Wildlife

Introduction

The Organic Administration Act, the Multiple-Use/Sustained-Yield Act, the National Forest Management Act, the Sikes Act, and USDA and Forest Service policy and agreements recognize the shared responsibilities between the Forest Service and the Alaska Department of Fish and Game (ADF&G) in the management of fish and wildlife resources on the Chugach National Forest. These and other laws acknowledge State of Alaska jurisdiction in resident fish and wildlife management. The Forest Service indirectly affects population numbers, diversity and species viability through the management of habitat. The Alaska National Interest Lands Conservation Act (ANILCA) provides for the maintenance of sound populations of, and habitat for, wildlife species of value to the citizens of Alaska and the nation.

In recent decades, public interest and participation in nonconsumptive recreation such as wildlife viewing and photography, along with traditional consumptive activities such as hunting, have gained popularity on the National Forest System lands, including the Chugach National Forest. Increased interest in wildlife and its management has led to the establishment of wildlife advocacy organizations. Many of these organizations play an active role in wildlife management on the Forest in partnership with the State of Alaska and the Forest Service.

Legal and Administrative Framework

- The **National Forest Management Act of 1976 (NFMA)** states that forest plans must ‘‘provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area.’’
- **Ecosystem Management** - In 1992, the Chief of the Forest Service issued a statement committing the Forest Service to the practice of ecosystem management, which is an ecological approach to managing national forests and grasslands for multiple uses.
- The **Endangered Species Act of 1973** governs protection of specified species and the ecosystems upon which they depend.
- The **Forest Service Manual (2672)** requires the Regional Forester to identify sensitive species occurring within the region.
- The **Forest Service Manual (2672.4)** requires that a biological evaluation (BE) be prepared for all Forest Service activities to address impacts to Forest Service sensitive species.
- **36 CFR 219.27(g)** states that management prescriptions, where appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities.

- **36 CFR 219.19** requires the Forest Service to identify and prevent the destruction or adverse modification of habitat determined to be critical for threatened and endangered species. It states that fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species. Viable populations are defined as those with sufficient numbers and distribution of reproductive individuals to ensure their continued existence in the planning area.

Key Indicators

- Habitat for management indicator species, species of special interest, and threatened, endangered and sensitive species
- Distribution of wildlife habitat for management indicator species, species of special interest, and threatened, endangered, and sensitive species

Resource Protection Measures

See Revised Forest Plan, Chapter 3, Forestwide Direction for wildlife and specific species.

Analysis Process

For the Chugach Forest Plan revision, the habitat needs for sustaining viable populations of individual species are addressed in two ways. First, a coarse filter assessment was used to determine the level of protection offered through the land management prescription categories. Next, the species on the Forest were reviewed to determine if any species needed further analysis because they were at risk of not maintaining viable populations due to management. These management actions and conditions needed to ensure viable populations are addressed by guidelines for specific species or species groups. This is the fine filter approach to biological conservation.

Evaluating Viability

The National Forest Management Act (NFMA) requires that the Forest Service provide for the diversity of plants and animals, based upon the suitability and capability of each national forest, as a part of meeting overall multiple-use objectives (16 USC 1604(g)(3)(B)). The NFMA implementing regulations define diversity as "the distribution and abundance of different plant and animal communities and species within the area covered by a [forest plan]" (36 CFR 219.3). In addition to providing diversity direction (36 CFR 219.26), the NFMA regulations include the following provisions for managing habitat to maintain viable populations of wildlife species:

> Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one that has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well-

> distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well-distributed so that those individuals can interact with others in the planning area. (36 CFR 219.19)

Quantitative criteria for viability (or diversity) are not specified by either the Act or the regulations. The Forest Ecosystem Management Assessment Team defined viability as “the likelihood of a species persisting well-distributed throughout its range [for] a century or longer” (FEMAT 1993). For the Chugach, the evaluation of viability includes consideration of its unique wetland complexes, Prince William Sound archipelago environment as well as current scientific thinking on population viability and conservation biology, as found in the general literature and the Chugach and Tongass-specific assessments. Further discussion follows for two key terms: "well-distributed" and "continued existence."

Well-distributed. The phrase "well-distributed in the planning area" is used in the regulations. The planning area, for the Chugach Forest Plan and for the purposes of viability analysis, includes all National Forest land within the boundaries of the Chugach. The NFMA regulations provide that habitat must be “well-distributed” so that "individuals can interact with others in the planning area." Interaction is the key operative word, because different individual species often exhibit widely different movement and dispersal capabilities. The continued existence of a population within which interaction between individuals becomes difficult (significantly less frequent) or impossible may no longer be well-distributed. The fragmentation of habitats, which isolates and creates small insular populations, contributes to decreased population distribution and increased likelihood of local extirpation (Wilcove et al. 1986). Because of the nature of our landscape and the island archipelago, relatively isolated populations may already exist with naturally higher risks to local extirpation.

In the island archipelago and naturally fragmented landscapes of Southcentral Alaska, natural interaction is often problematic, especially for species that cannot move between islands. The insular distribution patterns of several small terrestrial mammal species among individual islands illustrate these dispersal limitations. MacDonald and Cook (1999) reported that eight mammal species are endemic to the Chugach. Southcentral Alaska most likely supports ecotypes and locally adapted species on individual islands; especially the less mobile species such as small mammals, amphibians, and many invertebrates, but such relationships have not been thoroughly investigated or described. Maintaining populations across the full range of environmental conditions over which they occur retains the genetic variability that is necessary for evolution and adaptation to environmental change (Lande and Barrowclough 1987). At a broad geographic scale, environmental variability on the Chugach is classified into ecological sections that exhibit differences in climate, geology, and species distributions (see Biodiversity section). For wide-ranging species (e.g., northern goshawk, brown bear), well-distributed populations are appropriately assessed among, and within, these ecological sections across the Forest. Since the

ecological sections represent significant transitions between major ecological regions, the geographic region was used to assess the wide-ranging species. For many other species, the appropriate scale will be finer, down to small individual islands within a geographic area (e.g., Montague Island vole).

Continued Existence. Time scale is a critical component for evaluating the potential effects of Revised Forest Plan alternatives on wildlife viability. The short-term, 10- to 15-year planning period is an inadequate scale for conducting a viability analysis, which must consider long-term, cumulative changes and consequences. There are many reasons for this. The processes of evolution, speciation, and natural extinctions occur over thousands to millions of years; even when accelerated by human activity, extinction or endangerment can require many decades if not centuries (Wilson 1988). If ecosystems remain within their expected range of variability under current climatic regimes and habitats remain abundant, available, and interconnected for all species currently extant in the Forest, then it is likely that species' populations would remain at high enough levels to ensure their continued persistence into the foreseeable future. Actions taken during a planning period, in combination with past and projected future actions, may be critical in affecting a forest's ability to maintain long-term habitat viability.

Therefore, the viability analysis used a 100-year time period, or planning horizon, which is probably the minimum period over which viability can be evaluated; the scientific literature suggests 100-1,000 years (Shaffer 1981, Soule and Wilcox 1980, Shaffer 1987). Furthermore, 100 years is the average rotation age under even-aged management, and thus the time period over which old-growth stand characteristics will be significantly affected. Forests managed under a 100-year rotation will continue to cycle through the stem exclusion phases of stand development, the least favorable phase for old-growth associated species and a permanent change in forest structure (see Biodiversity section for a fuller discussion). Such changes in forest stand structure and wildlife habitat capability require a commensurate period of time over which to assess the cumulative effects to viability. In the analysis, short-term changes must be accounted for to ensure that ephemeral stages of vegetation development, such as early seral stands, upon which some wildlife species depend are not lost at any stage during the long-term changes in forest structure. Thus, the analysis is not just a look at the forest condition at two points in time separated by a century, but a consideration of all the potential short-term effects that accumulate over the decades and result in the eventual expected forest structure. For wildlife habitats to remain viable over the entire planning period, habitats must not change beyond that expected under the normal range of variability under current climatic conditions during any period within the planning period. As discussed in the Biodiversity section earlier, the conservation of biodiversity requires both a “fine” and “coarse” filter approach. All species not individually addressed under Species Assessments are addressed through a “coarse” filter or ecosystem approach. For example, the marten need not receive the fine filter approach because its primary prey and other habitat requirements are fully protected by

the retention of the Chugach National Forest within the expected range of variability under current climatic conditions.

Coarse Filter Assessment

All vertebrate species were initially assessed by the coarse filter of the ecosystem concept. If the functional habitats and systems upon which a species depends are maintained across the Forest in a connected whole, then the species that depend on those systems will have their habitat needs met. The application of this concept ensures that viable habitats are available for most species on the Forest (see Biodiversity section and Appendix B). Initial analyses suggested that not all habitat needs for some species could be met by the coarse filter approach. These species and a few selected others were further assessed by the fine filter approach.

Species were selected for detailed habitat viability assessment based on 12 criteria:

1. Seasonal occurrence in Southcentral Alaska.
2. Geographic distribution within Southcentral Alaska.
3. Geographic distribution outside of Southcentral Alaska.
4. Estimated size of the population in Southcentral Alaska.
5. Population trend throughout the species' range.
6. Population trend of the species in Southcentral Alaska.
7. Vulnerability of habitats in Southcentral Alaska to modification as a result of land management activities currently implemented or proposed for implementation.
8. Vulnerability of the species to road construction and increased access.
9. Capability of the species to disperse.
10. Average number of young produced per breeding episode.
11. Minimum age of first reproduction (in females).
12. Knowledge about the species in Southcentral Alaska.

Species were ranked by level of concern from low to high, and those species that ranked high received a fine scale habitat viability assessment (Suring and Murphy 1998).

Fine Filter Assessment

Some species have narrow ecological amplitude, are dependent upon small-scale habitat features, or their viability may be at risk from non-habitat factors such as human disturbance. The viability of these species in not assured by an ecosystem level coarse filter, but must be assessed individually to determine risks to their viability. These species requiring this fine filter approach are listed as management indicator species and species of special interest, Forest Service sensitive species requiring a Biological Evaluation, or threatened or endangered

Species requiring a Biological Assessment and Section 7 consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as mandated by the Endangered Species Act. The Biological Assessment (BA), along with documentation of correspondence related to the BA, is found in Appendix G of the FEIS.

Management indicator species (MIS) are chosen for fine filter analyses because their habitat requirements, both specific and general, serve to indicate the outcome of management options implemented for many species with similar habitat requirements. For example, mountain goat habitat is similar enough to Dall sheep habitat that analyses for mountain goat are indicative of the effects of each Alternative upon Dall sheep habitat. Additionally, standards and guidelines developed for the conservation of seasonally important areas of goat habitat are equally applicable to Dall sheep and have been specifically linked to sheep habitat (USDA Forest Service 2000b).

Should monitoring or new information indicate MIS or their habitats change beyond that expected, those changes will indicate a need for management changes that may not have been anticipated: i.e., adaptive management.

Species of special interest (SSI) are chosen either because their habitat requirements are narrow enough that they may not be fully covered under a coarse filter approach, or because interest in them by the public or by land managers is best treated by highlighting them separately from other species. For example, Sitka black-tailed deer population viability could be assured in most areas of the Chugach National Forest by the coarse filter approach, but public interest in the species is best served by a more detailed evaluation of the effects of each alternative on the populations. To the contrary, bald eagles have specific nesting sites to which they return year after year, and such sites might not be adequately protected under a more general, coarse filter approach.

Forest Service sensitive species receive a fine filter analyses because experience on the Chugach National Forest or elsewhere within the Alaska Region of the National Forest System has shown that not all their habitat needs can be protected adequately under the coarse filter approach. Hence, their inclusion in the fine filter analyses is mandated by Alaska Region Forest Service directives.

Threatened and endangered species (TES) are included within the fine filter analyses for both legal and regulatory reasons, and because their very inclusion on the TES list is because their population viability is at risk.

As part of the fine filter analysis, protective measures designed to protect habitat for these species were developed and evaluated. Those protective measures that are likely to prove efficacious will be incorporated into Forestwide and Project-specific standards and guidelines (USDA Forest Service 2000b). The standards and guidelines providing such protective measures will prevent sensitive species and TES habitat from declining or being otherwise adversely affected.

Typically, habitat suitability index (HSI) models would be used to estimate existing and future habitat capability for each MIS. Habitat suitability models for the MIS have been developed for black oystercatchers, Kenai brown bear, moose, and mountain goats. No model has been developed for dusky Canada goose. Modeling of habitat suitability can produce misleading results without consideration for random environmental events such as spruce bark beetle epidemics and tectonic uplifts. Another limitation of HSI modeling is a requirement for a vegetation classification that is available for the entire area of interest. Differences in vegetation classification schemes make it difficult to compare model results. For this analysis, the moose HSI model was used to represent likely outcomes regarding habitat suitability between alternatives. The moose HSI model is not appropriate for population viability and is not used in that regard.

Habitat Viability Analysis

The viability analysis followed the general outline of panels used for the viability analysis on the Tongass National Forest. Each species was considered using the available information about habitat requirements, the direct, indirect and cumulative effects of management actions or activities on the habitat for each species.

Table 3-45 lists the management indicator species (MIS), threatened, endangered, and sensitive species (TES) and species of special interest (SSI) to be addressed in this analysis. The Forest Supervisor decided to use the following management indicator species: black oystercatcher, brown bear, dusky Canada goose, mountain goat and moose. These MIS were selected because their population changes are believed to indicate the effects of management activities.

Potential effects on the following species of special interest will also be discussed: gray wolf, lynx, Montague Island hoary marmot, Montague Island tundra vole, Sitka black-tailed deer, river otter, Townsend's warbler, wolverine, bald eagle, and osprey. Information on river otter habitats and populations has been included at the request of the Alaska Department of Fish and Game (ADF&G). Townsend's warblers are included, at the request of the USF&WS, as a focal species for old-growth habitats and land birds in general. Lynx and marbled murrelets are considered because there are reduced populations in much of their range in the lower 48 states. Sitka black-tailed deer are considered to be of special interest because of their extensive use for sport and subsistence hunting. Bald eagle is of interest because of its recent removal from the list of threatened and endangered species, and its status as the national symbol. Osprey is a species of special interest because it is naturally rare in Southcentral Alaska, which may be the northern periphery of the species' range.

Minimally Disturbed Areas

Of the more than 5.45 million acres of the Chugach National Forest, about 5.43 million acres (99 percent) are inventoried as roadless. Under any of the alternatives, the total percentage of the Forest that would be affected by any of the potential management activities would affect a minimum of the Forestwide wildlife habitat (from 0 to 4 percent of the roadless acres). Thus, the majority of the Chugach National Forest is effectively a conservation reserve where natural forces and non-industrial human use are the predominant disturbance factors.

Habitat viability analyses therefore were concentrated in those few areas that contained areas of specialized habitat or where the few management activities were planned. For example, moose habitats were evaluated primarily on the portion of the Kenai Peninsula managed by the Chugach National Forest because, unlike the Kenai where prescribed fire and other vegetation manipulation is planned, the rest of the Forest will be left subject to natural disturbance regimes to create or maintain existing moose habitat. Similarly, Sitka black-tailed deer habitats were more closely evaluated on Montague Island where Sitka black-tailed deer habitat would be most affected by potential actions. The areas where habitat viability evaluations were concentrated are identified under the Affected Environment for each species.

Table 3-45: Management indicator species (MIS), threatened and endangered species and sensitive species (TES/SS), and species of special interest (SSI) on the Chugach National Forest.

SPECIES	MIS	TES/SS	SSI
Brown Bear	X		
Black Oystercatcher	X		
Dusky Canada Goose	X	X	
Moose	X		
Mountain Goat	X		
Gray Wolf			X
Lynx			X
Marbled Murrelet			X
Montague Island Hoary Marmot			X
River Otter			X
Sitka Black-tailed Deer			X
Townsend's Warbler			X
Wolverine			X
Bald Eagle			X
Humpbacked Whale		X	
Montague Island Tundra Vole		X	
Northern Goshawk			X
Osprey			X
Peale's Peregrine Falcon		X	
Steller Sea Lion		X	
Trumpeter Swan		X	
Steller's Eider		X	

Affected Environment

Introduction

The Chugach National Forest in Southcentral Alaska provides a wide diversity of habitats that support over 232 vertebrate species, including approximately 51 mammals, 179 birds, and 2 amphibians. This represents 15 orders and 37 families of birds, and 6 orders and 13 families of mammals that occur on the Forest. The range of one subspecies (i.e., Kenai song sparrow) is restricted primarily to the Chugach National Forest. These species contribute to the overall health of the Forest as well as provide Forest users and visitors with a full range of opportunities that include consumptive and non-consumptive activities. In the last century, five species have been introduced (or possibly reintroduced) to the Forest, and one species has not been documented since the turn of the century (Burris and McKnight 1973, Lance 1999a).

In general, the Chugach has the same or more species present as were here during the late 1800s. The medium and large carnivores, including the brown bear, lynx, wolverine, and wolf are all here in healthy populations. Currently big game populations are at, or exceed, State of Alaska objectives over much of the Forest. Cooperative efforts have resulted in species, such as moose, being introduced. A small population of moose introduced on the Copper River Delta in 1956 has grown to about 1,300 animals (Crowley 1999). Sitka black-tailed deer, introduced to Hinchinbrook and Hawkins Islands, have increased and spread throughout Prince William Sound islands and the mainland (ADF&G 1985). The Copper River Delta is a unit of the western shorebird reserve network (USDA Forest Service 1989a).

Federal planning regulations require the use of management indicator species (MIS) for use in the Forest Plan revision process.

The management indicator species are used to: direct Forest Plan implementation, inventory, and monitoring activities; meet legal and policy requirements; set objectives for maintenance and improvement of habitat for the MIS in the alternatives; and quantify the amount and quality of habitats and population trends in each planning alternative.

In the selection of MIS, the following categories are represented where appropriate: endangered and threatened plant and animal species identified on state and federal lists for the planning area; species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished, or trapped; non-game species of special interest; and additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

Table 3-46 shows the number and percent of the species on the Forest using the General Habitat Types. While the greatest number of species use forested habitats, all habitat types on the Forest are important.

Table 3-46: Number and percent of species using the general habitat types.

General Habitat Types	Percent of Forest	Number of Species	Percent of Species
Forested	34.30	137	59.31
Scrub	32.80	119	51.52
Herb-Gram-Moss-Lichen	21.80	120	51.95
Sparsely Vegetated	17.04	46	19.91
Tidal Estuarine	1.62	86	37.23
Freshwater	18.39	121	52.38
Alpine	33.16	64	27.71
Riparian	27.03	96	41.56
Rocky Coast	2.59	33	14.29
Beach Assoc	13.23	75	32.47
Sheltered Inshore Waters	5.6	47	20.35

Table 3-47 shows the relative importance of the General Habitat Types to the Management Indicator Species, Threatened, Endangered, and Sensitive Species, and the Species of Special Interest.

Table 3-47: Relative importance of the general habitat types to management indicator species and species of interest.

	GENERAL HABITAT TYPES										
	Forested	Scrub	Herb-Gram-Moss-Lich	Sparsely Vegetated	Tidal Estuarine	Freshwater	Alpine	Riparian	Rocky Coast	Beach Assoc.	Sheltered Inshore Waters
Black Oystercatcher					Hi				Hi	Hi	Mod
Brown Bear	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Hi		Mod	
Dusky Canada Goose		Mod	Mod		Hi	Mod		Mod		Mod	
Moose	Hi	Hi	Mod			Mod		Hi			
Mountain Goat	Hi		Mod	Mod			Hi				
Gray Wolf	Mod	Mod	Mod			Mod	Mod	Hi			
Lynx	Hi					Mod	Mod				
Marbled Murrelet	Hi			Low						Mod	Hi
Montague Is. Hoary Marmot	Mod	Mod	Hi	Mod			Hi				
River Otter	Mod	Mod	Mod		Hi	Hi		Hi	Hi	Hi	
Sitka Black-tailed Deer	Hi	Mod	Mod				Hi	Mod		Mod	
Townsend's Warbler	Hi	Mod						Hi			
Wolverine	Mod	Low	Low	Mod	Low	Hi	Mod	Hi		Mod	
Bald Eagle	Hi		Mod		Hi	Mod		Hi	Mod	Mod	
Montague Is. Tundra Vole	Mod	Mod	Mod			Mod	Mod	Mod		Hi	
Northern Goshawk	Hi	Low				Low		Low			
Osprey	Mod				Hi	Mod		Hi			
Peale's Peregrine Falcon				Low	Hi	Hi	Mod			Mod	
Steller Sea Lion					Mod				Hi	Hi	Mod
Trumpeter Swan					Hi	Hi					

Low = habitat rarely or potentially used; Mod = habitat used for feeding, refuge, or as secondary breeding habitat; Hi = habitat REQUIRED for feeding, refuge, and/or breeding.
Wolverine (*Gulo gulo katschemakensis*).

Management Indicator Species

Table 3-48 shows the amount of habitat available for each of the management indicator species on the Forest lands by Geographic Area.

Table 3-48: Acres of habitat for management indicator species by geographic area.

	Copper River Delta	Kenai Peninsula	Prince William Sound
Black Oystercatcher			21,500
Brown Bear	681,120	538,660	610,360
Dusky Canada Goose	541,750		26,980
Moose	257,690	488,890	*
Mountain Goat	86,010	841,240	409,300

Source: Chugach National Forest GIS corporate database using Land Cover Classes and species matrix. Values include only National Forest lands.
Habitat for MIS was described using the Land Cover Classes/ Species matrix database.
*Habitat for moose in Prince William Sound was not evaluated, as it is not expected to vary by alternative.

Black Oystercatcher

The black oystercatcher is one of the most abundant species of shorebirds in the Prince William Sound-Gulf of Alaska region (DeGange and Sanger 1986). The black oystercatchers are dependent on marine shorelines for their life requirements and are most abundant along low-sloping gravel or rocky shorelines (Andres 1998). The entire world population is estimated at about 11,000 individuals. More than 50 percent of that population occurs in Alaska and about 1,500-2,000 individuals reside in south coastal Alaska (Andres and Falxa 1995). Population trends for oystercatchers throughout their range are unknown, however, within in Prince William Sound, the populations are recovering from the effects of the *Exxon Valdez* oil spill in 1989 (Murphy et al. 1999).

Breeding habitat of black oystercatchers ranges from mixed sand and gravel beaches to exposed rocky headlands (Andres and Falxa 1995). Oystercatchers avoid vegetated habitats and are most abundant on non-forest islands (Webster 1941, Andres and Falxa 1995).

Continual disturbance from human activities is the greatest threat to breeding black oystercatchers. Disturbance often prevents pairs from nesting or causes them to abandon their nest sites (Andres 1998).

Forest management actions may influence the amount of human induced disturbance to oystercatchers based on different types of upland activities. This type of management may be increasingly important as human activity in Prince William Sound increases as a result of the new road to Whittier. Protection of areas with exceptionally high nesting densities of Prince William Sound, will be important to maintain current population levels (Poe and Murphy 1999).

Brown Bear

Brown bears are present throughout the Chugach National Forest on the mainland and on the major islands (Montague, Hinchinbrook and Hawkins) in Prince William Sound. Brown bear use a wide variety of habitats from sea level to alpine. Bears on the Kenai Peninsula are of most concern. This small population may be isolated on the Kenai Peninsula, and is subject to significant human impacts (Suring et al. 1998). The Kenai Peninsula brown bear has been listed by the State of Alaska as a population of special concern. An Interagency Brown Bear Study Team developed a conservation assessment on the status of the population of brown bears on the Kenai Peninsula. Specific elements of this assessment have been incorporated in the Revised Forest Plan and FEIS. The overall trend for the Kenai Peninsula brown bear is considered to be stable, however, actual population numbers are not available (ADF&G 1999c). Management agencies estimate the population to be around 280, ranging from 120 to 420 (Miller 1993).

Whether genetic isolation of the Kenai Peninsula population of brown bears has occurred is unknown (Shields 1998, in Interagency Brown Bear Study Team 1999). It is speculated that brown bear access to the mainland from the Kenai Peninsula is restricted by the narrow land gap between the Turnagain Arm of Cook Inlet and Prince William Sound; however, no work has been done to determine whether the physical or genetic isolation of the Kenai population exists in fact (Suring et al. 1998).

Brown bears are opportunistic wide-ranging foragers, so brown bear habitat may be anywhere a bear wants to be, but they do have seasonal habitat preferences. On the Kenai Peninsula immediately after emergence from the den, brown bears depend on forbs, horsetails, and graminoids, which are found in moist sites, often at low elevations. Ungulates may also form a large portion of the initial spring diet either as carrion or from direct predation, so brown bears also use the winter ranges of moose, Dall sheep, and other species as spring foraging habitat. Summer and autumn habitat for brown bears on the Kenai Peninsula is provided by streams that support spawning salmon. As autumn progresses, berries become a larger part of the brown bear diet and brown bears may move between berry patches, often at higher elevation, and the lower elevation salmon spawning streams (Suring et al. 1998).

Human activities, such as logging, mineral and energy development, water impoundments, recreational development, development of private lands, and hunting, have led to an increased likelihood of human-bear conflicts (Suring et al. 1998).

Brown bears have not been identified as a species requiring minimum patch sizes of a particular habitat type. They are not known to have specific vegetation corridor requirements, as they travel and disperse through a variety of terrain and vegetative conditions.

Southeast Alaskan brown bears are highly selective for the narrow, forested riparian zone during mid to late summer. They concentrate on specific segments

of streams where they catch spawning salmon. The forested riparian habitat associated with these salmon spawning streams provides security and resting habitats for brown bears. Maintaining riparian habitat and no-cut buffers are important for the long-term conservation of high-density brown bear populations (Titus and Beier 1999).

Increases in human activity in an area may result in increased direct human-induced deaths of bears.

Dusky Canada Goose

The dusky Canada goose is a medium-sized, dark-plumaged subspecies that nests in the Copper River Delta region of Southcentral Alaska, migrates along the Pacific Coast, and winters in southwestern Washington and Western Oregon. Originally thought to include geese breeding and coastal regions of Southeast Alaska and northern British Columbia, it is now recognized to be unique to a small part of the Gulf of Alaska (Bromley and Rothe 1999).

Monitoring of the population trend for this species for the past two decades indicates the population has declined both on wintering grounds and breeding grounds (Bromley and Rothe 1999). While the population has declined, the current population levels are similar to those in the 1950s, prior to the earthquake. Population trends, moreover, have remained stable for the last decade, suggesting that duskys are adapting to the habitat changes that resulted from the 1964 earthquake.

The Copper River Delta, the summer habitat of the geese, is a highly dynamic region continually influenced by tectonic, glacial, riverine, and tidal forces. Dusky geese were highly productive in the 1950s through the 1970s, and the population was thought limited by hunting mortality, primarily on the wintering grounds. There was minor loss of eggs to inundation by high spring tides, and similarly low rates of loss of adults, eggs, and young to predators. Indeed, numbers of geese responded quickly and positively to restrictive hunting regulations, and to the establishment of refuges on their wintering grounds during the mid-1960s. However, in 1964 an earthquake caused an uplift of the nesting grounds on the Copper River Delta, causing accelerated natural succession of marsh habitat. Earthquakes and uplift in the Copper River Delta have occurred at least four times in the past with return intervals of 600-900 years. Dusky Canada geese have apparently survived and persisted in spite of these stochastic events. Dusky Canada goose populations are expected to fluctuate within a range of natural variability. Although breeding success remained high during the first 12-15 years post-earthquake, substantial changes in nesting and brood-rearing habitat began to occur (Bromley and Rothe 1999).

Weathering of the newly uplifted marsh has increased succession with marsh plants being replaced by willows, alder, and sweet gale, and even more recently spruce and cottonwoods have become well established (Bromley and Rothe 1999).

Associated with changes in plant ecology on the Copper River Delta were associated faunal changes. In particular, brown bears and coyotes were found

more frequently on the nesting and brood-rearing areas and in greater numbers than previously and were much more active predators on the geese and their eggs. As succession progressed, predators varied in species, number, and effect on duskys (Bromley and Rothe 1999). Current research on predators of eggs, adults and goslings indicates that bald eagles may be deemed the most important predator on the Delta.

The population of duskys is now limited by factors associated with the earthquake and accelerated succession on the breeding grounds, primarily depredation of eggs, young, and adults. Significant management efforts on the breeding grounds have included the experimental testing, and now operational establishment and maintenance, of artificial nesting islands on the Copper River Delta. Duskys have consistently had much higher nest success on the structures than on the natural sites (Bromley and Rothe 1999).

In the short-term, accelerated succession is expected to continue on the Copper River Delta, and productivity of geese will likely remain low due to heavy predator activity. New marsh habitat will slowly develop on newly exposed tidal areas, but it won't be significant in influencing the status of the population. The artificial nesting program will likely continue, and while it is considered to be an important aide to gosling production, the degree to which goslings and nesting adult mortality negates or enhances production is unknown. As a result, continued monitoring is required (Bromley and Rothe 1999).

Moose

Moose are native to the Kenai Peninsula; they are also native to the Nellie Juan River valley area of Prince William Sound, and near Kings River, and in small populations on Hawkins and Hinchinbrook islands (Nowlin 1996). Moose were introduced in the Copper River Delta between 1949 and 1958, where they have become well established.

The current moose population for Copper River Delta is estimated to be approximately 1,300 animals (Crowley 1999). The population on the entire Kenai Peninsula is approximately 7,000 – 9,000 moose, of which about 1,000 of these are on the Chugach National Forest portion of the Kenai (Spraker personal communication). Moose populations on the overall Chugach National Forest currently appear to be stable (USDA Forest Service 1999c).

Moose habitat in Southcentral Alaska is associated primarily with riparian and post-glacial early-successional vegetation types. In most areas, much of the moose habitat is declining as a result of natural plant succession. Succession in some areas is transforming deciduous vegetation types (cottonwood, willow, etc.) into conifer stands. In other areas, climax deciduous vegetation is growing to sizes less valuable as moose browse (Lottsfeldt-Frost 2000).

On the Kenai Peninsula the factor limiting the growth of moose populations is the availability of early- to mid-successional habitat, and the main mortality factors are predation, hunting, and mortality from collisions with vehicles along the highway and railroad (Lottsfeldt-Frost 2000). Clearcut logging in some Kenai Peninsula conifer stands has returned vegetation to earlier successional stages

that may enhance or provide forage for moose, but the advantages of the temporarily increased forage may be offset by the longer period of reduced forage in the regenerating second-growth conifer forest. Most early- to mid-successional foraging habitat is largely a result of wildfires (Lottsfeldt-Frost 2000). Extensive spruce bark beetle outbreaks on the Kenai Peninsula (see Table 3-30a) are likely to increase the number and size of wildfires and concomitant production of moose foraging habitat. Such fires cannot be predicted nor can their extent be anticipated, so the production of acceptable foraging habitat to replace that lost through forest succession is a matter of happenstance. Hunting related mortality is controlled by the manipulation of hunting seasons, but other forms of mortality are no more predictable than are wildfire events. Accordingly, in the absence of directed habitat management, moose numbers may fluctuate unpredictably.

On the Copper River Delta, habitat conditions are expected to decline as successional changes cause mixed willow habitat types to mature, stagnate, and convert to alder, cottonwood, and conifer types. Mechanical treatments to alder/willow community types have been used to enhance moose habitat on the Copper River Delta (Lottsfeldt-Frost 2000). MacCracken and others (1997) found that the population on the west Delta was well below carrying capacity and could be increased. The greatest limiting factor for moose in this area is from hunting (Lottsfeldt-Frost 2000).

Mountain Goat

Mountain goats represent species using cliffs, alpine and subalpine, and old-growth forest habitats. Hunted populations may be sensitive to overharvest and human disturbance. The quantity and quality of winter habitat is the most limiting factor for mountain goats in Southcentral Alaska. Old-growth trees with large dense crowns have the highest value because they intercept the most snow and provide understory forage plants near the marine influence (Suring et al. 1992). Lack of snow interception in early successional stages, and lack of forage in middle successional stages, reduces their value as habitat. Further inland, mountain goat winter habitat is found on windswept rocky alpine ridges and south facing cliffs where vegetation free of snow is available.

They are also sensitive to low-level aircraft flights over summer alpine kidding habitats and wintering areas.

Current Forest Plan (1984) monitoring and aerial surveys indicate a stable to slightly increasing population surrounding the Copper River Delta and Prince William Sound and a slightly increasing population on the Kenai Peninsula (Crowley 1999). There are about 900 found on the Copper River Delta, 2,400 in Prince William Sound, and 4,500-5,800 on the Kenai Peninsula.

Species of Special Interest

Gray Wolf

The gray wolf inhabits the Kenai Peninsula, the mainland in Prince William Sound, and the Copper River Delta. Wolves require an adequate prey base of ungulates, beaver, and salmon. In most areas of Southcentral Alaska the gray wolf depends heavily on large ungulates such as moose, deer, caribou, mountain goats, and Dall sheep. Suitable habitats for wolves equate to areas capable of supporting this prey base. Wolves use a wide variety of habitats when prey are present, and can affect prey populations in those areas.

Due to social interactions, wolf densities do not exceed certain levels even when prey abundance is high. Densities of 0.1 adult wolves per square mile are considered high, and this density is often considered a saturation point beyond which wolf populations would not expand. Wolves have large home ranges (about 100 square miles per pack), use a wide variety of habitats, and are very mobile. They do not have specific vegetation corridor requirements, as they travel and disperse through a variety of terrain, vegetative conditions, and among islands separated by relatively narrow bodies of water (i.e., at least hundreds of yards) (Gasaway et al. 1983).

Wolves are legally hunted and trapped in Southcentral Alaska. Increased roaded access and increased human activity likely increase wolf deaths, both from legal and illegal hunting and trapping. Road management and increased regulation of legal harvests are seen as steps needed to reverse short-term population declines (Carnes et al. 1996).

Suring and Murphy (1998) examined the probable viability of 269 wildlife species and endemic subspecies in Southcentral Alaska. Their work suggested that wolf populations in the Chugach National Forest were secure, but the relatively isolated subpopulation of the gray wolf in the Copper River Delta was potentially at risk from management actions. Accordingly, only this small population was further evaluated. To maintain the small population in the Copper River Delta, reduction in wolf harvest may be necessary along road corridors (Carnes et al. 1996).

Lynx

Lynx are irregularly distributed throughout the Kenai Peninsula, the mainland of Prince William Sound, and on the Copper River Delta. Current lynx populations are believed to be below historical high levels. Lynx populations tend to follow cycles in the populations of snowshoe hare but typically lag behind those levels (Magoun and Johnson 1991).

Lynx use a variety of habitats, including spruce and hardwood forests, in early successional communities. The best lynx habitat in Alaska occurs where fires or other factors create and maintain a mixture of vegetation types with an abundance of early successional growth (Berrie and Stephenson 1994). This provides the best habitat for snowshoe hare and other small prey of lynx. The distribution and abundance of lynx appears to be tied to that of the snowshoe hare. Hares seek dense conifer thickets to feed on woody seedlings and

saplings and to escape predators and extreme cold; lynx frequent these habitats in search of prey (Koehler and Aubrey 1994). The lynx population on the Kenai Peninsula occurs within successional forest and alder dominated subalpine slopes.

Wildfire, an important factor in the dynamics of the northern boreal forest ecosystem (Viereck et al. 1992), is a major habitat modifier. Paragi and others (1997) suggest that optimal habitat for hare and lynx can be achieved in interior Alaska by frequent and numerous but relatively small fires, or large patchy fires with abundant unburned inclusions. However, the effects of spatial heterogeneity and juxtaposition of habitats on behavior and population dynamics of lynx are unstudied (Mowat et al. 1999).

Roads constructed for forest management, mining, or recreational purposes may increase the vulnerability of lynx to hunters and trappers (Koehler and Aubrey 1994). Lynx are legally trapped in all game management units.

Marbled Murrelet

The marbled murrelet is seabird that feeds below the water's surface on small fish and invertebrates, and is usually found within five miles of shore. Marbled murrelets nest on land, and lay only one egg. Unlike most other species in the family Alcidae, they do not nest in colonies, although at some sites they may nest in small aggregations. Except for the fall period when they are molting, flightless, and stay on the ocean, murrelets are known to fly to tree stands throughout the year.

Throughout much of its range in the Pacific Northwest, British Columbia, and Alaska, the marbled murrelet nests in large, mature coniferous trees within stands of structurally complex, coastal old-growth forest. Marbled murrelet-nesting habitat relationships are poorly understood in Southeast Alaska. Data from forested areas elsewhere within their range indicate that high volume stands of old-growth conifer forests in relatively close proximity to the coast are essential nesting habitat.

Recent surveys suggest that marbled murrelets are numerous and widespread throughout the coastal waters of Alaska, with estimates of 100,000 occurring in Prince William Sound (Kuletz 1997). Population trends within the Chugach National Forest are generally downward for the long-term, with a 67 percent decline since surveys were done in 1972 and 1973, but have been stable since 1990 (Kuletz 1997). Possible causes of estimated overall Alaska declines are oil spills, mortality from gill netting, cyclic changes in marine food productivity, and the harvesting of productive old-growth forests (which are likely their primary nesting habitat). The murrelet population was injured by the *Exxon Valdez* oil spill, when 12,800 to 14,800 were killed. The population in the oil spill area is considered to be recovering (*Exxon Valdez* Oil Spill Trustee Council 2000).

The listing of this species as threatened in Washington, Oregon, and California, and the reductions in habitat from timber harvesting, have raised concerns for the viability of this species in Southeast Alaska. An interagency conservation assessment (DeGange 1996) was conducted to synthesize literature and data

from Southeast Alaska to describe the natural history, habitat relationships and conservation status of the marbled murrelet. The assessment noted the uncertainties over how best to maintain habitat for viable, well-distributed populations of marbled murrelets in Southeast Alaska. Conceptually, uneven-aged silvicultural practices or extended harvest rotations may maintain sufficient forest structure to support nesting murrelets. However, given the uncertainties, the assessment concluded that a murrelet conservation strategy should consider a reserve-based approach, especially in those biogeographic provinces where substantial timber harvest has been concentrated and is projected to continue.

Montague Island Hoary Marmot

Montague Island hoary marmots were first described during the early 1900s, and have not been documented since. The endemic Montague Island hoary marmots were first reported by Heller (1910) in alpine habitat, near timberline, at Hanning and Zykoff Bays. There were no other recorded sightings of the marmot until 1978-79 when a marmot was seen along the northeastern coast on talus slopes.

Presently, the Montague Island hoary marmot is not provided any protective status. It is currently classified S2S3 by the Natural Heritage Program because they are endemic, found only on one island. Additionally, the population size and trends are unknown and there is a potential threat of habitat loss due to commercial timber harvest (Lance 1999a). Based on their limited, known distribution and questionable taxonomic status, Montague Island hoary marmots are a population of concern.

Marmots generally occupy open habitats such as alpine meadows and forest edge. Hoary marmots occur at high elevations, near timberline, on talus slopes, and alpine meadows (Lee and Funderburg 1982). Marmots feed mainly on green vegetation, especially grasses and forbs, but may also feed on fruit, grain, legumes, and occasionally insects (Nowack 1991).

Naturally occurring predators on Montague Island include raptors, brown bears, and river otters. In addition, mink were introduced to Montague Island in the early 1950s and are present today at unknown densities (Burris and McKnight 1973). Grizzly bears are known to feed on marmots, putting out great efforts digging them out of their dens (Bansfield 1974). Predation on marmots may occur in spring prior to the time of the first salmon runs. This protein source may be vital to bear survival when they arise from their dens (Lance 1999a).

Because there is no current information regarding population levels, or even persistence of this endemic population, there is some level of concern. Past road building for timber activities may have adversely affected talus slope habitats. Alpine habitats have not been affected (Lance 1999a).

River Otter

River otters are associated with coastal and fresh water aquatic environments and the immediately adjacent (within 100-500 feet) upland habitats. Their distribution is Forestwide in suitable habitats. Beach characteristics affect the availability of food and cover, and adjacent upland vegetation is also important in providing cover for otters. Old-growth forests have the highest habitat value,

providing canopy cover, large-diameter trees and snags, and burrow and den sites. Younger successional stages provide lower quality habitat.

River otters are common residents of coastal Alaska and occur throughout the Copper River Delta, Prince William Sound, and along the Kenai Peninsula. The river otters in Prince William Sound were considered a damaged resource by the 1989 *Exxon Valdez* oil spill but have been listed as recovered in 1999 (*Exxon Valdez* Oil Spill Trustee Council 2000). There is a concern that management for developed recreation within Prince William Sound may affect river otter populations.

Sitka Black-tailed Deer

Sitka black-tailed deer are indigenous to the coastal regions of Southeast Alaska and northwest British Columbia. Introduced to Hinchinbrook and Hawkins Islands in Southcentral Alaska from Sitka in 1916 with later supplemental stockings prior to 1925, Sitka black–tailed deer spread throughout Prince William Sound and peaked in population numbers by 1945 (Greise and Becker 1988). Sitka black-tailed deer have been hunted in the Prince William Sound area since 1935 and are the big game species receiving the highest sport and subsistence hunting use, not just in the Chugach National Forest, but also in the entire State of Alaska. On a statewide basis, Sitka black-tailed deer were harvested in greater numbers during the 1995-2000 regulatory years than were black bear, brown bear, elk, moose, mountain goat, Dall sheep, and musk-ox combined. The five-year trend for Sitka black-tailed deer harvest in the Prince William Sound area has been upward, with the highest harvest tending to come from Montague Island (ADF&G 2001b, 1999c). There are no estimates of Sitka black-tailed deer numbers, but population trends are tracked. Sitka black-tailed deer numbers in the Prince William Sound area are considered to be moderate to high, and show a general trend of increase, with occasional reductions caused by losses in severe winters (ADF&G 1999d).

Sitka black-tailed deer populations in Alaska are characterized by large fluctuations in population size. In winters of high snow, access to nutritional vegetation is limited and deer decline in body condition with large proportions of the deer population dying of starvation. The deer recover in number during successive winters of less severity (Reynolds 1979). Deer harvest in the Prince William Sound area is also closely tied to the severity of winter as reflected by snow depths. In years when the snow is deep, deer are pushed to lower elevations and more deer are harvest (ADF&G 1995, 1997, 1999d).

Deer forage at higher elevations, including the alpine, when snow depths are low enough to allow the availability of forage plants. Such plants include evergreen ground forbs such as goldthread, and with deeper snow, browse such as blueberry. Snow depths of greater than about two feet push the deer lower in elevation; in some winters down to the beach strand where snow accumulation is reduced or absent. Key deer winter range consists of mature conifer with enough gaps in the canopy to allow the understory shrub growth necessary for forage production - - - in other words, uneven aged climax conifer stands (many studies summarized in Shishido 1986).

Old-growth forests have the highest value during winter because they intercept snow and provide understory forage plants. Lack of snow interception in early successional stages during winters with deep snows and lack of forage in middle successional stages reduces their value as habitat.

Sitka black-tailed deer disperse through and use a variety of vegetation communities throughout the year, and no specific corridor requirements have been identified. Effects of patch size or induced forest fragmentation on deer habitat capability remain uncertain. Predation can act as a significant controlling factor on deer populations.

Townsend's Warbler

Townsend's warblers are fairly common breeding birds on the Chugach National Forest. In the fall, Townsend's warblers may depart interior Alaska by late August but they stay in Southeast Alaska until late September (Isleib and Kessel 1973). Townsend's warblers from this area are thought to winter from Northwestern Washington to Southern California (Pogson et al. 1999).

Townsend's warblers can be found primarily in coniferous forests or mixed forests where coniferous trees comprise a predominant feature of the habitats (Bent 1953, Erskine 1977).

The highest densities of Townsend's warblers (birds and routes) in the Alaska Breeding Survey are recorded on the eastern Kenai Peninsula (Andres personal communication). They also occurred in mixed coniferous-deciduous forests. On the Kenai Peninsula, Townsend's warblers were the most abundant breeding bird in 50- and 100-year old stands (Quinlan 1979).

Studies in Southeast Alaska suggest a preference for older conifer forest, but the relative importance of muskeg and commercial forest in Southeast remains unclear, making the assessment of the impact of logging on populations of Thompson's warblers in Southeast more complicated (Pogson et al. 1999). On the Kenai Peninsula, Quinlan (1979) reported that densities of Townsend's warblers in 30-year-old white spruce forest plots were less than half that found in 50- to 100-year-old white spruce forests.

At present little information on population trends in Canada or Alaska is available (Wright et al. 1998).

Additional information on this species' habitat requirements is needed, but the available information indicate that this species is likely sensitive to changes in the extent of mature forests that may occur due to insect infestations, fire or timber management (Collins et al. 1998, Pogson et al. 1999, Matsuoka et al. 1997).

Kenai Wolverine

Wolverines occur in small numbers throughout mainland Alaska primarily found in the remote areas of the State of Alaska. This little-known carnivore has been characterized as one of North America's most rare mammals (Banci 1994). The Kenai wolverine *(Gulo luscus katschemakensiis)* was described by Matschie in 1918 from the Kachemak Bay area of Southcentral Alaska and is known only from the Kenai Peninsula (Hall 1981).

The wolverine is an animal of montane forest, tundra, and taiga. Several factors appear to influence wolverine habitat selection at the landscape and stand levels. The distribution and density of large mammal carrion is a primary factor along with the level of human disturbance. Other habitat parameters such as escape cover from predators, availability of den sites, prey concentrations, and cover can affect daily movement and habitat use patterns (Howell 1999).

Wolverine in Idaho showed a significant preference for high elevation, rocky habitats in summer and montane conifer communities in winter. Females showed a specific preference for den sites and talus slopes, which were neither widely available nor evenly distributed across the landscape (Copeland 1996). Wolverines do not appear to avoid habitats inhabited by other predators, or areas with large openings. Thirty-four percent of wolverine relocations in Idaho were in openings that included burns and old clearcuts (Copeland 1996).

Human settlement and disturbance may have been a primary factor in the extirpation the wolverine from much other historic range (Wilson 1987). Human predation can also affect the wolverine population. Their low natural density and reproductive rate results in a reduced ability to compensate if trapping causes additive mortality (Van Zyll de Jong 1975). As a general rule, management actions that increase human access into remote areas, decrease the amount or distribution of carrion available, or disrupt sensitive areas such as denning habitat or dispersal corridors will decrease the effectiveness of wolverine habitat (Banci 1994). Conversely, management actions that improve habitat conditions for prey and carrion species have a positive affect on wolverine habitat. Wolverine in Idaho did not appear to avoid openings caused by timber harvest and fire (Copeland 1996).

A winter track survey done in 1995 in the Resurrection Pass was used to estimate wolverine density on the Kenai Peninsula (Golden 1996). Wolverine density on the Kenai Peninsula was estimated at that time to be 5.2 wolverine/1000km^2. Wolverines are commonly trapped on the Kenai Peninsula, and the harvest rate has declined only slightly since 1980. Trapping harvest on the Kenai Peninsula is probably a significant source of mortality for the population.

Three land management issues affect the long-term health and persistence of wolverine populations: a consistent and diverse source of large animal carrion, the presence of refugia from human disturbance, and an evaluation of management actions at the landscape level.

Bald Eagle

North America's bald eagle population reaches its highest density in southeast Alaska. Their nesting habitat is primarily old-growth trees along the coast and within riparian areas. Summer populations in Prince William Sound have been estimated at 5,000 individuals, including 1,800 to 2,000 pairs (ADF&G 1975, Bowman et al. 1993). The USF&WS and Forest Service maintain an interagency agreement for bald eagle habitat management in the Alaska Region, which includes standards and guidelines for regulating human disturbance within identified bald eagle use areas. A minimum 330-foot radius protective habitat management zone surrounds all identified eagle nest trees.

Northern Goshawk

The northern goshawk inhabits forested lands throughout North America, favoring dense stands of conifer or deciduous old growth for nesting habitat.

There is not much known of the distribution and abundance of goshawks on the Chugach National Forest. Within Southeast Alaska, the goshawk appears to be non-migratory, although it may occupy different, or overlapping, winter and breeding territories. Goshawks are medium-sized hawks and prey primarily on other birds (within Southeast Alaska, Steller's jay and varied thrush are common prey species).

A viability concern exists for the northern goshawk in Southeast Alaska due to its association with mature and old-growth forests and the decline in these habitats from timber harvesting. This concern was highlighted when the USF&WS received and accepted a petition to list the Queen Charlotte goshawk as endangered under the Endangered Species Act. Although the USF&WS determined that listing is not warranted at this time, they did express concern over goshawk population viability.

A conservation assessment (Iverson et al. 1997) was conducted to synthesize literature and original data from Southeast Alaska to describe the habitat relationships and conservation status of the northern goshawk.

Productive old-growth forest is an important component of goshawk habitat use patterns. Radio-marked goshawks consistently select this forest habitat type relative to availability, with 68 percent of all relocations occurring in productive old-growth forest. Most other habitat types (such as alpine, subalpine, peatland (muskeg), and clearcuts) were used infrequently or avoided by goshawks.

Timber harvesting on the Chugach (and on private lands in Southcentral Alaska) results in the conversion of old-growth forest (a selected habitat type) to young-growth forest (an avoided habitat type) and thus suggests decline in goshawk habitat capability. Iverson and others (1997) evaluated a variety of silvicultural techniques and concluded that stand structures selected by goshawks could be maintained using uneven-aged practices. Additionally, they concluded that goshawk habitat theoretically could be maintained across the landscape under a 300-year rotation.

Threatened, Endangered and Sensitive Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act of 1973, as amended. An endangered species is defined as one that is "in danger of extinction throughout all or a significant portion of its range." A threatened species is defined as one "that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range . . ." [FSM 2670.5 (81) and FSM 2670.5 (211), respectively]. A proposed species is defined as one for which "information now in possession of the USF&WS indicates that proposing to list the species as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threats are not currently available to support proposed rules" (FSM 2670.5). The Federally listed species within the boundaries of the Chugach National Forest are (National Marine Fisheries Service 1990):

Endangered Species

- Humpback whales (*Megaptera novaeangliae*)
- Steller (Northern) sea lion (*Eumetopias jubata*)

Threatened Species

- Steller's eider (*Polystica stelleri*)

Pursuant to Section 7 of the Endangered Species Act, a Biological Assessment was prepared to assess the effects of the Forest Plan revision on endangered or threatened species and ensure that proposed actions would not jeopardize the continued existence of listed species (Appendix G).

Based upon the analysis presented in Appendix G, activities allowed in the Revised Forest Plan would not adversely affect the humpback whale, Steller sea lion, Steller's eider or their habitats. In addition, formal and informal consultation procedures (as directed by the Endangered Species Act, as amended in 50 CFR 17.7, and Forest Service Manual 2670) are used with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service on all site-specific projects that implement the Revised Forest Plan. Forestwide standards and guidelines for threatened and endangered species also direct that all projects will comply with requirements of the Endangered Species Act and Forest Service Policy (FSM 2670).

Sensitive Species

Sensitive species are those plant and animal species identified by the Regional Forester for which population viability is a concern on national forest lands within the region. Either a significant current or predicted downward trend in population numbers or density, or a significant current or predicted downward trend in habitat capability that would reduce a species' existing distribution constitutes a viability concern. It is Forest Service policy to identify and manage sensitive species and their habitats to prevent the species from becoming threatened or endangered because of Forest Service management actions. The goal of the

Forest Service Sensitive Species Program (FSM 2670) is to ensure that species numbers and population distribution are adequate so that no federal listing will be required and no extirpation will occur on national forest lands.

The Forest Service has also entered into an interagency Memorandum of Understanding with the USF&WS and other federal agencies at the national level, and with the USF&WS and Alaska Department of Fish and Game at the regional level, to cooperate in the conservation of species tending toward federal listing so that listing is unnecessary. (See Revised Forest Plan, Appendix D)

The Alaska Region Sensitive Species List was first established in 1990, and a technical revision was completed in 1994 when 22 plants and Queen Charlotte goshawk were added. The list was revised in 1999 when four plants were removed from the list. There are 18 plants and 9 vertebrates currently designated as sensitive species within the Alaska Region. Ten plants and eight vertebrates are known or suspected to occur on the Chugach National Forest. Four vertebrate species are discussed below, two are discussed as species of special interest, and two are discussed under Management Indicator Species.

Montague Island Tundra Vole

Montague Island tundra vole were first collected from Montague Island, Prince William Sound, Alaska, and described as a new subspecies, *Microtus oeconomus elymocetes*, by Osgood in 1906 (Lance 1999b).

This subspecies is known only from Montague Island. This species is rated by the Nature Conservancy, Alaska Natural Heritage Program, as G5T2/S2, a population of highly ecological concern both at the state and national levels.

This vole occurs throughout Montague Island, and has been recorded from shoreline to alpine (Heller 1910, Lance 1999b, Lance and Cook 1995). High populations of *Microtus* are typically associated with early stages of plant succession (Rose and Birney 1985), when grasses and woody perennials dominate the plant community (Wetzel 1958). Montague Island tundra voles have most frequently been found in Beach Fringe zones, and are often found in association with riparian vegetation such as skunk cabbage (Weintraub and Cook 1992). Historically they have been reported in every vegetation type from shoreline to alpine, including forest (Heller 1910).

Currently, there are no data available on population estimates for the Montague Island tundra vole. Other populations of *Microtus* fluctuate cyclically with a roughly 3-year periodicity, and highs for one period are not necessarily similar to highs in another period. There is no reason to believe that Montague Island tundra voles do not experience large fluctuations in population numbers, and may exhibit population cycles as do other microtines. The U.S. Fish and Wildlife Service recommends further investigation of population trends prior to adopting further land use practices on Montague Island (Lance and Cook 1995).

Osprey

The best available information indicates that the osprey is naturally rare in Southcentral Alaska and this may represent the periphery of the species' range. Ospreys nest from late April through August and over winter in Mexico and Central America.

Little is known about the status of osprey populations in Alaska (Van Daele 1994). Limiting factors are unknown, but available nest sites and foraging areas do not appear to be limiting. Interaction and competition with the abundant bald eagle population may be a limiting factor.

Osprey nests are generally located in the hemlock/spruce forest type and usually near lakes, streams, beaver ponds, coastal beaches or large estuaries. Ospreys generally use broken-off snags or large green trees for nesting structures. Much of this habitat is intact on the Chugach National Forest and has not been modified through management activities. Apparently factors other than nest site habitat are affecting the distribution and abundance of osprey in Southcentral Alaska.

Osprey feed mainly on fish, but may occasionally take small mammals, birds, amphibians or small rodents (Van Daele 1994). More information about how other factors such as commercial fishing, seasonal abundance of prey species in the ocean environment, climate, and interactions between bald eagles, ravens, goshawks, and other raptors in Southcentral Alaska may affect osprey could lead to a better understanding of their limited abundance and distribution in Southcentral Alaska.

Peale's Peregrine Falcon

The Peale's peregrine falcon is a crow-sized falcon that breeds on the offshore islands along the coasts of Alaska and British Columbia.

The Peale's falcon breeds along the inner and outer coast of Prince William Sound, and along the Kenai Peninsula, mostly associated with colonies of sea birds. These birds feed on seabirds and gulls.

Common nesting habitats are ledges on tall cliffs. Nest site components for this bird include ledges, potholes, or small caves that are inaccessible to small mammalian predators and that provide protection from rain and excessive heat or cold. A source of water (river, coast, lake or marsh) is almost always close to the nest site, probably in conjunction with an adequate prey base. Other nest sites have been found on benches of rocky bluffs and abandoned nests of pelagic cormorants, bald eagles, and ravens. Peale's peregrine falcon populations are considered to be stable in Alaska (Schempf 1997).

Trumpeter Swan

Trumpeter swans are common residents of south coastal Alaska. They breed on the Kenai Peninsula and on the Copper River Delta on the Chugach National Forest. Trumpeter swans winter in ice-free areas throughout Southcentral and Southeast Alaska. Within the Forest, winter concentrations have been documented at Eyak Lake and Martin Lake near Cordova (ADF&G 1985) and other open water areas near Cordova (Islieb and Kessel 1973).

Nesting on the Chugach portion of the Kenai Peninsula portion is limited to the Portage-Twentymile drainage system, with only a few nest sites known. There is a large (hundreds) nesting population of trumpeter swans on the Copper River Delta.

The population of white swans on the Copper River Delta increased steadily between 1978 and 1985, in response to several years of good to excellent reproductive success during the early 1980s. The population leveled off in fall 1985 at 898 white swans and began a reverse trend, declining to a low of 526 swans in fall 1991. Since then, the number of swans has increased somewhat and seems to have stabilized. Reproductive success has fluctuated over the years, likely due in large part to weather conditions during the breeding season. Production in 1998 was above average (Logan 1998).

Surveys by the U.S. Fish and Wildlife Service (Logan 1998) estimated the Copper River Delta population to be about 800-900, and the five-year population trend is considered to be stable. Numerous swans from other parts of Alaska migrate through Southcentral Alaska.

Nesting areas for the trumpeter swans are limited. Only a small percentage of lakes contain a suitable blend of food and protective cover. A pair may use successful nest sites for 20 years or more. Loss of the nest or brood may result in desertion of the nesting territory (ADF&G 1985). Trumpeter swans are very sensitive to disturbances during the breeding season from such things as airplanes, boats, proximity to a road, or other human recreational activities.

Environmental Consequences

Introduction

The discussion of environmental consequences for wildlife is divided into five parts: (1) management indicator species; (2) species of special interest; and (3) threatened, endangered, and sensitive wildlife species viability; (4) general effects; and, (5) cumulative effects. Habitat capability estimates by alternative are projected for moose using a new model as discussed below. As a part of the demand for subsistence resources, deer and moose supply and demand is discussed in the community-by-community effects sections.

The purpose of this analysis is to evaluate how activities associated with Revised Forest Plan alternatives may affect the viability and distribution of wildlife species with potential conservation concerns.

Table 3-49 summarizes information regarding risks and concerns for the species of concern and presents additional information on habitat and possible approaches for maintaining populations well-distributed for those species.

These risk factors and the location where they occur on the Forest were a primary consideration in this analysis. The first step in each species assessment was to determine the risk factors for each species. Then management prescriptions were evaluated by category to determine the extent to which the species would be protected from the risk factors. Forestwide standards and guidelines were considered, as were standards and guidelines specific to each prescription when appropriate. Finally, an outcome or finding was made for each species.

Table 3-50 shows the array of management indicator species, threatened, endangered, and sensitive species, and species of special interest by general habitat type within the three geographic areas on the Chugach National Forest.

Table 3-51 summarizes the risks to species of concern by various habitat types.

Table 3-49: Some important habitat components and conservation options for selected species of concern.

Habitat Components or Considerations	Conservation Options
Black Oystercatcher Suitable Habitat. Other considerations: Dispersed or developed recreation on or near low gradient sand or gravel beaches. Effects of the Exxon Valdez oil spill.	Buffer zones with seasonal use restrictions placed around high concentrations of nesting oystercatchers. Sheltered bays that serve as winter refuge should be protected from human disturbance Source: Black Oystercatcher Assessment. Poe and Murphy 1999.
Brown Bear Productive anadromous fish habitat. Large unroaded areas with availability of summer alpine habitat. Other considerations: Road density and roaded access. Camp and community waste disposal sites.	750' buffers on moderate-gradient/mixed control and flood plain process group anadromous fish streams to provide screened foraging habitat. Manage human activity to minimize encounters and illegal kills; consider ways to concentrate human activity within landscapes. Source: Interdisciplinary Team meetings.
Dusky Canada Goose Suitable nesting habitat. Predation, both human and animal.	Continue artificial nest island program. Implement Dusky Canada goose strategy if population levels fall below. Source: Dusky Canada Assessment (Bromley and Rothe, 1999).
Copper River Gray Wolf Suitable habitat for prey species, especially moose. Other considerations: Road density and roaded access for hunting and trapping.	Maintain habitat to support ample prey populations. For moose maintain early seral conditions in winter range. Consider control of roaded access and work with ADF&G to manage illegal kills. Source: Gray Wolf Assessment. (Carnes, 1996).
Marbled Murrelet Productive old growth within 31 miles of the ocean, and at lower elevations in heads of bays. Other considerations: Gillnet mortality and other at-sea effects.	Maintain productive old growth in heads of bays, emphasizing those near aquatic or terrestrial concentration areas. Source: Marbled Murrelet Assessment. (Kuletz 1997).
Montague Island Marmot Suitable habitat. Other considerations: Road density and roaded access.	Surveys are needed to determine location and abundance of marmots on Montague Island. Source: Marmot Assessment. (Lance, 1999).
Montague Island Tundra Vole Suitable habitat. Other considerations: Road density and roaded access.	Protect beach fringes. Monitor populations on the island. Source: Vole Assessment. (Lance, 1999).
Northern Goshawk Productive old growth. Nest sites below 800 ft. elevation. Large (10,000-30,000 acres) use areas of mixed habitats.	Maintain productive old growth within large watersheds so that at least 33 percent is 100-200 years old, and 33 percent 200-300 years old. Nesting habitat (600+ acres) available in each 10,000-30,000 acre watershed. Source: Goshawk Assessment. (Iverson et al. 1997).
Wolverine Suitable habitat for prey species, especially moose. Other considerations: Road density and roaded access for hunting and trapping.	Maintain habitat to support ample prey populations. For moose maintain early seral conditions in winter range. Consider control of roaded access and work with ADF&G to manage illegal kills. Source: Wolverine assessment (Howell 1999).

Table 3-50: Management indicator species and species of interest showing general habitat types and geographic areas of concern.

Geographic Areas of the Chugach National Forest			
General Habitat Type	**Kenai Peninsula**	**Prince William Sound**	**Copper River Delta**
Early forest succession	Moose	Moose	Dusky Canada goose
	Lynx		Lynx
			Moose
			Trumpeter swan
Late forest succession	Townsend's warbler	Bald eagle	Bald eagle
	Marbled murrelet	Marbled murrelet	Northern goshawk
	Northern goshawk	Montague Island tundra vole	Townsend's warbler
		Northern goshawk	
		Sitka black-tailed deer	
		Townsend's warbler	
Alpine	Mountain goat		Mountain goat
		Montague Island marmot	
		Sitka Black-tailed deer	
Freshwater	Brown bear	River otter	Dusky Canada goose
	Wolverine		Trumpeter swan
			River otter
			Wolf
Riparian	Bald eagle	Bald eagle	Bald eagle
	Brown bear	Brown bear	Brown bear
	Moose	Osprey	Gray wolf
	Osprey	River otter	Moose
	River otter	Townsend's warbler	Osprey
	Townsend's warbler		River otter
	Wolverine		Townsend's warbler
Rocky Coast		Black oystercatcher	Black oystercatcher
		Steller sea lion	Steller sea lion
Beach Association.		Black oystercatcher	Black oystercatcher
		River otter	River otter
		Montague Island tundra vole	
Sheltered Inshore Waters		Marbled murrelet	Marbled murrelet
		Steller sea lion	Steller sea lion

Table 3-51: Potential risk factors to wildlife species of conservation concern by habitat.

	General habitats										
Potential Risks to Wildlife (from the Activity Matrix)	**Forested**	**Scrub**	**Herb—Gram-Moss-Lichen**	**Sparsely Vegetated**	**Tidal Estuarine**	**Freshwater**	**Alpine**	**Riparian**	**Rocky Coast**	**Beach Association**	**Sheltered Inshore Waters**
FS vegetation management	X	X	X					X		X	
FS fish habitat projects					X	X		X			
Pest management	X							X			
Insect and disease outbreaks	X							X			
Invasion by exotic plants	X	X	X			X		X		X	
Prescribed fire	X	X	X								
Timber harvest	X					X		X			
Minerals activities	X	X	X	X	X	X	X	X			X
Recreational gold panning				X	X	X	X	X			X
OHV designated routes, summer	X	X	X		X	X	X	X		X	X
OHV other purposes	X	X	X	X	X	X	X	X		X	X
Nonmotorized recreation use, hiking camping	X	X	X	X	X	X	X	X	X	X	X
Day use facilities			X		X	X		X		X	
FS recreational cabins	X	X	X		X	X				X	
Campgrounds	X	X	X		X	X		X		X	X
Hardened dispersed camping	X	X	X		X	X	X	X		X	X
Marine transfer facilities									X	X	
Boat docks and ramps						X				X	
Mode changes: parking lots at trailheads, ferry terminals, etc.	X	X	X			X		X		X	X
New roads	X	X	X		X	X		X		X	X
New trails	X	X	X	X	X	X	X	X			X
Trail reconstruction	X	X	X	X	X	X	X	X			X
Electronic sites							X				X

Management Indicator Species

The management prescriptions used in each alternative fall into categories that represent a broad spectrum of impacts on the landscape. Category 1 is described as primitive and allows natural processes to occur relatively free from the influence of humans. Category 2 is semi-primitive and human influences on the ecological processes are limited. Category 3 is moderate development. Management activities may occur but natural ecological processes and patterns will normally predominate. Category 4 is resource development emphasis and allows for a variety of habitat and recreational activities and development to occur. Category 5 is long-term disturbance with human influences on the ecological processes dominating. For the purpose of evaluating relative impacts to habitat for the various species, the prescriptions found in Categories 1 and 2 (total 17) are considered low impact, the prescriptions found in Category 3 (total 6) are considered moderate impact and Category 4 and 5 prescriptions (total 4) are considered high impact.

Black Oystercatcher

Black oystercatchers are dependent upon marine shorelines for their life requirements and are most abundant along low-sloping gravel or rocky shorelines (Andres 1998). Because this habitat occurs in patches, they are distributed unevenly throughout their range. Breeding habitat of black oystercatchers ranges from mixed sand and gravel beaches to exposed rocky headlands. Oystercatchers avoid vegetated habitats and are most abundant on non-forested areas and islands.

Black oystercatchers were an injured species due to the *Exxon Valdez* oil spill. The population of black oystercatchers within Prince William Sound is considered to be recovering at this time, but has not yet met specific recovery objectives.

Human and animal disturbance of black oystercatchers during the nesting season can result in nest abandonment, and continued disturbance may preclude the use of nesting beaches (Murphy et al. 1999). Black oystercatchers can recolonized abandoned nesting beaches within 7 years of the cessation of disturbance (Andres 1998).

A GIS model was created to identify potential black oystercatcher nesting habitat in Prince William Sound (Suring no date). The model serves as the best estimate about the location and amount of potential habitat that is available to Black Oystercatchers in Prince William Sound.

Areas were identified as high, medium or low in terms of habitat suitability. These points were overlaid with a GIS coverage of recreation destination points to assess potential disturbance effects on the Black Oystercatcher. Approximately 44 percent of the suitable habitats that were ranked as high and medium value overlap with recreation destination points. The remaining 56 percent of suitable habitat occur in low use areas or outside of expected recreational use areas.

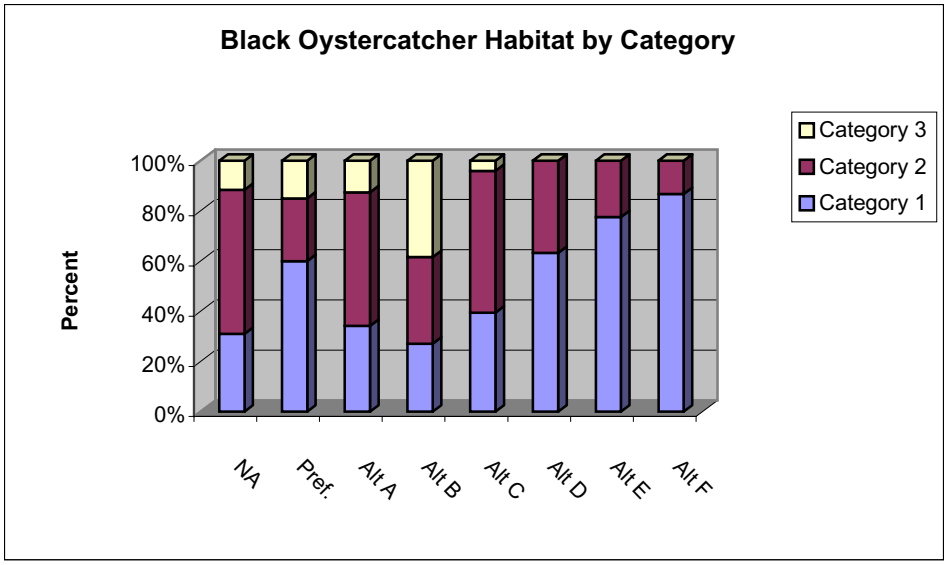
Seasonal no use restrictions and buffer zones placed around high concentration of nesting oystercatchers are believed to mitigate potential effects from dispersed recreation activities within Prince William Sound. The Seabird Rookeries and the Waterfowl and Shorebirds Habitats management guidelines will be applied to mitigate disturbances to those species as well. The Revised Forest Plan contains a guideline to provide a minimum distance buffer. Some level of disturbance is likely to occur under all alternatives.

The majority of recreational use of Prince William Sound by kayakers, boaters, and other water-borne recreationists is not within the management purview of the Forest Service, and recreational use is anticipated to increase because of improved access to Whittier. Black oystercatchers prefer sandy or gravelly beaches with a gentle gradient for nesting and these characteristics are often attractive to water-borne campers and day-users, so some disturbance to nesting black oystercatchers is inevitable but the level of disturbance is impossible to predict. More than 200 miles of beach in Prince William Sound is considered to be black oystercatcher nesting habitat, and some of that is in more remote locations such as Knight and Montague Islands that are more difficult to access

by kayakers or small boats. Disturbance to nesting black oystercatchers would be intermittent and of short duration, so total abandonment of any nesting beaches is not anticipated although individual nesting birds may be affected. In the worst case of beach abandonment, recolonization is likely in future years, so major threats to black oystercatcher population viability caused by unregulated activities in Prince William Sound are not expected. Standards and guidelines at the Forestwide level, and mitigation efforts at the project level, would limit any effects from Forest Service management or permitted activities. Accordingly, such activities are not expected to affect black oystercatcher populations or their habitat.

Figure 3-37 shows the distribution of potential black oystercatcher habitat by prescriptions category by alternative.

Figure 3-37: Distribution of potential black oystercatcher habitat on the Chugach National Forest by prescription category (21,500 acres).



Brown Bears

Brown bears are wide-ranging and use a variety of habitats. The late summer season has been identified as the most critical or limiting period for brown bear. Bears concentrate in lower elevation valley bottoms and along salmon streams during this season. This is often the season of highest human use in these areas, and the location of the most intense resource developments. Bears use a variety of habitats during this season, but the estuaries and riparian areas with anadromous fish are of the highest importance.

The literature indicates that brown bears can be also impacted by human activities in the winter (Olliff et al. 1999). There are three stages in the annual cycle where brown bears are vulnerable to the impacts of winter recreation use: (1) pre-denning, (2) denning, and (3) post-denning emergence. Conflicts could occur when snowmobile and skiing use coincides with spring bear emergence

and foraging. Research shows varying effects of human use on hibernating bears. One study in Alaska on the impact of winter sensing surveys and small fixed-wing aircraft on denning bears found none of the radio-collared bears deserted dens, and there was no evidence of mortality (Reynolds et al. 1984).

Habitat effectiveness for brown bears depends on the interactions of habitat quality, as described by vegetation, food availability, and abiotic factors and human activities. Modeling suggests that past management activities have reduced habitat effectiveness for bears, not just on the Chugach National Forest, but on a large portion of the Kenai Peninsula by more than 70 percent as a result of disturbance and mortality associated with human facilities and activities (Suring et al. 1998).

Habitat components such as availability of cover near salmon streams, availability of breeding habitats in alpine, and travel corridors were considered for this analysis. Also considered were the pattern and connections between landscapes. Human activities such as road access, mining operations, developed recreation, dispersed recreation, and waste disposal were also considered.

Forestwide standards and guidelines and a prescription specific for brown bears were developed during the planning process as tools to help maintain brown bear viability on the Chugach. The Brown Bear Core Area Management Area prescription limits human-bear interactions and prohibits Forest Service road construction and utility corridors. The standards to prevent brown bear access to food and garbage were developed during the planning process as tools to help maintain brown bear population and habitat viability on the entire Chugach National Forest, and particularly on the Kenai Peninsula portion. The entire Kenai Peninsula harbors between 250 and 300 brown bears with a total allowable take of 14 bears per year. Bear-human conflicts have increased on the Kenai Peninsula since the mid-1960s to the point where the 1995 fall hunting season was closed because of the excessive Defense of Life or Property (DLP) kill (Schwartz et al. 1999). The following Forestwide standard was developed to limit the attractiveness of garbage and food to bears and thus assist in limiting DLP take:

> Require disposal or removal of garbage from all permanent and temporary facilities, camps or sites to prevent habituation of wildlife. Require food and garbage to be stored in bear-proof containers or by methods that make it unavailable to wildlife.

Revised Forest Plan standards and guidelines were developed to provide 750-foot buffers along anadromous fish streams to provide screened foraging habitat for bears and to manage human activity to minimize encounters in all alternatives. There is a risk, albeit slight, that maintenance of vegetative cover along Class I anadromous streams would allow bears to approach undetected closer to anglers than might be the case were some vegetation was removed or altered, and thus slightly increase the chances of a bear-human conflict. Such risk to the human is outweighed by the assumption of increased benefit of

escape and hiding cover to enable bears feeding in the area to avoid other bears and humans, alike. The location of the trails is expected to result in overall reductions in human-bear conflicts.

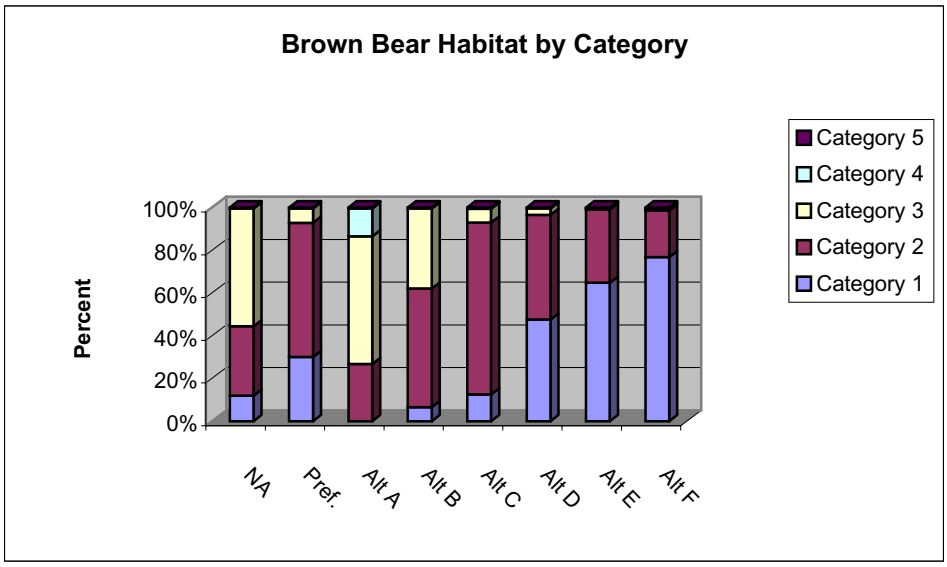
Figure 3-38 shows the distribution of potential brown bear habitat by prescription category by alternative. At the Forest scale, Alternative A would be considered to have the most potential for brown bear habitat disturbance, followed in decreasing potential by No Action, B, C, Preferred, D, E, and F.

Summer trail access in the Kenai Peninsula portion of the Chugach National Forest at the end of the first decade is projected to be slightly over 500 miles in the Preferred Alternative, although only 14 miles of that is planned for motorized use, with total summer trail access declining, in order, through Alternatives C, D, A, B, E, and No Action, to 309 miles in Alternative F (Table 3-70). The areas of the Kenai Peninsula accessible by road would remain at about current levels under all alternatives. Some campgrounds on the Kenai Peninsula currently have occupancy rates of between 80 and 100 percent on summer weekends and during salmon runs, and usage is not expected to decline.

The Brown Bear Core Area Management Area prescription sets a priority for managing to meet brown bear needs and reducing human-bear conflicts. Ranking the alternatives considering the amount of Brown Bear Core Area management prescription applied on the Kenai Peninsula, Alternative D has the most followed in descending order, Preferred, F, B, C, A, E, and No Action.

The likelihood of management activities affecting the viability of the brown bear on the Forest is low because the Forestwide standards and guidelines will be applied to help maintain the brown bear and its habitat. The largest potential impact from Forest management and permitted activities is on the Kenai Peninsula. Strategies and mitigation measures are in place to protect brown bears and their habitat, but the level of direct take of brown bears for DLP reasons cannot be predicted (USDA Forest Service 2000b). It is anticipated that any increased level of human-bear conflicts from increased access on Forest trails will be minor because the majority of DLP take of brown bears has been by residents of the Kenai Peninsula who are currently increasing in number. Should the brown bear population of the Kenai Peninsula portion of the Chugach National Forest become depleted, it would have ripple effects throughout the entire Kenai Peninsula because the brown bears traverse large areas and are often resident on lands under different management jurisdictions (Ernst personal communication). Influx of additional bears from outside the Kenai Peninsula is anticipated to be limited because of likely barriers to immigration, such as the narrow neck that connects the Kenai Peninsula to the mainland.

Figure 3-38: Distribution of potential brown bear habitat on the Chugach National Forest by prescription category (1,828,190 acres).



Dusky Canada Goose

The dusky Canada goose (duskys) is an Alaska Region sensitive species. Dusky Canada geese nest in the wetland complexes of the Copper River Delta. The area is highly dynamic and undergoing accelerated succession as a result of an earthquake and associated tectonic uplift. Habitat modeling to determine rate of succession has shown that dusky Canada goose nesting habitat will remain constant over the next 100 years and is not expected to be limiting (DeVelice 1999). Prior to the earthquake the dusky Canada geese primarily nested in the mixed grass/forb vegetation type (DeVelice 1999). The model predicted a decline in this habitat and a large increase in the shrub component over time. Since the earthquake, the geese have shifted their nesting preference and are currently nesting primarily in the new shrub areas. Nest predation has increased, but re-nesting has become more common (Campbell 1990). Secondary nest attempts are generally more successful as predators have a wider range of available alternative prey.

Risks to the dusky Canada goose would be associated with indirect effects of disturbance of nest sites, molting areas and fall concentration areas (Pacific Flyway Council 1997). In this regard, management area prescriptions that preclude such activities as nest island construction or predator control would increase the risk to viability of the dusky Canada goose.

Two Forestwide guidelines would apply to the dusky Canada goose: 1) seasonal restriction on human activities and 2) waterfowl and shorebirds habitat management.

Figure 3-39 shows the distribution of potential dusky Canada goose habitat on the Chugach National Forest by prescription category and alternative.

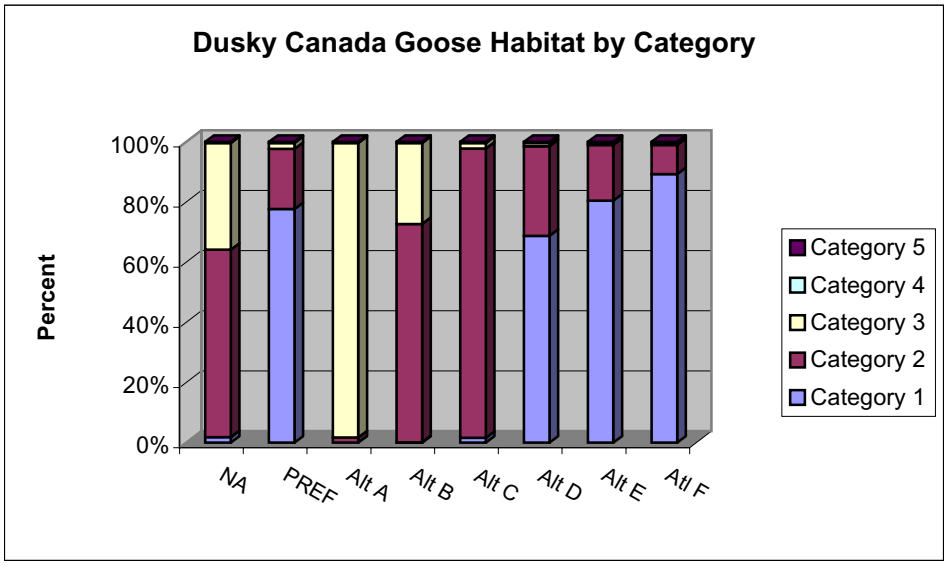
When ranked in order of decreasing amounts of risk to maintaining viable populations on the Copper River Delta, Alternative A is first followed by the No Action, B, C, Preferred, D, E, and Alternative F, in order. There is some risk associated with Alternative F, due to the factors mentioned above. Current management policy would preclude construction of artificial nesting islands for duskys in Alternative F unless the species were considered as a threatened or endangered species.

The likelihood of Forest management activities affecting the viability of the populations of the dusky Canada goose is low because the management area prescriptions applied to the Copper River Delta and the Forestwide standards and guidelines will be applied to protect nest sites.

Implementation of these standards and guidelines is expected to minimize any adverse effects on dusky Canada goose populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Random stochastic events, such as the uplift from the 1964 earthquake, are likely to occur in the future. Other earthquakes have occurred in the past and dusky Canada goose populations have persisted in the area. Populations are expected to fluctuate in response to these events and persist over time. Risks to the dusky are lowest on the Copper River Delta under the alternatives that allow active management activities to occur. Artificial nest platforms and predator control activities would enhance nesting success in the area, and likely speed up the recovery process (Campbell 1990).

Figure 3-39: Distribution of potential dusky Canada goose habitat on the Chugach National Forest by prescription category (541,750 acres).



Moose

Natural successional processes will decrease the amount of forage available for moose in both the Kenai and Copper River Delta geographic areas. The habitat suitability models (HSI) show in both instances a decrease in the quality of habitat for moose in winter. The HIS models were based primarily upon the quality of moose winter range (Lottsfeldt-Frost 2000) because that is thought to be the primary limiting factor for moose (MacCracken et al. 1997, Suring and Sterne 1998). Predictions in changes in moose forage over time were based solely on the assumption of only gradual natural disturbances occurring. Further sudden changes such as the earthquake that transformed much of the Copper River Delta cannot be predicted, although they are possible. It is recognized that this is likely not a valid assumption over the long term. In addition to discounting sudden natural changes, the HIS models ignore anthropogenic influences on the Chugach National Forest, and thus must be considered only a baseline estimate of the potential amount of moose winter habitat. The HSI models used were developed to describe the current habitat quality and not predict actual moose numbers.

Within the prescriptions there are various management activities permitted, not permitted or allowed under certain conditions. Of these activities, wildlife habitat improvement projects, prescribed fire, commercial timber harvest and new road construction have the greatest change in the amount of moose habitat. Of the management activities with a direct effect on moose habitat that may be permitted under the different alternatives, the only one planned for the Kenai Peninsula is prescribed fire.

Categories rated as low impact (Categories 1 and 2) allow for some wildlife habitat improvement projects and prescribed fire. Mechanical cutting of older forage species is an example of an improvement project that could benefit moose. Similarly, prescribed burning is a well-established tool that creates early seral communities important to moose. Low impact categories almost exclusively do not allow timber harvest of any kind or road building.

Category 3, moderate impact, prescriptions allow for wildlife habitat improvement projects, prescribed fire, timber harvest and road construction. In all cases wildlife habitat improvement projects can occur if they are needed. Prescribed burning would be used to create moose habitat. Some commercial harvest of timber may occur and has the potential to create early successional habitats for moose. Road building, with seasonal closures in some cases, would be allowed primarily to provide access to recreational areas.

High impact prescriptions would cause the most disturbances to moose and their habitat. The emphasis in these prescriptions would be dominated by human activity. Wildlife habitat improvement projects and prescribed burning can occur in two of the four prescriptions. Timber harvest can occur in one of the four prescriptions in an active attempt to manage for the spruce bark beetle infestation. New roads can be constructed in most cases.

Figures 3-40 and 3-41 show a comparison of moose winter habitat by prescription category by alternative for the Kenai Peninsula and for the Copper River Delta. For winter moose habitat on the Kenai Peninsula geographic area low impact prescriptions (Categories 1 and 2) dominate Alternatives Preferred, C, D, E, and F. In Alternatives A, B and No Action moderate impact prescription (Category 3) dominates. High impact categories do not dominate any alternative. For winter moose habitat on the Copper River Delta geographic area, low impact categories dominate all alternatives except Alternative A. Alternative A has moderate impact categories as its theme. No high impact categories dominate any alternative for the Copper River Delta.

Figure 3-40: Percent of prescription categories on the Kenai Peninsula that may affect moose winter habitat (482,100 acres).

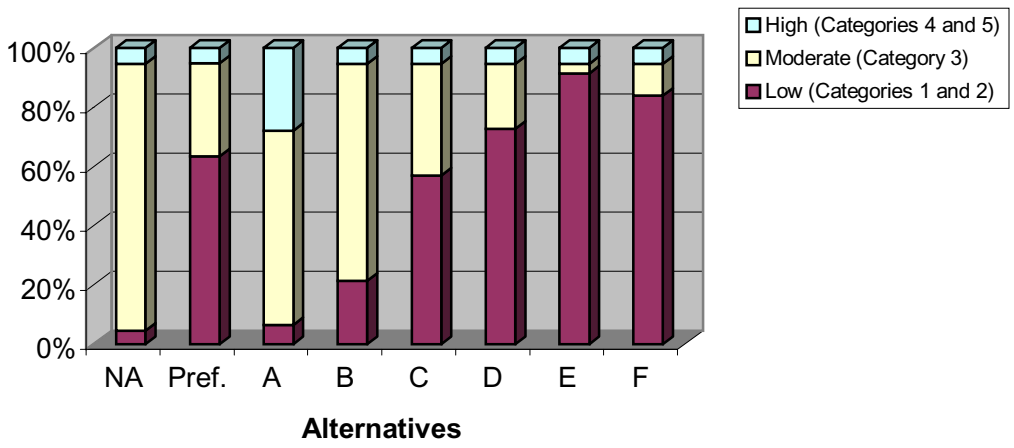
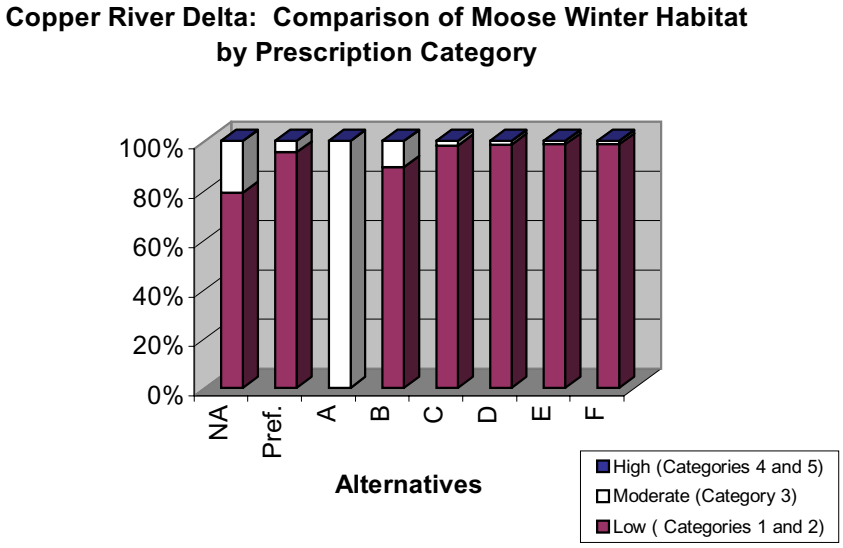


Figure 3-41: Percent of prescription categories on the Copper River Delta that may affect moose winter habitat (256,860 acres).



The only management activity planned on the Kenai Peninsula geographic area that may affect moose habitat is prescribed fire. In general, prescribed burns are planned in areas that offer no forage to moose, have a high probability of regenerating with plant species that moose prefer and are in (or near) moose winter range. The useful life of a burn for moose has been estimated at less than 50 years with moose densities peaking 20-25 years after the burn (LeResche et al. 1974). Weixelman and others (1988) found a 4-fold increase in browse production (lbs./acre) three years post burn.

Burning is planned for 3,300 acres per year in moose winter range in Alternatives Preferred, No Action, A, B, and C. Alternatives D, E and F have less acres planned for burning (average of 1,200 acres per year). The areas most likely to be burned are closed needleleaf, closed broadleaf and closed scrub/low and tall shrub. Of the approximately 100,000 acres in which prescribed fire might be used, only 0.033 percent would be deliberately burned in any year in Alternatives No Action, Preferred, A, B, and C, with only 0.012 percent burned in any year in Alternatives D, E, and F. Altering these landcover classifications to early seral plant communities by burning would slightly improve the habitat for moose over time. The most improvement would occur in Alternatives Preferred, No Action, A, B, and C with a slightly lower improvement seen in the remaining alternatives. Figures 3-42 and 3-43 show a comparison of the habitat suitability index by alternative.

The fire history of the Kenai Peninsula prior to the early 1900s is unclear, but from 1914 to 1999 about 75,000 acres have burned on the Chugach National Forest, with over 99 percent of that occurring on the Kenai Peninsula. The majority of the fires have been human-caused, and the average individual fire

has burned only 50 acres, with the range from ¼ acre or less to two fires that burned over 1,000 acres each. The average number of fires per year has been about 16. The larger fires mostly occurred prior to 1930 with the average individual fire size in the last decade averaging only 15 acres. The prescribed burns would thus exceed the long-term yearly average total burn amount of 800 acres. Because of the difference between the average fire size prior to 1930 and those after (Figure 3-15), the prescribed burns for any of the alternatives would fall within the known variation in fire size.

The historical high population of moose on the Kenai Peninsula prior to 1930 and smaller highs again in 1947 and 1969 were likely caused by the improved winter range that resulted from large fires (LeResche et al. 1974). In the absence of large wildfires, the prescribed fire regime in the alternatives would stabilize the amount of moose winter range on the Kenai Peninsula that would be created in any specific year. The creation of new winter range to replace that lost through normal forest succession would tend to stabilize moose populations on the Chugach National Forest portion of the Kenai area.

There is some uncertainty associated with the assumption of stabilizing moose browse production through the use of prescribed fire. Escaped campfires cause over 50 percent of the wildfires on the Kenai Peninsula. These fires average less than 15 acres per year, but may contribute to further browse production if the fires do not repeatedly burn the same area in successive years. Additionally, the Kenai portion of the Chugach National Forest is currently experiencing a massive outbreak of spruce bark beetle that may subject the closed needleleaf forest of over 43,000 acres to increased frequency and severity of natural wildfires. With such unpredictable, but likely, fires the amount of browse produced by prescribed fire under the alternatives is probably a minimum amount of browse production. Regardless, with prescribed fire, moose wintering habitat should remain healthy not just on the Kenai Peninsula but throughout the entire Chugach National Forest that currently supports moose.

Moose are thought to be comparatively tolerant to humans and have the ability to develop a high level of habituation (Shank 1979). In the winter, moose tend to move away from heavily used trails. In one study in Wyoming, 50 percent of the encounters between moose and snowmobiles resulted in displacement while 94 percent showed some form of disturbance. People on snowshoes or skis caused more disturbance than snowmobiles (Rudd and Irwin 1985). Collisions between moose and motorists on the Kenai Peninsula are also a severe problem (Del Frate and Spencer 1991).

Figure 3-42: Comparison of H.S.I. values when 3,300 acres per year of moose winter habitat are burned in the next 5 years and no management (natural succession).

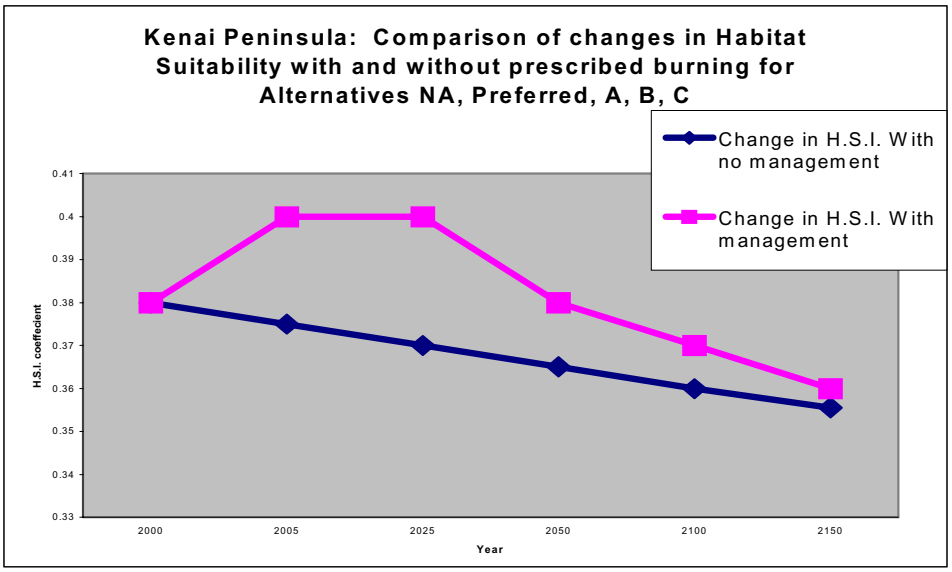
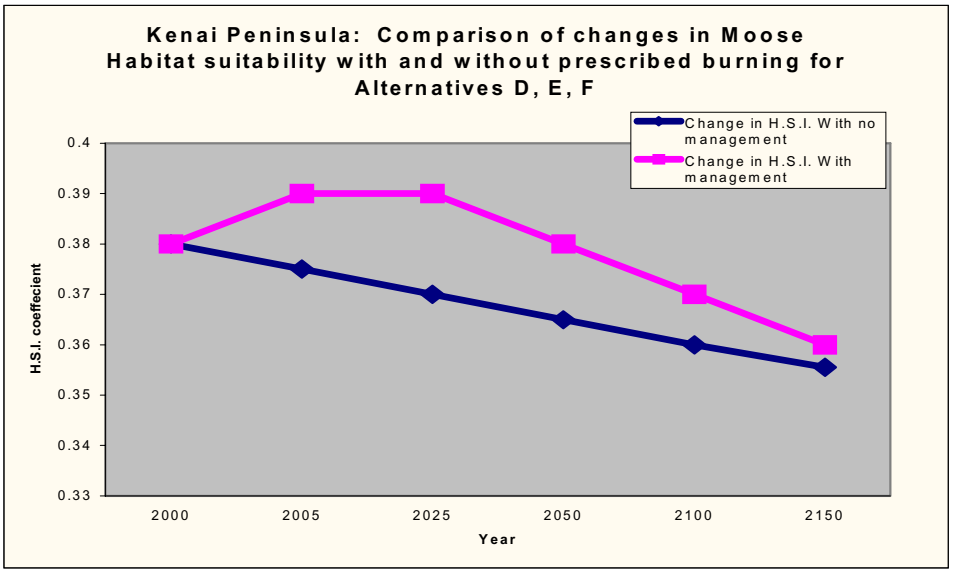


Figure 3-43: Comparison of H.S.I. values when 1,200 acres per year of moose winter habitat are burned in the next 5 years and no management (natural succession).



Mountain Goat

Mountain goats represent species using cliffs, alpine, subalpine, and old-growth habitats. The quantity and quality of the winter habitat is thought to be the most limiting factor for mountain goats in Southcentral Alaska (Suring et al. 1988). Mountain goats use old-growth forest habitat with trees having large dense crowns for winter shelter and as a foraging area. Mountain goats are usually found near escape cover, steep cliffs with slopes over 50 degrees. Forested habitat within one-quarter mile is highest value and value decreases out to one-half mile. Of the 5.45 million acres of Chugach National Forest, over 1.3 million acres (Table 3-48), or 24.5 percent, are mountain goat habitat. The maximum amount of proposed land management activities in Alternatives No Action, Preferred, A, B, and C is 45,000 acres in the first decade (Figure 3-17b), or less than 3.4 percent of the total available mountain goat habitat. Little to none of this proposed activity, however, is planned to occur in or adjacent to mountain goat habitat; therefore, Forest Service land management activities would not reduce the habitat below that amount available under the expected range of variability given current climatic conditions.

Mountain goats are sensitive to habitat change, disturbance and hunting pressure (Chadwick 1973). Aircraft disturbance can cause detrimental changes in mountain goats' energy balance, particularly when the goats are on winter range or kidding areas, where they are undergoing seasonal nutritional and energetic stress exclusive of anthropogenic disturbances. Such disturbance can occur as far away as 2 kilometer from a helicopter flight (Cote 1996). Long- and short-term effects of activities on mountain goats were considered. Developments near winter range would have long-term effects on individuals or herds. Aircraft overflights are a short-term limited duration activity. Based on an analysis of the effects of heli-skiing on the Kenai Peninsula, approximately 4 to 10 percent of the goat population in the project area would be affected 3 percent of the time (USDA Forest Service 1999f). The long-term effects of heli-skiing on mountain goats are being monitored in cooperation with ADF&G (USDA Forest Service 2000c).

Forestwide standards and guidelines for mountain goat habitat management were developed to reduce the effects from aircraft overflights. Timing guidelines would also apply (see Revised Forest Plan, Chapter 3).

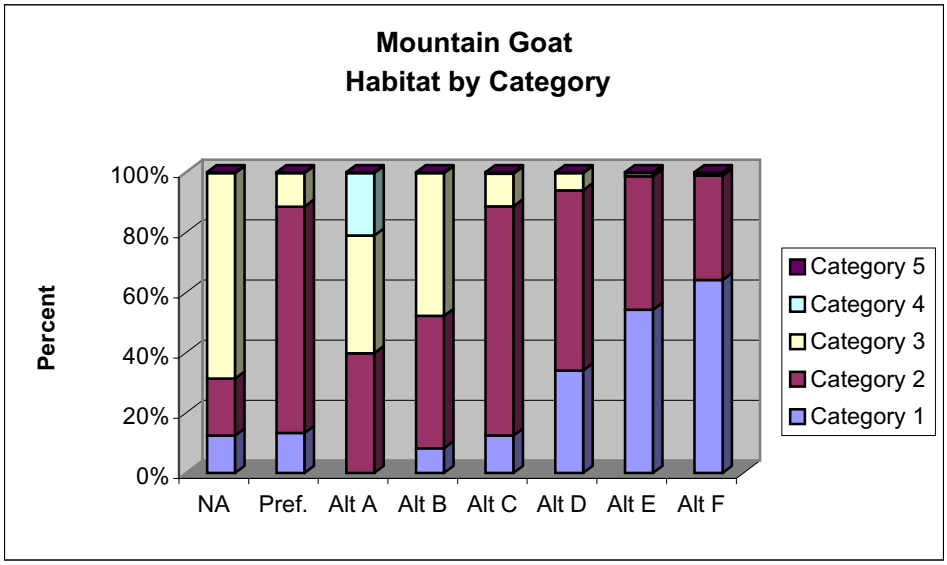
The differences among alternatives are shown in Figure 3-44. Ranked in order of increasing risk to mountain goat habitat abundance and availability are Alternative F, E, D, C, Preferred, B, A, and No Action.

Few of the management activities have potential to directly modify mountain goat habitat. The direct habitat modification due to utility towers or alpine campsites is not considered to have a major impact. Forestwide guidelines implemented at the project level will prohibit locating long-term concentrated human activities, such as permanent campsites at least one mile from winter range or kidding habitat (Revised Forest Plan, Chapter 3). Indirect effects from Forest Service permitted helicopter access for heli-skiing or heli-hiking has the greatest potential for indirect effects on the mountain goat herd. The likelihood of these activities

affecting the viability of the mountain goat population on the Forest is low. Forest Service permitted helicopter-based activities, such as fly-in skiing and hiking, would limit their potential disturbance of mountain goats by avoiding occupied winter habitats, and by avoiding landings during the kidding (and Dall sheep, lambing) period of May 15 through June 15 (USDA Forest Service 2000c, 1999f). Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest.

Predation, both human and animal, may detrimentally affect some local populations of mountain goats, but these factors are beyond the prediction or control of the Forest Service. None of the alternatives and their accompanying standards and guidelines is anticipated to reduce the availability of habitat for mountain goats beyond that currently within the expected range of variability under current climatic conditions. Accordingly, any vacated habitats will be available for future recolonization.

Figure 3-44: Distribution of potential mountain goat habitat on the Chugach National Forest by prescription category (1,336,300 acres).



Species of Special Interest

Gray Wolf

The Southcentral Alaska gray wolf populations were nearly extirpated in the 1920s, but have since recolonized the area. The wolves on the Kenai Peninsula were supplemented by a transplant from the 40 Mile area, east of Fairbanks near the Yukon border, in 1998 (ADF&G 2001a). Wolves have only recently moved into the Copper River Delta (Carnes et al. 1996).

Winter recreation has the potential to affect gray wolf movements and habitat use during periods of winter foraging and early spring denning. Studies of snowmobile use and wolf movement have shown that wolves tended to avoid areas of snowmobile activities in restricted use areas (USDI National Park Service 1996). Winter activities that compact snow, such as snowmobiling and cross-country skiing, provide travel routes into areas that may otherwise be inaccessible because of deep snow (Praguet et al. 2000).

Roads and mortality from increased hunting and trapping is a concern for the Copper River Delta gray wolf. The relatively low population (less than 50 animals) could be at risk of extirpation if hunting or trapping mortality increased. Increased mortality of wolves is a common effect due to increased road access (Carnes et al. 1996).

Maintaining abundant populations of prey species, controlling access on new roads and working with ADF&G to reduce or eliminate illegal harvest are the primary mitigation measures considered for this analysis

The differences in potential effects from management activities are shown in Figures 3-45a and b. No change in the Copper River Delta road density would result under any alternative. Currently, there are 19 miles of road resulting in a total density of 0.006 miles of road per square mile of area. The proposed Carbon Mountain Road, is not under Forest Service control, would add an additional 30 miles of road for a total road density of 0.015 miles of road per square mile of area. These road densities are well below the threshold of approximately 0.4 miles/square miles above which wolves are likely to be extirpated (Thurber et al. 1994).

The likelihood that the viability of wolves on the Forest would be affected by management activities is low. Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. Random, stochastic events may reduce localized wolf populations and even affect the viability of individual packs. Such reductions have occurred in the past for various reasons, but wolves have successfully recolonized the area and recolonization would likely reoccur. Such recolonization could occur from wolves extrinsic to the Chugach National Forest, or, more likely, from the majority of the Forest that would remain free of management activities deleterious to wolves and wolf habitat under any alternative.

Figure 3-45a: Distribution of potential gray wolf habitat on the Chugach National Forest by prescription category (2,742,210 acres).

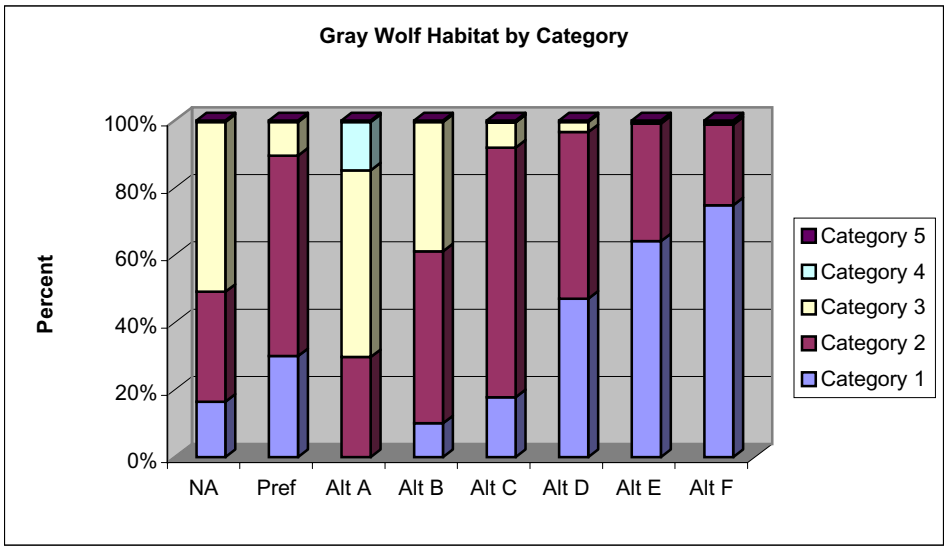
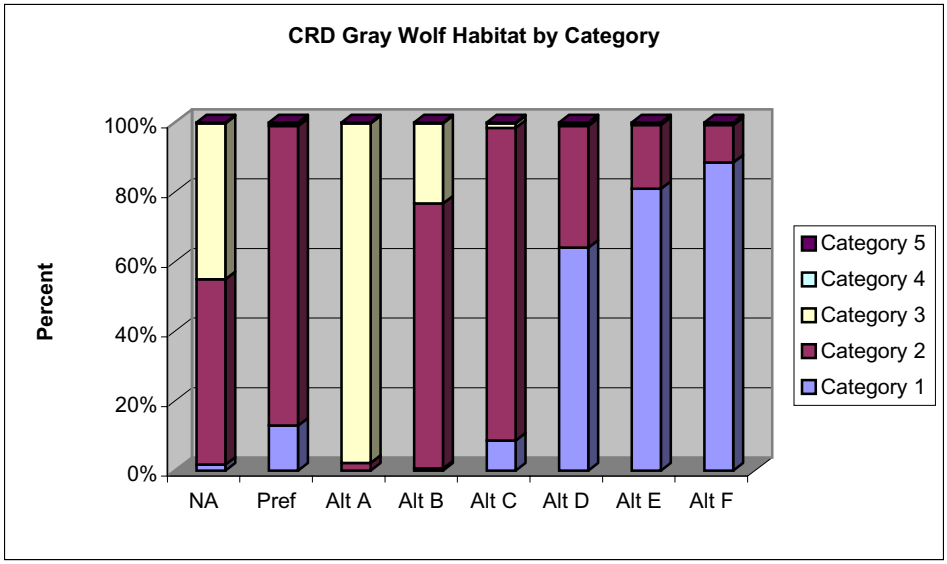


Figure 3-45b: Distribution of potential gray wolf habitat on the Copper River Delta by prescription category (783,740 acres).



Lynx

Lynx is a wide-ranging carnivore that is associated with the early seral broadleaf boreal forests. Its population fluctuates with changes in its primary prey species, snowshoe hare. The populations of lynx on the Forest are thought to be stable and within the range of historic viability.

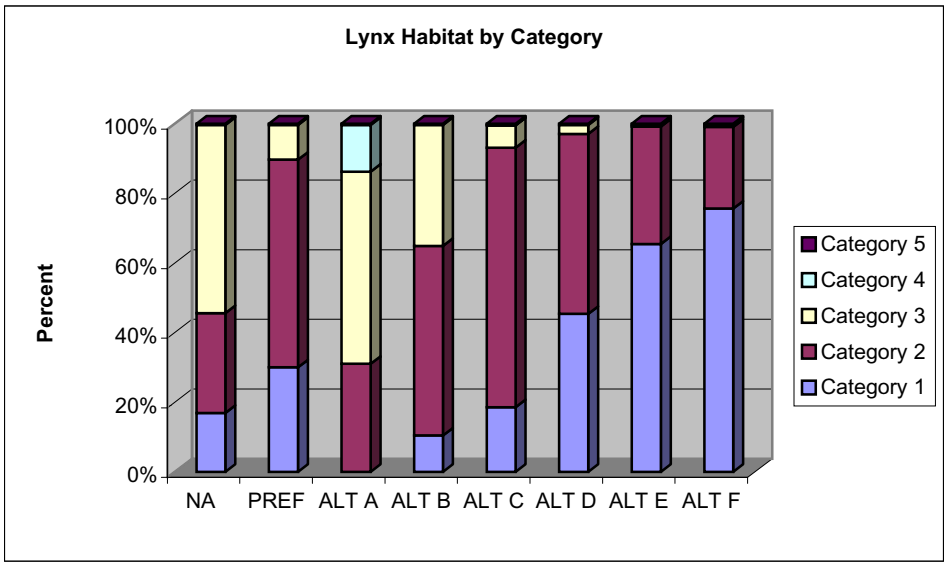
Risks to the viability of the lynx populations on the Forest include loss of early seral habitat necessary for prey abundance, and direct mortality associated with hunting and trapping. New roads and trails creating new access for trappers and hunters also affect lynx. Fragmentation and perforation of movement corridors by roads and developments may have reduced the ability of lynx to move to and from the mainland from the Kenai Peninsula (Bailey et al. 1986).

The differences between the potential effects of the alternatives are shown in Figure 3-46.

Changes in forest structural conditions from timber harvest, prescribed burning, and mechanical treatments may increase habitat for the lynx for the short term. The long-term effects of timber harvest and prescribed burning are not likely to affect the population viability of lynx on the Forest. Only a small percent of the total forest will be modified into early seral stages by any of the alternatives, and then only under favorable conditions.

Nonmotorized recreation activities, such as backcountry cross-country skiing or snowshoeing, may affect lynx, because the disturbance associated with these activities is dispersed and unpredictable (Gabrielsen and Smith 1995). Snowmobiling may be particularly adverse to lynx because this activity occurs when animals are frequently in poor condition due to winter stress (Anderson 1995).

Figure 3-46: Distribution of potential lynx habitat on the Chugach National Forest by prescription category (2,665,700 acres).



Marbled Murrelet

Marbled murrelets are considered to be an old-growth-related species, nesting where suitable mossy nesting platforms occur in forested stands. The current population of marbled murrelets in Prince William Sound is approximately 54,000, down from 159,000 in 1993 (Kuletz personal communication). Risks to murrelet habitat include timber harvest, insects and diseases, and fires. The differences among alternatives are shown on Figure 3-47.

Forestwide standards and guidelines were developed that may provide some protection from forest management activities. Timber harvest would only occur in four watershed associations out of 96 on the Forest. Total harvest proposed in Alternative A, would amount to less than one percent of the available old growth in Prince William Sound. This alternative proposes more timber harvest than any of the others that are under consideration. Other alternatives would harvest less old growth. The likelihood that this level of management activities would affect the viability of marbled murrelet populations is low under all alternatives.

There is a degree of uncertainty regarding the future of the remaining old growth habitats in relation to bark beetle activity. The species has likely encountered similar events in the past, and adaptive strategies may exist. An unknown portion of the murrelet population in Southcentral Alaska nests on the ground, or in crevices along rocky cliffs (Mendenhall 1992). Ground nesting may increase as the old growth conifer habitats continue to decline. Timber stands which are not affected by bark beetles or timber harvest will continue to provide nesting habitat.

Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic (random) events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.

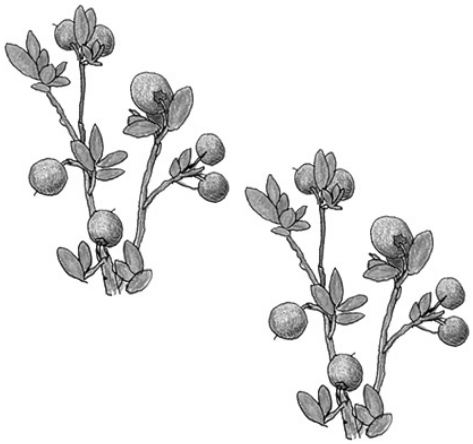
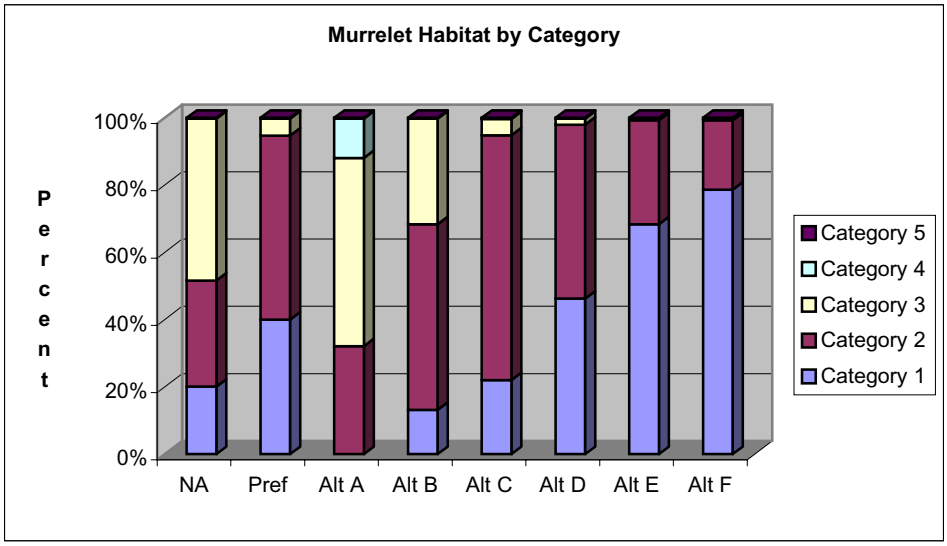


Figure 3-47: Distribution of potential marbled murrelet habitat on the Chugach National Forest by prescription category (1,455,520 acres).



Montague Island Hoary Marmots

Montague Island hoary marmots are thought to use alpine and talus slope habitats. They graze on grass and other herbaceous materials close to den sites.

Not much is known about the Montague Island hoary marmot or risks to its population viability. Road construction was considered to be the greatest risk to this species for this analysis. Road building and logging activities which cross talus slopes may affect the hoary marmot. Road construction in alpine meadow habitat would adversely affect the marmot, but this is unlikely to occur. Logging traffic has the potential to result in road kill of individuals.

Alternative A would pose the greatest potential risk to the population followed by B and the No Action, while the rest would all be similar in potential effects.

Project-level analysis for projects proposed on Montague would analyze the potential effects of those proposals on the species and its habitat.

There have been a few past projects that have modified habitat for the Montague Island hoary marmot, but the habitat is considered to be mostly intact. The effects of the introduction of deer and mink to the island on hoary marmots are unknown.

Risks to the Montague Island hoary marmot are low because harvest activities and road construction would not occur in alpine habitats. Uncertainty is high. There are very few records of the species and the status of the population, size, distribution, and habitat use is unknown.

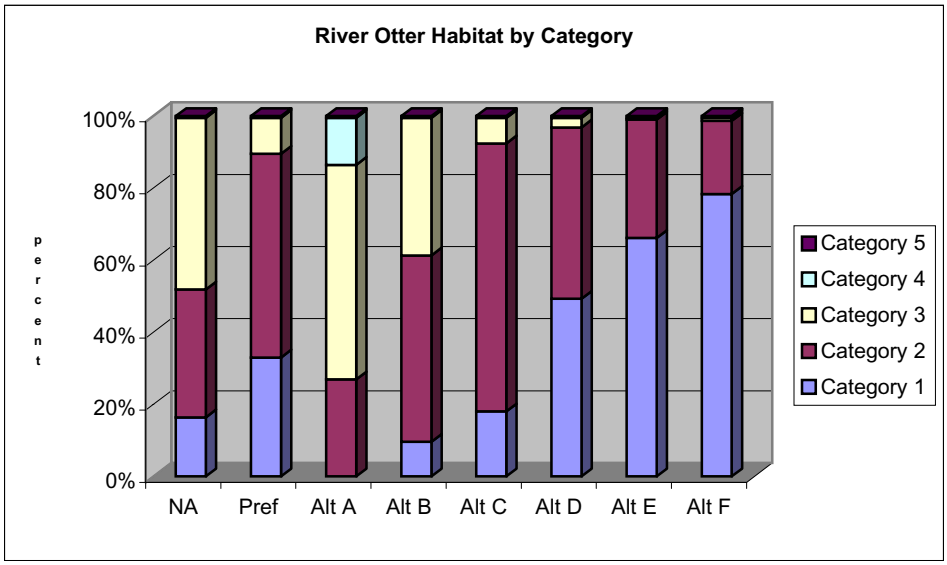
River Otter

River otters are common residents of coastal Alaska. They use the riparian areas, protected inlets, and coves. Individual otters have a home range that meets their needs for escape cover, denning habitat, and foraging areas where they feed on fish and marine invertebrates. They were considered a damaged species from the *Exxon Valdez* oil spill and are considered to be a recovered population. The differences in alternatives are shown in Figure 3-48.

The likelihood of forest management activities affecting the habitat viability of river otters on the Forest is low because project level analysis and implementation will apply the Forestwide standards and guidelines as mitigation for possible affects. Habitat for river otters would be protected under the forestwide sensitive area guidelines. Riparian habitats would also be maintained by application of fisheries, brown bear, and seasonal waterfowl standards and guidelines.

There is concern for the risks to the river otter posed by the projected increase of visitors to Prince William Sound through Whittier and the associated recreational development to accommodate them. It is impossible to predict the amount of recreational use of Prince William Sound shorelines, so some limited areas of river otter habitat may be adversely affected by intermittent human disturbance. Standards and guidelines for sensitive areas and other riparian-dependent species will limit disturbances to river otter habitat and prohibit long-term concentrated human activities in certain areas (Revised Forest Plan, Chapter 3, Forestwide Direction). Shoreline habitat in the Prince William Sound area of the Chugach National Forest is abundant, so river otter habitat would continue to remain well-distributed throughout the planning area.

Figure 3-48: Distribution of potential river otter habitat on the Chugach National Forest by prescription category (1,981,100 acres).



Sitka Black-tailed Deer

Sitka black-tailed deer are found throughout the islands and mainland of Prince William Sound. They use alpine and needleleaf habitat during the summer, and old-growth forest below 800 feet elevation during the winter. Loss of winter habitat would be the biggest risk to the Sitka black-tailed deer. Currently the population in Prince William Sound is considered to be at a moderate to high density.

Sitka black-tailed deer are an important subsistence resource for rural residents of the Chugach National Forest. There is a concern that proposed management activities could reduce the populations of deer in Prince William Sound. Harvest levels reported by hunters exceed ADF&G harvest objectives (ADF&G 1999a).

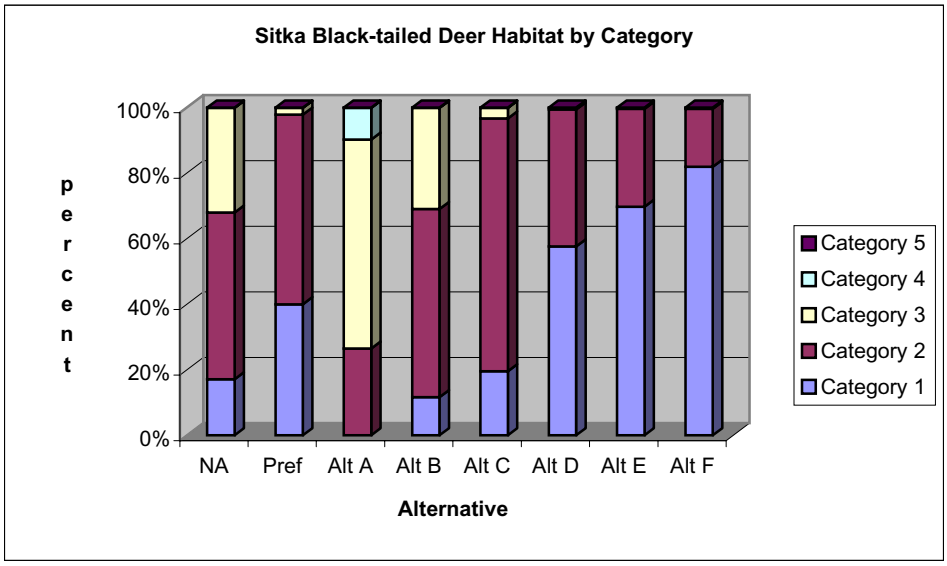
The differences in alternatives are shown in Figure 3-49.

Alternatives A, B and No Action would harvest timber, some of which would be on Montague Island where the highest harvest of Sitka black-tailed deer within the Prince William Sound area occurs. There is no scheduled timber harvest under Alternatives Preferred, C, D, E, and F. Such harvest would have an effect on the Montague Island Sitka black-tailed deer habitat, and potentially on those who depend on Sitka black-tailed deer for sport and subsistence purposes. Alternative A has the highest level of timber harvest at 3,250 acres to be harvested in Prince William Sound over the next decade. If all 3,250 acres were harvested off Montague Island and all the harvest area were concentrated in high value deer habitat, the total reduction of high value Sitka black-tailed deer habitat on Montague Island would be 9 percent, leaving 91 percent of the Montague Island high value Sitka black-tailed deer habitat remaining. Accordingly, this worst-case scenario would have an effect on a few specific sites, but would not affect the overwhelming majority of Sitka black-tailed deer habitat on Montague Island. In actuality, the effect on Montague Island Sitka black-tailed deer habitat would be less than this worst-case estimate. The entire potential 3,250 acres of timber harvest is not planned for Montague Island, nor is it planned to occur entirely in high value Sitka black-tailed deer habitat. Thus, the effect on Montague Island Sitka black-tailed deer habitat would be lessened, and the effect on the Sitka black-tailed deer habitat within the entire Prince William Sound area would be negligible.

There are approximately 456,420 acres of high value Sitka black-tailed deer habitat in the Prince William Sound area (of which only about 8 percent is on Montague Island). If all 3,250 acres potentially available for harvest under Alternative A were to be harvested in high value Sitka black-tailed deer habitat, the maximum reduction throughout the Prince William Sound area would be less than one percent. As noted, the entire potential harvest of 3,250 acres in the Prince William Sound Area is not planned to occur entirely in high value Sitka black-tailed deer habitat. Under any alternative, Sitka black-tailed deer habitat will be of sufficient quality, abundance, and distribution to allow the species to maintain healthy populations through the Prince William Sound area and the entire Chugach National Forest.

Sitka black-tailed deer populations fluctuate, primarily in response to the severity of winter weather. A winter of shallow snow cover allows Sitka black-tailed deer populations to increase while a winter with deep snow causes losses to the population, and a very severe winter may cause loss of up to 80 percent of the population (Reynolds 1979). It is to be expected that some populations or groups of Sitka black-tailed deer are ephemeral in nature, surviving in limited or marginal habitats. The groups persist during a period of mild winters, then are extirpated during a hard winter, and the area is recolonized during successive mild winters from expanding populations in adjacent higher quality habitats. These populations must be the exception rather than the rule, else harvest of Sitka black-tailed deer over the past decades would have not remained fairly constant or even increasing over the long-term. None of the alternatives considered have the potential to change things. Sitka black-tailed deer populations on the Chugach National Forest will remain viable.

Figure 3-49: Distribution of potential Sitka black-tailed deer habitat on the Chugach National Forest by prescription category (1,239,620 acres).



Townsend's Warbler

Townsend's warblers are locally abundant throughout the Chugach National Forest (Andres 1998). The Townsend's warbler is a neo-tropical migrant, breeding in Alaska and wintering from California to Nicaragua. They are largely restricted to mature forests with tall coniferous trees, and are abundant in large undisturbed tracts of contiguous forest, but will also use forests in late successional stages (Matsuoka et al. 1997).

No significant population trend data was detected from data collected by the Breeding Bird Survey, but the species may not be monitored with sufficient intensity to detect a trend in the population (Peterjohn et al. 1995). Populations of birds may be susceptible to traditional timber harvest methods of clearcutting and even-aged management (Wright et al. 1998). These harvest methods result

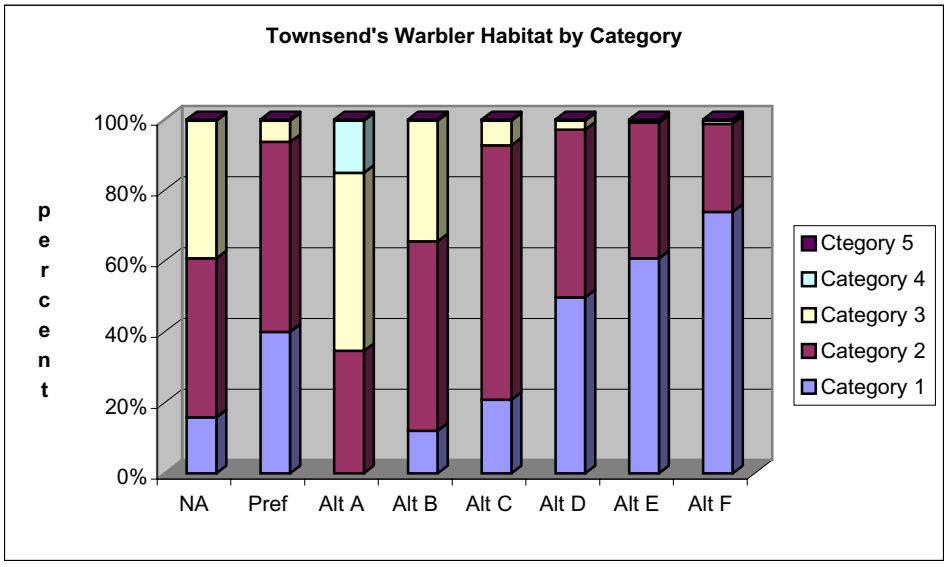
in loss of habitat features Townsend's warblers have been found to select (Matsuoka et al. 1997). This species may be most negatively affected by habitat loss in spruce stands with heavy spruce beetle mortality (Collins et al. 1998).

Forest management activities such as timber harvest, forest restoration, and prescribed burning would all have an effect on this species. The likelihood of these activities affecting the viability of the species on the Forest is low because 20 percent of the timber to be harvested would be cut using an uneven-aged prescription. Forestwide standards and guidelines for riparian areas and soils will provide large, tall mature trees along streams and within the managed stands. In addition, snag and green tree retention guidelines would provide a legacy of mature trees in the regenerating stand.

Timber harvest proposed in Alternatives A, B and No Action would have an effect on the Townsend's warblers in the project areas. Townsend's warbler habitat is well-distributed throughout the Forest, and the relative amount of forest modified would be small. The differences among the potential effects of the alternatives are shown in Figure 3-50.

Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic (random) events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.

Figure 3-50: Distribution of potential Townsend's warbler habitat on the Chugach National Forest by prescription category (734,280 acres).



Kenai Wolverine

Wolverines occur in small numbers throughout mainland Alaska primarily found in the remote areas of the state. This little-known carnivore has been characterized as one of North America's most rare mammals (Banci 1994). The Kenai Wolverine *(Gulo luscus katschemakensiis)* was described by Matschie in 1918 from the Kachemak Bay area of Southcentral Alaska and is known only from the Kenai Peninsula (Hall 1981).

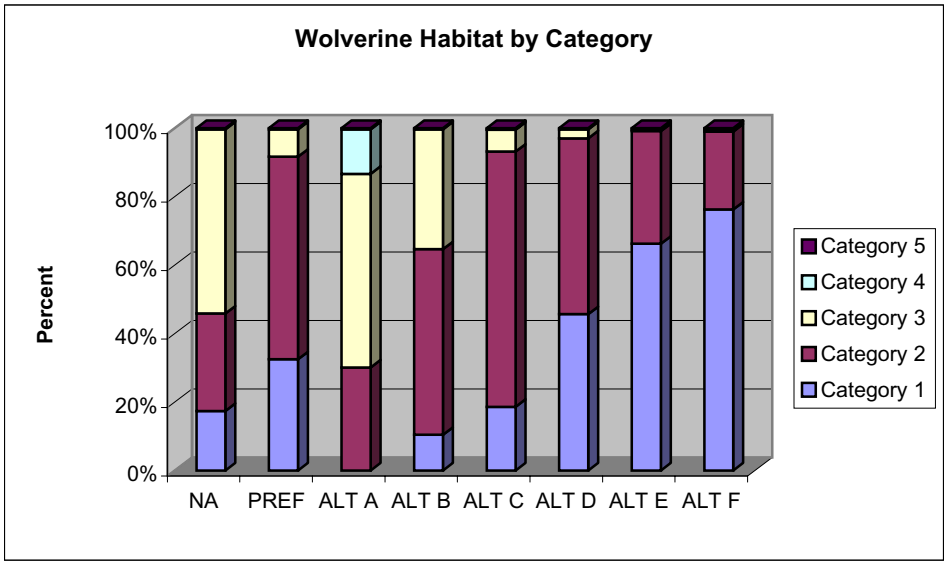
The wolverine is an animal of montane forest, tundra, and taiga. Other habitat parameters such as escape cover from predators, availability of den sites, prey concentrations, and cover can affect daily movement and habitat use patterns (Howell 1999).

Human access on snowmobiles in the winter or early spring could cause behavioral disturbance. This disturbance may impair kit survival if females use less secure den sites, however, neither construction of new motorized access points nor significant changes in existing snowmachine use is planned.

The following risk factors were considered in this analysis: big game winter range, refugia, human access and development, identification and conservation of important areas, wolverine harvest, and predator complex (Howell 1999).

The differences among the potential effects of the alternatives are shown in Figure 3-51.

Figure 3-51: Distribution of potential wolverine habitat on the Chugach National Forest by prescription category (3,153,870 acres).



The prescribed fires, which are proposed on the Kenai Peninsula, would increase the amount of forage for moose on the winter range. This has the likelihood of increasing 1) wolf kills, 2) human harvest carcasses, and 3) winter kills in severe winter, all of which can provide carrion for wolverines. The potential increase in moose populations and the winter kill in severe winters would increase the likelihood of wolverines finding carrion.

Increased road building, leading to increased human access, is not planned for the Chugach National Forest portion of the Kenai Peninsula. Howell (1999) identified human harvest of wolverines as a major mortality factor, and suggested that the populations might be declining as a result of over harvesting. Stable or decreasing the current access by humans for hunting and trapping of wolverines would not contribute to an increased loss of wolverines. Sport hunting/trapping take is outside the purview of the Forest Service. It is anticipated that the total available wolverine habitat would not decline on the Kenai Peninsula, thus maintaining viable populations of wolverine in the area.

Risks to the wolverine population or its habitat resulting from Forest Service management or permitted activities under any alternative are low. In some alternatives, long-term benefits from increased food supply caused by prescribed fire may be partially negated by large increases in winter motorized activities, but the trade-offs are not clear. Increases in snowmachine use are not likely in the steep alpine terrain often used for denning (Magoun 1995, Golden 1996), so any potential disturbance of individual females with young would be tempered by the overall increase in food for the population from prescribed fire or other vegetation manipulation. Effects from beneficial to neutral would result in decreasing rank order from the Alternative Preferred, No Action, C, B, A, D, E, and F. Direct mortality to wolverines resulting from hunting or trapping is not under the purview of the Forest Service and may influence the total amount of occupied available habitat. The unique genetic heritage of the Kenai wolverine cannot be replaced by recolonization of abandoned habitats by wolverines from outside the Kenai Peninsula.

Bald Eagle

Bald eagle nest protection standards are outlined in an Interagency Agreement with the U.S. Fish and Wildlife Service. There is a 330-foot retention zone around known eagle nest locations. There are also blasting, road constriction, and overflight restrictions. The active bald eagle nesting season is generally from March 1 to August 31.

Bald eagles are generally food-stressed during winter. High levels of human activities can potentially increase stress on winter bald eagles and result in increased mortality rates (Stalmaster and Gessaman 1984). Snowmobiles may be especially disturbing, probably due to random movement, loud noise, and operators who are generally exposed (Walter and Garrent 1981). Grubb and King (1991) found that pedestrians (hiker, anglers, and hunters) were the most disruptive type of human activities to bald eagles. All alternatives are considered to have similar effects.

The likelihood of management activities affecting viability of the populations of bald eagles on the Forest is low because the Forestwide standards will be applied to protect nest sites. Implementation of these standards and guidelines is expected to prevent any adverse effects on bald eagle populations and habitats and not result in a loss of species viability.

Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Northern Goshawk

At the present time, the only documented northern goshawk nests on the Forest are on the Copper River Delta and on the Kenai Peninsula.

Factors limiting northern goshawk populations on the Chugach National Forest are unknown but are considered to be similar to those described for Southeast Alaska. Timber harvest is considered to be the primary threat to nesting populations (Reynolds 1989, Crocker-Bedford 1990). However, forest harvest may be compatible provided habitat needs are provided at multiple scale levels (Reynolds et al. 1992; Squires and Reynolds 1997). Additional research and monitoring are needed to identify the factors that may currently be limiting to northern goshawk populations

In Southeast Alaska, goshawks exhibit a significant preference for productive old-growth forest, the general avoidance of all other habitat types, and a predominate use of lower elevations (less than 1,200 feet) and relatively gentle slopes (less than 35 percent) (Iverson et al. 1997).

The following Forestwide guidelines have been developed for northern goshawk habitats on the Forest:

1. Protect active goshawk nesting habitat. Active nests should have a forested 300-acre wind-firm zone (approximately 2000-foot radius) where available. Road construction through the zone is discouraged. Prevent continuous disturbance within 660-feet of the nest during the active nesting season (generally March 1 to July 31).
2. Conduct annual goshawk nest activity monitoring for not less than two years after discovery of active nests. If the previously active nests remain inactive for two consecutive years, protection measures for the site may be removed.

Implementation of these standards and guidelines coupled with additional research and monitoring is expected to prevent any adverse effects on northern Goshawk populations and habitats and not result in a loss of species viability.

The overall risk to northern goshawks is considered to be low and the same for all alternatives. The likelihood of forest management activities affecting the viability of the populations of northern goshawk on the Forest is low because the Forestwide standards and guidelines will be applied to protect nest sites.

Implementation of these standards and guidelines is expected to prevent any adverse effects on northern goshawk populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Threatened and Endangered Species

Formal and informal consultations procedures (as directed by the Endangered Species Act, as amended in 50 CFR 17.7, and Forest Service Manual 2670) are used with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service on all projects that implement the Revised Forest Plan. Forestwide standards and guidelines (see Revised Forest Plan, Chapter 3) for Threatened, Endangered, and Sensitive species direct that all projects will comply with requirements of the Endangered Species Act, as amended and Forest Service policy (FSM 2670). (see Appendix G).

Sensitive Species

Dusky Canada Goose

Environmental consequences for dusky Canada goose were covered in the discussion regarding MIS.

Montague Island Tundra Vole

At the present time, the Montague Island vole is known only from Montague Island. The potential habitats include all Land Cover Classes on the island.

Factors that limit Montague Island voles are unknown. Loss of habitat, predation, and disease may contribute to fluctuations in populations of this species. Timber harvest and road construction would have a direct effect on tundra vole habitat. Use of OHVs could indirectly influence the habitat for this species, especially through winter operations in the beach fringe habitats (Lance 1999b).

Alternatives that would allow timber harvest, road construction, or developed facilities would pose the greatest direct affect on tundra vole habitat on Montague Island. Activities that directly remove tundra vole habitat, such as road construction or developed facilities, would remove a small amount of habitat from the overall available habitat base of about 304 square miles, but the collateral disturbance at the road's edges or around the edges of developed facilities would provide some preferred early seral habitat. Alternatives A, B, and the No Action Alternative propose a maximum timber harvest of 3,250 acres over the nest decade. If all the harvest were scheduled for Montague Island, which it is not, the total alteration of potential Montague Island tundra vole habitat would amount to about 1.5 percent of that available to the vole. Mature coniferous forest is less preferred than early successional habitat, so the habitat change would temporarily provide more preferred habitat for the tundra vole before declining again to its background value. The other alternatives do not propose timber harvest or road construction on Montague Island and therefore would not affect the existing habitat for the tundra vole.

None of the tundra voles' habitat is in short supply, but some types appear to be preferred over others. Beach fringe is a preferred habitat of Montague Island tundra voles and Forestwide riparian area protective standards and guidelines would limit disturbance to the preferred habitat. The tundra vole is a habitat generalist and none of the Forest Service's management or permitted activities under any alternative have the potential to adversely affect the viability of the Montague Island tundra vole population or its habitat.

Osprey

There are no known osprey nests on the Chugach National Forest. Limiting factors for osprey populations are unknown, but availability of nest sites and foraging areas do not appear to be limiting. Osprey are sensitive to nest site disturbances during the nesting and brood rearing season. The Forestwide standards and guidelines (see Revised Forest Plan, Chapter 2) have been developed to provide for protection of nest sites as they are identified.

All alternatives are considered to have similar effects. The likelihood of forest management activities affecting the viability of the populations of osprey on the Forest is low because the Forestwide standards and guidelines will be applied to protect nest sites. Implementation of these standards and guidelines is expected to prevent any adverse effects on osprey populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Peale's Peregrine Falcon

The U.S. Fish and Wildlife Service maintains a database with confidential locations of all known nest sites of Peale's peregrine nest locations in Southcentral Alaska. Potential habitats include tall rocky cliffs and rocky bluffs.

The likelihood of forest management activities affecting the viability of the populations of Peale's peregrine falcon on the Forest is low because the Forestwide standards and guidelines will be applied. The Forestwide standards and guidelines for Seabird Rookeries, and Waterfowl and Shorebird habitats will also maintain foraging habitat for the falcon.

The effects of all alternatives are considered to be the same. Implementation of the Forestwide standards and guidelines is expected to prevent any adverse effects Peale's peregrine falcon populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of species viability.

Trumpeter Swans

At the present time, the only documented nesting habitat for trumpeter swans on the Forest is on the Copper River Delta and the Twentymile Drainage on the Kenai Peninsula. All of the nesting habitat would be classified as wetlands and/or riparian habitat.

Factors that limit trumpeter swan populations are unknown. Nesting, brood rearing, and wintering habitats for trumpeter swans are associated with streams, rivers, lakes and ponds. Swans seem to be more tolerant of humans during the

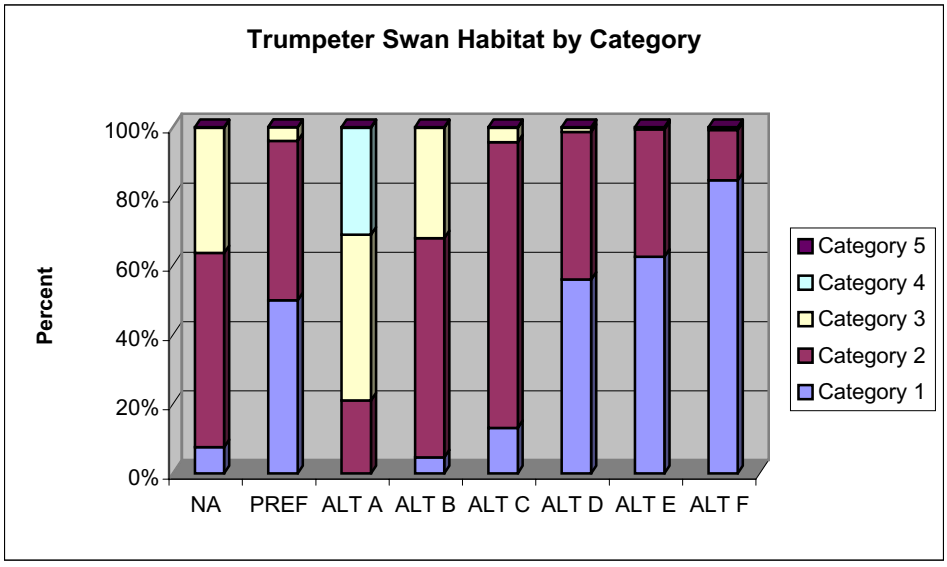
winter months, but display reduced tolerance as spring approaches. Nesting and brood rearing seasons are critical for swan survival and production. Disturbance by humans could have negative effects on trumpeter swans and other waterfowl. Standards and guidelines have been developed to provide for their habitat. Implementation of these standards and guidelines coupled with additional research and monitoring, is expected to prevent any adverse effects on trumpeter swan populations and habitats and not result in a loss of species viability.

The following Forestwide guideline has been developed for trumpeter swan habitats on the Forest:

1. Maintain a 2,640-foot (1/2 mile) no disturbance buffer around active trumpeter swan nests to ensure their solitude and maintain viable nesting habitat**.**

Figure 3-52 shows how the amount of potential trumpeter swan habitat varies by prescription category and alternative.

Figure 3-52: Distribution of potential trumpeter swan habitat on the Chugach National Forest by prescription category (628,410 acres).



The likelihood of forest management activities affecting the viability of the populations of trumpeter swans on the Forest is low because the Forestwide standards and guidelines will be applied to protect nest sites.

Implementation of these standards and guidelines is expected to prevent any adverse effects on trumpeter swan populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of species viability.

General Effects

Overall direct and indirect effects on wildlife (all species)

Effects on wildlife from fisheries management

Managing fish habitat usually consists of in-stream structural or riparian habitat improvement projects. Normally both of these management tools would result in higher quality habitat conditions for riparian-associated species. Alternatives No Action, Preferred, A, B, C, D, and E provide the greatest opportunity to use these management tools for increasing riparian habitat conditions. Alternative F provides for a lower level of riparian habitat management.

Effects on wildlife from fire management

The area of the Chugach National Forest exclusive of the Kenai Peninsula is in the coastal forest type, which is dominated by uneven-aged single tree replacement successional dynamics. Fires are virtually nonexistent and play little to no part in the dynamics of the Forest. Rather, single trees, or small groups of trees, senesce, die, and fall, forming a small gap in an otherwise closed canopy and allow seedlings and other understory vegetation to become established. Except in rare instances at the edge of such forest, wildlife habitat is little influenced by fire or fire management. This is not true of the Kenai Peninsula portion of the Chugach National Forest.

The forests of the Kenai Peninsula are interior boreal forest modified by the maritime influence of coastal climate. The fire history prior to the late 1800s of the Kenai Peninsula is unknown. Within burns that occurred after 1900, remnants of stumps and residual trees suggest that a climax forest with features of the coastal forest may have existed prior to the burns (Potkin 1997), but all the members of the current vegetational community were present 2,500 years ago (Ager 2000b). What is known is that the Kenai Peninsula vegetation is now extensively influenced by fire (Potkin 1997, Vierieck et al. 1992). From 1914 to 1999 about 75,000 acres have burned on the Kenai Peninsula. The majority of the fires have been human-caused, and the average individual fire has burned only 50 acres, with the range from ¼ acre or less to two fires that burned over 1000 acres each. The average number of fires per year has been about 16. The larger fires mostly occurred prior to 1930 with the average individual fire size in the last decade averaging only 15 acres.

Effective fire control since the mid-1900s has limited the size and intensity of the fires and resulted in much late-successional spruce and hemlock forest. Coinciding with the preservation of climax forest and the aging of the previously burned forest, extensive spruce bark beetle outbreaks have occurred on the Kenai Peninsula (see Figure 3-16). As the infested trees die and increase the availability of burnable fuels, wildfires are likely to increase in number and size. Lightning strikes are relatively rare and most of the recent fires have been human caused. These fires have, and will continue to, greatly influence the amount and availability of early- to mid-successional wildlife habitat on the Kenai Peninsula.

Managed fire can have a positive effect on wildlife habitats by increasing the amount and availability of plant nutrients, and by increasing the diversity of

vegetation, especially in early successional stages. Fire can be used as a primary management tool for improving and stimulating changes in wildlife habitat, particularly in creating early successional conditions that are favorable to big game management.

Although the current fire frequency may be higher than that of the distant past, the frequency of fires in the 1900s is within the expected range of variability under current climatic conditions, and the species such as moose, snowshoe hares, and their dependent predators, are within that expected range of variability. Alternatives that include the use of prescribed fire would maintain vegetation that is within the expected range of variability, even should occasional wildfires occur. Alternatives that emphasize improvement of wildlife habitat through active wildlife management would result in a greater use of prescribed fire for creating desired successional conditions. The greatest opportunity to use fire as a management tool to increase early seral conditions and to improve structural diversity are Alternatives No Action, Preferred, A, B, and C (see Table 3-35).

Effects on wildlife from insects and disease management

Forest insects and diseases have always been a natural component of the Forest. Along with fire, they were some of the most important disturbance agents in creating the current composition, structures and patterns of wildlife habitats.

On the Chugach National Forest exclusive of the Kenai Peninsula, uneven aged climax forests predominate. Insects and disease affect single trees, or small groups of trees, that senesce, die, and fall, forming a small gap in an otherwise closed canopy and allow seedlings and other understory vegetation to become established (Veblen and Alaback 1996). On the Kenai Peninsula, disease and insects play a more extensive role in forest dynamics. The forests of the Kenai Peninsula are currently experiencing a widespread spruce beetle infestation, particularly in those areas that have a more even-aged forest structure resulting from previous stand replacing disturbances (USDA Forest Service and State of Alaska 2000).

Many species of wildlife (such as lynx, marten, and three-toed woodpecker) depend on snags or downed woody material for sustaining portions of or all of their life requirements. Unique snag and downed woody dependent species may benefit most from periods of increased insect and disease activity. The alternatives do not differ significantly for predicted levels of endemic insect and disease activity. The less frequent epidemic outbreaks can have negative effects on wildlife habitats in several ways. Some examples include reductions in standing live biomass for species associated with late successional and old-growth habitats and removal of large areas that provide cover and security habitat for big game species.

Timber harvesting and related silvicultural activities can provide a tool for preventing or reducing the risk of a large insect or disease outbreak that may have negative effects on wildlife habitats for certain species. Areas in which timber stand improvement projects are proposed have the greatest opportunity to

reduce stand density and thereby reduce the risk to large insect and disease outbreaks. The acres available for timber stand improvements would be greatest in the Alternative No Action, A, and B. The opportunity for treatment would be much less in Alternatives C, D, E, F, and the Preferred Alternative.

Effects on wildlife from mineral exploration and extraction

Impacts to vegetation and disturbance effect to wildlife species would result from the construction and maintenance of roads and well pads during development and extraction. Only one exploration well is predicted to occur under the reasonably foreseeable level of development in any ten-year period. Applying Forestwide standards and guidelines to the lease would require close coordination of any proposed actions with the State of Alaska, U.S. Fish and Wildlife Service, Bureau of Land Management, and others.

No new lands would be made available or be authorized for leasing under any alternative. There are no changes in authorization in Alternatives B, E and F. In Alternative D, 4,500 fewer acres are authorized and 10,000 fewer acres are authorized in Alternatives C and No Action. Timing stipulations are increased from none in the No Action to 17,500 aces in Alternatives D, E, and F, about 60,000 acres in the Preferred, and to over 100,000 acres in Alternatives A, B, and C. The cumulative impacts of these increases in protection stipulations are expected to reduce the overall effects of disturbance on many wildlife species.

For individual project proposals, site-specific environmental analysis will include detailed surveys for MIS, SSI and TES species, and the project environmental analysis and Biological Evaluation that analyze the effects of those proposals on wildlife and habitats. As a result of that analysis, appropriate mitigation measures would be included in the project to sustain the Peale's peregrine falcon and its habitat. The Forestwide standards and guidelines for Seabird Rookeries, and Waterfowl and Shorebird habitats would also maintain foraging habitat for the falcon.

Effects on wildlife from recreation management

Certain types of recreational activities can result in the direct loss of wildlife habitat, disturbance, and temporary displacement of wildlife species. In general, developed recreation sites would not significantly change the composition or pattern of wildlife habitats across the Forest. Effects on wildlife would primarily be associated with increased disturbance from the recreationist. On the Kenai Peninsula, wildfires have affected the wildlife habitat by replacing late successional forest with early- to mid-successional vegetation beneficial to moose and other wildlife dependent upon such vegetation. The majority of wildfires have been human-caused such as those from escaped campfires.

Any expansion or construction of new facilities would include a biological evaluation to determine the effects to proposed or listed species as well as disclose the effects to species identified by the Regional Forester as needing additional management consideration.

Studies concerning the effect of visitors on mountain goats and their habitat applicable to the situation in the Chugach National Forest are few, and are non-

existent for Dall sheep. In Glacier National Park, visitor activity that was confined to established viewing sites did not affect mountain goat behavior or use of mineral licks, but unmanaged visitor activity and excessive truck noise on the highway did (Pedevillano and Wright 1987, Singer and Doherty 1985, Singer 1978). Because unmanaged visitor activity and abrupt changes in engine noise from the use of jake brakes affected goat behavior, even in a habituated population, viewing sites should be:

- situated so use by large commercial semi-truck and trailer rigs is discouraged;
- constructed so that abrupt gear changes are not necessary for vehicles entering and exiting the viewing area; and,
- constructed and managed (through visitor use signs) so that departures on foot away from the viewing area are discouraged.

The situation in Glacier National Park occurs adjacent to a mineral lick that is in close proximity and at a similar elevation to the highway and the viewing area. The high attractive value of the lick to the goats and the comparatively heavy traffic levels on U.S. Highway 2 in Glacier Park has at least partially habituated the goats there. The distance from the lick to the viewing site at Glacier National Park is 150 meters. On the Chugach National Forest, the lighter, more irregular, traffic levels argue for a longer avoidance distance for observation sites from goat habitat. Doubling the distance to 300 meters and ensuring that it is constructed below the elevation of goat habitat would eliminate almost all risk from viewer activity disturbing the mountain goats or alienating them from their traditional habitat. Using goats as a Management Indicator Species, a similar situation should prevail for Dall sheep.

Dispersed recreation, whether motorized or nonmotorized, has the potential to disturb and displace some wildlife species. Winter nonmotorized ROS classes have the largest amount proposed in Alternative D followed by No Action, C, E, B, F, A, and Preferred. For summer nonmotorized activities, ROS trends follow a similar pattern to that of winter with some slight variation; Alternative D has the most amount of land allocated followed by C, Preferred, A, E, F, and No Action.

The effects of motorized use and road density on habitat effectiveness and big game hunting have been discussed earlier in this section. In addition, areas currently not managed for motorized access are viewed by some as areas in which motorized access may be warranted. However, many of these nonmotorized areas provide some of the last bit of solitude for many wide-ranging forest carnivores. Research on wolves in the eastern U.S. (Mech et al. 1988) has provided forest managers with some very important information related to road densities and subsequent human access. The result of increases in these activities and exceeding road density thresholds usually winds up in the loss of these species from the area. The alternative that emphasizes the most motorized access and subsequent increase in over-the-snow winter motorized ROS acreage, and has the greatest potential to disturb or displace wildlife species, is Alternative B, followed by C, D, Preferred, A, E, No Action, and F. For

summer, a slightly different picture emerges with the highest motorized ROS acreage going to Alternative C, followed by B, D, A, Preferred, E, No Action, and F.

Dispersed recreation activities such as Nordic skiing, snowboarding, heli-hiking, wildlife viewing or photography have grown in popularity over the last two decades. During certain times of the year wildlife can often be adversely affected by people using the winter habitat to view them or take photographs. The potential for stress to wildlife caused by dispersed recreation activities such as Nordic skiing, snowboarding, heli-hiking, wildlife viewing or photography is based on the projections to 2010 in total recreation visitor days of these activities by alternative. It would be greatest in Alternative A, followed by B, C, No Action, Preferred, D, E, and F.

Effects on wildlife from aircraft overflights

In general, wildlife responds to low-altitude (300-800 feet) aircraft overflights (USDI National Park Service 1994). The manner in which they do so depends upon life history characteristics of the species, characteristics of the aircraft, flight activities, and a variety of other variables and factors such as season, location, habitat type, species, and previous exposure to aircraft. Over 200 published and unpublished reports may be found on the subject. Review of the literature shows that aircraft overflights may cause flushing of birds from feeding or nesting areas, alteration of movement or activity patterns, decreased foraging efficiency, panic running of big game animals, decreased young survival, and increased heart rates in big game animals.

Of primary concern is the change in behavior or physiological responses to the overflights and the animals' fitness or ability to survive. Some researchers believe that low-elevation overflights can cause excessive arousal and alertness or stress (Fletcher 1980, Fletcher 1990). If chronic, stress can compromise the general health of animals. The way animals respond to overflights could interfere with raising young, habitat use, and physiological energy budgets. Physiological energy budgets have been repeatedly documented and would suggest that some of these consequences occur. While individual and group behavioral responses by animals to overflights are well documented for several species, few studies have addressed the long term or indirect consequences. Such consequences may or may not occur and may be detectable only through long term studies (USDI National Park Service 1994).

To evaluate the severity of impacts of overflights at the project level, the Chugach National Forest will use the criteria found in the 1994 Report to Congress Report on the effects of aircraft on the National Park System (USDI National Park Service 1994). These criteria are summarized below.

Negligible Effects

- No species of concern are present, no/minor impacts expected.
- Minor impacts that do occur have no secondary (long-term or population) effects.

Low Impacts

- Non-breeders of concern present in low numbers
- Habitat is not critical for survival; not limited to the area targeted for overflights, etc.
- No serious concerns expressed by state or federal fish and wildlife officials.

Moderate Impacts

- Breeding animals of concern are present/present for critical life stages.
- Mortality/interference with activities necessary for survival likely to occur occasionally.
- Mortality/interference are not expected to threaten the continued existence of species in the area.
- State and federal officials express some concern.

High Impacts

- Breeding animals present in high numbers and/or during critical life stages.
- Overflight areas have history of use during critical life stages during critical periods.
- Habitat is limited and animals cannot relocate to avoid impacts.
- Mortality or other effects (injury, physiological stress, effects on reproduction and young raising) are expected on a regular basis; these effects threaten the continued survival of the species.
- State or federal officials express serious concern.

Using this evaluation process relies on the professional opinions and best judgments of wildlife managers and researchers. The levels of impact listed here are used to "trigger" actions to eliminate or reduce such impacts. In general, the Forest Service regards situations consistent with "low impacts" to warrant monitoring, while situations that represent "moderate impacts" or "high impacts" would require some type of mitigation.

The two main species subject to effects from aircraft, particularly helicopter, overflights are mountain goats and Dall sheep. The wildlife standards and guidelines in the Revised Forest Plan are designed to ensure the viability of species and their habitats. The primary threat on the Chugach National Forest to the viability of mountain goat and Dall sheep winter and birthing habitat is acoustic disturbance. Absolute noise levels are not nearly as important as changes in the noise levels, and location and intensity (influenced by distance) of the noise has a direct effect on the behavioral and physiological responses of sheep and goats.

Mountain goat and sheep response to acoustic disturbance ranges from increased alertness with concomitant increases in pulse and respiratory rates and suspension of feeding activities, through walking or trotting away to avoid the disturbance, to fleeing at a gallop to escape the disturbance. Flight typically halts at steep terrain that, for goats, usually includes cliffs, where the animals halt and maintain their heightened alertness until the disturbance passes. Sever disturbance can cause disruption in sheep and goat social structure, abandonment of habitat or physical harm to individual sheep and goats while fleeing. Sheep, and to a lesser extent goats, habituate to some degree to consistent low-level acoustical disturbance, such as where a mineral lick or other attractive habitat is in proximity to a highway. Habituation is minimized where traffic speeds and noises are not constant, such as where steep hills require commercial trucks to change gears, use compression braking, or other actions that cause an abrupt change in the noise level. Mountain goat and sheep alert and escape responses tend to be less for disturbances that are lower in elevation than the animals, and especially when the disturbances are located close to existing disturbance points (highways).

Because mountain goat and sheep react faster and more intensely to perceived threats from above than from below their elevation, habituation to aerial disturbances is rare, and the problem seems to be exacerbated with helicopters. The rotor noise from helicopters is never constant. Large variation in noise intensity results from: changes in helicopter direction in response to local differences in air conditions; changes in rotor path, speed and angle associated with ascent and descent; and changes in tail rotor speed and position associated with helicopter attitude can all cause changes in loudness and apparent direction of the noise.

Many studies have documented detrimental, or potentially so, effects of helicopter noise and disturbance on ungulates, but few have focused specifically on mountain goats. All such studies have emphasized that little habituation occurs in ungulate species to helicopter noise, and mountain goats least of all (Joslin 1986). Of the paucity of studies on goats, none have been completed for mountain goats in Southcentral or Southeast Alaska. Of those completed in areas outside of Alaska, the effect on goats of helicopter use in relation to energy exploration (Cote 1996, Joslin 1986, Foster and Rahs 1985) was emphasized over that of helicopter use in a recreational setting (Hamilton et al. 1996). Helicopter disturbance reports for Dall sheep are sparse, but helicopter

disturbances of bighorn sheep are similar to those for mountain goats (Stockwell et al. 1991).

No risk (≥ 1 mile)

Cote (1996) suggested a 2 kilometer avoidance distance for helicopters from mountain goat habitat, but several factors in his study make his findings of limited applicability to the Chugach National Forest. Unlike Southcentral Alaska where escape terrain is plentiful for mountain goats that are mostly in low-density populations, Cote's study was done in an area with extremely limited escape cover on a population of goats at high density; and unlike the infrequent flights of recreational helicopters in Southcentral Alaska, his helicopters were flying multiple times every day and his sampling period was but a short span of the total time helicopters were active in his area. Cote (1996) visually estimated the distance of helicopters from the goats and placed the distance into one of three categories: < 500 meters, 500 - 1,500 meters, and > 1,500 meters. His was an observational, not an experimental study, so only 7 of 81 tabulated encounters (Cote 1996:683), or < 9 percent, were in the middle category. Of his tabulated total, two-thirds were > 1,500 meters from the helicopter disturbance. The vast majority of his total observations resulted in light to moderate disturbance of the goats, and by distance category about 14 percent at < 500 meters, about 43 percent at 500 - 1,500 meters, and about 91 percent at > 1,500 meters were all of light or moderate disturbance. Cote's (1996) recommendation of 2 kilometer can only be considered as a 'no risk' avoidance distance. Hamilton and others (1996) suggested a slightly more modest ¾ miles (1.2 kilometer) 'no risk' avoidance distance in the Sawtooth National Forest where security terrain is more readily available. Accordingly, an avoidance distance of ≥ 1 mile (1.6 kilometer) would have negligible effects on either individual goats or the viability of their populations on the Chugach National Forest.

Low risk (≥ ½ mile)

Interpolation of Cote's (1996) data suggests that 65 to 80 percent of the flights he observed would have resulted in a moderate or less goat reaction at ½ mile (800 meters). Because of the small number of flights from recreational helicopters in the Chugach National Forest, the lower density of mountain goats, their smaller absolute numbers, and the increased availability of security terrain, the actual number of encounters between helicopters at ½ mile or less and goats that react in a moderate or less manner would be small; less than the low estimate of 65 percent of flights in Cote's study. Foster and Rahs (1985) suggest a 2 kilometer lateral separation level of all aircraft based on data from their earlier work, but concede that a minimum flight altitude of 600 meters above ground level would eliminate the disturbance to goats in their Stikine River study area. Accordingly, the ≥ ½ mile avoidance distance must be considered to be at low risk of disturbance to individual goats, and at low-to-no risk of threatening mountain goat population viability in the areas of the Chugach National Forest where recreational helicopter use occurs.

Low-to-moderate risk (> ¼ mile)

As a part of their Forest Service permitted operations, Glacier Powder Guides is required to record and report wildlife sightings to the Glacier Ranger District. On March 21, 1998, their helicopter inadvertently landed and discharged skiers about 2,000 feet from a group of 6 goats, none of which exhibited any reaction to the helicopter or the skiers. Although this close approach to mountain goats is not in keeping with the mitigation measures listed in their permit, neither is it unexpected. Fox (1984) found that aerial surveys counted notably fewer goats than did ground-based surveys simply because of the difference in motion of the observers. The Glacier Powder Guides report supports the recommendations of Stockwell and others (1991, cited in USDA Forest Service 1997) that resulted in the 1,500-foot avoidance distance (> 400 meters) accepted by the Tongass National Forest as a mitigation measure against disturbance of goats (USDA Forest Service 1995c, 1997). The 1,500-foot avoidance distance was accepted by the State of Alaska reviewers of the Revised Supplemental Draft Tongass Land Management Plan.

Monitoring of the disturbance effects of helicopters on mountain goat in the Tongass National Forest has not revealed any adverse affect on individual goats, their populations, or their habitats. Of 76 observations of mountain goats in the Tongass National Forest in 1999, 78 percent were of no disturbance, two percent were of light disturbance, and one percent was of moderate disturbance. Of those 76 total observations 31 percent were < 500 meters from the helicopter, only one percent of the goats were moderately disturbed, and none were greatly disturbed (USDA Forest Service 1999f).

Although Cote (1996) suggested a 2 kilometer avoidance of all mountain goat herds, he conceded that an above ground avoidance distance of > 300 meters was necessary when helicopters must overfly goat habitat. A 1,500-foot avoidance distance (> ¼ mile) should therefore be considered to be at low-to-moderate risk of disturbance to individual goats, and at low risk of threatening mountain goat population viability in the areas of the Chugach National Forest where recreational helicopter use occurs.

It must be borne in mind that some adverse effects on goats and goat populations may be masked by other factors and may take years, perhaps decades, to be discernable (Joslin 1986), but no adverse effects from helicopter acoustic disturbances has yet been found in the Tongass National Forest (Iverson personal communication).

The Alternatives, F, E, D, the Preferred, the No Action, C, B, and A, would have, in decreasing order, potential effects from aircraft overflights, but standards and guidelines would greatly reduce or eliminate any effect under all alternatives.

Effects on wildlife from timber management

The effects of vegetation management, especially timber harvest, can be an immediate change in structure and often composition of the vegetation of the treated area. Timber management can have both positive and negative effects on wildlife habitats and their associated species.

In the place of decreased levels of historical disturbance agents such as fire and insects and diseases, timber management can provide a vegetation treatment that helps shape the diversity of habitats by rearranging vegetation composition, structure and pattern across the Forest. All alternatives allocate some land to be managed for personal use forest products. For commercial timber harvest Alternative A would provide for the most harvest followed by No Action Alternative and Alternative B.

Timber management and related road building activity could result in the loss of habitat effectiveness and wildlife disturbance and displacement (see discussion earlier in this section for disclosure of predicted effects by alternative). Cutting of dead spruce trees and snags for house logs and firewood could affect the availability of these important resources for cavities, for nesting and security, and for snag dependent species. Standards and guidelines are proposed under all alternatives that would require at least a minimum level of snags and downed woody material to be maintained.

Timber stand improvement activities have the potential to accelerate growth and vigor and thereby reduce the forest susceptibility to insect and disease infestations. However, certain treatments such as precommercial thinning, done for growth and volume, can have a negative effect on certain prey resources. Prey species such as the snowshoe hare can have portions of their habitat made unusable for periods of time following these treatments. Arrangement and intensity of these activities could be moderated to provide both the prey and product industry with sustainable products and habitats.

Timber harvest activities were projected to occur under favorable economic conditions. Harvest would occur within four watershed associations, and would have the effect of concentrating within the effects of the activities within these watershed associations. When considered over the entire Forest or geographic area, timber harvest at projected levels would have a very low likelihood of affecting the viability of any species for the following reasons. The total acreages to be harvested in the near term or over the planning period would not significantly change the structural stage distribution of the Forest beyond the expected range of variability at either the Forest or geographic scale. Forestwide standards and guidelines provide for maintaining fine-scale habitats within the timber harvest units and would be applied through environmental analysis at the project level.

In decreasing order, Alternative A, the No Action Alternative, and Alternative B would have the most potential effects from timber harvest, but standards and guidelines would greatly reduce or eliminate any effect under these alternatives. The remaining alternatives would have no effect.

Effects on wildlife from access management

Objectives for managing roads and trails are driven by the desires of the public and the managing agency mandates, which generally are spelled out in policy, directives or laws. Roads or trails can be used as tools to access land for commodity production, such as timber and minerals, or can serve as

transportation systems supplying people access to areas of unique scenic beauty or to dispersed or developed recreational sites.

The effects of roads on contiguous blocks of forest are well documented (Reed et al. 1996) and affect a wide variety of species. Roads can directly remove habitat affecting those species that have limited dispersal capabilities, or greatly reduce the amount of interior forest available for species that are interior habitat specialists. Roads also provide access to the public, which reduces effectiveness of surrounding habitats for many wildlife species. Big game species are discussed in more detail in a previous section of this chapter. The alternatives might affect wildlife, in decreasing order of potential effect, the No Action Alternative, Alternatives A, B, and C, the Preferred Alternative, and Alternatives D, F, and E.

Trails on the other hand have effects that are much harder to describe, but have been linked to disturbance and displacement of some wildlife species. Recent information (Canada Lynx Conservation Assessment and Strategy 2000) suggests that snow compaction from over-the-snow uses (motorized and nonmotorized) could lead to increased competition for lynx prey resources from coyotes. Increased trail mileage or increased use of trails by recreationists has the potential to increase the numbers of human-bear interactions, but any increase is anticipated to be minimal by the implementation of the Brown Bear Core Area Management Area and Forestwide standards and guidelines.

Appendix F displays how motorized access (highway vehicles, high clearance vehicles, off road vehicles, motorcycles, and snowmachines) and nonmotorized access (horses, hikers, skiers, bicycles, and dog sleds) would be managed under each alternative.

Effects on wildlife from transportation/utility corridors

Land corridors set aside for roads and utility access can disturb or displace wildlife species by changing the arrangement of forested and non-forested vegetation types across the Forest. Some prescriptions within alternatives limit or preclude the construction of transportation/utility corridors as a wildlife habitat conservation measure. In areas where contiguous forest habitats exist, these corridors break up these contiguous blocks with long linear landscapes comprised primarily of cleared or early seral vegetation components. Improper power line design can result in potential electrocution hazard for certain raptor species. Studies of collisions by swans, cranes, and other waterfowl with utility corridor powerlines have not been done in Alaska. In other areas, the proportion of non-hunting mortality on waterfowl can exceed 50 percent, although in the Canada and Pacific flyways it is < 14 percent. Of the overall waterfowl collisions, geese make up < 7 percent of the total, and swans < 1 percent (Stout and Cornwell 1976).

The arrangements of these corridors on the landscape have the potential to affect the dispersal capability of some species of wildlife. Access by humans and their associated recreational activities disrupts and displaces some wildlife. All alternatives provide the same acres of transportation/utility corridors.

Cumulative Effects

The cumulative effects are similar in all alternatives. Most of the activities with the potential to negatively affect wildlife resources are beyond the scope of the Revised Forest Plan and outside of Forest Service control. The cumulative effects for wildlife resources considers land within the Forest boundary and the private and BLM land between the three major divisions of the Forest.

Wildlife resources on the Chugach are generally in good condition. Past mining activities affected forest structure by creating large expanses of early seral forest stands due to repeated burning and commodity extraction. Many of these stands have recovered, again providing an abundance of mature forests, especially in hemlock and spruce-hemlock stands. Railroads that were built along many of the streams on the Forest have given way to high-volume roads and utility corridors. Two of the major highways on the Forest, the Sterling and Seward Highways, create movement barriers to some wildlife species (moose, bears, lynx, etc.).

Forest vegetation is not evenly distributed across the Forest, generally occurring in a pattern following the drainage and glaciations from the Chugach and Kenai mountain ranges. The Forest position on the landscape is a vital connection for wildlife movements to and from the Peninsula through the Portage-Placer-Twentymile valley connection. The Nellie Juan - Snow River connection is an important corridor for movement of wildlife and serves as a major connection between Prince William Sound and the Kenai Peninsula. The Copper River valley is an important landscape connection to the Interior.

Many of the low-lying valley bottoms along the forested corridor on the Kenai Peninsula are being influenced by the expansion of towns and supporting facilities. Expansion in these valleys, like that occurring near Moose Pass and Cooper Landing, is strongly influencing the movement pattern of many of the wide-ranging wildlife species. Development of private lands negatively affects the availability and quality of wildlife habitats.

Generally, private and state lands have higher road densities than those found on adjacent National Forest System lands. Public access and the effect it has on some wildlife species is becoming a focal issue at the federal and state levels. Managing wildlife resources across these mixed ownerships is becoming increasingly complex, and many of the solutions often must be dealt with cooperatively.

For species that are subject to hunting, trapping, or other directly consumptive use, state and federal regulatory mechanisms play an important role in the population dynamics of the species. Population and harvest objectives, controlled by lengths and types of harvest seasons affect the numbers and distribution of wildlife on the Forest.

The Kenai Peninsula has received some of the most significant human impacts in Alaska, to the detriment of some wildlife populations and habitat (Suring et at. 1998). The human population increased from 24,600 to 48,815 between 1977

and 1998 (U.S. Department of Commerce, Bureau of the Census 1999). Logging, mineral and energy development, and water impoundments occur on the Kenai Peninsula and modify or destroy wildlife habitat. Subdivision development, livestock grazing, recreation development, and sport hunting also occur on the Kenai Peninsula.

As communities on the Kenai Peninsula continue to expand, many of the important forested connections will be affected or lost. Maintaining options in future within these narrow bands of habitat will become a high priority for many wide-ranging species. The cumulative effects of increased development, recreation, tourism, and use of the Kenai Peninsula would affect all wildlife, and the coterie of carnivores from wolf and lynx through brown bears would be affected the most. These species are dependent upon mixed and seasonal habitats and upon prey species that are themselves subject to cumulative changes. Forest Service management and permitted actions will be conducted to minimize or eliminate any adverse effects on wildlife habitats consistent with human health and safety as specified in the alternatives and accompanying Revised Forest Plan, but the majority of development and activities on the Kenai Peninsula outside of the Chugach National Forest are not necessarily subject to such restrictions. Human activities will continue to influence wildlife habitat in various and unpredictable ways.

Because the majority of the Chugach National Forest will be free of management or permitted activities, few habitats would be modified outside of those changes that occur naturally. Effects of noise from potentially increased winter vehicle use and aircraft use are expected to be localized along trails and in alpine areas used for heli-skiing and heli-hiking. Helicopter activity in the alpine is typically of limited duration and occurs only on those days and in those areas where risks to human health and safety are not excessive. Accordingly, overall changes in the acoustical environment are anticipated to be negligible, but may be noticeable on a site-specific basis. Forestwide, the wildlife and associated habitat resources will remain within expected ranges of variability under current climatic conditions.