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William C. Martin

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SOME ASPECTS OF THE NATURAL HISTORY OF COLFAX AND EASTERN TAOS COUNTIES, NEW MEXICO

WILLIAM C. MARTIN
Professor of Biology
University of New Mexico

INTRODUCTION

The Colfax County-eastern Taos County area of New Mexico is of vital interest to biologists and students of natural history because of its location relative to the flora and fauna of the southern Rocky Mountains and the Great Plains as well as the rather significant differences in elevation within the area. Elevations range from about 5,800 ft in the southeastern part to 13,160 ft at the summit of Wheeler Peak in the eastern part of Taos County, this being the highest peak in New Mexico.

The eastern one-third of the study area is bisected roughly north to south by a major stream, the Canadian River, which drains this portion of northern New Mexico as well as a small part of southern Colorado. The Canadian River receives the water of the Vermejo River, a much smaller stream which begins in the northwestern part of Colfax County in the vicinity of the 12,634 ft Costilla Peak, just south of the Colorado-New Mexico border.

Extensive stretches of the eastern, southeastern, and southern parts of Colfax County are an extension of the Great Plains and are represented for the most part by a shortgrass prairie with a flat to rolling topography broken here and there by small ranges of mountains or by hills, these typically not exceeding 9,000 ft in elevation.

The western part of the Colfax County-eastern Taos County area is mostly very mountainous, the higher elevations culminating in several peaks exceeding 12,000 ft. Areas above the 12,000 ft level support an alpine-tundra type vegetation as well as certain faunal species adapted to these higher elevations. The elements of the natural history of the western part of Colfax County and eastern Taos County are strongly influenced by the ecological conditions prevailing in the Sangre de Cristo Range, a part of the southern Rocky Mountain System.

The only significant body of water found in the study area is Eagle Nest Lake, a reservoir located just south of the resort town of Eagle Nest at an elevation of about 8,500 ft.

As is true throughout the Southwest, the amount and distribution of precipitation are important factors in the development, diversity, and maintenance of the flora and fauna. Although precipitation is not really abundant anywhere in the southwestern United States, this part of New Mexico usually receives a greater amount of precipitation than do areas to the south and southwest. Mean annual precipitation ranges from 16 to 20 in. with relatively heavy winter snows and summer rainfall in the form of frequent afternoon thundershowers, especially in more mountainous areas.

Mean temperatures range from a low of 0-12 F and a high of 32-44 in January to a low of 40-44 F and a high of 80-84 F in July.

Certain vegetation zones are clearly marked in this area and their designation is based primarily on vegetational and altitudinal criteria. These zones include shortgrass prairie, pinyon-juniper, mixed conifer, spruce-fir, and alpine-tundra

associations, each of which contains certain characteristic plants and animals.

In order to approach the discussion in a systematic fashion, the material is presented in terms of the flora and fauna characteristic of each major floristic association beginning with the shortgrass prairie at the lower elevations and proceeding step by step to the alpine-tundra located above treeline.

A map of the area (Fig. 1) presents a general idea of the extent and location of the associations under discussion. The map also indicates the position of major topographic features and their approximate elevations as well as other pertinent points of reference. A diagrammatic cross sectional view of the east-west axis of Colfax and eastern Taos counties (Fig. 2) shows the vertical relationships of the associations and briefly summarizes some important biological characteristics of each association.

SHORTGRASS PRAIRIE

The shortgrass prairie covers roughly one-third of the total study area and is relegated mostly to the eastern, southeastern, and southern parts of Colfax County. Elevations range from about 5,800 ft, the lowest point in Colfax County, to about 6,300 ft. The natural vegetation of the shortgrass prairie is dominated by various grasses, primarily blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*) which often form a lower stand beneath an overstory of taller grasses including western wheatgrass (*Agropyron smithii*), little blue-stem (*Andropogon scoparius*), and dropseed (*Sporobolus cryptandrus*), three-awn (*Aristida longiseta*), and sometimes galleta (*Hilaria jamesii*). Along streams or in the vicinity of seeps, certain sedges such as species of *Carex* may be more common than grasses.

Many forbs are also a feature of the shortgrass prairie, but often are not in equal abundance every year. Those most constantly present include globe mallow (*Sphaeralcea coccinea*), wild aster (*Aster tanacetifolius*), bahia (*Bahia oppositifolia*), gaura (*Gaura coccinea*), and Russian thistle (*Salsola kali tenuifolia*), a widely distributed introduced species found in disturbed areas. Many other forbs are present here also but differ considerably from year to year in their abundance; these include peppergrass (*Lepidium densiflorum*), stickseed (*Lappula redowskii*), Pursh's plantain (*Plantago purshii*), cryptantha (*Cryptantha crassisejala*), and white-stemmed evening primrose (*Oenothera albicaulis*). Other forbs, especially perennials, are either locally abundant or sometimes occur in large colonies. These are represented mostly by desert four-o'clock (*Mirabilis linearis*), lemonweed (*Psoralea lanceolata*), scurfpea (*P. tenuiflora*), fetid marigold (*Dyssodia papposa*), silky sophora (*Sophora sericea*), several wild buckwheats (*Eriogonum* spp.), and skeletonweed (*Lygodesmia juncea*).

On sandy soils, narrow-leaved yucca (*Yucca glauca*) may be

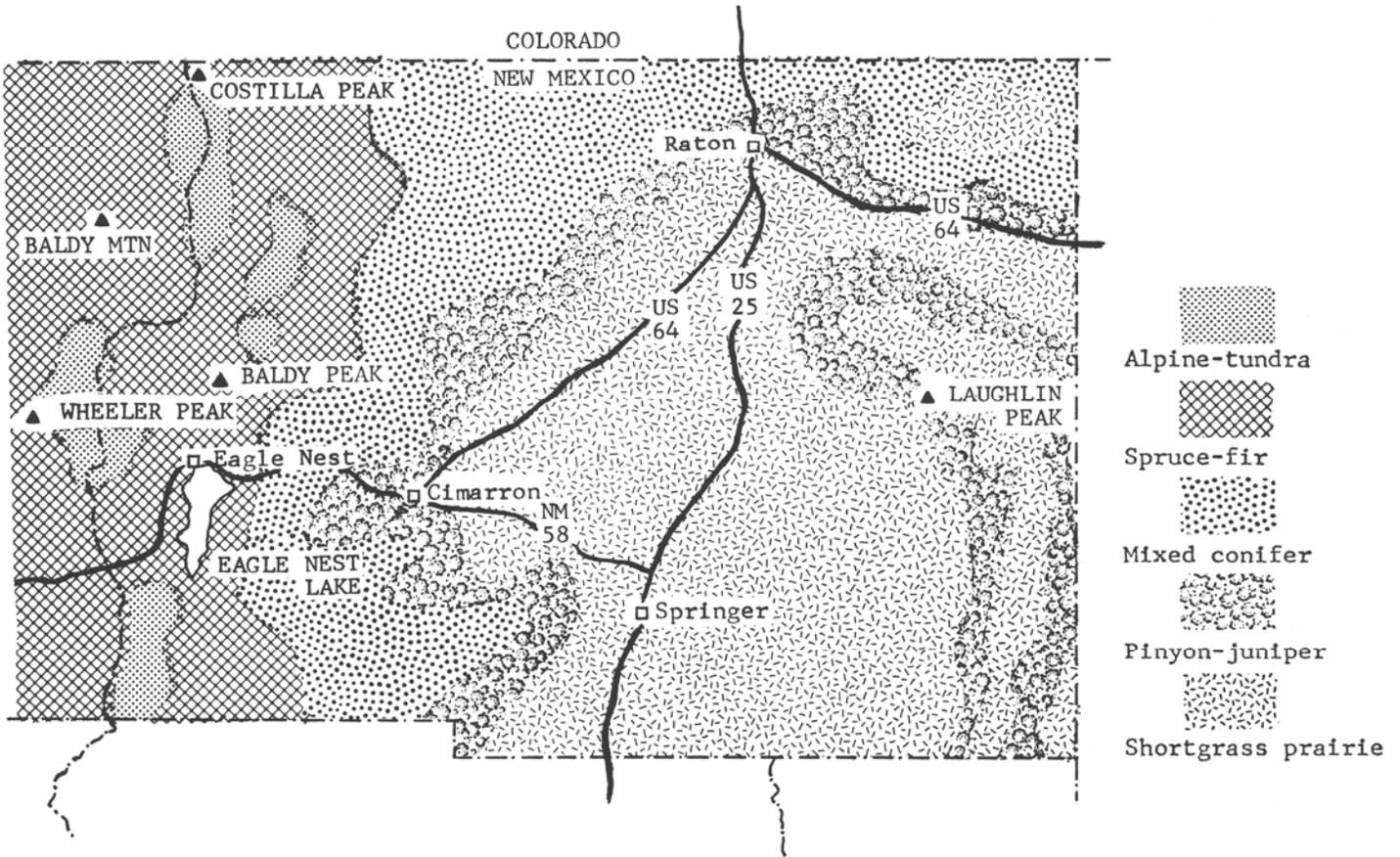


Figure 1. Map showing the general distribution of the life associations in Colfax and eastern Taos counties, New Mexico.

locally abundant, and on drier upland slopes prickly pear (*Opuntia polyacantha*) may occur.

Shrubs also may be locally abundant and vary in kind according to various edaphic factors. In disturbed habitats snake-weed (*Gutierrezia sarothrae*) and rabbitbrush (*Chrysothamnus nauseosus*) are found, but in well-drained, alkaline lowlands the more common shrubs are fourwing saltbush (*Atriplex canescens*), Nuttall's saltbush (*A. nuttallii*), and winterfat (*Eurotia lanata*). Along streambanks there are wild roses (*Rosa* spp.), squawbush (*Rhus trilobata*), willows (*Salix* spp.), cot-

tonwood (*Populus sargentii*), and sometimes boxelder (*Acer negundo*). The latter two species are the only conspicuous trees at this elevation.

Where the grassland has been badly disturbed, as by overgrazing or severe erosion, a discernible pattern of succession may follow, the initial stage composed of Russian thistle, goosefoot (*Chenopodium album*), peppergrass, prairie sunflower (*Helianthus petiolaris*), pigweed (*Amaranthus retroflexus* and *A. graecizans*), and knotweed (*Polygonum* spp.). The successional phases gradually proceed through species of both annual and perennial forbs as well as several genera of perennial grasses. After many years, the flora may again revert to a condition resembling the original shortgrass prairie stage.

Amphibians and reptiles are numerous in the shortgrass prairie. At least 30 species of amphibians and reptiles are at home in this grassland association, but several of them also occur at much higher elevations and in a wide range of floristic associations.

The more or less characteristic amphibians of the grassland, principally areas below 6,000 ft elevation, include the plains spadefoot toad (*Scaphiopus bombifrons*), western spadefoot toad (*S. hammondi*), Woodhouse's toad (*Bufo woodhousei*), sometimes occurring up to 8,000 ft elevation, probably Great Plains toad (*Bufo cognatus*), and leopard frog (*Rana pipiens*), the last widespread in distribution and ranging upward to an elevation of about 10,000 ft.

Reptiles are also common here and usually are found in drier habitats than are most amphibians. Two species of short-horned lizards (*Phrynosoma douglasi* and *P. cornutum*) are found here, but they also may occur in all associations up to

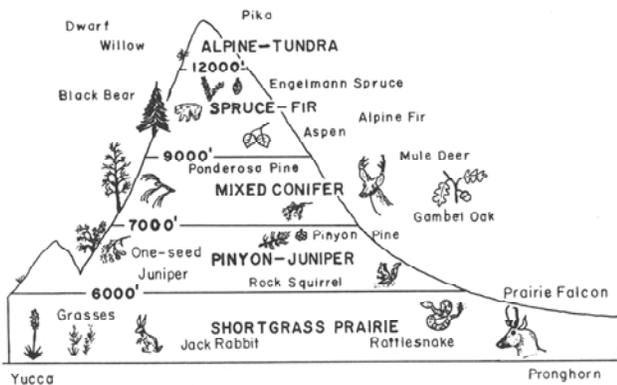


Figure 2. A diagrammatic cross-section through the Colfax County-eastern Taos County terrain showing the approximate vertical distribution and some of the members of the life associations. View is looking toward the north.

and including the spruce-fir. Both the Great Plains skink (*Eumeces obsoletus*) and many-lined skink (*E. multivirgatus*) are inhabitants of the shortgrass prairie, but the former may also occur in the pinyon-juniper woodland. In the eastern part of Colfax County, the whiptail (*Cnemidophorus sexilineatus*) appears in open grasslands.

Several snakes are more or less common to the prairie association, especially the western hognose snake (*Heterodon nasicus*), which seems to prefer sandy or gravelly places, the ringneck snake (*Diadophis punctatus arnyi*), western coach-whip (*Masticophis flagellum*), bullsnake (*Pituophis melanoleucus sayi*), eastern racer (*Coluber constrictor*), sometimes present also in woodland associations, corn snake (*Elaphe guttata*), mil ksnake (*Lampropeltis triangularum*), kingsnake (*L. getulus*), plains garter snake (*Thamnophis radix haydeni*), and wandering garter snake (*T. elegans*), the last ranging up to 10,000 ft elevation. Two species of poisonous snakes are represented here, the prairie rattlesnake (*Crotalus viridis*) which enjoys an extensive altitudinal range and the western diamond-back rattlesnake (*Crotalus atrox*). Both of these poisonous species inhabit grassland, brushland, woodland, rocky slopes, and canyons.

At least 20 species of mammals occur in the shortgrass prairie including several species of bats in two genera (*Myotis* and *Antrozous*), but bats generally can be expected to move freely through more than one association.

Other mammals include black-tailed jack rabbit (*Lepus americanus*), both thirteen-lined and spotted ground squirrels (*Citellus tridecemlineatus* and *C. spilosoma*), black-tailed prairie dog (*Cynomys ludovicianus*), and Botta's pocket gopher (*Thomomys bottae*). In addition there are both the silky and hispid pocket mouse (*Perognathus flavus* and *P. hispidus*), harvest mouse (*Reithrodontomys megalotis*), deer mouse (*Peromyscus maniculatus*), white-footed mouse (*P. leucopus*), and among the larger mammals, raccoon (*Procyon lotor*), western spotted skunk (*Spilogale gracilis*), striped skunk (*Mephitis mephitis*), which may occur at much higher elevations, and pronghorn (*Antilocapra americana*). Generations ago the bison (*Bison bison*) used to roam these grasslands, but the only ones left are found in captivity, as at Philmont Scout Ranch.

Although birds are abundant in the grassland, their ranges are more difficult to pinpoint with accuracy than those of most other organisms, but certain species are at least more common in the grassland region than at other elevations or in other habitats. The more common birds in the shortgrass prairie are the black-billed magpie (*Pica pica*), burrowing owl (*Speotyto cunicularia*), common nighthawk (*Chordeiles minor*), mountain plover (*Eupoda montane*), morning dove (*Zenaidura macroura*), peregrine falcon (*Falco peregrinus*), prairie falcon (*F. mexicanus*), bobwhite (*Colinus virginianus*), scaled quail (*Callipepla squamata*), ferruginous hawk (*Buteo regalis*) as well as other hawks, western meadowlark (*Sturnella neglecta*), and horned lark (*Eremophila alpestris*).

PINYONJUNIPER ASSOCIATION

In Colfax County, the pinyon-juniper association lies between the shortgrass plains and the mixed conifer association, mostly ranging from 6,000-7,000 ft elevation. This association covers large areas of central and eastern Colfax County. The dominant plants are Colorado pinyon (*Pinus edulis*) and one-seed juniper (*Juniperus monosperma*). At higher elevations in

this zone, the one-seed juniper is often replaced by the Rocky Mountain juniper *J. scopulorum*). Understory plants such as grasses are common in this association and include blue grama and galleta, especially in areas where the pinyon-juniper association merges with the shortgrass prairie. Other grasses, either abundant or scattered throughout the pinyon-juniper association, includes two species of Indian rice grass (*Oryzopsis hymenoides* and *O. micrantha*), Fendler's bluegrass (*Poa fendleriana*), Arizona fescue (*Festuca arizonica*), western wheatgrass, needle-and-thread grass (*Stipa comata*), sand dropseed, Junegrass (*Koeleria cristata*), and squirreltail (*Sitanion hystrix*).

The pinyon-juniper association is usually characterized by somewhat dry slopes, therefore the forbs are not as abundant as in more mesic areas. Also, some of the forbs are the same species as those found at lower elevations in the grassland and are representative of an extension of their range. The more common species of forbs include several members of the sunflower family, golden aster (*Chrysopsis villosa*), daisy fleabane (*Erigeron* spp.), prairie sunflower, Colorado rubberweed (*Hymenoxys richardsonii*), gumweed (*Grindelia squarrosa*), and several others. Also Russian thistle and globe mallow may be common, especially in the more disturbed situations.

Shrub cover is not abundant in the pinyon-juniper association, but is often mixed with the dominant species. The most common shrubs are mountain mahogany (*Cercocarpus montanus*), antelope brush (*Purshia tridentate*), big sage (*Artemisia tridentate*), estafiata (*A. frigida*), and snakeweed, the latter one often abundant in overgrazed areas. In addition there are species of serviceberry (*Amelanchier* spp.), fourwing saltbush, rock spiraea (*Holodiscus dumosus*), this species often more common at higher elevations, and squawbush. Many of the shrubs in this association are heavily browsed.

Here and there, especially in the upper reaches of the pinyon-juniper association, a kind of brushland may exist, principally composed of scrubby oaks (*Quercus* spp.), antelope brush, western black chokecherry (*Prunus virginiana melanocarpa*), and frequently species of serviceberry and hawthorn (*Crataegus* spp.).

Apparently there are no amphibians limited in distribution to the pinyon-juniper association, but some of the amphibians of primarily grassland habitats may occur at these higher elevations. For example, spadefoot toads are to be expected in the lower part of the pinyon-juniper association. Apparently if temporary or permanent water sources are available, certain wide-ranging species such as the tiger salamander (*Ambystoma tigrinum*), chorus frog (*Pseudacris triseriata*), and leopard frog can be found here. These three species often occur at elevations up to 10,000 ft or more.

Reptiles are more abundant than amphibians in the pinyon-juniper association. In addition to the several species which extend into this habitat from the shortgrass prairie, there are the collared lizard (*Crotaphytus collaris*), southern plateau lizard (*Sceloporus undulatus*), and among the snakes about the same species as found in the grassland, including the two rattlesnakes mentioned previously.

Many of the mammals are very widespread in their altitudinal distribution, but a number of them range primarily from the pinyon-juniper association to higher elevations and into other floristic zones. The most common mammals showing this distributional pattern are species of cottontail (*Sylvilagus* spp.), Colorado chipmunk (*Eutamias quad-*

ravittatus), rock squirrel (*Citellus variegatus*), Ord's kangaroo rat (*Dipodomys ordi*), brush mouse (*Peromyscus boylei*), rock mouse (*P. diffkilis*), white-throated woodrat (*Neotoma albigula*), and gray fox (*Urocyon cinereoargenteus*). Other mammals occurring here are also found in the grassland situation; they include several genera of bats, both western spotted skunk and striped skunk, bobcat, ringtail (*Bassariscus astutus*), raccoon, silky pocket mouse, western harvest mouse, deer mouse, and Botta's pocket gopher.

Although all of the birds of this area have the ability to move easily from association to association, certain species tend to restrict their movements to the grassland association for example and usually do not utilize the different kinds of cover afforded by the dominant plant species of the higher elevations. Some common birds of the pinyon-juniper association include western kingbird (*Tyrannus verticalis*), ash-throated flycatcher (*Myiarchus cinerascens*), probably Say's phoebe (*Sayornis soya*), Steller's jay (*Cyanocitta stelleri*), pygmy owl (*Glaucidium gnoma*), poor-will (*Phalaenoptilus nuttalli*), common nighthawk, screech owl (*Otus asio*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperi*), and species of sparrow (*Spizella* spp.).

MIXED CONIFER ASSOCIATION

The mixed conifer association is characteristic of slopes and ridges at elevations ranging from approximately 7,000 ft to an upper limit of about 9,000 ft where this zone comes in contact with the spruce-fir association. The mixed conifer association is often heavily forested and, although the dominant trees are principally Douglas-fir (*Pseudotsuga menziesii*), usually more common on north-facing slopes, and ponderosa pine (*Pinus ponderosa*), usually more prevalent on south-facing slopes, several other trees also may be evident. For example, the quaking aspen (*Populus tremuloides*) is often found in extensive populations representing a stage in succession following a major disturbance such as fire or extensive logging operations. Scattered stands of white fir (*Abies concolor*), and especially above the 8,000 ft level limber pine (*Pinus flexilis*) may also be seen.

Shrub communities, either as pure stands or as mixtures of species, include rock spiraea, wild currant (*Ribes cereum*) and often other currants and gooseberries, mountain lilac (*Ceanothus fendleri*), mountain mahogany, big sage, western black chokecherry, serviceberry (*Amelanchier alnifolia*), and bearberry (*Arctostaphylos uva-ursi*). In more mesic areas, especially in damp meadows or along streams, there are species of willows (*Salix* spp.), western birch (*Betula occidentalis*), red-stemmed dogwood (*Cornus stolonifera*), and shrubby cinquefoil (*Potentilla fruticosa*).

The often dense stands of timber are interrupted here and there by open meadows or sometimes open stands of the dominant trees. These open areas contain many species of grasses, mostly bluegrass (*Poa pratensis*), blue grama, needle-and-thread grass (*Stipa robusta*), and several species of muhly grass (*Muhlenbergia* spp.). Common grasses in disturbed ground are squirreltail, foxtail barley (*Hordeum jubatum*), windmill grass (*Schedonnardus paniculatus*), and downy chess (*Bromus tectorum*). Moist meadow and riparian communities support hairgrass (*Deschampsia caespitosa*) and reedgrass (*Calamagrostis canadensis*).

Forbs make up a significant part of the ground cover in the mixed conifer association, but the composition of species

differs considerably between relatively undisturbed and disturbed areas. Forbs in less disturbed meadows or sometimes in streamside associations are harebell (*Campanula rotundifolia*), Jacob's ladder (*Polemonium foliosissimum*), wild geranium (*Geranium fremontii*), yarrow (*Achillea lanulosa*), wild iris (*Iris missouriensis*), creeping clover (*Trifolium repens*), buttercups (*Ranunculus* spp.), milkvetch (*Astragalus agrestis*), locoweed (*Oxytropis lambertii*), cinquefoils (*Potentilla* spp.), and many others. On more disturbed sites more weedy forms prevail, such as pussytoes (*Antennaria rosea*), fendler sandwort (*Arenaria fendleri*), groundsel (*Senecio* spp.), golden aster, Colorado rubberweed, fleabane (*Erigeron flagellaris*), snake-weed, Russian thistle, and mountain sagebrush (*Artemisia frigida*).

Amphibians are not abundant in the mixed conifer association, but both the boreal chorus frog and leopard occur here, especially near or within aquatic habitats. Reptiles are much more numerous than amphibians in this association. Reptiles include the short-horned lizard, smooth green snake (*Opheodrys vernalis*), black-necked garter snake (*Thamnophis cyrtopsis*), wandering garter snake, and occasionally the prairie rattlesnake, but the latter is more typically an inhabitant of brushy or rocky slopes or canyons.

This association is an excellent habitat for many mammals, and several species occur at these and higher elevations for the most part. Shrews are often common, especially the masked shrew (*Sorex cinereus*), vagrant shrew (*S. vagrans*), and water shrew (*S. palustris*). A number of bats are also frequent inhabitants here, but some of them also occupy other associations as well; myotis (*Myotis* spp.), silver-haired bat (*Lasiorycteris noctivagans*), big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), and pallid bat (*Antrozous pallidus*) are probably the most common.

The rodents are especially well represented, such as the Colorado chipmunk, rock squirrel, Gunnison's prairie dog (*Cynomys gunnisoni*), Abert's squirrel (*Sciurus aberti*), red squirrel (*Tamiasciurus hudsonicus*), western harvest mouse, deer mouse, Mexican woodrat (*Neotoma mexicana*) and meadow vole (*Microtus pennylvanicus*) in open damp meadows or along the forest edge. More conspicuous mammals include black bear (*Ursus americanus*), raccoon, ermine (*Mustela erminea*) in montane meadows, mink (*M. vison*) along permanent watercourses, badger (*Taxidea taxus*) in open non-forested areas, striped skunk, bobcat, elk (*Cervus elaphus*), muledeer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), and mountain lion (*Felis concolor*).

The avian fauna of the mixed conifer association is similar in composition to that of the spruce-fir association; therefore both floristic zones will be considered together in the enumeration of the more common birds of these elevations. Probably at least 30 species of birds inhabit the mixed conifer and spruce-fir associations in the study area. Some of these birds are year-around residents.

The more common birds here are gray jay (*Perisoreus canadensis*), Stellar's jay, raven (*Corvus corax*), crow (*Corvus brachyrhynchos*), snowy owl (*Nyctea scandiaca*), pygmy owl (*Glaucidium gnoma*), sawwhet owl (*Aegolius acadicus*), great horned owl (*Bubo virginianus*), flammulated owl (*Otus flammeolus*), ruby-throated hummingbird (*Archilochus colubris*), yellow-bellied sapsucker (*Sphyrapicus varius*), band-tailed pigeon (*Columba fasciata*), turkey (*Meleagris gallopavo*), red-breasted nuthatch (*Sitta canadensis*), wren (*Troglodytes*

trogodytes), hermit thrush (*Hylocichla guttata*), Swainson's thrush (*H. ustulata*), western bluebird (*Sialia mexicana*), ruby-crowned kinglet (*Regulus calendula*), junco (*Junco hiemalis*), and pine siskin (*Spinus pinus*).

SPRUCE-FIR ASSOCIATION

This association is primarily a coniferous forest extending upward from the mixed conifer zone to timber line. Although the dominant trees are Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), several other conspicuous trees are also at home here, commonly aspen (*Populus tremuloides*), sometimes in almost pure stands, corkbark fir (*Abies lasiocarpa arizonica*), blue spruce (*Picea pungens*), white fir, which is more common at lower elevations, Douglas-fir, and bristlecone pine (*Pinus aristata*), the latter species a white pine usually inhabiting exposed ridges or slopes.

The deep forest canopy prevents the development of all but a relatively few understory plants, but under these conditions one can expect to find one or more grasses, including Letterman needlegrass (*Stipa lettermanii*), and several forbs and low shrubs, namely woodnymph (*Monoeses uniflora*), Indian pipe (*Pyrola elliptica*), pipsissewa (*Chimaphila umbellata*), red-orange columbine (*Squilegia elegantula*), bedstraw (*Galium boreale*), arnica (*Arnica cordifolia*), and whortleberry (*Vaccinium scoparium*), the latter species also occurring in the alpine-tundra association.

The more open forest supports species of grasses from several genera, mostly *Trisetum*, *Phleum*, *Bromus*, and *Festuca*, as well as several species of sedges from the genus *Carex*. Forbs occur also, but are represented by relatively few species.

Probably the most abundant understory herbs in this association occur in stands of aspen. The most common of these herbs are bracken fern (*Pteridium asquillinum pubescens*), blue columbine (*Aquilegia coerulea*), lousewort (*Pedicularis racemosa*), deer's ears (*Swertia radiata*), meadow rue (*Thalictrum fendleri*), mountain larkspur (*Delphinium barbeyi*), vetch (*Vicia americana*), golden pea (*Thermopsis pinetorum*), yarrow, and several members of the carrot family, including wafer parsnip (*Pseudocymopterus montanus*), cow parsnip (*Heracleum lanatum*), lovage (*Ligusticum porteri*), and sweet cicely (*Osmorrhiza obtusa*). Several genera of grasses are also in evidence here.

There are open meadows of various sizes throughout the spruce-fir association, typically characterized by a mixture of sedges and grasses as well as several species of forbs, but except for an occasional shrubby cinquefoil (*Potentilla fruticosa*) or dwarf juniper (*Juniperus communis*) around the margins of the meadows, shrubs tend to be uncommon.

The same amphibians are found here as in the mixed conifer association, but they are less common than in lower associations. The reptiles are also relatively few in number but may include such species as short-horned lizard, also found at lower elevations, smooth green snake, usually in meadows or along stream banks, wandering garter snake, a snake of many habitats, and even the prairie rattlesnake which occasionally may be found up to elevations as high as 11,000 ft.

Mammals of the spruce-fir zone are also frequently inhabiting the more exposed alpine-tundra association. For example, in rock slides in both areas the pika (*Ochotona princeps*) is found, but usually not below 11,000 ft elevation. Many other mammals are more or less in evidence here; these include yellow-bellied marmot (*Marmota flaviventris*), rock squirrel, which also occurs at elevations as low as 6,500 ft in the pin-

yon-juniper association, golden-mantled ground squirrel (*Citellus lateralis*), Gunnison's prairie dog, red squirrel, northern pocket gopher (*Thomomys talpoides*), bush-tailed woodrat (*Neotoma cinerea*), red-backed mouse (*Clethrionomys gapperi*), meadow vole (*Microtus pennsylvanicus*), usually near permanent water, long-tailed vole, western jumping mouse (*Zapus princeps*), an inhabitant of mesic meadows, ermine, also occurring in mesic meadows, long-tailed weasel (*Mustela frenata*), and bobcat.

ALPINE-TUNDRA ASSOCIATION

The alpine-tundra association occupies those areas found above the permanent treeline and is characteristic of a relatively small area in montane New Mexico. In the Colfax County-Taos County area, the alpine-tundra begins at an elevation of about 12,000 ft, extending to the tops of the highest mountains, in this instance the summit of Wheeler Peak at 13,160 ft. The lower border of this zone merges with the spruce-fir forest and is usually characterized by scattered, dwarf, wind-twisted and wind-trained spruce trees. The floristic composition of this zone in New Mexico is similar to that of alpine-tundra areas throughout the southern Rocky Mountain region.

Although trees do not occur in the typical sense in the alpine-tundra association proper, certain shrubs are rather common, especially willows. The several species of willows found here include the spreading or erect species such as *Salix pseudolapponum* and *S. planifolia monica* which are more common toward the lower limits of the association, and the prostrate, creeping species *S. petrophylla* and *S. nivalis saximontana* which may occur all the way to the alpine summits.

Common members of this association are the sedges and grasses. These species give much of the alpine-tundra area a grassland aspect. The most common sedges are alpine sedge (*Kobresia bellardii*), which is often a dominant species, especially in more favorable habitats, and in addition several species of common sedge (*Carex* spp.). In this habitat, rushes (*Juncus* spp.) are also more or less common. The alpine meadows are often represented by many grasses as well, including alpine bluegrass (*Poa alpina* and *P. arctica*) and other species of bluegrass which may extend into this zone from lower elevations, alpine timothy (*Phleum alpina*), spikegrass (*Trisetum spicatum*), tufted hairgrass (*Deschampsia caespitosa*), alpine redtop (*Agrostis humilus*), wild oat (*Avena mortoniana*), Thurber fescue (*Festuca thurberi*), sheep fescue (*Festuca ovina*), and timber oatgrass (*Danthonia intermedia*). Associated with the sedges and grasses are a number of forbs representing several families. In deeper soils one commonly finds alpine meadow rue (*Thalictrum alpinum*), bistort (*Polygonum bistortoides*), viviparous knotweed (*P. viviparum*), alpine geum (*Geum turbinatum*), alpine bluebells (*Mertensia alpina*), mountain dandelion (*Agoseris aurantiaca*), and yarrow. On shallower soils the composition of the flora usually becomes markedly changed; the most likely species in this kind of habitat are cushion pink (*Silene acaulis*), nailwort (*Paronychia pulvinata*), dwarf alpine clover (*Trifolium nanum*), alpine clover (*T. dasyphyllum*), Parry's gentian (*Gentiana parryi*), alpine cinquefoil (*Sibbaldia procumbens*), split-leaf paintbrush (*Castilleja rhexifolia*), spotted saxifrage (*Saxifrage bronchialis*), and cushion phlox (*Phlox caespitosa*). Although generally the exposed slopes are not noticeably

moist at these elevations, marshy meadows sometimes occur. The marshy areas are populated primarily by various sedges in the genera *Carex*, *Eleocharis*, and *Eriophorum*, as well as by such forbs as marsh marigold (*Caltha leptosepala*) and elephant antella (*Pedicularis groenlandica*).

As might be expected, due to the difficult environmental conditions, animal life is not especially abundant in the alpine-tundra. The more common mammals include pika, an inhabitant of talus slides, yellow-bellied marmot, occurring up to timberline, northern pocket gopher, frequently in alpine meadows, and long-tailed weasel, occurring in the lower fringes of the alpine meadows.

Bird life is also less abundant in the alpine tundra than at lower elevations, but one can expect to find horned lark (*Eremophila alpestris*), white-tailed ptarmigan (*Lagopus leucurus*), water pipit (*Anthus spinoletta*), and tree sparrow

(*Spizella arborea*) in this zone, the last species usually in willow thickets.

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