Terrestrial Species Component

Key Terms Used in This Section

Broad-scale species —Those species whose source habitats could be mapped reliably using a block size of at least 247 acres (100 hectares).

Ecological significance — In the *Scientific Assessment* and this EIS, refers to a specific method of judging the significance of changes (from historical) of cover types and terrestrial community types, based on class changes, regional changes, and departure indices. See Hann, Jones, Karl, et al. (1997, page 409) for details.

Emergent trees — Live or dead trees that are taller than the overall stand and thus emerge above it. Emergent trees are important to many wildlife species that use forest stand-initiation structural stages.

Fine-scale species —Those species whose source habitats could not be mapped reliably using a block size of at least 247 acres (100 hectares).

Source habitat —The composite of vegetation characteristics that contribute to terrestrial species population maintenance or growth in a specified time and space. Source habitats are described in Wisdom et al. (in press) using dominant vegetation cover type and structural stage combinations that can be estimated reliably at the 247-acre (100-hectare) patch scale. Various combinations of these cover type–structural stages make up the source habitats for the terrestrial species discussed in this EIS, and provide the range of vegetation conditions required by these species for food, reproduction, and other needs.

Special status species — Federally listed threatened or endangered species, federal proposed or candidate species, and species managed as sensitive species by the Forest Service and/or BLM.

Species-seasonal combinations — Represents a species and the season of year (summer, winter, or year-long) that it uses source habitat. It also indicates that some species may migrate within or outside the project area. For example: blue grouse use forest mosaic habitat (Family 3) in the summer and broad elevation old forests (Family 2) in the winter.

Terrestrial Family — An aggregate of groups of broad-scale terrestrial vertebrate species of focus for ICBEMP, organized into "families" based on habitat requirements (Wisdom et al. in press). Twelve Terrestrial Families were identified.

Terrestrial Group —Terrestrial vertebrate species of focus for ICBEMP, organized into groups based on habitat requirements (Wisdom et al. in press). Forty Terrestrial Groups are discussed in this EIS.

Vascular plant —A plant that has specialized tissues, which conduct nutrients, water, and sugars, along with other specialized parts such as roots, stems, and reproductive structures. Vascular plants include ferns, flowers, grasses, shrubs, trees, and many others.

Widely distributed species —Those species that occur on more than one administrative unit. Widely distributed species may be fine-scale or broad-scale based on habitat resolution; however, in this EIS, it was only possible to disclose specific quantitative effects of the alternatives on widely distributed species whose habitat could be reliably mapped using a block size of at least 247 acres.

Summary of Conditions and Trends

- Approximately 14,000 terrestrial plant and animal species were considered in the Terrestrial Ecology Assessment, including 548 vertebrates, 715 invertebrates, and more than 12,500 plant species. The Supplemental Draft EIS focuses on 91 terrestrial species (a total of 97 "species-seasonal combinations") that are of broad-scale concern and whose habitat could be mapped reliably using available broad-scale data.
- From historical to current periods, there has been an increase in fragmentation and loss of connectivity within and between blocks of habitat, especially in lower elevation forests, shrub steppe, and riparian areas in the interior Columbia River Basin. Fragmentation has isolated some animal and plant habitats and populations and reduced the ability of populations to disperse across the landscape, resulting in potential, long-term loss of genetic interchange.
- Declines in plant and animal terrestrial species are due to a number of human causes including: conversion of habitat to agriculture and urban development, grazing, timber harvest, introduction of exotic plant and animal species, recreation, high road densities, fire exclusion and fire suppression, and mining.
- Biological crusts have been degraded and their development has been inhibited in some rangeland cover types by recreational activities, excessive livestock grazing pressure, and exotic undesirable plant invasions. Degradation of biological crusts and inhibition of biological crust development often causes and perpetuates an increase in soil erosion.
- A general downward trend in habitat has been documented for most of the species-seasonal combinations analyzed for this project. The degree to which source habitats have declined is generally consistent across the project area. Even those species-seasonal combinations that have not declined more than 20 percent, when looking at the basin as a whole, do show greater declines in some areas.
- In total: 76 species-seasonal combinations have a downward trend for habitat. Habitats for 12 of the species-seasonal combinations have declined more than 50 percent; 43 have declined more than 20 percent.
- Four species-seasonal combinations have essentially a stable trend for habitat.
- Seventeen species-seasonal combinations have an increasing trend for habitat. Habitats for one species-seasonal combination have increased more than 20 percent, and habitats for five have increased more than 50 percent.
- Currently, less than 10 percent of the project area provides habitat for 14 of the species-seasonal combinations.
- Fifty-three cover type–structural stages have declined substantially in geographic extent from the historical to current period. Most of these source habitats (41 out of 53) are especially important to the species in the following Terrestrial Families: low elevation old forest, broad elevation old forest, early seral montane and lower montane forest, sagebrush, grassland, and open canopy sagebrush.

Introduction

From historical to current periods, there has been an increase in fragmentation and loss of connectivity within and between blocks of habitat, especially in lower elevation forests, shrub steppe, and riparian areas in the interior Columbia Basin.

The vast number of terrestrial species in the interior Columbia River Basin makes it a challenge to understand the regional ecology and evaluate the implications of proposed land management scenarios. Approximately 14,000 terrestrial plant and animal species were considered in the Terrestrial Ecology Assessment (Marcot et al. 1997), of which 548 are vertebrates (132 mammals, 362 birds, 27 reptiles, 27 amphibians). Approximately 715 invertebrates and more than 12,500 plant species were considered (see Table 2-22).

The Terrestrial Ecology Assessment (Marcot et al. 1997) compared prehistoric, historical, and current terrestrial environments and plant and animal communities and looked closely at habitat changes that would affect terrestrial species.

Changes in vegetation composition, distribution and structure, climate, water availability and quality, soil characteristics, and human disturbance may all affect the habitats of terrestrial species. The degree to which any species is affected depends on the magnitude of the changes, the ability of the species to move to other blocks of the same habitat or other habitats types, the distribution and interconnections of populations of species, the sensitivity of these species or their habitats to human activity, and many other factors that are not always well understood. Populations can increase or decrease because of habitat changes that affect their distribution, density, access to habitat, or a combination of all three. Thus, what may be harmful to one species may benefit or not affect another species, or may affect the ways that terrestrial species interact with each other (Marcot et al.1997).

From historical to current periods, there has been an increase in fragmentation and loss of connectivity within and between blocks of habitat, especially in lower elevation forests, shrub steppe, and riparian areas in the interior Columbia Basin. Fragmentation has isolated some animal and plant habitats and populations and reduced the ability of populations to disperse across the landscape, resulting in potential, long-term loss of genetic interchange.

Increasing human population in the project area has resulted in an increase in access and human activities. These uses can increase terrestrial species displacement and vulnerability to mortality, fragment habitat, and allow for access of exotic plants into new locations. In some places road density has increased to the point where some species will leave the area to avoid human activity.

Table 2-22. Terrestrial Species Considered in the Scientific Assessment.

	Total # of Species	Federally Listed			FS/BLM	
Type	**Considered**	**Threatened**	**Endangered**	**Proposed**	**Candidate**	**Sensitive**
Invertebrates	715[1]	1	5	0	0	23
Amphibians	27[2]	0	0	0	2	10
Reptiles	27	0	0	0	0	4
Birds	362[3]	1	1	0	0	66
Mammals	132	1	2	2	1	19
Plants	12,625[4]	4	3	1	7	700

[1] Number of species considered; the estimated number of invertebrates in the Assessment Area is more than 24,000.
[2] The spotted frog (*Rana pretiosa*) was separated into two species: the Oregon spotted frog (*Rana pretiosa*) and the Columbia spotted frog (*Rana lutevenis*) since the Draft EISs were prepared.
[3] Number includes 79 species which are accidental or casual species.
[4] Number of species considered; the estimated number of plants in the Assessment Area is approximately 19,000.

Source: Marcot et al. 1997. Sensitive Lists (see Appendix 6).

Changes from the Draft EISs

Terrestrial Species

Organization and Species Discussed

Information on terrestrial species in Chapter 2 of the Draft EISs was presented separately for each potential vegetation group (dry, moist, cold forest; dry grass, dry and cool shrub PVGs). Information was organized by taxonomic classification: plants (vascular, non-vascular), invertebrates, and vertebrates (amphibians, reptiles, birds, mammals). Information on biological crusts was presented in the Rangelands section of the Draft EISs.

Information on terrestrial species in this Supplemental Draft EIS is organized by taxonomic classification, undifferentiated by potential vegetation group, to provide overview and context. Information on biological crusts is presented as part of the plants discussion. The section on terrestrial vertebrates includes discussion of terrestrial source habitats for 91 species, based on the work developed by Widsom et al. (in press) after the Draft EISs were published. Of the 91 species under consideration in the Supplemental Draft EIS, approximately 27 were not included in the Draft EISs, and approximately 35 species that were discussed in the Draft EISs are not discussed here. This new analysis focuses on terrestrial vertebrate species habitats that might require further assessment and management at the broad scale.

Endemic Species

The Draft EISs presented maps and discussions of endemic species, as examples of species that may require special management emphasis to achieve their long-term evolutionary potential. Because endemic species are generally restricted to small portions of the project area and are best evaluated at finer scales, information on endemic species in the Supplemental Draft EIS has been condensed.

Northern Spotted Owl, Marbled Murrelets, and Peregine Falcon

The project area was adjusted for the Supplemental Draft EIS to exclude the area covered by the Northwest Forest Plan (see Chapter 1). This excludes habitat for northern spotted owls and marbled murrelets; therefore, these species are not discussed in the Supplemental Draft EIS. Also, the peregrine falcon was recently delisted by the U.S. Fish and Wildlife Service, and is now a Forest Service/BLM sensitive species.

Terrestrial habitat trends are not meant to be interpreted necessarily as trends in population size for individual species. In part this is because abundance of a species can be affected by factors other than habitat quality, quantity, or distribution. For example, even if habitat remains constant, climatic conditions during breeding or wintering may cause a change in a species population size or density. However, local habitat changes are still key to the potential to maintain sustainable populations.

Information in this section is presented by taxonomic classification of plants (non-vascular and vascular) and animals (invertebrates and vertebrates) to provide an overview of species and habitats under consideration in this EIS. This discussion parallels the information found in Chapter 2 of the Draft EISs. With the refined focus of this Supplemental Draft EIS, there is no longer specific direction in Chapter 3 for invertebrates, amphibians, or other fine-scale species. However the discussion remains in Chapter 2 for completeness of information and consistency with science.

The discussion of terrestrial vertebrates includes new information on source habitats, derived from Wisdom et al. (in press), which was completed after the Draft EISs were published. Following this are discussions on riparian / wetland vertebrate species, other habitat considerations, special status species, harvestability considerations, and viability considerations. Discussions of riparian- or wetland-dependent species are presented in this section to keep information about terrestrial species together. However, a more detailed discussion of riparian and wetland vegetation types is found in the Aquatic / Riparian / Hydrologic section of this chapter.

Terrestrial Integrity Considerations

In the Draft EISs three concepts developed by the Science Team to account for terrestrial integrity were presented: species viability, long-term evolutionary potential, and multiple ecological scales and evolutionary time frames. The second and third concepts concern rare or endemic species or species at the edges of their range. They are less applicable in the Supplemental Draft EIS because they deal with species that are better evaluated at finer scales even though some benefits are anticipated from this project. Viability of broad-scale species of concern is the concept focused on in this Supplemental Draft EIS.

A list of terrestrial species was reviewed by expert panels (see Appendix 6). From this list, broad-scale and fine-scale species of concern were identified (see Lehmkuhl et al. 1997 and Wisdom et al. in press). Effects of the alternatives will be disclosed for species with a viability concern, as determined by the science panels.

Plants

The plant discussion was derived from Marcot et al. (1997) unless otherwise indicated. That publication contains additional information on the species groups discussed below.

The project area is known to support more than 12,500 plant species (Table 2-22, earlier in this section), including more than 8,000 vascular plants and over 4,500 species of non-vascular plants (bryophytes) and plant allies (lichens and fungi).

This richness in plant diversity is a reflection of the many different habitats found within the interior Columbia Basin, ranging from alpine to desert conditions with a variety of bedrock types, soils, and temperature and moisture regimes. Plants are primary producers, organisms that convert the energy of the sun into food and nutrients for other living organisms, making them a critical component in the maintenance of ecosystems. Commercial resources critical to the region's economy are provided by plants, including trees, forage, and other special plant products.

Many groups of plants and related organisms play multiple, but poorly understood, roles in functional ecosystems. Different levels of information are available for each of the plant groups. The vast majority of available information relates to vascular plant species (especially those that are economically valuable) although nonvascular plants and plant allies often play critical roles in ecosystems.

Non-vascular Plants and Plant Allies

Bryophytes

Bryophytes are non-vascular plants, lacking specialized tissues for conducting nutrients and water. Bryophytes include mosses, liverworts, and hornworts. More than 800 species of bryophytes are known to occur in the project area, approximately 40 percent of which appear to be rare or endemic. Bryophytes are found on a range of substrates, including wet or alkaline soils, rocks, peatlands, geothermal areas, and decaying wood. They are important sources of food and shelter for vertebrates and invertebrates. Biological (microbiotic) crusts in rangelands consist of both bryophytes and lichens, covering and protecting the area between grass clumps and / or shrubs from erosion (see discussion below). Terrestrial bryophytes are affected when their substrate or associated microclimate is modified. For riparian and aquatic species, changes in water quality are important determinants of population health and viability.

Fungi

A key role of fungi in ecosystems is that of decomposer, recycling nutrients within an ecosystem to make them available for use by other organisms. Many species of fungi facilitate moisture and nutrient absorption by plants through beneficial, mycorrhizal, relationships with plant roots. Many fungi are important food items for a range of vertebrates and invertebrates. Other fungi in the project area are of commercial value and economic importance. Many of the known species appear to be local or regional endemics.

Lichens

Lichens, which are organisms made up of algal and fungal components, are represented by more than 1,000 species within the project area. Lichens function in a wide variety of ecosystems as food sources for animals, and they contribute organic matter to forest and rangeland soils. Some lichens are used as food and dyes by American Indians, while others are thought to have medicinal qualities. Lichens are a key component of biological crusts in rangeland environments (see next section). Lichens are affected when their substrate (for example, wood, soil, rock) is modified through community successional changes, timber harvests, livestock grazing, fire and invasive plant species. Artificially dense forest stands create unsuitable habitat for most lichen species.

Biological Crusts

Biological crusts consist of lichens, bryophytes, algae, microfungi, cyanobacteria, and bacteria growing on or just below the soil surface (Eldridge and Greene 1994). Biological crusts play a role in soil stability, nutrient cycling, and soil moisture, and in interactions with vascular plants. Lichens and algae provide forage for invertebrates, and some lichens provide forage for big game species during critical winter periods (Thomas and Rosentreter 1992). The ecological role of biological crusts is probably most substantial in arid ecosystems in which above-ground productivity is inherently low. Cover types in the project area that can be associated with substantial biological crust development include: salt desert shrub, low sagebrush, big sagebrush, and juniper woodland. (See Appendix 13 for additional information on biological crusts.)

In some areas biological crusts can account for 70 to 80 percent of the living cover (Belnap 1990). Biological crusts contribute to aggregate structure, and thus soil stability, by binding soil particles (Belnap and Gardner 1993; Campbell et al. 1989; Danin et al. 1989; Danin and Yaalon 1980; Graetz and Tongway 1986; Schulten 1985). The resulting surface roughness reduces water velocity and associated erosion and creates ponding that enhances sediment deposition (Alexander and Calvo 1990; Brotherson et al. 1983). Soils stabilized by biological crusts tend to have greater concentrations of organic material, nitrogen, exchangeable manganese, calcium, potassium, magnesium, and available phosphorus (Harper and Pendleton 1993). However, the availability of the nitrogen that is fixed by biological crusts, and its necessity to vascular plants and community structure and function, continue to be unresolved issues (Evans and Ehleringer 1994; Harper and Pendleton 1993; Rychert et al. 1978; Snyder and Wullstein 1973).

The influence of biological crusts on infiltration and soil moisture is not definitive; it depends on soil type, climate, disturbance history, states of wetness of a particular soil type when it is rewetted, and types of organisms in the crust and their degree of development (Seyfried 1991, Williams 1993). The influence of biological crusts has been reported as positive (Johnson and Blackburn 1989, Johnson and Gordon 1986, Loope and Gifford 1972, Seyfried 1991), negative (Bond 1964, Brotherson et al. 1983, Graetz and Tongway 1986, Rogers 1977, Stanley 1983), or neutral (Fletcher 1960, Williams 1993). Biological crusts can be present on, and their development can be enhanced by, soil types that physically cause ponding of water on the surface, or soil types that are composed of clay and fine silt and are characterized by poor soil moisture infiltration (Eldridge and Greene 1994).

Biological crusts and vascular plants have complex interrelationships that can be either competitive, mutualistic, or neutral, depending on the growth stage of the organisms, climate, soil resources, plant–animal interactions, and resource management. Increased seedling establishment and plant species richness are attributed to an increased availability of microsites, nutrients, and water resulting from biological crust structure (Beymer and Klopatek 1992; Graetz and Tongway 1986; Kleiner and Harper 1972, 1977; Meyer 1986; Mucher et al. 1988; Eckert et al. 1986; Harper and Marble 1988; St Clair et al. 1984; Sylla 1987, in West 1990). In other instances, biological crusts have been described as inhibiting the establishment of vascular plant seedlings and reducing community structure (Dulieu et al. 1977, McIlvanie 1942, Savory and Parsons 1980). While some plants, such as needlegrass, are better adapted morphologically to establish in well-developed biological crusts (West 1990), establishment of other plants, such as less-adapted weedy exotics, is probably inhibited by intact microbiotic crusts development (Rosentreter 1994) More research is needed to further understand the interrelationship of biological crusts and seedling establishment.

Activities that disturb the soil surface—including grazing, off-road vehicle use, recreational hiking, and others—can reduce the maximum potential development of biological crusts. Continuous season-long grazing is harmful to microbiotic crusts, as shown by Jeffries and Klopatec (1987) and Brotherson et al. (1983). Likewise, short-duration grazing strategies characterized by intense physical impact to the soil surface are harmful to biological crusts, especially on rangeland characterized by wet winter and dry summer climates in the Great Basin. Early winter grazing when soils are wet or frozen is not harmful to biological crust cover. Heavy grazing that persists into the late winter and early spring, however, becomes harmful (Marble and Harper 1989) because it limits the time available for regrowth of lichens and algae. These organisms can continue to grow from late winter through early spring because of optimal soil water conditions, but growth is disrupted if heavy livestock grazing persists. After early to late spring, soil water conditions are no longer optimal for biological crust development. The results of these studies appear applicable to salt desert shrub and adjacent dry sagebrush (for example, low sage and big sagebrush) cover types in the project area.

Biological crusts can be temporarily damaged by fire (Harper and Marble 1988, West 1990). Algal and cyanobacterial components of biological crusts can recover within 5 to 10 years after a fire event, whereas lichens and mosses might require 10 to 20 years to achieve substantial cover (Johansen and Rayburn 1989). With the invasion of flammable exotic grasses, such as cheatgrass, fire frequency has increased. Fire intervals of less than 5 years, which pose a substantial risk to biological crusts, have been documented on the exotic annual grasslands of the Snake River Plain (Whisenant 1990).

More research needs to be conducted on biological crusts to ascertain their ecological roles, particularly with regard to hydrology, nutrient cycling, energy flow, and biodiversity. Relative to other regions of the western United States, for example the Colorado Plateau, there has been a lack of research conducted within the interior Columbia River basin to ascertain the response of biological crusts to land use disturbances such as livestock grazing. Biological crusts are not inventoried by the BLM or Forest Service in a manner that determines condition and extent at multiple scales. Therefore, broad-scale trends of actual biological crusts extent and development between historical and current periods are not presented in this EIS.

Vascular Plants

Vascular plants conduct nutrients and water within a system of roots, stems, leaves, and reproductive structures. Vascular plants include ferns (and their allies), cone-bearing plants (conifers), and flowering plants. More than 8,000 vascular plant species are found within the project area. They are remarkably diverse, inhabiting the full spectrum of aquatic, riparian, and terrestrial habitats.

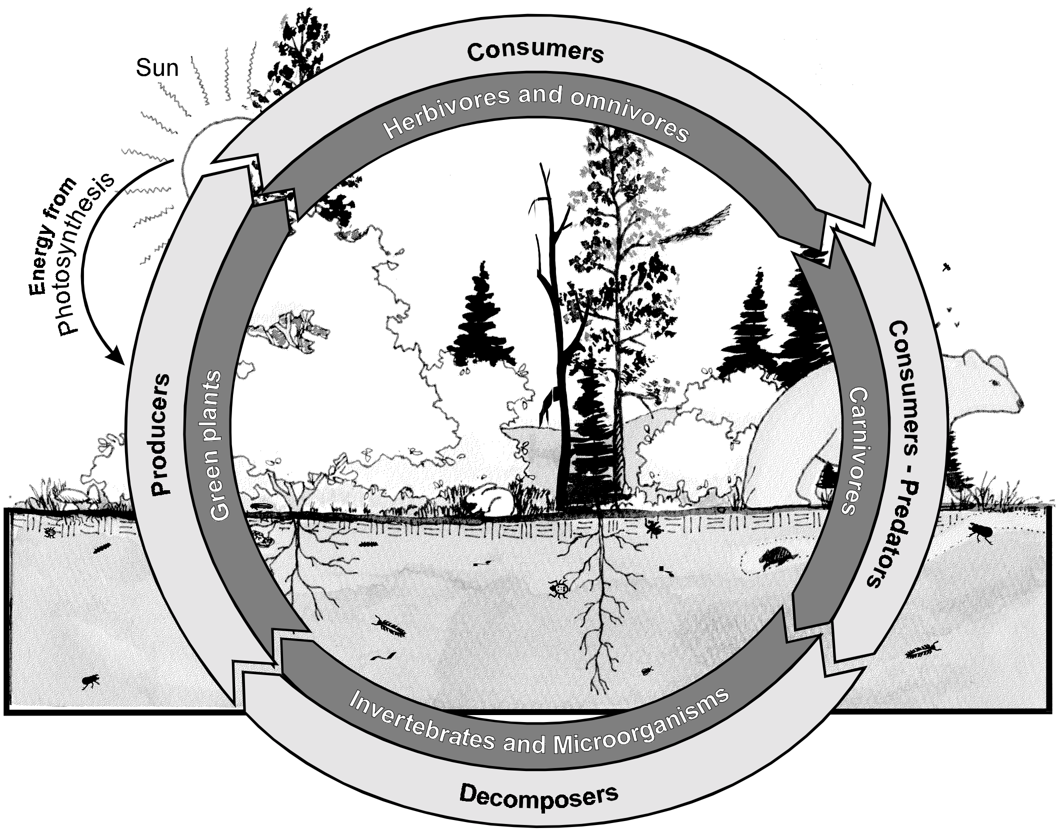
Vascular plants function as the basis of the food webs that sustain life on earth (see Figure 2-13). They protect soil from wind and water erosion by the binding action of their roots and the protection afforded by their above-ground parts. They further serve to moderate stream temperatures by providing shade to streams, enhancing habitat for aquatic- and riparian-dependent species. Vascular plants provide shelter (hiding cover and protection from the elements) for many animals. Most of the economically and culturally important plants within the project area are vascular species (for example, trees for fiber, grasses for forage).

Among the vascular plant species known to occur within the project area, nearly 700 are tracked by the Forest Service and BLM as sensitive (rare) species. Many are restricted to very narrow geographic areas. Nearly 100 species are of cultural interest to American Indian tribes. Many of the terrestrial plant communities within the basin have been, and continue to be, altered by human-caused actions. The *Scientific Assessment* found that native bunchgrass communities, low-elevation cedar / hemlock forests, and the Palouse prairie have shown significant losses in the last century. In contrast, the number of acres occupied by exotic annual plants has greatly increased during the same time period.

Many activities have adversely affected distribution and size of plant populations, reproductive capability, and interpopulation interactions of vascular plant communities within the project area; including land conversion to agriculture, livestock grazing, proliferation of exotic plant species, and changes in the historical fire regime.

Animals

Terrestrial animals are key components in all parts of the energy cycle (see Figure 2-13). They provide food, nutrients, and energy to each other and the system as a whole. Conditions and activities that change terrestrial animal populations through positive or negative modification of their habitats can affect the cycling of energy, nutrients, and other ecosystem processes essential to forest and rangeland health. Such changes can also affect socio-economic health because terrestrial animals also contribute to social and economic systems through their recreational, business, cultural, educational, and



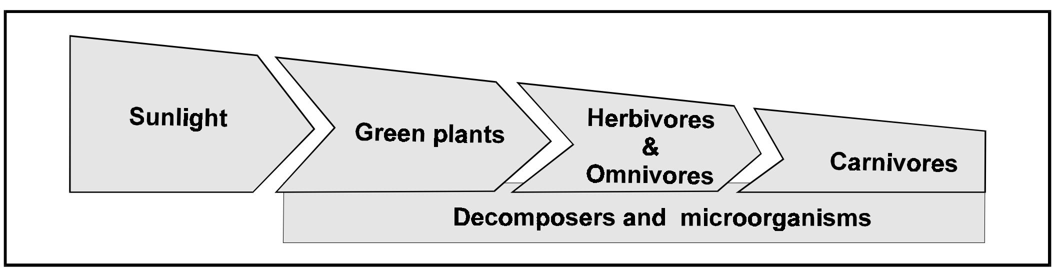


Figure 2-13. Energy Flow: Terrestrial Food Chain.

Green plants function as the basis of the food webs that sustain life on earth. They capture energy from the sun and pass the energy on to other organisms. Terrestrial animals also are key components in all parts of the energy cycle, providing food, nutrients, and energy to each other and the system as a whole. The transfer and cycling of energy and nutrients through a complex series of organisms eating other organisms is called a food web.

Conditions and activities that change terrestrial plant and animal populations through positive or negative modification of their habitats can affect the cycling of energy, nutrients, and other ecosystem processes essential to ecosystem health. Such changes can also affect socio-economic conditions, because terrestrial plants and animals also contribute to social and economic systems through their recreational, economic, cultural, medicinal, educational, spiritual, and other values.

spiritual values. Unless otherwise noted, the invertebrate and vertebrate discussion was derived from Marcot et al. (1997).

Invertebrates

Background

Some of the common groups of invertebrates include arthropods, mollusks, earthworms, protozoa, and nematodes. A diversity of habitat composition and structure is important to ensure that appropriate habitat is available for invertebrates. Appropriate soil structure and chemistry are important for soil invertebrates. Insects sometimes play an important role, in concert with drought and fire, in shaping stand and landscape structure. Invertebrates also perform vital functions in the forest by decomposing wood and litter that return nutrients to the energy cycle, and by serving as food for all other groups of animals. In addition, invertebrates turn over soil (increasing its productivity), pollinate flowers, and disperse seeds.

Invertebrates use a variety of habitat patches and microsites in forests and rangelands that may appear uniform. Important habitats for invertebrates include tree, shrub, herb and grass canopies; downed wood; snags; flowers; plant litter; and soils. Many unique and some rare or endemic species (species with very limited distribution) of invertebrates depend on talus, caves, bogs, springs, gravel, and other habitat features. Even after fires, islands of unburned trees or large trees with thick bark, shrubs, herbs, grass, and litter provide places for insects and other invertebrates to survive and recolonize.

Current Conditions and Trends

According to estimates made for the project area, only about 15 percent of invertebrate species that could potentially exist in the area have been identified. Populations of some invertebrates have declined. However, habitat requirements for invertebrates are generally at a scale so fine that it is difficult to precisely establish their current condition or status.

Factors that have caused some declines of invertebrates include: the use of pesticides; loss of litter and dead plant material; decline in forbs due to grazing, range treatments, fire exclusion, and increased fire frequency; disturbance of springs, wetlands, talus slopes, caves, and other special habitats; and conversion of grasslands and shrublands on private land to agriculture for crop production. Except for species being considered for special species status, impacts from these disturbances on invertebrates are largely unknown.

Of the known species of invertebrates, many have been accidentally or intentionally introduced via vehicles, cargo, animals, wind, and other means. Competition, displacement, and interbreeding of exotic invertebrate species pose an increasing threat to native invertebrates, plants, and other animals.

Vertebrates

Terrestrial vertebrates are important components of the project area's ecosystems. They occupy widely diverse habitats in the basin and play various ecological roles. Many of the terrestrial vertebrate species can be found in several environments, but others are restricted to one or two specific vegetative communities. For example, woodpeckers, in general, need dead trees for nesting and feeding, but for the hairy woodpecker, the species of dead tree is not as important for nest site selection as the size (it needs to be greater than 10 inches in diameter). For the pileated woodpecker, on the other hand, both the size (greater than 20 inches in diameter) and the species of the tree are important for nesting and feeding.

Animals that are most vulnerable to changes in habitat are those that (1) depend on a narrow range of habitats and (2) are not very mobile. Mobile species and animals that use a variety of habitats usually can move into other habitat types or patches when disturbance occurs. Changes in disturbance patterns and created habitats have allowed exotic animal species, such as starlings and bull frogs, to invade and compete with native species. Fragmentation has increased isolation of different terrestrial vertebrate populations and limited genetic interchange between populations.

Fire is an important element in habitat condition. Fire changes the composition and distribution of vegetation, and it improves the palatability and nutritional value of forbs, grasses, and some shrubs. Fire also increases early spring green-up, which is important to nutrition of pregnant animals. In contrast, fire suppression and change in fire regimes due to exotic plant invasions have reduced the quality of many big game habitats (Lyon et al. 1995).

Habitat for many terrestrial vertebrate species has declined greatly in the basin. Declines are due to a number of human causes: increasing urbanization; conversion of lands to agriculture; and intensive management of forests, rangelands, and other biomes to meet human demands for food, shelter, and leisure. In the United States, declines in habitat during the past century are largely responsible for the increase in the number of species listed as threatened, endangered, proposed, or candidate species under the Endangered Species Act (Wisdom et al. in press).

Amphibians

Background

Amphibians are relatively common in dry and moist forests. Moist forests have a particularly rich diversity of amphibians due to the dampness and high presence of aquatic habitats. Cold forests and subalpine areas are generally too cold, with too short a breeding season, to provide much habitat for amphibians. In dry grasslands and dry and cool shrublands, critical seasonal and permanent wetland habitats are not common. Consequently, amphibian diversity is and probably always was predictably low in dry grasslands and dry and cool shrublands of the project area. Amphibians help to control insects; turn over soils; create burrows for other species; serve as food to fish, small birds, and mammals; and indicate water quality and quantity.

A number of amphibian species have declined or disappeared from portions of their ranges because of undetermined factors.

Current Conditions and Trends

A number of amphibian species have declined or disappeared from portions of their ranges because of undetermined factors. These include the Columbian spotted frog, northern leopard frog, and western toad.

Amphibians often use downed wood, talus, and trees, but they must be near water to reproduce. Many salamander and frog populations are vulnerable because of changes or reductions in available riparian habitats brought on by logging, grazing, road or trail construction. Mining of talus and rock for road construction, large reservoir construction, and other activities are also affecting amphibians. Introductions of exotic fish and the bullfrog can also cause a detrimental effect because they prey on native amphibians. Many constructed ponds, catchments, and spring developments on rangelands have increased amphibian habitat, but groundwater developments and water diversions into troughs and tanks have altered other habitat areas. Amphibians are also affected by changes in invertebrate populations, and by climate changes.

Reptiles

Background

Reptile distribution is influenced more by climate and terrain than by vegetation type or structure. Downed logs, talus, and rocks are important habitat features. Most reptiles are restricted to open areas and lowlands because, as cold-blooded animals, they need warmer temperatures and sunny sites such as rocky areas to regulate body temperature. Reptiles are highly susceptible to changes in climate and microsite, especially in forested ecosystems, which are at the upper elevation end of their range. On the rangelands of the project area many reptiles are also on the northernmost limits of their ranges as they are more common in the Great Basin and Mojave deserts to the south. Reptiles help to control rodents and insects (on and below the ground surface), provide food for birds and mammals, and provide burrows for other animals.

Current Conditions and Trends

In general, reptile diversity currently is high in rangelands, but species on the edge of their ranges appear to be especially susceptible to habitat degradation and climate change (Collopy and Smith 1995).

Several species of reptile, while still common, appear to have declining trends, including the common garter snake and the sharptail snake. The loss of habitat has probably adversely affected several species such as the longnose leopard lizard and the sagebrush lizard. Losses to collecting have affected the western pond turtle and Mojave black-collared lizard.

Since their habitat in the lowlands is influenced more directly by elevation, aspect, and physical features (rock, talus, terrain, and soil characteristics) than by vegetation, some of the vegetation changes due to overgrazing, exotic species invasion, and fire suppression may not have affected all reptiles as much as other species. Highways, reservoirs and other human-created structures are barriers to movement for reptiles. Changes in populations of invertebrates and small mammals also limits prey for some reptiles.

Birds

Background

Birds use all the structural stages of forestlands, shrublands, and grasslands. Many species also use dead trees and downed logs. The presence of riparian vegetation accommodates additional bird species, such as ducks and shorebirds, some of which stop only during migration (Collopy and Smith 1995). Moist forests typically have multiple layers of trees, which provide a wider variety of bird habitats than are found in dry forests. Fewer birds use cold forests than use moist forests, because climatic conditions caused by elevation lead to lower diversity in tree species, fewer insects for food, and the shorter growing season. A wide variety of birds also use grasslands and shrublands although generally fewer than forestlands.

A number of birds species in the project area have experienced long-term declines in population numbers, due to declines in a wide variety of habitats.

Current Conditions and Trends

A number of birds species in the project area have experienced long-term declines in population numbers, due to declines in a wide variety of habitats. For example, white-headed woodpeckers and flammulated owls using forested habitats, Columbian sharp-tailed grouse and sage grouse using shrubland habitats, and a number of neotropical migrant birds using grassland and riparian habitats apparently have declined in abundance.

Forest habitat for some birds has been negatively affected through reductions in extensive areas with large, shade-intolerant tree species alive and dead (western larch, western white pine and ponderosa pine) because of past forest harvesting and exotic blister rust that affected western white pine (Hann, Jones, Karl, et al. 1997). Loss of native grasslands and reduction in grassland cover have reduced plant and insect forage, nesting habitat, and hiding cover for several bird species. Improper livestock grazing and increased fire frequency due to the spread of annual exotic species (such as cheatgrass) also may damage nests of ground-nesting birds, such as short eared owl and long billed curlew, in grassland habitats. Improper livestock grazing, succession, and increases in fragmentation of habitats have favored the cowbird, a nest parasite that reduces the reproductive success of many species. Cowbirds appear to be increasing at the expense of other species, by taking advantage of habitat changes.

Declines in species such as sage grouse, Brewer's sparrows, and sage sparrows can be attributed to changes in shrubland structure, abundance, and distribution. Habitat is becoming more and more disjunct (areas have become isolated from each other), and blocks of habitat are becoming smaller islands. Changes in riparian and wetland habitat, and native grasslands, are also linked to some species declines. Loss of grass and shrub cover, and loss of structural diversity, have significantly reduced plant and insect forage, nesting habitat, and hiding cover for several species, leading to declines in sharp-tailed grouse, upland sandpipers, mountain quail, and grasshopper sparrows. However northern flicker, house wren, mountain bluebird, American robin, and gray flycatcher have increasing poplation trends, partly due to expansion in juniper woodland habitat (Collopy and Smith 1995).

Neotropical migratory birds breed and nest within the project area, but winter in south and central America. Thus, a reduction in species may be associated with changes both within and outside of the project area. The greatest impact to neotropical migratory birds appears to be the loss of riparian and wetland habitat, but native grasslands may be linked to some species' declines. Riparian vegetation is used by 64 percent of these species (Saab and Rich 1997).

Mammals

Background

Mammals use a wide variety of forestland, shrubland and grassland habitats, including burrows below the surface, litter, downed logs, rock outcrops, openings, young forests with or without shrubs, and middle, late, and old forests. As with birds, more mammal species use moist forests than use other vegetation groups. The other types of vegetation are used by similar numbers of species. The project area supports a high diversity of bats, which help control insect populations.

Current Conditions and Trends

Some species of mammals have decreased while others have increased in the project area. Those that have increased are often species which have been able to adapt to habitat changes (some ground squirrels), species which have been favored as game animals (elk and white-tailed deer), or species which have benefitted from control of other species (some smaller predators have benefitted from control of large predators such as grizzly bears and wolves). Species that have decreased often have specific habitat requirements (stands of old, large trees), have been controlled (large predators), or are adversely affected by human activities.

As with birds, some mammals have been negatively affected by reductions in extensive areas with large, shade-intolerant tree species alive and dead (western larch, western white pine and ponderosa pine) because of past forest harvesting and exotic blister rust that affected western white pine. Many small mammals rely on the sagebrush steppe and grassland ecosystems. Several ground squirrels in the area have subspecies with very limited distributions. Loss of native plants, rodent poisoning, and soil compaction due to excessive livestock grazing pressure are affecting several species. Area of shrub steppe vegetation is declining because of conversion to crested wheatgrass, extensive planting of introduced grasses, introduction of exotic weed species, and changes in fire intensity and frequency. Increased density of juniper woodlands has reduced sagebrush and bunchgrass understory, which may reduce habitat diversity for small mammals in dry shrublands (Collopy and Smith 1995).

Bats typically roost in crevices and caves, but structures such as bridges, mines, and buildings have expanded roosting areas for bats, which may help offset human disturbance to habitat for some bat species from exploration of caves and old mine shafts. Insect control efforts reduce prey for bats. Few bat populations have been monitored, and their status is generally unknown.

Source Habitats for Terrestrial Vertebrates

Background: Refined Terrestrial Vertebrates Analysis

In the Draft EISs, the effects on terrestrial species were disclosed for 107 individual species and 15 waterbird and shorebird groups (Lehmkuhl et al. 1997). Results were disclosed for broad groupings of species (amphibians; reptiles; waterbirds and shorebirds; raptors and gamebirds; woodpeckers, nuthatches, and swifts; cuckoos, hummingbirds, and passerines; bats and small mammals; carnivores; and ungulates).

After the Draft EISs were distributed, an effort was undertaken to refine the terrestrial vertebrate analysis resulting in the identification of 12 Terrestrial Family groupings. This effort is documented in Wisdom et al. (in press) from which, unless otherwise cited, information in this section is derived.

The objectives of this additional effort were to:

1. Identify terrestrial vertebrate species whose habitats might require further assessment and management at broad spatial (geographic) scales;
2. Determine species relationships with source habitats;
3. Conduct a spatial assessment of source habitats for broad-scale species of focus;
4. Develop a system to evaluate source habitats for individual species as well as groups of species;
5. Identify species whose populations or habitats may be negatively affected by roads and associated factors; and
6. Describe broad-scale implications of managing for terrestrial vertebrates whose source habitats have undergone long-term declines in geographic extent.

This effort resulted in 173 species (see Appendix 6). This list of species was intended to be inclusive rather than exclusive and to help focus analysis on ecosystem conditions. It should not be interpreted as a list of species representing a critical legal or biological threshold.

Of the 173 species, 82 species were identified whose habitats could not be mapped reliably using the broad-scale data available for the project. These finer-scale species are primarily riparian- or wetland-dependent, and are discussed collectively in this EIS.

Ninety-one species were identified whose habitat could be mapped reliably using the broad-scale data available for the project. These 91 species were deemed broad-scale and were carried forward for more specific analysis. Of the 91 species, 64 had been analyzed by Lehmkuhl et al. (1997) and included in the Draft EISs. (See Appendix 6 for lists of species with changes in status.) Forty-three of the individual species analyzed by Lehmkuhl et al. were not carried forward to the new analysis because they were classified as fine-scale or had predicted habitat or population outcomes of 1, 2, or 3, indicating less concern for persistence (see the Draft EISs and Lehmkuhl et al. 1997 for discussions of outcomes).

To determine habitat-species relationships for the 91 broad-scale species, "source habitats" were identified using information developed for the project area (Wisdom et al. in press, Vol. I, pages 51 to 55). Source habitats were defined as characteristics of vegetation that contribute to a species' population maintenance or growth over time and within an area. Source habitats were described using the dominant vegetation cover type and structural stage combinations that can be estimated reliably at the 247-acre (100-hectare) patch scale.

To provide for seasonal variation, seasonal habitat use was considered for the 91 species. Because some species use different source habitats during different seasons, they were counted more than once, resulting in a total of 97 ***species-seasonal combinations*** for analysis. For example, blue grouse appears twice: blue grouse-summer, and blue grouse-winter.

The 97 species-seasonal combinations then were clustered into 40 groups based on similarities in source habitats, and 37 of the 40 groups were placed within 12 "Terrestrial Families", again based on similarities in source habitats (see Appendix 6). Families were named using generalized vegetative themes as shown in Table 2-23, which shows how the 37 groups of broad-scale species of focus were placed into the 12 Terrestrial Families. In this EIS, effects are disclosed for these 12 Terrestrial Families.

The three other groups are composed of four species: black rosy finch and gray-crowned rosy finch (Group 38), Lewis' woodpecker (Group 39), and brown-headed cowbird (Group 40). The species in Groups 38 and 39 were not included in one of the Families because their habitats are restricted to small areas which were potentially under-sampled because of the finer scale pattern in which their habitats exist. The rosy finches (Group 38) use some habitats common to Rocky Mountain bighorn sheep in Family 5. The brown-headed cowbird (Group 40) was excluded from the Families because of its unique dependence on agricultural and livestock-dominated environments.

This approach focused on the management implications of changes in source habitat on groups of species and "families" of groups, rather than on individual species. The direction of change in source habitats from historical to current agrees with the direction of change identified by Lehmkuhl et al. (1997) for over 95 percent of the species that also were analyzed in the Draft EISs.

Table 2-23. Terrestrial Family Groupings.

Source Habitats Restricted to:	Source Habitats Predominated by:	Terrestrial Family Group	Terrestrial Family	Terrestrial Family Name
Forests only	Old forest stages, low elevation	1, 2, 3	1	Low Elevation Old Forest
	Old forest stages, all elevations	4 – 13	2	Broad Elevation Old Forest
	Broad range of structural stages	14 – 17	3	Forest Mosaic
	Forest stand-initiation stage (early seral)	18	4	Early Seral Montane and Lower Montane
Combination of forests and rangelands	Broad range of forest and rangeland cover types	19 – 22	5	Forest and Range Mosaic
	Forests, woodlands, and montane shrubs	23 – 25	6	Forest, Woodland, and Montane Shrubs
	Forests, woodlands, and sagebrush	26 – 28	7	Forests, Woodlands, and Sagebrush
	Unique combination of rangeland cover types and early and late seral forests	29	8	Rangeland and Early and Late Seral Forest
	Woodlands	30	9	Woodlands
Rangelands only	Broad range of grassland, shrublands, and other cover types	31, 32	10	Range Mosaic
	Sagebrush	33 – 35	11	Sagebrush
	Grassland and open canopy sagebrush	36, 37	12	Grassland and Open Canopy Sagebrush

Source: Adapted from Wisdom et al. (in press), Volume 1, Figure 5.

There has been a general downward trend in habitat for most species-seasonal combinations. Currently less than 10 percent of the basin provides habitat for 14 of the species-seasonal combinations whose source habitats have declined more than 20 percent.

In total:

- **76 species-seasonal combinations have downward trend for habitat**
  - habitats for 12 species-seasonal combinations have declined more than 50 percent
  - habitats for 43 species-seasonal combinations have declined more than 20 percent
  - habitats for 21 species-seasonal combinations have declined less than 20 percent
- **4 species-seasonal combinations have a stable trend for habitat**
- **17 species-seasonal combinations have an increasing trend for habitat**
  - habitats for 11 species-seasonal combinations have increased less than 20 percent
  - habitat for 1 species-seasonal combination has increased more than 20 percent
  - habitats for 5 species-seasonal combinations have increased more than 50 percent.

Figure 2-14 illustrates the general trends in source habitat from historical to current periods.

Species-seasonal combinations whose source habitats declined are associated with a wide variety of forested and rangeland environments. The degree to which source habitats have declined is generally consistent across the basin. Even habitats for those species-seasonal combinations that have not declined more than 20 percent in geographic extent across the basin show greater declines in some areas. The trend for species-seasonal combinations was generally similar on both federal and private lands, although generally federal lands declined to a lesser extent.

When the species-seasonal combinations are combined into groups and the groups are combined into families, similar results confirm that a wide variety of source habitats have declined in the basin. At the Terrestrial Family level, 10 of the 12 Families (all but Families 3 and 9) contain at least one group whose source habitats have declined by more than 20 percent from that historically.

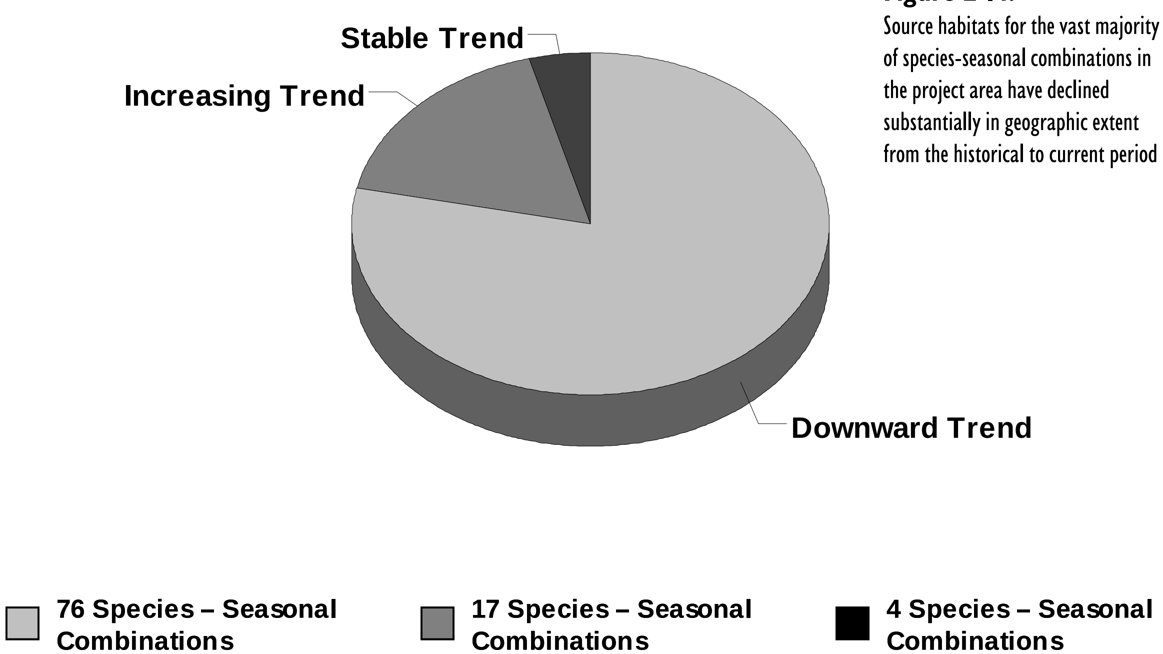


Figure 2-14.
Source habitats for the vast majority of species-seasonal combinations in the project area have declined substantially in geographic extent from the historical to current period

Terrestrial Families: Current Conditions and Trends

Family clusters are a coarse-filter approach. The use of Terrestrial Families may have tenuous value when applied to a single subbasin or smaller area. However, they can be effectively applied to develop broad-scale ecosystem strategies across large geographic areas of the basin, such as single or multiple RAC/PAC areas (see Map 1-1 in Chapter 1). Effective use of the Terrestrial Families requires verifying trends exhibited by the groups included in the Family.

Following is a brief discussion of each of the 12 Terrestrial Families. Subbasins with potential for restoration of habitats for Terrestrial Families 1, 2, 4, 11, and 12 were identified by the Science Advisory Group (Map 2-11a). For a more complete discussion, including range and trend maps, see Wisdom et al. (in press).

Terrestrial Family 1 (Low Elevation, Old Forest)

Terrestrial Family 1 (old forest, low elevation source habitat) includes white-headed woodpecker, white-breasted nuthatch, pygmy nuthatch, Lewis woodpecker (migrant population), and western gray squirrel. Declines in source habitat for Terrestrial Family 1 are largely related to reductions in the old-forest lower montane community type. Declines were considered ecologically significant. For example, basin-wide there has been an 81 percent decline in geographic extent of late seral single-layered lower montane forests from historical levels. In the northeastern portion of the basin the declines are close to 100 percent.

The primary causes for the wide-spread decline in source habitat for Family 1 are timber harvest and fire exclusion. Timber harvest has resulted in the replacement of late seral with mid seral forests. Fire exclusion has resulted in a gradual shift from shade-intolerant species, such as ponderosa pine, to shade-tolerant species, such as Douglas-fir and grand fir. Additionally, increased human occupancy and use of lands that historically supported lower montane forests have contributed to the decline.

Source habitats for Family 1 also have shifted geographically across the basin. Source habitats are now found farther south in areas with a warmer average climate. Many of the increases in source habitat result from fire exclusion in what would historically have been fire-maintained savannahs with scattered large trees.

Roads also probably adversely affect Family 1, by facilitating the harvest of large diameter trees, snags and gray squirrels, the Family's only mammal.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: pygmy nuthatch and Lewis' woodpecker. The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from "A" to "D" for pygmy nuthatch and from "A" to "E" for Lewis' woodpecker (see Table 2-23a). The predicted population outcomes on all lands decreased similarly for each species. These reductions indicate substantial increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 2 (Broad Elevation, Old Forest)

Terrestrial Family 2 (old forest, broad elevation source habitat) includes blue grouse (winter), northern goshawk (summer), flammulated owl, American marten, fisher, Vaux's swift, Williamson's sapsucker, pileated woodpecker, Hammond's flycatcher, chestnut-backed chickadee, brown creeper, winter wren, golden-crowned kinglet, varied thrush, silver-haired bat, hoary bat, boreal owl, great gray owl, black-backed woodpecker, olive-sided flycatcher, three-toed woodpecker, white-winged crossbill, woodland caribou, and northern flying squirrel. Wide-spread declines in source habitat for Terrestrial Family 2 are largely related to reductions in late-seral, lower montane, single layer forest and late-seral, subalpine, multi-layer forest. Basin-wide, 59 percent of watersheds exhibit declining trends in source habitat for Family 2. Basin-wide there has been an 81 percent decline in extent of late-seral single-layered lower montane forest from historical levels, and 64 percent decline in late-seral, subalpine, multi-layer forest. Watersheds with declining trends are concentrated in the northern part of the basin and in the Snake River drainage. Not all species-seasonal combinations in Family 2 have seen declines in source habitat: trends for three-toed woodpeckers are upward, and trends for Vaux's swift, great gray owl, and woodland caribou are neutral.

Map 2-11a. Proposed Terrestrial Family Habitat Restoration Emphasis: Terrestrial Families 1, 2, 4, 11, 12.

Table 2-23a. Predicted Environmental Outcomes and Population Outcomes.

Species	Predicted Environmental Outcomes-FS/BLM lands		Predicted Population Outcomes-Cumulative, All lands	
	Historical	Current	Historical	Current
Family 1				
pygmy nuthatch	A	D	A	D
Lewis' woodpecker (migrant)	A	E	A	E
Family 2				
American marten	B	D	B	D
flammulated owl	B	D	B	D
northern goshawk (summer)	A	C	A	C
hoary bat	A	C	A	C
black-backed woodpecker	A	C	A	C
woodland caribou	C	D	E	E
Family 3				
blue grouse (summer)	A	B	A	B
lynx	A	A	A	C
wolverine	A	C	A	D
Family 4				
Lazuli bunting	A	C	A	D
Family 5				
gray wolf	A	C	A	D
grizzly bear	A	C	A	E
Rocky Mountain bighorn sheep (summer)	C	C	C	E
Rocky Mountain bighorn sheep (winter)	C	D	C	E
Family 6				
rufous hummingbird	A	B	A	B
northern goshawk (winter)	A	B	A	B
Family 7				
long-eared myotis	A	B	A	C
Family 8				
western bluebird	A	C	A	C
Family 9				
ash-throated flycatcher	B	B	B	B
Family 10				
pronghorn	A	C	A	C
short-eared owl	A	C	A	D
striped whipsnake	A	A	A	B
Washington ground squirrel	A	C	B	E
Family 11				
Brewer's sparrow	A	B	A	C
sage grouse (summer)	A	C	A	D
sage grouse (winter)	A	C	A	D
Family 12				
Columbian sharp-tailed grouse (summer)	B	D	B	E
grasshopper sparrow	B	D	B	E

The wide-spread decline in source habitat for Terrestrial Family 2 are primarily caused by timber harvest and fire exclusion. This has resulted in a gradual shift from shade-intolerant species (such as western larch, western white pine, and ponderosa pine) to shade-tolerant species (such as western redcedar, western hemlock, Douglas-fir and grand fir).

Source habitats for Family 2 also have shifted geographically across the basin. Similar to the situation for Terrestrial Family 1, areas showing increases in source habitat are now located to the south, and areas with decreases are farther to the north. However, the areas with increases for Family 2 are not as far south as they are for Family 1, because in the higher elevation environments associated with Family 2, successional processes respond more quickly to fire suppression.

Roads also probably adversely affect species in Family 2, by facilitating the harvest of large diameter trees and snags and the poaching of woodland caribou. Roads can also increase trapping pressure on martens and fishers.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for six species in this Family: American marten, flammulated owl, northern goshawk (summer), hoary bat, black-backed woodpecker and woodland caribou. The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from “B” to “D” for American marten and flammulated owl; from “A” to “C” for northern goshawk (summer), hoary bat, and black-backed woodpecker; and from “C” to “D” for woodland caribou (see Table 2-23a). The predicted population outcomes on all lands decreased similarly for each species, except the woodland caribou which remained stable at “E”. These reductions indicate increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin, especially for the American marten, flammulated owl, and woodland caribou.

Terrestrial Family 3 (Forest Mosaic)

The members of Terrestrial Family 3 (forest mosaic) tend to be generalists that use a wide-range of forest conditions. They include the hermit warbler, pygmy shrew, wolverine, lynx, blue grouse (summer), and mountain quail (summer). Basin-wide, source habitat for Family 3 has not declined substantially in amount; 22 percent of watersheds exhibited declining trends in source habitat for this Family, with only the Upper Clark Fork ERU demonstrating a predominantly declining trend in source habitats. However, although the overall amount of source habitats for Family 3 have changed little since the historical period, there have been notable changes in the types of terrestrial community that make up their source habitat. For example, there is less early and late seral stages and more mid seral, lower montane forests. Because the members of this Family are generalists, such changes in type of habitat are less detrimental than they might be for more specialized species.

The primary cause of change in source habitat for Family 3 is timber harvest, which has reduced the snags and emergent large trees that would have occurred in early seral forests, thus substantially simplifying the structure of the early seral patches. Additionally, these early seral areas have more disturbed soil and are more heavily infested by noxious weeds. Another change that has occurred is the shift of upland herbland to mid seral, lower montane forest. Historically these areas were typically a savannah with scattered large trees. The change to mid seral trees is due primarily to fire exclusion and excessive livestock grazing.

Source habitats for Terrestrial Family 3 also have shifted geographically across the basin. In the northern and eastern portions of the basin, source habitats have generally decreased, while they increased in the southern and western portions of the basin.

Various human activities have probably affected Family 3. Roads facilitate the trapping of wolverine and lynx. Hydroelectric impoundments along the Columbia River and its tributaries have reduced habitat for mountain quail. Also, declines in quality of riparian shrubland, although too fine scale to be identified with broad-scale data, may have resulted in loss of habitat for mountain quail. Thinning some early seral forest types may reduce habitat for lynx.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for three species in this Family: blue grouse (summer), lynx and wolverine. The predicted environmental outcomes on Forest Service- and BLM- administered lands have remained stable at an “A” for lynx, decreased from “A” to “B” for blue grouse (summer), and decreased from “A” to “C” for wolverine (see Table 2-23a). These reductions indicate increased risk to the continued persistence of wolverine on Forest Service- and BLM- administered lands. The predicted population outcomes on all lands decreased from “A” to “C” for lynx, from “A” to “B” for blue grouse (summer), and from “A” to

"D" for wolverine. These reductions indicate increased risk to the continued persistence of lynx and wolverine on all lands in the Basin.

Terrestrial Family 4 (Early Seral Montane and Lower Montane)

Terrestrial Family 4 (early seral forest source habitat) is made up of only the lazuli bunting. This species depends on early seral, shrub-dominated conditions in forested environments. Basin-wide, 60 percent of watersheds exhibit declining trends in source habitat for this Family.

The primary causes for the change in the extent of source habitat for Family 4 are fire exclusion and the frequency and rate of timber harvest. The five-year regeneration requirement related to The National Forest Management Act may have shortened the time that stands remain in the early seral stage, by accelerating regeneration. Also, timber harvest practices have reduced the snags and emergent large trees that would have occurred in early seral forests, thus substantially simplifying the structure of the early seral patches.

Source habitats for Terrestrial Family 4 are spatially separated across the basin. In the Northern Cascades, Central Idaho Mountains, and Snake Headwaters ERUs, source habitats have generally increased, while they have decreased in other portions of the basin.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for the one species in this Family: the Lazuli bunting. The predicted environmental outcome on Forest Service- and BLM- administered lands decreased from "A" to "C" for this species (see Table 2-23a). The predicted population outcome on all lands decreased from "A" to "D." These reductions indicate increased risk to the continued persistence of Lazuli bunting on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 5 (Forest and Range Mosaic)

The members of Terrestrial Family 5 (forest and range mosaic) use a wide variety of forest, woodlands, and rangelands as source habitat. They include the gray wolf, grizzly bear, mountain goat, long-eared owl, California bighorn sheep, and Rocky mountain bighorn sheep (summer and winter). Basin-wide, 35 percent of watersheds exhibit declining trends in source habitat for Family 5. The greatest decline in habitat has been in the Lower Clark Fork ERU, although the Columbia Plateau, Upper Clark Fork, and Upper Snake ERUs also show decreasing trends in over half of the watersheds.

The primary causes for the change in the extent of source habitat for Family 5 are invasion of exotic plants, agriculture, and urban development. This is especially true in non-forested communities; upland herbland and upland shrubland have sharply declined because of these factors. Old forest structural stages have shifted to mid seral stages. Ecologically significant losses of western white pine, whitebark pine, western larch, and limber pine have occurred. Mountain goat and bighorn habitat has been adversely affected by fire suppression, which has allowed an increase in tree density in formerly open stands.

The pattern of source habitats for Family 5 also has shifted spatially across the basin, resulting in fragmented and more simplified patch composition and structure.

Various human activities have probably affected Family 5. Roads facilitate human access into wolf and grizzly habitat, which increases the opportunity for human-caused mortalities and displacement of wolves and grizzly bears. Mountain goats and bighorn sheep can be adversely affected by hunting (both legal and illegal), recreational hiking, timber harvest, road construction, and mining. Degradation of riparian vegetation has negatively affected foraging areas. Finally, bighorn sheep have been adversely affected by disease transmission and competition for forage from domestic sheep.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for three species in this Family: gray wolf, grizzly bear, and Rocky Mountain bighorn sheep (summer and winter). The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from "A" to "C" for gray wolf and grizzly bear and from "C" to "D" for Rocky Mountain bighorn sheep (winter); however, it remained stable at a "C" for Rocky Mountain bighorn sheep (summer) (see Table 2-23a). The predicted population outcomes on all lands decreased from "A" to "D" for gray wolf, "A" to "E" for grizzly bear, and "C" to "E" for Rocky Mountain bighorn sheep (summer and winter). These reductions indicate substantial increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 6 (Forest, Woodland, and Montane Shrub)

The members of Terrestrial Family 6 (forest, woodland, and montane shrub) use a wide variety of forest, woodlands, and rangelands as source habitat. Species include the rufous hummingbird, broad-tailed hummingbird, sharptail snake, California mountain kingsnake, black-chinned hummingbird, and northern goshawk (winter). Basin-wide, 45 percent of watersheds exhibit declining trends in source habitat for Family 6, particularly in the Blue Mountains, Northern Glaciated Mountains, Lower Clark Fork, and Upper Clark Fork ERUs. Data indicating trends in the condition of several special habitat features important to members of this Family are not available at the broad scale.

The primary causes for the change in extent of source habitat for Family 6 are fire exclusion, heavy livestock grazing, intensive timber harvest, and road building. There have been ecologically significant declines in early seral and late seral, single layer, montane forest and in the upland shrub community, some of which transitioned to upland woodland. Fire exclusion can allow increased canopy cover which reduces understory shrubs and herbs; heavy grazing can have a similar effect. Fire exclusion and heavy grazing can also simplify habitat patterns.

The pattern of source habitats for Terrestrial Family 6 also have shifted spatially across the basin, resulting in fragmented and more simplified patch composition and structure. Amounts of source habitats also have shifted geographically across the basin. In areas in the northern and eastern portions of the basin, source habitats generally have decreased, while they have increased in the central and southern portions of the basin.

Various human activities have probably affected Family 6. For example, humans can have a direct effect on snakes in this Family through collection, harassment, and mortalities.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: rufous hummingbird and northern goshawk (winter). The predicted environmental outcomes on Forest Service- and BLM-administered lands have decreased from "A" to "B" for both species (see Table 2-23a). The predicted population outcomes on all lands decreased similarly for each species. These reductions indicate only slight increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 7 (Forest, Woodland, and Sagebrush)

The members of Terrestrial Family 7 (forest, woodland, and sagebrush) use a complex pattern of a wide variety of forest, woodlands, and sagebrush cover types as source habitat. They include the Yuma myotis, long-eared myotis, fringed myotis, long-legged myotis, pine siskin, pale western big-eared bat, western small-footed myotis, spotted bat, and pallid bat. The bats in Family 7 also require special habitat features such as cliffs, caves, bark, or snags. Basin-wide, trends for Family 7 source habitats are relatively stable or increasing; 32 percent of watersheds exhibiting declining trends, particularly the Upper Snake, Columbia Plateau, and Lower Clark Fork ERUs.

Stable trends in source habitats throughout much of the basin reflects the ability of the species in Family 7 to use a wide variety of cover types and structural stages. Losses in one source habitat have generally been offset by increases in another. However, basin-wide changes in landscape patterns and simplification of patch composition and structure may have adversely affected members of this Family.

The pattern of source habitats for Terrestrial Family 7 has not shifted spatially across the basin to any great degree. In the northern and eastern portions of the basin, source habitats are decreasing somewhat.

Various human activities have likely affected Family 7. Humans can have a direct effect on bats through disturbance at roosts, loss of roosts, and mortality. Roads can indirectly contribute to this by increasing access to roosts. Loss of riparian habitat to dams and water diversions and degradation of vegetation through road construction, grazing, and recreation activities may have reduced prey and roosts for bats.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for one species in this Family: the long-eared myotis. The predicted environmental outcome on Forest Service- and BLM- administered lands has decreased from "A" to "B" for this species (see Table 2-23a). This reduction indicates only slight increased risk to the continued persistence of this species on Forest

Service- and BLM- administered lands. The predicted population outcome on all lands decreased from "A" to "C." This reduction indicates increased risk to the continued persistence of long-eared myotis on all lands in the Basin.

Terrestrial Family 8 (Rangeland and Early and Late Seral Forest)

The only member (western bluebird) of Terrestrial Family 8 (rangeland and early and late seral forest) uses early and late seral forests, woodlands, shrublands, and grasslands as source habitat. Basin-wide, 72 percent of watersheds exhibit declining trends in source habitat for Family 8. Trends in the Northern Great Basin and Owyhee Uplands ERUs are neutral, but in all other ERUs the trend is decreasing.

The primary causes for change in extent of source habitat for Family 8 are fire exclusion, heavy livestock grazing, intensive timber harvest, and road building. There have been ecologically significant declines in early seral, late seral, single layer, montane forest, upland shrublands, and upland herblands. Fire exclusion can allow increased canopy cover which reduces understory shrubs and herbs; heavy grazing can have a similar effect. Fire exclusion and heavy grazing can also simplify habitat patterns. Timber harvest and fire exclusion have resulted in a gradual shift from shade-intolerant species to shade-tolerant species. Also, timber harvest practices have reduced the snags and emergent large trees that would have occurred in early seral forests, thus substantially simplifying the structure of the early seral patches.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for the one species in this Family: the western bluebird. The predicted environmental outcome on Forest Service- and BLM- administered lands decreased from "A" to "C" for this species (see Table 2-23a). The predicted population outcome on all lands also decreased from "A" to "C". These reductions indicate increased risk to the continued persistence of western bluebird on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 9 (Woodland)

The two members of Terrestrial Family 9 (woodland; species include the ash-throated flycatcher and bushtit) primarily use upland woodlands and upland shrubland community groups. Basin-wide, 18 percent of watersheds exhibit declining trends in source habitat for Family 9, with only the Northern Cascades ERU showing more watersheds with decreasing trends than with increasing trends.

The increasing trends in source habitats throughout much of the basin are due to increases in the juniper–sagebrush cover type, which has more than doubled in the basin due to livestock grazing and fire suppression. However, the quality of these source habitats may be lower than it was historically because of increased density of woodlands and loss of native herbacious understories and loss of large decadent trees.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for one species in this Family: the ash-throated flycatcher. The predicted environmental outcome on Forest Service- and BLM- administered lands has remained stable at "B" for this species (see Table 2-23a). The predicted population outcome on all lands also remained stable at "B". This stability indicates little risk to the continued persistence of ash-throated flycatcher in the Basin.

Terrestrial Family 10 (Range Mosaic)

The members of Terrestrial Family 10 (range mosaic) use a variety of shrublands, woodlands, and herblands as source habitat. They include the ferruginous hawk, burrowing owl, short-eared owl, vesper sparrow, lark sparrow, western meadowlark, pronghorn antelope, mojave black-collared lizard, longnose leopard lizard, striped whipsnake, longnose snake, ground snake, Preble's shrew, white-tailed antelope squirrel, Washington ground squirrel, Wyoming ground squirrel, and Uinta ground squirrel. Basin-wide, 52 percent of watersheds exhibit declining trends in source habitat for Family 10. Watersheds with declining trends are concentrated in the northern half of the basin and the Snake River drainage. Nine ERUs show declining trends greater than 50 percent.

The upland shrubland and herbland terrestrial communities both have had ecologically significant declines. The upland shrubland decline was caused by conversion to agriculture and increases in the exotic herbland, upland herbland, and upland woodland. The upland herbland decline was caused by conversion to agriculture and increases in mid seral, lower montane forest and upland shrubland. In general, patch habitat quality declined from historical because of conversion to agriculture, successional transitions caused by fire exclusion, and excessive livestock grazing. These have caused higher levels of canopy closure of shrubs.

The pattern of source habitats for Terrestrial Family 10 also has shifted spatially across the basin. Watersheds with neutral or increasing trends in source habitats are concentrated in the south-central portion of the basin, with all other areas having decreases.

Various human activities have probably affected Family 10. Biological crusts can be destroyed by livestock trampling and off-road vehicles. Poisoning and recreational shooting can adversely affect all four species of ground squirrels in Family 10, which in turn can adversely affect owls and other species. Fences can restrict pronghorn antelope movement.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for four species in this Family: pronghorn, short-eared owl, striped whipsnake and Washington ground squirrel. The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from “A” to “C” for pronghorn, short-eared owl, and Washington ground squirrel, and remained stable at “A” for the striped whipsnake (see Table 2-23a). The predicted population outcomes on all lands decreased from “A” to “C” for pronghorn, from “A” to “D” for short-eared owl, from “B” to “E” for Washington ground squirrel, and from “A” to “B” for striped whipsnake. These reductions indicate increased risk to the continued persistence of pronghorn, short-eared owl, and Washington ground squirrel on Forest Service- and BLM- administered lands and on all lands in the Basin, with the risk for Washington ground squirrel being substantially increased on all lands. There has been little increased risk to the continued persistence of striped whipsnake on Forest Service- and BLM- administered lands and only a slight increased risk on all lands in the Basin.

Terrestrial Family 11 (Sagebrush)

Nearly all the members of Terrestrial Family 11 (which includes sage grouse [summer], sage grouse [winter], sage thrasher, Brewer’s sparrow, sage sparrow, lark bunting, pygmy rabbit, sagebrush vole, black-throated sparrow, kit fox, and loggerhead shrike) use open and closed canopy, low-medium shrub stages of big sagebrush, low sagebrush, and mountain big sagebrush as source habitat. Other

The upland shrubland communities used by members of Family 11 have had an ecologically significant decline; this decline is the major cause of change in source habitats for this Family.

important source habitats include salt desert shrub, antelope bitterbrush–bluebunch wheatgrass, and herbaceous wetlands. Basin-wide, 42 percent of watersheds exhibit declining trends in source habitat for Family 11. For the most part, the Northern Cascades, Southern Cascades, Northern Glaciated Mountains, and Lower Clark Fork ERUs contain little habitat for members of this Family. Of the remaining ERUs, the Upper Clark Fork, Upper Snake, and Snake Headwaters ERUs show a declining trend; the others have a neutral trend.

There has been a broad-scale redistribution of habitats and a broad-scale reduction, fragmentation, and simplification of habitats for this Family. The upland shrubland communities used by members of Family 11 have had an ecologically significant decline; this decline is the major cause of change in source habitats for this Family. The upland shrubland decline was caused by conversion to agriculture and increases in the exotic herbland, upland herbland and upland woodland. In general, patch habitat quality declined from historical because of conversion to agriculture, successional transitions caused by fire exclusion, and excessive livestock grazing, causing higher levels of canopy closure by shrubs.

Various human activities have probably affected Family 11. Humans can have a direct effect on the species in this Family through disturbance at sage grouse leks (breeding sites) and winter areas, and mortalities. Biological crusts can be destroyed by livestock trampling and off-road vehicles. Poisons targeted at coyotes can adversely affect kit fox.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: Brewer’s sparrow and sage grouse (summer and winter). The predicted environmental outcomes on Forest Service- and BLM-administered lands have decreased from “A” to “B” for Brewer’s sparrow and from “A” to “C” for sage grouse (summer and winter) (see Table 2-23a). These reductions indicate increased risk to the continued persistence of sage grouse on Forest Service- and BLM- administered lands. The predicted population outcomes on all lands decreased from “A” to “C” for

Brewer's sparrow and from "A" to "D" for sage grouse. These reductions indicate increased risk to the continued persistence of both these species on all lands in the Basin.

Terrestrial Family 12 (Grassland and Open-canopy Sagebrush)

The members of Terrestrial Family 12 (which includes Columbian sharp-tailed grouse [summer], clay-colored sparrow, grasshopper sparrow, and Idaho ground squirrel) are closely associated with upland herblands, primarily fescue–bunchgrass. Basin-wide, 60 percent of watersheds exhibit declining trends in source habitat for Family 12, occurring across most ERUs.

There has been a broad-scale redistribution of habitats and a broad-scale reduction, fragmentation, and simplification of habitats for this Family. Upland shrubland and herbland terrestrial communities both show ecologically significant declines. The upland shrubland decline was caused by conversion to agriculture and increases in the exotic herbland, upland herbland, and upland woodland. The upland herbland decline was caused by conversion to agriculture and increases in mid seral, lower montane forest, and upland shrubland. In general, patch habitat quality declined from historical because of conversion to agriculture, successional transitions caused by fire exclusion, and excessive livestock grazing, which have caused higher levels of canopy closure of shrubs. Bunchgrasses (critical habitat components for Family 12) were substantially affected by high intensity grazing in the late 1800s and early 1900s. Increasing forest encroachment adversely affects the Idaho ground squirrel.

Various human activities have probably affected Family 12, through habitat loss due to agriculture, residential development, and increased recreational activities. Biological crusts can be destroyed by livestock trampling and off-road vehicles. Recreational shooting adversely affects Idaho ground squirrels.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: Columbian sharp-tailed grouse and grasshopper sparrow. The predicted environmental outcomes on Forest Service- and BLM-administered lands have decreased from "B" to "D" for both species (see Table 2-23a). These reductions indicate increased risk to the continued persistence of Columbian sharp-tailed grouse and grasshopper sparrow on Forest Service- and BLM- administered lands. The predicted population outcomes on all lands decreased from "B" to "E" for both species. These reductions indicate substantial increased risk to the continued persistence for both these species on all lands in the Basin.

Substantially Declining Source Habitats

Wisdom et al. (in press) identified 155 cover type structural stage combinations that constituted terrestrial source habitats. Further analysis by the EIS team indcated that 53 of these have declined in geographic extent by at least 20 percent from the historical to the current period for the project as a whole. In addition, not only was the decline for these 53 apparent for the project area as a whole, but declines outnumbered increases at a more local (ERU) level, showing that the decline was generally present throughout most areas within the project area (see Appendix 5). These 53 cover type-structural stage combinations represent source habitats that have declined substantially in geographic extent from historical to current periods and will be referred to as such in many places in Chapters 2 through 4 in this EIS.

All the species in the 12 Terrestrial Families use some of these 53 cover type–structural stages as source habitats. However, most of these substantially declining source habitats (41 out of 53) are especially important to the species in five of the Terrestrial Families (Families 1, 2, 4, 11, and 12). The remaining 12 source habitats are habitat only for species in one of the other 7 Terrestrial Families.

The 5 Terrestrial Families represent a subset of the 12 Terrestrial Families with source habitats that declined to the greatest extent between historical and current periods. They best represent the "habitats at risk" Families. It is probable that declines in populations of species in these five Terrestrial Families are generally attributable to substantial declines in the geographic extent of some source habitats.

Roads and Wide-ranging Carnivores

Roads can pose a direct threat to population fitness for a number of wide-ranging terrestrial carnivores by facilitating over-trapping or other fatal interactions with humans. For the gray wolf and grizzly bear, researchers have verified a strong negative relationship between road density and population fitness.

Roads hypothetically pose a direct threat to population fitness for a number of wide-ranging terrestrial carnivores by facilitating over-trapping or other fatal interactions with humans.

Similar relationships have been hypothesized for wolverine and lynx.

Because of the observed or suspected effects on population fitness, the current abundance of source habitats in relation to road density was mapped for gray wolves, grizzly bears, wolverine, and lynx. The mapping was intended to identify large areas with abundant source habitats and low road densities, which presumably would have the highest potential to support persistent populations. This mapping effort identified seven areas: the Greater Yellowstone area, the Northern Continental Divide area, the North Cascades area, the Bitterroot–Central Idaho area, the Eagle Cap Wilderness–Hells Canyon area, the Owyhee area, and the Crater Lake area (Map 2-11b). All of these areas are within or adjacent to wilderness areas or national parks, most occur at high elevations, and most are currently occupied by all or most of the four carnivore species. Four of these areas are partially outside of the ICBEMP project area. Only a small portion (less than 5 percent) of the Bitterroot–Central Idaho area (Area 4) is outside the project area. In contrast, less than 10 percent of the Greater Yellowstone Area (Area 1) and North Cascades area (Area 3) are contained within the project area, and only about 50 percent of the Crater Lake area (Area 7) is within the project area.

All seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *grizzly bears*. Four of the seven areas are either currently occupied by grizzly bears or are within areas that have had occasional sightings or potential occurrences since 1970. These are: the Greater Yellowstone area, Northern Continental Divide area, North Cascades area, and Bitterroot–Central Idaho area. (Two other areas currently occupied by grizzly bears, the Selkirk and Cabinet–Yaak areas, contain no subbasins with both moderate to high abundance of source habitats and zero to low road density and therefore are not included in the seven areas.)

Five of the seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *wolves*. These are: the Greater Yellowstone area; Northern Continental Divide area; Bitterroot–Central Idaho area; Eagle Cap Wilderness–Hells Canyon area; and Owyhee area. However, only three of the seven areas are currently occupied by wolves: Greater Yellowstone area; Northern Continental Divide area; and Bitterroot–Central Idaho area. Wolves have recently been released in the Greater Yellowstone area and Bitterroot–Central Idaho area, resulting in rapid population growth in these areas.

Six of the seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *wolverines*. These are: the Greater Yellowstone area; Northern Continental Divide area; North Cascades area; Bitterroot–Central Idaho area; Eagle Cap Wilderness–Hells Canyon area; and Carter Lake area. All six of these areas have had verified occurrences of wolverine since 1961. The largest concentration of occurrences appears to be within the Bitterroot–Central Idaho area.

Six of the seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *lynx*. These are: the Greater Yellowstone area; Northern Continental Divide area; North Cascades area; Bitterroot–Central Idaho area; Eagle Cap Wilderness–Hells Canyon area; and Carter Lake area. Of these six, the Carter Lake area may be outside the geographic range of lynx. In contrast to wolverine, the majority of verified lynx locations corresponded to subbasins with a high abundance of lynx source habitats, regardless of road density.

Two important points can be derived from this information. First: large areas of the basin composed of moderate or high abundance of source habitats may not be used, or may be under-used, by wide-ranging carnivores because of negative interactions with humans, which are facilitated by roads. Second: areas with moderate or high abundance of source habitats and low road densities could serve as 'building blocks' from which an overall network of habitats for wide-ranging carnivores could be devised.

Riparian–Wetland Species

NOTE: See the Aquatic/Riparian/Hydrologic section for additional discussion of riparian and wetland vegetation types.

Riparian areas contain the most biologically diverse habitats on federal lands, because of their variety of structural features including live and dead vegetation, and because of the close proximity of riparian areas to water bodies. Riparian areas are valuable to terrestrial vertebrates for food, cover, and water (Bull 1977; Thomas et al. 1979). They provide important habitat

Map 2-llb. Carnivore Habitat with Low Road Density.

Photo #14

Not available in PDF.

Riparian areas serve as migration routes for elk and other big game between summer and winter ranges. These areas are also valuable for other terrestrial vertebrates for food, cover, and water.

Photo by USFS.

for over half of the terrestrial vertebrate species in the project area; in some locations an even higher percentage applies. For example, of the 378 terrestrial species known to occur in the Blue Mountains, 75 percent either directly depend on riparian areas or use them more than other habitats (Thomas et al. 1979). Riparian areas provide nesting and brooding habitat for birds. They also provide thermal cover and favorable microclimates for many terrestrial vertebrate species because of increased humidity, a higher transpiration rate, shade, and increased air movement helping in homeostasis (a condition where energy expenditure is minimized), especially when surrounded by non-forested ecosystems (Thomas et al. 1979).

Riparian areas contain the most biologically diverse habitats on federal lands.

Common deciduous trees and shrubs in riparian areas—such as cottonwood, alder, willow, and red osier dogwood—are important food sources for mammals such as deer, elk, moose, hares, rabbits, voles, and beavers, as well as other animals. Riparian areas that consist of aspen and cottonwood, incorporating herbaceous and shrubby components, are very important for numerous species of amphibians, reptiles, birds, and mammals. Riparian areas also serve as big game migration routes between summer and winter range; provide travel corridors or connectors between habitat types for many terrestrial species such as carnivores, birds, and bats; and play an important role within landscapes as corridors for dispersal of plants (Bull 1977; Gregory et al. 1991; Heinemeyer and Jones 1994; Thomas et al. 1979; Vogel and Reese 1995; Washington Department of Fish and Wildlife 1995).

Riparian habitat is used by numerous terrestrial species. The combinations of various structural stages, contrast and water provides a wide array of habitats. For example large numbers of neotropical migrant bird species (species that breed in North America and winter in Central or South America) use riparian habitat either exclusively or in combination with only one other habitat type. Within the project area, 84 of the 132 breeding migrant birds (64 percent) use riparian vegetation for nesting or foraging (Saab and Rich 1977).

Wetlands also provide important habitat for a variety of species, including resident and migratory birds (for example, swallows, flycatchers, waterfowl, and shorebirds); mammals (for example, bats, ungulates, and beavers); unique plant species (for example, cattails, sedges, rushes, pond lilies, and willows); amphibians (for example, salamanders and frogs); and invertebrates (for example, caddisflies, mayflies, and dragonflies). Seasonal wetlands are often shallow and fill up quickly in early spring with the onset of groundwater recharge or thawing conditions. These areas provide critical habitat for birds because conditions are favorable for production of invertebrates, an important food supply for migratory birds. Permanent wetlands are usually deeper water bodies that provide habitat and food for animals throughout the spring and summer.

Riparian and wetland habitats are too fine a scale to be identified with the broad-scale vegetation data used by this project (see Appendix 6 for list of fine scale species of concern). Therefore, only general broad-scale issues have been identified for riparian and wetland habitats. These broad-scale issues are: some riparian or wetland areas have declined in extent due to conversion to agriculture and other uses; other riparian or wetland areas have been degraded from activities such as grazing and recreation; the introduction of exotic plant and animal species has adversely affected riparian and wetland habitats; and dams and their operation have negatively affected riparian habitat. Many riparian shrub habitats have declined because of overgrazing (resulting in increases in native and exotic grasses) or fire exclusion (resulting in increases in conifers).

Special Habitat Features

Special habitat features are those non-vegetative factors or finer-scale characteristics of vegetation that also contribute to stationary or positive population growth. Special habitat features identified by species experts include: caves, cliffs, talus, and burrows, which are non-vegetative factors; and snags, downed logs, large hollow trees, shrub or herb understories, shrub / herbaceous, wetland / riparian, mountain shrubs, deciduous tree riparian, and vegetation contrast (Table 2, Vol. 3, Wisdom et al., in press). Thirty-one of the 40 groups and 11 of the 12 Terrestrial Families contain at least one species that uses a special habitat feature. Only Terrestrial Family 4, which contains only the Lazuli bunting, does not contain at least one species that uses these features (Wisdom et al. in press).

It is not possible to quantify the extent of the special habitat features at the broad scale because the features are too fine scale to be identified. However, most species that use them can be adversely affected by human activities. For example, rock climbing on cliffs or cutting snags for fuelwood can adversely affect dependent species.

Snags and Downed Wood

Snag-dependent species tend to increase along with the number of snags until other factors become limiting. Snag diameter and height and downed log quantity and size are important criteria for selection by dependent species (Thomas et al. 1979, Torgersen and Bull 1995). Most of the snag-dependent birds and small mammals are insectivorous and may play a role in regulating insect populations. Downed wood is important to a wide variety of terrestrial species.

Basin-wide there have been changes in the number of snags and amount of downed logs (see Table 2-23b). Generally there are fewer snags than historically where timber management or salvage of dead trees (wildfire or insect killed) has occurred. In areas where management has not occurred, there are often more snags than historically because of fire suppression actions. Roads in riparian areas have led to lower snag and downed wood levels in portions of riparian areas because of removal of dead trees for fuelwood or by timber harvesting. The diversity of habitat created by a fire pattern mosaic is rarely present in managed stands.

Special Status Terrestrial Species

Special status species include federally listed threatened or endangered species, federal proposed and candidate species, species managed as sensitive species by the Forest Service and / or BLM, and rare or narrow endemic species.

Not all federal candidate species or agency sensitive species are necessarily in decline; some species are little-known or naturally rare because of habitat rarity. It is suspected that no vertebrate species have become extirpated (local extinction) from the project area in recent decades. Although it is possible that undescribed, locally endemic species or subspecies might have vanished before they could be studied, information on other taxa is lacking (Marcot et al. 1997).

Table 2-22 (earlier in this section) provides the number of species of terrestrial organisms evaluated for the project; the number of federally listed threatened, endangered, candidate and proposed species; and BLM- or Forest Service-designated sensitive species (Marcot et al. 1997). Table 2-24 lists threatened, candidate, and proposed species; Appendix 6 lists the sensitive species.

Table 2-23b. Predicted Number of Snags And Pieces of Downed Wood Per Acre.[1]

Potential Vegetation Group	Historical	Current
	Number of large snags per acres	
Cold Forest	4.03	4.23
Dry Forest	1.92	1.56
Moist Forest	4.33	3.89
Riparian Woodland	3.13	1.82
Woodland	0.00	0.40
	Downed wood pieces per acre	
Cold Forest	9.19	9.14
Dry Forest	2.23	2.41
Moist Forest	2.10	8.00
Riparian Woodland	2.16	1.45
Woodland	0.00	0.40

[1] The predicted number of snags per acre and pieces of downed wood per acre, by Potential Vegetation Group, on Forest Service- and BLM- administered lands within the Interior Columbia River Basin project area, for the historical and current time periods.

Threatened, Endangered, Proposed, or Candidate Species

Under the Endangered Species Act of 1973, an *endangered* species is any species in danger of extinction throughout all or a significant portion of its range. A *threatened* species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. *Proposed* species have been proposed to the U.S. Fish and Wildlife Service or the National Marine Fisheries Service for listing as threatened or endangered. *Candidate* species are those that may be proposed for listing in the future. Table 2-24 shows the federally listed, proposed, and candidate plant, animal, and fish species in the project area (current as of November 1999). Both terrestrial and aquatic species were included here so that all species would be in one table.

All of the threatened or endangered terrestrial vertebrates have recovery plans or strategies approved by the U.S. Fish and Wildlife Service. There is an EIS for reintroduction of gray wolves, which provided the basis for wolves being reintroduced in Idaho in 1995 and 1996. See Appendix 6 for the listed species in the project area and the status of their recovery plans and critical habitat.

Populations of both peregrine falcons and bald eagles are static or increasing slightly in the project area. Peregrine falcons were delisted in September 1999. Bald eagles were reclassified from endangered to threatened in 1995; and the U.S. Fish and Wildlife Service has recently proposed that the bald eagle be delisted. The primary reason for recovery is restriction of pesticides that caused eggshell thinning and reproductive failures, but habitat improvement and road and human access management also contributed to their increase.

Gray wolves are known to occur in Idaho and in Montana. Wolves are listed as endangered in the project area in northern Montana, northern Idaho, Oregon, and Washington. Experimental populations of wolves exist in central and southern Idaho and southwestern Montana. These reintroduced populations of wolves in Yellowstone and Central Idaho appear to be expanding rapidly, with estimates of more than 10 packs in both areas in 1999. The population in north central Montana also appears to be stable or slowly expanding. Depredation on livestock continues to be a source of concern as populations expand. Management actions related to confirmed livestock depredation are the major source of human-related mortality. At the current rate of growth, it is estimated that wolves in the northern Rocky Mountains should be recovered and possibly considered for delisting by late 2002 (E. Bangs, USFWS, personal communication).

Table 2-24. Terrestrial and Aquatic Threatened, Endangered, Proposed, and Candidate Species.

Common Name	Scientific Name	FWS Status
Animals		
Woodland caribou	*Rangifer tarandus caribou*	E
Whooping crane	*Grus americana*	E, XN
Gray wolf	*Canis lupus*	E, XN
Bald eagle	*Haliaeetus leucocephalus*	T
Grizzly bear	*Ursus arctos*	T
Lynx	*Lynx canadensis*	PT
Northern Idaho ground squirrel	*Spermophilus brunneus*	PT
Washington ground squirrel	*Spermophilus washingtoni*	C
Columbia spotted frog	*Rana luteiventris*	C
Oregon spotted frog	*Rana pretiosa*	C
Invertebrates		
Utah valvata snail	*Valvata utahensis*	E
Snake River physa snail	*Physa natricina*	E
Idaho springsnail	*Fontelicella idahoensis*	E
Banbury springs limpet	*Lanx spp.*	E
Bruneau hot springsnail	*Pyrgulopsis bruneauensis*	E
Bliss Rapids snail	*Taylorconcha serpenticola*	T
Plants		
Applegate's milkvetch	*Astragalus applegatei*	E
Malheur wirelettuce	*Stephanomeria malheurensis*	E
Wenatchee Mountains (Oregon) checkermallow	*Sidalcea oregana var. calva*	E
Water howellia	*Howellia aquatalis*	T
MacFarlane's four-o'clock	*Mirabilis macfarlanei*	T
Ute's lady tresses	*Spiranthes diluvialis*	T
Howell's spectacular thelypody	*Thelypodium howellii spp. spectabilis*	T
Spalding's catchfly	*Silene spaldingii*	PE
Christ's Indian paintbrush	*Castilleja christii*	C
Basalt fleabane (daisy)	*Erigeron basalticus*	C
Slick spot peppergrass	*Lepidium papillifernm*	C
Northern wormwood	*Artemisia campestris* var. *wormskioldii*	C
Umtanum desert-buckwheat	*Eriogonum codium*	C
Showy stickseed	*Hackelia venusta*	C
White Bluffs bladderpod	*Lesquerella tuplashensis*	C
Fish		
White sturgeon (Kootenai River)	*Acipenser transmontanus*	E
Sockeye salmon (Snake River)	*Oncorhynchus nerka*	E
Chinook salmon (Upper Columbia River)	*Oncorhynchus tshawytscha*	E
Steelhead (Upper Columbia River)	*Oncorhynchus mykiss mykiss*	E
Borax Lake chub	*Gila boraxobius*	E
Lost River sucker	*Deltistes luxatus*	E
Shortnose sucker	*Chasmistes brevirostris*	E
Steelhead (Snake River)	*Oncorhynchus mykiss mykiss*	T
Steelhead (Mid Columbia)	*Oncorhynchus mykiss mykiss*	T
Fall chinook salmon (Snake River)	*Oncorhynchus tshawytscha*	T
Spring/summer chinook salmon (Snake River)	*Oncorhynchus tshawytscha*	T
Bull trout	*Salvelinus confluentus*	T
Hutton tui chub	*Gila bicolor spp.*	T
Foskett speckled dace	*Rhinichthys osculus spp.*	T
Warner sucker	*Catostomus warnerensis*	T
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	T

Key:
C = Federally candidate species
E = Federally listed as endangered
PE = Federally proposed as endangered
T = Federally listed as threatened
PT = Federally proposed as threatened
XN = Experimental, non-essential

Source: U.S. Fish and Wildlife Service (July 15, 1999), Federal Register 18/28/99 and 10/25/99

Grizzly bears are known to occur in northern and eastern Idaho and in Montana. Grizzly bear populations appear to be increasing in the Yellowstone and the Northern Continental Divide recovery areas and are near recovery goals, although human-caused mortalities of females continue to be a concern. The Selkirk, Cabinet–Yaak, and Northern Cascades recovery areas appear to have small populations and are not yet approaching recovery goals. Recent research on collared bears has shown movement between the Selkirk and Cabinet–Yaak ecosystems within 20 miles of the U.S.–Canada border. The U.S. Fish and Wildlife Service has concluded that the two areas should now be considered as one ecosystem for grizzly bear recovery purposes. There have been no recent, confirmed reports of grizzly bears in the Bitterroot recovery area. Currently the U. S. Fish and Wildlife Service is preparing an EIS related to reintroduction of grizzly bears in the Bitterroot recovery area.

Woodland caribou are currently restricted to the Selkirk Mountains in northeastern Washington and northern Idaho. The population was augmented from 1987 to 1990 and is now estimated to number from 60 to 65 individuals. It is believed that predation by mountain lions is currently limiting the population, with human-caused mortality and direct disturbance as contributing factors.

Whooping cranes in Idaho are designated as an experimental population as part of the effort to establish additional populations. In Montana, whooping cranes are still listed as endangered. Sighting records indicate that whooping cranes do not currently occupy the western portion of Montana included in the project area.

Plant species that are federally listed as threatened or endangered and that occur in the project area include: Water howellia (threatened), Applegate's milk-vetch (endangered), MacFarlane's four-o'clock (threatened), Ute's lady-tresses (threatened), Howell's spectacular thelypody (threatened), Malheur wire-lettuce (threatened), and Wenatchee Mountains checkermallow, Applegate's milk-vetch, Howell's spectacular thelypody, and Malheur wire-lettuce occur only in Oregon; water howellia and Ute's lady-tresses occur throughout the project area; MacFarlane's four-o'clock occurs in Idaho and Oregon; and the Wenatchee Mountains Checkermallow occurs in Washington. Of the listed plant species only Applegate's milkvetch, Malheur wirelettuce, and MacFarlane's four-o'clock have approved recovery plans.

In 1998, the U.S. Fish and Wildlife Service proposed to list the lynx as threatened. Lynx are uncommon, but widely distributed, in the project area. A decision on listing is anticipated in January 2000. The northern Idaho ground squirrel, limited to localized mountain meadows in west central Idaho, has also been proposed for listing as threatened. The Spalding's catchfly, found in localized populations throughout the Palouse region in northeast Oregon and southeast Washington has been proposed for listing as threatened.

Candidate species in the project area are the Columbia spotted frog (eastern Oregon and Washington and southwestern Idaho), Oregon spotted frog (limited areas in the eastern Cascades), Washington ground squirrel (north central Oregon and south central Washington), Christ's paintbrush (south central Idaho), basalt daisy (south central Washington), slick spot peppergrass (south western Idaho), northern wormwood (north central Oregon and south central Washington), Umtanum desert-buckwheat (south central Washington), showy stickseed (central Washington), and White Bluffs bladderpod (south central Washington).

Agency Sensitive Species

The Forest Service and the BLM also maintain regional and state lists of *sensitive* species for which there are significant current or predicted downward trends in population numbers, density, or habitat capability; or species with limited distribution.

Currently 23 invertebrates, 14 amphibians or reptiles, 66 birds, 19 mammals, and more than 700 plant species are listed as sensitive by the Forest Service and / or the BLM in the project area. See Appendix 6 for a list of these species. Many invertebrates listed as sensitive are not included in the appendix since habitat for such species is managed at a finer scale than this EIS.

Endemic Species

Endemic species are those that occur naturally in a certain region and whose distribution is relatively limited to a particular area. A number of endemic species exist in the project area. These species are often either locally or regionally endemic, are disjunct from other populations of the same species, or occur at the periphery of their range. Centers of concentration of species rarity and endemism and high biodiversity were identified in Marcot et al. (1997). These centers of concentration seemed to pertain to taxonomic groups with low mobility. Disturbance regimes probably play a role in maintaining biodiversity of some centers of concentration (Marcot et al. 1997). Endemic species are best evaluated at finer scales, although effects on a few can be determined at the broad scale. Where this occurs, they are included in this EIS as species of broad-scale concern.

Rare plant communities were identified in the basin (Marcot et al. 1997). Some plant communities are rare because they depend on a unique set of abiotic features or because of land-altering human activities. Increases in human influence have caused some plant communities to decline further. Typically, rare plant communities occupy small areas which are better suited to finer-scale analysis.

Hunting,Viewing, and Collecting Considerations

Forests and rangelands are used by many big game species that are socially and economically important for hunting and viewing. Many are used for food and other cultural and spiritual values by local American Indian tribes and are often addressed in treaties. Historical accounts are not conclusive, but it appears that elk, mule deer, and white-tailed deer populations in forests are higher than they were before European settlement. Mule deer and white-tailed deer numbers peaked between 1940 and 1960 and possibly exceeded the capacity of their winter range. Numbers have fallen since these highs, and mule deer numbers have stabilized in recent years while white-tail numbers are slowly rising. Basin-wide white-tailed deer populations are considerably smaller than mule deer populations. The loss to human development of winter range for mule deer and overall habitat for white-tailed deer is the main limiting factor for these species. Elk have expanded their ranges in recent times, providing increased hunting opportunities but also causing potential damage in the rural and agricultural interface on private lands. In some forest settings, elk and deer are using dense stands of shade-tolerant understory trees for cover, which they would not have used as extensively under natural fire regimes.

Many of the current high populations of some big game species can be partially attributed to access management programs that control the use of roads by hunters and selective animal harvest strategies. Access management strategies among agencies to reduce vulnerability to mortality associated with roads is common for elk management. Increases in the density and use of roads across the project area provide a major factor in human-caused mortality in all big game species (Lyon et al. 1995, Marcot et al. 1997).

Bighorn sheep, mountain goats, and moose are also popular for hunting and viewing. While some bighorn populations are maintaining current numbers, other populations are generally declining because of widespread habitat changes, such as replacement of grasses, forbs, and low shrubs with tall shrubs and trees, which bighorns avoid because of increased predation. Fire exclusion and grazing of domestic livestock make contributions to these habitat changes (Lyon et al. 1995). Disease transmission from domestic sheep to bighorns is also a concern. There are two subspecies of bighorn sheep in the basin—the California bighorn sheep and Rocky Mountain bighorn sheep. It is estimated that there are about 5,000 of the former and 15,000 of the latter in the basin. State wildlife management agencies estimate that there is sufficient vacant historical habitat to double or triple the number of bighorns in the basin. Mountain goats have extended their range into areas where they have not been historically, but some populations have declined for unknown reasons (Marcot et al. 1997). Mountain goats are sensitive to human activity and roads. Moose are gradually increasing in most forest habitats, especially near Canadian moose populations and where transplant programs have been implemented. Poaching can be a limiting factor for moose colonizing new areas.

Like most native big game species, populations of pronghorn antelope were decimated by unregulated hunting between 1850 and 1920. Since then populations have increased because of regulated hunting and improved range conditions. However, available pronghorn populations have been affected by loss of habitat, fire suppression, increases in coyotes and dogs, transportation systems, human habitation, grazing, and fencing that is not compatible with pronghorn movements (Lyon et al. 1995). Populations of this lowland species have become more disjunct (populations have become isolated from each other) and blocks of habitat are becoming islands.

Populations of the bobcat and other fur-bearing species appear to be increasing as demand for their fur decreases. Bobcats have an important interaction with black-tailed jackrabbits and cottontail rabbits in the shrub steppe areas, and may help to reduce crop damage during periods of high jackrabbit population cycles (Collopy and Smith 1995).

Black bears and mountain lions are hunted to a limited extent. Although specific population numbers are not available, indices seem to indicate populations of these species are stable or increasing.

Numerous small game species (grouse, squirrels, turkeys, rabbits) are hunted. Populations of some of these species are felt to be declining and are included as species of focus.

A number of plants are collected for food and other uses. For example, many people collect berries and mushrooms when they are in season. Also, a number of plant species are important to the members of American Indian tribes for food, medicinal, and spiritual purposes. These plants and their uses are presented in Appendix 8.

There is an increasing use of herbaceous plants for commercial purposes. These uses are often for health or medicinal reasons, and the increasing popularity of "natural" remedies is increasing demand for some species. This can have an adverse effect on localized populations of the collected species, although the degree of these effects can not be identified at the broad scale.