Appendix 5. Key Habitats of Featured Species

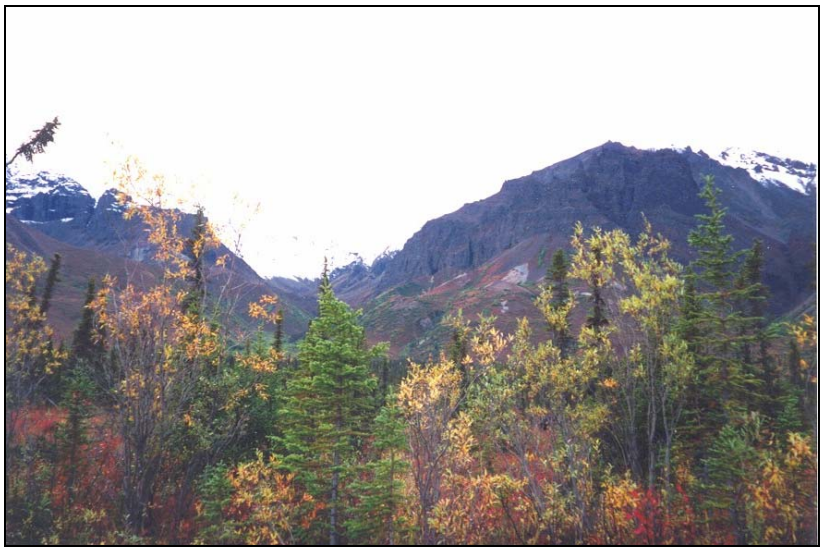
Appendix 5.1 Forest Habitats

Featured Species-Associated Forest Habitats: Boreal Forest and Coastal Temperate Forest

There are approximately 120 million acres of forestland (land with > 10% tree cover) in Alaska (Hutchison 1968). That area can be further classified depending on where it occurs in the state. The vast majority of forestland, about 107 million acres, occurs in Interior Alaska and is classified as "boreal forest." About 13 million acres of forest occurs along Alaska's southern coast, including the Kodiak Archipelago, Prince William Sound, and the islands and mainland of Southeast Alaska. This is classified as coastal temperate rain forest. The Cook Inlet region is considered to be a transition zone between the Interior boreal forest and the coastal temperate forest. For a map showing Alaska's land status and forest types, see Figure 5.1 on page 2.

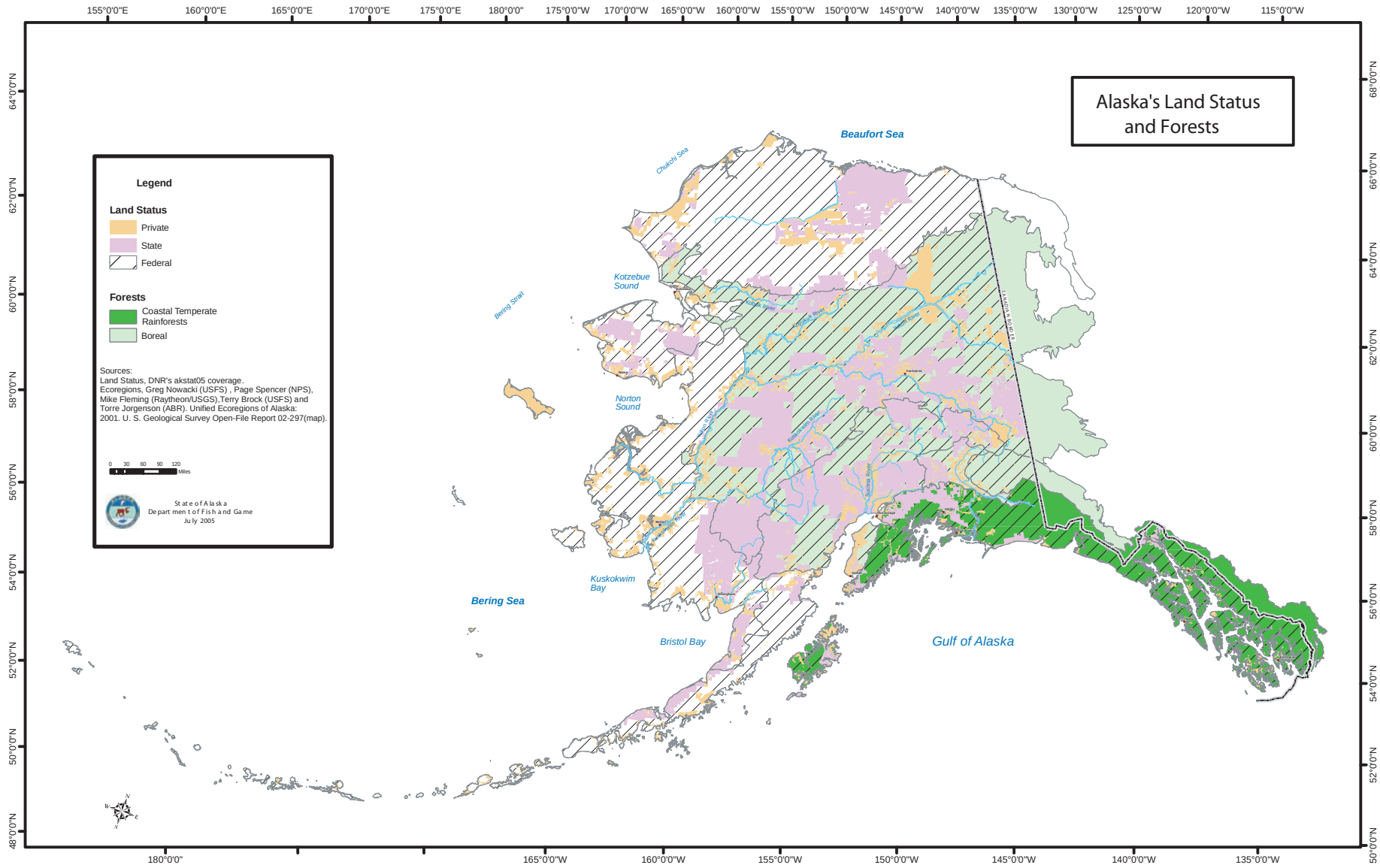
Boreal Forest

The boreal zone is a broad northern circumpolar belt that spans up to 10° of latitude in North America. The boreal forest of North America stretches from Alaska to the Rocky Mountains and eastward to the Atlantic Ocean and occupies approximately 28 % of the continental land area north of Mexico and more than 60 % of the total area of the forests of Canada and Alaska (Johnson et al. 1995). Across its range, coniferous trees make up the primary component of the boreal forest. Dominant tree species vary regionally depending on local soil conditions and variations in microclimate. Broadleaved trees, such as aspen and poplar, occur in pure stands or mixed with conifers. "Boreal forest" and "taiga" are often used interchangeably to refer to the plant communities in this region. Taiga is a Russian word originally applied to the broad ecotone between sub-Arctic forest and tundra in Eurasia. Its use has been expanded to include sub-Arctic forests in Eurasia and North America.



Boreal forest, Nabesna D. Ryland, ADF&G

In Alaska, the boreal biome stretches from the Kenai Peninsula to the south slope of the Brooks Range (Viereck and Little 1972). A transition zone exists south of the Alaska Range in the region surrounding Cook Inlet and stretching northward into the Susitna River Valley.



Appendix 5.1. Alaska's land status and forest types.

Boreal Forest-Associated Species

Varied Thrush, *Ixoreus naevius*
American Three-toed Woodpecker, *Picoides tridactylus*
Black-backed Woodpecker, *Picoides arcticus*
Northern Flicker, *Colaptes auratus*
Violet-green Swallow, *Tachycineta thalassina*
Hermit Thrush, *Catharus guttatus*
White-crowned Sparrow *Zonotrichia leucophrys*
Belted Kingfisher, *Ceryle alcyon*
Dark-eyed Junco, *Junco hyemalis*
Northern Hawk Owl, *Surnia ulula*
Boreal Owl, *Aegolius funereus*
Great Gray Owl, *Strix nebulosa*
Great Horned Owl, *Bubo virginianus*
Merlin, *Falco columbarius*
Harlan's Hawk, *B. j. harlani* or Red-tailed hawk, *Buteo jamaicensis*
Sharp-shinned Hawk, *Accipiter striatus*
Northern Goshawk, *Accipiter gentilis atricapillus*
Olive-sided Flycatcher, *Contopus cooperi*
Blackpoll Warbler, *Dendroica striata*
Rusty Blackbird, *Euphagus carolinus*
Wilson's Warbler, *Wilsonia pusilia*
Keen's mouse, *Peromyscus keeni* complex
Kenai marten, *Martes Americana kenaiensis*
Kenai red squirrel, *Tamiasciurus hudsonicus kenaiensis*
Kenai brown bear, *Ursus arctos*
Columbia spotted frog, *Rana luteiventris*

Interior Forested Lowlands and Uplands[1]

Needleleaf, broadleaf, and mixed forest communities occur across a variety of sites in the boreal zone. Communities composed of tall scrub typically exist in areas of exposed alluvial soil, such as floodplains, streambanks, and lake margins, on burned or otherwise disturbed areas, and near timberline. Low scrub communities develop in moist areas and on slopes with northern aspects. The wettest sites support a mixture of tall scrub swamps, low scrub bogs, or scrub/graminoid communities.

Coniferous forests in the boreal ecoregion are dominated by spruce and occur over a variety of site conditions. White spruce (*Picea glauca* [Moench] Voss) occurs on warm, dry, south-facing slopes on well-drained sites along rivers where permafrost is absent, and at timberline where drainage is good. Dominant understory components in white spruce stands include shrubs such as resin birch (*Betula glandulosa* Michx.), prickly rose (*Rosa acicularis* Lindl.), alder (*Alnus* spp.), willow (*Salix* spp.), buffaloberry (*Shepherdia canadensis* [L.] Nutt.), highbush cranberry (*Viburnum edule* [Michx.] Raf.), and bearberry (*Arctostaphylos* spp.). Herbs such as twinflower (*Linnaea borealis* L.); feathermosses (*e.g. Hylocomium splendens,* and *Pleurozium schreberi*), club lichens (*Cladonia* spp.), and leaf lichens (*Peltigera* spp.) are widespread throughout the boreal forest.

Black spruce (*Picea Mariana* [Mill.] B.S.P.) forests are found on floodplain terraces and flat to rolling uplands on well-drained to poorly drained soils. Tamarack (*Larix laricinia* [Du Roi] K.

[1] Plant community descriptions primarily taken from:

Gallant, A.L., E.F. Binnian, J.M. Omernik, and M.B. Shasby. 1995. Ecoregions of Alaska. USGS Professional Paper 1567. U.S. Government Printing Office, Washington, DC. 73 p.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification. USFS General Technical Report PNW-GTR-286. Portland , OR. 278 p.

Koch) may be associated with black spruce in wet bottomland areas. Low shrubs typically associated with black spruce include Labrador-tea (*Ledum* spp.), prickly rose, *Vaccinium* spp., and resin birch. The ground is usually covered with a continuous layer of mosses (*e.g. Hylocomium splendens, Pleurozium schreberi, Polytrichum* spp., and *Sphagnum* spp.) and lichens (*e.g. Peltigera* spp. and *Cladonia* spp.).

Deciduous forests of balsam poplar, quaking aspen, or a mix of the 2 develop on floodplains of meandering rivers. These forest types often follow the establishment of alder and willow thickets and may be subsequently replaced by stands of white spruce. Understory shrubs associated with broadleaf forests include alder, willow, and prickly rose. Herbaceous species typically found in the understory include horsetail (*Equisetum spp*), bluejoint grass (*Calamagrostis canadensis* [Michx.] Beauv.), and cow parsnip (*Heracleum lanatum* Michx.). Mixed forests are dominated by different combinations of spruce, birch, and aspen. Understory species include alder, bluejoint grass, bearberry, and Labrador-tea.

Interior highlands consisting of rounded low mountains primarily sustain dwarf scrub vegetation and open spruce stands, with graminoid-herbaceous communities occurring in poorly drained areas. Open coniferous forests and woodlands typically dominated by white spruce with black spruce, birch, and aspen codominants are often found above 500 m up to timberline. These forest types contain an open shrub layer consisting of resin birch, alder, willow, prickly rose, buffaloberry, and other ericaceous shrubs. Ground cover generally consists of a layer of mosses and lichen similar to those found in conjunction with black spruce.

Boreal forest, Susitna Basin D. Ryland, ADF&G

Interior bottomlands associated with the larger rivers in the Interior are typified by poorly drained, shallow soils, often over permafrost. Bottomland coniferous forests are dominated by white spruce, black spruce, or a combination of the two. Closed stands of white spruce occupy terrace locations with well-drained soils. Understory vegetation consists primarily of low and dwarf scrub such as *Vaccinium* spp. and dwarf birch often accompanied by twinflower and horsetail. A well-developed layer of feathermoss is also common. Closed stands of black spruce occur on floodplains often associated with white spruce and paper birch on well-drained sites. Understory vegetation is composed of alder, prickly rose, willow, Labrador-tea, *Vaccinium* spp., and a moss layer including *Hylocomium* spp. and *Pleurozium* spp. Colder, wetter sites are occupied by black spruce woodlands with a tall shrub understory consisting of alder, willow, and resin birch. On these sites, the tall shrub understory is a more important component of the habitat

than in closed stands. Ericaceous shrubs (*e.g. Vaccinium* spp., *Ledum* spp., and *Empetrum nigrum*) commonly occur with sedges (*Carex* spp.), bluejoint grass, mosses, and lichen.

Bottomland deciduous forests consist primarily of closed stands dominated by balsam poplar (*Populus balsamifera* L.) or quaking aspen with an understory of alder, willow, prickly rose, highbush cranberry, buffaloberry, and red-osier dogwood (*Cornus stolonifera* Michx.). An herbaceous layer consisting of northern bedstraw (*Galium boreale* L.), dwarf dogwood (*Cornus canadensis* L.), horsetail, and bluebell (*Mertensia paniculata* [Ait.] G. Don) is typical. Mixed forests are predominantly made up of paper birch with spruce cohorts or white spruce with balsam poplar. Understory species are generally the same as those found with broadleaf or white spruce-dominated stands.

Cook Inlet: A Transition Zone

The area around Cook Inlet is a transition zone between the coastal rain forest and the Interior boreal region. This ecoregion has the mildest climate in the boreal region of Alaska and is generally free from permafrost. Tall scrub communities dominated by alder and willow, either alone or in combination, form thickets on streambanks, floodplains, and drainage ways. Mesic graminoid herbaceous and low scrub graminoid communities occur across a range of moist to dry sites. Dry to mesic sites may be dominated by a combination of grasses (*Festuca* spp., *Deschampsia beringensis*, *Poa eminens*), forbs such as monkshood (*Acontium delphinifolium* DC.) and bluebell, and ericaceous shrubs. Coniferous, deciduous, and mixed forest stands are common. Needleleaf forests include white, black, and Sitka spruce depending on soil conditions and microclimate. Deciduous forests are dominated by quaking aspen, paper birch, balsam poplar, and black cottonwood. Mixed forest types may contain codominant cohorts that include spruce in combination with any of these broadleaf species.

White spruce forests are typically found on well-drained sites. Black spruce, paper birch, balsam poplar, and aspen are common codominant components with white spruce. Low shrubs associated with white spruce stands include dwarf birch (*Betula nana* L.), *Vaccinium* spp., Labrador-tea, crowberry (*Empetrum nigrum* L.), buffaloberry, and prickly rose. Herbaceous cover varies depending on canopy density and local moisture regime. Horsetail, twinflower, and bluejoint grass are all commonly found in conjunction with white spruce. Mosses, such as *Hylocomium* spp. and *Pleurozium* spp., often form a continuous layer under dense canopies.

Quaking aspen can form almost pure stands on relatively warm, well-drained, upland soils. Stands often contain balsam poplar, spruce, and paper birch cohorts. Associated shrubs include alder, willow, prickly rose, buffaloberry, and highbush cranberry. Herbaceous cover is generally sparse under closed stands but may include scattered bluejoint grass, fireweed (*Epilobium angustifolium* L.), horsetail, northern commandra (*Geocaulon lividum* [Richards.] Fern.), and northern bedstraw. Lichens and mosses are scarce. Open stands of quaking aspen tend to have a denser herbaceous understory.

Paper birch generally occupy dry to moist sites in the Cook Inlet region. Open stands of paper birch on drier, warmer sites may include white spruce, while wetter sites may include a black spruce component; however, spruce are not usually abundant in closed paper birch stands. Understory components include alder, prickly rose, and highbush cranberry. Stands that are more

open may include resin birch. The herb layer is usually dominated by bluejoint grass; however, horsetail and bluebell are common understory components.

Black spruce tends to be dominant on poorly drained sites and may include a paper birch cohort. Alder is the most common tall shrub associated with black spruce. Low shrubs include prickly rose, willow, Labrador-tea, twinflower, and *Vaccinium* spp. Feathermosses are common, along with *Sphagnum* spp., on wetter sites. Open black spruce forests or stands may include bush cinquefoil (*Potentilla fruticosa* L.), crowberry, and resin birch along with willow, alder, and herbs, such as horsetail and bluejoint grass.

Ecological Role of Boreal Forest Habitats

Forest ecosystems support relatively high levels of biodiversity because they have many vertically differentiated niches, and because they have large accumulations of biomass that can support a diverse food web. Forests with high structural and/or vegetative diversity will also include horizontally differentiated niches, such as edges between forest communities and meadows, or where different vegetative conditions meet within a plant community. The boreal forest region is a large and diverse patchwork of distinctive ecosystems and flora in which complex interrelationships between climate, solar radiation, surface water, slope, aspect, soil characteristics, permafrost, and disturbance regimes create patterns of vegetation across the landscape. As a result, the boreal forest includes a range of habitat types that vary from closed forest to open shrub and herbaceous communities that inhabit both uplands and wetlands.

Birds represent the largest class of vertebrates in the boreal forest. Over 80 % of all terrestrial vertebrates associated with the western boreal region of Canada are birds (Niemi et al. 1998). Of the various species that rely on the boreal forest, approximately 20 % are permanent residents; the remainder are migrants that spend the summer breeding season in the boreal forest (Smith 1993. Birds play a fundamental ecological role in the forest, and data supporting the importance of birds in maintaining healthy forested ecosystems is increasing. During summer, most forest birds eat insects, particularly moth larvae. Research indicates that birds can reduce insect densities (Holmes et al. 1979; Atlegrim 1989), especially when the insect populations are at either low or endemic levels (Crawford and Jennings 1989; Holmes 1990; Torgerson et al. 1990).

For birds in the boreal region, there appears to be a close relationship between habitat diversity and species diversity (Kessel 1998). Some deciduous forest types in the boreal region have a great potential for providing multiple habitat niches. Cottonwood forests in the upper Susitna River basin were found to support high numbers of breeding species of boreal forest birds and the greatest density of breeding territories compared to other boreal forest types in the area. Kessel (1998) hypothesized the high occupancy and species richness found in the cottonwood forests was due to the high productivity of the floodplain ecosystems where these forests were found and the structural diversity within the forest that created many vertical habitat niches. While boreal spruce forests tend to have lower bird densities and species richness than deciduous forests, they provide more stable habitat for resident species, such as Boreal Chickadees, White-winged Crossbills, and Great Horned Owls. The greatest densities of permanent residents occur in forests dominated by white spruce (Kessel 1998).

In the boreal forest, harvest of floodplain white spruce has the potential to reduce age-class diversity at the landscape level. Forest on floodplains and islands have a lower probability of experiencing stand-replacement fire, and therefore, grow considerably older and more complex than forest stands that experience frequent fires. These stands support a large proportion of the boreal forest's species diversity, particularly invertebrates and nonvascular plants.

Kessel (1998) concluded that most bird species are relatively specific with regard to aspects of their structural habitat requirements across their geographic ranges and that much of the habitat variation previously reported in North America is the result of considering only macrohabitats or measuring factors only indirectly related to a species' ecology. Many boreal forest birds use macrohabitat across forest types while occupying specific habitat niches. For example, across most of Alaska, Gray-Cheeked Thrush, Fox Sparrow, and White-Crowned Sparrow occupy shrub habitats. However, where specific shrub habitat features occur within a forest, these species will nest under the canopy and superficially appear to be birds of forest habitat (Kessel 1998). Even small patches of different habitat within uniform stands can be enough to account for the occurrence of a particular species. For example, in their analysis of habitat associations of breeding birds of boreal forest in Alaska, Willson and Comet (1996) noted that 1–2 spruce trees in a deciduous stand was enough for Ruby-Crowned Kinglet or Hermit Thrush to hold a territory, and that these species would forage in the surrounding deciduous vegetation.

Many forest bird species, such as flycatchers, thrushes, and wood warblers, use boreal forests for breeding and rearing young, but winter as far away as Central or South America. Such birds require boreal forest habitats for survival. Many of the long-distance migrants are particularly sensitive to fragmentation of breeding habitat (Smith 1993), and Alaska's boreal forest is an important part of the breeding range of several species of boreal forest landbirds known to be declining in other portions of their North American range.

Boreal Forest Conservation Status

Overall, Alaska's forest habitats are generally healthy. However, localized development will likely continue to result in substantial habitat alteration. Opportunities should be sought that alleviate negative impacts, and maintain connectivity and suitable areas of quality habitat important to the sustainability of species.

Approximately 37% of the total area in Alaska's boreal forest region lies within state or federal conservation units, including federal and state wildlife refuges, parks, national monuments, and other designations. These areas were designated by the state and federal governments to preserve unique or fragile ecosystems and historic sites and to protect essential fish and wildlife habitat. The remaining lands consist of other state lands, municipal or borough lands, Native allotment and corporation lands, and other private holdings.

Management goals and objectives for the conservation units reflect the importance of each area with regard to conserving essential fish and wildlife habitats, and as such, there are usually some restrictions on development within these areas. Generally, the laws and regulations, management plans, goals, and objectives written to guide the management of these areas recognize their importance as essential fish and wildlife habitat, along with the protection of important cultural

and historic sites. As a result, development activities on some lands are often restricted or closely controlled to prevent changing the natural character of the lands and waters.

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Coastal Temperate Rain Forest

Coastal temperate rain forests are rare globally, occurring in only 6 or 7 places in the world, where mountains abut the ocean at higher latitudes. These areas experience a maritime climate, with cool summers, warm winters, and abundant precipitation distributed throughout the year.

As trees in this forest age and become decadent, they either die in place or are toppled by wind, creating a small gap in the overhead canopy. This break in the canopy allows light to reach the forest floor, promoting the growth of new trees and understory vegetation. Over time, this high-frequency, low-intensity disturbance results in a forest with many ages of trees and many small gaps intermingled on a fine spatial scale. Such forests are called "old growth." Essential features of old growth include a multilayered canopy, the presence of large (for the site), old trees, a well-developed understory, and dead and down trees on the forest floor.

The vast majority of Alaska's coastal temperate rain forests are in an old-growth condition. Young, primary forests develop on lands newly exposed by landslides, receding glaciers, or beach uplift. When old-growth forests are felled, either by clearcutting or by catastrophic winds, secondary succession also creates a new, young forest. Whether the young, developing forest is the result of primary or secondary succession, the 2 are similar structurally and functionally. These young forests are characterized by uniform tree ages less than 150 years old, a single-layered canopy, and a relatively depauperate understory. It takes 200–300 years for young-growth stands to develop the compositional and structural characteristics of old growth.

Coastal Temperate Rain Forest Types

Alaska's old-growth rain forest can be further subdivided into different forest "types," or habitats, based on the dominant tree species and on forest productivity. The dominant tree species and major types are described below.

Coastal temperate rain forest J. Schoen

Species— The cooler temperatures, low sun angles, and short summer growing season in higher-latitude forests favor dominance by conifers. In coastal Alaska, the most abundant tree species is western hemlock (*Tsuga heterophylla*), followed by Sitka spruce (*Picea sitchensis*), mountain hemlock (*Tsuga mertensiana*), Alaska yellow cedar (*Chamaecyparis nootkatensis*), western red cedar (*Thuja plicata*), and lodgepole pine (*Pinus contorta*). Deciduous hardwoods, including alder (*Alnus*

spp.) and cottonwood (*Populus balsamifera*), are least common, being found mostly on avalanche slopes, active riparian zones, and mainland river drainages in Southeast Alaska.

Western hemlock is ubiquitous throughout the Alexander Archipelago and predominates on well-drained, organic soils. There, individual trees may be > 6 ft in diameter and > 500 years old. At higher elevations, higher latitudes, and colder temperatures, western hemlock is replaced by the closely related mountain hemlock (*Tsuga mertensiana*). Both species gradually fade out as one moves north and west through the coastal temperate rain forest ecosystem, where Sitka spruce becomes more dominant.

Sitka spruce occurs throughout the coastal temperate rain forest. On Kodiak and Afognak islands, the forests are nearly pure Sitka spruce stands. In Southeast Alaska, Sitka spruce occur most often in mixed stands with hemlock and cedar, but do occur in pure stands on some active alluvial and colluvial soils, including riparian areas, avalanche slopes, and uplifted beach zones. Sitka spruce are less shade tolerant than other species, and they disproportionately colonize new openings following wind-throw, or clearcutting. In Alaska, the largest Sitka spruce trees can exceed 225 ft in height and 12 ft in diameter.

Western red cedar and Alaska yellow cedar represent a small but important component of the coastal temperate rain forest in Southeast Alaska. Yellow cedar occurs throughout the Alexander Archipelago and Prince William Sound. Western red cedar is restricted to the southern half of the Alexander Archipelago. Both species are most abundant on poorly drained, acidic soils, where they are able to outcompete hemlock and spruce. Natural resistance to decay by both cedar species results in an abundance of dead-standing snags in the forest, but rot-resistant heartwood means relatively few cavities for nesting, roosting, and foraging. Both species are economically valuable and have been disproportionately targeted for logging in recent years. In addition, stands of Alaska yellow cedar have been experiencing a significant natural decline since the late 1800s. Whether this is a function of climate change or some biotic factor is currently unknown.

Major habitat types in the coastal temperate rain forest are defined in terms of their relative mix of species. The species mix, in turn, is a function of soil type and drainage, elevation, and latitude. For the coastal temperate rain forests of Alaska, the major forest types include: western hemlock (46% of area), mixed hemlock/spruce (26%), Sitka spruce (17%), cedar (5%), and hardwood/deciduous (4%) (Hutchison 1968).

Coastal temperate forest, sixty-year growth J. Schoen

Productivity— There is a second dimension, or criteria, against which forests in Alaska can be classified. Forest "productivity" refers to the rate of tree growth and is reflected in the overall size and biomass of trees on a given site. Highly productive forests are different structurally than unproductive forests, and they tend to occur in different landscape positions than unproductive forests. For example, we might find a stand of large hemlock trees growing on the toe-slope of a hillside at low elevation and a sparse stand of small hemlocks growing on a wind-battered ridge at high elevation. Both stands would have the same species composition, but they would look, and function, very differently in terms of wildlife habitat value. The productivity of the forest also has obvious importance from the timber industry's standpoint, with more productive stands being much more profitable to log. As a result, forest inventories often include a breakdown by forest productivity, or size class.

At the coarsest level, the forest can be classified as "commercial" or "noncommercial," depending on whether the forest meets certain requirements for timber extraction. It reflects an economic, not ecological, judgment, but it suffices as a coarse-scale separation of forest types based on size and structure, and so has value as a descriptor of habitat conditions. All of Alaska's forestland has been classified in those terms, and we adopt them in this plan.

Beyond this coarse scale breakdown, the commercial (or productive) forestland can be further defined in terms of tree size (e.g., mean tree diameter or height) and stand biomass (e.g., wood volume per acre). These descriptors are more difficult to discern from remote sensing (i.e., from aerial photographs), involve more subjectivity, and thus, have more error. Although these distinctions are important from a wildlife standpoint, they are probably more detailed than we need consider for the purpose of this plan. It is important, nonetheless, to recognize a general pattern within productive forestland across Alaska, and particularly within the coastal forest type: The forest acreage at the lower end of the productivity scale vastly outweighs the forest acreage at the highly productive end. In other words, the bigger the trees in a stand are, the rarer the stand is. Not surprisingly, the more productive stands in the forest have been disproportionately logged in the past and wildlife biologists have identified this "high-grading" as a long-term conservation concern (Schoen et al 1988; Kiester and Eckhardt 1994).

Within the coastal temperate rain forest, most of the forested land is noncommercial, or "unproductive." Approximately 5.9 million acres, or 45%, is classified as commercial forestland. Of that commercial forestland, the vast majority (85%) exists in Southeast Alaska (i.e., south of Yakutat). The balance exists in Prince William Sound and Afognak Island. The vast majority of forestland in coastal Alaska falls within one of two national forests: The Tongass National Forest in Southeast Alaska, and the Chugach National Forest in Southcentral Alaska. These are, by far, the two largest forests in the National Forest system.

Coastal Forest-Associated Species

Marbled Murrelet, *Brachyramphus mamoratus*
Prince of Wales Spruce Grouse, *Falcipennis canadensis isleibi*
Blue Grouse, *Dendragapus obscurus*
Canopy nesting Pacific-slope Flycatcher, *Empidonax difficilis*
Golden-crowned Kinglet, *Regulus satrapa*
Townsend's Warbler, *Dendroica townsendi*
Varied Thrush, *Ixoreus naevius*

White-winged Crossbill, *Loxia leucoptera*
Rufous Hummingbird, *Selasphorus rufus*
Belted Kingfisher, *Ceryle alcyon*
Black-backed Woodpecker, *Picoides arcticus*
Dark-eyed Junco, *Junco hyemalis*
Wilson's Warbler, *Wilsonia pusilla*
Hermit Thrush, *Catharus guttatus*
White-crowned Sparrow, *Zonotrichia leucophrys*
Pine Grosbeak, *Pinicola enucleator*
Red Crossbill, *Loxia curvirostra*
Pine Siskin, *Carduelis pinus*
Red-breasted Sapsucker, *Sphyrapicus rubber*
Hairy Woodpecker, *Picoides villosus*
Northern Flicker, *Colaptes auratis*
Boreal Chickadee, *Poecile hudsonica*
Chestnut-backed Chickadee, *Poecile rufescens*
Red-breasted Nuthatch, *Sitta Canadensis*
Brown Creeper, *Certhia americana*
Smith's Longspur, *Calcarius pictus*
Northern Pygmy-Owl, *Glaucidium gnoma*
Barred Owl, *Strix varia*
Northern Saw-whet Owl, *Aegolius acadicus*
Western Screech Owl, *Otus kennicottii*
Great Gray Owl, *Strix nebulosa*
Great Horned Owl, *Bubo virginianus*
Bald Eagle, *Haliaeetus leucocephalus*
Merlin, *Falco columbarius*
Sharp-shinned Hawk, *Accipiter striatus*
Northern Goshawk, *A. g. atricapillus*
Queen Charlotte Goshawk, *A. g. laingi*
Northern Goshawk, *A. g. atricapillus*
Black Merlin, *F.c. suckelyi*
Wood frog, *Rana sylvatica*
Long-toed salamander, *Ambystoma macrodactylum*
Rough-skinned newt, *Taricha granulosa*
Ermine, *Mustela erminea* complex
Marten, *Martes Americana/caurina* complex
Flying squirrel, *Glaucomys sabrinus griseifrons/alpinus*
Long-tailed vole, *Microtus longicaudus/coronarius* complex
Keen's mouse, *Peromyscus keeni* complex
Sitka tundra vole, *Microtus oeconomus sitkensis*

Ecological Role of Coastal Temperate Rain Forest Habitats

Coastal temperate rain forests are characterized by cool summers, mild winters, and abundant precipitation distributed throughout the year (Alaback 1991). The absence of a dry season makes wildfire extremely rare, so individual trees can live to very old age. Many trees are > 300 years old, while the oldest trees may be > 1000 years old. Trees can live to extremely old age (800 years or more) before succumbing to disease or rot. The primary agent of disturbance in this forest is wind, which typically topples 1–3 trees at a time, creating a constantly shifting fine-grained mosaic of small openings within the forest (Lertzman et al. 1996; Ott 1997). This gap-phase dynamic produces, over time, a forest with trees of many ages, a multilayered canopy, a diverse, lush understory, and an abundance of dead trees either standing (snags) or lying on the ground in various stages of decay (Capp et al. 1992). These structural and compositional features make old growth valuable as habitat for many wildlife species.

The wind-dominated disturbance regime produces a structurally diverse and highly productive forest. Where it occurs in the Pacific Northwest, this forest type produces more living plant biomass than any other terrestrial ecosystem, including tropical rain forests (Waring and Franklin 1979). Its structural complexity provides niches for diverse animals, including at least 53 species of mammals, 231 birds, and 5 species of amphibians and reptiles (Taylor 1979; MacDonald and Cook 1996a, 1996b). For the coastal rain forest habitat type, the Strategy primarily highlights

nongame species, subspecies, and endemics that are associated with it; these species were selected because of conservation concerns, economic importance, or as indicator species for the health of this biome.

Marbled Murrelet

Juvenile Marbled Murrelet
R. MacIntosh, USGS

Following is an illustration of the ecological role of coastal temperate rain forests for one species, the Marbled Murrelet (*Brachyramphius marmoratus*); the health of its Alaska population is closely tied to health of this particular biome and the adjoining marine environment.

The Marbled Murrelet is a small seabird that ranges along the northwestern coastline of North America, from central California to Alaska's Aleutian Islands. It spends most of its life at sea, but unlike other seabirds, flies inland to nest in the forest on mossy platforms near the tops of old-growth trees (Nelson 1997). Marbled Murrelets are currently listed as a threatened species in California, Oregon, Washington, and British Columbia, but are relatively abundant in Alaska, where an estimated 91% of the world's population exists (McShane et al. 2004). Estimates of the Alaska population are driven in large part by a single at-sea survey conducted by the USFWS in 1994, which placed the population in Southeast Alaska at 687,061 (±201,162) *Brachyramphus* murrelets (Agler et al. 1998). By these estimates, Southeast Alaska alone contains approximately 65% of the world's Marbled Murrelets, making it the geographic and demographic epicenter of the bird's range.

A number of studies have demonstrated that Marbled Murrelets have declined dramatically in the southern half of their range, primarily due to loss of suitable nesting habitat from logging (Bryant et al. 1997; McShane et al. 2004). In the Pacific Northwest, approximately 5% of the original, coastal, old-growth forest remains. Other factors that may contribute to the decline include increased predation (by crows, jays, and other corvids), entanglement in gillnets, and oil pollution.

Like other seabirds, the Marbled Murrelet has low fecundity, becoming sexually mature between 3 and 5 years old, and then laying only a single egg per year. Because it nests in trees, it is exposed to avian predators in the form of ravens, crows, Steller's Jays, Northern Goshawks, Peregrine Falcons, and various owls. Preferred nesting habitat is 20–40 meters up in old-growth trees. Murrelets prefer to nest near the tops of trees but beneath overhanging limbs to provide cover from overhead predators. The bird does not add material to a nest, but looks for a broad, mossy platform that occurs naturally in these wet forests. Because the platform must be broad to support the bird, it nests primarily in older trees that have had time to develop these structures.

Research on nesting habits of these birds suggests that within forest stands, Marbled Murrelets tend to select for older, larger trees (Hamer and Nelson 1995). Older trees tend to have larger limb structures and larger moss platforms, which provide more suitable nesting sites for the

birds. The disproportionate logging emphasis on larger trees (e.g., high-grading) in Southeast Alaska may be having a disproportionately high impact on the nesting habitat of these birds.

One of the essential attributes of old-growth forest is the existence of gaps in the canopy that allows Marblet Murrelets to access nest stands and fly below the canopy. Conservation of these types of forest stands is important for the long-term conservation of murrelet nesting habitat.

Other species

In the case of the Marbled Murrelet, coastal old-growth forests provide important structural attributes needed for nesting and reproduction. Other species, including many woodpeckers and owls, depend on large-diameter snags for excavating cavities for nesting and roosting, or in the case of the Rufous Hummingbird, build their nests from the mosses and lichens they find in old-growth forests. Other species depend on coastal forests because their primary food lives in the forest. Examples include the Northern Goshawk, which hunts beneath the overstory and captures a variety of old-growth associated birds and small mammals, or the brown creeper, which forages in the bark crevices of larger, old-growth trees. Still other animals are dependent on the perpetually moist, humid environment of the rain forest, including species like the rough-skinned newt, the wood frog, and long-toed salamander.

The coastal, old-growth rain forest is an extraordinarily complex, stable habitat type. Over thousands of years, many wildlife species have evolved in special ways to exploit this forest for food, shelter, and security. The ecological web of interactions in the coastal rain forest is rich, and understanding of its complexities is only now starting to emerge through ongoing scientific study.

Coastal Temperate Rain Forest Conservation Status

Coastal temperate rain forests are rare worldwide. Only 30–40 million ha (2–3%) of the world's estimated 1.3 billion ha of temperate forest can be classified as coastal temperate rain forest (Ecotrust et al. 1995). Alaska contains approximately 6,649,460 ha of coastal temperate rain forest, of which about 800,000 ha has been altered by human impacts (Ecotrust et al. 1995). Most of this development has come in the form of clearcut logging and associated road building, especially on the more productive forest lands in Southeast Alaska.

Some of the more intensively logged areas in Southeast Alaska include the northern half of Prince of Wales Island, northern Kuiu Island, Northeast Chichagof Island, North Baranof Island, Zarembo Island, Mitkof Island, Heceta Island, Tuxekan Island, and Long Island. Heavily logged areas overlap to a great extent with underlying calcium carbonate soils, or karst, which allows for good drainage and more productive tree growing conditions. There has been less logging in Southcentral Alaska and the Kodiak Archipelago, primarily because tree size and growth rates diminish with increasing latitude (Farr and Harris 1979). Logging on private, Native corporation lands has been significant throughout this biome, accounting for approximately half of all logged areas.

Over 95% of the coastal temperate rain forest land lies within the Tongass and Chugach National forests—two of the largest national forests in the United States. These lands are managed for multiple uses, including a mix ranging from wilderness to intensive development. The allocation

of lands to conservation or development status is governed by a comprehensive Forest Plan, which is developed through a public process, and revised every 10–15 years. The Tongass is currently managed under a Forest Plan that was finalized in 1997. The Chugach is managed under a Forest Plan that was revised in 2001. About 22% of the Tongass National Forest is zoned for development, and about 18 % of the forested acres of the Tongass are currently available for commercial timber harvest purposes (http://www.fs.fed.us/r10/TLMP/ROD/ROD_COV.PDF). About a third of that available forested acreage has been harvested since the 1950s.

Although a relatively small percentage of the forest area has been logged, much of the logging to date has been concentrated in the most productive stands with the largest trees. Not only are "big-tree" forests unique structurally and functionally (Kirchhoff and Schoen 1987), but they tend to occur in certain landscape positions that make them especially valuable to particular wildlife species. For example, big tree forests are often found on alluvial soils (the flood plain of rivers and streams), or on colluvial soil types (the toe slopes of steep hill sides), where species like brown bears (*Ursus arctos*) and Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) find preferred habitat (Schoen et al. 1988). These floodplains and alluvial soils are often also associated with highly productive streams and aquatic habitats.

The disproportionate harvest of relatively rare, "big-tree" stands has been a primary conservation concern in Southeast Alaska for decades (Kirchhoff 1989; Keister and Eckhardt 1994). Maintaining sustainable and well-distributed populations of all fish and wildlife species should focus on preserving the natural diversity of forest conditions (species, structure, and landscape position) within this biome.

Threats to Alaska's boreal forest and coastal temperate rain forest habitat range from minor, short-term impacts that may occur in association with virtually any forestland use activity, to the potentially significant loss of habitat due to the conversion of forestlands to other uses. These losses may be partial or complete, but they are often permanent changes to the landscape.

Timber harvesting activities, if properly planned and implemented, should result in only short-term impacts to the forest habitat. If, however, harvest activities are not conducted in accordance with appropriate best management practices (BMPs), such as those found in regulation under the Forest Resources and Practices Act, there is the possibility that they will affect slope stability or disrupt soil regimes. These in turn could lead to such impacts as increased soil erosion or even mass wasting, reduced natural regeneration or shifts in vegetative species composition, impacts to water quality, excessive windthrow, and increased fire risk.

Many timber roads and landings constructed for harvest are temporary or seasonal. If properly constructed with issues such as drainage adequately addressed, they represent short-term impacts. Permanent roads, however, can lead to long-term impacts associated with habitat fragmentation.

The fragmentation of forest habitats is a more significant threat to wildlife because it tends to be long term. The construction of permanent roads, and the installation of pipelines and other utilities impact forested areas via ground disturbance, the clearing of trees and understory species, as well as the bisecting of habitats.

Habitat fragmentation from road construction and pipeline installation occurs on lands that are open to development activities regardless of ownership. These impacts can be local, such as for a subdivision road or oil pad development, or regional as is the case for many oil and gas pipelines. The construction of roads often opens areas for additional settlement or development and can lead to the loss of habitat through conversion to other uses.

In May 2005 the Roadless Area Conservation Rule was repealed by the Bush Administration. This rule was issued by the USFS in January 2001 to protect areas within national forests that were currently roadless. “Roadless areas” are places where no roads have been constructed, and where as a result, no logging or other development has occurred. These areas provide unfragmented habitats that support fish and wildlife species under unaltered conditions, an increasingly rare situation.

Large-scale land conversion for development and settlement is the single greatest threat to Alaska’s forest habitats. The loss of forest habitat through conversion to another use often results in a permanent loss of that habitat. Many of these land use conversions are relatively unregulated, at least in comparison to timber harvest activities. The FRPA (Forest Resources and Practices Act) does not apply to the clearing of timber in order to convert the land to another use, and there is no comparably comprehensive act that addresses the development of land for uses such as agriculture, golf courses, mining, subdivision development, or other commercial uses.

Mining activities in Alaska threaten forest habitats by conversion, and may contribute pollution to associated waters from mine tailings and chemicals used during the extraction process. Recent advances in technology have allowed for the use of lower grade ores and spurred renewed interest in mining operations.

Lastly, impacts such as insect infestation, similar to the spruce bark beetle that may flourish under warming climatic conditions, will likely continue to alter Alaska’s forest habitats.

The Alaska FRPA and its associated regulations govern commercial timber harvest activities on state, municipal, and private forestlands. This statue identifies and requires the use of specific best management practices (BMPs) for timber harvest activities. The Alaska Department of Natural Resources Division of Forestry (DOF) administers the provisions of the act and provides oversight of commercial forest harvest activities pursuant to FRPA.

The Department of Environmental Conservation (DEC) and DNR’s Office of Habitat Management and Permitting (OHMP) coordinate with the DOF in implementing FRPA and perform specific oversight roles themselves. DEC is given deference in matters related to water quality issues, and the OHMP receives deference in regard to the protection of riparian buffers within harvest areas.

Timber harvest activities on federal forestlands are not subject to FRPA; however, the management standards on federal land generally meet or exceed the FRPA standards. Most timber harvest occurs on Alaska’s 2 national forests, and falls under the regulatory jurisdiction of

the USFS. The forest planning process allows for public review and has a large public involvement component.

The State of Alaska owns approximately 24.9 million acres of forested lands (Department of Commerce Community and Economic Development 2005). The use of these lands is regulated by area or regional plans. Generally, regional plans have been developed, or will be developed under the sustainable yield and multiple use principles and for consistency with AS 41.17. Regional plans have been completed for about two-thirds of all state land. Where no plan exists, a site-specific plan must be adopted under AS 38.04.065(h) to classify the land before a timber sale can occur.

Approximately 2 % of the state's forested lands, or just over 2 million acres, is within 2 designated state forests. The 247,000-acre Haines State Forest, established by the legislature in 1982, includes the Chilkoot, Chilkat and Ferebee drainages in the northern portion of Southeast Alaska. In Interior Alaska, the 1.8 million-acre Tanana Valley State Forest, which extends from Manley to Tok, was created in 1983. The primary purpose in establishing state forests is to provide for the production, utilization, and replenishment of timber resources while allowing other beneficial uses of public land and resources (AS 41.17.200[a]).

The DOF manages forests on state land that have been classified as timberlands via implementation of the FRPA. The FRPA delineates 3 management regions: Region I, Region II, and Region III. These regions correlate with the Southeast, Southcentral, and Northern areas of the state. The FRPA establishes district riparian standards for each of these regions.

The DOF plans for timber management on state lands by first reviewing existing regional plans to ensure that proposed actions are consistent, and then preparing a Five-Year Schedule of Timber Sales. These schedules are prepared annually by each of the DOF's 10 area offices, and provide the public, the timber industry, and agencies with an overview of proposed timber harvest areas, timber sale access and reforestation plans.

The next step is preparation of a Forest Land Use Plan (FLUP) for each proposed timber sale or personal use harvest area on state lands. FLUPs provide information on the location, access, harvest methods, duration, and proposed reforestation for individual sale. FLUPs are required to follow the multiple use and sustained yield principles. Consideration must be given to current, past, and potential uses of the land, including timber harvesting for commercial and personal use; fish and wildlife habitat; water bodies, water quality and watersheds; riparian, wetland and ocean shoreline vegetation; recreation and tourism; agriculture and grazing; mining and material extraction; and soil characteristics. FLUPs are subject to public and agency review for sale approval or denial. Current FLUPs exist for Fairbanks, Delta, Kenai-Kodiak (combined), Northern Southeast (Haines), southern Southeast (Ketchikan), and the Matanuska-Susitna areas.

Once a timber sale is adopted, a contract is issued either through the bid process or via negotiations. The FRPA requires that timber operators submit a Detailed Plan of Operation (DPO) for timber harvest activities that are subject to the Act. In addition to state lands, this includes harvests on municipal and private forestland.

State timber sales with the Coastal Zone must be consistent with the ACMP and local Coastal Zone Management Plans. The standards contained in the FRPA are the coastal standards for timber harvesting, so if timber sales comply with the act, they are consistent. The DOF must issue proposed and final coastal consistency determinations under the timelines set by 11 AAC 150.

As mentioned above, timber harvests on municipal and private lands are also subject to provisions found in the FRPA. These provisions apply to the harvest activities themselves; municipal and private lands do not typically have a planning process that is analogous to that for state lands. The FRPA does treat municipal and private lands differently from state lands with regard to riparian standards. Public lands typically have stricter riparian standards than private lands, including having wider riparian buffers with wider no-cut zones adjacent to water bodies.

In Alaska, private forestlands include those owned by Native corporations, universities, the Alaska Mental Health Trust Authority, and private citizens. Approximately 30 million acres of Alaska's forestlands are privately owned (Department of Commerce Community and Economic Development 2005). Timber harvests on municipal and privately owned forestlands within the coastal zone are regulated in the same manner as state lands. DPOs must be submitted, and the DOF is responsible for ensuring consistency by regulating adherence to the FRPA standards. Forest habitats within legislative designated Special Areas are afforded some protection from development under management plans specific to those areas.

Federal forested lands fall under the jurisdiction of federal management agencies. Approximately 77 million acres of Alaska's forests are federally owned (Department of Commerce Community and Economic Development 2005). The USFS is responsible for Alaska's 2 national forests, the Chugach and the Tongass. The Tongass National Forest is the largest single forest ownership in the state. It is located in Southeast Alaska and contains 46% of Alaska's timberland. The Tongass National Forest consists of 16.9 million acres, of which 4% is available for commercial timber harvest. The second largest federally owned forest is the Chugach National Forest. Located in Southcentral Alaska, this forest encompasses much of the Prince William Sound area and consists of 5.3 million acres.

Federal lands managed by agencies other than the USFS are not typically managed for commercial timber harvest. There are 17 units of the National Park System in Alaska under the management of the National Parks Service; 10 were created in the 1980s through ANILCA. The USFWS manages the 16 national wildlife refuges in Alaska. The BLM manages its own lands specific to their land-use plans developed to sustain the health and diversity of natural resources.

Recommended conservation actions for Alaska's forest habitats include the establishment and maintenance of protected areas, forest practices that provide for sustainable timber harvest in designated areas, support for efforts to eliminate wasteful consumption and lastly, where needed, appropriate forest restoration programs.

Projects involving the development of protected forested areas, understanding species/habitat relationships and sustainable forest management are critical to the conservation of Alaska's boreal forests and coastal temperate rain forests.

Monitoring and research efforts that reduce impacts to forest habitats from mining operations, road construction, and timber harvest should be emphasized.

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