided by overhanging trees, grass and shrubs and by snags in the water. Submergent aquatics are virtually absent below the headwaters, probably because of the low clarity of the waters. A more detailed report on the Moapa River is in preparation (Deacon and Bradley, ms.).

Meadow Valley Wash, tributary of Moapa River, is permanent only in the headwaters near Ursine and for a short distance near Caliente where springs maintain a constant but small flow throughout the year. The headwaters section maintains a relatively low temperature throughout the year (57° in June, 1962) has a gravel, rubble and sandy bottom, visibility of about two feet, depths of six feet, and meanders through meadowland with extensive areas of sedge, rush and cattails creating large marshy areas in certain localities.

The portion near Caliente is shallower with a smaller stream flow. The bottom is composed of gravel, sand and mud; visibility is about one foot, width to six feet and depth to one foot. Sedges, rushes and cattails also occur here extensively.

Virgin River terminates in Clark County after running a 150-mile course from Washington County, Utah. The river in places is more than 130 feet wide. A few clear tributary streams enter the Virgin River as it flows across the Arizona "strip" in extreme northwestern Arizona. Usually shallow (to 2 feet in depth), there is an occasional pool of more than six feet in depth. A few gravel to rubble riffles exist as well-spaced features of the generally shallow stream. The sandy-mud banks are often 10 feet or more in height. Vegetation in the moderately swift-flowing river is absent except in the backwater areas. Streamside vegetation is typical of the stream riparian community discussed above.

The Colorado River below Davis Dam forms a 14-mile border between Nevada and Arizona before leaving the state boundaries. Prior to construction of Davis Dam, this section of the river was highly unstable with a continually shifting channel. With the construction of Davis Dam the channel became somewhat more stable; and in recent years channel stabilization work has confined the river to a well-defined channel. Depth varies from 5 to 12 feet immediately below the dam, depending on the release of water. For the first four miles below the dam the stream is deep and the flow is swift. In this area the predominately sandy bottom is dotted with numerous gravel bars. Farther downstream the channel widens, flow becomes

reduced, and the stream becomes relatively shallow with a sandy bottom. The numerous and extensive marshy areas that once characterized this part of the river bed have been almost completely eliminated by the channel stabilization work. Some backwater areas, eddies, and sloughs still exist.

The streamside vegetation is typical of the stream riparian community previously described. In backwater or marshy areas, cattail (Typha anqustifolia) and nutgrass (Scirpus acutus) are common, along with pondweeds (Potomogeton and Zannichellia). Cladophora occurs on the gravel bars during the summer months.

Although aquatic insects are not abundant, midges, dragonflies, damselflies, and beetles are present. In addition, snails (Lymnaea) and freshwater shrimp (Gammarus sp.) are found.

The two headwaters situations which occur in southern Nevada present widely differing pictures. The typical headwaters species, Rhinichthys osculus, is abundant only in the headwaters of Meadow Valley Wash and in the clear water of tributary streams entering Virgin River. These habitats in Virgin River tributaries also contain relatively large populations of Lepidomeda mollispinis. The fact that R. osculus is absent from the warm headwaters of Moapa River is unexplainable at present since this species does occur abundantly in thermal waters in Pahranagat Valley and Ash Meadows as well as other places throughout the western United States. Crenichthys baileyi and Moapa coriacea occur in the thermal headwaters of Moapa River. In general Moapa occurs most abundantly in streams, and Crenichthys occurs most abundantly in spring pools. It seems possible that the presence of Moapa may have contributed to the failure of R. osculus to successfully utilize this particular environment. In turn it appears that Moapa has been adversely affected by the introduction of Poecilia mexicana, a species which in Moapa River reaches its greatest abundance in flowing waters.

The larger, cooler, relatively swift waters of Colorado River, Virgin River, Moapa River and Meadow Valley Wash contain large populations of Gila robusta. In addition Pantosteus delphinus, Pantosteus sp. and Catostomus latipinnis occur commonly in the Virgin River. The most abundant fish in this lower section of the Virgin River is Plagopterus argentissimus. This species is absent from Meadow Valley Wash and Colorado River and occurs only rarely in Moapa River.

The backwater areas, eddies and sloughs along the lower portions of the Colorado, Virgin and Moapa Rivers provide the primary habitat for such species as Cyprinus carpio, Notropis lutrensis, Pimephales promelas, Lepomis macrochirus, L. cyanellus, and Micropterus salmoides. The swifter main channel provides a habitat for Salmo qairdneri, Xyrauchen texanus, Gila robusta, and Ictalurus pu nctatus.

Vegas Creek was tributary to the Colorado River through Vegas Wash some 20 years ago. With the development of Las Vegas and attendant increased water use, this stream, together with its single native fish population, Rhinichthys osculus became extinct.

The creek had its head at Tule Springs, flowed through the city of Las Vegas, through what is now the Henderson slough and into the Colorado River through Vegas Wash. Some of the remnant waters in the area now contain the introduced mosquitofish (Gambusia affinis).

Numerous exotic species have been introduced throughout southern Nevada. Their introduction has nearly always adversely affected the native populations. Although it is difficult to keep abreast of the rapid dispersal which these forms are making throughout the area, the presently known distribution is presented in Appendix II.

The birds found here also commonly occur in the other aquatic communities.

Beaver, muskrat and the soft-shelled turtle (Trionyx ferox) occur throughout Virgin and Moapa Rivers as well as below Davis Dam in the Colorado River. The River Otter is rare in this community.

Lake Community: The lake community in southern Nevada is restricted to two large reservoirs, Lakes Mead and Mojave. These

communities have developed only within the past 25 years following the construction of Hoover Dam (first filled in 1941) and Davis Dam (first filled in 1951). Prior to construction of the dams the river was heavily silt laden, highly fluctuating, extremely swift flowing and probably held three native fish species in fair abundance throughout the year (Xyrauchen texanus, Gila robusta, Ptychocheilus lucius). Three additional species, (Salmo clarki, Catostomus latipinnis and Gila cypha) may have occurred occasionally. Mayflies (Ephemeroptera) and Caddisflies (Trichoptera) were abundant (La Rivers, 1962, p. 188) and a few marshes occurred along the river course, especially near the southern tip of the state. The river was, however, largely confined between the rock walls of deeply incised canyons.

The filling of the reservoirs and introduction of sport fishes has caused extensive changes in the characteristics of the biota. Some of the most readily apparent include: (1) Almost complete elimination of the Colorado River Squawfish (Ptychocheilus lucius), (2) marked reduction in mayfly and caddisfly populations, (3) increased plankton populations, (4) development of a significant sport fishery.

Today this portion of the Colorado River exists as a lake community. Lake Mead contains about 32 million acre feet of water, 163,000 surface acres, is some 115 miles in length and 500 feet in maximum depth. It consists of two major basins, Boulder and Virgin, which are connected by Boulder Canyon, about 9 miles in length and very narrow. Boulder Basin and Virgin Basin are 4 and 8 miles wide respectively. Lake Mojave is much smaller, containing 1,820,000 acre feet of water covering 30,000 surface acres. It is 65 miles in length and about 100 feet in maximum depth. For most of its length, Lake Mojave is confined between steep to vertical cliffs; in the lower part of the lake it widens to a maximum of 4 miles.

Information on Lakes Mead and Mojave is available in reports by Jonez and Sumner, 1954; La Rivers, 1962; Moffett, 1943; Smith et al., 1960; Thomas, 1954; Nat. Res. Council, 1941, 1947; Anderson and Prichard, 1951; Deacon and Haskell, 1963, in press; Miller, 1952; Wallis, 1951. The lakes are characterized by wide fluctuations in water level (Less in Mojave than in Mead), and large volumes of water flowing through them. This creates a situation which prevents establishment of significant quantities of rooted aquatic vegetation. With the operation of Glen Canyon Dam the fluctuation will probably be considerably reduced. The bottom fauna is also sparse, leaving plankton as the primary food source at the base of the food chain. A significant contribution to Lake Mead productivity is made by bacterial organisms living in bottom sediments.

The threadfin shad has become the most abundant fish in both Mead and Mojave. Important game species in the two lakes include largemouth bass (Micropterus salmoides), channel catfish (Ictalurus punctatus), black crappie (Pomoxis nigromaculatus), and bluegill (Lepomis macrochirus). In addition carp are numerous in both reservoirs, and Lake Mojave has an important trout fishery (largely Salmo qairdneri).

Kokanee salmon (Oncorhynchus nerka) are being planted in an effort to add this species to the fishery. Native species present and common to abundant in the lakes include the humpback sucker (Xyrauchen texanus) and the bonytail chub (Gila robusta).

Birds typical of the other aquatic communities are also found here.

Aquatic mammals such as beaver, muskrat and the rare river otter are representative of this community.

TABLE 4. A summary of the distribution of the biota in the zonal biotic communities of southern Nevada. Communities are grouped as desert, montane, and hydric-aquatic communities. Transzonal communities are not considered since they pass through two or more of the zonal communities. Code letters for the biotic communities are: Cr = creosote bush, Bl = blackbrush, JP = juniper-pinyon, FP = fir-pine, Br = bristlecone pine, PA = pseudo-alpine, DS = desert spring and marsh, SR = stream riparian, ST = stream, La = lake.

	Desert Communities			Montane Communities					Hydric-Aquatic Communities				
Biota	Cr	Bl	Total	JP	FP	Br	Pa	Total	DS	SR	St	La	Total
Vascular Plants	256	185	311	258	275	75	13	414	21	36	3	0	50
Fish	0	0	0	0	0	0	0	0	20	0	21	17	41
Amphibians	0	0	0	0	0	0	0	0	7	7	7	3	9
Reptiles (total)	30	19	30	9	5	0	0	9	0	14	1	0	15
Turtles	1	1	1	0	0	0	0	0	0	0	1	0	1
Lizards	14	13	14	7	4	0	0	7	0	7	0	0	7
Snakes	15	5	15	2	1	0	0	2	0	7	0	0	7
Birds (total)	33	26	40	47	89	29	5	107	202	159	15	44	245
Permanent residents	8	6	9	12	15	7	0	24	22	18	0	2	26
Summer residents	6	8	11	13	31	18	0	24	19	20	3	0	28
Winter residents	10	7	10	3	4	0	0	5	65	40	7	27	71
Non-residents	9	5	10	19	39	4	5	54	107	87	5	16	139
Mammals (total)	44	33	48	46	38	23	1	49	26	37	7	2	45
Insectivores	0	0	0	0	1	1	0	1	0	0	0	0	1
Bats	14	6	14	8	9	3	0	10	6	9	6	0	9
Rodents	16	14	18	22	15	10	1	22	10	18	1	1	19
Lagomorphs	2	2	2	3	3	2	0	3	2	2	0	0	2
Carnivores	9	6	9	9	7	4	0	9	4	6	0	1	9
Ungulates	3	5	5	4	3	3	0	4	4	2	0	0	5
Totals	363	263	429	360	407	127	19	579	276	253	54	70	405

ANALYSIS OF THE DISTRIBUTION OF THE BIOTA WITHIN BIOTIC COMMUNITIES

The varied topography and geographical position of southern Nevada, in combination with the climatological history has produced a diverse biota. Pleistocene climates permitted northern elements to extend into southern Nevada. As desert conditions developed these elements became isolated in the higher mountainous regions. Southern elements have invaded the area both by accompanying the spread of desert environments and by using waterways as routes of dispersal into the desert. As communities differentiated and developed characteristic biota s, certain species were forced into the more mesic stream habitats from what was probably a more general distribution over the region.

The ecological isolation, resulting from the development of desert conditions, has produced a number of endemic species. Approximately 2.1 percent of the vascular plants, 45.0 percent of the fishes, and 1.4 percent of the mammals are endemic to southern Nevada. In addition, there are a number of well differentiated populations which are endemic at the subspecific level.

Habitat diversity expressed as the number of species found within communities is best developed at the middle elevations. The number of species of vascular plants and vertebrates found in each community are given in Table 4. The desert, montane, and hydric-aquatic communities are all diverse and over four hundred species are found in each of these major habitats. To aid in a comparison of communities, the percent of the total of each group as well as the percent of the total biota for each community is given in Table 5. The communities with the largest percentage of the biota are found at the lower or middle elevations, and are discussed below.

TABLE 5. The percent of the total vascular plants and vertebrates which are found in each biotic community.

Biota	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La
Vascular Plants	36.4	26.3	9.2	39.4	36.7	43.7	39.1	10.7	1.8	2.8	5.1	0.4	0
Fish						0	0	0	0	48.8	0	51.1	41.5
Amphibians	0	0	0	0	0	0	0	0	0	70.0	70.0	70.0	30.0
Reptiles	77.0	48.8	20.2	56.5	23.1	15.4	12.8	0	0	0	35.9	2.5	0
Birds	11.4	8.9	4.1	19.0	16.2	12.8	30.8	10.0	1.7	69.5	54.9	5.2	15.2
Mammals	60.2	45.2	37.0	52.0	63.0	53.5	52.0	31.5	1.4	35.6	50.7	9.7	2.8
Total	31.4	22.7	9.7	34.0	31.1	33.7	35.2	11.0	1.6	23.8	21.9	4.7	6.0

The biotic communities discussed here share portions of their biota with adjacent communities. The transzonal communities, and in particular the desert riparian and riparian and cliff communities are made up of species which have their main distribution within nearby zonal communities. However, since the zonal communities occur as belts along environmental gradients, they most clearly reflect ecological zoning of the biota. An analysis of these communities is attempted below.

The distribution of the vascular plants within zonal communities is presented in Table 6. The creosote bush community has a large number of species (46.5 percent of the plants found within the community) restricted to this zonal community. It shares 47.6 percent of its flora with the adjacent blackbrush community. One reason for the large number of species restricted to this community is that a large number of herbaceous plants of the Sonoran Desert are found at the lower elevations in the extreme southern portion of the state. Thirty-seven and four-tenths percent of the flora in the fir-pine community does not occur in other zonal communities. This is probably due to the isolation and differentiation of northern elements since the end of the Pleistocene. The blackbrush and juniper-pinyon communities are largely made up of species that are shared with lower and higher communities. The bristlecone-pine community is largely made up of species that are also found within the fir-pine community. The pseudo-alpine community shares a high percentage of its plants with adjacent montane communities.

The distribution of reptiles within zonal communities is given in Table 7. A distributional pattern of impoverishment in the higher elevational communities is clearly indicated. The creosote bush community has 77 percent of the reptiles found in southern Nevada. Of these, 36.7 percent are restricted to this community and 60 percent are shared with the blackbrush community. By contrast only 12.8 percent of the reptiles are found in the fir-pine community and none are restricted to this community. Reptiles do not occur in the bristlecone pine and pseudo-alpine communities.

The distribution of birds within zonal communities is given in Table 8. None of these communities have a large number of birds restricted to them. However, the montane communities, (fir-pine and juniper-pinyon) have approximately one-fourth of their respective avifaunas restricted to that particular community. The bristlecone-pine and pseudo-alpine communities do not have any species of birds restricted to them. The seasonal occurence of birds within zonal communities was analyzed and is given in Table 9. In the desert communities (creosote bush and blackbrush) residents, and non-residents are well represented. In the montane communities the percentage of summer residents increases with elevation as the percentage of winter residents declines. Non-residents become more important in the lower montane communities and make up 43.8 percent of the avifauna in the fir-pine community. In the bristlecone pine and pseudo-alpine communities, winter residents are not present. The avifauna of the pseudo-alpine community is exclusively non-resident.

The distribution of mammals within the zonal communities is presented in Table 10. Twenty-seven and two-tenths percent of the mammals present in the creosote bush community are restricted to that community. Sixty-three and five-tenths percent of the mammals occur also in the adjacent blackbrush community. The blackbrush and juniper-pinyon communities have a mammalian fauna which is shared with both lower and higher zonal communities. The higher montane communities (fir-pine, bristlecone pine, and pseudo-alpine) do not have any species of mammals restricted to them. All of the species represented in the bristlecone pine and pseudo-alpine communities are also found within the fir-pine community. A marked impoverishment of the montane fauna occurs in the two higher communities.

The hydric-aquatic communities are characterized by a sizable number of reptiles, birds, and mammals whose main distributions are found within adjacent terrestrial communities. In addition there are a number of mammals, one reptile, most of the amphibians, and many shore and water birds which find a suitable habitat in these mesic to aquatic environments. The desert springs and marshes

and stream riparian communities have a more varied biota than the stream and lake communities due to their more diverse habitat coupled with the ectone or "edge effect" provided by these and the adjacent terrestrial communities. These communities have 276 and 253 species respectively, compared to the 54 and 70 species found in the stream and lake communities. These two communities provide suitable habitats for fish, amphibians, numerous mammals and a rich winter resident and non-resident avifauna.

The vegetation of southern Nevada is varied and may be used along with the physical features of the environment as a basis for delimiting natural communities. The distributions of fishes, amphibians, and reptiles are largely limited by physical factors such as available water, humidity, and temperature. In contrast the distribution of birds and mammals is more complex. Fish are restricted to aquatic communities, amphibians to the mesic habitats within the desert environment, and reptiles, because of unfavorable temperatures at the higher elevations, are restricted to the lower and middle elevations. These three groups show a generalized distributional pattern of impoverishment along environmental gradients away from ideal habitats. In direct contrast, mammals, birds, and vascular plants exhibit a pattern of replacement, not impoverishment. These types of distributional patterns are clearly indicated for zonal communities in Figure 4.

The biotic communities described here are natural groupings of plants and animals which co-exist and interact with each other. Their present distribution and position as members of these biotic communities are the result of their evolutionary history as individual populations, dispersal, and segregation by past climatic events into present day natural communities.

TABLE 6. The distribution of vascular plants within each zonal biotic community in southern Nevada.

Biotic Community	Restricted to Community	Creosote bush	Blackbrush	Juniper-pinyon	Fir-Pine	Bristle-cone pine	Pseudo-Alpine
	The percent of the plants of each community found in other communities						
Creosote bush	46.5	100	47.6	19.9	4.3	0.4	0
Blackbrush	9.2	68.0	100	46.0	10.3	2.2	0
Juniper-pinyon	24.0	19.8	33.0	100	48.5	6.6	0.8
Fir-Pine	37.4	4.0	6.9	45.4	100	23.9	2.6
Bristlecone pine	16.0	1.3	5.3	22.7	84.0	100	14.7
Pseudo-Alpine	15.4	0	0	15.4	53.9	84.9	100

TABLE 7. The distribution of the reptiles of each zonal biotic community in southern Nevada.

Biotic Community	Restricted to Community	Creosote bush	Blackbrush	Juniper-pinyon	Fir-Pine	Bristle-cone pine	Pseudo-Alpine
	Percent Distribution in Zonal Communities						
Creosote	36.7	100	60.0	16.7	3.3	0	0
Blackbrush	0	100	100	27.9	5.5	0	0
Juniper-Pinyon	0	55.5	55.5	100	55.5	0	0
Fir-Pine	0	20.0	20.0	100	100	0	0
Bristlecone Pine	0	0	0	0	0	0	0
Pseudo-Alpine	0	0	0	0	0	0	0

TABLE 8. The distribution of the birds of each zonal biotic community in southern Nevada.

Biotic Community	Percent distribution in each community						
	Restricted to Community	Creosote bush	Blackbrush	Juniper-pinyon	Fir-Pine	Bristle-cone pine	Pseudo-Alpine
Creosote	15.1	100	60.5	28.3	39.4	12.1	9.5
Blackbrush	3.8	77.0	100	54.0	58.0	19.4	7.7
Juniper-pinyon	23.4	19.3	29.8	100	66.0	21.2	4.3
Fir-pine	24.7	18.0	16.8	34.8	100	32.6	4.5
Bristlecone Pine	0	13.8	17.3	34.4	100	100	17.3
Pseudo-Alpine	0	60.0	40.0	40.0	80.0	100	100

TABLE 9. The seasonal occurrence of the avifauna of each zonal biotic community. (Based on percent of the total for each community.

Biotic Community	Permanent Resident		Summer Resident		Winter Resident		Non-Resident		Total
	No.	%	No.	%	No.	%	No.	%	
Creosote bush	9	27.2	6	18.2	10	30.3	8	24.3	33
Blackbrush	7	26.9	6	23.1	8	30.8	5	19.2	26
Juniper-pinyon	12	25.6	14	29.2	3	6.4	18	39.3	47
Fir-pine	15	16.9	31	34.8	4	4.5	39	43.8	89
Bristlecone pine	7	24.2	18	62.0	0	0	4	13.8	29
Pseudo-Alpine	0	0	0	0	0	0	5	100	5

TABLE 10. The distribution of the Mammals of each zonal biotic community in southern Nevada.

Biotic Community	Percent Restricted to Community	Creosote bush	Blackbrush	Juniper-Pinyon	Fir-Pine	Bristle-cone pine	Pseudo-Alpine
Creosote	27.2	100	63.5	56.9	31.8	20.4	2.3
Blackbrush	0	85.0	100	87.9	51.5	33.3	3.0
Juniper-pinyon	4.4	54.4	63.0	100	69.6	45.6	2.2
Fir-pine	0	36.8	44.7	84.2	100	60.5	2.6
Bristlecone pine	0	39.2	47.9	91.2	100	100	4.3
Pseudo-Alpine		100%	100%	100%	100%	100%	100%

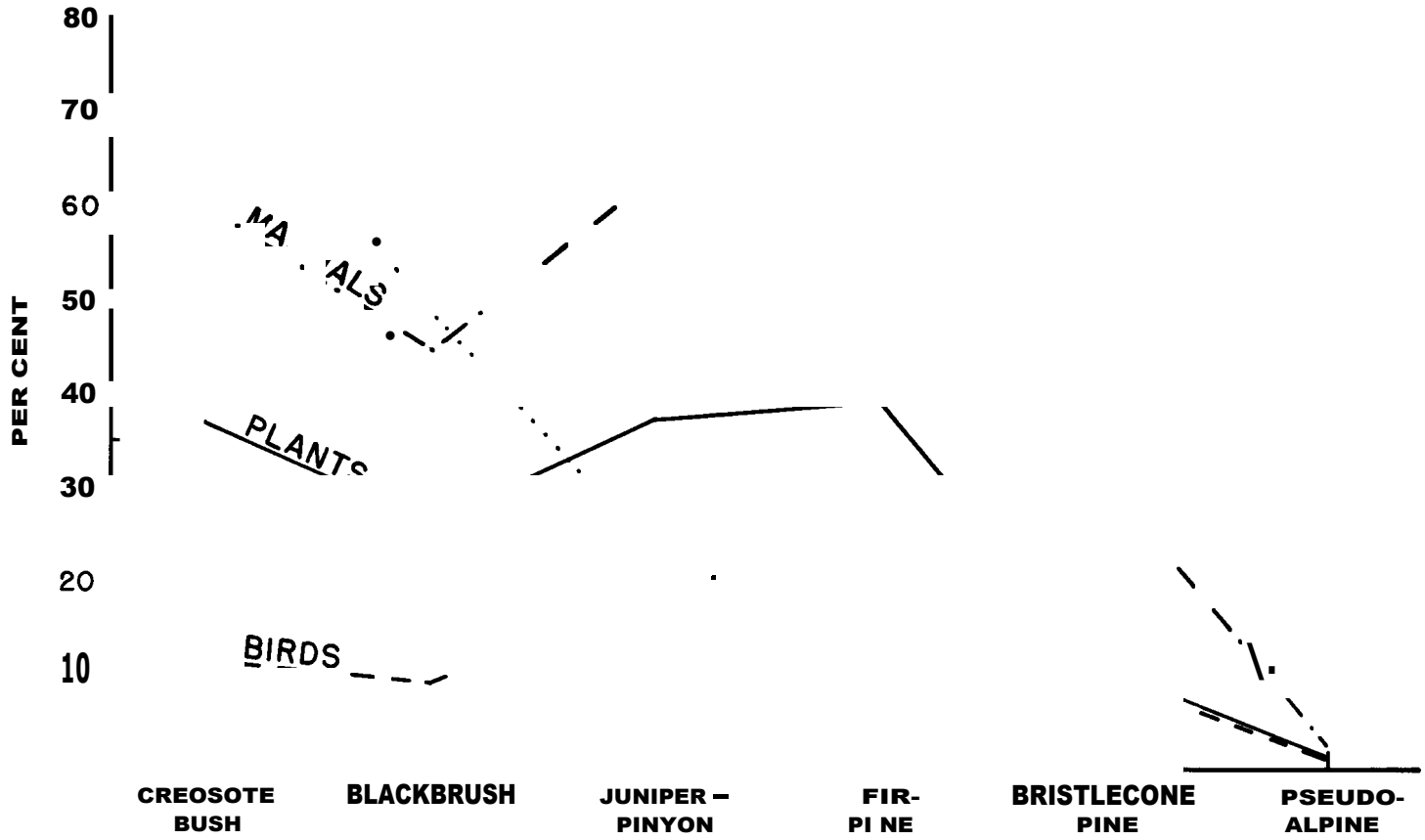

Fig. 4. **Per cent of the total number of species in each group that occurs in each of the plant communities indicated.**

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Appendices. Checklists of the biota of southern Nevada indicating distribution and relative abundance in biotic communities.

Code letters for the biotic communities are:

Cr = creosote brush
Bl = blackbrush
Sa = saltbrush
DR = desert riparian
JP = juniper-pinyon
RC = riparian and cliff face
FP = fir-pine
Br = bristlecone pine
PA = pseudo-alpine
DS = desert spring and marsh
SR = stream riparian
St = stream
La = lake

Code letters for relative abundance are:

A = abundant
FC = fairly common
C = common
U = uncommon
R = rare
X = record of occurrence
* = introduced

Code letters for seasonal occurence for birds are:

PR = permanent resident
SR = summer resident
WR = winter resident
T = transient
V = visitant
Ac = accidental
X = record of occurrence

Plant names follow Munz and Keck (1959), Clokey (1951), Kearney and Peebles (1960). Vertebrate names follow Blair et al. (1957).

APPENDIX I: Check list of the plants of southern Nevada with their distribution and relative abundance in biotic communities

Species	Biotic Communities												
	Cr	Bl	Sa	DR	J	RC	FP	Br	PA	DS	SR	St	La	Other
Plants														
Polypodiaceae														
Adiantum capillus-veneris						X								X
Cheilanthes covillei						X								
Cheilanthes feei					X	X	X							
Cysopteris fragilis						X	X							
Notholaena				X	X	X								
Pellaea breweri							X							
Pellaea longimucronata						X								
Pityrogramma triangularis						X								X
Polystichum scapulinum						X								X
Woodwardia fimbriata						X								X
Ophioglossaceae														
Botrychium lunaria								X						
Selaginellaceae														
Selaginella leucobryoides						X								
Equisetaceae														
Equisetum kansanum							X							X
Pinaceae														
Abies concolor						X	X	X						
Juniperus communis							X	X						
Juniperus monosperma					X	X	X							
Juniperus scopulorum					X	X	X							
Juniperus osteosperma					X	X	X							
Pinus aristata							X	X						
Pinus flexilis							X	X						
Pinus monophylla					X	X								
Pinus ponderosa					X	X	A							
Gnetaceae														
Ephedra funerea	X			X										
Ephedra nevadensis	X	X	X	X										

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Ephedra torregana	X													
Ephedra viridis		X	X	X	X	X								
Typhaceae														
Typha angustifolia	X									X	X			
Gramineae														
Agropyron desertorum							X							
Agropyron saxicola					X	X	X							
Agropyron spicatum					X		X							
Agropyron subsecundum						X	X							
Agropyron trachycaulum		X		X	X	X	X							
Agrostis alba		X			X									X
Agrostis exarata					X		X							X
Agrostis semiverticillata							X							X
Aristida ad scens ionis	X		X	X										
Aristida glauca		X			X	X	X							
Buoteloua aristidoides		X		X										
Bouteloua barbata	X	X		X										
Bromus anomalus						X	X	X						
Bromus ciliatus					X	X	X	X						
Bromus marginatus						X	X							
Bromus rubens	X	X	X	X	X	X								
Bromus tectorum	X	X	X		X	X								
Bromus trinii					X	X								
Dactylis glomerata					X									X
Deschamps ia caespitosa					X		X							X
Distichlis spicata			X							X	X			X
Elymus canadensis				X		X								
Elymus cinereus					X	X								
Festuca octoflora	X	X		X	X	X								
Fe stuca ovina						X	X	X						
Hilaria jamesii		X	X	X		X								
Hilaria rigida	X	X	X	X	X	X								

APPENDIX I (Continued)

Species	Biotic Communities											
	Cr	Bl	Sa	DR		RC	FP	Br	PA	DS	SR	St	La	Other
Hordeum leporinum	X	X			X									
Hordeum perenne														X
Muhlenbergia andina							X							
Muhlenbergia curtifolia							X							
Muhlenbergia porteri		X		X	X									
M uhlenbergia squarrosa					X	X	X							
Oryzop sis hymenoides	X	X	X	X	X	X								
Oryzop sis micrantha					X	X	X							
Panicum hauchucae					X	X								
Phleum pratense							X							
Phragmites communis													X	
Poa bigelovii						X								
Poa fendleriana					X	X	X							
Poa longiligula					X	X	X	X						
Poa nevadensis					X	X	X							
Poa pratensis						X	X	X						
Poa secunda						X	X	X	X					
Sitanion hystrix					X	X	X	X	X					
Sporobolus contractus		X												
Sporobolus cryptandrus		X		X	X	X	X							
Sporobolus flexuosus	X													
Stipa comata						X	X							
Stipa coronata		X		X	X	X	X							
Stipa lettermanii							X							
Stipa speciosa		X			X		X							
Tridens mutica	X				X	X	X							
Tridens pulchella	X	X	X	X										
Trisetum spicatum					X	X	X	X	X					
Cyperaceae														
Carex abrupta							X	X						
Carex aurea					X	X	X	X						X
Carex festivella						X	X							

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Carex hassei					X	X	X							
Carex interior							X							
Carex multicostata							X							
Carex praegracilis					X	X	X							
Carex straminiformis							X							
Carex subfusca							X	X						
Carex vallicola							X	X						
Eleocharis parishii						X	X	X						
Juncus balticus					X									
Juncus brunnescens					X	X								
Juncus longistylis							X							
Juncus torreyi												X		
Tuncus xiphioides						X								
Schoenus nigricans						X	X							X
Scirpus paludosus														X
Liliacae														
Allium nevadense		X			X	X	X							
Brodiaea capitata	X	X	X	X	X	X								
Calochortus flexuosus		X	X	X	X	X								
Calochortus rhodothecus						X	X							
Fritillaria atropurpurea						X	X							
Smilacina stellata					X	X	X							
Amaryllidaceae														
Agave utahens is				X	X	X								
Iridaceae														
Sisyrinchium bellum						X								
Sisyrinchium halophilum				X	X	X								
Orchidaceae														
Epipactis gigantea					X	X	X							
Habenaria leucostachys						X	X							
Habenaria spars iflora						X	X							
Salicaceae														
Populus angustifolia							X							

APPENDIX I (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Populus fremontii											X	X		X
Populus tremuloides						X	X	X						
Salix exigua														X
Salix gooddingii											X	X		X
Salix lasiolepis						X	X	X			X			
Fagaceae														
Quercus gambelli					X	X	X							
Quercus turbinella					X	X	X							
Utricaceae														
Urtica helosericea					X									
Loranthaceae														
Arceuthobium compylopodum					X	X	X	X						
Phoradendron californicum	X			X						X	X			
Phoradendron juniperinum					X									
Santalaceae														
Comandra pallida						X	X							
Polygonaceae														
Chorizanthe brevicornu	X													
Chorizanthe corrugata	X													
Chorizanthe rigida	X	X												
Chorizanthe thurberi	X													
Eriogonum angulosum	X	X												
Eriogonum cernuum					X	X	X							
Eriogonum deflexum	X	X	X	X	X									
Eriogonum densum	X	X	X	X	X	X								
Eriogonum fasciculatum	X	X		X										
Eriogonum heermannii		X												
Eriogonum inflatum	X	X	X	X	X	X								
Eriogonum microthecum					X	X	X							
Eriogonum nidularium	X	X	X	X										
Eriogonum parryi	X		X											
Eriogonum reniforme	X	X	X	X										

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	El	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Oder
Eriogonum sulcatum					X	X	X							
Eriogonum thomasii	X			X										
Eriogonum trichopes	X		X	X										
Eriogonum umbellatum					X	X	X							
Eriogonum vimineum	X	X	X	X	X	X								
Oxytheca perfoliata	X	X	X	X										
Polygonum buxiforme							X							
Polygonum persicaria						X	X							
Polygonum sawatchense						X	X	X						
Rumex crispus					X	X	X							
Rumex hymenosepalus	X	X		X										
Rumex salicifolius					X	X								
Chenopodiaceae														
Allenrolfea occidentalis			X											X
Atriplex cane scens	X	X	X	X										
Atriplex confertifolia	X	X	X	X										
Atriplex hymenelytra	X		X	X										
Atriplex lentiformis	X		X											
Atriplex parryi	X		X											
Atriplex polycarpa	X		X											
Atriplex rosea*					X									
Blitum capitatum						X	X							
Chenopodium fremontii						X	X							
Eurotia lanata	X	X	X	X										
Grayia spinosa	X	X	X	X										
Kochia californica				X						X				
Salsola kali*														
Suaeda torreyana			X							X				
Amaranthaceae														
Amaranthus blitoides						X								
Amaranthus retroflexus*							X							
Nyctaginaceae														
Abronia nana							X							

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Abronia orbiculata				X		X								
Abronia villosa	X			X										
Allionia incarnata	X	X		X										
Boerhaavia wrightii	X			X										
Mirabilis bigelovii	X	X		X	X									
Mirabilis froebelii	X	X		X	X	X								
Mirabilis multiflora						X	X							
Mirabilis oxybaphoides							X							
Oxybaphus pumilus						X	X							
Portulacaceae														
Montia perfoliata					X	X								
Montia spathulata						X								
Caryophyllaceae														
Arenaria filiorum								X	X					
Arenaria kingii							X							
Arenaria macradenia					X									
Arenaria rubella								X						
Cerastium arvense							X							
Cerastium beeringianum								X	X					
Lychnis drummondii								X						
Scopulophila rixfordii				X		X								
Silene antirrhina				X										
Silene clokeyi								X						
Silene verecunda					X	X	X							
Ranunculaceae														
Anemone lithophylla						X	X							
Anemone tuberosa				X	X	X								
Aquilegia elegantula						X	X							
Aquilegia scopulorum									X					
Aquilegia shockleyi					X	X	X							
Clematis ligusticifolia					X	X	X							
Delphinium amabile	X	X		X										
Myosurus capulatus				X		X								

APPENDIX I: (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Ranunculus cymbalaria					X	X	X							X
Thalictrum fendleri						X	X							
Berberidaceae														
Berberis fremontii				X	X	X								
Berberis repens							X							
Papaveraceae														
Arctomecon californica	X			X										
Arctomecon merriami	X													
Argemone platyceras	X	X	X	X	X	X								
Eschscholtzia glyptosperma	X										X			
Eschscholtzia minutiflora	X	X		X										
Fumariaceae														
Corydalis aurea						X	X							
Cruciferae														
Arabis fendleri					X	X	X							
Arabis hirsuta					X	X								
Arabis holboellii							X							
Arabis pendulina					X	X	X	X						
Arabis perennans	X													
Arabis pulchra		X		X	X									
Camelina microcarpa														X
Caulanthus crassicaulis					X	X	X							
Caulanthus cooperi	X													
Caulanthus latisiliquus	X			X										
Descurainia californica							X							
Descurainia obtusa					X	X								
Descurainia pinnata	X	X	X	X	X	X	X							X
Descurainia sophia*					X	X	X							X
Dithyrea californica	X													
Dithyrea wislezeni	X													
Draba brachystylis							X							
Draba cuneifolia		X		X	X	X	X	X						
Draba jaegeri						X		X	X					

APPENDIX I (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	Pa	DS	SR	St	La	Other
Draba paucifructa						X	X	X						
Erysimum capitatum					X	X	X							
Lepidium flavum	X			X										
Lepidium fremontii	X	X	X	X										
Lepidium lasiocarpum	X	X		X	X	X	X							
Lepidium montanum	X	X												
Lepidium virginicum*							X							
Lesquerella gordoni	X			X										
Lesquerella hitchcockii						X	X	X						
Lesquerella latifolia					X	X		X						
Lesquerella wardii						X								
Physaria chambersii	X	X	X	X	X	X	X							
Rorippa nasturtium-aquaticum*					X					X	X			X
Sisymbrium altissimum*	X	X		X	X									
Stanleya elata				X	X	X								
Stanleya pinnata	X	X	X	X	X	X								
Streptanthus cordatus					X	X	X							
Streptanthella longirostris	X	X	X	X										
Thysanocarpus curvipes		X												
Capparidaceae														
Cleome lutea	X			X										
Polanisia trachysperma					X									
Saxifragaceae														
Boykinia jamesii						X	X	X						
Fendlerella utahensis					X	X								
Philadelphus occidentalis						X	X	X						
Crossulariaceae														
Ribes aureum														X
Ribes cereum					X	X	X							
Ribes montigenum						X	X	X	X					
Rosaceae														
Amelanchier utahensis					X	X	X							
Cercocarpus intricatus						X	X							

APPENDIX I (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Cercocarpus ledifolius					X	X	X						
Chamaebatiaria millefolium						X	X						
Coleogyne ramossima	X	X			X	X	X						
Cowania stansburiana				X	X	X	X						
Fallugia paradoxa				X	X	X	X						
Holodiscus microphyllus						X	X	X					
Ivesia cryptocaulis								X	X				
Ivesia jaegeri						X	X	X					
Ivesia sabulosa					X		X						
Peraphyllum ramosissimum					X								
Petrophytum caespitosum					X	X	X						
Physocarpus monogynus					X	X							
Pontentilla beanii								X					
Pontentilla crinita						X	X						
Pontentilla monspeliensis					X	X	X						
Pontentilla propinqua						X	X						
Prunus emarginata						X	X						
Prunus fasciculata				X	X	X							
Purshia glandulosa					X	X							
Purshia tridentata					X	X							
Rosa woodsii					X	X	X						
Rubus leucodermis						X	X						
Rubus procerus*							X						
Leguminosae													
Acacia greggii	X			X								X	
Astragalus aequalis					X	X	X						
Astragalus amphioxys	X	X		X	X	X	X						
Astragalus arrectus		X		X	X	X							
Astragalus austrinus		X			X								
Astragalus beckwithii					X	X	X						
Astragalus calycosus					X	X							
Astragalus coccineus		X		X									
Astragalus funereus					X	X	X						

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Astragalus lentiginosus		X		X	X	X	X	X			X			
Astragalus minthorniae					X	X								
Astragalus mohavensis		X		X	X	X								
Astragalus newberryi		X		X	X	X	X							
Astragalus nuttallianus		X												
Astragalus platytropis								X	X					
Astragalus preussii	X										X			
Astragalus tidestromii	X	X		X										
Cassia armata	X			X										
Cercis occidentalis					X	X								
Dalea californica	X	X		X										
Dalea fremontii	X	X		X										
Dalea mollis	X	X		X							X			
Dalea neomexicana	X			X										
Dalea polyadenia	X													
Glycyrrhiza lepidota				X										
Krameria parvifolia	X	X	X	X										
Lotus rigidus	X	X		X							X			
Lupinus alpestris					X	X	X							
Lupinus arizonicus	X				X									
Lupinus brevicaulis	X	X		X										
Lupinus rubens	X	X	X	X	X	X								
Lupinus spars iflorus	X			X										
Medicago lupulina*		X		X	X	X								
Medicago sativa*														X
Melilotus albus*				X	X	X								
Melilotus indicus*														X
Melilotus officinalis*					X	X								X
Oxytropis oreophila						X		X	X					
Petalostemum searlsiae				X	X	X	X							
Prosopis iuliflora	X		X	X						X	X			
Prosopis pubescens	X		X	X						X	X			
Psoralea castorea	X													

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Trifolium monanthum							X							X
Trifolium gymnocarpon						X	X							X
Geraniaceae														
Eurodium cicutarum	X	X		X										X
Linaceae														
Linum australe					X	X								
Linum lewisii					X	X	X	X						
Zygophyllaceae														
Larrea tridentata	X	X	X	X										
Tribulus terrestris														X
Rutacae														
Thamnosma montana	X	X	X	X		X								
Polygalaceae														
Polygala acanthoclada				X	X	X								
Euphorbiaceae														
Croton californicus				X		X								
Ditaxis divers iflora						X	X							
Euphorbia albomarginata	X	X		X										
Euphorbia fendleri					X		X							
Euphorbia polycarpa	X			X										X
Euphorbia robusta						X	X							
,Tragia stylaris				X			X							
Anacardiaceae														
Rhus trilobata				X	X	X								
Celastraceae														
Fors ellesia clokeyi						X	X							
Fors ellesia nevadensis					X	X								
Aceraceae														
Acer glabrum					X	X	X							
Rhamnaceae														
Ceanothus greggii					X	X	X							
Ceanothus martini							X							
Rhamnus betulaefolia						X								
Rhamnus californica					X	X	X							

APPENDIX I (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La Other
Vitaceae													
Vitis arizonica				X	X	X				X	X		X
Malvaceae													
Hibiscus denudatus											X		
Malvastrum rotundifolium	X			X									
Sphaeralcea ambigua	X	X	X	X									
Sphaeralcea angustifolia		X			X								
Sphaeralcea grossulariaefolia					X	X	X						
Sphaeralcea parvifolia						X	X						
Tamaricaceae													
Tamarix pentandra				X						X	X		X
Violaceae													
Viola charlestonensis						X	X	X					
Viola nephrophylla						X	X						
Loasaceae													
Eucnide urens	X			X									
Mentzelia albicaulis		X		X	X	X	X						
Mentzelia laevicaulis		X		X	X	X	X						
Mentzelia nitens	X			X							X		
Mentzelia tricuspis	X	X		X	X	X					X		
Petalonyx nitidus	X	X	X	X	X								
Cactaceae													
Coryphantha rosea					X	X	X						
Echinocactus acanthodes	X	X		X									
Echinocactus polycephalus	X	X		X									
Echinocereus engelmannii	X	X		X	X								
Echinocereus mohavensis						X	X						
Mammillaria deserti		X		X	X								
Mammillaria tetrancistra		X											
Opuntia acanthocarpa	X	X	X	X									
Opunta basilaris	X	X	X	X	X	X							
Opunta bigelovii	X		X	X									
Opuntia charlestonensis					X	X	X						

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Opuntia chlorotica		X		X	X	X								
Opuntia echinocarpa	X	X	X	X	X	X								
Opuntia erinacea	X	X		X										
Opuntia ursina		X	X	X	X									
Opuntia mojavensis				X		X								
Opuntia parishii	X	X												
Opuntia polyacantha		X		X	X									
Opuntia ramosissima	X	X	X	X	X	X								
Onagraceae														
Epilobium adenocaulon				X	X	X	X							X
Epilobium angustifolium						X	X							
Epilobium nevadense						X	X							
Epilobium saximontanum						X	X	X						
Gaura coccinea	X	X		X										
Gayophytum laxispermum						X	X	X						
Gayophytum nuttallii						X	X							
Gayophytum ramosissimum							X							
Oenothera alyssoides	X	X		X										
Oenothera brachycarpa							X							
Oenothera brevipes	X	X		X										
Oenothera caespitosa	X	X	X	X	X	X	X	X						
Oenothera californica	X	X		X										
Oenothera chamaenerioides	X	X												
Oenothera clavaeformis	X	X	X	X	X	X	X							
Oenothera cavernae		X		X										
Oenothera decorticans	X	X		X										
Oenothera hookeri					X		X							
Oenothera lavandulaefolia						X	X							
Oenothera longissima							X							
Oenothera multijuga	X			X								X		
Oenothera pallidum	X	X		X										
Oenothera primiveris	X	X	X	X										
Oenothera pterosperma					X									

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Oenothera refracta	X			X										
Umbelliferae														
Angelica kinglii						X	X							X
Angelica scabrida						X	X							
Caucalis microcarpa				X		X								
Cymopterus aboriginum	X	X		X										
Cymopterus gilmani	X	X		X										
Cornacae														
Garrya flavescens					X	X	X							
Lomatium parryi						X	X							
Ericaceae														
Arctostaphylos pungens					X	X	X							
Pyrola chlorantha						X	X							
Primulaceae														
Androsace septentrionalis						X	X	X						
Dodecantheon jeffreyi							X	X						
Oleaceae														
Forestiera neomexicaa						X								
Fraxinus anomala					X	X								
Fraxinus velutina				X	X	X						X		
Menodova spinescens	X	X	X	X										
Loganiaceae														
Buddleja utahensis		X		X	X	X								
Gentianaceae														
Frasera albomarginata					X	X	X							
Gentiana affinis						X	X	X						
Gentiana tortuosa							X	X	X					
Apocynaceae														
Amsonia brevifolia	X	X		X										
Amsonia tomentosa	X	X		X										
Apocynum androsaemifolium							X							
Apocynum medium							X							
Asclepiadaceae														
Asclepias capricornu				X	X	X	X							

APPENDIX I (Continued)

Species	Biotic Communities											
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Asclepias erosa	X	X		X										
Astephanus utahensis		X		X										
Funastrum hirtellum				X									X	
Convolvulaceae														
Convolvulus arvensis*					X									
Cuscuta denticulata	X												X	
Cuscuta nevadensis	X													
Polemoniaceae														
Eriastrum dens ifolium	X	X												
Eriastrum eremicum		X		X		X								
Gilia aggregata					X	X	X							
Gilia arenaria	X													
Gilia bigelovii	X													
Gilia filiformis	X			X										
Gilia latiflora	X			X										
Gilia latifolia	X													
Gilia leptomeria	X			X										
Gilia ochroleuca	X			X	X	X								
Gilia polycladon	X	X		X										
Gilia scopulorum	X													
Gilia sinuata					X									
Gilia stellata	X	X		X		X								
Langloisia matthewsii	X													
Langloisia punctata	X													
Langloisia setosissima	X	X		X										
Leptodactylon pungens		X		X	X	X								
Linanthus dimissus	X	X		X		X								
Linanthus dichotomus		X												
Linanthus nuttallii					X	X	X							
Phlox covillei					X	X	X	X						
Phlox gracilis					X									
Phlox stansburyi					X	X								
Hydrophyllaceae														
Emenanthe penduliflora					X									

APPENDIX I (Continued)

Species	Biotic Communities											
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Eriodictyon anqustifolium				X	X	X								
Eucrypta micrantha	X													
Nama demis sum	X			X										
Nemophila aurita														
Phacelia affinis	X	X				X								
Phacelia coerulea	X													
Phacelia crenulata	X													
Phacelia curvipes					X									
Phacelia fremonti	X	X	X	X	X	X								
Phacelia ives iana	X	X		X										
Phacelia lemmoni	X													
Phacelia leucophylla		X		X	X	X	X	X						
Phacelia pachyphylla	X			X										
Phacelia palmeri	X			X										
Phacelia pedicellata	X			X										
Phacelia pulchella						X	X							
Phacelia rotundifolia	X	X		X										
Phacelia-vallis-mortae	X	X	X	X										
Tricardia watsonii	X			X										
Boraginaceae														
Am s inckia tes sellata	X			X										
Cryptantha angustifolia	X													
Cryptantha circumscissa	X	X		X										
Cryptantha decipien s					X	X								
Cryptantha echinella					X	X	X							
Cryptantha flavoculata						X	X							
Cryptantha gracilis		X		X	X	X	X							
Cryptantha j ame sii					X	X	X							
Cryptantha micrantha	X	X		X										
Cryptantha nevadensis	X			X										
Cryptantha pectocarya	X			X										
Cryptantha recurvata	X			X										
Cryptantha tumulosa				X	X	X								

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR		RC	FP	Br	PA	DS	SR	St	La	Other
Cryptantha utahensis	X	X	X	X										
Cryptantha virginensis	X	X		X										
Hackelia floribunda					X	X	X							
Heliotropium curassavicum	X													
Lappula redowskii					X	X	X							
Lithospermum incisum							X							
Pectocarya heterocarpa	X			X										
Pectocarya platycarpa	X			X										
Pectocarya recurvata	X			X										
Pectocarya setosa	X			X										
Plagiobothrys jonesii	X	X		X	X									
Verbenaceae														
Lippia wrightii	X	X		X										
Verbena bracteata					X	X	X							
Verbena goodingii					X	X	X							
Labiatae														
Hedeoma nana				X	X	X	X							
Hyptis emoryi	X			X								X		
Murrubium vulgare														X
Mentha arvensis					X									X
Monardella odoratissima							X							
Salazaria mexicana	X	X		X										
Salvia carnosa	X	X		X	X	X								
Salvia columbariae	X	X		X	X									
Solanaceae														
Datura meteloides	X	X		X	X									
Lycium andersonii	X		X	X										
Lycium cooperi				X										
Lycium pallidum	X		X	X										
Nicotiana attenuata					X	X	X							
Nicotiana trigonophyla	X			X										
Physalis crassifolia	X			X										
Physalis fendleri					X	X	X							
Physalis hederaefolia					X	X								

APPENDIX I (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Solanum triflorum				X										
Scrophulariaceae														
Antirrhinum filipes	X													
Castilleja chromosa		X		X	X	X								
Castille'a clokeyi							X	X						
Castille'a linariaefolia						X	X							
Cordylanthus glandulosus					X	X								
Mimulus bigelovii	X	X		X	X		X							
Mimulus guttatus					X	X	X							X
Mohavea confertifolia	X			X										
Pedicularis semibarbata						X	X							
Penstemon ambiguus	X	X		X										
Penstemon bicolor		X		X	X									
Penstemon bridgesii					X	X	X	X						
Penstemon eatonii					X	X	X	X						
Penstemon keckii							X	X						
Penstemon palmeri	X	X		X	X	X	X							
Penstemon thompsoniae							X	X						
Penstemon utahensis		X		X	X	X								
Synthyris ranunculina							X	X						
Verbascum thapsus					X	X								
Veronica americana					X		X							X
Veronica anagallis-aquatica					X		X							X
Bignoniaceae														
Chilopsis linearis				X							X			
Orbanchaceae														
Orobanche californica					X		X							
Orobanche fasciculata	X				X	X	X							
Plantaginaceae														
Plantago insularis	X			X										
Plantago maior											X			
Plantago spinulosa	X	X												
Rubiaceae														
Galium bifolium							X							

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Galium hypotrichium						X	X	X						
Galium munzii						X	X							
Galium parishii					X	X	X							
Galium proliferum		X		X										
Galium watsonii				X	X	X								
Galium galioides							X							
Caprifoliaceae														
Sambucus caerulea						X	X							
Symphoricarpos longiflorus					X	X	X							
Symphoricarpos parishii						X	X							
Symphoricarpos tetonensis						X	X							
Valerianaceae														
Valeriana puberulenta						X								
Cucurbitaceae														
Cucurbita foetidissima	X			X	X									
Cucurbita palmata	X													
Campanulaceae														
Lobelia splendens						X								X
Nemacladus glanduliferus	X	X		X										
Compositae														
Acamptopappus shockleyi	X	X			X									
Achillea lanulosa*							X							
Amphipappus fremontii	X	X												
Antennaria aprica						X	X	X						
Antennaria cocinnea							X							
Antennaria parvifolia									X					
Antennaria rosea							X							
Antennaria soliceps								X						
Artemisia dracunculoides							X							
Artemisia ludoviciana							X							
Artemisia michauxiana						X	X	X						
Artemisia tridentata		X		X	X	X	X							
Artemisia spinescens	X	X												

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Aster abatus	X	X		X										
Aster cane scens							X							
Aster hirtifolius					X	X	X							
Aster leucanthemifolius		X		X	X	X	X							
Aster leucelene					X									
Atrichoseris platyphylla	X			X							X			
Baccharis emoryi	X	X		X										
Baccharis glutinosa				X							X			
Baccharis sergiloides				X		X								
Baccharis viminea				X		X								
Bahia dissecta						X	X							
Baileya multiradiata	X	X	X	X	X									
Baileya pauciradiata	X													
Baileya pleniradiata	X	X		X										
Bebbia j cea				X										
Brickellia atractyloides		X		X										
Brickellia desertorum	X	X												
Brickellia frutescens	X													
Brickellia grandiflora							X							
Brickellia oblongifolia					X	X	X							
Calycoseris wrightii	X	X		X										
Centaurea picris		X												
Chaenactis carphoclinia	X			X										
Chaenactis douglasii					X	X	X							
Chaenactis fremontii	X	X		X										
Chaenactis macrantha	X													
Chaenactis stevioides	X	X		X	X	X								
Chrysothamnus gramineus						X	X	X						
Chrysothamnus nauseosus				X	X	X	X							
Chrysothamnus paniculatus				X	X	X								
Chrysothamnus parryi						X	X							
Chrysothamnus teretifolius				X	X									
Chrysothamnus viscidiflorus					X	X	X							

APPENDIX I (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Cirsium clokeyi						X	X	X						
Cirsium mohavense	X									X				
Cirsium neomexicanum		X		X	X									
Cirsium nidulum					X	X	X							
Cirsium rothrockii						X								
Crepis intermedia						X	X	X						
Crepis nana								X	X					
Crepis occidentalis						X	X							
Dicoria clarkae	X													
Dyssodia acerosa	X													
Dyssodia cooperi	X	X		X										
Dyssodia thurberi	X	X		X	X									
Encelia farinosa	X			X							X			
Encelia frutescens	X			X										
Encelia virginensis	X			X										
Enceliopsis argophylla	X			X										
Enceliopsis nudicaulis	X													
Erigeron argentatus						X	X							
Erigeron clokeyi						X	X	X						
Erigeron concinnus	X	X	X	X	X									
Erigeron divergens				X	X									
Erigeron flagellaris							X							
Erigeron uncialis						X	X	X						
Eriophyllum pringlei	X	X		X	X									
Eriophyllum wallacei	X			X							X			
Filago californica	X													
Franseria dumosa	X	X		X										
Franseria eriocentra	X													
Gaillardia arizonica					X									
Geraea canescens	X			X							X			
Glyptopleura marginata	X													
Glypropleura setulosa	X			X										
Grindelia squarrosa				X										
Gutierrezia lucida		X		X	X									

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Gutierrezia sarothnae				X	X	X								
Haplopappus acradenius		X								X				
Haplopappus bloomeri						X	X	X						
Haplopappus brickellioides	X									X				
Haplopappus cuneatus		X		X	X	X								
Haplopappus goodingii	X			X										
Haplopappus linearifolius	X	X		X	X									
Helianthus annuus					X	X	X			X				X
Hymenoclea salsola		X	X	X	X	X								
Hymenopappus eriopodus	X	X		X	X	X	X							
Hymenoxys acaulis							X							
Hymenoxys cooperi					X	X	X	X						
Hymenoxys lemmonii								X						
Iva axillaris										X				
Laetuca serriola							X							
Lepidospartum latisquamum				X										
Lygodesmia exigua	X	X		X										
Lygodesmia grandiflora				X										
Malacothrix glabrata	X			X										
Malacothrix sonchoides	X													
Microseris linearifolia	X			X										
Monoptilon bellidiforme	X	X		X							X			
Monoptilon bellioides	X													
Nemoseris neomexicana	X			X										
Palafoxia linearis	X										X			
Pectis papposa	X			X										
Perityle emoryi	X			X							X			
Peucephyllum schottii														
Pluchea camphorata	X													
Pluchea sericea	X			X						X	X			
Porophyllum gracile	X													
Psathyrotes annua	X	X		X										
Psathyrotes ramosissima	X													
Psilactis coulteri	X													

APPENDIX I (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR		RC	FP	Br	PA	DS	SR	St	La	Other
Psilostrophe cooperi	X	X		X										
Senecio lynceus							X	X						
Senecio monoensis					X	X	X							
Senecio spartioides							X							
Senecio stygius				X	X	X	X							
Solidago petradoria							X							
Solidago sparsiflora							X							
Solidago spectabilis				X										
Sonchus oleraceus														X
Stephanomeria cinerea	X			X										
Stephanomeria exigua	X	X		X	X									
Stephanomeria pauciflora		X		X	X									
Stephanomeria tenuiflora	X													
Stylocline micropoides	X													
Syntrichopappus fremontii	X													
Tanacetum compactum								X						
Taraxacum offincinale*							X							X
Tetradymia axillaris				X	X									
Tetradymia cane scens					X	X	X							
Viguiera deltoidea	X													
Viguiera multiflora					X	X	X							
TOTAL SPECIES 704	256	185		65	277	258	308	275	75	13	21	36	3	0	53

APPENDIX II: Checklist of the fishes of Southern Nevada with their distri-
bution and relative abundance in biotic communities.

BIOTIC COMMUNITIES

Desert Spring and Marsh: Pluvial White River; Pluvial Death Valley — Stream — Lake

SPECIES	ro	ite / gs in	ol pri gs	ite 'v lley	hra aq V	Sp / ad at	oa R / s of	gers S / er	ue oi S ring	an Spring	Hole	p nas in	h ma adow	Ri	ead Valley ash	irgin	olorado River	ake ead	ake oj
C[illegible]																			
*Dorosoma petenense																	X	A	A
S[illegible]																			
*Oncorhynchus [illegible]																			
*S[illegible]																	R	R	R
*S[illegible] clarki																			
*S[illegible] gairdneri																	A	C	A
C[illegible]																			
Catostomus latipinnis																C	R		
Xyrauchen texanus																	C	C	C
Pantosteus delphinus															C	C			
Pantosteus intermedius			C	X															
Pantosteus sp.																			
C[illegible]																			
*Cyprinus [illegible]io														C	U	U	A	A	A
*Carassius auratus										A									
*Notemigonus crysoleucas																			
Ptychocheilus lucius																			
Gila robusta														A		C	C	C	C
Gila bicolor	X																		
Moapa coriacea																			
Rhinichthys osculus													C	R	C	C			
*Notropis lutrensis														•		C	C		
*Pimephales romelas														•		U	C		
Lepidomeda mollispinis																			
Lepidomeda altivelis																			
Lepidomeda albivallis																			
Plagopterus argentissimus														R	R	[illegible]	A		
I[illegible]																			
*Ictalurus punctatus																		A	C
*Ictalurus [illegible]																		R	R
C[illegible]																			
Empetrichthys merriami																			
Empetrichthys [illegible]																			
Crenichthys baileyi		A	R		A	A													
Crenichthys nevadae	A																		
Cyprinodon nevadensis												C	A						
Cyprinodon diabolis																			
Poeciliidae																			
*Gambusia [illegible]					C	A		C	C	[illegible]		C	A	A	C	C	R		
*Lebistes reticulatus								C	C										
*Poecilia latipinna								C	C										
*Poecilia mexicana					A	A	A		A					A					
*Xiphophorus ma culatus																			
C[illegible]																			
*Cichlasoma nigrofasciatum					A			A											
*Cichlasoma severum																			
C[illegible]																			
*Micropterus salmoides			X	X	[illegible]									U	U	[illegible]	C	A	A
*Lepomis macrochirus																	C	C	A
*Lepomis cyanellus														C	[illegible]		C	C	A
*Pomoxis nigromaculatus																		A	C
TOTALS: 42 Species	2	2 [illegible]	6	9		4 [illegible]		8	5	2	1	5	14	7	10	15	13		16

APPENDIX III: Checklist of the amphibians of Southern Nevada with their distribution and relative abundance in biotic communities.

Species	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
										Biotic Communities				
Ambystoma tigrinum*														X
Scaphiopus hammondi											R	R		
Bufonidae														
Bufo cognatus										X	X	X	X	
Bufo compactilis													X	
Bufo microscaphus										X	X	X		
Bufo punctatus										C	C	C		
Bufo woodhousei										X	C	C	X	
Hylidae														
Hyla regilla										C				X
Ranidae														
Rana pipiens										X	X	X		
Rana catesbeiana*										X	X	X		
TOTALS 10 species	0	0	0	0	0	0	0	0	0	7	7	7	3	2

APPENDIX IV: C S N .

B C

S	Cr	Bl	Sa	DR	JP	RC	FP	B	PA	DS	SR	S	L	O
T T T														
T														
G	U X													
T														
L														
G														
C	U X	X	X	X	U									
I														
C	A R	X	A											X
C	U C		C	X	X									
C	C X	X	X		X									
D	C		C											X
P	A R	X	X											
S	C X		X											
S														
S	C C	X	X											X
S														
U	C R	X	X											
U	U R		X											
U	A C	X	C											
X														
X	C A		X											
S														
E														
E														
T														
C	A C	X	C	R										X
H														
H														
S														
L														
Leptotyphlops														
C														
A														

APPENDIX IV (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	1E	RC	FP	Br	PA	DS	SR	St	La	Other
Chionactis occipitalis														R
Coluber constrictor														R
Tantilla utahensis														R
Hypsiglena torquata	R			R							R			
Lampropeltis getulus	R													
Ma sticophis flagellum	C	C												
Ma sticophis taeniatus	X	X		R										
Phyllorhynchus decurtatus	X			X							X			A
Pituophis catenifer	C	X		X	X		X				X			
Rhinocheilus lecontei	R													
Salvadora hexalepis	R	U		X										
Sonora semiannulata	X			X							X			X
Trimorphodon lambda	X			X							X			X
Crotalidae														
Crotalus atrox	X										X			
Crotalus cerastes	C			C							C			
Crotalus mitchelli	C	R		R	R									
Crotalus scutulatus	C													
TOTALS 39 species	30	18	8	22	9	6	5	0	0	0	14	1	0	7

APPENDIX V: Checklist of the birds of southern Nevada with their distribution and relative abundance in biotic communities.

Species	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
	Biotic Communities													
Gaviidae														
Gavia immer (Common Loon)										X				FCWR
Podicipitidae														
Aechmophorus occidentalis (Western Grebe)										X				CWR
Podiceps auritus (Horned Grebe)														
Podiceps caspicus (Eared Grebe)										OWR			CWR	AWR
Podilymbus podiceps (Red billed Grebe)										(FCWR OSV				FCWR
Pelecanidae														
Pelecanus erythrorhynchos (White Pelican)													RT	RT
Pelecanus occidentalis (Brown Pelican)														Ac
Phalacrocoracidae														
Phalacrocorax auritus (Double crested cormorant)										X			CWR	CWR
Fregatidae														
Fregata magnificens (Magnificent Frigate bird)													Ac	
Ardeidae														
Ardea herodias (Great Blue Heron)										(FCWR OSR			FCWR	FCWR
Botaurus lentiginosus (American Bittern)														
Butorides virescens (Green Heron)										RSR				
Casmerodius albus (Common Egret)														
Florida caerulea (Little Blue Heron)										Ac				
Florida thula (Snowy Egret)										USV	USV			FCWR
Hydranassa tricolor (Louisana Heron)										Ac				
Ixobrychus exilis (Least Bittern)														
Nycticorax nycticorax (Black-crowned Night Heron)										UPR				

APPENDIX V (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Ciconiidae														
Mycteria americana (Wood Ibis)										RSV				
Threskiornithidae														
Plegadis chici (White-faced Ibis)										RSV				
Phoenicopteridae														
Phoenicopterus ruber (Flamingo)														Ac
Anatidae														
Aix sponsa (Wood Duck)										RV		RV		
Arias acuta (Pintail)										FCWR				FCWR
Anas carolinensis (Green-winged Teal)										FCWR		OSR		FCWR
Arias cyanoptera (Cinnamon Teal)										CT		OSR		CT
Arias discors (Blue-winged Teal)										UT		OSR		UT
Anas platyrhynchos (Mallard)										CT FCPR				CT FCPR
Anas strepera (Gadwall)										FCWR				FCWR
Anser albifrons (White-fronted Goose)										R		R		R
Aythya affinis (Lesser Scaup)										UWR				UWR
Aythya americana (Redhead)										UWR		UWR		UWR
Aythya collaris (Ring-necked Duck)										FCWR				FCWR
Aythya marila (Greater Scaup)										RT				
Aythya valisineria (Canvasback)										UWR				UWR
Branta canadensis (Canada Goose)										CT FCWR				CT FCWR
Branta nigricans (Black Brant)														Ac
Bucephala albeola (Bufflehead)										UWR				UWR
Bucephala clangula (Common Golden-Eye)										UWR				UWR
Bucephala islandica (Barrow's Golden-eye)														RWR
Chen hyperborea (Snow Goose)										RWR				RWR
Lophodytes cucullatus (Hooded Merganser)														

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Mareca americana (American Widgeon)									FCWR			FCWR	FCWR	
Mergus merganser (Common Merganser)									OWR			FCWR	FCWR	
Merqus serrator (Red-breasted Merganser)													UWR	
Olor columbianus (Whistling Swan)									UWR				UWR	
Oxyura jamaicansis (Ruddy Duck)									CWR OSV			CWR	CWR	
Spatula clypeata (Shoveler)									UWR				UWR	
Cathartidae														
Cathartes aura (Turkey Vulture)	FCSR	FCSR	FCSR	FCSR	FCSR	FCSR	OSR	USR	X			X		
Accipitridae														
Accipiter cooperii (Cooper's Hawk)	X						UT		FCWR			FCWR		
Accipiter gentilis (Goshawk)							RPR							
Accipiter striatus (Sharp-shinned Hawk)	X						UPR		UWR			UWR		
Aquila chrysaetos (Golden Eagle)	X					FCPR	FCPR	FCSR	X		X		X	
Buteo jamaicensis (Red-tailed Hawk)	OSR CWR	OSR CWR	X	CWR	CPR	CSR	CSR	CSR	CWR			CWR		
Buteo lagopus (Rough-legged Hawk)				Ac								X		
Buteo regalis (Reffuginous Hawk)				RWV								RWV		
Buteo swainsoni (Swainson's Hawk)									X			AWV		
Circus cyaneus (Marsh Hawk)									CPR			CPR		
Haliaeetus leucocephalus (Bald Eagle)	RV													
Parabuteo unicinctus (Harris' Hawk)				Ac										

APPENDIX V (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Pandionidae														
Pandion haliaetus (Osprey)											X			
Falconidae														
Falco columbarius (Pigeon Hawk)										UWR	UWR			
Falco mexicanus (Prairie Falcon)	FCWR						X			FCWR	FCWR			
Falco peregrinus (Peregrine Falcon)										X	X			
Falco sparverius (Sparrow Hawk)	CWR	CWR		CWR				X		CWR	CWR			
Phasianidae														
Alectoris graeca (Chukar)*														X
Callipepla squamata (Scaled Quail)*														X
Francolinus francolinus (Black Francolin)*														X
Francolinus pendicerianus (Gray Francolin)*														X
Lophortyx gambeli (Gambel's Quail)	CPR	X		CPR		FCPR					CPR			
Phasianus colchicus (Ring-necked Pheasant)*														X
Meleagrididae														
Meleagris gallopauo (Turkey)*														X
Gruidae														
Grus canadensis (Sandhill Crane)										RT	RT			
Rallidae														
Fulica americana (American Coot)										AWR OPR		CWR	AWR	
Gallinula chloropus (Common Gallinule)										RSR	RSR			
Porzana carolina (Sora)										R	R			
Rallus limicola (Virginia Rail)										RSR				

Species	Biotic Communities
Charadriidae	
Charadrius alexandrinus (Snowy Plover)	Ac Ac
Charadrius semipalmatus (Semi-palmated Plover)	Ac
Charadrius vociferus (Killdeer)	CWR CWR OPR
Squatarola squatarola (Black-bellied Plover)	Ac Ac
Scolopacidae	
Actitis macularia (Spotted Sandpiper)	USR X OWR
Capella gallinago (Common snipe)	CWR CWR
Catoptrophorus semipalmatus (Willet)	UT UT
Ereumetes mauri (Western Sandpiper)	CT CT
Erolia minutilla (Least Sandpiper)	UT (UT • OWR
Limnodromus scolopaceus (Long-billed Dowitcher)	UT UT
Limosa fedoa (Marbled Godwit)	RT RT
Numenius americanus (Long-billed curlew)	RT RT
Numenius phaeopus (Whimbrel)	Ac
Totanus flavipes (Lesser Yellow-legs)	UT UT
Totanus melanoleucus (Greater Yellow-legs)	UT UT OWR
Tringa solitaria (Solitary Sandpiper)	UT UT
Recurviro stridae	
Himantopus mexicanus (Black-necked Stilt)	UT UT
Recurvirostra americana (American Avocet)	FCT FCT OSR

APPENDIX V (Continued)

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Phalaropodidae														
Lobipes lobatus (Northern Phalarope)						UT	UT				UT			
Steganopus tricolor (Wilson's Phalarope)						FCT	FCT							
Laridae														
Chlidonias niger (Black Tern)						RSV					X			
Hydroprogne caspia (Caspian Tern)											Ac			
Larus argentatus (Herring Gull)											RWV			
Larus californicus (California Gull)						X					UPR			
Larus delawarensis (Ring-billed Gull)						X					CWR			
Larus philadelphia (Bonaparte's Gull)						RV					RV			
Sterna albifrons (Least Tern)						RT					RV			
Sterna forsteri (Forster's Tern)											RT			
Columbidae														
Columba fasciata (Band-tailed Pigeon)														
Columbigallina passerina (Ground Dove)						Ac								
Pteroclurus exuatus (Common Sand Grouse)														X
Scardafella inca (Inca Dove)						Ac								
Zenaida asiatica (White-winged Dove)						X	USR							
Zenaidura macroura (Mourning Dove)				CSR		(CSR	CSR UWR							
Cuculidae														
Coccyzus americanus (Yellow-billed Cuckoo)						OV	OV							
Geococcyx californianus (Road-runner)	UPR	UPR	UPR	UPR	UPR						UPR	UPR		

APPENDIX V (Continued)

Species	Biotic Communities											
	Bl	Sa	DR	J	RC	FP	Br	PA	DS	SR	St	La Other
Tytonidae												
Tyto alba (Barn Owl)												
Strigidae												
Aegolius acadicus (Saw-whet Owl)						RPR	RPR					
Asio flammeus (Short-eared Owl)									X			
Asio otus (Long-eared Owl)				UPR	UPR				UPR	UPR		
Bubo virginianus (Great-horned Owl)			UPR	UPR	UPR	UPR			UWR	UPR		
Glaucidium gnoma (Pygmy Owl)						Ac						
Nyctea scandiaca (Snowy Owl)									Ac			
Otus asio (Screech Owl)				UPR					UPR			
Otus flammeolus (Flammulated Owl)						Ac						
Speotyto cunicularia (Burrowing Owl)	UPR								UPR			
Caprimulgidae												
Caprimulgus vociferus (Whip-poor-will)						Ac						
Chordeiles acutipennis (Lesser Nighthawk)	CSR	CSR	CSR	CSR					CSR	CSR		
Chordeiles minor (Comming Nighthawk)	FCSR	FCSR	FCSR	FCSR	FCSR	X			FCSR	FCSR		
Phalaenoptilus nuttalli (Poor-will)	CSR	CSR				X			CSR	CSR		
Apodidae												
Aeronautes saxatalis (White-throated Swift)	USR	CSR	CSR	CSR	CSR	CSR	CSR	CSR X	CSR(CSR OWR	OWR		
Chaetura vauxi (Vaux's Swift)	UT					UT				UT		
Trochilidae												
Archilochus alexandri (Black-chinned Hummingbird)										RSR		
Archilochus anna (Anna's Hummingbird)						USR						
Archilochus costae (Costa's Hummingbird)			USR			USR						
Selasphorus platycercus (Broad-tailed Hummingbird)				CSR	CSR	ASR	CSR					
Selasphorus rufus (Rufous Hummingbird)	X				CFT	CFT						

Species	Biotic Communities												
	Cr	Bl	Sa	DR	IP	RC	FP	Br	PA	DS	SR	St	La	Other
Alecedinidae														
Megaceryle alcyon (Belted Kingfisher)							RT		RT		RT			
Picidae														
Asyndesmus lewis (Lewis' Woodpecker)							RFT		X					
Centurus uropygialis (Gila Woodpecker)											USR			
Colaptes auratus (Yellow-shafted Flicker)							RT		RT		RT			
Colaptes cafer (Red-shafted Flicker)				CWR			FCSR	FCSR	CWR		CWR			
Dendrocopus scalaris (Ladder-backed Woodpecker)		FCPR					X		X					
Dendrocopus villosus (Hairy Woodpecker)							FCSR	FCSR	UWR		UWR			
Melanerpes formicivorus (Acorn Woodpecker)							Ac							
Sphyrapicus thyroideus (Williamson's Woodpecker)							RSR	RSR						
Sphyrapicus varius (Yellow-bellied Sapsucker)					X		USR		FCWR		FCWR			
Tyrannidae														
Contopus sordidulus (Western Wood Pewee)							FCSR	FCSR	UT		UT			
Empidonax difficilis (Western Flycatcher)							FCT OSR		FCT		FCT			
Empidonax hammondii (Hammond's Flycatcher)							UT		UT		UT			
Empidonax oberholseri (Dusky Flycatcher)							USR		UT					
Empidonax traillii (Traill's Fly-catcher)									USR	X				

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Empidonax wrightii (Gray Flycatcher)				USR									X	
Muscivora forficata (Scissor-tailed Flycatcher)											Ac			
Myiarchus cinerascens (Ash-throated Flycatcher)		FCSR		FCSR	FCSR			OSV			X		X	
Myiarchus tyrannulus (Wied's Crested Flycatcher)													X	
Nuttallornis borealis (Olive-sided Flycatcher)								USR			RT			
Pyrocephalus rubinus (Vermilion Flycatcher)				UPR							UPR		UPR	
Sayornis nigricans (Black Phoebe)				FCWR							FCPR		FCPR	
Sayornis sayus (Say's Phoebe)	CWR	CWR		CPR							CPR		CPR	
Tyrannus tryannus (Eastern Kingbird)													Ac	
Tyrannus verticalis (Western Kingbird)											CSR		CSR	
Tyrannus vociferans (Cassin' s Kingbird)													Ac	
Alaudidae														
Eremophila alpestris (Horned Lark)	FCPR													
Hirundinidae														
Hirundo rustica (Barn Swallow)											USR		USR	
Petrochelidon pyrrhonota (Cliff Swallow)				X			FCSR				FCSR		FCSR	
Progne subis (Purple Martin)													X	
Riparia riparia (Bank Swallow)													X	
Stelgidopteryx ruficollis (Rough-winged Swallow)											FCSR		FCSR	
Tachycineta bicolor (Tree Swallow)											CT		CT	
Tachycineta thalassina (Violet-green Swallow)								CSR		CSR	CT		CT	

APPENDIX V (Continued)

Species	Biotic Communities													Other
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	
Corvidae														
Aphelocoma coerulescens (Scrub Jay)					CSR	CSR	FCSV	FCSV		FCWV				
Corvus brachyrhynchos (Common Crow)										CWR	CWR			
Corvus corax (Common Raven)	CPR	CPR	X	CPR						CPR	CPR			
Cyanocitla stelleri (Steller's Jay)							RSR	RSR						
Gymnorhinus cyanocephala (Pinon Jay)					RV		X							
Nucifraga columbiana (Clark's (Nutcracker)							FCPR	FCPR	X					
Pica pica (Black-billed Magpie)										RV	RV			
Paridae														
Auriparus flaviceps (Verdin)				FCPR						FCPR	FCPR			
Baeolophus inornatus (Plain Titmouse)					UPR									
Parus gambeli (Mountain Chickadee)					CWR		APR	APR		X				
Psaltriparus minimus (Common Bushtit)	CV	CV		CV	CPR	CPR	CV			CV		CV		
Sittidae														
Sitta canadensis (Red-breasted (Nuthatch)							RWR				X			
Sitta carolinensis (White-breasted Nuthatch)							FCPR	FCPR		FCT	FCT			
Sitta pygmaea (Pygmy Nuthatch)							CPR	X						
Certhiidae														
Certhia familiaris (Brown Creeper)							UPR	UPR			X			
Cinclidae														
Cinclus mexicanus (Dipper)							RV				X			
Troglodytidae														
Campylorhynchus brunneicapillus (Cactus Wren)	FCPR	FCPR	X	FCPR										

Species	Biotic Communities													Other
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	
Catherpes mexicanus (Canon Wren)	FCWR	FCWR		FCPR	X	FCPR	FCPR			X				
Cistothorus palustris (Long-billed Marsh Wren)										CWR	CWR			
Salpinctes obsoletus (Rock Wren)	FCPR	FCPR		FCPR	FCPR	FCPR	OPR	X		X		X		
Thryomanes bewickii (Bewick's Wren)				CWR						CWR	CWR			
Troglodytes acdon (House Wren)				CT	CT	CT	(USR CT			FCWR	FCWR			
Troglodytes troglodytes (Winter Wren)										RWR				
Mimidae														
Mimus polyglottos (Mockingbird)				CPR						CPR		CPR		
Oreoscoptes montanus (Sage Thrasher)	UWR	UWR			UPR					UWV		UWV		
Toxo stoma bendirei (Bendire's Thrasher)					RSR									
Toxostoma dorsale (Crissal Thrasher)			UWR	UWR						UPR		UPR		
Toxo stoma lecontei (LeConte's Thrasher)	FCPR		FCPR	FCPR						FCPR				
Toxo stoma rufun (Brown (Thrasher)										Ac				
Turdidae														
Hylocichla guttata (Hermit (Thrush)						USR	USR	USR		X		X		
Hylocichla ustulata (Swainson' s Thrush)							X			X		X		
Ixoreus naevius (Varied Thrush)							Ac							
Myadestes townsendi (Townsend's Solitaire)		X			X		UPR			OWV				
Sialia currucoides (Mountain Bluebird)	FCWR	FCWR		FCWR	X					FCWR				

Species	Biotic Communities													Other
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	
Sialia mexicana (Western Bluebird)	CWR	CWR			CPR		CSR	CSR			CWR	CWR		
Turdus migratorius (Robin)				CWR			USR	USR			AT CWR	AT CWR		
Sylviidae														
Polioptila caerulea (Blue-gray Gnatcatcher)				UPR	UPR	X								
Polioptila melanura (Black-tailed Gnatcatcher)				UPR										
Regulus calendula (Ruby-crowned Kinglet)					FCT	FCT	USR	USR			CWR	CWR		
Regulus satrapa (Golden-crowned Kinglet)							Ac							
Motacillidae														
Anthus spinoletta (Water Pipit)	CWR						X							
Bombycillidae														
Bombycilla cedrorum (Cedar Waxwing)				FCWR							FCWR	FCWR		
Bombycilla garrula (Bohemian Waxwing)											RT			
Ptilogonatidae														
Phainopepla nitens (Phainopepla)				CWR	X						CWR			
Laniidae														
Lanius excubitor (Northern Shrike)				Ac										
Lanius ludovic.ianus (Loggerhead Shrike)				CPR							CPR			
Sturnidae														
Sturnus vulgaris (Starling)											CWR OPR	CWR OPR		
Vireonidae														
Vireo bellii (Bell's Vireo)													USR	
Vireo gilvus (Warbling Vireo)				FCT		FCT	USR				FCT	FCT		
Vireo solitarius (Solitary Vireo)					FCT	FCT	USR					X		

APPENDIX V (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Vireo vicinior (Gray Vireo)							X				UT			
Parulidae														
Dendroica audubonii (Audubon's Warbler)						X	FCSR	FCSR		CWR	CWR			
Dendroica coronata (Myrtle Warbler)							X			OWV	OWV			
Dendroica graciae (Grace's Warbler)							Ac							
Dendroica nigrescens (Black-throated Gray Warbler)					FCSR	X	FCSR				X			
Dendroica occidentalis (Hermit Warbler)							RT				RT			
Dendroica petechia (Yellow Warbler)						OSR				UT	UT			
Dendroica townsendi (Townsend's Warbler)					UT		UT			UT	UT			
Geothlypis trichas (Yellowthroat)										USR	USR			
Helmitheros vermivorus (Worm-eating Warbler)							Ac							
Icteria virens (Yellow-breasted Chat)										USR	USR			
Mniotilta varia (Black and White Warbler)											Ac			
Oporornis tolmiei (MacGillivray's Warbler)						RSR				UT	UT			
Parula americana (Parula Warbler)							Ac							
Sciurus aurocapillus (Ovenbird)										Ac				
Sciurus noveboracensis (Northern Water Thrush)										RT	RT			

Species	Biotic Communities												Other
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St La	
Setophaqo picta (Painted Redstart)											Ac		
Setophaqa ruticilla (American Redstart)											RT	RT	
Vermivora celata (Orange-crowned Warbler)											UT RWR	UT \-RWR	
Vermivora luciae (Lucy's Warbler)											X	USR	
Vermivora virginiae (Virginia's Warbler)						USR						X	
Wilsonia citrina (Hooded Warbler)											Ac		
Wilsonia pusilla (Wilson's Warbler)					FCT		FCT				FCT	FCT	
Ploceidae													
Passer domesticus (House Sparrow)*											APR	APR	
Icteridae													
Agelaius phoeniceus (Red-winged Blackbird)											CPR	CPR	
Eyphagus cyanocephalus (Brewer's Blackbird)											CWR	CWR	
Icterus bullockii (Bullock's Oriole)											CSR	CSR	
Icterus cucullatus (Hooded Oriole)											Ac		
Icterus parisorum (Scott's Oriole)		CSR			CSR	CSR							
Molothrus ater (Brown-headed Cowbird)											FCPR	FCPR	
Sturnella neglecta (Western Meadowlark)											CWR	CWR	
Xanthocephalus xanthocephalus (Yellow-headed Blackbird)											UV	UV	
Thraupidae													
Piranga ludoviciana (Western Tanager)					X	X	CSR				CT	CT	
Piranga rubra (Summer Tanager)												X	
Piranga flava (Hepatic Tanager)				X	X								
Fringillidae													
Ammodramus savannarum (Grasshopper Sparrow)												OT	
Amphispiza belli (Sage Sparrow)	CWR	CPR	X								X		
Amphispiza bilineata (Black-throated Sparrow)	CPR		X								X		

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Calomospiza melanocorys (Lark Bunting)	UT			UT								UT		
Carpodacus cassinii (Cassin's Finch)					X	X		FCPR	FCPR				X	
Carpodacus mexicanus (House Finch)	UPR	UPR		FCPR								APR	APR	
Chlorura chlorura (Green-tailed Towhee)					X		FCSR	FCSR				OWR	OWR	
Chordestes grammacus (Lark Sparrow)												UT	UT	
Cuiraca caerulea (Blue Grosbeak)												USR	USR	
Hesperiphona vespertina (Evening Grosbeak)								UWR				UT	UT	
Junco caniceps (Gray-headed Junco)								FCSR	FCSR			FCWR	X	
Junco hyemalis (Slate-colored Junco)		OWV		OWV	OWV	OWV	OWV	OWV				OWV		
Tunco oreganus (Oregon Junco)				CWR	CWR	CWR	C	CWR	X			FCWR	FCWR	
								-OSR						
Loxia curvirostra (Red Crossbill)								UPR	UPR				X	
Melospiza lincolnii (Lincoln's Sparrow)				FCT				FCT				FCT	FCT	
Melospiza melodia (Song Sparrow)					X	X						(-USR	CWR	
												'-CWR		
Passerculus sandwichensis (Savannah Sparrow)												FCWR	FCWR	
Passerella iliaca (Fox Sparrow)													RFT	
Passerina amoena (Lazuli Bunting)				USR	USR							FCT	FCT	
Pheucticus ludivicianus (Rose-breasted Grosbeak)												Ac	Ac	
Pheucticus melanocephalus (Black-headed Grosbeak)							CSR	CSR				RWR	RWR	
Pipilo aberti (Abert's Towhee)				CWR								CWR	CWR	
Pipilo erythrophthalmus (Rufous-sided Towhee)				UWR	FCSR	FCSR	X					UWR	UWR	

APPENDIX V (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Pooecetes gramineus (Vesper Sparrow)					UT						UT	UT		
Pyrrhuloxia cardinalis (Cardinal)				Ac										
Spinus lawrencei (Lawrence's Goldfinch)												Ac		
Spinus pinus (Pine Siskin)						CT	FCSR	FCSR			FCWR	FCWR		
Spinus psaltria (Lesser Goldfinch)				UWR			X				UPR	UWR		
Spinus tristis (American Goldfinch)											UWR	UWR		
Spiza americana (Dickcissel)				Ac										
Spizella arborea (Tree Sparrow)											OWR			
Spizella atrogularis (Black-chinned Sparrow)						RSR								
Spizella breweri (Brewer's Sparrow)					USR		X				FCWR	FCWR		
Spizella passerina (Chipping Sparrow)					CSR	CSR	CSR				FCT	(FCT		
Zonotrichia albiocollis (White-throated Sparrow)											OWR	OWR		
Zonotrichia atricapilla (Golden-crowned Sparrow)				RWR							Ac			
Zonotrichia leucophrys (White-crowned Sparrow)				AWR	CWR	FCWR	UWR				AWR	AWR		
Zonotrichia querula (Harris' Sparrow)												Ac		
TOTALS 290 Species	33	26	12	55	47	37	89	29	5		202	159	15	44	7

APPENDIX VI: Checklist of the mammals of southern Nevada with their distribution and relative abundance in biotic communities.

Species	Biotic Communities												
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Soricidae														
Sorex tenellus							R	R						
Phyllostomatidae														
Macrotus californicus	A		X						X	A	X		X	
Vespertilionidae														
Antrozous pallidus	C	U	X						C	C	X		X	
Corynorhinus townsendii	C	C	X	C	U	U	U		X	X	X			
Eptesicus fuscus	U	U	X	X	C	C	A	C	X	X	X		X	
Euderma maculata	R						R							
Lasionycteris noctivagans	R						R			R				
Lasiurus borealis														
Lasiurus cinereus														
Myotis californicus	A	A	X	X	U	U			A	C	X			
Myotis evotis					U	U	C	U						
Myotis subulatus					R	R	R							
Myotis thysanodes	R						R							
Myotis velifer	U									U				
Myotis volans					C		A	C						
Myotis yumanensis	R									R				
Pipistrellus hesperus	A	A	X	A	A	A	U							
Molossidae														
Tadarida brasiliensis	C	C	X	X	U				X	X	X		X	
Sciuridae														
Citellus lateralis					U	A	A	U						
Citellus leucurus	C	C	C	C	C	U	R							X
Citellus tereticaudus	C									C				
Citellus townsendi	R			U										
Citellus variegatus		U		U	C	C	C	C						
Eutamias dorsalis					C	C	C	C						
Eutamias palmeri					U	A	A	C						
Eutamias panamintinus				R	C	C	R							
Eutamias umbrinus						C	C	R						

APPENDIX VI (Continued)

Species	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
	Biotic Communities													
G[illegible]														
Thomomys umbrinus	R	C	R	R	R	R	C	R		C	C			A
H[illegible]														
Dipodomys deserti	C			X							X			
Dipodomys merriami	A	A	C	A	U					C	A			A
Dipodomys microps	R	U	X	R										
Dipodomys panamintinus		R		X	R									
Perognathus formosus	A	A	X	C	U						X			
Perognathus longimembris	A	A	X	C	U						X			
Perognathus parvus				U	U	U								
Perognathus pencillatus											X			
Perognathus spinatus														
C[illegible]														
Microtus montanus														
Neotoma cinerea					U	A	A	U						
Neotoma lepida	C	C	X	A	A	A	U			U	U			X
Ondatra zibethicus										X	X	X	X	X
Onychomys torridus	U	U	U	U	U					U	U			
Peromyscus boylei					R	R								
Peromyscus crinitus	C	A	X	A	C	A	U	R		R	R			
Peromyscus eremicus	C	C	X	C	C	R				U	A			
Peromyscus maniculatus	R	C	X	C	A	A	A	C	X	A	A			X
Peromyscus truei					A	A	C	R						
Reithrodontomys megalotis		U		C	A	A	U	R						
Sigmodon hispidus														
M[illegible]														
M[illegible] musculus*	R									A	U			A
E[illegible]														
Erethizon dorsatum				U	U	U	C	U						
Ca[illegible]														
Castor canadensis					U	U	C	U			X			
L[illegible]														
Lepus californicus	C	C	X	C	U	U	R	R		X	C			X

APPENDIX VI (Continued)

Species	Biotic Communities													
	Cr	Bl	Sa	DR	JP	RC	FP	Br	PA	DS	SR	St	La	Other
Sylvilagus auduboni	C	C	X	C	U	U	R				C			X
Sylvilagus nuttalli				X	U	U	C	U		X				
Canidae														
Canis latrans	C	C	C	C	C	C	C	U		X	C			X
Urocyon cinereoargenteus	U	U	U	C	C	C	C	U		X				
Vulpes macrotis	C	C	C	C	U					X				
Procyonidae														
Procyon lotor	U										U			X
Bassariscus astutus	U			U			X				U			X
Mustelidae														
Lutra canadensis														
Mephitis memphitis	U										C			X
Mustela frenata					X	X	X							
Spilogale gracilis	U	U		U	U	U					C			X
Taxidea taxus	C	C	X	C	C	X	R							
Felidae														
Felis concolor					R	R	R	R						
Lynx rufus	U	U	U	C	C	C	U	U		X	X			
Tayassuidae														
Tayassu tajacu*	X	X								X				
Antilocapridae														
Antilocapra americana*		X		X	X	X				X				
Cervidae														
Cervus canadensis					C	C	U	U						
Odocoileus hemionus		U		U	C	C	C	U						
Bovidae														
Ovis canadensis	R	A	C	A	A	C	C	U		X	C			
Equidae														
Equus asinus*	X	X	X	X						X				
TOTALS 73 Species	44	33	27	38	46	39	39	24	1	26	38	7	2	18