An Archaeological Survey of the CHUSKA VALLEY and the Chaco Plateau New Mexico

Part I

Natural Science Studies

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CHAPTER II

ECOLOGICAL AND GEOGRAPHIC DISTRIBUTION OF VERTEBRATES IN THE SHIPROCK AREA, SAN JUAN COUNTY, NEW MEXICO

By

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There is much land in northwestern New Mexico that could be valuable cropland with the addition of water. As a first step in bringing water to these now arid lands, Navajo Dam was built on the upper San Juan River a short distance south of the Colorado state line.

Surveying, leveling, and construction of canals and pumping areas for distribution of the water must be completed before these lands can be brought into production. As now envisioned, a number of years will pass before completion of the project.

There is another type of activity that must be completed before the present land surface is disrupted. Much irreplaceable cultural material and related data will be lost forever by the necessary construction and farming of the area. The archaeologist must, by sampling techniques, salvage and interpret this data.

One source of information on the environments in which prehistoric man lived is the bone material recovered from archaeological sites. Not only do the bone remains give information about animals utilized by man, but also about the vegetation and climate. Before meaningful interpretation of such remains can be made, there must be established a base of comparison. This present study, concerned with the distribution and ecology of the higher biota, is such a base.

The study has been handled somewhat differently than might have been the case if the objectives had been different. For example, relatively little attention has been paid to the larger animals, since these are of little value in ecological reconstructions. Again, little original study has been involved in subspecific determinations; the limitations in studies of archaeological bone are such that it is only in exceptional cases that subspecies can be identified with any significant degree of certainty.

Published records, specimens and field notes in the Museum of Southwestern Biology, University of New Mexico, and field work in the San Juan Basin of New Mexico supported by the Museum of New Mexico, the National Science Foundation, and by myself have been utilized in assembling this report, which has been done under contract with the Museum of New Mexico.

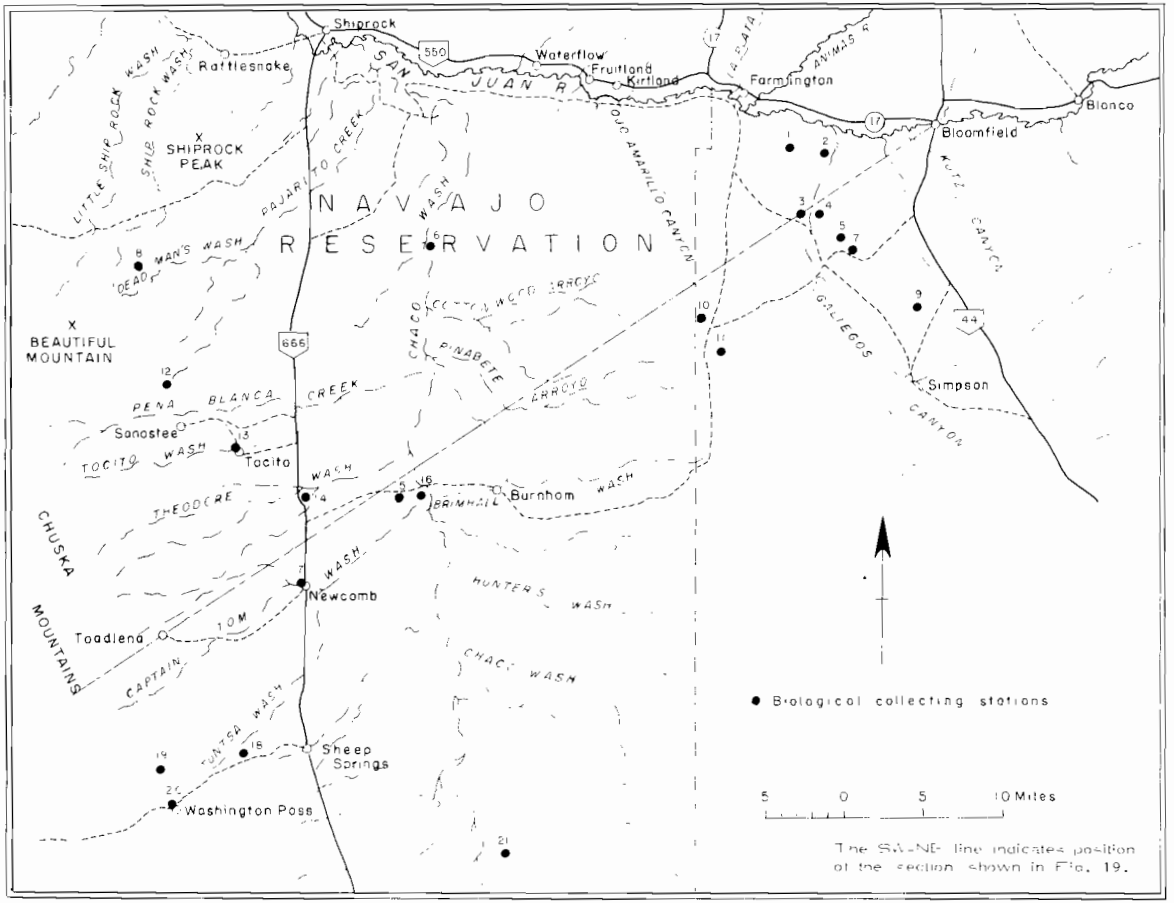

Fig. 18. Map showing location of biological collecting stations.

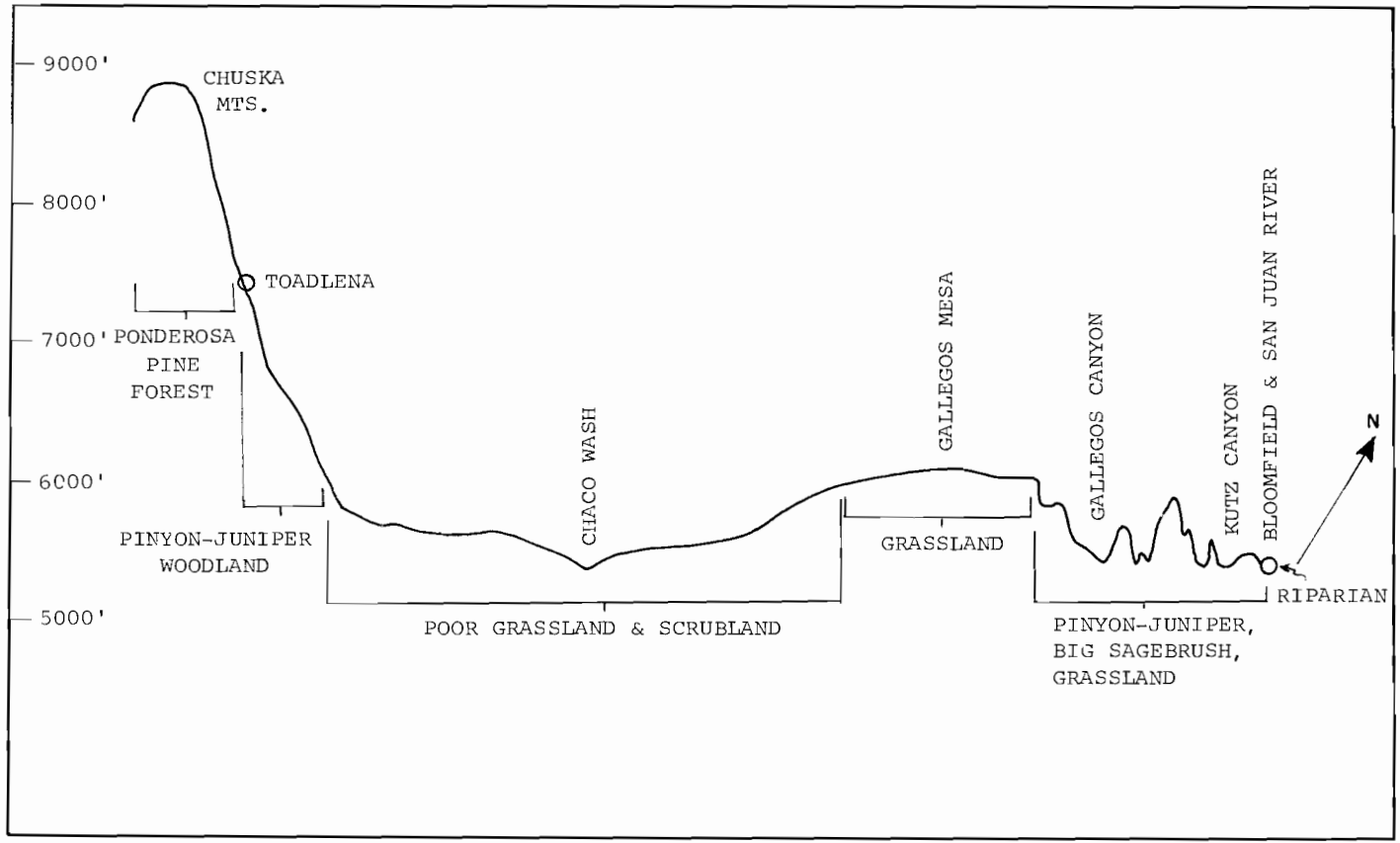

Fig. 19. Approximate SW-NE section across the study area, passing through Toadlena and Bloomfield. The altitudes of vegetational types are approximate.

I wish to thank L. D. Potter, Chairman of the Department of Biology, University of New Mexico, for use of departmental facilities. J. S. Findley, W. C. Martin, and W. Degenhardt, curators of sections of the Museum of Southwestern Biology, have aided greatly in allowing use of the collections and by giving various suggestions. C. J. Jones, Assistant Curator, also has helped in many ways. Field crews of the Museum of New Mexico have produced much information and several important specimens. I also wish to thank F. Banfield of the Canadian National Museum and J. Darling of Albuquerque for aiding in the field work during 1963; D. M. Niles accompanied me during part of 1960.

The Study Area

The boundaries of the study area are somewhat arbitrary and, in a few instances, a bit vague. This due in part to vagueness in published reports (e.g., Aztec-Farmington area). The general limits and major collecting stations are shown in Figure 18.

Topography and Geology

Altitudes within the study area range from over 8800 feet in the Chuska Mountains to less than 5000 feet at Shiprock. Relief in an approximately southwest-northeast section is shown, greatly exaggerated, in Figure 19.

In general, the San Juan Valley is bounded by sandstone cliffs or steep slopes of weathered shale. Tributary canyons in the east (Kutz, Gallegos, and Ojo Amarillo) are incised into sandstone and shale at their mouths and for a considerable distance along their lengths. Chaco Wash, although forming somewhat of a canyon at places, runs for most part in a shallower valley (Fig. 20). Throughout its drainage, however, areas of relief appear in the form of sandstone or shale erosion remnants; volcanic plugs and dikes appear in several areas also. Many of the arroyos draining the east side of the Chuska Mountains have rather deep valleys, and many show relatively recent entrenchment of their flood plains.

The Chuska Mountains rise steeply in the western portion of the study area. In many places, cliffs are present. Much of the highest portion is essentially a plateau.

Gallegos Mesa is a relatively high, rolling, undissected area (Fig. 21). The substratum is mostly sandy. This area and the land to the east consists of Tertiary sandstone and shale except where Gallegos Canyon and the San Juan Valley have been incised into the underlying Cretaceous formations. To the west, Cretaceous sandstones and shales are present into the eastern foothills of the Chuska Mountains where Quaternary landslide debris and earlier Mesozoic formations also appear. The bulk of the higher Chuskas consists of Tertiary sandstone with igneous outcrops appearing at places on top. Quarternary fill is present in most larger drainageways, and a well developed terrace system, presumably mostly of Pleistocene age, is present in the San Juan Valley.

Substrata vary considerably within the study area. Much of Gallegos Mesa is moderately to very sandy, but the Cretaceous areas tend toward clay substrata. Sandy areas, often in the form of dunes, may appear locally anywhere in the area, particularly in the vicinity of washes.

Climate

The most noticeable climatic feature of the study area is the extreme aridity. Annual precipitation throughout the lower elevations is less than ten inches (Table 2). Unfortunately, data are not available for the higher elevations, but portions of the Chuska Mountains probably average more than twenty inches per year. In a general way, precipitation increases with altitude. Much precipitation is received in the form of thunderstorms during mid and late summer.

Flora

In general the distribution, density, and kind of higher plants in the study area depend largely on the following factors: precipitation, exposure, substratum, grazing, and underground water. The factors are greatly interwoven so that correct interpretation of factors controlling distribution often is difficult or, at this stage of knowledge, impossible.

Precipitation controls the distribution of many plants and probably is the dominant control in altitudinal distribution in the region. Where precipitation is relatively great, as in the Chuska Mountains, forest and woodland tend to dominate. As precipitation decreases at lower altitudes, grasslands appear, and with further decrease in precipitation, these become very open and associated with xeric, shrubby growth.

Exposure affects this picture through variations in insolation and wind on different slopes. Thus temperatures, evaporative rates, and edaphic conditions vary. Generally, plants less affected by extreme aridity are found on southernly slopes and plants requiring more mesic conditions on northerly slopes. Many species, of course, can exist under both conditions.

Substrata affect plant distribution to a considerable degree in the study area. This feature, often in conjunction with slope effects, plays a large part in the distribution of junipers in relation to grasses, for example. In the midst of grasslands of fine to sandy substrata, junipers and a number of shrubs unrepresented in the grassland often are found; under these conditions, such plants usually are on rocky outcrops.

Overgrazing has greatly affected the area. Sheep apparently were introduced into the region by the Navajo Indians in the 1700's and cattle are now raised in some areas. The result has been considerable reduction of some kinds of plants and increases in others. For example, big sagebrush, *Artemisia tridentata*, probably occurred in scattered form in earlier days. Now, it forms extensive stands along the eastern edge of the study area (Castetter, 1956).

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Underground and flood waters play roles particularly in the San Juan Valley and in major tributaries. Riparian growth depends in large part upon availability of underground water, and some forms of riparian growth require flooding for successful reproduction. Poor drainage of flood waters from precipitation and the consequent increase in soil salinity also govern in part the distribution of such plants as greasewood, Sarcobatus vermiculatus.

It is useful in describing the flora of an area to be able to characterize it in a very few words. Commonly, the names of one or a few noticeable or numerous plants are used to refer to an associated group of plants. Thus an animal may be spoken of an living in pinyon-juniper woodland. In such a case, "pinyon-juniper woodland" essentially stands for a whole group of plants commonly associated with pinyons and junipers, and does not stand for only these two trees.

As with many simplifications, there is danger if the concept is not well defined. In any such floristic association, boundaries are not distinct: that is, members of the association do not occur only with pinyons and junipers nor do they all occur everywhere that pinyons and junipers occur (in fact, junipers themselves often occur without pinyons). Some plants occur in several floristic associations, or overlap into others to greater or lesser degree, or occur within the association only in special and limited situations.

The vegetation of the study area is described here in terms of such associations, with a general description of each association used here. In general, the ecological distribution of the vertebrate fauna is necessarily given in these terms. Attempts to tie the ecology of most vertebrates to more specific kinds of plants or plant complexes must await thorough study of necessities and preferences in food, cover, and other environmental factors for each individual kind of animal. The generalized altitudinal distribution of plant associations in the study area is shown in Figure 19, More exact localities for specific plants are given in schedules that appear later in these pages.

PONDEROSA PINE-DOUGLAS FIR FOREST

This association requires relatively mesic conditions. It is restricted in the study area to the higher portions of the Chuska Mountains. Here not only is summer precipitation from thunderstorms more plentiful than at lower altitudes, but also, and more importantly for the coniferous trees, winter snows are deep and lasting.

Ponderosa pine, Pinus ponderosa, is the common large tree, growing in open stands (Fig. 22). In canyons and on northern slopes, ponderosa pine is joined by or replaced by Douglas fir, Pseudotsuga taxi-

Fig. 20. Chaco Valley, 14 miles south and 6 miles east of Shiprock (town). View is to the south. (Compare with Fig. 30.)

TABLE 2

ANNUAL PRECIPITATION

Station	Precip. (in.)
Bloomfield	9.14
Fruitland	6.76
Farmington	8.44
Shiprock	7.59

Fig. 21. Callegos Mesa grasslands Vegetation in foreground is Ephedra and rice grass. In the background, junipers appear near the rim of the drop-off into the San Juan Valley.

Fig. 22. (above). Ponderosa pine forest, Chuska Mts., 8 miles west and 1 mile south of Sheep Springs.

Fig. 24 (below). Pinyon-juniper growth along the east side of the Chuska Mountains, about one mile south of Toadlena.

Fig. 23 (below). Douglas fir, aspen, and oak on a north-facing slope, in the same locality as Fig. 22.

folia. Occasional blue spruce, Picea pungens. also are present. Mesic areas, where not overshadowed by the large conifers, often support stands of aspen, Populus tremuloides; drier areas support Gambel oak, Quercus gambelii.

Various other trees and shrubs may occur in small numbers on the forest floor or slopes, but the above are the major forms. In addition to woody plants, a large variety of other kinds occur, ranging from bracken ferns to orchids (see later schedules).

In many areas, openings within the forest allow rather extensive meadows to form. In some cases, considerable areas of meadows with groves and isolated trees of Gambel oak are present, forming a type of savanna.

Numerous springs and ponds occur in the ponderosa pine-Douglas fir zone. In such areas, sedges and other marsh-dwelling plants are frequently common. At its lower edge, this association may merge rather extensively with pinyon-juniper woodland.

PINYON-JUNIPER WOODLAND

Pinyon-juniper woodland is more widely spread in the study area than the preceding association. It forms an extensive band along the mountain slopes below the high mountain forest and occurs in the broken country on the south side of the San Juan River and the east-facing slopes of Gallegos Canyon. Larger rock outcrops in the northern and western portions, such as Hogback Mountain and sandstone outcrops north and east of Beautiful Mountain, support sparse numbers of some pinyon-juniper association members.

Sometimes called pygmy forest, the woodland is characterized by the relatively short growth form of Colorado pinyon, Pinus edulis, and oneseeded juniper, Juniperus monosperma. The latter commonly extends to lower altitudes than does pinyon pine, however. Gambel oak is a common associate, particularly in the higher portions of the unit. A variety of shrubs occur. Big sagebrush, Artemisia tridentata, is a common understory plant. Mountain mahogany, Cercocarpus montanus, and squawberry, Rhus trilobata, also occur, particularly about rocks. As in higher-altitude vegetation, grassy areas may appear. (Fig. 25)

BIG SAGEBRUSH

In the western portions of the study area, big sagebrush is an understory plant in pinyon-juniper woodland. In the east, however, it forms extensive stands where it is by far the commonest plant. The reason for this difference seems to be that extensive, nearly flat areas are present in the east at an altitude where pinyon-juniper growth is confined mostly to slopes; the sagebrush, which grows most abundantly on flats, thus leaves the pinyon-juniper woodland and becomes a dominant form instead of an understory plant. In the west, at the altitude where conditions favor big sagebrush, extensive flat areas are rare and pinyon-juniper growth occurs together with the sagebrush.

In the study area, big sagebrush occurs in more or less pure stands only in a band a few miles wide west on highway N.M. 44.

Small amounts of grass, particularly rice grass, Oryzopsis hymenoides, occur in the sagebrush stands along with some Mormon tea, Ephedra spp., and other low plants.

GRASSLAND

Generally below the pinyon-juniper and big sagebrush areas are the grasslands. There are places, however, where the pinyon-juniper woodland and the grassland habitats are reversed altitudinally. This is the case most noticeably at the northern edge of Gallegos Mesa, where the rim area and the broken country leading into the San Juan Valley support woodland, while grassland occurs to the south on the more level area above the valley.

Well developed grassland is limited mainly to Gallegos Mesa (Fig. 21) and the bajada of the Chuska Mountains and Beautiful Mountain; it is not continuous along the base of the Chuskas, however.

A number of grasses appear, but most noticeable is rice grass. Grama grasses probably were the most common grasses of the area in earlier times, but such is not the case at present. Aside from the grasses, a number or other plants occur, including Mormon tea, cacti, especially Opuntia polycantha, and tumbleweed, Salsola kali. Rabbit bush, Chrysothamnus, and snakeweed, Gutierrezia, are not uncommon.

Altitudinally below these grasslands is a sparsely vegetated area of very scattered grasses, herbs, and bushes (Fig. 26). Tumbleweed is a prominent member of the vegetation. In sandy areas, kinds and numbers of plants increase (Fig. 20) and may include much four-wing saltbush, Atriplex canescens, and wolfberry, Lycium pallidum.

DESERT WASH VEGETATION

A somewhat distinctive vegetation appears along medium and large drainageways, from marginal pinyon-juniper growth into the lowest portions of the area. Greasewood often is common as is four-wing saltbush, and salt cedar, Tamarix pentandra, appears in many areas where water is close to the surface. Rabbitbush and other composites may be common.

RIPARIAN VEGETATION

Riparian vegetation often includes the plants of the desert wash group, but usually includes cottonwoods, Populus wislizeni, and often such other trees as box elder, Acer negundo, wild olive, Forestiera noemexicana, and several species of willows, Salix spp. The introduced salt cedar is common in places and also the introduced Russian-olive, Elaeagnus angustifolia, occurs in the San Juan Valley and in at least a few usually dry washes. Often, grasses and sedges are common.

This vegetation is limited primarily to the San Juan Valley. Small areas including some of the members of the association, such as cottonwoods, occur in larger washes throughout the area.

Accounts of Vertebrate Species

In the following accounts, the order of presentation follows Schmidt (1953) for the amphibians and reptiles, Hall and Kelson (1959) for the mammals, and The American Ornithologists' Union Checklist of North American Birds (1957) for the avifauna.

Following most localities for the tetrapods is a number in parentheses. Such numbers refer to the number of specimens in the Museum of Southwestern Biology from the locality. Some specimens are in the Canadian National Museum and are designated by CNM. Records from the biological literature are followed by a citation to the work.

Amphibians

Many amphibians of the Southwest are in evidence only during restricted portions of the year. They may emerge from various hiding places to breed and feed only during the rainy season, when the humidity may be high enough to prevent dessication and when rain pools furnish breeding places. A collector lucky enough to be in the right place at the right time may be able to collect large numbers of these animals. If the collector is not so lucky, species that may be plentiful may go entirely unrecorded.

Ambystoma tigrinum
Tiger Salamander

Considerably more material is required for satisfactory results on a subspecific level for this animal. In the four localities within the study area represented by specimens, apparently three distinct color patterns are present. Most notably different, perhaps, is the sample from the lower portion of the basin south of Farmington. There is some doubt, however, that the lowland forms are necessarily all native. The owner of one trading post told me that most of the artificial tanks south of the San Juan River were devoid of salamanders until tank trucks carrying water for oil drilling rigs began to enter the area. Until such time as more material becomes available, the tiger salamanders of the study area are not assigned to subspecies.

This salamander in larval form (or in adult form during breeding season) may be expected in most permanent or semipermanent bodies of water, at any altitude. The adult animals, except during the breeding season, may live in rodent burrows and natural crevices.

Localities: 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W (10); Deadman's Lake, 5 miles west of Toadlena, Chuska Mountains (3); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (larvae - no specimens); Washington Pass, Chuska Mountains (3); Basalt Lake, 2 miles south of Washington Pass, Chuska Mountains (3).

Scaphiopus bombifrons
Central Plains Spadefoot

This species is considered monotypic.

The single specimen from the study area was collected by D. M. Niles from the bottom of a sandy, shallow arroyo after a light shower. This toad probably occurs only in the lower parts of the basin.

Localities: Chaco Wash west of Burnham (1).

Bufo punctatus
Red-spotted Toad

This is a monotypic species.

The only records for the San Juan Basin of New Mexico are from the study area. One individual was heard calling and was collected on 3 July and four animals on 17 July. Thunderstorms had occurred in the general area on both occasions. The toads were collected about the edges of permanent, seep-fed pools. It may be noted, however, that these pools are in a deep arroyo and are essentially destroyed every time the arroyo runs. The toad probably is limited to the lower portions of the area.

Localities: Tocito (5).

Bufo woodhousei
Woodhouse's Toad

The Bufo woodhousei of the study area are assigned to B. w. woodhousei. This is the commonest toad of the study area, occurring from the lowest portions of the study area into the high mountains. It appears somewhat less apt to breed in temporary rain pools than the spadefoot toads, prefering more permanent tanks and ponds.

Localities: About 3 miles east and 3 miles south of Farmington (2); about 5 miles west and 2 miles south of Bloomfield (6); Gallegos Canyon, Sec. 9, T28N-R12W (1); Tocito (5); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1).

Rana catesbiana
Bullfrog

The bullfrog apparently is introduced into the San Juan drainage (Stebbins, 1954, p. 131). It occurs in permanent bodies of water and is known only from the lower portions of the study area.

Localities: 1 1/2 miles west of Farmington (12); Gallegos Canyon, 6 miles south of San Juan River (sight record).

Rana pipiens
Leopard Frog

Leopard frogs from the study area may be considered as R. p. pipiens. Like the bullfrog, the leopard frog occurs in permanent water and is not found far from such water. Permanent ponds, lakes, cattle tanks, rivers, and springs are inhabited. Usually fair amounts of aquatic and water-edge vegetation are required. No altitude within the study area is beyond the range of this animal.

Localities: San Juan River (Van Denburgh, 1924, p. 199); 1 1/2 miles west of Farmington (4); Gallegos Canyon, 6 miles south of San Juan River (sight record); 5 miles north of Newcomb (2); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (sight record); Washington Pass, Chuska Mountains (9).

Reptiles

Two groups of reptiles are represented surely within the study area: lizards and snakes. There is a possibility of a third group, turtles, in the San Juan River, but specimens are not known.

The kinds of lizards in the area should be well represented by the collections. Most kinds are diurnal and easily seen. Most snakes, however, are nocturnal to greater or lesser extent and many have very secretive habits. Thus, the kinds of snakes in the area are probably less well known at present.

Crotaphytus collaris
Collared Lizard

Collared lizards from the San Juan Basin seem to be intergrades between C. c. baileyi and C. c. auriceps. Adult males have the yellow on the head and other portions of the body that characterizes C. c. auriceps (Fitch and Tanner, 1951). Some features of their markings, however, seem to be characteristic of C. c. baileyi, including usual presence of distinct markings on the underside of the head and on the dorsal surfaces of the thigh and shank. On the basis of comparisons between preserved specimens, those from the western portion of the basin in New Mexico appear to be somewhat nearer C. c. auriceps than those from farther east.

This is a creature of the lowlands and foothills, predominantly in rocky areas. It occurs up to at least 6600 feet in the Chuska Mountains and probably somewhat higher.

Localities: Gallegos Canyon, Sec. 9, T28N-R12W (1); 5 miles east and 2 miles north of Sheep Springs (2); Chuska Mountains, 4 miles west of Sheep Springs (1).

Holbrookia maculata
Lesser Earless Lizard

The study area is well within the range of H. m. approximans, although under the present status of subspecific classification for this species this means relatively little. This lizard is a lowland creature, occurring on the more level areas of the basin. It is most common on a sandy substratum, but has been collected on occasion on harder surfaces (but not on rock).

Localities: 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (2); about 10 miles south and 6 miles east of Farmington (1); 7 miles east and 10 miles south of Farmington (1); 11 miles east and 13 miles south of Farmington (5); 14 miles south and 2 miles west of Farmington (3); about 3 miles north and 1/2 mile west of Sanostee (1); 25 miles southeast of Fruitland (Van Denburgh, 1924, p. 203); Newcomb (1).

Sceloporus undulatus
Eastern Fence Lizard

All specimens from the study area are referred to the subspecies S. u. elongatus on the basis of scale counts and color pattern. This lizard is most common in rocky outcrops, but occurs also in thick shrub vegetation along washes and in more barren places where crevices in arroyo walls, etc., afford cover. It occurs from the lowest portions of the basin into ponderosa pine forest in the Chuska Mountains.

Localities: 1 mile east of Waterflow (1); about 3 miles east and 3 miles south of Farmington (1);

Gallegos Canyon, Sec. 9, T28N-R12W (3); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); about 3 miles north and 1/2 mile west of Sanostee (4); Chaco Wash west of Burnham (3); 8 miles south and 4 miles west of Shiprock Peak (sight record); 5 miles north and 6 miles east of Newcomb (1).

Sceloporus graciosus
Sagebrush Lizard

All specimens from the study area are referred to the subspecies S. g. graciosus. In the study area, this lizard appears confined to the lower portions. Washes and flats are inhabited, but rock outcrops avoided. In most shrub areas, this is the most common lizard.

Localities: 3 miles east and 3 miles south of Farmington (3); 7 miles east and 10 miles south of Farmington (6); 11 miles east and 13 miles south of Farmington (10); 14 miles south and 2 miles west of Farmington (10); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (9); Sec. 28, T28N-R13W (1); Gallegos Canyon, Sec. 9, T28N-R12W (2); Chaco Wash west of Burnham (2); about 3 miles north and 1/2 mile west of Sanostee (2); Tocito (1); Newcomb (2).

Urosaurus ornatus
Tree Lizard

One specimen is known from the study area and seems referable to U. o. linearis. This subspecies is distributed mainly to the south of the study area. Other tree lizard specimens known from the San Juan Basin of New Mexico are from Chaco Canyon National Monument and seem to be intergrades between U. o. wrighti and U. o. levis, but nearer the former. Urosaurus o. wrighti supposedly occurs in extreme northwestern New Mexico (though I have seen none), northern Arizona, extreme southwestern Colorado, and part of Utah; U. o. levis occurs in the east of the basin, in Rio Arriba and Sandoval Counties. The specimen from the study area was collected by J. S. Findley from a low portion of the basin.

Localities: 5 miles north and 5 miles east of Newcomb (1).

Uta stansburiana
Side-blotched Lizard

Specimens from the study area are of the subspecimen U. s. stansburiana. This animal has been collected only from below the pinyon-juniper woodland habitats. The creature commonly is associated with rocks, but also occurs occasionally in wash vegetation and within sparser growth near rocky areas.

Localities: 3 miles east and 3 miles south of Farmington (4); Gallegos Canyon, Sec. 9, T28N-R12W (1); 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W (1); about 4 miles south of Gallegos Store, near Gallegos Canyon (1); about 3 miles north and 1/2 mile west of Sanostee (4); 30 miles southeast of Fruitland (Van Denburgh, 1924, p. 204); Tocito (1); Chaco Wash west of Burnham (4).

Phrynosoma douglassi
Short Horned Lizard

The few specimens from the study area may be assigned to P. d. ornatissimum, but seem to show some intergradation with P. d. hernandesi, the subspecies to the west of the study area. This area lizard was quite scarce in the study area and was found only in the lowlands. Judging from its altitudinal range elsewhere in the basin, however, it probably occurs in small numbers into ponderosa pine forest in the Chuska Mountains.

Localities: Chaco Wash west of Burnham (1); 2 miles northwest of Nageezi (1); Newcomb (1).

Cnemidophorus tigris
Western Whiptail

The western whiptail of the study area is C. t. septentrionalis. The lizard has been captured only in the vicinity of major washes in the study area; extensive interfluvial areas are not inhabited. Wash vegetation is inhabited in greatest numbers, but grassland and shrubland (except big sagebrush) near washes may support the reptiles also. Altitudinally, it seems to occur almost entirely below the sagebrush level. It is seldom found about rocks or on a bedrock substratum.

Localities: About 3 miles east and 3 miles south of Farmington (2); Kutz Canyon at junction with Highway 44 (1); Gallegos Canyon, Sec. 9, T28N-R12W (10); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (10); Chaco Wash west of Burnham (12); 5 miles north and 6 miles east of Newcomb (3).

Cnemidophorus velox
Plateau Whiptail

This monotypic species occurs in greatest numbers in the pinyon-juniper woodland surrounding the lower portions of the basin. It occurs sparsely in habitats near the lower edge of the woodland, but not into the lowest portions of the study area.

Localities: About 3 miles north and 1/2 mile west of Sanostee (1).

Cnemidophorus inornatus
Little Striped Whiptail

The taxonomy of this species (and most other species of Cnemidophorus) has been in a very unsatisfactory state for many years. Current studies, particularly by J. W. Wright, should clarify the situation in the near future.

The lizard has been collected in the basin only in the Gallegos Mesa area. Its habitat is rather well developed grassland, from the lower edges of the big sagebrush growth to a level where grasses become sparse. On the basis of habitat, it eventually may be found in the grasslands south of the study area and in grasslands along the eastern flank of the Chuska Mountains and Beautiful Mountain.

Localities: 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (15); 7 miles east and 10 miles south of Farmington (3); 11 miles east and 13 miles south of Farmington (9); 14 miles south and 2 miles west of Farmington (10).

Thamnophis dorsalis
Black-necked Garter Snake

This snake, known until recently as T. cyrtopsis, is represented in the study area by the nominate subspecies. It normally is found near permanent streams.

Localities: Farmington (Milstead, 1953, pp. 348-49).

Thamnophis elegans
Western Garter Snake

Thamnophis elegans vagrans is the subspecies in the study area.

The western garter snake occurs about permanent or semi-permanent bodies of water. It may, particularly in more mesic situations, be found some distance from any water, however. All altitudes within the study area are within its range of tolerance.

Localities: San Juan River (Van Denburgh, 1924, p. 224); Washington Pass, Chuska Mountains (Jones, sight record).

Masticophis taeniatus
Striped Whipsnake

The striped whipsnake is known from the study area only from a literature record. On geographic grounds, the subspecies probably should be M. t. taeniatus. Elsewhere in the San Juan-Chaco drainage, the animal has been found most commonly in pinyon-juniper woodland.

Localities: Shiprock (Van Denburgh, 1924, p. 218).

Arizona elegans
Glossy Snake

Only two specimens are known from the San Juan drainage of New Mexico. The specimens have not, as yet, been compared exhaustively with specimens from elsewhere, but superficial examination leads me to place them with the subspecies known from the south, A. e. philipi.

The first specimen was taken along the edge of a sandy wash tributary to Gallegos Canyon (Harris, 1963, p. 25). Vegetation was sagebrush along with such shrubs as rabbitbush; grassland was nearby. The second specimen was captured by Alan Brew in a sandy area just west of Chaco Wash.

Localities: 11 miles east and 13 miles south of Farmington (1); 3 1/2 miles east and 4 miles north of Newcomb (1).

Pituophis catenifer
Gopher Snake

Specimens from the study area appear to be intergrades between P. c. deserticola and P. c. affinis, but nearer the former. Anterior dorsal blotches usually are black, but the degree of confluence between dorsal blotches, and between dorsal and adjacent lateral blotches, is quite variable.

Gopher snakes show a wide tolerance for differing ecological habitats, occurring from the lowest portions of the basin to considerable altitudes, probably into the lower edges of ponderosa pine forest.

Localities: Waterflow (1); between Farmington and Bloomfield on New Mexico Highway 17 (1); Gallegos Canyon, Sec. 9, T28N-R12W (1); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (2); 1 1/2 miles west and 7 miles south of Bloomfield, Sec. 4, T27N-R11W (1).

Crotalus viridis
Western Rattlesnake

Three described subspecies meet in the general area; more specimens are needed before referring the rattlesnakes of the study area to subspecies. The western rattlesnake appears quite rare in the study area, but probably occurs in all major habitats.

Localities: 1 mile northeast of Shiprock (Gehlbach, 1956, p. 371); Fruitland (Van Denburgh, 1924, p. 228); Gallegos Canyon, Sec. 9, T28N-R12W (1).

Birds

There have been relatively few bird studies in the San Juan Basin of New Mexico and no detailed studies covering all seasons and habitats. Thus, despite the generally more advanced state of ornithology in North America, the bird life of the study area is less well known in detail than the mammalian fauna or, probably, the reptilian and amphibian faunas.

The ability to cover long distances and the phenomenon of migration create special problems in geographic and ecologic studies of birds.

Until intensive study at all seasons is carried out on the avifauna of the area, these problems will prevent satisfactory knowledge of the birds of the study area.

Most of the records in the following list are, as is commonly the case with birds, based on sight identifications only. Thus not only would identification to subspecies be based almost entirely upon geographic range, but occasional lapses in specific identification may well have occurred. In view of the subspecific problems, which will be resolved only over a period of some years, birds are given only to species. Unpublished records are followed by the initials of the identifier (JD= John Darling; JSF= James S. Findley; AHH= Arthur H. Harris; DMN= David M. Niles) and/or, where backed by a specimen in the collections of the Museum of Southwestern Biology, by the initials MSWB. Where the observer has seen evidence of a bird breeding in the study area, or where a published record so states, the locality is followed by the word "breeds" in parentheses.

Many volumes have been devoted to the ecological and seasonal distribution of birds. The reader who wishes to delve deeper into these subjects may consult such works. Here, a very brief statement is given to align the reader to the most likely distribution in time and space. These statements are meant only as generalizations and omit the many finer details and exceptions. The descriptions of the localities shown in the List of Collection Stations later in these pages will give such details as are actually available for the study area itself.

Although the 142 kinds of birds listed below include most of the common and many of the more rare birds that occur in the area, there undoubtedly will be more added in both categories in the years to come.

Podiceps caspicus
Eared Grebe

Limited to relatively large areas of permanent water.

Localities: Nesting on two lakes at 9000 feet, south end of Chuska Mountains (F. Bailey, 1928, p. 77).

Podilymbus podiceps
Pied-billed Grebe

This bird, like the eared grebe, is found on bodies of permanent water.

Localities: Farmington (Bailey, 1928, p. 81).

Ardea herodias
Great Blue Heron

Water bodies containing vertebrate life may be visited by this large bird.

Localities: Small lakes in the Chuska Mountains among the yellow pines and aspens up to about 9000 feet (Bailey, 1928, p. 87); Farmington area (Evans and Taulbee, 1947, p. 106).

Nycticorax nycticorax
Black-crowned Night Heron

This is a bird found mainly around permanent waters.

Localities: Farmington-Aztec area (breeds) (Ligon, 1961, p. 340).

Anas platyrhynchos
Mallard

This duck may be found on almost any body of water during migration.

Localities: 3 miles east and 1 1/4 miles south of Farmington, San Juan River (JD); Chuska Mountains above 8000 feet. (Bailey, 1928, p. 111); Farmington area (Evans and Taulbee, 1947, p. 106).

Anas strepera
Gadwall

"Wherever there are lakes, ponds or marshes" (Ligon, 1961, p. 47).

Localities: Chuska Mountains to 8800 feet (Bailey, 1928, p. 115).

Anas carolinensis
Green-winged Teal

Virtually any body of water may support this bird during migration.

Localities: To 9000 feet in the Chuska Mountains (Bailey, 1928, p. 122); Farmington area (Evans and Taulbee, 1947, p. 106); 1 1/2 miles west of Farmington (MSWB).

Anas discors
Blue-winged Teal

The blue-winged teal may be found in temporary and other bodies of water, large or small.

Localities: Common to 8400 feet on top of Chuska Mountains during migration (Bailey, 1928, p. 125).

Mareca americana
American Widgeon

This bird occurs in lakes and rivers in migration and while wintering.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Aythya affinis
Lesser Scaup

The lesser scaup occurs in lakes and rivers during migration and while wintering.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Mergus merganser
American Merganser

Larger rivers and lakes are occupied by this fish-eater.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Cathartes aura
Turkey Vulture

This scavenger occurs in (or over) most habitats within the basin except in winter.

Localities: Near Shiprock (Bailey, 1928, p. 152); 3 miles east and 3 miles south of Farmington (JD, AHH); 5 miles north and 6 miles east of Newcomb (AHH); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, 4 miles west of Sheep Springs (AHH).

Accipiter gentilis
Goshawk

This bird of prey is generally found in mountain forests.

Localities: Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Accipiter striatus
Sharp-shinned Hawk

This hawk generally occurs in mountain forests, but may be found elsewhere in migration.

Localities: Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Buteo jamaicensis
Red-tailed Hawk

This common hawk is found almost everywhere that trees grow.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); about 12 miles south of Bloomfield (JD); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, Washington Pass (JSF).

Buteo swainsoni
Swainson's Hawk

This hawk usually is found in low, relatively open country; it is absent from the area in winter.

Localities: Near Shiprock (breeds) (Bailey, 1928, p. 168).

Buteo regalis
Ferruginous Hawk

The ferruginous hawk is concentrated in the lower country and up into pinyon-juniper woodland.

Localities: Fruitland (Bailey, 1928, p. 173).

Aquila chrysaetos
Golden Eagle

This large bird may be seen in any part of the study area.

Localities: 13 miles south 1/2 mile west of Bloomfield (JD); Chuska Mountains, apparently on breeding grounds (Bailey, 1928, p. 177).

Circus cyaneus
Marsh Hawk

This bird is restricted mostly to the lowlands in the study area.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chaco Wash west of Burnham (DMN); 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W (AHH).

Falco mexicanus
Prairie Falcon

This hawk nests in high cliff areas. It probably occurs throughout the lower portions of the study area where proper nesting areas are present.

Localities: 3 miles east and 3 miles south of Farmington, apparently nesting (JD).

Falco peregrinus
Peregrine Falcon

Usually about streams and larger lakes, this falcon may be found elsewhere on occasion, particularly in winter.

Localities: 4 miles east and 7 1/2 miles south of Farmington (JD).

Falco columbianus
Pigeon Hawk

This animal may be expected in almost any area during migration.

Localities: Shiprock (Ligon, 1961, p. 83).

Falco sparverius
Sparrow Hawk

The sparrow hawk may nest at most altitudes within the study area except, possibly, the higher portions of the Chuska Mountains; nesting usually is in trees. It may occur virtually anywhere during the fall.

Localities: Fruitland (MSWB); Farmington (JD); about 12 miles south of Bloomfield (JD); Washington Pass, Chuska Mountains (JSF).

Callipepla squamata
Scaled Quail

This game bird is most common in the lowlands, rarely occurring far into pinyon-juniper woodland.

Localities: More or less distributed in the San Juan Valley (Bailey, 1928, p. 215); 4 miles south and 1 mile east of Kirtland (JD); Farmington area (Evans and Taulbee, 1947, p. 106); Chaco Wash west of Burnham (DMN).

Lophortyx gambelii
Gambel's Quail

Introduced into the San Juan Basin, this quail is in many of the lower portions of the study area along the San Juan Valley.

Localities: San Juan Valley (Farmington) section (Ligon, 1961, p. 97); Farmington area (Evans and Taulbee, 1947, p. 106); 3 miles east and 3 miles south of Farmington (JD).

Phasianus colchicus
Ring-necked Pheasant

The pheasant, like Gambel's quail, is an introduced game bird in the study area. It probably is limited to the San Juan Valley immediately adjacent to the river.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Meleagris gallopavo
Turkey

Wild turkeys are limited to the pine forests of the Chuska Mountains.

Localities: Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Rallus limicola
Virginia Rail

This bird is a marsh dweller.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Fulica americana
American Coot

The coot occurs "wherever there are marshes, ponds, and lakes with rank growths of aquatic vegetation" (Ligon, 1961, p. 110).

Localities: Chuska Mountains, at about 8000 feet (Bailey, 1928, p. 245).

Charadrius vociferus
Killdeer

This shore bird is common around seeps, tanks, pools, and other water bodies in the lower portions of the study area and possibly high into the Chuska Mountains.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); 4 miles east and 7 1/2 miles south of Farmington (JD, AHH, MSWB); Tocito (AHH); 5 miles north of Newcomb (AHH).

Capella gellinago
Common Snipe

Common snipe are most common about marsh vegetation.

Localities: Near Farmington (Bailey, 1928, p. 256); Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains, about 9000 feet (Bailey, 1928, p. 256).

Actitis macularia
Spotted Sandpiper

The spotted sandpiper generally is found along stream and lake shores.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Tringa solitaria
Solitary Sandpiper

This shore bird generally occurs as a migrant around bodies of water.

Localities: 1 1/2 miles west of Farmington (MSWB).

Zenaidura macroura
Mourning Dove

Mourning doves are ubiquitous during the summer; it may winter in the area in small numbers.

Localities: Shiprock (Bailey, 1928, p. 301); Farmington area (Evans and Taulbee, 1947, p. 106); 3 miles east and 3 miles south of Farmington (AHH); 7 1/2 miles south and 4 miles east of Farmington (AHH); 8 miles south and 4 miles west of Shiprock Peak (AHH); Gallegos Canyon, Sec. 9, T28N-R12W (AHH); 3 miles north and 1/2 mile west of Sanostee (AHH); Chaco Wash, 14 miles south and 6 miles east of Shiprock (town) (AHH); Chaco Wash west of Burnham (breeds) (DMN); 5 miles north of Newcomb (AHH); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH).

Bubo virginianus
Great Horned Owl

This bird may be expected throughout the area.

Localities: Liberty (Bailey, 1928, p. 321); 7 1/2 miles south and 4 miles east of Farmington (AHH).

Specotyto cunicularia
Burrowing Owl

This owl is an inhabitant of open, low country, particularly in prairie dog towns.

Localities: Map shows general breeding range extending over the San Juan Basin (Bailey, 1928, p. 238, map).

Chordeiles minor
Common Nighthawk

Common nighthawks occur throughout the study area during the warmer portions of the year.

Localities: 4 miles east and 7 1/2 miles south of Farmington (JD); Chaco Wash west of Burnham (DMN); Chuska Mountains, 1 mile south of Toadlena (AHH); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, 4 miles west of Sheep Springs (AHH); Washington Pass, Chuska Mountains (JSF).

Aeronautes saxatalis
White-throated Swift

White-throated swifts generally breed only in cliff areas.

Localities: San Juan River, 3 miles east and 1 1/2 miles south of Farmington (JD); 3 miles east and 3 miles south of Farmington (JD, AHH).

Archilochus alexandri
Black-chinned Hummingbird

This small hummingbird may be expected in the more heavily vegetated portions of the study area during the warm part of the year.

Localities: Shiprock, 5000 feet (Ligon, 1961, p. 159).

Selasphorus platycercus
Broad-tailed Hummingbird

Forested mountains and probably along the San Juan River are likely places to look for this bird during the warm season.

Localities: Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, Washington Pass (JSF).

Megaceryle alcyon
Belted Kingfisher

As implied by its name, the kingfisher is found around fish-

bearing waters almost exclusively.

Localities: 1/2 mile southwest of Fruitland (JD); Farmington area (Evans and Taulbee, 1947, p. 106).

Colaptes cafer
Red-shafted Flicker

Wooded areas are the common habitats of this bird.

Localities: Shiprock (Bailey, 1928, p. 378); 1/2 mile southwest of Fruitland (JD); Farmington area (Evans and Taulbee, 1947, p. 106); Washington Pass, Chuska Mountains (JSF).

Melanerpes formicivorus
Acorn Woodpecker

Acorn woodpeckers are limited to forested mountain areas in the study area.

Localities: Chuska Mountains, 8500 feet (Bailey, 1928, p. 387); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH).

Asyndesmus lewis
Lewis' Woodpecker

This woodpecker occurs both in the wooded valleys and in the mountain forests.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Sphyrapicus varius
Yellow-bellied Sapsucker

The yellow-bellied sapsucker is found generally in the higher mountains in summer; it may enter the lower river valleys in winter.

Localities: Fruitland (Bailey, 1928, p. 395); Farmington area (Evans and Taulbee, 1947, p. 106); Washington Pass, Chuska Mountains (JSF).

Sphyrapicus thyroideus
Williamson's Sapsucker

This is a summertime dweller in the high mountain forests.

Localities: Chuska Mountains (breeds) (Bailey, 1928, p. 398, map).

Dendrocopos villosus
Hairy Woodpecker

Hairy woodpeckers may be expected wherever there are wooded areas.

Localities: Fruitland (Bailey, 1928, p. 403); Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Dendrocopos pubescens
Downy Woodpecker

This woodpecker occurs in much the same situations as does the hairy woodpecker.

Localities: Shiprock, 5000 feet (Bailey, 1928, p. 406); 1 1/2 miles west of Farmington (MSWB); Farmington area (Evans and Taulbee, 1947, p. 106).

Picoides tridactylus
Northern Three-toed Woodpecker

This woodpecker is limited to high mountain forests in the study area.

Localities: Chuska Mountains, 8800 to 9000 feet (breeds) (Bailey, 1928, p. 412).

Tyrannus verticalis
Western Kingbird

The western kingbird occurs mostly below pinyon-juniper woodland.

Localities: Shiprock (breeds) (Bailey, 1928, p. 416); Chaco Wash west of Burnham (DMN).

Tryannus vociferans
Cassin's Kingbird

Cassin's kingbird generally is found at somewhat higher altitudes than the western kingbird, in woodland and ponderosa pine forest.

Localities: Farmington-Aztec area (breeds) (Ligon, 1961, p. 340); 18 miles south and 2 1/2 miles west of Bloomfield (JD).

Myiarchus cinerascens
Ash-throated Flycatcher

This flycatcher generally occurs below heavily forested mountain areas.

Localities: Shiprock (breeds) (Bailey, 1928, p. 424); 4 miles east and 7 1/2 miles south of Farmington (JD, AHH, MSWB); about 12 miles south of Bloomfield (JD).

Sayornis nigricans
Black Phoebe

Black phoebes commonly occur in well-watered areas. The study area seems to be north of the general range of this bird.

Localities: 1/2 mile southwest of Fruitland (JD).

Sayornis saya
Say's Phoebe

Say's phoebe is most common in the lower, more arid portions of the basin and, probably, along the San Juan River.

Localities: 3 miles east and 7 1/2 miles south of Farmington (breeds) (JD).

Empidonax difficilis
Western Flycatcher

This bird usually breeds in higher mountain areas, but may occur at lower altitudes, particularly during migration.

Localities: Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (MSWB); Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Nuttallornis borealis
Olive-sided Flycatcher

Except in migration, this flycatcher usually is found in the high mountain areas.

Localities: Shiprock (Bailey, 1928, p. 445).

Eremophila alpestris
Horned Lark

The horned lark is one of the most common birds of the study area. It occurs throughout the lower portions of the basin, mostly below woodland growth.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); 7 miles east and 10 miles south of Farmington (AHH); 11 miles east and 13 miles south of Farmington (AHH); 14 miles south and 2 miles west of Farmington (AHH); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (AHH); 16 miles south and 1 mile west of Farmington (AHH) 12 miles south of Bloomfield (JD); 3 miles north and 1/2 mile west of Sanostee (AHH); Chaco Wash west of Burnham (DMN); 5 miles north of Newcomb (AHH); at Newcomb (AHH); 4 1/2 miles north and 1 1/2 miles east of Newcomb (AHH).

Tachycineta thalassina
Violet-green Swallow

Although generally more common in the mountain forests, violet-green swallows may occur also at lower altitudes along the San Juan River. They leave the state for the fall and winter seasons.

Localities: 3 miles east and 1 1/2 miles south of Farming-

ton, San Juan River (JD); Chuska Mountains (breeds) (Ligon, 1961, p. 341); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, Washington Pass (JSF).

Stelgidopteryx ruficollis
Rough-winged Swallow

This swallow is known in the study area only from appearance along the San Juan River.

Localities: Near Shiprock (breeds) (Bailey, 1928, p. 459).

Hirundo rustica
Barn Swallow

Barn swallows occur in the San Juan Valley and perhaps elsewhere in the basin and in the lower portions of the mountains. As with the other swallows, it leaves the area in winter.

Localities: 1/2 mile southwest of Fruitland (JD); Farmington-Aztec area (breeds) (Ligon, 1961, p. 340).

Petrochelidon pyrrhonota
Cliff Swallow

This is a common swallow in cliff areas, particularly along the San Juan River.

Localities: Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 462); 1/2 mile southwest of Fruitland (JD); 3 miles east and 3 miles south of Farmington (breeds) (JD, AHH); 8 miles south and 4 miles west of Shiprock Peak (AHH).

Progne subis
Purple Martin

This migrant occurs in the high mountains, particularly in ponderosa pine forest.

Localities: Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Cyanocitta cristata
Blue Jay

This is an eastern bird occurring only accidentally in the study area.

Localities: Fruitland (Ligon, 1961, p. 198).

Cyanocitta stelleri
Stellar's Jay

Stellar's jay lives in mountain forests in summer. In winter, it inhabits such forests but also may occasionally venture into the lowlands.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Bailey, 1928, p. 475, map); Chuska Mountains, Washington Pass (JSF).

Aphelocoma coerulescens
Scrub Jay

Scrub jays commonly occur in woodland growth.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains, 1 mile south of Toadlena (AHH).

Pica pica
Black-billed Magpie

The wooded and farmed areas of the San Juan Valley are inhabited by this showy bird.

Localities: Near Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 482); 1/2 mile southwest of Fruitland (JD); Farmington-Aztec area (breeds) (Ligon, 1961, p. 340); Farmington area (Evans and Taulbee, 1947, p. 106); Farmington (MSWB).

Corvus corax
Common Raven

Ravens are common over most or all of the study area.

Localities: Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 487); 8 miles south and 4 miles west of Shiprock Peak (AHH); Chaco Wash west of Burnham (DMN); 3 miles north and 1/2 mile west of Sanostee (AHH); Tocito (AHH); 5 miles north of Newcomb (AHH); 5 miles north and 6 miles east of Newcomb (AHH); Newcomb (AHH); Chuska Mountains, Washington Pass (JSF); 12 miles east and 7 miles south of Sheep Springs (AHH).

Corvus brachyrhynchos
Common Crow

This smaller relative of the raven is limited mainly to the river valley.

Localities: Farmington-Aztec area (breeds) (Ligon, 1961, p. 340).

Gymnorhinus cyanocephala
Pinyon Jay

As implied by the name, pinyon jays are commonest in the pinyon-juniper woodland habitat, but they may occur also in ponderosa pine forest.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Nucifraga columbiana
Clark's Nutcracker

This bird is limited to high mountain forests.

Localities: Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Parus atricapillus
Black-capped Chickadee

These chickadees occur in the vegetation along the river valleys in winter and probably in the higher mountain areas both in winter and summer.

Localities: Fruitland, 5000 feet (Bailey, 1928, p. 507); Farmington area (Evans and Taulbee, 1947, p. 106).

Parus gambeli
Mountain Chickadee

Mountain chickadees are common inhabitants of mountain areas in summer, some moving into the river valley habitats in winter.

Localities: Shiprock (Ligon, 1961, p. 208); Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Bailey, 1928, p. 509).

Parus inornatus
Plain Titmouse

This bird is found most often in pinyon-juniper woodland.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (Bailey, 1928, p. 511); Chuska Mountains, 1 mile south of Toadlena (AHH).

Psaltriparus minimus
Common Bushtit

Bushtits may appear in the lower portions of the area in winter, but in summer commonly are found in pinyon-juniper woodland.

Localities: Shiprock, 5000 feet (Bailey, 1928, p. 518); vicinity of the Chuska Mountains (Bailey, 1928, p. 519, map).

Sitta carolinensis
White-breasted Nuthatch

This bird seems to prefer ponderosa pine forest in summer, but sometimes descends into the lower river valley in winter.

Localities: Fruitland (Bailey, 1928, p. 522); Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds)

(Bailey, 1928, p. 522); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH).

Sitta pygmaea
Pigmy Nuthatch

Distribution of this nuthatch is similar to the white-breasted nuthatch.

Localities: Fruitland (Bailey, 1928, p. 525); Chuska Mountains (breeds) (Bailey, 1928, p. 525, map); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, Washington Pass (JSF).

Certhia familiaris
Brown Creeper

Brown creepers are mainly birds of the higher mountain forests, but some descend to lower altitudes in winter.

Localities: Near top of Chuska Mountains, about 9000 feet (breeds) (Bailey, 1928, p. 528); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, Washington Pass (JSF).

Cinclus mexicanus
Dipper

Dippers generally are found near high mountain streams, but some may descend to lower altitudes in winter.

Localities: Farmington area (Evans and Taulbee, 1927, p. 106).

Troglodytes aedon
House Wren

House wrens may be expected in any wooded areas.

Localities: Chuska Mountains (breeds) (Bailey, 1928, p. 536); Chuska Mountains, Washington Pass (JSF, MSWB).

Thryomanex bewickii
Bewick's Wren

This wren may occur in almost any wooded area.

Localities: Shiprock (Bailey, 1928, p. 540); Farmington-Aztec area (breeds) (Ligon, 1961, p. 341); Chuska Mountains (breeds) (Bailey, 1928, p. 539).

Telmatodytes palustris
Long-billed Marsh Wren

This is a bird of marshy areas along lakes and streams.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Catherpes mexicanus
Canyon Wren

Canyon wrens generally are found in rugged, rocky areas.

Localities: 4 miles south and 1 mile east of Kirtland (JD).

Salpinctes obsoletus
Rock Wren

Rock wrens occur anywhere in the study area where there are rocky outcrops.

Localities: Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 549, map); Farmington-Aztec area (breeds) (Ligon, 1961, p. 341); 4 miles east and 7 1/2 miles south of Farmington (JD); 3 miles north and 1/2 mile west of Sanostee (AHH); Chaco Wash west of Burnham (DMN); Chuska Mountains (breeds) (Bailey, 1928, p. 549, map); Chuska Mountains, 1 mile south of Toadlena (AHH).

Mimus polyglottos
Mockingbird

This common bird occurs from the lowest portions of the study area into the lower portions of the mountains.

Localities: Farmington (breeds (Bailey, 1928, p. 551); Gallegos

Canyon, Sec. 9, T28N-R12W (AHH); 7 1/2 miles south and 4 miles east of Farmington (breeds) (JD, AHH); 12 miles south of Bloomfield (JD); Chaco Wash west of Burnham (DMN, MSWB); 5 miles north of Newcomb (AHH); Newcomb (AHH).

Dumetella carolinensis
Catbird

The catbird is an eastern bird reported from the area only once.

Localities: Shiprock (Bailey, 1928, p. 554).

Oreoscoptes montanus
Sage Thrasher

This bird's summer and nesting range is in big sagebrush; in winter, it is entirely or mostly out of the area.

Localities: Shiprock (breeds) (Bailey, 1928, p. 560); 12 miles south of Bloomfield (JD).

Turdus migratorius
Robin

Robins inhabit the mountain forests and the river valley habitats, with some wintering in the latter. They may occur ocasionally in the better developed riparian growths along dry washes in summer.

Localities: Farmington-Aztec area (breeds) (Ligon, 1961, p. 340); Farmington area (Evans and Taulbee, 1947, p. 106); 3 miles east and 3 miles south of Farmington (JD); Chaco Wash west of Burnham (DMN); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (AHH); Chuska Mountains, Washington Pass (JSF).

Hylocichla guttata
Hermit Thrush

This thrush inhabits high mountain areas in summer and may be found in low areas with considerable vegetative cover during migration.

Localities: Shiprock, 5000 feet (Bailey, 1928, p. 571); Chuska Mountains, 8800 feet (Bailey, 1928, p. 571); Chuska Mountains (breeds) (Ligon, 1961, p. 341); Chuska Mountains, Washington Pass (JSF).

Sialia mexicana
Western Bluebird

These birds mostly inhabit open mountain forest in summer, moving to lower country in late summer before migrating from the area.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains, Washington Pass (JSF).

Sialia currucoides
Mountain Bluebird

Mountain bluebirds inhabit the high forests in summer, moving to lower country in winter.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Myadestes townsendi
Townsend's Solitaire

The distribution of Townsend's solitaire in the study area is similar to that of the mountain bluebird.

Localities: Fruitland, 5000 feet (Bailey, 1928, p. 580); Chuska Mountains (breeds) (Bailey, 1928, p. 580).

Polioptila caerulea
Blue-gray Gnatcatcher

This small bird is most common in pinyon-juniper woodland, but may be found in lower wooded areas during migration.

Localities: Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 583).

Regulus satrapa
Golden-crowned Kinglet

This kinglet generally dwells in the high mountain forests, but may appear in the lower wooded areas in migration and possibly wintering.

Localities: Chuska Mountains (Bailey, 1928, p. 585).

Regulus calendula
Ruby-crowned Kinglet

This is the common kinglet of the area, occurring in the high mountains in summer and with some wintering at lower elevations.

Localities: Fruitland, 5000 feet (Bailey, 1928, p. 586); Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Bombycilla cedrorum
Cedar Waxwing

This bird is most likely to occur in the vegetation of the San Juan Valley.

Localities: Shiprock (Bailey, 1928, p. 593).

Lanius ludovicianus
Loggerhead Shrike

This bird is common throughout the lower portions of the study area into pinyon-juniper woodland.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); about 12 miles south of Bloomfield (JD); 3 miles east and 3 miles south of Farmington (AHH); 7 miles south and 6 miles west of Bloomfield (AHH); 14 miles south and 2 miles west of Farmington (AHH); Chaco Wash west of Burnham (DMN, MSWB); 5 miles north of Newcomb (AHH); 5 miles north and 6 miles east of Newcomb (AHH); 12 miles east and 7 miles south of Sheep Springs (AHH, MSWB).

Sturnus vulgaris
Starling

The starling has been introduced into the New World. It now occurs in the San Juan Valley.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Vireo gilvus
Warbling Vireo

This bird may be found in mountain forests and in vegetation along the San Juan River.

Localities: Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 606); 1 1/2 miles west of Farmington (MSWB); Chuska Mountains, Washington Pass (JSF).

Vermivora luciae
Lucy's Warbler

This warbler apparently is accidental in the San Juan Valley.

Localities: Shiprock (Bailey, 1928, p. 609).

Dendroica petechia
Yellow Warbler

The yellow warbler may be found in river valley vegetation and in the lower mountain forests.

Localities: Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 613).

Dendroica audubonl
Audubon's Warbler

This migrant occurs in the mountain forests and in the San Juan Valley.

Localities: Shiprock, 5500 feet (Bailey, 1928, p. 618); Chuska Mountains, Washington Pass (JSF).

Dendroica nigrescens
Black-throated Gray Warbler

Distribution patterns of this warbler are similar to those of the Audubon's warbler.

Localities: Shiprock (Ligon, 1961, p. 251); Chuska Mountains (Ligon, 1961, p. 251).

Seiurus noveboracensis
Northern Waterthrush

Dense vegetation along streams and lakes is inhabited by this bird. It is a migrant.

Localities: Shiprock (Bailey, 1928, p. 626); 1/2 mile west of Farmington (MSWB).

Oporornis tolmiei
MacGillivray's Warbler

This warbler occurs in the mountain forests and, probably, in the San Juan Valley during migration.

Localities: Chuska Mountains (breeds) (Bailey, 1928, p. 627).

Geothlypis trichas
Yellowthroat

Yellowthroats generally are found around rank pond or stream edge vegetation.

Localities: Shiprock (Bailey, 1928, p. 628); Farmington-Aztec area (breeds) (Ligon, 1961, p. 340).

Icteria virens
Yellow-breasted Chat

Thick, brushy vegetation in the San Juan Valley is inhabited by this bird.

Localities: Shiprock (breeds) (Bailey, 1928, p. 630); Farmington-Aztec area (breeds) (Ligon, 1961, p. 340).

Setophaga ruticilla
American Redstart

The American redstart apparently is a rare wanderer into the area.

Localities: Shiprock (Bailey, 1928, p. 633).

Passer domesticus
House Sparrow

The house sparrow has been introduced into North America. In the study area, it is found predominately about settlements.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Newcomb (AHH).

Sturnella neglecta
Western Meadowlark

Meadowlarks usually are found in areas of good grass cover.

Localities: Along the San Juan River (Bailey, 1928, p. 642); Farmington area (Evans and Taulbee, 1947, p. 106).

Xanthocephalus xanthocephalus
Yellow-headed Blackbird

This bird almost undoubtedly occurs along the San Juan River and apparently in local marshy areas elsewhere in the lower portions of the basin. It migrates from the area in winter.

Localities: Chaco Wash west of Burnham (DMN).

Agelaius phoeniceus
Red-winged Blackbird

This blackbird occurs in marshy areas along the San Juan Rivers.

Localities: Shiprock (breeds) (Bailey, 1928, p. 646, map); Liberty (Bailey, 1928, p. 646;

map); Fruitland (Bailey, 1928, p. 649); Farmington (breeds) (Bailey, 1928, p. 646, map); Farmington area (Evans and Taulbee, 1947, p. 106); 1/2 mile southwest of Fruitland (JD).

Icterus bullocki
Bullock's Oriole

This oriole is known from along the San Juan Valley. It leaves the area in winter.

Localities: Shiprock (breeds) (Bailey, 1928, p. 654); Farmington-Aztec area (breeds) (Ligon, 1961, p. 654).

Euphagus cyanocephalus
Brewer's Blackbird

"They prefer grassy meadows with sparse wooded borders." (Ligon, 1961, p. 264). They also occur about small seeps and other areas of permanent or semi-permanent water in the lower portions of the study area.

Localities: 1/2 mile southwest of Fruitland (JD); Farmington (Bailey, 1928, p. 657); 5 miles north of Newcomb (AHH, MSWB).

Cassidix mexicanus
Boat-tailed Grackle

This bird occurs in marshy areas.

Localities: Farmington-Aztec area (breeds) (Ligon, 1961, p. 340).

Molothrus ater
Brown-headed Cowbird

These cowbirds are found in the river valley vegetation.

Localities: Shiprock (breeds) (Bailey, 1928, p. 660); Fruitland (Bailey, 1928, p. 660).

Piranga ludoviciana
Western Tanager

Western tanagers occur primarily in mountain forests, but also into pinyon-juniper growth and in river valley habitats. They leave the area in winter.

Localities: 1/2 mile southwest of Fruitland (JD); Chuska Mountains, Washington Pass (JSF).

Pheucticus melanocephalus
Black-headed Grosbeak

The black-headed grosbeak occurs during the warmer seasons in the mountainous areas of the basin.

Localities: Chuska Mountains, Washington Pass (JSF).

Guiraca caerulea
Blue Grosbeak

Blue grosbeaks occur in the lower portions of the basin about thick vegetation.

Localities: Shiprock (Bailey, 1928, p. 677); Chaco Wash west of Burnham (breeds) (DMN, MSWB).

Passerina amoena
Luzuli Bunting

This bird inhabits "timbered watercourses and streambank cover, particularly willows, ..." (Ligon, 1961, p. 271).

Localities: Shiprock (Bailey, 1928, p. 679); Farmington-Aztec area (breeds) (Ligon, 1961, p. 341).

Carpodacus mexicanus
House Finch

House finches occur in irrigated valleys, in settlements, and in the mountains into the pine belt.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Newcomb (AHH).

Spinus pinus
Pine Siskin

These birds are in mountain forests in summer, in foothills and valleys in winter.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Ligon, 1961, p. 341).

Spinus tristis
American Goldfinch

American goldfinches commonly are found in the river valley vegetation.

Localities: Shiprock (Ligon, 1961, p. 279); Farmington (Ligon, 1961, p. 279); Farmington area (Evans and Taulbee, 1947, p. 106).

Spinus psaltria
Lesser Goldfinch

This goldfinch occurs in irrigated valleys and probably other places in the lower portions of the area where large amounts of weeds grow.

Localities: Shiprock, about 5000 feet (Bailey, 1928, p. 703).

Loxia curvirostra
Red Crossbill

This record of a crossbill was of a bird unidentified to species; it is, however, most likely this species.

Localities: Chuska Mountains at 8300 feet (Bailey, 1928, p. 708).

Chlorura chlorura
Green-tailed Towhee

This towhee occurs mostly in the higher mountains, particularly in brushy areas. It migrates from the area in winter.

Localities: Chuska Mountains, Washington Pass (JSF).

Pipilo erythrophthalmus
Rufous-sided Towhee

The rufous-sided towhee occurs in mountain areas in summer; in winter, some remain in the area in the lower, well vegetated portions of the region.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Calamospiza melanocorys
Lark Bunting

This is a bird of the valleys and open lowlands.

Localities: Shiprock (Bailey, 1928, p. 720).

Chondestes grammacus
Lark Sparrow

Lark sparrows usually occur in more open areas, but may be found into pinyon-juniper woodland or even open pine forest.

Localities: Foothills of the Chuska Mountains (Bailey, 1928, p. 727).

Amphispiza bilineata
Black-throated Sparrow

This sparrow occurs throughout most of the lower portions of the basin.

Localities: Shiprock (Ligon, 1961, p. 293); 7 1/2 miles south and 4 miles east of Farmington (AHH, MSWB); about 12 miles south of Bloomfield (JD); Chaco Wash west of Burnham (DMN).

Amphispiza belli
Sage Sparrow

Big sagebrush is the most common habitat of this sparrow.

Localities: Farmington-Aztec area (breeds) (Ligon, 1961, p. 341); about 12 miles south of Bloomfield (JD).

Junco hyemalis
Slate-colored Junco

Slate-colored juncos apparently are quite rare in the San Juan Basin; when they occur, they are winter visitors.

Localities: Shiprock (Ligon, 1961, p. 296).

Junco oreganus
Oregon Junco

This junco may be expected almost anywhere in the basin during the winter.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains, ranging from 9000 feet on top of the mountains down to 5000 feet at Shiprock and the San Juan Valley (Bailey, 1928, p. 738).

Junco caniceps
Gray-headed Junco

This bird occurs mostly in mountain forests, but also into lower valleys in winter.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains (breeds) (Ligon, 1961, p. 341); Chuska Mountains, 3 miles west and 2 miles north of Toadlena (AHH); Chuska Mountains, Washington Pass (JSF).

Spizella arborea
Tree Sparrow

This sparrow is a winter visitor to the valley area.

Localities: Shiprock (Bailey, 1928, p. 744).

Spizella passerina
Chipping Sparrow

This is a migratory sparrow generally found in wooded areas.

Localities: Shiprock, 5000 feet (breeds) (Bailey, 1928, p. 745); Chaco Wash west of Burnham (DMN).

Spizella breweri
Brewer's Sparrow

Brewer's sparrow occurs mainly in big sagebrush habitats.

Localities: Farmington-Aztec area (breeds) (Ligon, 1961, p. 340); about 12 miles south of Bloomfield (JD).

Zonotrichia querula
Harris' Sparrow

This is a rare wanderer from more easterly regions.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106).

Zonotrichia leucophrys
White-crowned Sparrow

Present in the river valley in winter, this sparrow probably is entirely absent from the study area in summer.

Localities: Shiprock (Bailey, 1928, p. 753); Farmington area (Evans and Taulbee, 1947, p. 106).

Passerella iliaca
Fox Sparrow

This large sparrow is present in the higher mountain areas in winter.

Localities: Chuska Mountains near Cottonwood Pass, 8500 feet (Bailey, 1928, p. 730).

Melospiza lincolnii
Lincoln's Sparrow

Lincoln's sparrow is present in migration in the river valley.

Localities: Shiprock (Bailey, 1928, p. 759).

Melospiza melodia
Song Sparrow

Song Sparrows occur in high mountain habitats and, in winter, in the lower river valleys.

Localities: Farmington area (Evans and Taulbee, 1947, p. 106); Chuska Mountains, 8500 feet (Bailey, 1928, p. 757).

Mammals

The kinds of mammals from the study area probably are quite well known in the sense that relatively few kinds actually present are not recorded. In the latter category probably are several carnivores, such as raccoon, ring-tail, spotted skunk, and bear. Other "missing" members of the fauna likely are few in numbers or trap-shy. In this category are such possibilities as the desert shrew and Merriam's shrew.

Ecologically, the mammals are less well known. This study, a study in the nearby Navajo Reservoir District (Harris, 1963), and other studies by myself in the San Juan Basin supply the bulk of detailed ecological data for most of the mammalian fauna. At the present stage of knowledge, limiting factors can only be surmised in most cases.

Sorex vagrans
Vagrant Shrew

A shrew from the Chuska Mountains was assigned by Findley (1955, p. 51) to S. v. monticola, with the remark that there is a broad zone of intergradation with S. v. obscurus. This small insectivore is known only from the ponderosa pine-Douglas fir forest of the Chuska Mountains with the study area.

Localities: Chuska Mountains, Washington Pass, 6 miles east of Crystal (3).

Myotis yumanensis
Yuma Myotis

Pending further work on this bat, the specimen from the study area is not assigned to subspecies. In general, it fits in with the dark specimens recorded by Harris and Findley (1962, p. 198). The specimen was taken in a mist net over a spring-fed pool formed by the collapse of part of an arroyo wall over the arroyo channel (Fig. 27).

Localities: Tocito (1).

Myotis evotis
Long-eared Myotis

The nominate subspecies is present within the study area. Specimens were taken in mist nets over a cattle tank in ponderosa pine-Douglas fir forest.

Localities: Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1) (1, CNM).

Myotis thysanodes
Fringed Myotis

The study area is within the geographic range of M. t. thysanodes. The specimen from the study area was taken at the same place as were those of M. evotis.

Localities: Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1).

Myotis californicus
California Myotis

Specimens from the study area are referred to M. c. stephensi. Unlike the preceding species of Myotis, the California myotis is most common at lower

altitudes. It usually is found flying in the vicinity of cliffs and rock outcrops, often in association with Pipistrellus hesperus. One individual was taken from behind a large boulder leaning against a cliff face. It is believed to have flown from behind a nearby slab of rock where Tadarida brasiliensis and Antrozous pallidus also were roosting (see T. brasiliensis account for further details).

Localities: 3 miles east and 3 miles south of Farmington (1); 8 miles south and 4 miles west of Shiprock Peak (2); about 3 miles north and 1/2 mile west of Sanostee (1).

Myotis subulatus
Small-footed Myotis

The study area is well within the geographic range of M. s. melanorhinus. The small-footed myotis is somewhat intermediate in altitudinal range, occurring sparingly at lower altitudes and continuing upward in somewhat greater numbers into ponderosa pine-Douglas fir forest.

Localities: About 2 miles south and 2 miles west of Bloomfield (1); 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W (1); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (3) (1, CNM).

Lasionycteris noctivagans
Silver-haired Bat

This is a monotypic species. The animal is most common in high mountain forest, but has been taken elsewhere in the basin in well developed pinyon-juniper woodland.

Localities: Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (2) (1, CNM).

Pipistrellus hesperus
Western Pipistrelle

The subspecific taxonomy of this bat in northwestern New Mexico seems somewhat complex. Until thorough studies are carried out, the pipistrelles of the study area are referred to P. h. hesperus.

This pipistrelle is a lowland bat, commonly found around cliffs and rock outcrops and about large wash vegetation. Elsewhere in the basin, it has been taken in pinyon-juniper growth, but only sparingly.

Localities: About 3 miles east and 3 miles south of Farmington (3); 8 miles south and 4 miles west of Shiprock Peak (1); Tocito (4); 5 miles north of Newcomb (6); Chaco Wash west of Burnham (1).

Eptesicus fuscus
Big Brown Bat

Eptesicus fuscus pallidus is the subspecies of the Rocky Mountains and Southwest. The big brown bat is common in the high mountain forests. It occurs also to the lower portions of the pinyon-juniper woodland, but usually is sparse in such habitat. It has not been taken below pinyon-juniper growth in the study area.

Localities: About 3 miles east and 3 miles south of Farmington (1); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1).

Lasiurus cinereus
Hoary Bat

Lasiurus cinereus cinereus occurs in continental United States.

The hoary bat has been taken only in ponderosa pine-Douglas fir

forest in the study are, but probably occurs at times in lower, well vegetated areas.

Localities: Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (4) (4, CNM).

Antrozous pallidus
Pallid Bat

Antrozous pallidus pallidus is the subspecies of the study area. It is present in largest numbers in the lower portions of the study area, but also is found at higher altitudes, into ponderosa pine-Douglas fir forest. A common type of roost is a loosened slab of sandstone having an inch or two of space between the slab and the cliff face.

Localities: 3 miles east and 3 miles south of Farmington (1); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); 8 miles south and 4 miles west of Shiprock Peak (1); 16 miles south and 1 mile west of Farmington (1); Tocito (5); 5 miles north of Newcomb (4); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1) (4, CNM).

Tadarida brasiliensis
Brazilian Free-tailed Bat

The subspecies of western United States is T. b. mexicana. The only specimens from the San Juan Basin of New Mexico are from the study area. Two specimens were collected from behind a slab of sandstone along cliffs forming the south canyon wall of the San Juan River. Approximately a dozen individuals were present in association with a greater number of pallid bats and, apparently, a California myotis. Other specimens were mist netted over a spring-fed pool in a deep arroyo.

Localities: 3 miles east and 3 miles south of Farmington (2); Tocito (7).

Sylvilagus nuttallii
Nuttall's Cottontail

Nuttall's cottontail from the Chuska Mountains has been referred to the subspecies S. n. pinetis (V. Bailey, 1931, p. 60). This cottontail is known from the higher portions of the Chuska Mountains only. Farther north, in the Navajo Reservoir District, it is known to occur in well developed pinyon-juniper growth, and may occur in similar habitat in the Chuskas.

Localities: Chuska Mountains, Washington Pass, 6 miles east of Crystal (1).

Sylvilagus audubonii
Desert Cottontail

The cottontail of the lower portions of the San Juan Basin in New Mexico has been assigned to the subspecies S. a. warreni (V. Bailey, 1931, p. 59).

The desert cottontail commonly extends into pinyon-juniper woodland at the upper end of its altitudinal range. In some places, at least, it thus is brought into close association with Nuttall's cottontail. Below this habitat, it is almost ubiquitous where good cover in the form of plants, rocks, or large animal burrows occurs.

Localities: Fruitland (Nelson, 1909, p. 232); about 3 miles east and 3 miles south of Farmington (sight); Gallegos Canyon, Sec. 9, T28N-R12W (sight); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (sight; 7 1/2 miles south and 4 miles east of Farmington, SE 1/4 SE 1/4 Sec. 31, T28N-R12W (sight); 9 miles south and 6 1/2 miles west of Bloomfield (2); 11 miles east and 13 miles south of Farmington (sight); 3 miles north and 1/2 mile west of Sanostee (sight); Tocito (sight); Chaco Wash, 6 1/2 miles east and 5 1/2 miles north of Newcomb (sight); 5 miles north and 6 miles east of Newcomb (sight).

Lepus californicus
Black-tailed Jack Rabbit

Lepus californicus texianus is the subspecies ascribed to northwestern New Mexico. This large lagomorph commonly is found in areas of shrubs high enough to provide cover but not so high or so dense as to prevent the animal from watching approaching or pursuing enemies. Thus it occurs most commonly in sagebrush and amidst the growth along washes. In some areas, it occurs in open pinyon-juniper woodland and even into the lowest portions of ponderosa pine forest, but generally in small numbers. It has not been observed in these habitats in the study area. Open grassland is sparsely inhabited or uninhabited unless good cover is nearby.

Localities: Fruitland (Nelson, 1909, p. 145); about 3 miles east and 3 miles south of Farmington (sight); 7 1/2 miles south and 4 miles east of Farmington, SE 1/4 SE 1/4 Sec. 31, T27N-R12W (sight); 11 miles east and 13 miles south of Farmington (sight); Chaco Wash, 14 miles south and 6 miles east of Shiprock (town) (sight); Chaco Wash west of Burnham (sight); Chaco Wash, 6 1/2 miles east and 5 1/2 miles north of Newcomb (sight); about 1 mile east of Tocito (sight).

Eutamias minimus
Least Chipmunk

Eutamias minimus operarius has been reported from the Chuska Mountains, presumably from ponderosa pine-Douglas fir forest.

Localities: Chuska Mountains (V. Bailey, 1931, p. 90).

Eutamias dorsalis
Cliff Chipmunk

The cliff chipmunks of the study area are in a northern extension of the range of E. d. dorsalis. The specimen from the study area extends the known geographic range of the cliff chipmunk in this region some thirty airline miles north of published records. It probably continues north to at least Beautiful Mountain. The cliff chipmunk probably is limited to the pinyon-juniper zone in the study area.

Localities: Chuska Mountains, about 1 mile south of Toadlena (1); Chuska Mountains, 4 miles west of Sheep Springs (sight).

Eutamias quadrivittatus
Colorado Chipmunk

Specimens from the study area have been said to be intergrades between E. q. quadrivittatus and E. q. hopiensis, but referable to the former (White, 1953, p.568).

Along the cliffs of the San Juan Valley's south wall, and canyon walls of tributaries, the Colorado chipmunk occurs in extremely sparse pinyon-juniper growth. Indeed, pinyon often is absent or represented by only a few individual trees. In the Chuska Mountains, the animal was seen only in the higher portions, in ponderosa pine-Douglas fir forest and oak savanna.

Localities: About 3 miles east and 3 miles south of Farmington (4); Chuska Mountains about 2 miles west and 1 mile north of Toadlena (1); Chuska Mountains, Washington Pass, 6 miles east of Crystal (14).

Citellus leucurus
White-tailed Antelope Squirrel

At present, these ground squirrels are referred to C. l. pennipes. Studies are underway to determine if noticeable intergradation is occurring with C. l. cinnamomeus, which supposedly contacts the range of this subspecies in the Four Corners area.

This species is the common ground squirrel throughout the lowest portions of the San Juan Basin

and as high as sparse pinyon-juniper woodland. It perhaps is commonest in somewhat level, nonrocky areas, but occurs also about rocks and even in cliff areas. It occurs sympatrically with E. quadrivittatus along the southern edge of the San Juan Valley, with E. dorsalis in the foothills of the Chuskas, and with C. spilosoma wherever the latter occurs. There may be a slight preference for sandy areas in the low portions of the area, but harder substrata are utilized also.

Localities: Shiprock (Howell, 1938, p. 176); Fruitland (V. Bailey, 1931, p. 95); 7 miles west and 3 1/2 miles south of Farmington, Ojo Amarillo Canyon (sight); about 3 miles east and 3 miles south of Farmington (4); 6 1/2 miles west and 4 miles south of Farmington, Ojo Amarillo Canyon (sight); Chaco Wash, 14 miles south and 6 miles east of Shiprock (town) (2); 7 miles south and 6 miles west of Bloomfield Sec. 4, T27N-R12W (3); 7 miles east and 10 miles south of Farmington (1); 11 miles east and 13 miles south of Farmington (1); Chaco Wash west of Burnham (1); 5 miles north and 6 miles east of Newcomb (4); Newcomb (4) (2, CNM); Chuska mountains, 4 miles west of Sheep Springs (1) (1, CNM); about 12 miles east and 7 miles south of Sheep Springs (5).

Citellus spilosoma
Spotted Ground Squirrel

The taxonomy of this animal, as with most other grassland mammals of the San Juan Basin of New Mexico, is currently under study. The study area is, at present, included within the geographic range of C. s. cryptospilotus.

The spotted ground squirrel is most common in the grasslands in the Gallegos Mesa area. The specimen from Tocito Arroyo probably indicates a population along the east base of the Chuska Mountains and Beautiful Mountain. Most specimens are from moderately to very sandy areas. A few are from more consolidated substrata.

Localities: Chaco Wash, 14 miles south and 6 miles east of Shiprock (town) (5); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (1); 11 miles east and 13 miles south of Farmington (2); 14 miles south and 2 miles west of Farmington (1); 12 miles south of Bloomfield (1); Tocito (1); Chaco Wash west of Burnham (2).

Citellus variegatus
Rock Squirrel

The geographic range of C. v. grammurus includes the study area. This large ground squirrel is absent from most of the study area. It occurs sparsely in the cliffs on the south side of the San Juan Valley and has been seen in pinyon-juniper woodland in the Chuska Mountains. It probably occurs to the highest portions of the Chuskas.

Localities: Gallegos Canyon, Sec. 9, T28N-R12W (sight); about 1 mile south of Toadlena (sight); Chuska Mountains (V. Bailey, 1931, p. 107).

Citellus lateralis
Golden-mantled Ground Squirrel

This ground squirrel occurs in the Chuska Mountains, within the geographic range of C. l. lateralis. It has not been oberved below ponderosa pine forest in the Chuska Mountains, but is common there.

Localities: Chuska Mountains about 3 miles west and 2 miles north of Toadlena (2); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1); Chuska Mountains, Washington Pass, 6 miles east of Crystal (19).

Cynomys gunnisoni
Gunnison's Prairie Dog

Cynomys gunnisoni zuniensis occurs in the study area. This large rodent is common in the grasslands of the study area. One town extends along US 666 for about two miles. They also occur in the higher portions of the Chuska Mountains. In the study area, the limiting factor appears to be the necessity for grasses. Thus the animal is absent in many of the less vegetated portions of the study area.

Field archaeologists of the Museum of New Mexico reported one area where there were chocolate-brown prairie dogs together with normally colored individuals. On checking, I found that a portion of that town (near Tocito) was dug into a stratum of dark, carbonaceous shale; those animals living in these burrows were extremely dark in color due to shale powder in their pelage and were very conspicuous.

Localities: North side of valley at Fruitland (V. Bailey, 1931, p. 129); Farmington (sight); Sec. 28, T28N-R13W (1); 5 1/2 miles east and 1/2 mile south of Shiprock Peak (sight); 26 miles north by road of Newcomb, on US Highway 666 (1) (1, CNM); 25 miles north by road of Newcomb, on US Highway 666 (1); 1 mile northwest of Tocito (2); Chuska Mountains (Hollister, 1916, p. 34).

Sciurus aberti
Abert's Squirrel

The type locality of S. a. chuskensis is the Chuska Mountains, 9000 feet, New Mexico.

Bailey (1931, p. 73) states that "These squirrels are common all through the yellow-pine forest of the Chuska Mountains." Abert's squirrel is limited rather strictly to ponderosa pine forest in other areas. There are no locality records for the animal that definitely are within the study area.

Tamiasciurus hudsonicus
Red Squirrel

Specimens from the Chuska Mountains have been assigned to the subspecies T. h. mogollonensis. Red squirrels occur in areas of Douglas fir in the high portions of the Chuska Mountains.

Localities: Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (sight); Chuska Mountains, Washington Pass, 6 miles east of Crystal (5).

Thomomys bottae
Southern Pocket Gopher

Two subspecies of this rodent occur in the study area. In the mountainous areas is T. b. perampulus; in the lowlands, T. b. aureus. The mountain subspecies is quite common in the high meadows of the Chuska Mountains. The lowland subspecies may be common in the San Juan Valley, but is of local occurrence elsewhere; sandy areas along washes appear most suitable, but populations are spotty in such situations and the animals also may appear some distance from washes. Lowland areas deficient in vegetation are uninhabited.

Localities: Shiprock (V. Bailey, 1915, p. 75); Fruitland (V. Bailey, 1915, p. 75); about 3 miles east and 3 miles south of Farmington (1); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (1); 7 miles east and 10 miles south of Farmington (1); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1, CNM); 4 miles west and 5 miles south of Sheep Springs (5).

Thomomys talpoides
Northern Pocket Gopher

Thomomys talpoides fossor is the subspecies of northern pocket gopher in the study area. This gopher is limited in distribution in the study area to the high portions of the Chuska Mountains.

Localities: Chuska Mountains, Washington Pass, 6 miles east of Crystal (3).

Perognathus flavus
Silky Pocket Mouse

Silky pocket mice from the San Juan Basin of New Mexico have been included in the subspecies P. f. hopiensis. Recent studies (Harris, Ms.), however, indicate no subspecific difference between silky pocket mice from this area and from near Albuquerque where P. f. flavus supposedly occurs.

Silky pocket mice are relatively uncommon in the study area, but occur from the lowest portions into sparse pinyon-juniper growth. They commonly are taken on harder ground than are Apache pocket mice, but also do occur with them in small numbers.

Localities: Shiprock (Goldman, 1932, p. 90); Fruitland (Goldman, 1932, p. 90); about 3 miles east and 3 miles south of Farmington (2); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (1); Chaco Wash. 14 miles south and 6 miles east of Shiprock (town) (1); Tocito (1); 5 miles north and 5 miles east of Newcomb (1); 5 miles north and 6 miles east of Newcomb (1); Newcomb (1, CNM); Chuska Mountains, 4 miles west of Sheep Springs (1).

Perognathus apache
Apache Pocket Mouse

The study area is in the geographic range of P. a. apache. Apache pocket mice are the common pocket mice of the study area. They are particularly abundant in sand dune areas, but occur in fair numbers throughout the lower portions of the study area where the substratum is at least moderately sandy. They have not been taken in or above the pinyon-juniper woodland.

Localities: 3 miles east and 3 miles south of Farmington (1); Gallegos Canyon, Sec. 9, T28N-R12W (1); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); Gallegos Canyon, 5 miles east and 7 1/2 miles south of Farmington (1); Chaco Wash, 14 miles south and 6 miles east of Shiprock (town) (47); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (2); 7 miles east and 10 miles south of Farmington (2); 11 miles east and 13 miles south of Farmington (1); 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W (2); 5 miles north and 5 miles east of Newcomb (1); Newcomb (1).

Dipodomys ordii
Ord's Kangaroo Rat

Dipodomys ordii longipes is the subspecies ascribed to the study area. This rat is found throughout the lower portions of the study area, into the lower edges of pinyon-juniper woodland. In areas of hard soil, the animal is rare; in moderately to very sandy substrata, it may be abundant locally. In sparse pinyon-juniper growth west of Sheep Springs, its burrows were present along the edge of a grassy, overgrazed meadow, in soft sand and associated with big sagebrush and other shrubs.

Localities: Shiprock (Setzer, 1949, p. 558); Fruitland (Setzer, 1949, p. 558); Gallegos Canyon, Sec. 9, T28N-R12W (2); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (sight);

Gallegos Canyon, 5 miles east and 7 1/2 miles south of Farmington (1); 8 miles south and 4 miles west of Shiprock Peak (1); Chaco Wash, 14 miles south and 6 miles east of Shiprock (town) (25); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (1); 7 miles east and 10 miles south of Farmington (1); Tocito (2); 5 miles north and 6 miles east of Newcomb (sight); 5 miles north and 5 miles east of Newcomb (1); Chaco Wash west of Burnham (4); Newcomb (3); Chuska Mountains, 4 miles west of Sheep Springs (burrows).

Dipodomys spectabilis
Banner-tailed Kangaroo Rat

The banner-tailed kangaroo rats of the New Mexican San Juan Basin have been described as a distinct subspecies, D. s. clarenci (Goldman, 1933, p. 467). This large rodent is limited to the better grassed areas of the study area.

Localities: Near Fruitland and near Bloomfield, north side San Juan River (V. Bailey, 1931, p. 260); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (2); Gallegos Store, 10 miles south and 7 miles west of Bloomfield (1); about 4 miles west and 12 1/2 miles south of Shiprock Peak (burrows).

Reithrodontomys megalotis
Western Harvest Mouse

Reithrodontomys megalotis aztecus occurs in the study area. Croplands, marshes, meadows, and vegetated washes commonly are inhabited by this mouse. Usually, some grasses (or sedges) are present, but such may be sparse. Southwest of Shiprock Peak, it was found living in dense grass growing in hollows on otherwise bare sandstone. It occurs at all altitudes available in the study area.

Localities: Fruitland (Howell, 1914, p. 30); 1 1/2 miles west of Farmington (4); Farmington (1); 1 1/2 miles west of Bloomfield (10); Bloomfield (1); Gallegos Canyon, Sec. 9, T28N-R12W (4); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); 8 miles south and 4 miles west of Shiprock Peak (1, CNM); 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W (2); Tocito (1); Chaco Wash west of Burnham (4); Chuska Mountains, Washington Pass (4).

Peromyscus crinitus
Canyon Mouse

Peromyscus crinitus auripectus occurs in the study area. Cliffs and rock outcrops with rubble about their bases are inhabited by the canyon mouse. It occurs in the lower areas and, probably, into pinyon-juniper woodland.

Localities: About 3 miles east and 3 miles south of Farmington (3); 8 miles south and 4 miles west of Shiprock (1) (2, CNM); about 3 miles north and 1/2 mile west of Sanostee (2).

Peromyscus maniculatus
Deer Mouse

The study area is within the geographic range of P. m. rufinus. The deer mouse occurs throughout the study area, in virtually every habitat. It is particularly common in the higher portions of the Chuska Mountains.

Localities: About 3 miles east and 3 miles south of Farmington (4); Gallegos Canyon, Sec. 9, T28N-R12W (3); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); 7 miles east and 10 miles south of Farmington (1); 8 miles south and 4 miles west of Shiprock Peak (1) (1, CNM); 9 miles south and 6 1/2 miles west of Bloomfield (5); 16 miles south and 1 mile west of

Farmington, Sec. 17, T26N-R13W (5); about 3 miles north and 1/2 mile west of Sanostee (no specimens saved); Chaco Wash west of Burnham (9); 5 miles north and 6 miles east of Newcomb (2); 4 miles west of Sheep Springs (1, CNM); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1) (1, CNM); Chuska Mountains, Washington Pass, 6 miles east of Crystal (16); about 12 miles east and 7 miles south of Sheep Springs (1).

Peromyscus truei
Pinyon Mouse

The nominate subspecies occurs in the study area. This mouse usually is associated with pinyon-juniper woodland. It may occur in rocky or nonrocky areas.

Localities: Near Fruitland (V. Bailey, 1931, p. 153); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); Chuska Mountains, 4 miles west of Sheep Springs (3) (5, CNM).

Onychomys leucogaster
Northern Grasshopper Mouse

The grasshopper mouse of the study area is O. l. pallescens. Occurrence is throughout the lower portions of the study area, to as high as the lower portion of the pinyon-juniper zone. Greatest numbers are reached in grasslands and in shrub-grasslands having a somewhat sandy substratum.

Localities: Near Fruitland (V. Bailey, 1931, p. 138); Gallegos Canyon, Sec. 9, T28N-R12W (1); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); Gallegos Canyon, 5 miles east and 7 1/2 miles south of Farmington (1); Chaco Wash, 14 miles south and 6 miles east of Shiprock (town) (8); 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W (1); 8 miles south and 4 miles west of Shiprock Peak (1) (1, CNM); 11 miles east and 13 miles south of Farmington (3); 5 miles north and 6 miles east of Newcomb (4).

Neotoma albigula
White-throated Wood Rat

White-throated wood rats of the study area have been assigned to N. a. albigula. Further work may show some intergradation with N. a. laplataensis, which occurs to the north of the study area. This wood rat occurs commonly among rocks, in pinyon-juniper woodland and in smaller numbers at lower elevations. Most utilize rocks for nest sites, but occasionally nests are built around the base of trees or bushes.

Localities: About 3 miles east and 3 miles south of Farmington (1); Gallegos Canyon, Sec. 9, T28N-R12W (1); Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1); 9 miles south and 6 1/2 miles west of Bloomfield (1); 11 miles east and 13 miles south of Farmington (1).

Neotoma stephensi
Stephen's Wood Rat

The form occurring in northwestern New Mexico is N. s. relicta. This species appears restricted to pinyon-juniper growth. Nests commonly include large amounts of juniper twigs, often green, and usually are built among rocks or about the bases of juniper trees. They also may be built at some distance above the ground in juniper trees. Although not recorded from the western portions of the study area, this probably is a reflection of the

lesser amount of trapping in the pinyon-juniper growth of the Chuska Mountains.

Localities: About 3 miles east and 3 miles south of Farmington (2).

Neotoma mexicana
Mexican Wood Rat

The western portion of the study area falls into the geographic range of N. m. inopinata; the eastern, in or near the range of N. m. fallax.

The Mexican wood rat occurs in relatively well vegetated areas, usually among rocks. The cliffs along the San Juan Valley and the higher portions of the Chuska Mountains both support members of this species. Judging from elsewhere in the basin, it may also occur in well developed pinyon-juniper growth in the Chuskas.

Localities: Fruitland and Chuska Mountains, 8800 feet (Goldman, 1933, p. 472); Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (1).

Neotoma cinerea
Bushy-tailed Wood Rat

Neotoma cinerea arizonae is the subspecies within the study area. This rodent is a rock dweller, occurring from the lower portions of the study area into the pinyon-juniper zone. It usually is associated with cliffs, but occurs also in smaller outcrops.

Localities: Shiprock (V. Bailey, 1931, p. 191); Fruitland (Goldman, 1910, p. 106); Farmington (V. Bailey, 1931, p. 191); about 3 miles north and 1/2 mile west of Sanostee (1); 5 miles north and 6 miles east of Newcomb (1).

Microtus pennsylvanicus
Meadow Vole

This isolated population of meadow voles in the San Juan Basin makes up the subspecies M. p. aztecus. This rodent is limited to the San Juan Valley and its major tributaries to the north. I have found it only in sedge beds. It probably extends west along the San Juan River to the vicinity of Shiprock.

Localities: Fruitland and Farmington (V. Bailey, 1931, p. 203); 4 miles west of Bloomfield (1); 1 1/2 miles west of Bloomfield (2).

Microtus longicaudus
Long-tailed Vole

Microtus longicaudus mordax occurs in the study area. It is limited in the study area to the high portions of the Chuska Mountains.

Localities: Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs (2); Chuska Mountains, Washington Pass, 6 miles east of Crystal (42).

Ondatra zibethicus
Muskrat

The San Juan drainage supports members of the subspecies O. z. osoyoosensis. This large microtine rodent occurs in marshes and along vegetated irrigation ditches in the San Juan Valley.

Localities: Farmington (V. Bailey, 1931, p. 207); Bloomfield (1).

Mus musculus
House Mouse

This is an introduced, Old World mouse. Apparently it is restricted in the study area to the San Juan Valley.

Localities: Fruitland (V. Bailey, 1931, p. 135); Farmington (1); 1 1/2 miles west of Bloomfield (2); Bloomfield (1).

Erethizon dorsatum
Porcupine

Erethizon dorsatum couesi is the subspecies found in the study

area. This large rodent occurs in the San Juan Valley and in pinyon-juniper woodland and ponderosa pine-Douglas fir forest. In many other places, it often wanders far from such habitats, however, and thus may be expected occasionally anywhere in the study area.

Localities: Shiprock, Fruitland, Farmington, and Chuska Mountains (V. Bailey, 1931, p. 224).

Canis latrans
Coyote

The study area is within the range of C. l. mearnsi. This dog is not now common in the study area, but in the past ranged throughout the region.

Localities: Fruitland (V. Bailey, 1931, p. 318); Chaco Wash west of Burnham (heard); Chuska Mountains (V. Bailey, 1931, p. 318).

Canis lupus
Gray Wolf

The population of gray wolves that inhabited the study area were of the subspecies C. l. youngi. Gray wolves probably were, at one time or another, in all habitats of the study area.

Localities: Chuska Mountains (V. Bailey, 1931, p. 310).

Vulpes fulva
Red Fox

The Rocky Mountain area subspecies is V. f. macroura. This fox is known in the study area only from the vicinity of the San Juan Valley and its tributaries.

Localities: Shiprock, Liberty, Fruitland and Farmington (V. Bailey, 1931, p. 297).

Vulpes macrotis
Kit Fox

The subspecies present is V. m. neomexicana.

Although V. Bailey (1931, p. 298) had reports of kit foxes in the San Juan Basin, specimens were not known from the area. It seems reasonably common in the better developed grasslands and probably occurs in most areas below pinyon-juniper woodland.

Localities: 11 miles east and 13 miles south of Farmington (1); 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W (1).

Urocyon cinereoargenteus
Gray Fox

The Southwestern subspecies of gray fox is U. c. scotti. The gray fox is most common in areas of pinyon-juniper growth. In the Navajo Reservoir District, northeast of the study area, it is present also in the lower part of the ponderosa pine forest.

Localities: Chuska Mountains (V. Bailey, 1931, 1. 301).

Mustela frenata
Long-tailed Weasel

The long-tailed weasels of the study area should be of the subspecies M. f. nevadensis. Records for the San Juan Valley appear not to be based on specimens. In the study area, it probably is limited to the San Juan Valley, but may occur also in the Chuska Mountains.

Localities: Shiprock, Fruitland, and near Farmington (V. Bailey, 1931, p. 328).

Mustela vison
Mink

Mustela vison energumenos is the subspecies of the study area.

These animals have been reported only along the valleys of the San Juan and its major tributaries.

Localities: Liberty, Fruitland, and along Animas and San Juan Rivers near Farmington (V. Bailey, 1931, p. 325).

Taxidea taxus
Badger

New Mexico falls within the geographic range of T. t. berlandieri. The badger probably occurred throughout the study area. None was seen during the periods of investigation.

Localities: Throughout the San Juan Valley (V. Bailey, 1931, p. 345).

Mephitis mephitis
Striped Skunk

Mephitis mephitis estor occurs in the study area. The striped skunk may be expected in more mesic portions of the study area.

Localities: Shiprock, Fruitland, and Chuska Mountains (V. Bailey, 1931, p. 333).

Lynx rufus
Bobcat

Lynx rufus baileyi is the subspecies of the study area. Broken country throughout the study area may be occupied by bobcats.

Localities: Fruitland (V. Bailey, 1931, p. 291).

Odocoileus hemionus
Mule Deer

The nominate subspecies occurs in the San Juan Basin. Brushy and wooded areas are inhabited, both in the lowlands and in the mountains.

Localities: Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington (1).

Antilocapra americana
Pronghorn

The pronghorn is represented in the study area by A. a. americana. The pronghorn is primarily an animal of the open grasslands and occurs in the study area (Harris, 1963, p. 48). S. L. Peckham (personal communication, November, 1963) reports seeing "a herd of eleven and then two other individuals not more than two or three miles from Gallegos Trading Post." It seems likely that most of the nonmountainous area has supported pronghorn in the past.

Discussion

In general, there is little that is unusual about the higher flora and fauna of the study area, but as with most regions within the Southwest, it has a degree of uniqueness in composition.

The San Juan Basin of New Mexico lies somewhat at the fringes of more easily characterized biotas, those of the Colorado River drainage to the west and north and of the Rio Grande drainage to the northeast, east, and southeast. Overlap in the study area of the two biotas results in the presence of some members of both; many species, however, reach their geographic limits before attaining the study area, and thus many kinds considered typical of one or the other area are absent from the study area.

Climatic conditions more typical of one of the areas may have been present in the past. If so, remains of past faunas should tend in com-

Fig. 25. Grassland areas within pinyon-juniper woodland. East side of Chuska Mountains, four miles west of Sheep Springs.

Fig. 26 (above). Vegetation is sparse in the arid, low elevations. This locality is approximately 12 miles east and 7 miles south of Sheep Springs. Looking west, with the Chuska Mountains in the distance.

Fig. 27 (below). Tocito arroyo.

position to resemble the present fauna of that area and be less like that of the other area than is the case at present.

Another factor of the present biota is the presence of a boreal, montane element. This element is restricted now to the higher portions of the study area; past presence at lower elevations of the climatic conditions suitable to this element also should be revealed in recovered faunal material.

This report, then, gives the present geographic and ecologic distribution of the vertebrate fauna and thus gives a basis for comparison with past faunas as revealed by archaeological remains. Differences between the present and past faunas may be the result of man's effect upon the area or the result of climatic or other natural environmental changes. With the information contained in this report, it is hoped that reasonable interpretation of past faunas from the area may be made.

LIST OF COLLECTION STATIONS

Twenty-one major collection stations within the study area are represented in the Museum of Southwestern Biology collections (Fig. 18). In addition are a number of localities that were visited only briefly and where only one to several specimens were collected. Much of the basis for generalizations about the biota come from the major stations, so each such station is described here in terms of general vegetation and its physical features. Numbers given before the station locality refer to a like number in figure 18.

1. 3 miles east and 3 miles south of Farmington. This station is in a canyon tributary to the San Juan Valley. Collecting was carried out from about one mile south of the canyon's mouth to the floodplain of the San Juan River. It was visited in 1960 and 1963.

The canyon walls are of high sandstone cliffs and the floor, for the most part, very sandy. One-seeded junipers, but few or no Colorado pinyons were scattered along the floor of the canyon and on the slopes and cliffs. Grasses were very sparse, and the most noticeable lower vegetation was of big sagebrush. Apacheplume occurred along minor drainageways. Along the basal areas of the cliffs, Utah serviceberry, Amelanchier utahensis, and squawberry, Rhus trilobata, occurred. Some yucca, Yucca glauca, prickly pear cactus, probably Opuntia polycantha, and small cane cactus, Opuntia sp., were present.

At the mouth of the canyon, in 1963, little other vegetation than big sagebrush, Artemisia tridentata, rabbitbush, Chrysothamnus spp., and snakeweed, Gutierrezia sp., was present. The area obviously was greatly overgrazed and grasses, for all practical purposes, nearly eradicated.

2. Gallegos Canyon, Sec. 9, T28N-R12W. Most trapping at this station was on the west side of the canyon. General vegetational features are shown in figure 28. In addition to plants mentioned in that figure, wild olive, Forestiera neomexicana, occurred near the banks singly or in thickets; sparse grasses were scattered throughout; occa-

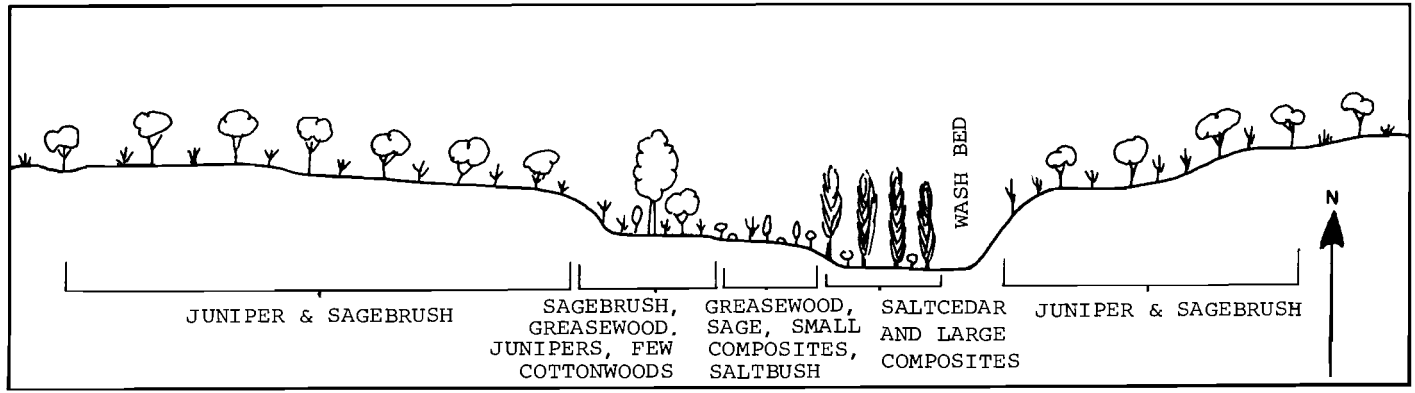

Fig. 28. Generalized profile and plant distribution across Gallegos Canyon, Sec. 9, T28N-R12W.

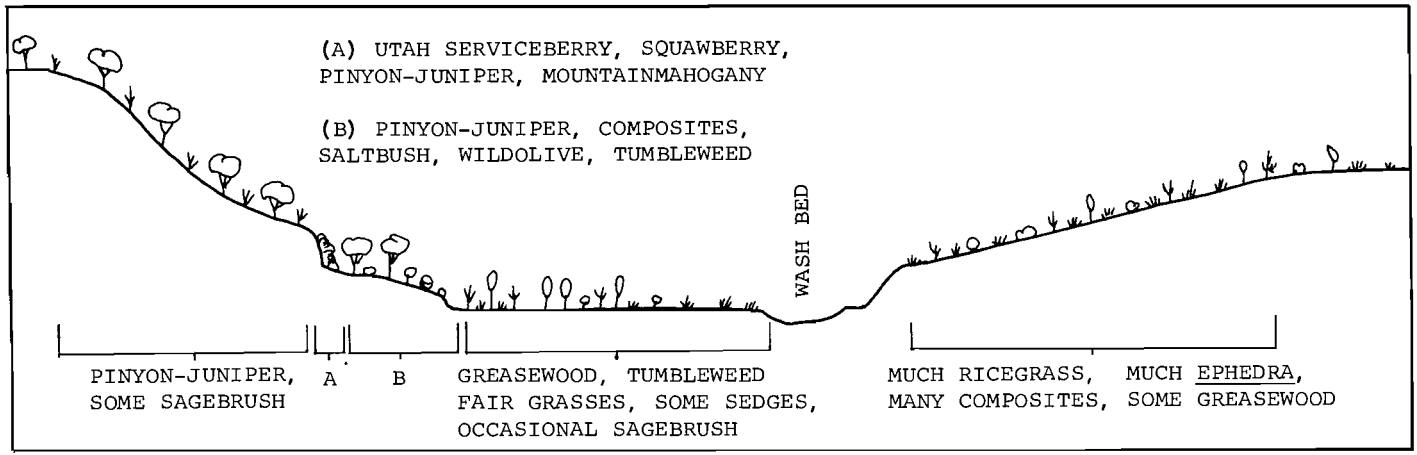

Fig. 29. Generalized profile and plant distribution across Gallegos Canyon, 7-1/2 mi. south and 4 to 5 mi. east of Farmington.

sional areas of sedges and grasses occurred along the edges of the arroyo channel, and prickly pear cacti occurred in small numbers in most areas.

3. Gallegos Canyon, 7 1/2 miles south and 4 miles east of Farmington.

4. Gallegos Canyon, 5 miles east and 7 1/2 miles south of Farmington. These two stations are on opposite sides of Gallegos Canyon. The west slope consists of weathered shales, sandstones, and conglomerates; low cliffs are formed in several areas. The east bank consists of almost concealed sandstone and much loosely consolidated or unconsolidated sand.

Vegetational relationships are shown in figure 29. Sparse grasses occurred throughout, but were found in large numbers only on the floodplain.

5. 7 miles south and 6 miles west of Bloomfield, Sec. 4, T27N-R12W. This station is similar in type to the upper portions of Station 4. Vegetation is very similar except for the entire absence of greasewood, Sarcobatus vermiculatus. This station was visited in 1960, three years before Station 4 was trapped. Grasses at that time were much less prominent and Ephedra the most noticeable vegetation. Yucca glauca was present, also. The substratum is very loose and sandy.

6. Chaco Wash, 14 miles south and 6 miles east of Shiprock (town). This station, in the lower portion of the study area, was trapped mainly in an extremely sandy area, part of which is shown in figure 30 (see figure 20 for a view of the surrounding, less sandy area).

Vegetation consisted in large part of greasewood, fourwing saltbush, Atriplex canescens, and grasses, particularly rice grass, Oryzopsis hymenoides. Tumbleweed, Salsola kali, and Dicoria paniculata were quite plentiful.

7. 7 miles east and 10 miles south of Farmington. This station is very similar to Station 5. Rice grass was the common grass, with many composites (snakeweed, rabbitbush) and much Mormon tea, Ephedra.

8. 8 miles south and 4 miles west of Shiprock Peak. Trapping was done along a narrow gap through a long outcrop of Gallup sandstone, on the canyon wall, on top of the sandstone, and to the south of the gap. Substrata in the latter area vary from clayey to quite sandy.

Vegetation south of the gap consisted primarily of rice grass and spiny salt-bush, Atriplex confertifolia. Some composites, such as rabbitbush, were present along the minor drainageways. In rocks about the cliff bases, small amounts of big sagebrush appeared along with sparse grasses. The area within the gap supported a few individuals of plant kinds that more often are found at higher altidudes: pinyons, Pinus edulis, junipers, Juniperus monosperma, squawberry, Utah serviceberry, and Gambel oak. Quercus gambelii. A few single-leaf

ash plants, Fraxinus anomala, and some wild olive were present. One oak appeared closely similar to Q. turbinella, one of two places in the study area where I have seen this plant.

On the north-sloping top of the sandstone, vegetation was sparse except in areas similar to pot-holes in shape, though varying from a few feet to some ten yards in diameter. These supported good growths of grasses.

9. 11 miles east and 13 miles south of Farmington. This section was on the borderline between big sagebrush on the east and grassland on the west. Snakeweed was common as was Mormon tea in stabilized sand dunes. Salt grass, Distichlis stricta, was common along the floodplain of a small, nearby wash, but other grasses were not common.

10. 14 miles south and 2 miles west of Farmington. This station is similar to most others on Gallegos Mesa and immediately east of Gallegos Canyon. The gentle hills are very sandy, with grasses and Mormon tea quite common. Unlike most areas, however, prickly pear cactus was quite common. Some Yucca glauca was present and a little cane cactus.

11. 16 miles south and 1 mile west of Farmington, Sec. 17, T26N-R13W. Camp was near the head of a canyon tributary to Gallegos Canyon. The canyon is cut in shale and sandstone.

In the canyon, fourwing saltbush, greasewood, some salt cedar, Tamarix pentandra, and a very little big sagebrush was present. Fair amounts of tumbleweed were present also, as were occasional clumps of Ephedra.

Above the canyon, on the north side, unstabilized dunes alternate with wind-scoured clay. Fair, but short grass, yucca, fourwing saltbush, greasewood, and Mormon tea occurred. Snakeweed was present along the canyon's lip.

Several dirt tanks on the canyon floor held water; others were dry.

12. About 3 miles north and 1/2 mile west of Sanostee. This station, as Station 8, was in a gap through Gallup sandstone. Here, however, the outcrops are relatively low and the gap wide. The substratum away from the sandstone is not noticeably sandy except in washes.

Although several grasses were present, rice grass was absent. Along washes, composites and fourwing saltbush were prominent, along with tumbleweed. Squawberry and wolfberry were present on cliffs; on the gentle eastern slope of the sandstone, one-seeded juniper, mountain mahogany, Cercocarpus montanus, oak, Q. cf. turbinella, and Utah serviceberry appeared. Most such plants were greatly dwarfed. Scattered big sagebrush, mockorange, Philadelphus microphyllus, and Yucca glauca were present on some slopes.

13. Tocito. Tocito Wash, a short distance northwest of Tocito, is entrenched some twenty feet into its old floodplain (Fig. 27). Perman-

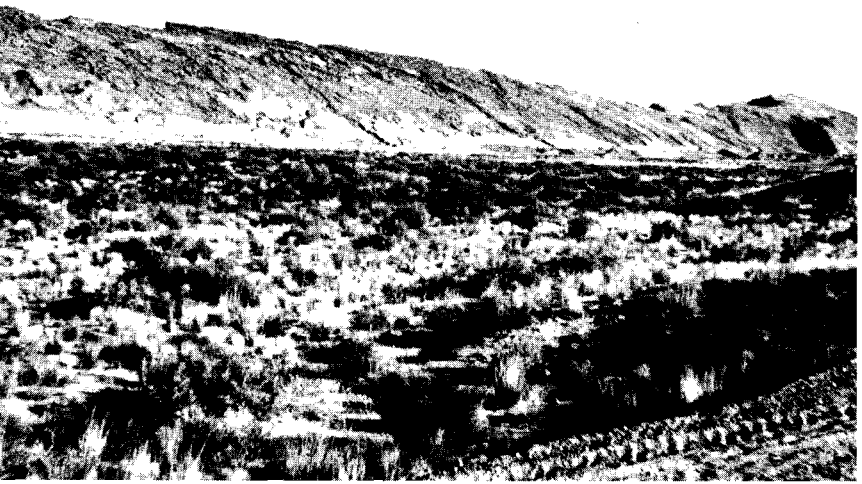

Fig. 30. Sand dune vegetation along Chaco Wash, 14 miles south and 6 miles east of Shiprock (town). Hogback Mountain lies in background. View is toward the northwest.

Fig. 32. Grassy valley, with surrounding sparse pinyon-juniper growth, 4 miles west of Sheep Springs.

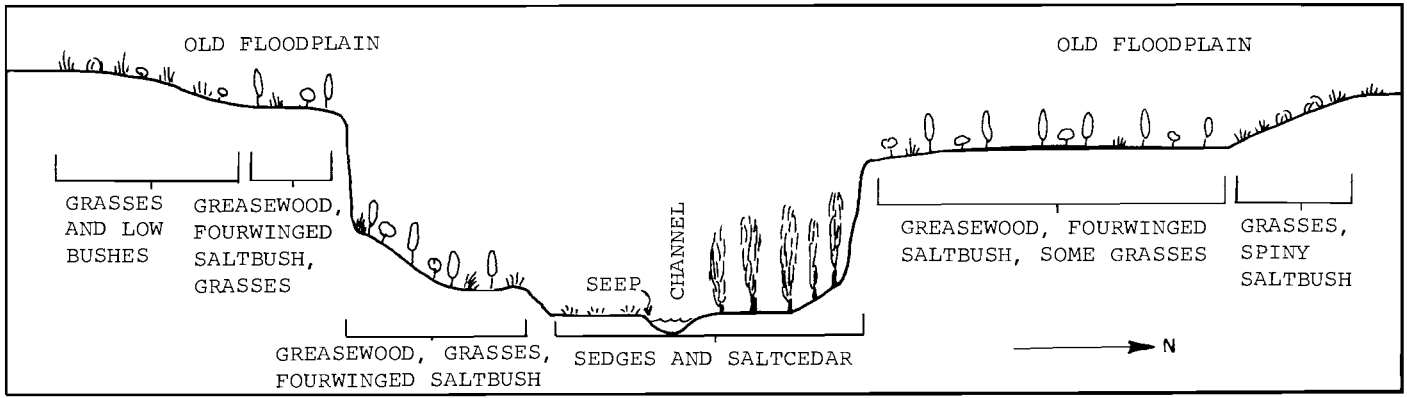

Fig. 31. Generalized profile across Tocito Arroyo near Tocito.

ent seeps and springs occur on the arroyo floor and lower portions of the arroyo walls, with formation of pools in the arroyo channel and elsewhere. Low sandstone outcrops appear near the south bank, west of the station, but were not trapped.

On the floor of the arroyo grew considerable amounts of sedges, but these formed thick growth only locally. Salt cedar and various grasses grew on the present floodplain. On slopes and on a bench that is present in places some eight or ten feet above the present floodplain, fourwing saltbush and greasewood grew, along with some tumbleweed. The now dissected, old floodplain was vegetated with fourwing saltbush and lesser amounts of greasewood and grasses. Rising from this old floodplain are slopes that supported grasses and low bushes such as spiny saltbush (Fig. 31).

14. 5 miles north of Newcomb. Several springs and pools appear here on both sides of US Highway 666. These springs appear along dikes radiating out from a nearby volcanic plug, Bennett Peak.

An entrenched arroyo in the area supported fair numbers of salt cedar plants. Outside the arroyo, much tumbleweed and greasewood, with lesser amounts of fourwing saltbush and spiny saltbush occurred. Fair grasses were present; sedges and marsh-dwelling plants grew in small numbers around pools and an irrigation ditch that fed from some of the pools.

15. 5 miles north and 6 miles east of Newcomb. Camp at this station was just off a pipeline road that led south from the Burnham road. Almost level expanses of fine sandstone are present with occasional small, higher remnants. Larger outcrops occurred a short distance to the west, along with weathered shale exposures. To the north, a very sandy substratum is present and supports large amounts of grasses, particularly rice grass. Much snakeweed, rabbitbush, and fourwing saltbush were mixed in with some Ephedra. Around camp, little other than fourwing saltbush occurred.

16. Chaco Wash west of Burnham. This station was trapped in 1960, three years earlier than Station 15, which lies only a short distance west. This station was on the western edge of the Chaco Wash floodplain. Sandstone outcrops occur a few hundred feet farther west.

A few scattered cottonwoods, large amounts of salt cedar, and some willows were present on the floodplain near the channels. Fourwing and spiny saltbush, snakeweed, and sparse grasses were common further from the channels, as was tumbleweed. Much greasewood grew in some areas, particularly those that were very sandy.

17. Newcomb. Most trapping was done on the mesa and in Captain Tom Wash, both just west of Newcomb. The mesa has a rather hard substratum as does part of the valley formed by Captain Tom Wash. In other areas of the wash, however, much blow sand is present and dunes are actively encroaching on new areas.

The harder substratum supported little but very sparse grass, tumbleweed, and spiny saltbush. The arroyo bottoms had much salt

cedar, some Russian olive, Elaeagnus angustifolia, and cottonwood, and small amounts of grass. Most heavily vegetated in general were the sandy areas on which grew wolfberry, Lycium pallidum, fourwing saltbush, some greasewood, and some snakeweed.

18. Chuska Mountains, 4 miles west of Sheep Springs. Trapping at this station was carried out in a small, open valley (Fig. 32) and in hills. A number of rock outcrops are present in the higher areas. Bare, weathered shale exposures with reptilian fossils are common west of the valley. A clay substratum is present in the valley's central portion, but the northwestern side is quite sandy.

Vegetation on the hills consisted of rather sparse pinyon-juniper woodland (Fig. 24). Scattered plants of big sagebrush occurred both among the woodland growth and about the valley edges. Apacheplume, Fallugia paradoxa, and mountain mahogany occurred on some slopes. The central portions of the valley were covered by extremely short grasses. Several kinds of cacti were found around the valley edges and on slopes. Snakeweed and some fourwing saltbush also were present in open, level areas.

19. Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs. This station is at the northern end of an igneous outcrop atop the Chuska Mountains. Steep slopes and rocky ledges occur in the igneous area; the substratum away from such areas generally is quite level and is sandy except where silt has built up in wet, heavily vegetated areas. Several springs are active along the base of the igneous formation.

Ponderosa pine-Douglas fir forest was well developed at this station (Figs. 22 and 23). The fir, Pseudotsuga taxifolia, was concentrated mainly on the steeper, north-facing slopes; leveler areas supported open stands of ponderosa pine, Pinus ponderosa. Aspen, Populus tremuloides, were not uncommon on the slopes and Gambel oak occurred throughout the area, though commonest on slopes and in more xeric exposures. Large numbers of bracken ferns, Pteridium, occurred in many places. Damp areas around and below springs supported much grass and sedge growth along with marsh plants. Some such areas were carpeted with liverworts. Fallen trees were plentiful. A dirt cattle tank was present, also.

20. Chuska Mountains, Washington Pass, 6 miles east of Crystal. This locality was visited in 1956 by J. S. Findley and J. Sands and again in 1959 by J. S. Findley and C. J. Jones. The following notes were quoted from the field journal of J. S. Findley.

> A small creek flows down a canyon just west of our camp. Large yellow pine are common on west and south slopes. Douglas fir and aspen take over on north and east slopes. Gambel oak is seen on dryer slopes, in places forming a chaparral-like growth.
>
> Jim set 38 traps along the creek in thick forbs and small deciduous trees. He also made 5 gopher sets in meadows along the stream. The meadows are heavily overgrazed by Navajo sheep and horses and are grown up in places with forbs and false hellebore.

21. About 12 miles east and 7 miles south of Sheep Springs. This station was at the western edge of rather broken country of sandstone and shale outcrops. Sand dunes are common along wash edges and about some rocky outcrops. To the east, the country is more level, though with some sandstone prominences, and the substrata vary locally from clay to sand (Fig. 26).

In the Sandy areas, sparse growths of snakeweed and other composites and of Ephedra occurred. Some sand sagebrush, Artemisia filifolia, also occurred. Considerable amounts of tumbleweed and lesser amounts of fourwing saltbush and spiny saltbush were present in less sandy places.

LIST OF PLANTS IN THE STUDY AREA

Listed here are plants from, or from very near, the study area present in the Herbarium of the Museum of Southwestern Biology. Some of these plants were collected and identified by myself; others have been collected and identified by students, botanists, and others through the years. There undoubtedly are plants in the herbarium from the study area which are not in this list and almost undoubtedly some identifications will be changed with further work. Records other than my own were taken directly from a yet incomplete card file of herbarium specimens.

Likely considerably less than half the total number of higher plants present in the study area are listed here. Even some conspicuous forms, such as aspen, are not represented. Nevertheless, some idea of the vegetation can be gained from the list. Other records are available in the botanical literature. Despite its age, probably the Flora of New Mexico (Wooton and Stanley, 1915) is the best single source for plants of the study area. For the most part, this list follows the order of plants in Flora of Arizona (Kearney and Peebles, 1951), as do the common names used.

Plants known to be introduced into the United States are designated with an asterisk.

PTERIDOPHYTA
Ferns and fern allies

Polypodiaceae
Fern Family

Pteridium aquilinum L.
Bracken Fern

Chuska Mountains.

SPERMATOPHYTA
Seed Plants

Pinaceae
Pine Family

Pinus edulis Engelm.
Colorado Pinyon.

5 miles south of Washington Pass, Long Lake, Chuska Mountains, 8800 feet; west slope Chuska Mountains, just west of Crystal.

Pinus ponderosa Lawson.
Ponderosa Pine
West slope Chuska Mountains, just north of Crystal; Washington Pass, Chuska Mountains, 8000 feet.

Picea pungens Engelm.
Blue Spruce

Near Washington Pass, Chuska Mountains; Washington Pass, Chuska Mountains, 8000 feet.

Pseudotsuga taxifolia (Poir.) Britton.
Douglas Fir
Washington Pass, Chuska Mountains, 8000 feet; 3 miles south of Washington Pass, Chuska Mountains.

Cupressaceae
Cypress Family

Juniperus communis L.
Common Juniper
Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs; Chuska Mountains, Washington Pass; East slopes Chuska Mountains, 3 miles south of Washington Pass, 8800 feet.

Juniperus scopulorum Sarg.
Rocky Mountain Juniper
1 mile east of Crystal.

Ephedraceae
Joint-fir Family

Ephedra Torreyana Wats.
Joint-fir
5 miles southwest of Farmington; 6 miles south of Bloomfield; 5 miles north and 6 miles east of Newcomb.

Ephedra viridis Coville.
Joint-fir

West of Rattlesnake; near Waterflow; near Farmington; about 5 miles south by road of Farmington.

Typhaceae
Cat-tail Family

Typha angustifolia L.
Cat-tail
Near Fruitland.

Alismaceae
Water-plantain Family

Alisma triviale Pursh.
Water-plantain
Pond below eastern scarp of Chuska Mountains, 3 miles south of Washington Pass, 8500 feet.

Sagittaria cuneata Sheld.
Arrow-head
Fruitland.

Gramineae
Grass Family

Bromus anomalus Rupr.
Brome.
Near Whiskey Lake.

*Bromus tectorum L.
Brome

Scuth of Farmington; west slope of Chuska Mountains; Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs.

*Poa pratensis L.
Kentucky Bluegrass
Chuska Mountains, 8000 feet.

Poa interior Rydb.
Bluegrass
Chuska Mountains about 3 miles west and 2 miles north of Toadlena; Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs.

Distichlis stricta (Torr.) Rydb.
Saltgrass
Junction of Capt. Tom Wash and the Chaco, 5300 feet.

Agropyron smithii Rydb.
Wheatgrass
1 mile east of Crystal, west flanks of Chuska Mountains, 7200 feet.

Agropyron trachycaulum (Link) Malte.
Wheatgrass

1 mile east of Crystal, west flanks of Chuska Mountains, 7200 feet.

Sitanion hystrix (Nutt.) J. G. Smith.
Squirrel-tail
West slope of Chuska Mountains, northeast of Crystal.

Deschampsia caespitosa (L.) Beauv.
Hair Grass
Whiskey Lake, 8600 feet.

*Agrostis alba L.
Bent Grass
Twp. 29N, Mer. 12W; 4 miles east of Crystal, west flank of Chuska Mountains, 7800 feet.

Agrostis palustris Huds.
Bent Grass
Twp. 29N, Mer. 12W.

Alopecurus aequalis Sobol.
Fox-tail
Chuska Mountains, northeast of Crystal.

*Polypogon monspeliensis (L.) Desf.
Rabbit-foot Grass
Bloomfield area.

*Phleum pratensis L.
Timothy
Washington Pass, Chuska Mountains.

Sporobolus airoides Torr.
Dropseed
3 miles north of Shiprock 5500 feet; Newcomb.

Blepharoneuron tricholepis (Torr.) Nash.
Pine Dropseed
Deadman Lake, 4 miles west of Toadlena, Chuska Mountains.

Oryzopsis hymenoides (Roem. and Schult.) Ricker.
Ricegrass
Breaks south of Farmington; broken hills 7 miles south of Bloomfield; near Washington Pass, Chuska Mountains.

Piptochaetium fimbriatum (H. B. K.) Hitchc.
Pinyon Ricegrass.
West of Farmington.

Stipa comata Trin. & Rupr.
Needlegrass
North of Crystal.

Aristida longiseta Steud.
Red Threeawn
Bloomfield area.

Hilaria Jamesli (Torr.) Benth.
Hilaria
West of Rattlesnake.

Bouteloua gracilis (H. B. K.) Lag.
Blue Grama
Whiskey Lake, Chuska Mountains, 8600 feet.

Andropogon hallii Hack.
Bluestem
East slope of Chuska Mountains.

Liliaceae
Lily Family

Veratrum californicum Druand.
False-hellebore
Washington Pass.

Allium macropetalum Rydb.
Onion
South of Farmington.

Yucca glauca Nutt.
Yucca
Bloomfield.

Smilacina racemosa (L.) Desf.
False-Solomonseal
Chuska Mountains.

Orchidaceae
Orchis Family

Corallorhiza maculata Raf.
Coral-root
Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs.

Salicaceae
Willow Family

Populus wislizeni (Wats.) Sarg.
Valley Cottonwood
Newcomb.

Salix irrorata Anderss.
Willow
Chuska Mountains, Crevesse Canyon.

Betulaceae
Birch Family

Alnus sp.
Alder
Chuska Mountains.

Fagaceae
Beech Family

Quercus gambelii Nutt.
Gambel Oak
8 miles south and 4 miles west of Shiprock Peak.

Chenopodiaceae
Goosefoot Family

Atriplex canescens (Pursh.) Nutt.
Fourwing Saltbush
About 3 miles north and 3 miles west of Sanostee; 5 miles north and 6 miles east of Newcomb; Newcomb.

Sarcobatus vermiculatus (Hook.) Torr.
Greasewood
Newcomb; 5 miles north of Newcomb.

Amaranthaceae
Amaranth Family

Tripterocalyx micranthus (Torr.) Hook.
Tripterocalyx
Newcomb.

Tripterocalyx wootonii Standl.
Tripterocalyx
About 3 miles north and 1/2 mile west of Sanostee; Newcomb.

Cruciferae
Mustard Family

Lepidium montanum Nutt.
Peppergrass
Mesas south of Shiprock.

Dithyrea wislizeni Engelm.
Spectacle-pod
Summit, Detached Mesa, south of Shiprock.

Capparidaceae
Caper Family

Cleome lutea Hook
Yellow Bee-plant
About 3 miles north and 1/2 mile west of Sanostee; about 6 miles east and 10 miles south of Farmington.

Saxifragaceae
Saxifrage Family

Saxifraga rhomboidea Greene
Saxifrage
Chuska Mountains.

Philadelphus microphyllus Gray
Mockorange
About 3 miles north and 1/2 mile west of Sanostee.

Ribes cereum Dougl.
Wax Currant
Chuska Mountains.

Rosaceae
Rose Family

Amelanchier utahensis Koehne
Serviceberry
West of Rattlesnake; 8 miles south and 4 miles west of Shiprock Peak; about 3 miles north and 1/2 mile west of Sanostee.

Potentilla fruticosa L.
Bush Cinquefoil
Whiskey Lake, Chuska Mountains.

Potentilla Anserina L.
Silverweed
Chuska Mountains, several miles northeast of Crystal; near Washington Pass.

Cercocarpus montanus Raf.
Alder-leaf Mountain-mahogany
About 3 miles north and 1/2 mile west of Sanostee.

Purshia tridentata (Pursh.) DC.
Antelope-brush
West slope Chuska Mountains, northeast of Crystal.

Leguminosae
Pea Family

Lupinus pusillus Pursh.
Lupine
Farmington; sandy breaks of San Juan River, south of Bloomfield.

Lupinus sitgreavesii Wats.
Lupine
Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs.

Astragalus praelongus Sheldon
Milk-vetch
Farmington.

Astragalus nuttallianus DC.
Milk-vetch
Sandy mesas north of Shiprock; Shiprock; Farmington; Chuska Mountains.

Glycyrrhiza lepidota (Nutt.) Pursh.
Licorice
East of Shiprock.

Geraniaceae
Geranium Family

Geranium richardsonii Fisch. & Trauty
Cranesbill
Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs; Chuska Mountains, Washington Pass.

Geranium eremophilum Woot. & Standl.
Cranesbill
Chuska Mountains, about 3 miles west and 2 miles north of Toadlena.

Geranium caespitosum James
Cranesbill
Chuska Mountains, northeast of Crystal.

Erodium cicutarium (L.) L'Her.
Heron-bill
About 3 miles north and 1/2 mile west of Sanostee.

Linaceae
Flax Family

Linum aristatum Engelm.
Flax
Northeast of Burnham's Trading Post; Chuska Mountains, north of Crystal.

Anacardiaceae
Cashew Family

Rhus trilobata Nutt.
Skunkbush
8 miles south and 4 miles west of Shiprock Peak.

Aceraceae
Maple Family

Acer glabrum Torr.
Rocky Mountain Maple
Chuska Mountains.

Malvaceae
Mallow Family

Sphaeralcea incana Torr.
Globemallow
Fruitland.

Sphaeralcea leptophylla (Gray) Rydb.
Globemallow
Fruitland; gravelly bluffs of San Juan west of Farmington; Farmington.

Sphaeralcea coccinea (Pursh) Rydb.
Globemallow
Mesa south of Farmington; about 3 miles north and 1/2 mile west of Sanostee.

Tamaricaceae
Tamarix Family

*Tamarix pentandra Pall.
Salt Cedar
Newcomb.

Loasaceae
Loasa Family

Mentzelia pumila (Nutt.) Torr. & Gray.
Stick-leaf
West of Rattlesnake; San Juan River south of Bloomfield; about 4 miles south (by road) of Farmington; about 6 miles east and 10 miles south of Farmington; 5 miles north and 6 miles east of Newcomb; Newcomb.

Elaeagnaceae
Oleaster Family

*Elaeagnus angustifolia L.
Russian-olive
Newcomb.

Onagraceae
Eveningprimrose Family

Epilobium adenocaulon Hausskn.
Willow-weed
Near Washington Pass; 3 miles south of Washington Pass, east scarp of Chuska Mountains.

Oenothera runcinata (Engelm.) Munz.
Eveningprimrose
20 miles south of Bloomfield.

Umbelliferae
Parsley Family

Berula erecta (Huds.) Corville
Water-parsnip
5 miles north of Newcomb.

Oleaceae
Olive Family

Forestiera neomexicana Gray
Adelia
Bloomfield; 8 miles south and 4 miles west of Shiprock Peak.

Polemoniaceae
Phlox Family

Gilia subnuda Torr.
Gilia
Barren breaks north of Shiprock.

Boraginaceae
Borage Family

Cryptantha flava (A. Nels.) Payson
Cryptantha
Sandy breaks of San Juan River south of Bloomfield.

Solanaceae
Potato Family

Lycium pallidum Miers.
Wolf-berry
Farmington; Newcomb.

Physalis fendleri Gray
Groundcherry
Chuska Mountains

Physalis longifolia Nutt.
Groundcherry
Farmington.

Solanum elaeagnifolium Cav.
White-horse-nettle
About 3 miles north and 1/2 mile west of Sanostee.

Solanum triflorum Nutt.
Nightshade
Farmington.

Datura meteloides DC.
Sacred Datura
Shiprock

Scrophulariaceae
Figwort Family

Penstemon barbatus (Cav.) Roth.
Beardtongue
Chuska Mountains, near Washington Pass.

Penstemon angustifolius Nutt.
Beardtongue
South of Farmington; south of Bloomfield; 2 miles southeast of Burnham's Trading Post.

Pennstemon rydbergii A. Nels.
Beardtongue
Near Whiskey Lake, Chuska Mountains.

Penstemon linarioides Gray.
Beardtongue
Chuska Mountains.

Mimulus glabratus H. B. K.
Monkey-flower
Near Washington Pass.

Plantaginaceae
Plantain Family

Plantago purshii Roem. & Schult.
Plantain.
Bloomfield area.

Caprifoliaceae
Honeysuckle Family

Symphoricarpos palmeri G. N. Jones
Snowberry
Chuska Mountains, 8 miles west and 1 mile south of Sheep Springs.

Compositae
Sunflower Family

Chrysopsis foliosa Nutt.
Golden-aster
About 3 miles north and 1/2 mile west of Sanostee.

Aster arenosus (Heller) Blake.
Aster
About 5 miles south and 1 mile east (by road) of Farmington.

Xanthium saccharatum Wallr.
Cocklebur
5 miles north of Newcomb.

Wyethia scabra Hook.
Mule-ears
South of Bloomfield.

Helenium hoopesii Gray
Orange sneeze-weed
Chuska Mountains about 3 miles west and 2 miles north of Toadlena.

Senecio longilobus Benth.
Threadleaf Groundsel
About 3 miles north and 1/2 mile west of Sanostee; 5 miles north of Newcomb.

Taraxacum officinale Weber.
Dandelion
Bloomfield area.