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WILDLIFE HABITATS IN MANAGED RANGELANDS--THE GREAT BASIN OF SOUTHEASTERN OREGON

MANMADE HABITATS

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ABSTRACT

Manmade structures on rangelands provide specialized habitats for some species. These habitats and how they function as specialized habitat features are examined in this publication. The relationships of the wildlife of the Great Basin to such structures are detailed.

KEYWORDS: Wildlife habitat, range management.

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This publication is part of the series **Wildlife Habitats in Managed Rangelands The Great Basin of Southeastern Oregon.** The purpose of the series is to provide a range manager with the necessary information on wildlife and its relationship to habitat conditions in managed rangelands in order that the manager may make fully informed decisions.

The information in this series is specific to the Great Basin of Southeastern Oregon and is generally applicable to the shrub-steppe areas of the Western United States. The principles and processes described, however, are generally applicable to all managed rangelands. The purpose of the series is to provide specific information for a particular area but in doing so to develop a process for considering the welfare of wildlife when range management decisions are made.

The series is composed of 14 separate publications designed to form a comprehensive whole. Although each part will be an independent treatment of a specific subject, when combined in sequence, the individual parts will be as chapters in a book.

Individual parts will be printed as they become available. In this way the information will be more quickly available to potential users. This means, however, that the sequence of printing will not be in the same order as the final organization of the separates into a comprehensive whole.

A list of the publications in the series, their current availability, and their final organization is shown on the inside back cover of this publication.

Wildlife Habitats in Managed Rangelands — The Great Basin of Southeastern Oregon is a cooperative effort of the USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, and United States Department of the Interior, Bureau of Land Management.

Introduction

Manmade structures, such as buildings, roads, bridges, rock walls, and wooden corrals and fences have long been a part of western rangelands. Although they were not built with an idea of blending into their surroundings, after being weathered and molded by the environment, these manmade intrusions become part of the landscape. Few men living can remember when they were not there. Such structures, when obviously "old" or of a past era, come to be considered as part of our national heritage and are preserved for the consideration and enjoyment of the public.

The rustic individualism reflected by these structures is captured by artists with brush and camera. But little does an artist know of the role the environment has played in molding their character. True, the builder has left behind the design of his labor, and weather and age have blended both labor and design into its surroundings. But, the sun and wind and rain and snow are not alone in contributing to making an abandoned homestead a thing of rustic attractiveness. The generations of plants and animals that live along each stretch of road and fence, under each bridge, and in and around each abandoned homestead add the final touches of individualism.

Although man has seldom viewed his intrusions into the environment as habitats for wildlife, their value as wildlife habitat is slowly being perceived. For example, Lustig (1976:4), in his article "Living Fences. . .An Alternative," put it this way:

> Robert Frost's poem 'Mending Fences' popularized the old proverb 'good fences make good neighbors.' However, for today's ecologically aware populus [sic], a more appropriate statement might be 'good fences bring good neighbors.' And so they do; both in urban and rural areas. . . . Any concerned land owner can easily change an ecologically sterile boundary line or fence row into a 'mini' wildlife sanctuary and thereby maximize the species diversity that he and his family can enjoy at their very doorsteps.

Structures, such as fences, have the potential to become habitats for wildlife. They provide certain habitat features that allow species to invade and to exist in areas that would be otherwise unsuitable. This effect is particularly pronounced in the Great Basin where the terrain is relatively gentle over vast expanses and the structural diversity of the vegetation is relatively simple.

In the wildlife sense, such structures may be thought of as manmade habitats (Appendix 1). A land manager should consider this aspect of old structures when decisions are made about their future.

It is the purpose of this discussion to point out wildlife habitat values of manmade structures in rangelands, and to make suggestions about how such habitat values may be enhanced.

Abandoned Homesteads

Abandoned homesteads have been and are being destroyed because of their ramshackle condition, hazard to humans or livestock, and other reasons. But, destruction of such historic sites on public lands appears to contradict the intent of the Historic Preservation Act (1966: 915) which states:

> ...That Congress finds and declares-
>
> (a) That the spirit and direction of the Nation are founded upon and reflected in its historic past;
>
> (b) That the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people;
>
> (c) That, in the fact of ever-increasing extensions of urban centers, highways, and residental, commercial, and industrial developments, the present governmental and nongovernmental historic preservation programs and activities are inadequate to insure

> future generations a genuine opportunity to appreciate and enjoy the rich heritage of our Nation. . . .

Further, the National Environmental Policy Act (1969, p. 852), under "Title 1, Declaration of National Environmental Policy," states that:

> (4) preserve important historic, cultural, and natural aspects of our heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice. . . .

And destruction of homesteads is not in keeping with Bureau of Land Management policy (United States Department of the Interior Bureau of Land Management Manual 623 1).

The most obvious management interest in abandoned homesteads is for their historical and cultural value. But they also provide wildlife habitat. Most abandoned homesteads have four features that make them valuable as habitat-buildings and associated structures, introduced vegetation, a permanent source of water, and a creation of diversity in an otherwise homogeneous habitat. Any or all of the following features may be found around these old homesteads: house and outbuildings, rock or rail fences, irrigation ditches, root cellars, primitive roads, culverts, ponds, springs, wells, ornamental trees and shrubs, fruit trees, refuse piles or pits, abandoned machinery, and fenced grave sites.

BUILDINGS

Abandoned wooden buildings (fig. 1) serve as habitat for a variety of animals (Bailey 1936, Orr 1954, Stebbins 1954, 1966). Lizards and snakes use them for sunning, shade, and shelter, as places to feed, and as reproductive sites. Screech owls (*Otus asio*) use building-interiors for roosting and rearing young. Barn swallows *Hirundo rustica*) nest inside buildings (fig. 2), and cliff swallows (*Petrochelidon pyrrhonota)* construct nests on the outer walls. Common flickers (*Colaptes auratus)* often peck holes through the outer wall of "double-walled" buildings and nest in the interspaces (fig. 3). These "cavities" are secondarily inhabited by bats (Orr 1954), chipmunks (*Eutamias* spp.), deer mice *(Peromyscus maniculatus),* woodrats *(Neotoma* spp.), American kestrels (*Falco sparverius),* and starlings (*Sturnus vulgaris*).

Bats use the interior of old buildings as night roosts where they hangup while digesting their food; bats may also use them as sites in which to hibernate (Barbour and Davis 1969, Orr 1954). Buildings which are located in cool sites and have tarpaper siding may have bats roosting under the tarpaper during the day.

Figure 1 .-Abandoned wooden buildings (homesteads) serve as habitat for a variety of wildlife species. The introduced vegetation is particularly important to birds. (Bureau of Land Management photograph)

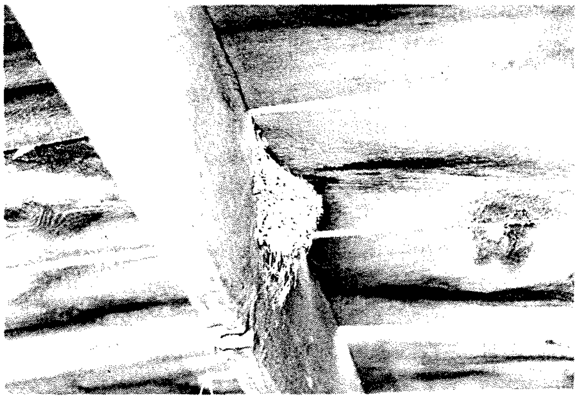

Figure 2.—A barn swallow ***(Hirundo rustica)*** nest on a beam inside an abandoned wooden building. (Chris Maser photograph)

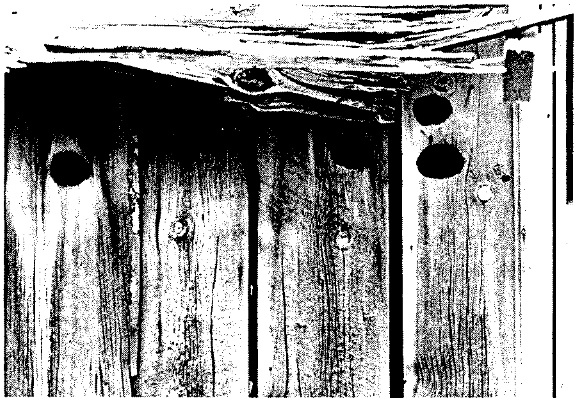

Figure 3.-Common flickers (***Colaptes auratus***) often peck holes through the outer wall of “double-walled” buildings and nest in the interspaces. In this case, the holes are in the wall under the overhang of the roof. These “cavities” are secondarily inhabited by other species of wildlife. (Chris Maser photograph)

Figure 4.—A deer mouse (Peromyscus ***maniculatus***) nest within the top of the door casing of an abandoned homestead. (Chris Maser photograph)

Larger animals, such as mountain cottontail rabbits (*Sylvilagus nuttalli*), ground squirrels (*Spermophilus* spp.), yellow-bellied marmots (*Marmota flaviventris*), long-tailed weasels (*Mustela frenata),* striped skunks *Mephitis mephitis),* spotted skunks *(Spilogale putorius*), and badgers (*Taxidea taxus*), live under buildings, whereas deer mice (fig. 4) and woodrats (fig. 5) frequent all stories. Even collapsed wooden buildings and piles of wooden fence posts are used as shelter and as sites for rearing young by lizards, snakes, mountain cottontail rabbits, yellow-bellied marmots, ground squirrels, woodrats, deer mice, long tailed weasels, and others.

Abandoned wooden buildings are used as hiding and thermal cover, and as sites for reproduction, feeding, hibernation, sunning, and as elevated lookouts by a variety of wildlife. Buildings constructed of rock (fig. 6) are more important than are wooden buildings as habitat for lizards, snakes, and digging rodents, such as ground squirrels and marmots, because they more closely simulate their natural habitat.

Figure 5.—Bushy-tailed **woodrat** (Neofoma Cinerea) nest in the attic of an abandoned homestead. (Chris Maser photograph)

Figure 6.—Buildings constructed of rock are important as habitat for lizards, snakes, and digging rodents because **they** more closely simulate their natural habitat. (Bureau of Land Management photograph)

The concentration of animals is, in turn, attractive to predators. Predators frequently found in association with abandoned buildings include hawks, owls, long-tailed weasels, badgers, coyotes (*Canis latrans*), and bobcats (Lynx *rufus*).

INTRODUCED VEGETATION

Homesteaders often planted shade and fruit trees and shrubs. Many abandoned home sites still have Lombardy poplars (*Populus nigra*) (fig. 7), white poplars *(Populus alba)* (fig. 8), cottonwoods *(Populus* spp.), and black locusts (*Robinia pseudoacacia)* growing around them. These trees stand out in stark contrast to a generally treeless landscape and are commonly used as perching sites and nesting locations for such birds as northern orioles (*Icterus galbula),* western kingbirds (*Tyrannus verticalis*), black-billed magpies *(Pica pica)* (fig. 9), black-headed grosbeaks *(Pheucticus melanocephalus),* red-tailed hawks *(Buteo jamaicensis)* (fig. 10), ferruginous hawks *(Buteo regalis),* golden eagles (*Aquila chrysaetos),* great

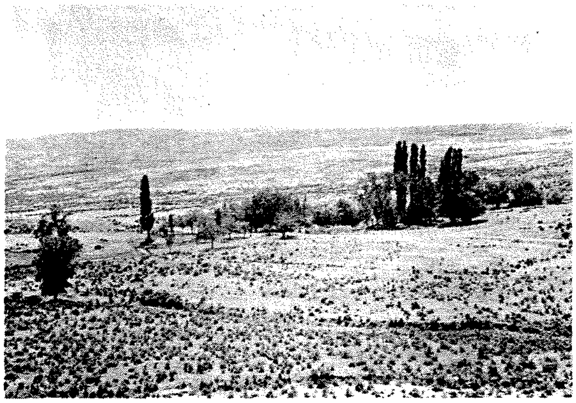

Figure 7.-The tall, narrow trees are Lombardy poplars (Populus nigra). They are not self-producing. (Bureau of Land Management photograph)

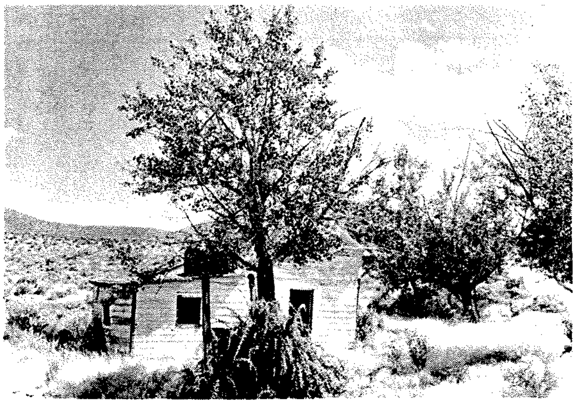

Figure 8.—White poplars (Populus *alba*) are self-producing. Note the young trees in the lower right corner. (Chris Maser photograph)

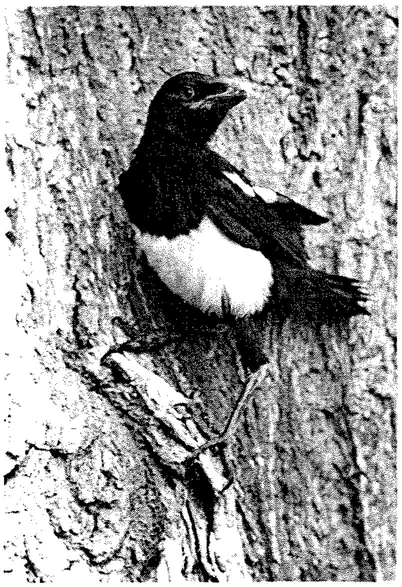

Figure 9.—Black-billed magpies (Pica pica) often perch and nest in trees around abandoned homesteads. (Robert R. Kindschy photograph)

Figure 10.—Red-tailed hawks (Buteo jamaicensis) are one of the raptors that nest around abandoned homesteads. (Robert R. Kindschy photograph)

horned *owls (Bubo virginianus),* long-eared owls *(Asio otus),* and flickers (Marion and Ryder 1975, Olendorff and Stoddart 1974, Schnell 1968, Seibert et al. 1976, Smith et al. 1972, Snow 1974a, Woffinden 1975). Common flickers excavate cavities in dead trees and in dead limbs on live trees. The abandoned nest-cavities are secondarily used by mountain bluebirds *(Sialia currucoides),* western bluebirds *(Sialia mexicana),* starlings, violet-green swallows *(Tachycineta thalassina),* American kestrels, and bats. In addition, hoary bats *(Lasiurus cinereus)* roost in the foliage of these trees during their spring and fall migrations (Bailey 1936, Constantine 1959, 1966). Many homesteads also have shrubs around them-some introduced, some native. Shrubs are used for nesting by such birds as gray flycatchers *(Empidonax wrightii),* house finches *(Carpodacus mexicanus),* and lazuli buntings *(Passerina amoena).* The presence of trees and shrubs greatly increases habitat diversity. Trees are particularly important in this regard (fig. 11).

Figure 11 .-The trees that were planted around old homesteads are particularly important as habitat for nesting birds. (Bureau of Land Management photograph by M. Hurd)

WATER

Homesteads were normally located near a source of permanent water, usually a spring, stream, or river. Springs that were made into reservoirs, but not maintained, often developed riparian and aquatic vegetation (fig. 12). Some reservoirs contain fish and bullfrogs *(Rana catesbeiana).* Western harvest mice *(Reithrodontomys megalotis)* and montane voles *(Microtus montanus)* may occupy the marshy areas; and yellow warblers *(Dendroica petechia),* short-eared owls *(Asio flammeus),* American avocets *(Recurvirostra americana),* red-winged blackbirds *(Agelaius phoeniceus),* killdeer *(Charadrius vociferus),* mallards *(Anus platyrhynchos)* (fig. 13), cinnamon teal *(Anus cyanoptera),* marsh hawks *(Circus cyaneus)* (fig. 14), and other birds nest in and around the riparian vegetation (Evans and Kerbs 1977, Greenwell 1952). In addition, migratory waterfowl are frequent visitors during the spring and fall.

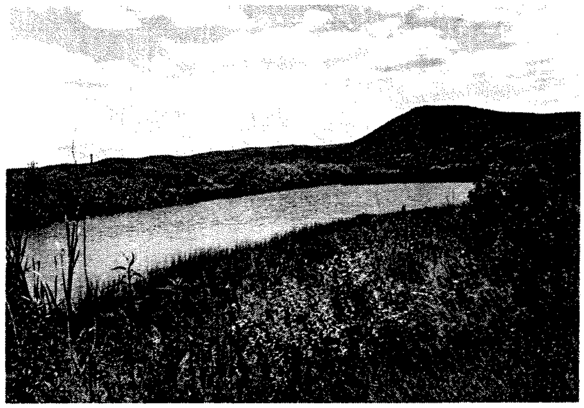

Figure 12.-Springs that were made into reservoirs, but then were no longer maintained, often developed riparian and aquatic vegetation. (Bureau of Land Management photograph by Robert R. Kindschy)

Figure 13.-Mallards (Anus platyrhynchos) can be found nesting in marshy areas surrounding homestead reservoirs that are no longer maintained.

Figure 14.— Marsh hawks (Circus cyaneus) also nest in marshy areas surrounding homestead reservoirs that are no longer maintained.

The presence of the water attracts many animals. Tracks of California quail (*Lophortyx californicus),* rabbits, mule deer (*Odocoileus hemionus),* pronghorns ***(An tilocapra americana),*** coyotes, and bobcats are often observed near water.

DIVERSITY

Buildings, trees, shrubs, and permanent sources of water associated with abandoned homesteads provide three essential habitat components-food, water, and cover-in a relatively small area. This combination contrasts dramatically with the surrounding, comparatively sterile, habitats (fig. **15).** In so doing, they add greatly to the diversity and richness of an area. Abandoned homesites, then, provide habitat for species that would be otherwise scarce or absent in the locale. They also act to concentrate a number of common species.

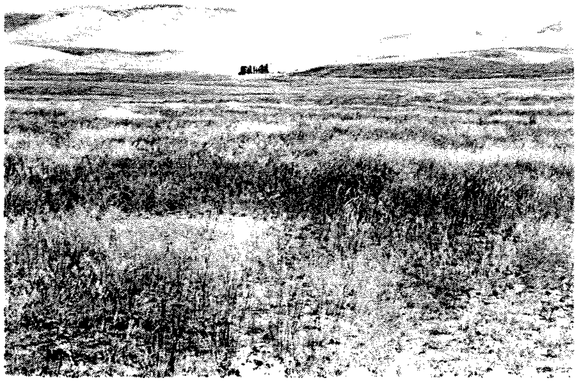

Figure 15.— Old homesteads contrast dramatically with the surrounding, relatively homogeneous rangeland habitats. (Bureau of Land Management photograph by Robert R. Kindschy)

Some habitat attributes created by abandoned homesteads are relatively unstable, and time exacts a toll on many of them. Wooden buildings are dismantled, vandalized, burned, or gradually deteriorate. Some of the introduced vegetation, such as Lombardy poplar, is not self-reproducing and gradually dies.

Diversity created by abandoned homesteads is long lasting but changes over time. For example, vegetation, such as white poplar, is self-perpetuating and can remain more or less intact for over a century. The source of water, however, preceded the homestead and will outlast it (fig. 16). These abandoned works of man, therefore, enhance the habitat for a variety of species of wildlife for a time, allowing some to live in areas that otherwise would be unsuitable.

Roads and Bridges

Unpaved roads are highly visible features of managed rangelands; there are thousands of miles of such roads in the Great Basin. The terrain crossed by some roads necessitates the building of bridges. Although roads and bridges improve or create habitat for some species of wildlife, they degrade or destroy habitat for others. This statement may also apply to paved roads (Leedy 1975, Leedy et al. 1975).

ROADS

Although there are some positive effects of roads on some wildlife species, in general, roads have adverse effects on the broad spectrum of wildlife regardless of where or how they are constructed (Oxley et al. **1974).** Adverse effects are compounded when roads are built in or adjacent to riparian zones.

The positive habitat values of rangeland roads lie primarily in their design and con-

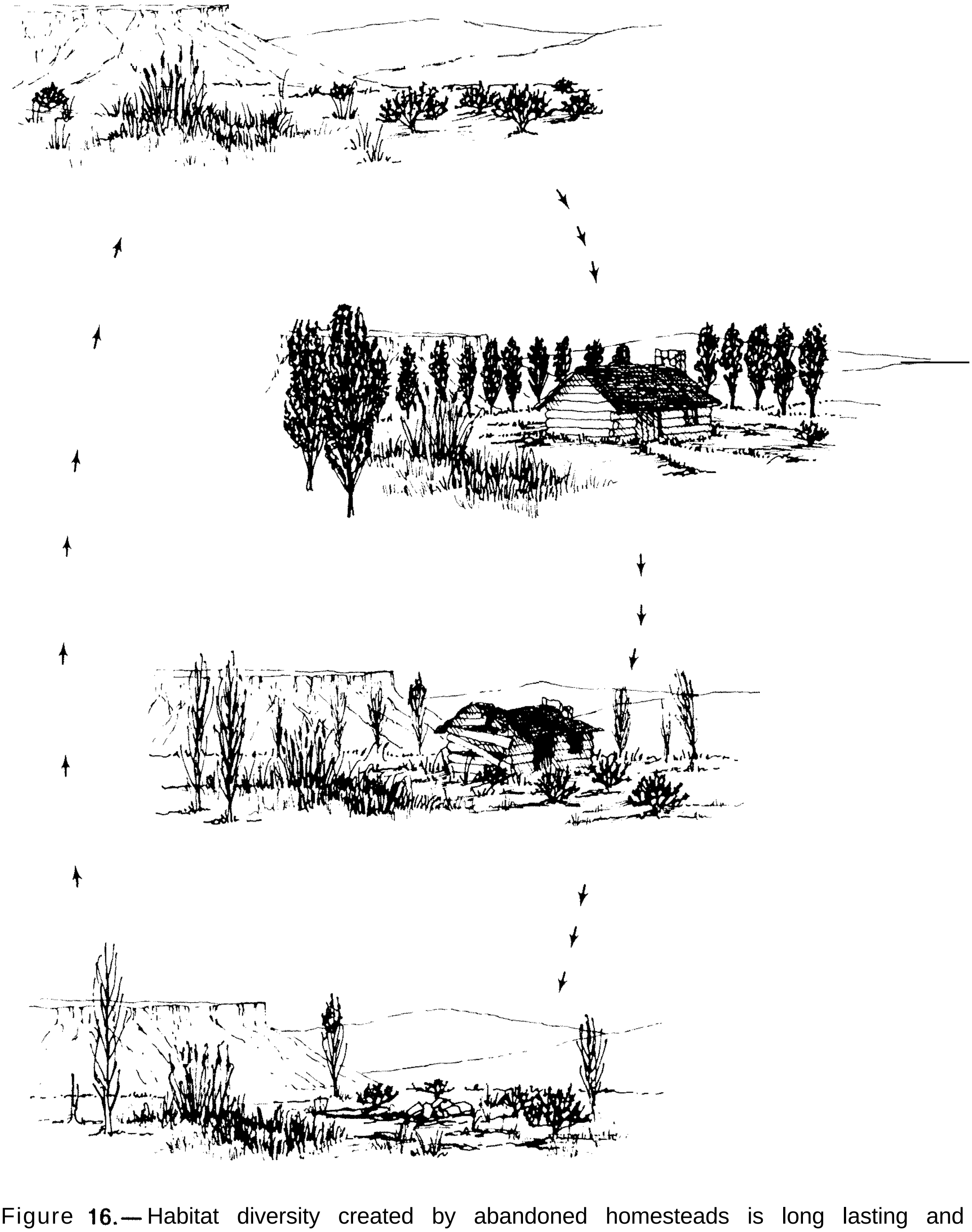

Figure 16.—Habitat diversity created by abandoned homesteads is long lasting and changes over time. Ultimately, the source of water that preceded the homestead will outlast it.

Figure 17.— Roadbanks and roadsides often enable a type of vegetation to become established that differs from that of the surrounding country, creating habitat diversity and edge-effect.

struction. Roadbanks cut into uneven terrain may require stabilization to prevent erosion, but roadsides through even terrain seldom need to be stabilized. Roadbanks and roadsides often enable a type of vegetation to become established that differs from that of the surrounding country, creating habitat diversity and edge-effect (fig. 17).

Habitat changes may be produced by exposure of several soil horizons of different textures, removal of top soil, piles of loose soil and rock, creation of moister conditions in borrow ditches and pits, installation of culverts, fertilization of cuts and fills, seeding raw banks, etc. Such alterations are particularly important as habitat where conditions are created that did not previously exist and there are wildlife species that can exploit them.

These areas are often "colonized" by ground squirrels (*Spermophilus* spp.), pocket mice (*Perognathus* spp.), kangaroo rats (*Dipodomys* spp.), voles (*Microtus* spp.), rabbits, and hares (*Lepus* spp.) (Douglas and Johnson 1972), and may act as routes of dispersal from one area to another by forming a physical link of suitable habitat through otherwise uninhabitable terrain. For example, Getz et al. (1978) wrote:

> Roadsides that provide habitats different from those occurring in adjacent areas are potential avenues of dispersal for various groups of animals. In particular, this applies to those roadsides that have dense grassy vegetation. Such roadsides provide dispersal routes for grassland species. . . .

A somewhat different set of circumstances applies to minimum standard roads through flat terrain in areas of the Great Basin. In this case, a roadbed is often lower than the "bank" because the debris (soil and rocks) is simply pushed aside with a bulldozer, creating small cuts and ridges along the road's edge (figs. 18 and 19). Soil in these ridges is often better drained and remains more friable than does that of the surrounding flatlands, particularly when much clay is present. The combination of better drainage and greater friability allows animals, such as kangaroo rats, which are relatively poor diggers, to live in and disperse along the soil ridges. This is especially important when the surrounding flatland soil is saturated with water during the winter or when it is too hard for them to dig through during the summer. Soil ridges often are nearly free of perennial vegetation and are gradually built up through additional soil deposits during road maintenance activities, thus providing a well-defined habitat.

At times, construction results in piles of debris (soil, rocks, and brush) along a road. These piles become inhabited by animals such as ground squirrels, kangaroo rats, pocket mice, harvest mice, deer mice, and sage voles (*Lagurus curtatus*). Although the piles offer elevated sites with better drainage and easier digging, they are usually scattered in distribution and may take longer to be occupied. Most of the debris piles seem to be unaffected by

Figure 18.-Construction of minimum standard roads through flat terrain may create small roadbanks, thereby adding to habitat diversity. (Bureau of Land Management photograph)

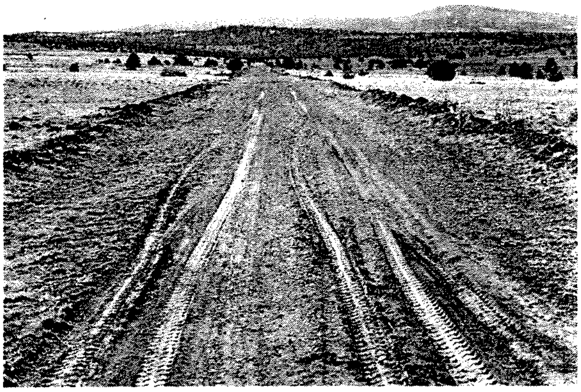

Figure 19.-Construction of minimum standard roads through flat terrain may create small ridges of soil. Soil in these ridges is often better drained and remains more friable than does that of the surrounding flatlands, making it good habitat for small mammals, such as the Ord kangaroo rat (*Dipodomys ordi*). (Chris Maser photograph)

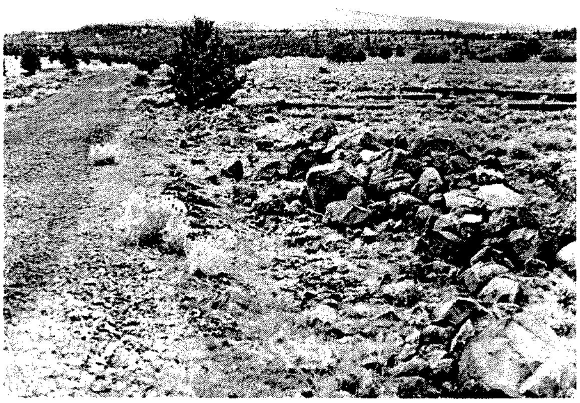

Figure 20.— Road construction with a bulldozer through rocky soil-especially soil containing large rocks and boulders-creates a ridge strewn with large individual rocks or clusters of big rocks. Mantled ground squirrels (*Spermophilus lateralis*) and yellow-bellied marmots (*Marmota flaviventris*) are closely associated with large rocks which serve as elevated look-outs, and large roadside rocks have allowed both rodents to survive in and disperse through otherwise unsuitable habitats. (Chris Maser photograph)

road maintenance and gradually blend into the surrounding landscape. As they become overgrown with vegetation, they gradually lose their habitat-qualities for kangaroo rats, but become better habitat for mice and voles.

Due to their scattered distribution, debris piles appear to be less important as dispersal routes than do the soil ridges.

Talus formations are mimicked by large rock and boulder ridges and land-fills created during road construction. This type of roadside talus, which may be inhabited by marmots, ground squirrels, woodrats, mice, weasels, and other animals, is normally restricted in distribution. On the other hand, road construction with a bulldozer through rocky soil-especially soil containing large rocks and boulders-creates a ridge strewn with large individual rocks or clusters of big rocks (fig. 20). These talus-like rows of large rocks are used by lizards, marmots, and mantled ground squirrels *(Spermophilus lateralis).* Mantled ground squirrels and yellow-bellied marmots are closely associated with large rocks which serve as elevated lookouts, and large roadside rocks have allowed both rodents to survive in and disperse through otherwise unsuitable habitats.

The occupancy of these roadside habitats by reptiles and small mammals provides prey for predators and food for scavengers. The combination of animals and vehicular traffic produces a situation where many animals are killed by cars or by shooting from cars (Case 1978, Oxley et al. 1974). Consequently, there seems to be a concentration of predators and scavengers along such roads, including snakes, hawks, owls, turkey vultures *(Cathartes aura),* common crows *(Corvus brachyrhynchos),* common ravens *(Corvus corax)*, black-billed magpies, coyotes, and long-tailed weasels,

Where road construction and maintenance creates ditches, water often collects and remains available to wildlife for varying periods following rain storms. This frequently creates areas where the vegetation receives greater than normal moisture and in turn produces more biomass that remains green longer. In rare circumstances, the collection of water within borrow pits and ditches forms areas where aquatic or riparian zone vegetation may be found. These more mesic conditions in a typically xeric landscape contribute to diversity and are often attractive to wildlife for water, food, and cover.

For the broad spectrum of wildlife, on the other hand, roads largely destroy habitat and often promote soil erosion (Kitchings et al. 1974), but their greatest long-term impact on wildlife is increased human access and increased use of previously remote areas (Albrecht and Smith 1977, Davey 1974, Snyder et al. 1976). Greater vehicular access, unless carefully managed, intensifies fishing, hunting, and trapping pressures on animals, such as Alvord cutthroat trout (*Salmo clarki* subspecies), jackrabbits (fig. 2 1), ground squirrels, coyotes, badgers, bobcats (fig. 22), pronghorns, and mule deer.

Increased access also allows these pressures to be more evenly distributed. There is

Figure 21.— Black-tailed jackrabbits (*Lepus californicus*) are often hunted for sport; increased vehicular access into an area will intensify the hunting pressures on this species and on others. (Robert R. Kindschy photograph)

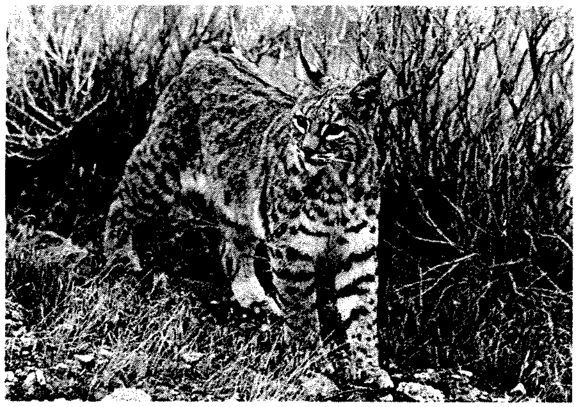

Figure 22.-Greater vehicular access, unless carefully managed, intensifies trapping pressures on fur-bearing mammals, such as the bobcat (Lynx *rufus*). (Robert R. Kindschy photograph)

little doubt that access augments the potential for enjoyment and exploitation of the wildlife resource, but this can be good or bad depending on the wildlife management objective and the intensity of the management, including enforcement of regulations. Improved access. however, is seldom related to a wildlife management objective. The impacts on wildlife. therefore, are apt to be negative.

Greater access also intensifies harassment of species, such as the sage grouse (*Centrocercus urophasianus*), ferruginous hawk (Olendorff and Stoddart 1974, Snow 1974a), prairie falcon (*Falco* ***mexicanus)*** (Parker 1973, Snow

1974b), Peregrine falcon (*Falco peregrinus*)—listed as endangered-(Federal Register 1976, Porter et al. 1973, Snow 1972), and the golden eagle (Snow 1973). For example, Ellis et al. (1969) documented a loss of 30 raptors along a 19-kilometer (12 mi) segment of a powerline. Fourteen of the birds were golden eagles, and most of the carcasses had bullet wounds. Mortality by shooting appears to occur most frequently when powerlines and roads are within 183 meters (600 ft) of each other.

BRIDGES

Although bridge construction alters the habitat at the site, bridges may produce new wildlife habitat-values, depending on the type of bridge. Bridges of creosote-impregnated wood exhibit little or no value as wildlife habitat (fig. 23). Unimpregnated, wooden bridges appear to have limited value to nesting swallows and roosting bats, but these bridges tend to vibrate. Traffic on such bridges is quite noisy and creates dust. When wooden bridges are abandoned, however, they become more valuable as wildlife habitat. The creosote is leached away over time and the absence of traffic reduces the disturbance to wildlife.

On the other hand, traffic over concrete bridges (fig. 23) is relatively quiet when compared to that crossing wooden bridges. Concrete bridges do not allow dust to sift through, and in addition produce shade, a cool microclimate, and simulate cliffs and caves. The concrete surface provides a structure which allows barn swallows and cliff swallows to build their nests on the suspension beams. Some species of bats, such as little brown myotis (*Myotis lucifugus*), Yuma myotis (*Myotis yumanensis*), California myotis (*Myotis californicus*), big brown bats (*Eptesicus fuscus*), and pallid bats (*Antrozous pallidus*), use the concrete surfaces under bridges as night-roosts (Greenhall and Paradiso 1968, Maser[1], Orr 1954). When available, suitable cracks and crevices in the concrete are used as day-roosts and sites for rearing young by such species as the pallid bat (Krutzsch 1946, Orr 1954, Storer 1931).

In addition, bridges-especially concrete bridges-produce a cool microclimate that is attractive to flying insects. Such insects, in turn, provide a food source for the insectivorous birds and bats that are associated with the bridges.

[1] Maser. Chris. Unpublished data on file at the Puget Sound Museum of Natural History. University of Puget Sound, Tacoma. Washington.

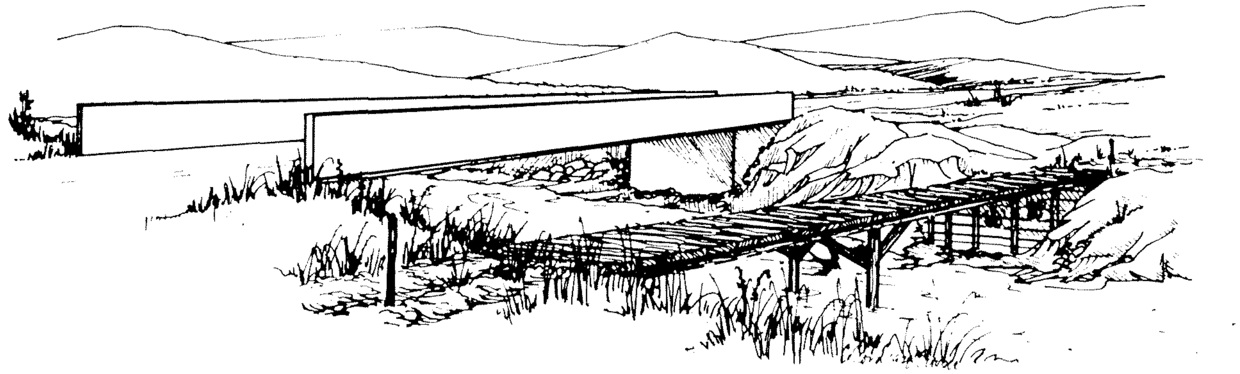

Figure 23.-Bridges of creosote-impregnated wood exhibit little or no value as wildlife habitat. They are noisy and dusty. Concrete bridges, on the other hand, are relatively quiet and do not allow dust to sift through. In addition, they produce shade, a cool microclimate, and simulate cliffs and caves. If a bridge (wooden or concrete) with well-established wildlife use is to be replaced, it may be desirable to construct the new bridge alongside of the old one, retaining the old bridge as wildlife habitat.

Rock Walls, Rock Jacks, Rock Cribs, and Sheepherder Monuments

Due to their mode of construction-essentially loose piles of large, irregular rocks-rock walls, rock jacks, rock cribs, and sheepherder monuments all simulate talus. These rock piles are honey-combed with protected spaces which provide shelter from the elements for a variety of species. The spaces are sheltered from winter winds thereby reducing the chill factor, but on the other hand, these spaces are much cooler than surrounding areas in summer.

Such spaces are used by a variety of prey species-vertebrate and invertebrate-which in turn are consumed by predators. The animal biomass associated with these structures seems to be much greater than in similar areas lacking them (Sinclair et al. 1967).

ROCK WALLS

Walls constructed of rock, usually lava, provide stable habitats for a variety of animals (Lustig 1976, Sinclair et al. 1967) (fig. 24). Lizards, such as western fence lizards (***Sceloporus occidentalis)*** and side-blotched lizards (***Uta stansburiana);*** snakes, such as blue racers (***Coluber constrictor),*** gopher snakes ***(Pituophis melanoleucus),*** and western rattlesnakes (***Crotalus viridis)*** (fig. 25); birds, such as rock wrens ***(Salpinctes obsoletus),*** canyon wrens (***Catherpes mexicanus),*** and Say's phoebes ***(Sayornis saya***); and mammals, such as mountain cottontail rabbits, chipmunks, yellow-bellied marmots, ground squirrels, deer mice, canyon mice ***(Peromyscus crinitus),*** woodrats, long-tailed weasels, and skunks, all use rock walls for feeding and for reproduction (Bailey 1936, Burt and Grossenheider 1964, Maser [unpublished data][2], Peterson 1961, Stebbins 1954, 1966). Some animals, such as lizards, snakes, and ground squirrels, spend much time sunning themselves on the walls during the spring, summer, and fall, and hibernate in or beneath the walls during the winter. These, and other animals, also depend upon the walls as elevated lookouts.

Figure 24.—Rock walls, usually made of lava, provide stable habitats for a variety of animals. (Bureau of Land Management photograph)

Figure 25.—The western rattlesnake (*Crotalus viridis*) is a frequent inhabitant of rock walls. (Bureau of Land Management photograph by Grant Baugh)

ROCK JACKS

Rock jacks (fig. 26) are usually built so that the rocks are initially elevated off of the ground. When the supporting wooden structure deteriorates, the pile of rocks has a habitat function similar to that of the rock cribs discussed next. The distance above ground determines which animals can seek shelter

'See footnote 1.

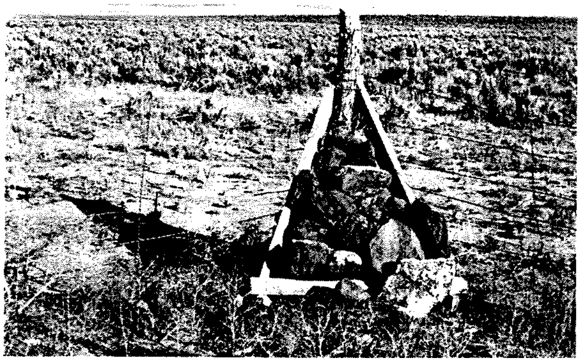

Figure 26.-A rock jack is usually built so that the rocks are initially elevated off of the ground. (Chris Maser photograph)

beneath them. For example, a rock jack in which the bottom rocks are 15 cm (6 in) above the ground creates a large enough space for a mountain cottontail, whereas a Townsend ground squirrel ***(Spermophilus townsendi)*** can utilize a space that is only 10 cm (4 in) high, and a rattlesnake can use a 5-cm (2-m) space.

Rock jacks constructed with large rocks, 30 to 60 cm (12 to 34 in) in diameter, show greater use by wildlife (reptiles, birds, and mammals) than do those composed of rocks less than 30 cm (12 in).

Wildlife uses of rock jacks are varied; they include: feeding, reproduction, escape, shade, shelter from wind, sunning, perching, and lookouts. Since rock jacks are used to stabilize fences, they are incorporated at varying intervals, usually 30 to 50 meters (98 to 164 ft) into kilometers (miles) of livestock fence. As a result, they form dispersal routes through otherwise uninhabitable country for animals, such as the desert woodrat ***(Neotoma lepida)*** (fig. 27).

ROCK CRIBS

Rock cribs (figs. 28 and 29) offer essentially the same function as wildlife habitat as do rock jacks, but for a smaller variety of species. Since rock cribs rest on the ground surface, wildlife use is limited to those species that can climb within or on top of the rocks. Cottontail rabbits, for example, are largely eliminated as

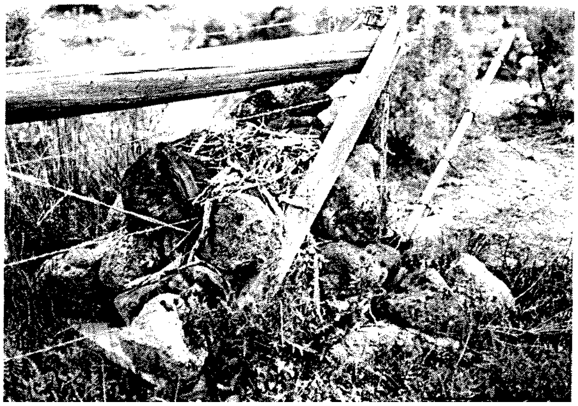

Figure 27.-Since rock jacks are used to stabilize fences, they are incorporated into kilometers (miles) of livestock fence. As a result, they form dispersal routes through otherwise uninhabitable terrain. In this case a desert woodrat (Neotoma *lepida)* is inhabiting such a rock jack, as evidenced by its nest. (Chris Maser photograph)

users of rock cribs, but lizards, snakes, woodrats, ground squirrels, and weasels have free access to the security of a crib. As with rock jacks, the size of the rocks used in construction also determines which species can use a rock crib. Albeit, small rocks, 15 to 20 cm (6 to 8 in) in diameter, give an appearance of "neatness"

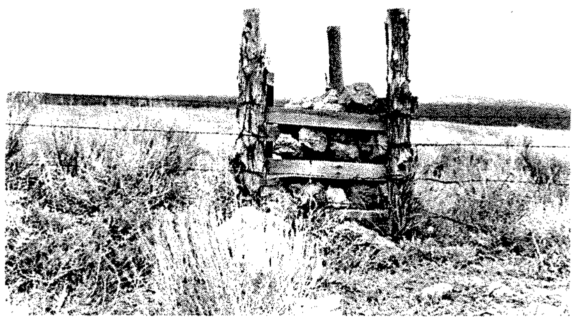

Figure 28.-A wooden rock crib, if constructed with large rocks, has essentially the same function as wildlife habitat as does a rock jack. Since the rocks are not initially elevated off of the ground, however, a few of the larger animals, such as the mountain cottontail rabbit (*Sylvilagus nuttalli*), may be excluded from inhabiting wooden rock cribs. (Chris Maser photograph)

Figure 29.-A wire rock crib can be used as habitat by animals as large as Beiding ground squirrels (*Spermophilus beldingi*). Larger animals are excluded, however, by the smaller-sized rocks used in these cribs and by the diameter of the wire mesh. (Chris Maser photograph)

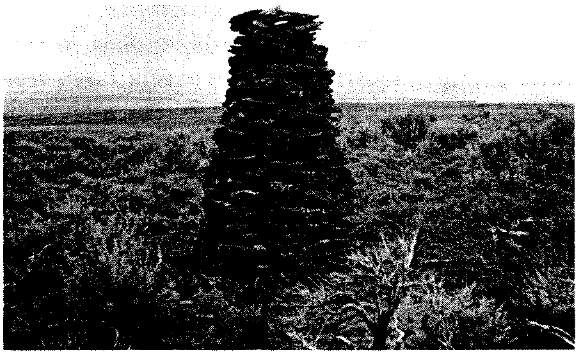

Figure 31 .-Sheep-herder monuments consist of piles of rocks. (Bureau of Land Management photograph)

Figure 32.-Sheep-herder monuments are often located on or near the tops of hills and serve as perching sites for raptors, such as golden eagles (*Aquila chrysaetos*). (Bureau of Land Management photograph)

and are sometimes thought to be more esthetically pleasing, the "neatness" and "esthetics" of a crib made with small rocks diminishes its usefulness to wildlife (fig. 30).

Rock cribs are also used to stabilize fences and may create routes of dispersal for some species of wildlife.

Figure 30.-A "neat" or "esthetically pleasing" wire rock crib is made with small rocks which lack the large spaces between them, and a small-mesh wire is used to contain the rocks. This combination of construction materials can eliminate all but the smaller animals, such as deer mice (Peromyscus *maniculatus*) or desert woodrats (Neotoma *lepida*), from using such a rock crib as habitat. (Bureau of Land Management photograph by A. K. Majors)

SHEEPHERDER MONUMENTS

Sheepherder monuments (figs. 31 and 32), which are more or less randomly distributed, consist of piles of rocks. They serve essentially the same habitat function for wildlife as do rock jacks and rock cribs, but do not form dispersal routes. Often located on hill Lops. they serve as perching sites for raptors, such as golden eagles.

Wooden Corrals and Fences

Wooden corrals (figs. 33 and 34), and fences with wooden posts (fig. 35) appear to belong largely Lo past decades. Most new fences are constructed with steel posts.

Although often associated with old homesteads, wooden fences also may be isolated from such sites. Those few that remain are used by western fence lizards for sunning and

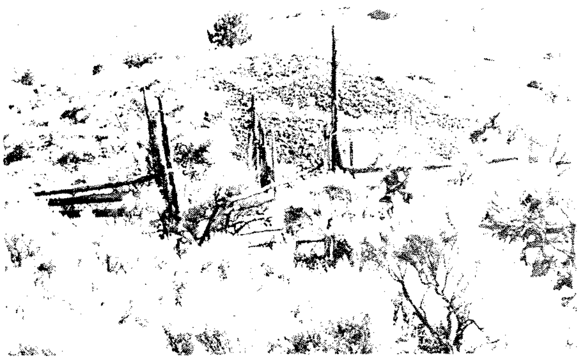

Figure 33.-Wooden corrals are used as perches by many birds. (Chris Maser photograph)

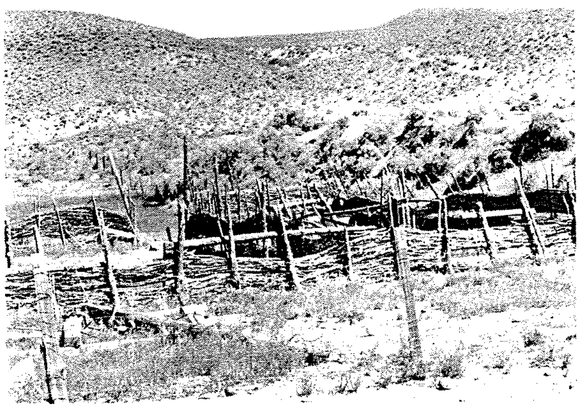

Figure 34.—In addition to providing perches for birds, wood corrals can also provide animals with shade and protection from wind. (Chris Maser photograph)

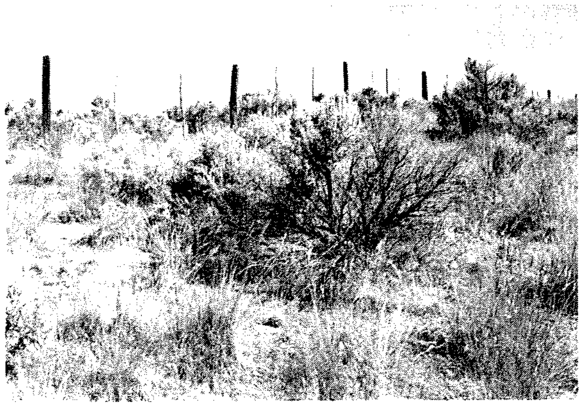

Figure 35.—The wooden posts in this fence can be used as perches by birds and as shade by small, ground-dwelling animals on hot, cloudless days. (Bureau of Land Management photograph)

by chipmunks, raptors, shrikes (*Lanius* spp.). and other birds as lookouts. In addition. shade from these posts is sought by lizards. snakes, small birds, and small mammals to escape the heat on hot cloudless days.

Cavities are often found in decaying fence posts and are used by small cavity-nesting birds such as bluebirds, house wrens (*Troglodytes aedon*), swallows. chickadees (*Parus* spp.), and mammals such as bats, deer mice, and chipmunks. These sources of nesting sites allowed some species to temporarily invade otherwise unsuitable habitats. and a species'

Figure 36.-Fences frequently occur along edges between vegetation of different types or different structural conditions. Fences, in this sense, created and/or maintain habitat diversity and often are particularly rich in wildlife. (Bureau of Land Management photograph)

decline in such areas may be related to the gradual loss of that habitat.

Fences frequently occur along edges between vegetation of various types or in different stages of development (fig. 36). As such, they are of particular value to some species and are often particularly rich in wildlife.

Powerlines

Powerlines have become common and, perhaps, inevitable features of the landscape. They have potential as wildlife habitat and have other influences on wildlife. The impacts of powerlines on wildlife depend on: (1) size of lines, poles, and towers, (2) voltage of lines, (3) location, size, and shape of rights-of-way, and (4) the type of vegetation management within rights-of-way.

POWERLINES, POLES, AND TOWERS

Raptors, such as golden eagles, red-tailed hawks, and ferruginous hawks, use powerlines, poles, and towers as sites for perching and nesting (Gilmer and Wiehe 1977, Marion and Ryder 1975, Olendorff 1972, Olendorff and Stoddart 1974). In early years, small distribution lines, such as the Rural Electrification Administration (REA) type, electrocuted many raptors, especially golden eagles (Boeker 1974, Boeker and Nickerson 1975, Fitzner 1975, Harrison 1963, Olendorff 1972, Smith and Murphy 1972, Snow 1973). In recent years, however, powerlines, poles, and towers have been modified not only to make lines safe for raptors but also to adapt poles and towers as sites for perching and for nesting (Miller et al. 1975, Nelson and Nelson 1977). Thus, in some cases, it has been possible to turn a wildlife liability into an asset.

In addition, many birds are killed when they collide with towers and lines, particularly small-diameter, closely spaced transmission and secondary distribution lines (Anderson 1978. Anderson et al. 1975, Kemper 1964, Krapu 1974, Scott et al. 1972, Stout and Cornwell 1976). Satisfactory solutions to this problem have yet to be found.

Extra high voltage power lines (500 KV+) produce a corona effect-ozone production, noise, and flashes of light. Although the unusual olfactory, auditory, and visual stimuli of the corona effect may be adverse to wildlife (Kline 1971, Young 1973), such adversity has not been conclusively proven (Goodwin 1975).

Extra high voltage power lines (500 KV+) also produce electric and magnetic field effects. These fields can induce voltages and currents in plants and animals near such lines (Jack Lee, personal communication, Miller and Kaufman 1978). But thus far, no adversity to wildlife has been demonstrated by the electric field effect (Bankoske et al. 1976).

RIGHTS-OF-WAY

Managed rights-of-way are beneficial to some wildlife and detrimental to others. The two primary features of rights-of-way that influence wildlife are alteration of existing vegetation and increased human access via roads.

In many areas, the most obvious feature of a right-of-way is alteration of the habitat within it. Tail vegetation, such as trees and shrubs, are initially eliminated. Subsequent management may maintain the vegetation in the right-of-way in an earlier, lower structural condition (fig. 37). If efforts are not made to remove trees and shrubs as they reappear, the site may return to its original condition. Thus, plant species composition and diversity may not be significantly affected over time (Ludwig et al. 1977, Potter and Krenetsky 1967).

Where heavy shrub growth is removed or trees are felled to clear a right-of-way, there should be a corresponding increase in grasses and forbs (Barney and Frishknecht 1974, Clary 1974, Erdman 1970, Ludwig et al. 1977). Although increases may be related to an increased amount of sunlight and consequent drying of the site (Jameson 1970), there is considerable annual variability in herbage production which is presumably a product of precipitation. If undisturbed, a site will progress by stages back to its original structural condition (Barney and Frishknecht 1974).

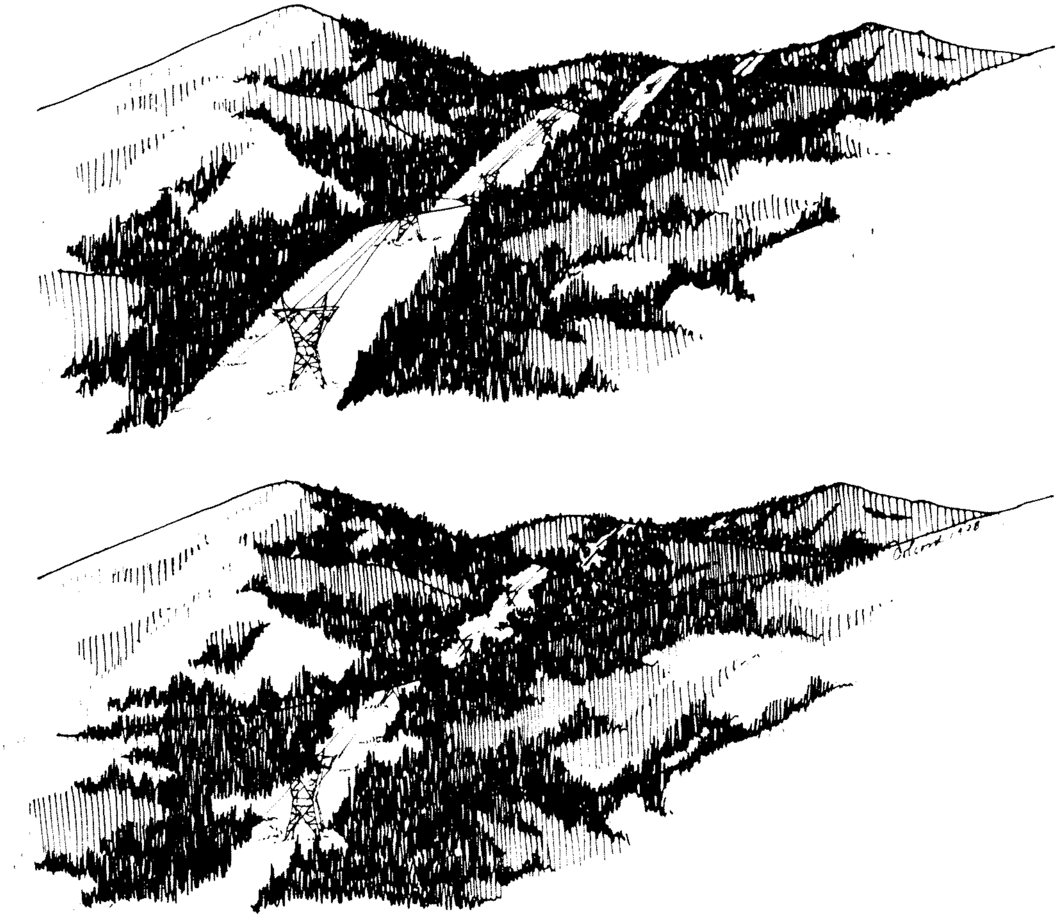

Figure 37.— In many areas, the most obvious feature of a right-of-way is alteration of the habitat within it. Once established, subsequent management may maintain the vegetation in a right-of-way in an earlier, lower structural condition. Powerline rights-of-way can be designed with irregular borders to enhance edge effect and to make them as aesthetically pleasing as possible.

Right-of-way construction can either create or deplete habitat diversity. For example, a right-of-way through a small, isolated stand of juniper will eliminate a locally rare habitat, reduce contrast, eliminate edge, and thereby reduce habitat diversity. Whereas a right-of-way through an extensive stand of juniper will open up some of the stand, create a new structural condition, produce edge, and thereby increase habitat diversity.

Where diversity has been created by a right-of-way, Anderson et al. (1977) found that bird species diversity was correlated with the width of the right-of-way. This was due to habitat alteration of sufficient size to support those species of birds that required either the type of habitat created, or the edge-effect, or both. There is some evidence to indicate that mammals react to rights-of-way in a similar fashion (Goodwin 1975, Schreiber and Graves 1977).

It is doubtful that maintenance of powerline rights-of-way in rangelands will require extensive manipulation of vegetation since most plant communities are relatively low in structure. Where such manipulation is required, however, application of herbicides is the treatment often used.

Application of herbicides to control sagebrush (*Artemisia* spp.) in rights-of-way adversely affects some species, such as the sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella brewed),* and sage grouse

(Baker et al. 1976, Braun and Beck 1976, Gabrielson and Jewett 1970, Klebenow 1969, Schroeder and Sturges 1975). Treatment may not only reduce local populations of sage grouse (Klebenow 1970, Rogers 1964) but also may detrimentally affect food supplies of pronghorns and mule deer on the immediate winter range (Cole 1956, Martinka 1967, Smith 1959). Further, spraying rights-of-way for shrub control may locally reduce or eliminate forbs and arthropods that are important sources of food for some species of wildlife, such as leopard lizards *(Crotaphytus wislireni)*, blue racers, sage grouse, loggerhead shrikes *(Lanius ludovicianus)*, northern grasshopper mice *(Onychomys leucogaster)*, and sage voles (Martin 1970, Maser et al. 1974, Parker and Pianka 1976, Peterson 1970, Tanner and Krogh 1974). This, in turn, affects the food supply of predators, such as gopher snakes and burrowing owls *(A thene cunicuiaria)* (Marti 1974, Maser et al. 1971, Zarn 1974).

Maintenance of rights-of-way for powerlines, however, usually involves only a minor portion of the general area. While impacts on wildlife may be pronounced on the areas treated, the overall effect may be quite small.

The reduction of the vegetation from shrubs, trees, or both to a grass-forb condition will benefit species that are adapted to such conditions, for example, the horned lark *(Eremophila alpestris)*. Rights-of-way will also provide pronounced edges between woody vegetation and largely herbaceous vegetation. Edges, in turn, are indicative of some measure of diversity in a rather homogeneous habitat.

Herbicides accomplish control of unwanted vegetation without the soil disturbance associated with mechanical methods of control. Further, because the dead plant material is usually left in place to decay, the impact on habitat structure is delayed and less severe.

The use of herbicides has been the subject of recent controversy concerning potential direct and indirect hazards to wildlife. Specific hazards involving the use of chemicals range from negligible (Bollen et al. 1970 and 1977. Montgomery and Norris 1970) to acute poisoning (Norris 1974).

Although mechanical manipulation of vegetation or the use of prescribed burning have immediate, dramatic impacts on habitat structure and may be used to accomplish the same goals as herbicide treatments, they avoid the controversy over herbicides.

Croplands

The purpose of this treatment is simply to note that croplands occur in the midst of managed rangelands (fig. 38). They are so different in ecological makeup that they require a totally different management viewpoint.

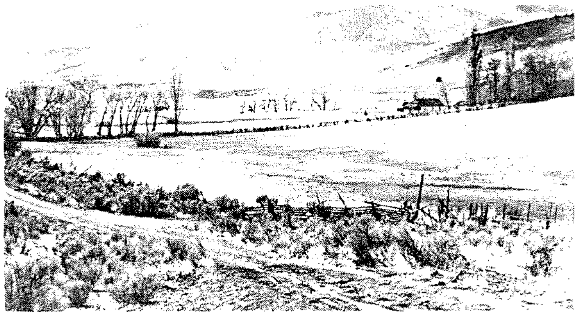

Figure 38.—Croplands occurring amidst managed rangelands are so different in ecological make-up that they require a totally different management viewpoint. (Bureau of Land Management photograph by Robert R. Kindschy)

De Loach (1971:225) said: ". . .the objective of agriculture is to encourage the growth of a foreign organism, a crop, at a high density and to suppress. . .organisms that might compete with it. . . ." Kennedy (1968) suggested that agriculture and conservation are no longer compatible concepts and should be considered separately.

> "When man dug holes here and there and planted a few seeds for his food, ample diversity of species remained, but this resulted in small crop yields both because of competition from other plants (weeds) and because insects, birds, and mammals all took their share of the crop" (Pimentel 1971:212).

In modern agricultural practice in North America, however, large fields are often planted with a single-species. This specialization has resulted from the economic needs and technology of a mechanized society and has created a greatly simplified environment (Pimentel 1971). Such monocultures are basically unstable and lack the checks and balances of a natural, diverse ecosystem. Agricultural crops, therefore, require constant human care (such as cultivation) and control (with insecticides, rodenticides, herbicides, or all three) if a crop is to produce as desired.

Plant and animal communities that surround croplands exert a constant, often negative, influence on production. When native plants and animals use agricultural crops as habitat, they are normally termed pests; however, "Pests exist only in man's own view of nature and their existence results. . .from his. . .resource management practices" (Pimentel 1971:211).

Small, diversified family farms were excellent habitat for wildlife. They provided increased structural diversity, and therefore, increased habitat diversity through a good mix of food, cover, and water within surrounding, rather homogeneous rangelands. The many small, irregular fields with a variety of crops created an abundance of structurally diverse edges; and tillage offered a variety of soil textures for burrowing animals. Uncultivated fence-rows and ditch banks provided strips that not only acted as primary habitat for some species but also provided travel lanes between fields for other species. These situations were ideal for species, such as gopher snakes, California quail, ring-necked pheasant (*Phasianus colchicus),* voles, rabbits, weasels, skunks, and foxes (*Vulpes* spp.).

Replacement of small farms by large farms dependent on mechanization and specialized crop monocultures caused a drastic decline in wildlife habitats within and adjacent to croplands. And. because of the decreased crop stability-increased crop vulnerability-resulting from the greatly simplified "agricultural ecosystem," man is more and more inclined to view native wildlife as actual or potential "pests" to his crops.

The erratic economics of agriculture is considered to be the primary impetus behind increasing crop specialization in North America. In addition, governmental influence on modern agriculture, which has attempted to maintain low-cost food production, has largely made the small, diversified farm uneconomical. Consequently, most have disappeared. In turn, for modern agriculture to survive economically, modifications in farming strategies have been necessary, and the following changes in land use have resulted:

1. Increased specialization of farms (growing fewer crops in larger fields) caused amalgamation of small, individual fields.

2. Increased size of individual farms due to large, specialized corporate farms replacing small, diversified family farms.

3. Increased use of modern machinery that is more easily and more economically operated in large fields.

4. Increased clearing of fence rows to gain more land for agriculture (Shrubb 1970, Van Deusen 1978)—2.6 kilometers (1 mile) of fence row may occupy .2 hectare (.5 acre) (Moore et al. 1967).

5. Increased use of large, sprinkler irrigation systems that eliminate uncultivated irrigation ditches and their banks.

6. Replacement of uncultivated earthen irrigation ditch banks with concrete.

7. Federal aid to farmers through the Agricultural Stabilization and Conservation Service for various types of land "reclamation."

Although these factors reduce habitat for many species of wildlife within agricultural lands (Allen et al. 1973), they also create habitat for a few species, such as the exotic ring-necked pheasant. For example, with specialization, came larger individual fields and, therefore, extensive monocultures. The small, diversified family farms have been replaced by large, specialized corporate farms with modern machinery that can only be utilized efficiently and economically in large, single-product fields.

From the foregoing discussion, it should be recognized that where agricultural crops occur in managed rangelands, they may be primarily considered as being in conflict with most wildlife species. In some cases, these conflicts may be severe, such as heavy grazing by deer on hay crops or by rodent damage to grain crops. But agricultural lands do provide habitats for some game species that are particularly adapted to agricultural conditions-such as the exotic pheasant. In addition, some native species, such as quail and cottontail rabbits, may take advantage of edges created between cropland and rangeland.

Management Tips

ABANDONED HOMESTEADS

When considering historical and wildlife values, it is desirable to retain abandoned homesteads, regardless of their age. Not only do they add character and historical interest to the landscape but they also add wildlife habitat diversity. Although it may be uneconomical to maintain homesteads in a constant state of repair, it costs nothing to allow these habitats to remain-disintegrating slowly and naturally (fig. 39).

Allowing homesteads to disintegrate naturally is in keeping with the USDI Bureau of Land Management Manual 1602—Basic Guidance (1978 42C-42C3d) , under "Environmental Protection and Enhancement," which states that:

> c. In all land use and program decisions, protection of natural and man-made elements in the environment which have esthetic values of natural beauty, harmony, variety or uniqueness will be fully considered.
>
> d. In all land use and program decisions, protection of natural and man-made elements in the environment which contribute to the cultural heritage of human society, or to human understanding of ecological processes, will be fully considered.

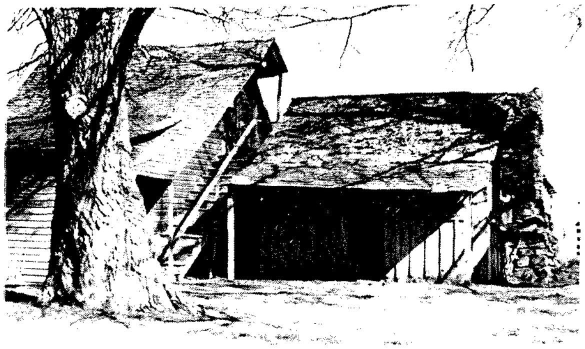

Figure 39.-Although it may be uneconomical to maintain homesteads in a constant state of repair, it costs nothing to allow these habitats to remain — disintegrating slowly and naturally. Once a homestead site has been established and the introduced vegetation, such as trees and shrubs, has become part of the landscape, the site can be planned for and managed as wildlife habitat. (Bureau of Land Management photograph)

> e. If there is no cost involved, ecological, esthetic or human interest values will be protected or enhanced through careful design and execution of Bureau programs. If preservation or enhancement of these values would result in loss of other resource values or increase in program costs, the long range cost is compared to the long range results. Great weight is given to preservation of a wholesome continually productive environment for future generations.

If maintenance of a wooden homestead is a management objective, however, it would be a good idea to refer to the overview article by Rowell et al. (1977) on the preservation of log cabins.

Once a homestead site has been established and the introduced vegetation, such as trees and shrubs, has become part of the landscape, the site can be planned for and managed as wildlife habitat. Moreover, use as wildlife habitat can easily be perpetuated by scheduling the replanting of trees and shrubs to assure maintenance of the habitat over time.

If livestock are to be grazed in the vicinity of an abandoned homestead, it may be advisable to fence the livestock out of the homestead site. Such action not only will greatly prolong the site's value but also will encourage and protect the development of relatively dense vegetation, enhancing the value of the site as wildlife habitat.

It may be wise *not* to show the locations of abandoned homesteads on tourist and recreational maps, thereby eliminating much potential disturbance and vandalism.

Finally, if a management plan includes the alteration of an abandoned homestead, the site should be examined by both a wildlife biologist and a cultural resource specialist (USDI Bureau of Land Management Manual 62311. The value of these abandoned homesteads as wildlife habitat should be added to their historical value as reasons to continue their existence.

ROADS

Banks, soil ridges, and talus-like formations created by road construction form significant wildlife habitats in areas where the habitats that they mimic are naturally lacking. When and where these manmade habitats harbor uncommon wildlife or wildlife of special interest, they can be identified and managed as habitats with planned perpetuation and enhancement. It may also be desirable, under some circumstances, to purposefully create and maintain one or more such habitats in specific locations for specific species of wildlife.

BRIDGES

When possible, bridges should be constructed of concrete, masonry, or rock rather than wood; such bridges have the greatest potential as wildlife habitat. For example, the surface of the pillars and beams can be roughened so swallows will have an easier time attaching their nests and bats may gain a better purchase when roosting. Beams can have built-in ledges or bolted on planks to form nesting platforms for birds. Nesting boxes can be installed under bridges to further increase bird use. Bridges can also be designed with deep "crevices" so that bats can raise their young (fig. **40).**

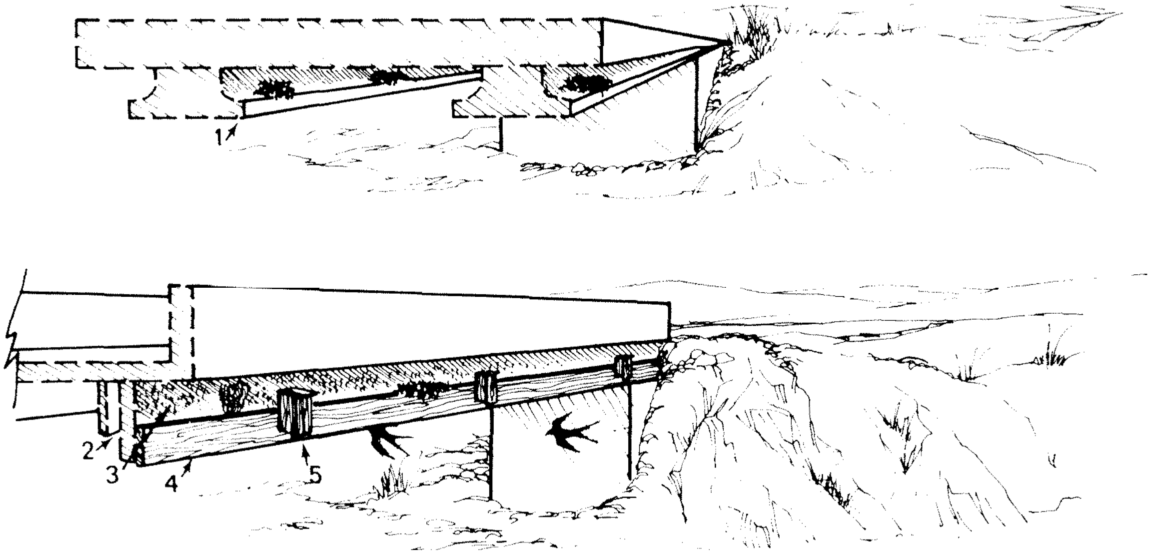

Figure 40.-Concrete bridges can be designed to enhance their potential as wildlife habitat: (1) expanded beams for nest construction, (2) manmade crevice in which bats can roost and rear young, (3) roughened concrete to aid nest construction by some species of birds, (4) wooden plank to create a platform on which birds can nest, and (5) bird boxes to enhance use by a variety of birds.

If a bridge with well-established wildlife use is to be replaced, it may be desirable to construct the new bridge alongside of the old one, retaining the old bridge as wildlife habitat (see fig. 23). The new bridge can be constructed with the above mentioned modifications to increase potential wildlife use. Thus, unusual wildlife habitats can be increased and maintained over time.

ROCK WALLS, ROCK JACKS, ROCK CRIBS, AND SHEEPHERDER MONUMENTS

If rock walls, rock jacks, rock cribs, and sheepherder monuments are to be constructed, wildlife values can be enhanced by using large rocks, 30 to 60 cm (12 to 24 in) in diameter. Wooden posts used in the construction of rock jacks and wooden rock cribs are used as perches by birds-particularly raptors (Marion and Ryder 1975). Rock walls and wire rock cribs, on the other hand, do not usually have wooden posts as part of their structure; but long wooden posts can be wired to a rock crib or placed inside of a crib and held in place with the rocks (fig. 41). Wooden posts can also be wired to steel posts or interspersed with steel posts along a fence, but they should be taller than the steel posts. Further, a wooden crosspiece secured to the top of a wooden post may enhance raptor use (fig. 42).

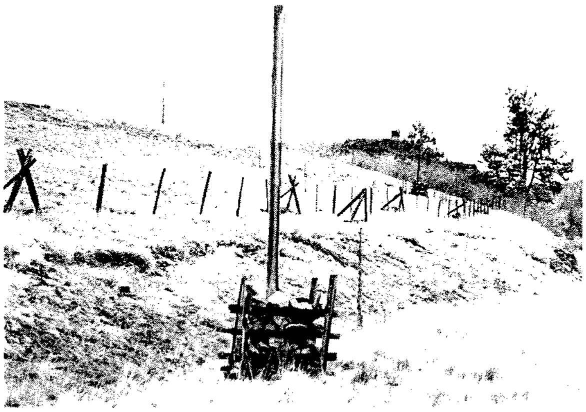

Figure 41.-Long wooden posts, but shorter than these old telephone poles, can be placed inside wire rock cribs and held in place with the rocks. Such posts can be used as perches by birds-particularly raptors- which will add to a rock crib's value as wildlife habitat. (Chris Maser photograph)

Wildlife use can be augmented by interspersing rock jacks on a fence stabilized primarily by rock cribs and vice versa and by the strategic placement of wooden perching posts. Bird boxes attached to fences can provide additional nesting and roosting places for birds and shelter for small mammals. The tops of these boxes may represent roosting sites for common nighthawks ***(Chordeiles minor)*** and sunning places for lizards (fig. 43). These structures add cover and form dispersal routes for some species of wildlife.

If a fence is to be removed, therefore, established wildlife-habitat values can be retained over long periods by leaving the rock structures intact.

WOODEN CORRALS AND FENCES WITH WOODEN POSTS

Abandoned wooden corrals, if left intact, will be used by wildlife for years as perches and for shade.

If a fence with wooden posts is to be replaced by an all-steel fence, then some of the wooden posts can be incorporated into the new fence. If a fence is to be removed and not replaced, however, then some of the wooden posts could be left intact. In this way they will continue to provide perches for raptors and other birds and shade for small ground-dwelling animals.

POWERLINES

Particular attention should be given to planning powerline routes that will minimize impacts on critical habitats, especially riparian zones.

Closure and non-maintenance of all possible roads associated with powerlines may contribute to the welfare of wildlife, but this will reduce human-wiidlife contacts. On the other hand, if roads must be open or maintained, then closure to other than official use would be of some value to wildlife.

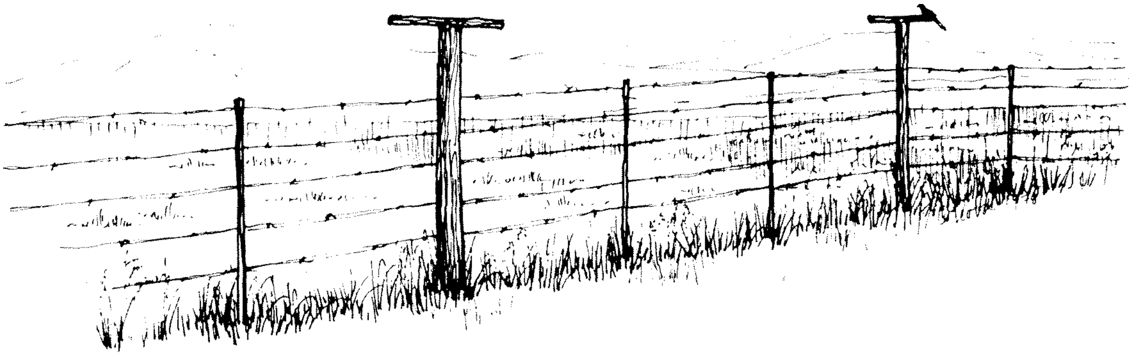

Figure 42.-Wooden posts can be interspaced along all-steel fences to enhance the habitat for perching birds. In addition, if the wooden posts are taller than the steel posts and have a wooden cross-piece secured to their tops, they may enhance use of the surrounding habitat by raptors.

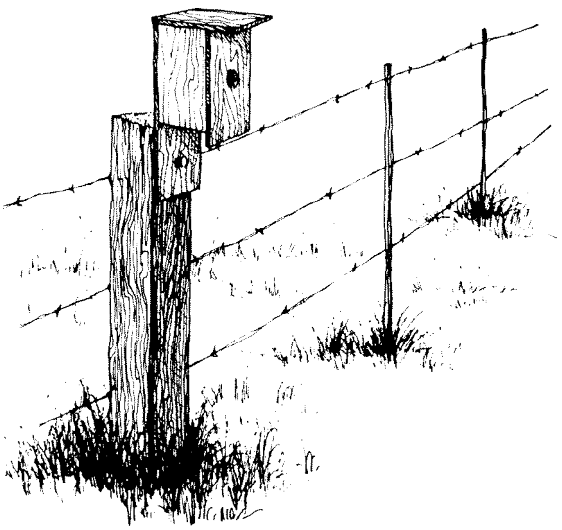

Figure 43.-Bird boxes attached to fences can provide additional nesting and roosting places for birds and shelter for small mammals. The tops of these boxes may represent roosting sites for common nighthawks (***Chordeiles minor)*** and sunning places for lizards.

If a right-of-way goes through an extensive area of similar habitat, such as a juniper woodland, it may be advantageous to wildlife if the right-of-way is made wide enough and of such a configuration so as to maximize wildlife diversity and to maintain self-sustaining populations of wildlife within its boundaries (see fig. 37). Conversely, a right-of-way that cannot be diverted around but must go through scarce habitat-habitat that occupies a small percent of the surrounding landscape-should be kept as narrow as possible.

When trees, such as juniper (*Juniperus* spp.), are killed, cut down or chained, leaving some dead, down woody debris will enhance habitat diversity and, therefore, wildlife species diversity (Maser and Gashwiler 1978).

Although all powerlines, poles, and towers should be made safe for birds, when a raptor nests within a tower in a way that a hazard is created, the nest should be moved, intact, to a new locality within the tower if possible and should be securely fastened. This action will remove the hazard and will allow the birds to successfully rear their young (Wayne Elmore, personal communication 19781. In addition, construction of nesting platforms on powerline towers has the potential of increasing raptor nesting habitat and reproductive success.

With careful planning and land-use management, powerline rights-of-way have the potential for creating wildlife habitats in specific localities. They may be used not only to increase habitat diversity but also to increase the populations of particular species of wildlife.

CROPLANDS

Proposed cropland development within managed rangeland should be evaluated for potential wildlife conflicts prior to its installation. The initial plan should provide a full analysis of those conflicts and how they are to be resolved. Most cropland developments within rangelands will be detrimental to native species because of the extreme alteration in their habitats (fig. 44). And species that will use such habitats are apt to become "pests."

Agricultural activities may provide a niche for exotic species, such as ring-necked pheasants. Their welfare can be enhanced by intentionally creating brush rows between fields, natural areas along irrigation ditches, etc.

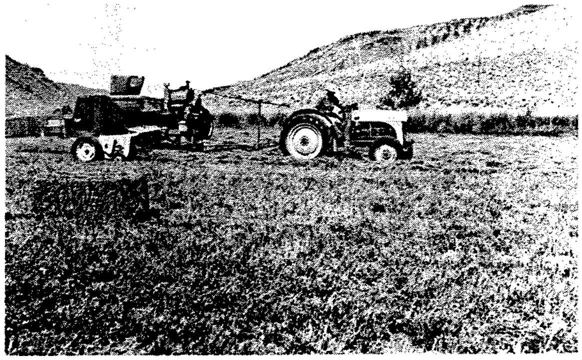

Figure 44.—Most cropland developments within rangelands will be detrimental to native species of wildlife because of the extreme alteration in their habitats. As a result, those wildlife species that will use cropland habitats are apt to become "pests." (Bureau of Land Management photograph by M. Hurd)

Summary

Manmade structures, such as homesteads, bridges, and rock walls, blend into the rangelands of the Great Basin with the passage of time. They create habitat diversity in large expanses of otherwise relatively homogeneous landscapes, thereby increasing the diversity of wildlife (fig. 45). And they may be esthetically pleasing.

Manmade structures, when obviously "old" or of a past era, come to be considered as part of our national heritage and by law may be preserved for the reflective consideration and enjoyment of the public. These structures, when considered as habitat, also become part of our natural heritage in that they bring man closer to wildlife.

The importance of manmade structures as habitats for wildlife is just being perceived in land management. And it is possible, with careful planning, to manage such structures simultaneously for the enhancement and perpetuation of their cultural and their wildlife values. In turn, this will provide greater enjoyment for the land owners-the public.

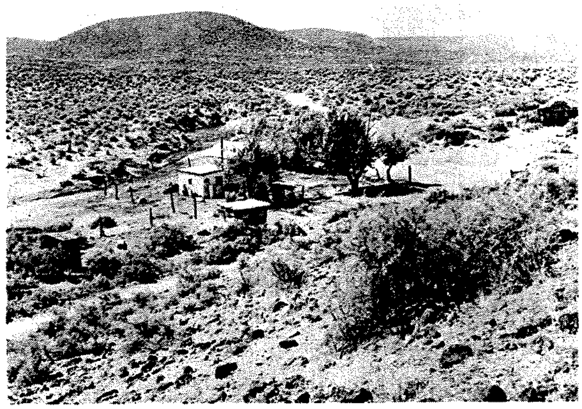

Figure 45.—Manmade structures, such as homesteads, blend into the rangelands of the Great Basin with the passage of time. In so doing, they create habitat diversity in large expanses of otherwise relatively homogeneous landscapes, thereby increasing the diversity of wildlife. Note: The grassy area immediately above the house is a spring — the homestead's water supply. (Chris Maser photograph)

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Appendix 1

Generalized response of terrestrial species of vertebrate wildlife to manmade habitats.

Legend: 0 = generally neutral response
— = generally negative response
+ = generally positive response

Wildlife species: Common name	Scientific name	Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
Amphibians							
long-toed salamander	*Ambystoma macrodactylum*	+	0	+	0	0	—
Great Basin spadefoot	*Scaphiopus intermontanus*	+	—	+	0	—	—
western toad	*Bufo boreas*	+	0	+	0	—	—
Woodhouse toad	*Bufo woodhousei*	+	0	+	0	—	—
Pacific tree frog	*Hyla regilla*	+	—	+	0	—	—
spotted frog	*Rana pretiosa*	+	0	0	0	0	0
leopard frog	*Rana pipiens*	+	0	0	0	0	—
bullfrog	*Rana catesbeiana*	+	0	0	0	0	0
Reptiles							
collard lizard	*Crotaphytus collaris*	—	—	—	0	—	—
leopard lizard	*Crotaphytus wislizeni*	—	—	—	+	—	—
western fence lizard	*Sceloporus occidentalis*	0	—	+	—	—	—
sagebrush lizard	*Sceloporus graciosus*	0	0	0	0	—	—
side-blotched lizard	*Uta stansburiana*	—	—	+	0	—	—
desert horned lizard	*Phrynosoma platyrhinos*	0	—	0	0	0	—
short-horned lizard	*Phrynosoma douglassi*	0	—	0	0	0	—
western skink	*Eumeces skiltonianus*	+	—	+	+	—	—
western whiptail	*Cnemidophorus tigris*	+	—	+	+	—	—
rubber boa	*Charina bo ttae*	+	—	+	+	—	—
yellow-bellied racer	*Coluber constrictor*	+	—	+	+	—	—
striped whipsnake	*Masticophis taeniatus*	+	—	+	+	—	—
gopher snake	*Pituophis melanoleucus*	+	—	+	+	—	—
common garter snake	*Thamnophis sirtalis*	+	—	+	0	—	—
wandering garter snake	*Thamnophis elegans*	+	—	+	0	—	—
western ground snake	*Sonora semiannulata*	+	—	+	0	—	—
night snake	*Hypsiglena torquata*	+	—	+	+	—	—
western rattlesnake	*Cro talus viridis*	+	—	+	+	—	—
Birds							
common loon	*Gavia immer*		0	0	0	0	0
red-necked grebe	*Podiceps grisegena*	—	0	0	0	0	0
horned grebe	*Podiceps auritus*	—	0	0	0	0	0

Appendix 1 (continued)

Common name	Scientific name	Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
eared grebe	*Podiceps nigricollis*	—	0	0	0	0	0
western grebe	*Aechmophorus occidentalis*	—	0	0	0	0	0
pied-billed grebe	*Podilymbus podiceps*	—	0	0	0	0	0
white pelican	*Pelecanus erythrorhynchos*	—	0	0	0	0	—
double-crested cormorant	*Phalacrocorax auritus*	—	0	0	0	0	0
great blue heron	*Ardea herodias*	+	0	0	0	0	—
green heron	*Butorides virescens*	+	0	0	0	0	0
cattle egret	*Bubulcus ibis*	+	0	0	0	0	—
common egret	*Casmerodius albus*	+	0	0	0	0	—
black-crowned night heron	*Nycticorax nycticorax*	+	0	0	0	0	0
American bittern	*Botaurus lentiginosus*	+	0	0	0	0	0
least bittern	*Ixobrychus exilis*	+	0	0	0	0	0
white-faced ibis	*Plegadis chihi*	+	0	0	0	0	0
whistling swan	*Olor columbianus*	+	0	0	0	0	—
Canada goose	*Branta canadensis*	+	0	0	0	0	—
white-fronted goose	*Anser albifrons*	+	0	0	0	0	—
snow goose	*Chen caerulescens*	+	0	0	0	0	—
Ross' goose	*Chen rossii*	+	0	0	0	0	—
mallard	*Anas platyrhynchos*	+	0	0	0	0	—
gadwall	*Anas strepera*	+	0	0	0	0	—
pintail	*Anas acuta*	+	0	0	0	0	—
green-winged teal	*A nas crecca*	+	0	0	0	0	—
blue-winged teal	*Anas discors*	+	0	0	0	0	—
cinnamon teal	*Anas cyanop tera*	+	0	0	0	0	0
American wigeon	*Anas americana*	+	0	0	0	0	—
northern shoveler	*Anus clypeata*	+	0	0	0	0	—
wood duck	*Aix sponsa*	+	0	0	0	0	0
redhead	*A ythya americana*	+	0	0	0	0	0
ring-necked duck	*Aythya collaris*	+	0	0	0	0	—
canvasback	*A y thya valisineria*	+	0	0	0	0	0
greater scaup	*A ythya marila*	+	0	0	0	0	0
lesser scaup	*Aythya affinis*	+	0	0	0	0	0
common goldeneye	*Bucephala clangula*	+	0	0	0	0	0
Barrow's goldeneye	*Bucephala islandica*	+	0	0	0	0	0
bufflehead	*Bucephala albeola*	+	0	0	0	0	0
oldsquaw	*Clangula hyemalis*	+	0	0	0	0	0
King eider	*Somateria spectabilis*	+	0	0	0	0	0
ruddy duck	*Oxyura jamaicensis*	+	0	0	0	0	0
hooded merganser	*Lophodytes cucullatus*	+	0	0	0	0	0

Appendix 1 (continued)

Common name	Scientific name	Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
common merganser	*Mergus merganser*	+	0	0	0	0	0
red-breasted merganser	*Mergus serrator*	+	0	0	0	0	0
turkey vulture	*Cathartes aura*	+	+	+	+	+	—
goshawk	*Accipiter gen tilis*	+	0	0	0	0	0
sharp-shinned hawk	*Accipiter striatus*	+	0	0	0	0	0
Cooper's hawk	*Accipiter cooperii*	+	0	0	0	0	0
red-tailed hawk	*Buteo jamaicensis*	+	+	+	+	—	—
Swainson's hawk	*Buteo swainsoni*	+	+	+	+	—	—
rough-legged hawk	*Bu teo lagopus*	+	+	+	+	—	—
ferruginous hawk	*Bu teo regalis*	+	—	+	+	—	—
golden eagle	*Aquila chrysaetos*	+	+	+	+	—	—
bald eagle	*Haliaeetus leucocephalus*	+	+	+	+	—	—
marsh hawk	*Circus cyaneus*	+	—	+	+	—	—
osprey	*Pandion haliaetus*	+	0	0	0	0	0
prairie falcon	*Falco mexicanus*	+	0	+	+	—	—
peregrine	*Falco peregrinus*	+	0	+	+	—	—
merlin	*Falco columbarius*	+	0	+	+	—	—
American kestrel	*Falco sparverius*	+	0	+	+	—	—
blue grouse	*Dendragapus obscurus*	+	0	+	0	0	—
ruffed grouse	*Bonasa umbellus*	+	0	0	0	0	—
sage grouse	*Centrocercus urophasianus*	+	0	0	0	0	—
California quail	*Lophortyx californicus*	+	0	+	+	—	—
mountain quail	*Oreortyx pictus*	+	0	0	0	—	—
chukar	*Alectoris chukar*	+	0	+	0	0	—
gray partridge	*Perdix perdix*	+	0	0	0	—	—
ring-necked pheasant	*Phasianus colchicus*	+	—		0	—	—
sandhill crane	*Grus canadensis*	+	0	0	0	—	—
Virginia rail	*Rallus limicola*	+	0	0	0	0	0
sora	*Porzana carolina*	+	0	0	0	0	0
American coot	*Fulica americana*	+	0	0	0	—	—
snowy plover	*Charadrius alexandrinus*	+	0	0	0	0	—
killdeer	*Charadrius vociferus*	+	0	0	0	0	—
mountain plover	*Charadrius montanus*	+	0	0	0	0	—
common snipe	*Capella gallinago*	+	0	0	0	0	—
long-billed curlew	*Numenius americanus*	—	0	+	0	0	—
semi-palmated plover	*Charadrius semipalmatus*	+	0	0	0	0	—
spotted sandpiper	*Actitis macularia*	+	0	0	0	0	—
solitary sandpiper	*Tringa solitaria*	+	0	0	0	0	—
greater yellowlegs	*Tringa melanoleuca*	+	0	0	0	0	—

Wildlife species: Common name	Scientific name	Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
lesser yellowlegs	***Tringa flavipes***	+	0	0	0	0	
willet	***Catoptrophorus semipalmatus***	+	0	0	0	0	
pectoral sandpiper	***Calidris melanotos***	+	0	0	0	0	
Baird's sandpiper	***Calidris bairdii***	+	0	0	0	0	
least sandpiper	***Calidris minutilla***	+	0	0	0	0	
western sandpiper	***Calidris mauri***	+	0	0	0	0	
long-billed dowitcher	***Limnodromus scolopaceus***	+	0	0	0	0	
marbled godwi t	***Limosa fedoa***	+	0	0	0	0	
American avocet	***Recurvirostra americana***	+	0	0	0	0	
black-necked stilt	***Himantopus mexicanus***	+	0	0	0	0	
Wilson's phalarope	***Steganopus tricolor***	+	0	0	0	0	
northern phalarope	***Lobipes lobatus***	+	0	0	0	0	
herring gull	***Larus thayeri***	+	0	0	0	0	
California gull	***Larus californicus***	+	0	0	0	0	
ring-billed gull	***Larus delawarensis***	+	0	0	0	0	
Franklin's gull	***Larus pipixcan***	+	0	0	0	0	
Bonaparte's gull	***Larus Philadelphia***	+	0	0	0	0	
Forster's tern	***Sterna forsteri***	+	0	0	0	0	
Caspian tern	***Hydroprogne caspia***	+	0	0	0	0	
black tern	***Chlidonias niger***	+	0	0	0	0	
rock dove	***Columba livia***	+	+	+	0	0	
mourning dove	***Zenaida macroura***	+	0	0	0	0	
yellow-billed cuckoo	***Coccyzus americanus***	+	0	0	0	0	
barn own	***Tyto alba***	+	–	i-	+	0	
screech owl	***Otus asio***	+	–	+	+	0	
flammulated owl	***Otus flammeolus***	+	–	+	+	0	
great horned owl	***Bubo virginianus***	+	–	+	+	+	
pygmy owl	***Glaucidium gnoma***	+	–	+	+	+	
burrowing owl	***Athene cunicularia***	+	–	+	+	0	
long-eared owl	***Asio otus***	+	–	+	+	0	
short-eared owl	***Asio flammeus***	+	0	+	+	0	
saw-whet owl	***Aegolius acadicus***	+	0	0	+	0	
poorwill	***Phalaenoptilus nuttallii***	+	0	+	0	0	
common nighthawk	***Chordeiles minor***	+	+	+	0	0	
black swift	***Cypseloides niger***	+	0	+	0	0	
Vaux's swift	***Chaetura vauxi***	+	0	+	0	0	
whitethroated swift	***Aeronautes saxatalis***	+	0	+	0	0	
black-chinned hummingbird	***Archilochus alexandri***	+	0	0	0	0	
Anna's hummingbird	***Calypte anna***	+	0	0	0	0	

Wildlife species

Common name	Scientific name	Abandoned home	Roads and bridge	Rock walls, jacks, and monuments	Wood corrals and	we	op
broad-tailed hummingbird	*Selasphorus platycercus*	+	0	0	0	0	0
rufous hummingbird	*Selasphorus rufus*	+	0	0	0	0	0
calliope hummingbird	*Stellula calliope*	+	0	0	0	0	0
belted kingfisher	*Megaceryle alcyon*	+	—	0	0	0	0
common flicker	*Colaptes auratus*	+	—	0	—	0	0
Lewis' woodpecker	*Asyndesmus lewis*	+	—	0	—	0	0
yellow-bellied sapsucker	*Sphyrapicus varius*	+	0	0	0	0	0
Williamson's sapsucker	*Sphyrapicus thyroideus*	+	0	0	0	0	0
hairy woodpecker	*Dendrocopos villosus*	+	0	0	0	0	0
downy woodpecker	*Dendrocopos pubescens*	+	0	0	0	0	0
white-headed woodpecker	*Dendrocopos albolarvatus*	+	0	0	0	0	0
eastern kingbird	*Tyrannus tyrannus*	+	0	0	0	0	—
western kingbird	*Tyrannus verticalis*	+	—	+	0	0	—
ash-throated flycatcher	*Myiarchus cinerascens*	+	0	+	+	0	—
Say's phoebe	*Sayornis saya*	+	+	+	+	0	0
willow flycatcher	*Empidonax traillii*	+	0	0	0	0	—
Hammond's flycatcher	*Empidonax hammondii*	+	0	0	0	0	—
gray flycatcher	*Empidonax wrightii*	+	+	+	+	0	—
western flycatcher	*Empio?onax difficilis*	+	0	0	0	0	—
western wood pewee	*Contopus sordidulus*	+	0	0	0	0	—
olive-sided flycatcher	*Nu ttallornis borealis*	+	0	0	0	0	—
horned lark	*Eremphila alpes tris*	0	+	+	0	0	—
violet-green swallow	*Tachycineta thalassina*	+	0	0	0	0	—
tree swallow	*Iridoprocne bicolor*	+	0	0	0	0	—
bank swallow	*Riparia riparia*	+	+	0	0	0	—
rough-winged swallow	*Stelgidop teryx ru ficollis*	+	+	0	0	0	—
barn swallow	*Hirundo rus tica*	+	+	0	0	0	—
cliff swallow	*Petrochelidon pyrrhonota*	+	+	0	0	0	—
gray jay	*Perisoreus canadensis*	+	0	0	0	0	—
Steller's jay	*Cyanocitta stelleri*	+	0	0	0	0	—
scrub jay	*Aphelocoma coerulescens*	+	0	+	0	0	—
black-billed magpie	*Pica pica*	+	+	+	+	0	—
common raven	*Corvus corax*	+	+	+	+	+	—
common crow	*Corvus brachyrhynchos*	+	0	+	0	0	—
pinyon jay	*Gymnorhinus cyanocephalus*	+	0	+	+	0	—
Clark's nutcracker	*Nucifraga columbiana*	+	0	0	0	0	0
black-capped chickadee	*Parus atricapillus*	+	0	0	0	0	0
mountain chickadee	*Parus gambeli*	+	0	0	0	0	0
bushtit	*Psaltriparus minimus*	+	0	0	0	0	0

Common name	Scientific name	Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
white-breasted nuthatch	*Sitta carolinensis*	+	0	0	0	0	0
red-breasted nuthatch	*Sit ta canadensis*	+	0	0	0	0	0
brown creeper	*Certhia familiaris*	+	0	0	0	0	0
dipper	*Cinclus mexicanus*	+	+	0	0	0	0
house wren	*Troglodytes aedon*	+	+	+	0	0	0
winter wren	*Troglodytes troglodytes*	+	+	0	0	0	0
long-billed marsh wren	*Telmatody tes palus tris*	+	0	0	0	0	0
canyon wren	*Catherpes mexicanus*	+	+	+	0	0	0
rock wren	*Salpinctes obsoletus*	+	+	+	0	0	0
gray catbird	*Dumetella carolinensis*	+	0	0	0	0	0
brown thrasher	*Toxos toma ru fum*	+	0	0	0	0	—
sage thrasher	*Oreoscoptes montanus*	+	0	+	0	0	—
American robin	*Turdus migratorius*	+	0	+	0	0	—
varied thrush	*Ixoreus naevius*	+	0	0	0	0	—
hermit thrush	*Catharus guttatus*	+	0	0	0	0	0
Swainson's thrush	*Catharus ustulatus*	+	0	0	0	0	0
veery	*Catharus fuscescens*	+	0	0	0	0	0
western bluebird	*Sialia mexicana*	+	0	+	+	0	—
mountain bluebird	*Sialia currucoides*	+	0	+	+	0	—
Townsend's solitaire	*Myadestes townsendi*	+	0	+	0	0	0
blue-gray gnatcatcher	*Popioptila caerulea*	+	0	+	0	0	0
water pipit	*Anthus spinoletta*	+	+	+	0	0	—
bohemian waxwing	*Bombycilla garrulus*	+	0	0	0	0	0
cedar waxwing	*Born b ycilla cedrorum*	+	0	0	0	0	0
northern shrike	*Lanius excubitor*	+	+	+	+	0	0
loggerhead shrike	*Lanius ludovicianus*	+	+	+	+	0	0
starling	*Sturnus vulgaris*	+	0	0	0	0	+
solitary vireo	*Vireo'solitarius*	+	0	0	0	0	0
red-eyed vireo	*Vireo olivaceus*	+	0	0	0	0	0
warbling vireo	*Vireo gilvus*	+	0	0	0	0	0
orange-crowned warbler	*Vermivora celata*	+	0	0	0	0	0
yellow warbler	*Dendroica petechia*	+	0	0	0	0	0
yellow-rumped warbler	*Dendroica coronata*	+	0	0	0	0	0
black-throated gray warbler	*Dendroica nigrescens*	+	0	0	0	0	0
Townsend's warbler	*Dendroica townsendi*	+	0	0	0	0	0
ovenbird	*Seiurus aurocapillus*	+	0	0	0	0	0
MacGillivray's warbler	*Oporornis tolmiei*	+	0	0	0	0	0
common yellowthroat	*Geothlypis trichas*	+	0	0	0	0	0
yellow-breasted chat	*Icteria virens*	+	0	0	0	0	0

Appendix 1 (continued)

Wildlife species		Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
Common name	Scientific name						
Wilson's warbler	*Wilsonia pusilla*	+	0	0	0	0	0
American redstart	*Setophaga ruticilla*	+	0	0	0	0	0
house sparrow	*Passer domesticus*	+	+	+	+	0	
bobolink	*Dolichonyx oryzivorus*	+	0	0	0	0	—
western meadowlark	*Sturnella neglecta*	+	0	+	+	0	—
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	+	0	0	0	0	—
red-winged blackbird	*Agelaius phoeniceus*	+	0	0	0	0	—
northern oriole	*Icterus galbula*	+	0	0	0	0	0
Brewer's blackbird	*Euphagus cyanocephalus*	+	0	0	0	0	
brown-headed cowbird	*Molothrus ater*	+	0	0	0	0	—
western tanager	*Piranga ludoviciana*	+	0	0	0	0	0
rose-breasted grosbeak	*Pheucticus ludovicianus*	+	0	0	0	0	0
black-headed grosbeak	*Pheucticus melanocephalus*	+	0	0	0	0	0
indigo bunting	*Passerina cyanea*	+	0	0	0	0	0
lazuli bunting	*Passerina amoena*	+	0	0	0	0	0
evening grosbeak	*Hesperiphona vespertina*	+	0	0	0	0	0
purple finch	*Carpodacus purpureus*	+	0	0	0	0	—
Cassin's finch	*Carpodacus cassinii*	+	0	0	0	0	—
house finch	*Carpodacus mexicanus*	+	0	0	0	0	—
common redpol	*Acanthis flammea*	+	0	0	0	0	—
pine siskin	*Spinus pinus*	+	0	0	0	0	
American goldfinch	*Spinus tris tis*	+	0	0	0	0	—
lesser goldfinch	*Spinus psaltria*	+	0	0	0	0	
green-tailed towhee	*Chlorura chlorura*	+	0	0	0	0	—
rufous-sided towhee	*Pipilo erythrophthalmus*	+	0	0	0	0	—
Savannah sparrow	*Passerculus sandwichensis*	+	+	+	0	0	—
grasshopper sparrow	*Ammodramus savannarum*	+	+	+	0	0	—
vesper sparrow	*Pooecetes gramineus*	+	+	+	0	0	—
lark sparrow	*Chondestes grammacus*	+	0	+	0	0	—
sage sparrow	*Amphispiza belli*	+	0	+	0	0	
dark-eyed junco	*Junco hyemalis*	+	0	0	0	0	—
tree sparrow	*Spizella arborea*	+	0	0	0	0	—
chipping sparrow	*Spizella passerina*	+	0	0	0	0	—
Brewer's sparrow	*Spizella breweri*	+	0	+	0	0	
whi te-crowned sparrow	*Zonotrichia leucophrys*	+	0	+	0	0	—
golden-crowned sparrow	*Zonotrichia atricapilla*	+	0	+	0	0	—
fox sparrow	*Passerella iliaca*	+	0	0	0	0	
Lincoln's sparrow	*Melospiza lincolnii*	+	0	0	0	0	
song sparrow	*Melospiza melodia*	+	0	0	0	0	—

Wildlife species: Common name	Scientific name	Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
Lapland longspur	*Calcarius lapponicus*	+	0	+	0	0	—
snow bunting	*Plectrophenax nivalis*	+	0	+	0	0	—
Mammals							
Malheur shrew	*Sorex preblei*	+	—	0	0	—	—
wandering shrew	*Sorex vagrans*	+	—	+	+	—	—
Merriam shrew	*Sorex merriami*	+	—	+	+	—	—
little brown myotis	*Myotis lucifugus*	+	+	0	0	0	0
Yuma myotis	*Myotis yumanensis*	+	+	0	0	0	0
long-eared myotis	*Myotis evotis*	+	+	0	0	0	0
fringed myotis	*Myotis thysanodes*	+	+	0	0	0	0
long-legged myotis	*Myotis volans*	+	+	0	0	0	0
California myotis	*Myotis californicus*	+	+	0	0	0	0
small-footed myotis	*Myotis leibi*	+	+	0	0	0	0
silver-haired bat	*Lasionycteris noctivagans*	+	+	0	0	0	0
western pipistrelle	*Pipistrellus hesperus*	+	+	0	0	0	0
big brown bat	*Eptesicus fuscus*	+	+	0	0	0	0
hoary bat	*Lasiurus cinereus*	+	0	0	0	0	—
spotted bat	*Euderma maculata*	0	0	0	0	0	—
western big-eared bat	*Plecotus townsendi*	+	+	0	0	0	0
pallid bat	*Antrorous pallidus*	+	+	0	0	0	0
pygmy rabbit	*Sylvilagus idahoensis*	+	—	+	+	—	—
mountain cottontail	*Sylvilagus nuttalli*	+	—	+	+	—	—
white-tailed jackrabbit	*Lepus townsendi*	+	—	0	0	—	—
black-tailed jackrabbit	*Lepus californicus*	+	—	0	0	—	—
least chipmunk	*Eutamias minimus*	+	—	+	+	—	—
yellow-pine chipmunk	*Eutamias amoenus*	+	—	+	+	0	—
yellow-bellied marmot	*Marmota flaviventris*	+	—	+	+	0	—
antelope ground squirrel	*Ammospermophilus leucurus*	0	—	0	0	—	—
Townsend ground squirrel	*Spermophilus townsendi*	+	—	+	+	—	—
Richardson ground squirrel	*Spermophilus richardsoni*	+	—	+	+	—	—
Belding ground squirrel	*Spermophilus beldingi*	+	—	+	+	—	—
mantled ground squirrel	*Spermophilus lateralis*	+	+	+	+	0	0
Townsend pocket gopher	*Thomomys townsendi*	+	+	0	0	+	—
northern pocket gopher	*Thomomys talpoides*	+	+	0	0	+	—
little pocket mouse	*Perognathus longimembris*	0	—	0	0	—	—
Great Basin pocket mouse	*Perognathus parvus*	+	—	0	0	+	—
dark kangaroo mouse	*Microdipodops megacephalus*	0	—	0	0	—	—
Ord kangaroo rat	*Dipodomys ordi*	+	+	0	0	0	—

Appendix 1 (continued)

Common name	Scientific name	Abandoned homesteads	Roads and bridges	Rock walls, jacks, cribs, and monuments	Wood corrals and fences	Powerlines	Croplands
chisel-toothed kangaroo rat	*Dipodomys microps*	+	+	0	0	0	—
beaver	*Castor canadensis*	—	—	0	0	—	—
western harvest mouse	*Reithrodontomys megalotis*	+	—	+	0	+	—
canyon mouse	*Peromyscus crinitus*	0	0	+	0	—	—
deer mouse	*Peromyscus maniculatus*	+	—	+	+	0	—
northern grasshopper mouse	*Onychomys leucogaster*	+	—	0	0	—	—
desert woodrat	*Neo toma lepida*	+	—	+	+	0	—
bushy-tailed woodrat	*Neo toma cinerea*	+	—	+	+	0	—
montane vole	*Microtus montanus*	+	—	0	0	+	—
long-tailed vole	*Microtus longicaudus*	+	—	0	0	+	—
sage vole	*Lagurus curtatus*	0	+	+	0	—	—
muskrat	*Ondatra zibethicus*	—	0	0	0	0	—
western jumping mouse	*Zapus princeps*	+	—	0	0	—	—
porcupine	*Erethizon dorsatum*	+	—	—	0	—	—
coyote	*Canis latrans*	+	—	—	0	—	—
red fox	*Vulpes vulpes*	+	—	+	+	+	—
kit fox	*Vulpes macrotis*	+	—	+	+	+	—
raccoon	*Procyon lotor*	+	—	+	+	—	—
long-tailed weasel	*Mustela frenata*	+	—	+	+	—	—
mink	*Mustela vison*	+	—	+	0	—	—
badger	*Taxidea taxus*	+	—	+	+	+	—
spotted skunk	*Spilogale putorius*	+	—	+	+	—	—
striped skunk	*Mephitis mephitis*	+	—	+	+	—	—
river otter	*Lutra canadensis*	0	—	0	0	—	—
cougar	*Felis concolor*	+	—	0	0	—	—
bobcat	*Lynx rufus*	+	—	—	0	—	—
mule deer	*Odocoileus hemionus*	+	—	—	—	—	—
pronghorn	*Antilocapra americana*	—	—	—	—	—	—
bighorn sheep	*Ovis canadensis*	—	—	—	—	—	—