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THE FOREST ECOSYSTEM OF SOUTHEAST ALASKA

4. Wildlife Habitats

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ABSTRACT

The effects of logging and associated activities on the habitat of the major forest wildlife species in southeast Alaska are discussed and research results applicable to this region are summarized. Big game, furbearers, and nongame species are considered with respect to their habitat requirements and behavior.

Recommendations are made for habitat management with primary concern for wildlife populations. Future needs for wildlife habitat research in southeast Alaska are presented.

Keywords: Wildlife management, wildlife conservation, habitats, forest clearcutting, wildlife food plants.

PREFACE

This is the fourth in a series of publications summarizing knowledge about the forest resources of southeast Alaska.

Our intent in presenting the information in these publications is to provide managers and users of southeast Alaska's forest resources with the most complete information available for estimating the consequences of various management alternatives.

In this series of papers, we will summarize published and unpublished reports and data as well as the observations of resource scientists and managers developed over years of experience in southeast **Alaska**. These compilations will be valuable in planning future research on forest management in southeast Alaska. The extensive lists of references will serve as a bibliography on forest resources and their utilization for this part of the United States.

Previous publications in this series include:

1. The Setting
2. Forest Insects
3. Fish Habitats



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¹Much of this paper is based on an unpublished report by Dr. Neil J. Hosley. Also see Hosley (1969).

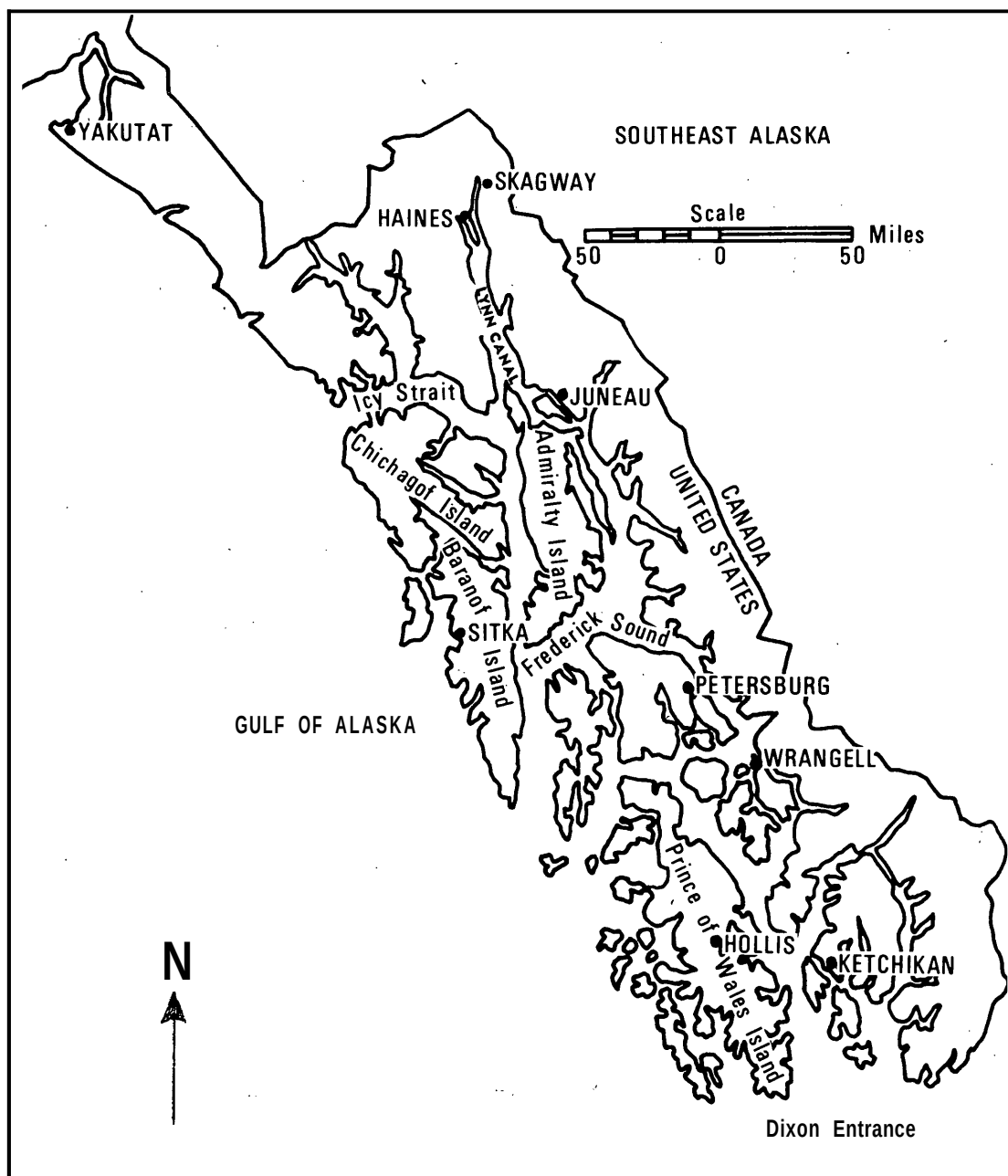


Figure 1.--Map of southeast Alaska east of the 141st meridian.

INTRODUCTION

The effects of man's activities on the habitat of wild animals in southeast Alaska (fig. 1) has only recently been of much concern. Construction of the first pulp mill in southeast Alaska was completed less than 20 years ago, so the potential problems which timber harvesting might cause with respect to wildlife habitat and populations have not yet become readily apparent. Many of the principles of wildlife management which have been developed in other parts of the country can be applied to southeast Alaska; however, this region is sufficiently different in many respects from other areas to warrant a significant local research program.

To date the research effort devoted to better understanding wildlife populations and their habitat in southeast Alaska has been minimal. The Alaska State Department of Fish and Game has studied deer populations for several years and has initiated a study of the distribution and movements of brown bears. The Bureau of Sports Fisheries and Wildlife has for several years been investigating the biology and habitat requirements of the bald eagle. The U.S. Forest Service has done some work in assessing habitat requirements of brown bears. All these agencies, as well as the wildlife department of the University of Alaska, have contributed information about the wildlife populations of southeast Alaska. However, the general lack of information limits the ability of habitat managers to make the best decisions in many instances.

The purpose of this report is to briefly summarize the known habitat requirements of southeast Alaska's major wildlife species and to point out some of the areas where further research is needed for effective management of wildlife populations and habitat.

HABITAT VEGETATION

The forests of southeast Alaska are divided at about latitude 56° N. into two general types. North of this line the forest is primarily western hemlock and Sitka spruce. South of the division line western redcedar and Alaska-cedar are represented to a greater extent (Taylor 1953).

The Tongass National Forest, which takes in most of southeast Alaska's forested area, covers 15,915,000 acres, of which 11,321,000 acres are considered commercial forest. Timber species include 57 percent hemlock, 22 percent hemlock-spruce, 14 percent spruce, and 7 percent cedar. Approximately 95 percent of the total forest is in old-growth stands (Hutchison 1967).

Taylor (1932b) and Palmer² listed common wildlife habitats and their important plant species as follows.³

1. Beach fringe

Oregon crab apple, *Malus diversifolia* (Bong.) Roem.
Red alder, *Alnus rubra* Bong.
Sitka alder, *Alnus sinuata* (Reg.) Rydb.
Willow, *Salix* L.
Red-osier dogwood, *Cornus stolonifera* Michx.
Sedge, *Carex* L.
Beach ryegrass, *Elymus arenarius* L.
Large-flowered spear-grass, *Poa eminens* Presl
Fescue grass, *Festuca* L.
Bluejoint, *Calamagrostis canadensis* (Michx.) Beauv.
Reed bent grass, *Calamagrostis nutkaënsis* (Presl) Steud.
Bent grass, *Agrostis* L.
Manna grass, *Glyceria pauciflora* Presl
Meadow barley, *Hordeum brachyantherum* Nevski
Beach pea, *Lathyrus maritimus* L.
Beach lovage, *Ligusticum scoticum* L.
Nootka lupine, *Lupinus nootkatensis* Donn
Goose-tongue, *Plantago maritima* L.
Arrow grass, *Triglochin maritimum* L.
Seabeach sandwort, *Honckenya peploides* (L.) Ehrh.
Sea milkwort, *Glaux maritima* L.
Small bedstraw, *Galium trifidum* L.
Cleavers, *Galium aparine* L.
Seaside crowfoot, *Ranunculus cymbalaria* Pursh
Western buttercup, *Ranunculus occidentalis* Nutt.
Yellow monkey flower, *Mimulus guttatus* DC.

2. Climax forest

Western hemlock, *Tsuga heterophylla* (Raf.) Sarg.
Sitka spruce, *Picea sitchensis* (Bong.) Carr.
Western redcedar, *Thuja plicata* Donn
Mountain hemlock, *Tsuga mertensiana* (Bong.) Carr.
Alaska-cedar, *Chamaecyparis nootkatensis* (D. Don) Spach
Early blueberry, *Vaccinium ovalifolium* Sm.
Red huckleberry, *Vaccinium parvifolium* Sm.
Devilsclub, *Oplopanax horridus* (Sm.) Miq.
Pacific red elder, *Sambucus callicarpa* Greene
Salmonberry, *Rubus spectabilis* Pursh
Rusty menziesia, *Menziesia ferruginea* Sm.
Bunchberry, *Cornus canadensis* L.
Goldthread, *Coptis* Salisb.
Club-moss, *Lycopodium* L.
Cucumber-root, *Streptopus amplexifolius* (L.) DC.

²L. J. Palmer. Major vegetative types of southeastern Alaska. U.S. Fish and Wildlife Service Report, 16 p., mimeographed, 1942.

³Tree and shrub species names mainly follow Viereck and Little (1972); herbaceous plant names mainly follow Hultén (1968), Anderson (1959), or Kelsey and Dayton (1942).

Simple-stemmed twisted-stalk, *Streptopus roseus* Michx.
 Kruhsea, *Streptopus streptopoides* (Ledeb.) Frye & Rigg
 Single delight, *Moneses uniflora* (L.) Gray
 Lace flower, *Tiarella* L.
 Five-leaf bramble, *Rubus pedatus* Sm.
 Deerberry, *Maianthemum dilatatum* (How.) Nels. & Macbr.
 Yellow skunk cabbage, *Lysichiton americanus* Hult. & St. John
 Single-flowered clintonia, *Clintonia uniflora* (Schult.) Kunth
 Spreading mod-fern, *Dryopteris dilatata* (Hoffm.) Gray
 Oak-fern, *Gymnocarpium dryopteris* (L.) Newm.
 Dagger-fern, *Polystichum munitum* (Kaulf.) Presl
 Lady fern, *Athyrium filix-femina* (L.) Roth
 Deer-fern, *Blechnum spicant* (L.) Roth
 Salal, *Gaultheria shallon* Pursh
 Mertens coral-root, *Corallorrhiza maculata* Raf.
 Heart-leaved twayblade, *Listera cordata* (L.) R. Br.

3. Open stream banks and meadows

Western thimbleberry, *Rubus parviflorus* Nutt.
 Lyall nettle, *Urtica Lyallii* S. Wats.
 Salmonberry, *Rubus spectabilis* Pursh
 High bushcranberry, *Viburnum edule* (Michx.) Raf.
 Pacific red elder, *Sambucus callicarpa* Greene
 Nootka rose, *Rosa nutkana* Presl
 Stink currant, *Ribes bracteosum* Dougl.
 Pacific serviceberry, *Amelanchier florida* Lindl.
 Fireweed, *Epilobium angustifolium* L.
 Hornemann willow-herb, *Epilobium Hornemannii* Rchb.
 Cow parsnip, *Heracleum lanatum* Michx.
 Goatsbeard, *Aruncaus sylvester* Kostel.
 Yellow monkey flower, *Mimulus guttatus* DC.
 Alpine heuchera, *Heuchera glabra* Willd.
 Kamchatka fritillary, *Fritillaria camschatcensis* (L.) Ker-Gawl.
 Western columbine, *Aquilegia formosa* Fisch.
 Bongard buttercup, *Ranunculus Bongardi* Greene
 Western buttercup, *Ranunculus occidentalis* Nutt.
 Northern geranium *Geranium erianthum* DC.
 Shooting star, *Dodecatheon* L.
 Beach strawberry, *Fragaria chiloensis* (L.) Duchesne
 Saxifrage, *Saxifraga* L.
 Sitka great burnet, *Sanguisorba stipulata* Raf.
 Bent-leaved angelica, *Angelica geniflexa* Nutt.
 Hemlock parsley, *Conioselinum chinense* (L.) BSP.
 Beach lovage, *Ligusticum scoticum* L.
 Villous cinquefoil, *Potentilla villosa* Pall.
 Silverweed, *Potentilla anserina* L.
 Alaska violet, *Viola Langsdorffii* Fisch.
 Stream violet, *Viola glabella* Nutt.
 Deer cabbage, *Fauria crista-galli* (Menzies) Makino
 Long-leaved starwort, *Stellaria longifolia* Muhl.
 Siberian spring beauty, *Claytonia sibirica* L.
 Baneberry, *Actaea rubra* (Ait.) Willd.
 Delphinium-leaved aconite, *Aconitum delphinifolium* DC.
 Nootka lupine, *Lupinus nootkatensis* Donn
 Beach pea, *Lathyrus maritimus* L.

4. Muskegs

Western hemlock, *Tsuga heterophylla* (Raf.) Sarg.
Lodgepole pine, *Pinus contorta* Dougl.
Western redcedar, *Thuja plicata* Donn
Alaska-cedar, *Chamaecyparis nootkatensis* (D. Don) Spach
Labrador-tea, *Ledum groenlandicum* Oeder
Bog laurel, *Kalmia polifolia* Wang.
Crowberry, *Empetrum nigrum* L.
Bog-rosemary, *Andromeda polifolia* L.
Mountain-cranberry, *Vaccinium vitis-idaea* L.
Bog blueberry, *Vaccinium uliginosum* L.
Rusty menziesia, *Menziesia ferruginea* Sm.
Salal, *Gaultheria shallon* hrsh
Sundew, *Drosera* L.
Cotton grass, *Eriophorum* L.
Bunchberry, *Cornus canadensis* L.
Starflower, *Trientalis europaea* L.
Cloudberry, *Rubus chamaemorus* L.
Nagoon-berry, *Rubus arcticus* L.
Rush, *Juncus* L.
Yellow skunk cabbage, *Lysichiton americanum* Hult. & St. John
Silverweed, *Potentilla anserina* L.
Deerberry, *Maianthemum dilatatum* (How.) Nels. & Macbr.
Club-moss, *Lycopodium* L.
Bracken, *Pteridium aquilinum* (L.) Kuhn
Yellow marsh marigold, *Caltha palustris* L.

5. Alpine meadows

Crowberry, *Empetrum nigrum* L.
Aleutian heather, *Phyllodoce aleutica* (Spreng.) Heller
Mertens mountain heather, *Cassiope Mertensiana* (Bong.) D. Don
Luetkea, *Luetkea pectinata* (Pursh) Ktze.
Alpine azalea, *Loiseleuria procumbens* (L.) Desv.
Alaska blueberry, *Vaccinium alaskensis* How.
Arctic wormwood, *Artemisia arctica* Less.
Arctic willow, *Salix arctica* Pall.
Nootka lupine, *Lupinus nootkatensis* Donn
Narcissus-flowered anemone, *Anemone narcissiflora* L.
Spotted saxifrage, *Saxifraga bronchialis* L.
Coast saxifrage, *Saxifraga fermginea* Graham
Purple mountain saxifrage, *Saxifraga oppositifolia* L.
Prickly saxifrage, *Saxifraga tricuspidata* Rottb.
Sibbaldia, *Sibbaldia procumbens* L.
Caltha-leaved avens, *Geum calthifolium* Menzies
Broad-petaled gentian, *Gentiana platypetala* Griseb.
Holy grass, *Hierochloë alpina* (Sw.) Roem. & Schult.
Alpine bluegrass, *Poa alpina* L.
Stiff club moss, *Lycopodium annotinum* L.
Kamchatka fritillary, *Fritillaria camschatcensis* (L.) Ker-Gawl.
Sedge, *Carex* L.
Bunchberry, *Cornus canadensis* L.
Coastal fleabane, *Erigeron peregrinus* (Pursh) Greene
Deer cabbage, *Fauria crista-galli* (Menzies) Makino
Nagoon berry, *Rubus arcticus* L.
Salmonberry, *Rubus spectabilis* Pursh

Inside the forest, skunk cabbage occurs in the wet hollows; devilsclub, Pacific red elder, and salmonberry are found in the openings; and ericaceous shrubs and herbs occur in stands with a large percentage of hemlock.

Avalanche areas generally have as pioneer species fireweed, horsetails, goatsbeard, club-moss, crowberry, mountain-cranberry, alder, Pacific red elder, and stink currant.

Steeper, drier slopes are likely to have many lichens and such species as crowberry and mountain-cranberry. More gentle slopes with deeper soils maintain alder, elder, currant, and goatsbeard.

Taylor (1932a) found that, as site quality decreased, *Cornus* and *Vaccinium* increased. Increases in site quality showed increases in salmonberry and devilsclub. Willows are virtually lacking on the islands of southeast Alaska and, generally, are not important as food for wildlife on the mainland.

By comparing known food habits with Taylor's (1932b) common habitat descriptions, we can arrive at some idea of use of these habitats by the important game animals of southeast Alaska (table 1). The alpine habitat use shown in this table was not included by Taylor, probably because very little was known about the use of alpine vegetation by wildlife in southeast Alaska at that time, as well as today. Nevertheless, alpine habitat utilization is included, based on small bits of information gathered from several sources.

Table 1.--Number of plant species used¹ by Southeast Alaska game species, by habitat types

Habitat types	Black bear	Brown bear	Black-tailed deer	Moose	Mountain goat	Blue grouse
Beach fringe	1	1	3	2	1	1
climax forest	8	12	12	13	12	14
Open stream-banks and meadows	4	4	5	10	6	6
Muskegs	3	5	3	3	3	5
Alpine meadows	8	9	11	10	6	10
Pioneer communities	2	2	2	2		
Avalanche areas	3	5	4	2	2	1

¹Use is primarily as food, occasionally as cover.

GAME SPECIES AND HABITAT

BLACK BEAR (*Ursus americanus*)

In southeast Alaska, the black bear is found along the forested mainland and on the larger islands south of Frederick Sound. As the continental glacier receded, this bear apparently came from a southern refugium. It is associated with forests while the brown bears are more adaptable (Klein 1965b).

The black bear prefers semiopen forest areas with fruit-bearing pioneer shrubs and herbs, lush grasses, and succulent forbs (Erickson 1965a). Dufresne (1955) felt that burns were favored by black bears for their subsequent berry patches. Cutover areas, then, if not too large, should also afford favorable habitat.

The black bear is omnivorous (Seton 1929). In spring the food is predominantly plant material. Skunk cabbage is a favorite at this time, Hatler (1965-66) found horsetails in 86 percent of food samples. Additional items are grasses, wild rhubarb, bedstraw, and lousewort. Cranberries contribute to the spring diet in some areas (Hatler 1965-66), and intertidal sedges are frequently utilized.

As summer approaches, the herbaceous foods are supplemented by a wide variety of fruit-bearing plants' (Erickson 1965a). Where available, salmon are a favorite summer food. Skunk cabbage is still taken (Dufresne 1955).

In fall the chief foods are crowberries, cranberries, raspberries, blueberries, and wild crab apples. Salmon continue to be taken when possible. In late fall, foods become scarce and grass is again a staple (Erickson 1965a).

Animal matter is a minor part of the diet. Besides fish, insects and mussels are taken, and carrion is accepted and relished. They may occasionally take deer fawns.

Following clearcut logging in southeast Alaska, an increase in food materials available to black bears may result in increases in bear populations. However, as the new stands close in and food supplies decrease, bear populations likewise may decline. Lauckhart (1955) stated that feeding may take place on newly-formed sapwood of trees 25 to 45 years old, resulting in weakened or killed trees, but this condition has rarely been observed in southeast Alaska.

BROWN BEAR (*Ursus arctos*)

The brown bear of coastal Alaska and the grizzly of the interior areas are alike in most respects. Although we are concerned only with the brown bear in this publication, some observations of grizzly bear habitat may apply,

In southeast Alaska brown bears are restricted to the mainland and Admiralty, Baranof, and Chichagof Islands. The greatest densities are on the islands; on the mainland, abundance is localized around the

larger river valleys of the Coast Mountains (Erickson 1965b; Klein, Troyer, and Rausch 1958). Following the retreat of the continental glacier, brown bears apparently immigrated to their southeast Alaska range from a northern refugium. This range suggests their arrival very early in the postglacial period, possibly before the sea level had risen and prior to the arrival of the black bear and most ungulates (Klein 1965b).

Although much remains to be known about brown bear habitat requirements, some generalities can be made. Substantial mountain meadows or grassland areas are important in the southeastern Alaska bear range. The denser bear populations occur where there are lush grassland types (Erickson 1965b). Beach grass and sedge flats are an important source of spring food (fig. 2). Most feeding on tideflats and beaches is along a forested fringe, indicating need for this type of cover (Perensovich 1964).



Figure 2.--Brown bears seasonally utilize the beach fringe for food, Admiralty Island.

Resting cover is often at or above timberline; hibernation also occurs at or above timberline (Lentfer et al. 1970). Sunny areas are used when the weather is cold, alders furnish hot weather cover, and snowbanks are used when flies are troublesome (Seton 1929).

Over a 30-year period, the belief has been that logging need not interfere with existing bear numbers. On Admiralty Island, for instance, not over 40 percent of the area *can* be logged. Sustained yield management with a rotation of 75 to 85 years would result in a small part of the area being logged at any one time (Heintzleman 1939). There appears to be no general shift of bear populations from cutting areas. Even in the neighborhood of active logging, bears continue to feed, generally at night, on salmon streams. However, the timber around two adjoining bays should be logged at different times.⁴ Wherever possible, log rafts should be located where they will not destroy the vegetation of tidal flats or disturb bear activity.

Effects of logging on brown bear populations are more likely to be caused by the human element than by changes in environment. Proper garbage disposal, so as not to attract bears, would eliminate much of the killing of "nuisance" animals. Around permanent or seasonal communities, brown bears are eliminated to protect property or just to avoid having them around. Fishermen often shoot bears because they are believed to be a **competing** predator.

Williams (1952) felt that logged areas supplemented by blowdowns and burns were important in furnishing food, shelter, and sanctuary for bears. It is generally agreed that, for a period of perhaps 20 years, cutover areas have a greater vegetable food supply for bears than the old-growth forest (Heintzleman and Terhune 1934). An increase in small mammals, which bears eat, may also be found in cutover areas. Early pioneer stages of succession with abundant grasses and herbs appear to be especially attractive. These are scarcely represented in climax timber stands (Erickson 1965b).

Although salmon and brown bears are usually considered inseparable, bears do not entirely forsake the highlands (Murie 1959). Some bears apparently do not visit salmon streams. These *seem* to be old males unable to hold their place on the streams, males recovering from fighting at streams, and females with cubs of the year. Stonorov and Stokes (1970) noted that large bears were the dominant bears fishing at the McNeil River Falls on the Alaska Peninsula, while next in order of dominance were females with cubs 1- or more-years-old. Ten percent were estimated to not use the salmon streams (Heintzleman and Terhune 1934,⁵). Erickson (1965b) stated that, when berry crops ripened, bears frequently left salmon streams. Favored fruits are blueberries, cranberries, and salmonberries. Meehan (1961) considered highbush cranberries to be a major food. In spring, animals killed by avalanches or those which starved during the winter are sought out. Clark (1957) gave elderberry,

⁴Michael M. Perenovich, Jr. Brown bear studies--progress report, 1965. U.S. Forest Service, North Tongass National Forest, Unpublished report, 10 p., 1965.

⁵Frank Dufresne and Jay P. Williams. Admiralty Island bear estimate. U.S. Department Agriculture, Alaska Game Commission, and U.S. Forest Service, p. 1-8, 1932.

highbush cranberry, crowberry, and bearberry as bear foods on Kodiak Island. He estimated that, over the year, grazing and the use of berries accounted for three-fourths of the diet.

In areas logged by high-lead, Perenovich (1964) found that the ground cover and shrubby plant species 2 years after logging were essentially the same as before. One year after logging the available quantities of blueberry, devilsclub, rusty menziesia, bunchberry, deerberry, salmonberry, skunk cabbage, and Pacific red elder had been reduced by the mechanical effects of logging. However, by the second year, recovery was well under way and it seemed probable that within 5 years after logging the quantity of bear foods would be greatly increased.

Little information is available on the brown bear's need for cover. Holzworth (1930) says that, while not feeding or roaming, bears return to certain thickets to rest. He also said that they like to sit for hours on a high ledge,

So far as escape cover is concerned, bears unquestionably make good use of coniferous stands and alder thickets. This raises the question of whether or not young stands a few years after logging would provide an effective cover.

With the possible exception of the wolf, no Alaskan game animal produces such diverse opinions about its welfare as the brown bear. Many commercial fishermen would like to see bear numbers reduced, or even eliminated. The Kodiak stockmen would like the bears eliminated from their vicinity, if not from the island. Bear hunters would like the complete island of Kodiak given over to bear production. Biologists, doing their best to determine populations, distribution, annual production, and harvests, believe the bears of southeast Alaska could safely take a higher harvest. Those interested in guided hunts contend that the harvest should be lighter to produce large trophies for the few. An outdoor writer says that logging spells doom for the bear, while indications from sample plots on cuttings point to better conditions for bears. All these conflicting opinions emphasize the need for continuing and more intense fact-finding. Many of the answers can be obtained only over a fairly long period. Others require greater intensity of effort. And, after the answers are available, education of the public will be necessary for general support for a given program. When there is a better understanding of the brown bear's habitat requirements, the effects of logging will be better understood.

SITKA BLACK-TAILED DEER (*Odocoileus hemionus sitkensis*)

The Sitka black-tailed deer came to southeast Alaska from the south, following the retreat of the last continental ice sheet (Klein 1965b). It is found throughout the island archipelago and along the mainland from Dixon Entrance north to Icy Strait and lower Lynn Canal (fig. 1). Stocking, over a 30-year period, extended the range to Yakutat, Prince William Sound, and Kodiak Island (Olson 1953). In this general area along the coast, the winter mean temperature is about 32° F., and precipitation is 60 to 150 inches per year. Cold, interior air tends to offset the warm flow from the coast. To the north and east, deer numbers decrease rapidly. Inland, on eastern slopes, precipitation is much less

and spruce-hemlock forests are replaced by spruce-fir-birch types. The deer has never adapted to this drier situation. Even in the more favorable coastal climate, severe winters have occurred periodically and deer losses are high. The deep snows and colder winters of the mainland create less desirable habitat than is found on the adjacent islands (Klein 1965b). The dissected island coastlines afford more winter range in proportion to land area than is the case on the mainland. This relationship of land area to the amount of coastline is believed to be pertinent in deer distribution (Olson 1953).

The deer, in severe winters, may be confined to the beach fringes. However, it seems that they are able to range back to the point where snow is at least 15 inches deep. Except in winters of unusually deep snow, the deer range to elevations of at least 1,500 feet. During mild winters in southeast Alaska, very few deer may be found on the beaches as late as January. They come down to lower elevations only as far as they are forced by snow (Olson 1952).

In a study of deer-vegetation relationships on two islands in southeast Alaska, Klein (1965a) attributed better condition of deer and their range on one island basically to the more severe climate. The island with the better deer herd and range was near the mainland and had deep snows frequently enough to cause severe deer losses. This mortality prevented serious overuse of the range. On the other island, which was on the western edge of the Alexander Archipelago and experienced a much milder climate with only light snowfalls, the greater deer population pressure kept the range overbrowsed and even eliminated some of the more nutritious forage species.

Klein (1965a) also observed that vegetation from alpine and muskeg areas is of higher forage quality than from forested areas. Soils are important in determining quantity and types of vegetation but are less important than altitude, exposure, and cover type in affecting forage quality.

Spring and summer are times of high deer metabolism and nutritional demands. However, as the quantity of food increases in summer, quality decreases because of maturity in the plants. Spring and summer are the critical periods for deer growth. Winter is a period of growth dormancy, and dietary deficiencies may cause death because of loss of condition. The physiological activity of the bucks increases in spring--a surplus of fat should build up before the rut, which is the period of greatest physiological drain. With does the greatest drain is during lactation (Klein 1965a).

In another study, Klein (1957) found that the largest deer were in areas with a high proportion of land above timberline. He thought that logging, *if extensive clearcuts were avoided*, would benefit deer. In southeast Alaska, snow depths of over 2 feet make food in large clearcuttings unavailable while, in uncut timber, deer can still find food. In this sense, cutting might reduce winter range. Also, it emphasizes the need for leaving uncut strips along beaches. Animal die-offs can occur when food is either good or poor because everything in the way of food becomes unavailable.

In British Columbia, Cowan (1945) found deer numbers very low in large areas of climax coastal forest (one deer per square mile), while in cutover areas with regenerating vegetation there were 20 deer per square mile. He believed that clearcutting small blocks, with unlogged blocks between, would provide nearly optimum conditions for deer.

In summer, Sitka black-tails prefer succulent plants, grasses, and herbaceous foods to browse (Olson 1952). Tree moss is eaten in summer and is also rated high as a winter food (Cowan 1945).

Traditionally Sitka deer populations have been thought of as having heavy, periodic mortality. This has resulted from deep snows forcing the animals onto a narrow strip along the beaches. Food supplies may still be adequate, but deep snow makes it unavailable. Recovery from a die-off seems fairly rapid, so periods of "overpopulation" result (Klein and Olson 1960).

Based on experience on Vancouver Island (Robinson 1958), cuttings in old stands in southeast Alaska should result in an increase of deer food. However, since winter temperatures in southeast Alaska are lower and snow accumulation at or near sea level is greater, it does not necessarily follow that deer populations will also increase. As the new stands mature and preferred browse is gradually overtaken by conifers, less food is available and numbers and condition of deer should decline. Production would then continue at a low level until new cuttings became available. In British Columbia the patchwork logging for pulpwood was considered ideal for game production (Robinson 1958). Cowan (1951) sums up present management by saying that, since winter range is so limited, the minimum carrying capacity in years of severe climatic conditions is the safe carrying capacity.

Management should aim at forage availability somewhere between that of a mild and that of severe winter range. It should anticipate fluctuations in the basic herds and manage the populations accordingly. This involves perfecting techniques for appreciating changes when they occur and providing biological knowledge and legislative means for taking advantage promptly of all management opportunities. This is the ideal which can be reached in southeast Alaska only after herd increases *can* be fully utilized. Under present hunting pressures, the ideal winter is one in which there is some die-off but in which extreme losses do not occur.

The wolf is the only serious predator on deer in southeast Alaska. It is restricted to the mainland and the islands southeast of Frederick Sound (Klein and Olson 1960). Wolves theoretically have a greater reproductive potential than deer, but mortality and social factors operate to prevent wolves from overrunning their food supply (Rausch 1966). Merriam⁶ concluded that on small islands (e.g., 30 square miles), deer populations can be practically exterminated by wolves; but on larger islands (e.g., 150 square miles) wolves and deer are likely to develop

⁶Harry R. Merriam. Relationship between deer and wolves on Coronation Island, southeast Alaska. Paper presented at Northwest Section, Wildlife Society, La Grande, Oregon, 3 p., 1966.

a balance. However, under certain conditions, e.g., severe winters and scarcity of alternate prey species, wolves may severely depress declining populations of moose or other ungulates.

To summarize our present knowledge of the Sitka black-tailed deer, the situation is one of good deer populations and limited use. Deer are found throughout the islands and mainland from Dixon Entrance to Icy Strait. From an estimated population of 250,000, only about 5-percent harvest was estimated for 1966. To balance productivity with harvest, at least four times as many deer could be taken.

Logging will produce greater total amounts of deer food over a period of perhaps 20 years following cutting. However, the critical winter use is limited by snow depths; and in periods of deep snows, deer may be confined to available old-growth stands at low elevations. Regardless of increased summer browse, a decrease in these old-growth stands could result in a net decrease of deer numbers.

Wolves are the only important predator on the deer of the region. No wolves are found on Admiralty, Baranof, and Chichagof Islands. Although they are a desirable check in some deer areas, wolves have been shown to decimate the deer on small islands. They may also suppress already declining populations of moose or other ungulates in some cases.

Probably the greatest problems at present in southeast Alaska deer management are (1) identifying, determining carrying capacities of, and maintaining major deer winter ranges, and (2) harvesting deer populations so that maximum recreational values are realized with continuing high productivity (Klein 1957).

MOOSE (*Alces alces*)

With the exception of the Yakutat area, moose in southeast Alaska are presently found only in scattered areas. These are mainly in the larger river valleys which originate in Canada. The moose have moved down these rivers (except for a herd at Berner's Bay which is the result of a stocking program). They have occasionally strayed to the islands near the Stikine such as Wrangell, Woronkofski, and Mitkof; however, establishment there is doubtful because winter forage is virtually nonexistent. The occupied southeast Alaska range coincides with the occurrence of cottonwood, willow, and elder (Olson 1953).

All the important moose ranges of southern Alaska have resulted from disruption of the original forest, producing second growth and abundant food. In southeast Alaska much of the important range was produced by glacier recession. Pulpwood logging, if properly planned, may increase the possible moose range in southeast Alaska where hardwoods are present or would become established. Spencer and Chatelain (1953) state that fire, beaver activity, flooding, ice activity, glacier recession, and land clearing all contribute to moose range. Chatelain (1952) stated that all important moose ranges are in transition. The early stages of succession are most favorable, and mixed stands are best (Peterson 1955).

On the Kenai National Moose Range, hardwood food production increased significantly in 5 years and reached a peak 17 years after a burn. A high level of production was being maintained for 16 to 18 years and was expected to be lost in another 20 years. Three years after the fire the burn area supported 15 percent of the moose in the Refuge and after 11 years, 60 percent (Spencer and Hakala 1964).

Obviously, southeast Alaska, with its paucity of hardwood moose foods, is much less favorable range than the Kenai Peninsula or the interior.

Canadian experience has shown that the best moose range is one with a variety of palatable species, predominantly in an early stage of growth, but with an intermix of older forest stands bearing palatable coniferous trees (Cowan, Hoar, and Hatter 1950). The populations declined, due to malnutrition, as the climax stage approached. This involves about a two-third reduction in palatable browse. As the forest ages, carotene values and possibly total mineral content increase. However, at the same time, ascorbic acid, ether extractives, total carbohydrates, and proteins decrease. So, the declining carrying capacity, as the forest approaches the climax, is due to decreases in both quantity and quality of food produced.

Winter food supplies ordinarily regulate moose populations in a given area (Leopold and Darling 1953). Alaskan moose depend heavily on willow and birch in winter and cannot survive on alder (Alaska Department Fish and Game 1962). Le Resche and Davis (1971) found that on the Kenai Peninsula lowbush cranberry and forbs were heavily used by moose during the winter, depending primarily upon snow depth.

Viereck⁷ found that willows of the 'Yakutat foreland' were the major winter food for a large herd of moose. The area has had much uplift and subsidence causing extensive areas of successional vegetation (willows and black cottonwood). This area probably will not remain highly productive for more than 20 to 30 years. Rather heavy moose browsing keeps willows producing and may slow succession.

In summary, moose ranges of southeast Alaska are limited in extent due to the scarcity of suitable food species. Pulpwood cuttings may enlarge these ranges, but this depends on whether or not willow and cottonwood will invade the cuttings.

MOUNTAIN GOAT (*Oreamnos americanus*)

The southeast Alaskan range of the goat is in the coastal mountains from Portland Canal north through the St. Elias Mountains. It is not native to the islands of the Alexander Archipelago, but a sizable herd has been established on Baranof Island*.

⁷L. A. Viereck. Yakutat willow report. Forestry Sciences Laboratory, Institute of Northern Forestry, USDA Forest Service, College, Alaska, 13 p., typed, 1966.

⁸David R. Klein. A reconnaissance study of the mountain goat in Alaska. M.S. thesis, University of Alaska, 121 p., 1953.

The goat usually is found in rugged topography where it takes advantage of the protection afforded. However, in southeast Alaska, it is found below the most rugged topography at elevations of 3,000 to 3,500 feet. A coniferous forested area on steep slopes with rock outcrops is needed for winter range. This combination offers cover and access to food. Snow melts slowly above 4,000 feet so the use of alpine areas is for a comparatively short period. There is seasonal altitudinal movement from the high summer range to winter range below timberline. This migration usually takes place on the same mountain. However, erratic herd movements to new ranges sometimes occur. In late winter, shelter is considered an important need (see footnote 8).

The food of the goat is mainly grasses and sedges, with some browsing in winter. On winter range, almost any available food species (except alder) is taken (see footnote 8).

So far, goat populations have held up well, and there has been little concern about their management. It would seem, however, that there should be efforts to identify habitat types **used** as winter range by goats and to determine the relation of cuttings to goat populations, from the standpoints of availability and use of winter food and cover.

WOLF (*Canis lupus*)

There is probably no animal in North America toward which feelings have been more hostile than the timber wolf. Early settlers greatly feared wolves. To protect the cattle and sheep of the West, wolves were shot, trapped, and poisoned; then they were attacked as predators on big game. In Alaska the greatest concern ~~was~~ shown for the reindeer and caribou herds prior to statehood, but a general control campaign ~~was~~ carried on over the whole territory. Then the wolf came to be viewed in a new light. It ~~was~~ finally realized that, when abundant big game herds were not being harvested to keep in line with productivity, wolf predation could be an asset rather than a liability. And, although the wolf bounty continues in southeast Alaska, its validity is being questioned. The wolf is ~~now~~ protected in some areas as a big game trophy animal through closed seasons, bag limits, and limitation of airplane hunting.

Wolves are indigenous to most of southeast Alaska except Admiralty, Baranof, and Chichagof Islands. Historically they probably followed deer to the islands to which they could swim. Rausch (1966) suggested that both mortality and social factors operate to prevent wolves from overrunning their ungulate food supply. In southeast Alaska the main wolf foods are deer, beaver, and goat, with moose important in some areas.

It is difficult to draw a fine line between wolf predation which is beneficial and that which is harmful. For the most part there is a strong tendency over larger ranges for wolves to reach a natural balance with their ungulate prey. However, there is speculation that in some local situations wolves may be seriously depleting game populations, e.g., deer in the Petersburg and Wrangell area and moose at Yakutat and in the Taku River valley.

Probably the greatest service which wolves perform in southeast Alaska is not through keeping an equilibrium with deer but in reducing

overpopulations to a point where food plants can recover. Then, of course, the remaining animals attain a better condition (Merriam 1964).

In general, then, land uses which cause fluctuations in populations of prey species will indirectly contribute to the status of wolf populations.

BLUE GROUSE (*Dendragapus obscurus*)

In addition to wanting more big game such as elk, most southeast Alaska hunters would like more small game, and the blue grouse seems best suited of the upland species to produce this type of hunting.

Gabrielson and Lincoln (1959) stated that this is the only upland game bird of timbered areas in southeast Alaska. However, the same authors stated that Franklin's grouse has been recorded from Prince of Wales Island. The range of the blue grouse is given as throughout southeast Alaska from Glacier Bay south on the mainland and the islands, except Prince of Wales and many of the smaller islands to the west. However, a population does occur on Coronation Island, a small island west of Prince of Wales, so it is quite possible that they are also found on Prince of Wales Island.

In southeast Alaska, the blue grouse is found in the climax forests, muskegs, and subalpine forests (Weeden 1965). In summer it is found in forest edges, cuttings, and along roads from elevations of about 150 to 1,200 feet and in the forest edges and subalpine type from 2,100 to 2,600 feet. In late Summer and fall, it is common at timberline, feasting on berries and insects. In winter it is in the forest from sea level to around 2,600 feet (Gabrielson and Lincoln 1959, Williams 1966, Weeden and Ellison 1968).

In a 4-year, May-August study in British Columbia, it was found that most birds of all age classes were in the "very open" type of habitat. Of total birds shot or observed, 115 were in "very open" and 18 in "very dense" habitats (Bendell and Elliott 1966). Females with broods occurred primarily in very open areas; and even though chicks may have been hatched in dense vegetation, they selected open-type habitat when they first established territories (fig. 3). Edges between open and dense cover seemed to be no attraction. Habitat selection occurred in the spring, and the open, dry breeding range needed was often supplied by logging and burning.

No detailed study has been made of blue grouse food habits in southeast Alaska. However, in summer they are known to feed on berries and in winter they take buds and needles of conifers and leaves from such species as strawberry and cinquefoil (Gabrielson and Lincoln 1959). Blue grouse also feed extensively on crowberry in southeast Alaska.

Ellison⁹ gave the winter diet as hemlock and spruce needles along with buds of aspen, willow, birch, and soapberry and fruits of highbush

⁹Laurence N. Ellison. The grouse of Alaska. Unpublished report, Alaska Department Fish and Game, Wildlife Notebook Series, No. 2, 2 p., undated.



Figure 3.--Blue grouse chick, Mitkof Island.

cranberry. He gave as the principal fall foods blueberries, "mountain cranberries," bearberries, and rose hips. Taken as a whole, coniferous needles were the most important type of food in Alaska. Pines were taken to a considerable extent while spruce assumed a somewhat lesser role; hemlock and yew were utilized in very small amounts. Coniferous leaf buds were frequently fed upon.

Another study gave hemlock as a staple April food of male birds on Kupreanof and Kuiu Islands, southeast Alaska (Stewart 1944),

Studies of winter foods over the whole range of the blue grouse showed conifer needles making up 90 percent of the food volume. Buds and twigs accounted for 4.5 percent, green leaves (other than coniferous) 2 percent, and fruits and seeds 3.5 percent. Pine, spruce, and hemlock were used in fair amounts. The leaves of small cranberry, spreading wood fern, and foamflower, the buds of aspen, and the fruits of salal and rose were used (Beer 1943, Stewart 1944).

Spring foods included sizable amounts of conifer needles, but these were mixed with a variety of foods of many other types. Toward the north, Sitka spruce needles were especially important. Staminate cones of conifers were taken in fairly large quantities, and the pistillate cones were occasionally taken (Stewart 1944).

Early summer studies showed a great decrease in the use of conifer needles. Fruits and seeds reached high levels of use, various flowers were frequently taken, and animal foods were an important part of the diet. These latter foods were mainly insects (scarabid beetles, leafhoppers, and sawfly larvae).

In late summer an even greater proportion of fruits and seeds was taken, Green leaves were utilized to a great extent, but coniferous needles received only minor use. The fruits and seeds came mainly from blueberry, pine, rose, serviceberry, mountain ash, and currant. Among the insects taken, grasshoppers, ants, and leafhoppers were most important (Stewart 1944).

Fall data showed coniferous needles again making up 51 percent of the diet, green leaves forming 26 percent, fruits and seeds 22 percent, and flowers (including staminate and pistillate cones of hemlock and spruce) a small quantity (Stewart 1944).

In Canada, patch cuttings of pulpwood apparently maintained stable grouse populations. Larger clearcut areas produced more birds soon after timber harvesting occurred, but in 10 or 12 years, as new growth became dense, populations declined sharply. Thus, the repeated patch cuttings resulted in more even production and greater recreational values (Robinson 1958). Although clearcut areas might increase production of young birds in southeast Alaska, overwinter survival might not be as good. Clearcuts can be used for brood rearing, but timber is necessary for wintering.

VANCOUVER CANADA GOOSE (*Branta canadensis fulva*)

The Vancouver Canada goose nests in a generally solitary fashion throughout its range, which extends from Cross Sound and Lynn Canal south to Dixon Entrance, on both the mainland and the islands of the Alexander Archipelago (Hansen 1962). This sedentary subspecies of Canada goose winters mainly in southeastern Alaska. Although this population has yet to be accurately enumerated, it probably numbers about 50,000 birds.

This subspecies of Canada goose provides essentially the only opportunity for hunters in southeastern Alaska to bag a goose. Nevertheless, because of the great number of isolated bays and other goose habitat throughout this area and the relative scarcity of hunters, proportionately few of these birds are taken,

Intertidal and estuarine areas throughout southeast Alaska are a very important part of the year-round habitat of this species. Sedge and grass flats are used extensively for feeding and brood rearing, with intertidal invertebrates undoubtedly making up a major portion of the diet of young birds. In the fall these geese feed heavily on berries and grasses associated with open muskeg. Beaver ponds and shallow lakes provide important freshwater feeding and brood-rearing areas. Log storage areas must be carefully selected to avoid disturbance to these birds and their estuarine habitat.

FUR BEARERS AND HABITAT

Since the days of exploration and colonization of southeast Alaska, fur-bearing mammals have played an important role in the economy of the area. The demand for furs depends to a great extent on the whims of female fashions, and so the kinds of furs which are sought change from

time to time. In the late 1950's, for example, long-haired furs such as lynx, wolf, and fox generally weren't in demand. Since then, however, values have increased again. Recently, concern over the harvesting of "endangered" species and those not found abundantly has caused changes in demand. For example, many firms have stopped using wolverine as a trim on parka hoods because of the scarcity of this animal.

In this report, only those fur bearers which are associated with forest lands will be discussed. Hence, some of the more important fur bearers--the marine mammals (sea otter, seals, etc.)--will not be considered.

BEAVER (*Castor canadensis*)

The islands of southeast Alaska have little range with the hardwoods necessary for beaver food, although the mainland affords somewhat better habitat. The animals are usually found in the valleys of slow-moving streams where there is little timber. If logging a given area has any effect on beaver populations, it should be in the form of more beaver food, at least for a limited time. Seton (1929) listed aspen, birch, and willow as important food plants but said that beaver would also eat alder. Alder is undoubtedly a major food of beaver in southeast Alaska. Hemlock and crab apple are also utilized.

A potential problem in southeast Alaska might be associated with underharvesting of beaver in valleys which contain black cottonwood. If beaver trapping should continue at a low level, these animals might limit the timber and browse production of the cottonwood,

MARTEN (*Martes americana*)

The marten is an animal of mature, coniferous forests (Martin 1957). Seton (1929) said that it avoids even the edges of clearings.

In Canada, marten were practically absent from recently logged or burned areas. Aspen-birch stands were particularly poor habitat. The cover of later successional stages seems necessary. In these, den sites are provided. Black spruce muskeg has few small mammals and so is low in carrying capacity for marten (Devos 1951).

The marten is found naturally in southeast Alaska along the mainland and on Admiralty, Kuiu, Kupreanof, and Revillagigedo Islands, and was stocked in 1934 on Prince of Wales, Baranof, and Chichagof Islands.

Generalizing on the food of the marten, Seton (1929) emphasized the outstanding importance of mice. He also listed grouse, rabbits, squirrels, birds and their eggs, frogs, fish, insects, carrion, and berries. The red squirrel is probably one of the more important marten foods in southeast Alaska. Food habits generally seem to be governed by availability and the diet is flexible (Lensink, Skoog, and Buckley 1955).

MINK (*Mustela vison*)

In southeast Alaska more mink are normally taken than any other fur bearer. The animals spend the summer along streams and in the upland

muskegs but winter in a narrow ocean beach zone. Since mink are most common along the beaches, forest management will not affect them as much as other species. However, if cuttings are such that they produce more small mammals close to the shores and streams, the mink will benefit.

For den sites, mink prefer rocky, fairly steep beaches (but not bluffs). Mink are scarce along slightly sloping beaches where there is little cover at low tide.¹⁰ Mink fur production is the only present use of many coastal beaches in southeast Alaska (Croxtan 1960,¹¹).

Seton (1929) listed as mink foods fish, frogs, birds, rabbits, and small mammals. In southeast Alaska, invertebrates made up the bulk of the mink's diet (see footnote 10). These included blue mussels, clams, sea urchins, and Dungeness crabs. Log storage and pulpmill effluents must be considered as potential threats to these foods.

OTTER (*Lutra canadensis*)

Although the otter, like the mink, is a native in southeast Alaska, very few facts are available on it from this area. Like the mink, the otter is primarily an inhabitant of the beach and stream areas where its main foods are fish and shellfish. Otter also take swimming birds, including ducks and gulls. Log storage and pulpmill effluents may affect these food supplies.

NONGAME SPECIES AND HABITAT

Little is known about the small mammals which are such an integral part of the southeast Alaska forests. We have only very incomplete data on their distribution, their numbers, or their ecology. People working on the silviculture of the area agree that we should have more knowledge of these animals.

BALD EAGLE (*Haliaeetus leucocephalus*)

The bald eagle has gradually diminished from a general distribution throughout North America north of Mexico to a greatly reduced range. At present it is more abundant in Alaska than anywhere else on the continent (Gabrielson and Lincoln 1959). An aerial survey in southeast Alaska in 1967 indicated that the breeding population probably exceeded 8,000 birds (King, Robards, and Lensink 1972). It is ironic, though, that the bald eagle has gone through a long period of persecution in Alaska. From 1917 to 1953 bounties were paid in the territory on 128,273 eagles. In addition many eagles were destroyed without thought of bounty payments. The bounty act was repealed in 1953.¹²

¹⁰Samual J. Harbo, Jr. An investigation of mink in interior and southeastern Alaska. Master's thesis, University of Alaska, 93 p., 1958.

¹¹Loren W. Croxtan. A southeastern Alaska mink management study. Master's thesis, University of Alaska, 74 p., 1960.

¹²Fred C. Robards and James G. King. Census, nesting, and productivity of bald eagles, southeast Alaska, 1966. Unpublished report, U.S. Fish and Wildlife Service, 22 p., 1966.

In southeast Alaska, eagle nests are mainly built in trees. The most mature trees within several hundred feet of the shoreline are generally selected as nest sites. In spruce-hemlock stands on Admiralty Island, 85 to 90 percent of the nests were in the spruces; in the Chilkat River valley (fig. 4) most nests were in cottonwoods (see footnote 12). On Kodiak Island, nearly all eagle nests were in cottonwoods, while a few were on cliffs (Troyer and Hensel 1965); around Karluk Lake, all nests were in cottonwoods (Hensel and Troyer 1964). All nests found in a recent study were either along the seacoast or on major streams. The highest nesting density is along the open coast. Second growth is not used for nesting if there are any remains of virgin stands in the vicinity. This may be due to the heavier branching or stagheads of the large trees. Where logging has left no fringe of trees along the beach, this zone is completely bypassed in nesting (see footnote 12). Along 837 miles of coast, eagles observed in ~~summer~~ averaged 0.81 per mile of shoreline (on Admiralty Island, 0.89). The eagles seen were rarely back of the first line of tall trees unless there was a prominent ridge or point nearby.¹³

¹³Ralph H. Imler. Alaskan bald eagle studies. Unpublished report, Fish and Wildlife Service, Juneau, Alaska, 23 p., 1941.



Figure 4.--Salmon carcasses are an important late fall food for these eagles in the Klehini River valley, a tributary of the Chilkat River near Haines.

In southeast Alaska, eagles are largely beach scavengers. During salmon runs, the eagles join the other scavengers in feeding on dead and dying fish (Gabrielson and Lincoln 1959). In a study of food habits of bald eagles, Imler (see footnote 13) observed that fish were the major food taken (79 percent of food items in 304 eagle stomachs).

RED SQUIRREL (*Tamiasciurus hudsonicus*)

Red squirrels are very common on the mainland and many of the islands of southeast Alaska (Manville and Young 1965).

A study of red squirrel feeding on spruce seed was made in interior Alaska. In winter, the average consumption of white spruce cones was about 144 per day per squirrel. A marked preference was shown for white spruce over black spruce. On a diet of the latter, the squirrels rapidly lost weight. It was suggested that size and, perhaps, nutritive value were the causes of the choice (Brink and Dean 1966). In another interior Alaska study red squirrels in spruce stands on a hill were active throughout the winter. In all but the coldest weather, they climbed to tree branches and ate cones there. Lowland squirrels showed very little activity above snow during the colder periods.¹⁴ Since Sitka spruce seeds are about the same size as those of white spruce, the red squirrel probably is important in influencing the number of Sitka spruce seedlings in southeast Alaska. In a good seed year, however, it is likely that plenty of seed is left for regeneration. In any case, the red squirrel would be limited to the older forests rather than cutover lands.

FLYING SQUIRREL (*Glaucomys sabrinus*)

This squirrel is found over the southeast Alaska mainland and generally over the southern islands.

The species was found to do poorly on white spruce seeds, and it is thought that few spruce seeds would be eaten in the wild (Brink and Dean 1966). The flying squirrel's main diet consists of fruits and insects. It is generally associated with extensive stands of mature timber and seems to prefer mixed stands of conifers and hardwoods.

MICE (Cricetidae)

There are at least seven kinds of mice found in the wild in southeast Alaska. These are:

- Deer mouse (*Peromyscus maniculatus*)
- Northern bog lemming (*Synaptomys borealis*)
- Red-backed vole (*Clethrionomys rutilus*)
- Meadow vole (*Microtus pennsylvanicus*)
- Long-tailed vole (*M. longicaudus*)
- Tundra vole (*M. oeconomus*)
- Meadow jumping mouse (*Zapus hudsonius*)

The ranges of these are given in "Distribution of Alaskan Mammals" (Manville and Young 1965).

¹⁴Harry McClure Johnson. Winter microclimates of importance to Alaskan small mammals and birds. Ph.D. thesis, Cornell University, 109 p., 1954.

A study in interior Alaska described the red-backed vole as primarily found in valley lowlands, often with low vegetation but commonly including shrubby zones and trees (see footnote 14). Tundra voles were found in low, rank, and sedgy areas along river channels. Of all the small mammals studied, these were the most intolerant of low temperatures, but they remained active under the snow throughout the winter.

Writing of the Douglas-fir area of Oregon and Washington, Moore (1940) described the deer mouse as consuming more conifer seed than any other animal. It is found from the beaches to the summits of the Cascades with annual precipitation varying from inches to feet. In normal seed years, the forest provides this mouse with food from September to April. Even in poor seed years, deer mouse numbers remained fairly constant. Cage tests showed western hemlock and Douglas-fir seeds to be equally acceptable. Spruce seed was eaten regularly. Seeds of true firs were an important food item but were passed by if other species were available. Alder seed was rejected by the mice. Tender conifer seedlings are taken by the deer mouse but the extent of damage is not known (Moore 1940).

James (1956) stated that, in Oregon, a population of six or more mice per acre would make serious inroads into all but the largest seed crops. His results of a trapping study at the Maybeso Experimental Forest on Prince of Wales Island in southeast Alaska showed a potentially dangerous population of seed-destroying mice and shrews. He felt that seed acceptance tests were necessary to evaluate the possible damage. Pulpwood cuttings may sometimes require direct seeding to insure prompt regeneration of desirable species before brush competition becomes a problem. This may require mouse control in order to succeed. In another study in the Maybeso area, McGregor (1958) found the greatest deer mouse populations in the valley bottoms.

Working later over a 9-year period in the Maybeso area, Harris (1968) found deer mice six times more plentiful in timber than on cutover land, meadow voles six times more plentiful on cutovers, and shrews twice as plentiful on cutovers. However, at the end of the study, the plots were adequately stocked with crop trees.

All who have worked on the problem agree that careful study is needed of the effects of rodents on tree reproduction.

SHREWS (*Sorex*)

The shrews found in southeast Alaska are masked or common shrew (*Sorex cinereus*), dusky shrew (*S. obscurus*), and northern water shrew (*S. palustris*).

Little is known about this group beyond the generalities that they eat animal food including mice, and that they eat a surprising amount for their size. They are known to be seedeaters, however, so their effect on forest reproduction is in two directions (Moore 1940).

PORCUPINE (*Erethizon dorsatwn*)

Although the porcupine is generally distributed over the mainland of southeast Alaska, its range on the islands is imperfectly known. It

has been observed on Mitkof, Etolin, and Wrangell Islands but is much more common on the mainland.

In one study in southeast Alaska, hemlock was listed as the preferred food, but cottonwood and spruce were also utilized (Rhode 1937). In northern Alaska, Murie (1926) found that willow buds and catkins were often taken.

SNOWSHOE HARE (*Lepus americanus*)

Probably due to the predominance of conifers in the southeast Alaska island forests, this hare is found primarily on the glacial flats and river valleys of the mainland but only in restricted areas. It never reaches the high populations attained at cyclic peaks in the interior. In fact, it is too scarce to be important either now or probably in the near future, except for light local hunting and trapping.

SUMMARY AND RECOMMENDATIONS

From the previous discussions of the various animals found in southeast Alaska and their habitat requirements, we can make some generalizations concerning forest management for wildlife. As with fish habitat, recreation, timber, or any other forest use, the forest land manager must decide for what values he will manage, and in what way.

The two main habitat requirements for wildlife are food and cover. We have seen that many of the wildlife species in southeast Alaska utilize mature, old-growth forests, generally for cover. Some of the fur bearers and the bald eagle utilize the beach fringe as the most important part of their territories. Black-tailed deer use the beach timber during severe winter periods. Mountain goats descend from their summer alpine habitat to timber during parts of the winter. Bears seasonally use the timber bordering tidal meadows, beaches, and streams for cover (fig. 5).



Figure 5.--Tidal meadows and beach timber, such as shown here on Kupreanof Island, are important habitat for deer, bears, eagles, waterfowl, and furbearers.

At the same time, more food is produced in cutover areas for, say, 15 to 20 years following logging. This increase in food supplies may contribute to increased animal populations, provided that old-growth cover is available and that this increased food supply is available during winter months. The most utilized areas are the edges--the thickets which are found along the borders of timber stands and cutover areas.

In general then, it would appear that for maximum wildlife production, small patch cuts or clearcut strips with blocks or strips of timber left between them would be the ideal pattern. Cutting patterns should be planned so that, within a given range, sufficient logged areas of less than 20-year age would be available at all times, as well as sufficient mature timber and edges.

Timber along the beach and adjacent to grass flats should remain unlogged and of a sufficient width to maintain wintering herds, to provide escape cover and eagle nesting sites, and to alleviate the possibilities of blowdown. Until we have more definitive information upon which to base the desirable width of the beach fringe, a minimum of one-quarter mile would appear reasonable.

RESEARCH NEEDS

For the foreseeable future the greatest problem in forest-wildlife relationships in southeast Alaska is in the direction of the correlation of timber cutting methods with wildlife production. If real multiple-use forestry is to be practiced, these two resources must be managed together, along with water, recreation, esthetics, and other forest land uses (fig. 6). Some modifications are to be expected in the handling of each if the greatest good is to be attained.



Figure 6.--Waterfowl hunting is one of many forms of recreation pursued on National Forest lands in southeast Alaska.

Size of cutting areas and subsequent use by wildlife are primary concerns. Cuttings should be of a size to insure satisfactory reproduction of the forest. They should also be of a size to meet the needs of such species as deer, moose, bears, and--in some places--the mountain goat.

Due largely to the great increase of both the white-tailed and black-tailed deer following widespread cutting of the northern States' forests, we have come to think of cuttings, in general, as synonymous with more food and more game. However, in southeast Alaska the ecological situation is quite different. The topography is generally rugged, leading to rapid climatic and vegetational changes with elevation. These result in seasonal migrations of most of the more important game animals. The forests are unusual, with only two really important coniferous species and only very minor amounts of hardwoods. Since the stands are predominantly overmature and the cottonwood and willow intolerant, the broadleaved tree species present or likely to follow cutting are few. And, even though herbaceous and shrubby food plants may be plentiful in cutover areas, they may be unavailable because of snow depth through the winter. This may force deer to use the old-growth stands with their limited food supplies.

These inherent differences from other regions, the lack of forest harvest experience in southeast Alaska, and the preliminary nature of most of the past wildlife investigations in the area complicate the difficult decisionmaking tasks of the land manager.

The data necessary for effective management of both forests and wildlife could be obtained in several ways and with different intensities of effort:

- (1) Permanent sample plots could be established to trace the development of a given area through the stages of succession. Exclosures could be used to contrast areas used by wildlife with those not used.
- (2) Different successional stages might be selected and sampled, giving a faster but less confident idea of successional development.
- (3) Field observations could be used to evaluate the situation with still less definitive results.

As a basic starting point, the importance of old-growth forests to southeast Alaska wildlife needs to be established. Then changes in both the vegetation and the wildlife using it should be followed through the successional stages from cutting through the reestablished closed stand. Each stage should be evaluated as to food, cover, and carrying capacity for the brown and black bears, black-tailed deer, moose, goat, fur bearers, small mammals, blue grouse, and the bald eagle. A related problem is size and interspersed of cuttings. Another question is the utilization--particularly by bears, deer, eagles, and mink--of beach fringes of old growth compared with beach areas where cuttings have been made. Along with this, we also need to know the importance of old-growth communication lanes along streams or across large cuttings.

A study should be made of the nutritional changes in food plants at various stages in the succession, seasonally and with varying intensities of browsing. The effects of forest fertilization on quality and quantity of browse used by wildlife should be determined.

If it is desirable to establish brown bear, moose, goat, or perhaps other species on new ranges, any attempt at transplanting should be preceded by a careful study of available foods and cover, as well as potential interspecific competition. As a corollary, it might be possible to establish new ranges by introducing browse species such as cottonwood or willow.

A thorough evaluation should be made of the small mammals. This should cover their distribution, populations, seedeating, bark damaging, and browsing characteristics.

Full and proper utilization of the deer herd would be facilitated by investigation of means of promoting greater interest in deer hunting and of providing better access and facilities on little-hunted ranges.

Wolf-deer relationships on large ranges need evaluation, as do wolf-moose relationships in restricted ranges such as the Taku River valley.

Basic information is needed on the blue grouse. Its distribution, populations, food and cover requirements, use of cuttings, and a detailed, annual study are necessary for its effective management.

A careful study is needed to show the annual and potential values of southeast Alaska's wildlife populations. Even with minimum values assigned to the fragmentary data available on use of the wildlife resource, there are indications of an income of several million dollars to the State each year. A detailed, regional study would provide justification for better management.

If true multiple-use forestry is to be practiced in southeast Alaska, wildlife research by the U.S. Forest Service should parallel that devoted to other forest resources. This research should be conducted in cooperation with the State Department of Fish and Game, the Bureau of Sport Fisheries and Wildlife of the U.S. Department of Interior (including their Cooperative Wildlife Research Unit on the University of Alaska campus), and the Wildlife Department of the University of Alaska. Since the U.S. Forest Service is responsible for the management of most of the forested lands in southeast Alaska, it is only logical that it should contribute greatly to this research effort.

LITERATURE CITED

- Alaska Department of Fish and Game
1962. Annual report No. 12. 77 p., illus. Juneau, Alaska.
- Anderson, J. P.
1959. Flora of Alaska and adjacent parts of Canada. 543 p., illus. Ames: Iowa State Univ. Press.
- Beer, James
1943. Food habits of the blue grouse. J. Wildl. Manage. 7(1): 32-44, illus.
- Bendell, J. F., and P. W. Elliott
1966. Habitat selection in blue grouse. Condor 68(5): 431-446, illus.
- Brink, C. Holden, and Frederick C. Dean
1966. Spruce seed as a food of red squirrels and flying squirrels in interior Alaska. J. Wildl. Manage. 30(3): 503-512, illus.
- Chatelain, Edward F.
1952. Distribution and abundance of moose in Alaska. 3rd Alaska Sci. Conf. Proc., p. 134-136.
- Clark, Webster K.
1957. Seasonal food habits of the Kodiak bear. North Am. Wildl. Conf. Trans. 22: 145-151.
- Cowan, I. McTaggart, W. S. Hoar, and J. Hatter
1950. The effect of forest succession upon the quantity and upon the nutritive values of woody plants used as food by moose. Can. J. Res. 28, Sect. D (5): 249-271.
- Cowan, Ian McTaggart
1945. The ecological relationships of the food of the Columbian black-tailed deer, *Odocoileus hemionus columbianus* (Richardson), in the coast forest region of southern Vancouver Island, British Columbia. Ecol. Monogr. 15(2): 109-139, illus.
- 1951. Plant succession and wildlife management. 2nd Alaskan Sci. Conf. Proc., p. 322-327.
- Croxton, Loren W.
1960. Southeastern mink management studies. Alaska Dep. Fish & Game, Fed. Aid in Wildl. Restoration, Vol. 1, Proj. W-6-R-1, p. 366-371.
- DeVos, Antoon
1951. Recent findings in fisher and marten ecology and management. North Am. Wildl. Conf. Trans. 16: 498-507, illus.

- Dufresne, Frank
1955. Alaska's animals and fishes. 297 p., illus. Portland: Binsford and Mort.
- Erickson, Albert W.
1965a. The black bear in Alaska, its ecology and management. Alaska Dep. Fish & Game, Fed. Aid in Wildl. Restoration, Vol. V, Proj. W-6-R-5, 19 p.
- 1965b. The brown-grizzly bear in Alaska. Alaska Dep. Fish & Game, Fed. Aid in Wildl. Restoration, Vol. V, Proj. W-6-R-5, 42 p.
- Gabrielson, Ira N., and Frederick C. Lincoln
1959. Sitka blue grouse. *In* The birds of Alaska, p. 290-292. Harrisburg, Pa. : The Stackpole Co.
- Hansen, Henry A.
1962. Canada geese of coastal Alaska. North Am. Wildl. Nat. Resour. Conf. Trans. 27: 301-320, illus.
- Harris, A. S.
1968. Small mammals and natural reforestation in southeast Alaska. USDA For. Serv. Res. Note **PNW-75**, 7 p., illus. Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.
- Hatler, David F.
1965-66. Ecology of the black bear. Alaska Dep. Fish & Game, Fed. Aid in Wildl. Restoration, Vol. VII, Proj. W-15-R-1, p. 23-30.
- Heintzleman, B. F., and H. W. Terhune
1934. A plan for the management of brown bear in relation to other resources on Admiralty Island, Alaska. U.S. Dep. Agric. Misc. Publ. 195, 20 p., illus.
- Heintzleman, B. Frank
1939. Alaska brown bear conservation. J. For. 37(6) : 510-511.
- Hensel, Richard J., and Willard A. Troyer
1964. Nesting studies of the bald eagle in Alaska. Condor 66(4): 282-286, illus.
- Holzworth, John M.
1930. The wild grizzlies of Alaska. 417 p. New York: G. P. Putnam's Sons.
- Hosley, N. W.
1969. A selected bibliography of forest management-wildlife management for southeast **Alaska**. South. Ill. Univ. Dep. For. Publ. No. 3, 19 p.
- Hultén, Eric
1968. Flora of Alaska and neighboring territories; a manual of the vascular plants. 1,008 p., illus. Stanford: Stanford Univ. Press.

- Hutchison, O. Keith
 1967. Alaska's forest resource. *USDA For. Serv. Resour. Bull.* PNW-19, 74 p., illus. Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.
- James, G. A.
 1956. The rodent problem on cutover areas in southeast Alaska. *USDA For. Serv. Alaska For. Res. Cent. Tech Note No. 31*, 2 p.
- Kelsey, Harlan P., and William A. Dayton (eds.)
 1942. Standardized plant names. 2d ed., 675 p. Harrisburg, Pa.: J. Horace McFarland Co.
- King, James G., Fred C. Robards, and Calvin J. Lensink
 1972. Census of the bald eagle breeding population in southeast Alaska. *J. Wildl. Manage.* 36(4): 1292-1295, illus.
- Klein, David R.
 1957. The black-tailed deer in Alaska. *Fish & Wildl. Serv., Fed. Aid in Wildl. Restoration, Wildl. Manage. Ser. No. 1*, 13 p., illus.
- 1965a. Ecology of deer range in Alaska. *Ecol. Monogr.* 35(3): 259-284, illus.
- 1965b. Postglacial distribution patterns of mammals in the southern coastal regions of Alaska. *Arctic* 18(1): 7-20, illus.
- and Sigurd T. Olson
 1960. Natural mortality patterns of deer in southeast Alaska. *J. Wildl. Manage.* 24(1): 80-88, illus.
- Willard A. Troyer, and Robert A. Rausch
 1958. The status of the brown bear in Alaska. 9th Alaska Sci. Conf. Proc., p. 21-24.
- Lauckhart, J. Burton
 1955. The effect of logging old-growth timber on bear. *Soc. Am. For. Proc.*, p. 128-130.
- Lensink, Calvin J., Ronald O. Skoog, and John L. Buckley
 1955. Food habits of marten in interior Alaska and their significance. *J. Wildl. Manage.* 19(3): 364-368.
- Lentfer, Jack W., Richard J. Hensel, Leo H. Miller, Leland P. Glenn, and Vernon D. Berns
 1970. Remarks on denning habits of Alaska brown bears. *In Bears--their biology and management. Int. Union Conserv. Nat. & Nat. Resour., Morges, Switzerland. New Ser. No. 23*: 125-132, illus.
- Leopold, A. Starker, and Fraser F. Darling
 1953. Wildlife in Alaska. 129 p., illus. New York: The Ronald Press Co.

- LeResche, Robert E., and James L. Davis
1971. Moose research report. Alaska Dep. Fish & Game, Fed. Aid in Wildl. Restoration Proj. Progr. Rep., Vol. 12, 156 p.
- Manville, Richard H., and Stanley P. Young
1965. Distribution of Alaskan mammals. U.S. Fish & Wildl. Serv., Bur. Sport Fish, & Wildl. Circ. 211, 74 p., illus.
- Martin, P. W.
1957. Wildlife management and forest use in central British Columbia. For. Chron. 33(3): 205-207.
- McGregor, R. C.
1958. Small mammal studies on a southeast Alaska cutover area. USDA For. Serv. Alaska For. Res. Cent. Stn. Pap. No. 8, 9 p., illus.
- Meehan, William R.
1961. Observations on feeding habits and behavior of grizzly bears. Am. Midland Nat. 65(2): 409-412.
- Merriam, Harry R.
1964. The wolves of Coronation Island. 15th Alaskan Sci. Conf. Proc., p. 27-32,
- Moore, A. W.
1940. Wild animal damage to seed and seedlings on cut-over Douglas fir lands of Oregon and Washington. U.S. Dep. Agric. Tech. Bull. 706, 28 p., illus.
- Murie, O. J.
1926. The porcupine in northern Alaska. J. Mammalogy 7(2): 109-113, illus.
- Murie, Olaus J.
1959. Fauna of the Aleutian Islands and Alaska Peninsula. U.S. Dep. Int. Fish & Wildl. Serv. North Am. Fauna No. 61, 364 p., illus.
- Olson, Sigurd T.
1952. Black-tailed deer studies - 1952. Fed. Aid in Wildl. Restoration, Alaska, Proj. W-3-R-7, p. 1-9, illus.
- 1953. Distribution of some big game animals in southeast Alaska with particular reference to the Sitka blacktail deer. 4th Alaskan Sci. Conf, Proc., p. 182-186.
- Perensovich, Michael M.
1964. Brown bear studies--interim report--1958-1963. USDA For. Serv. North Tongass Natl. For. 42 p.
- Peterson, Randolph L.
1955. North American moose. 280 p. Toronto: Univ, Toronto Press.

- Rausch, Robert A.
1966. Wolf studies. Alaska Dep. Fish & Game, Fed. Aid in Wildl. Restoration, Proj. W-6-R-5 and 6 and W-15-R-1, 43 p.
- Rhode, Clarence
1937. Nature's pincushion. Alaska Sportsman 3(1): 12, 20, illus.
- Robinson, D. J.
1958. Forestry and wildlife relationship on Vancouver Island. For. Chron. 34(1): 31-36.
- Seton, Ernest Thompson
1929. Lives of game animals. Vol. 11, part 1, 367 p., illus. New York: Doubleday Doran and Co.
- Spencer, David L., and Edward F. Chatelain
1953. Progress in the management of the moose of south central Alaska. North Am. Wildl. Conf. Trans. 18: 539-552.
- and John B. Hakala
1964. Moose and fire on the Kenai. 3d Annu. Tall Timbers Fire Ecol. Conf, Proc., p. 10-33, illus.
- Stewart, Robert E.
1944. Food habits of blue grouse. Condor 46: 112-120, illus.
- Stonorov, Derek, and Allen W. Stokes
1970. Social behavior of the Alaska brown bear. *In* Bears--their biology and management. Int. Union Conserv. Nat. & Nat. Resour., Morges, Switzerland, ~~M~~ Ser. No. 23: 232-254, illus.
- Taylor, R. F.
1932a. Plant indicators in southeastern Alaska. J. For. 30(6): 746.
- 1953. The role of forest research in developing an Alaskan resource. 4th Alaskan Sci. Conf. Proc., p. 97-105.
- Taylor, Raymond F.
1932b. The successional trend and its relation to second-growth forests in southeastern Alaska. Ecology 13(4): 381-391, illus.
- Troyer, Willard A., and Richard J. Hensel
1965. Nesting and productivity of bald eagles on the Kodiak Nat. Wildlife Refuge, Alaska. Auk 82(4): 636-638.
- Viereck, Leslie A., and Elbert L. Little, Jr.
1972. Alaska trees and shrubs. U.S. Dep. Agric. Agric. Handb. 410, 265 p., illus,

Weeden, Robert B.

- 1965, Grouse and ptarmigan in Alaska, their ecology and management, Alaska Dep. Fish & Game, Fed. Aid in Wildl. Restoration, Vol. V, Proj. W-6-R-5, 110 p., illus.

——— and Laurence N. Ellison

1968. Upland game birds of forest and tundra. Alaska Dep. Fish & Game Booklet Ser. No. 3, 44 p., illus.

Williams, Carrol B., Jr.

1966. Possible grouse damage on true firs. USDA For. Serv. Res. Note PNW-39, 7 p., illus. Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.

Williams, J. P.

1952. Alaskan adventure. 299 p., illus. Harrisburg, Pa.: The Stackpole Co.

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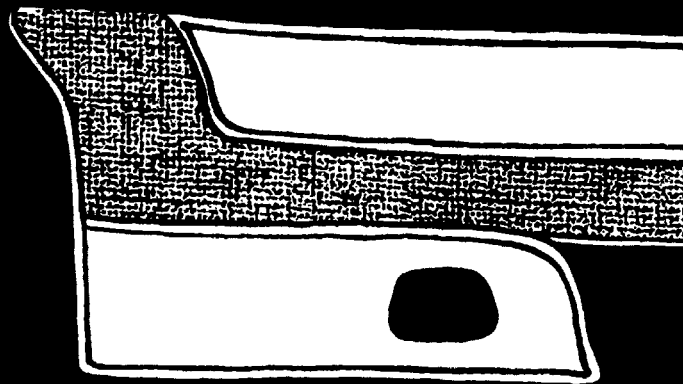
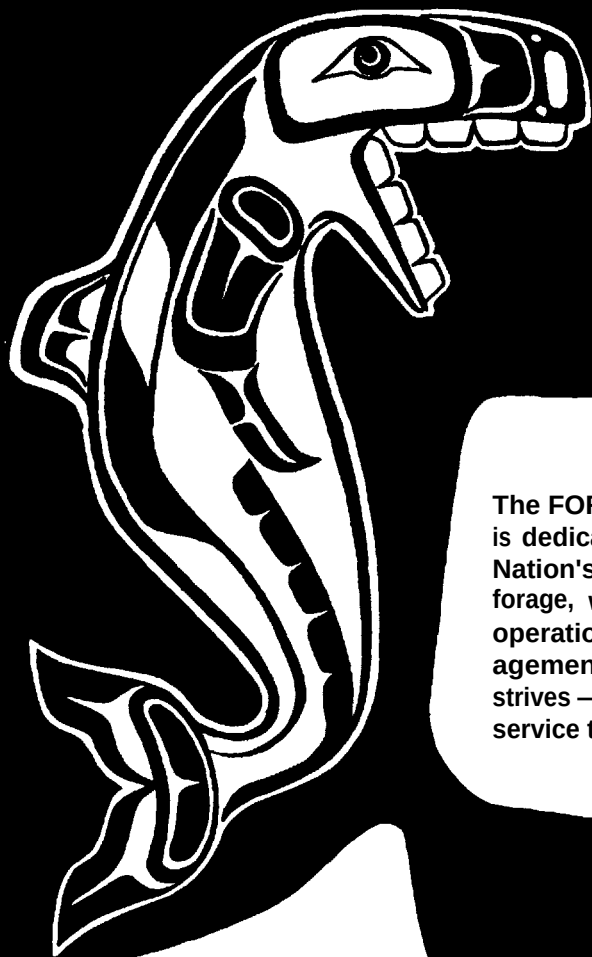
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