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THE FRANKLIN'S GROUSE OF SOUTHERN SOUTHEAST ALASKA

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INTRODUCTION

In Southeast Alaska there is an isolated and little-known population of a "Franklin-like" grouse (Dendragapus canadensis franklinii) inhabiting some of the islands at the southern extremity of the Alexander Archipelago.

Although there is very little scientific information published regarding the Franklin's grouse in Alaska, this report is an attempt to consolidate the available information so that this species can be considered along with other species currently being examined for viability and distribution concerns in "A proposed Strategy for Maintaining Well-Distributed, Viable Populations of Wildlife Associated with Old-Growth Forests in Southeast Alaska" (Suring et al. 1993).

DISTRIBUTION

The Franklin's grouse in Alaska appears to be a species which has persisted in low densities on and near Prince of Wales Island (Figure 1). The core area of documented sightings during this century have come from central and northern Prince of Wales Island, with other sightings occurring on islands adjacent to northern Prince of Wales Island (Gustafson 1993).

The occurrence of this species in Alaska was first reported on Prince of Wales Island (Osgood 1905), followed by evidence of the species on Warren and Zarembo Islands (Swarth 1911). In 1990 I found avian keels beneath a northern goshawk (Accipiter gentilis) nest on Suemez Island. These bones were later identified as spruce grouse remains (Gibson, pers. comm.). Also on Suemez Island, a nesting female Franklin's grouse with six eggs was reported by foresters within a proposed logging unit in May of 1993. Additionally, specimens have also recently been acquired from Heceta and Kosciusko Islands. Peter Walsh (pers. comm.) had one observation of this species on Mitkof Island in December 1989. Although there are indications the species could also occur on other islands within the southern portion of the Alexander Archipelago, no confirmed observations have been reported from the coastal mainland of either Southeast Alaska or British Columbia. Consequently, the species appears to be absent from the Queen Charlotte Islands of British Columbia to the south and from most, if not all, of the adjacent mainland to the east (ADF&G 1978, Campbell 1990). The spruce grouse population in closest proximity to the one described here is located in much drier habitats on the east side of the coast range in British Columbia.

IMMIGRATION AND ISOLATION

Spruce grouse have been characterized as reluctant to cross open areas and non-coniferous forests (Laughlin 1988), although they may sometimes traverse stands of deciduous growth during periods of dispersal and migratory movements (Boag and Schroeder 1992). They are also poor long-distance flyers, and may exist as isolated populations on islands which are separated by more than one mile of water. In Michigan, for example, there is no evidence that spruce grouse have ever occurred on Isle Royale or other islands more than a mile from the mainland. Spruce grouse are, however, found on islands one mile or less offshore in the Great Lakes where suitable habitats are available (Ammann 1963).

Of the southeastern Alaska islands having evidence of occupancy, only Warren and Mitkof are separated by more than one mile from Prince of Wales, which is the apparent core area of the population. However, there are no confirmed historical records of the species on Warren Island, and there is only a single known observation from Mitkof. Except for its proximity to Zarembo via a series of smaller islands, Prince of Wales is isolated from the next nearest mainland connection by nearly four miles of salt-water. Zarembo is separated from other islands in the direction of the mainland by nearly two or more miles.

The reasons for the peculiar distribution of Franklin's grouse within the Alexander Archipelago remain unknown. Perhaps individual birds reached Zarembo, or other islands, by flying distances of more than one mile. Alternatively, the occurrence of this population may have been influenced by the location of past glacial systems. The isostatic and eustatic forces of glaciation, for example, have considerably altered sea levels at various times along Pacific Northwest Coasts (Thomson 1981), perhaps allowing immigration along routes currently inaccessible. A particular combination of glacial and geological forces could have provided land connections in some coastal areas, but not in others, and potentially explain how Franklin's grouse spread to southern Southeast Alaska, but are absent from Vancouver Island, the Queen Charlotte Islands, and northern Southeast Alaska. After the retreat of massive glacial systems, sea levels reportedly rose, which could have then isolated Franklin's grouse on different islands within the southern portion of the Alexander Archipelago. Consequently, it is possible that this relict population has been geographically isolated since the late Pleistocene, and that immigration occurred along a corridor linking an elevated Stikine River delta to Rynda, Mitkof, Sokolof, Vank, Zarembo, Bushy, Shrubby, and Prince of Wales Islands. Although shallow water currently covers this area, this corridor could have been a "land-bridge" at a time when sea levels were lower. This theory may also explain how marmots (Marmota spp.), which no longer occur on Prince of Wales Island, and northern flying squirrels (Glaucomys sabrinus) became inhabitants of this island, even though they have limited abilities to cross salt-water barriers.

LITERATURE REVIEW

During the past 90 years, the Franklin's grouse in Alaska has been given little more attention than three minor references in the

scientific literature. In 1903, Wilfred H. Osgood collected an adult female and a clutch of 5 eggs from a nest situated on the ground in what he described as the "deep woods" near the head of Twelve-Mile Arm on Prince of Wales Island. Although Osgood collected this specimen soon after arriving on Prince of Wales Island, he also recorded that the natives and miners of the region called this bird the "black grouse" and thought it was quite rare (Osgood 1905). The Alexander Expedition of 1909 did not encounter the Franklin's grouse in Southeast Alaska, but received information from various store-keepers, prospectors, and natives regarding the occurrence of the species on Prince of Wales (Swarth 1911). Shed feathers or droppings that were probably from Franklin's grouse were also found on Warren Island, and an expedition member observed a hunter carrying a Franklin's grouse on Zarembo Island. In the third reference to this species, Gabrielson reported observing photographs of live birds taken near Klawock on Prince of Wales Island (Gabrielson and Lincoln 1959). No other citations regarding this species in Southeast Alaska were found in the scientific literature.

SPECIMENS AND VARIATION

Until recently, spruce grouse of the "franklinii" group were represented from Alaska only from a single museum specimen. This adult female, taken by Wilfred H. Osgood on Prince of Wales Island on 27 May 1903 (Osgood 1903), is now at the Smithsonian Institution in Washington D. C. A second specimen, a male, was taken on the island by Paul Coffey on 14 September 1982. In 1993 the author, with the help of other biologists, assembled a series of five more specimens. Two of these were taken by a hunter on Kosciusko Island in the spring of 1990 and retrieved from a taxidermy shop, one was collected on Heceta Island, one was collected on Prince of Wales Island, and the fifth was struck by a car on Prince of Wales Island. Two of these specimens are at the University of Alaska Museum in Fairbanks and four of them are now at the American Museum of Natural History in New York City.

All of the known specimens were recently examined by a taxonomist at the American Museum of Natural History, where they were compared to specimens of the "franklinii" group which were taken elsewhere. This comparison resulted in morphometric and other variations being observed in the Southeast Alaska birds. The Alexander Archipelago birds may represent an undescribed form, perhaps intermediate between franklinii and canadensis. Work is in progress to provide a more detailed description of this form.

EVOLUTION

The most probable evolutionary origin of the spruce grouse was in eastern Asia (Johnsgard 1973) where separation of what was probably a ptarmigan-like ancestor into two populations gave rise to the Siberian sharp-winged grouse (Falcipennis falcipennis) and the North American spruce grouse.

Unlike spruce grouse, however, both the blue grouse (Dendragapus obscurus) and the sage grouse (Centrocerus urophasianus), appear to have their origins in western North America, perhaps evolving from a Tetrao-like ancestral type which may have invaded relatively

early from Asia (Johnsgard 1983). Sage grouse and blue grouse, with their mutual specialized physiological adaptations (inflatable cervical sacs), parallel breeding behavioral patterns (strutting), and similarities in the downy young, appear to be more closely related than are blue grouse and spruce grouse. Essentially, it appears that spruce grouse are forest-adapted members of the ptarmigan (Lagopus) complex, while the blue grouse are forest-adapted representatives of the prairie/scrubland Tympanuchus complex.

TAXONOMY

There has been and continues to be considerable controversy regarding grouse taxonomy. It is thought by some biologists, for example, that spruce grouse should be placed in the genus of its recognized closest relative, the Siberian sharp-winged grouse, and that its more distant cousin, the blue grouse, belongs in a separate genus.

Spruce grouse were originally classified as Dendragapus canadensis by Linnaeus in 1758. In recognition of its dissimilarities to Dendragapus, American spruce grouse were reclassified as two separate species in the genus Canachites; spruce grouse (C. canadensis) and Franklin's grouse (C. franklinii) (Ridgway and Friedmann 1941, not seen in the original). Later, it was placed back into the genus Dendragapus and merged into a single species, D. canadensis (Short 1967). Although there has been much disagreement regarding the classification of spruce grouse, Potapov (1985, not seen in the original), Boag and Schroeder (1992), and Johnsgard (1973) believe that the nearest living relative to the North American spruce grouse appears to be the Siberian spruce, or "sharp-winged," grouse. Although Short discussed the distinctness of the downy young, he apparently did not consider important the difference in the number of rectrices (16 in Falcipennis vs. 18 in Dendragapus) or absence of inflatable cervical sacs in Falcipennis. It is for reasons such as this that other specialists in grouse biology believe that spruce grouse are not congeneric with the larger, booming blue grouse, and that the generic name Falcipennis should be used for the former (Potapov 1985, Boag and Schroeder 1992).

BIOLOGY AND NATURAL HISTORY

No field studies of the Franklin's grouse in Alaska have ever been initiated. Consequently, the biology and habitat requirements of this species within a temperate rainforest ecosystem are not well known. Elsewhere, the species occurs in much drier climates, but the research from these places, particularly within fire ecosystems, may not be applicable to the habitats found in Southeast Alaska.

Gabrielson and Lincoln (1959) reported that, "No other Alaskan grouse clings so closely to the spruce timber as this bird." Armstrong (1984) stated that they inhabit Sitka spruce-hemlock forests and nest on the ground at the base of a tree or under a log. The Forest Service has rated old-growth as a high-use habitat, important for both the reproduction and foraging of Franklin's grouse in southern Southeast Alaska (USDA-Forest Service

1983). Young second-growth sawtimber, however, was evaluated by the Forest service as of "no-use" for either reproduction or feeding. Presumably, ground cover for concealment, forage species such as Vaccinium, and lower level branches for roosting would not be readily available in closed-canopy second growth. The earlier successional stages following clearcutting, though, were rated by the Forest Service as of moderate use for feeding, but of no use as reproductive habitat for Franklin's grouse (USDA-Forest Service 1983).

On the Chugach National Forest, the Forest Service uses D. c. atratus, a different subspecies of spruce grouse, as an indicator of late successional forest (old-growth) habitat (USDA-Forest Service 1984). Ellison (1975), who studied spruce grouse on the Kenai Peninsula near the Chugach National Forest, described their habitat in the boreal forest of Alaska as consisting of a rather closed-canopied, coniferous forest found in late stages of succession.

These descriptions, however, are in contrast to what has been reported elsewhere in North America. Other research, particularly within fire-ecosystems, has documented utilization under varying circumstances in a variety of early successional stands of pine and spruce (Szuba and Bendell 1983, Boag and Schroeder 1987, Johnsgard 1973) medium-sized stands (Ammann 1963), tall/old forests with understory cover (Szuba and Bendell 1983), mixed-age stands (Ammann 1963), and sparse stands of older conifers that contain other young species-specific trees (Johnsgard 1983, Ammann 1963). Although some researchers have emphasized canopy height as an indicator of spruce grouse densities within their study areas, canopy height alone is a poor indicator of population density as other factors, such as understory availability and density, are also very important (Szuba and Bendell 1983). It is also true that within specific forests, spruce grouse seem to select specialized microhabitats (Boag and Schroeder 1992) in which habitat-use differs significantly seasonally (Pendergast and Boag 1970). Spruce grouse select habitats of different composition and structure at different seasons, and habitat selection also varies according to sex (Allan 1985). Consequently, habitat utilization can vary in forests of different ages and locations, and Ratti et al. (1984) emphasize the importance of local investigations to determine habitat utilization for proper management of this species.

POTENTIAL HABITAT COMPONENTS

Spruce grouse show a preference for short-needled conifers (Ammann 1963), particularly various species of spruce (Ellison 1966, Hohf et al. 1987, and Boag and Schroeder 1992) and lodgepole pine (Pendergast and Boag 1970, Zwickel et al. 1974, Schroeder and Boag 1991, Boag and Schroeder 1992). Mixed stands of spruce and pine may also be particularly important (Ratti et al. 1984, Robinson 1980, and Hohf et al. 1987). Consequently, stands in Southeast Alaska which contain Sitka spruce (Picea sitchensis) or shore pine (Pinus contorta contorta) and mixed stands which contain both species, may be essential to Franklin's grouse in this locality. It is also significant, though, that spruce grouse seem to seek-out

and select specific microhabitats within a forest (Boag and Schroeder 1992), and that patterns of habitat use change seasonally as these birds experience a radical transition from summer to winter diets (Allan 1985).

Related to the presence of spruce are observations that, during incubation, female Franklin's grouse appear to feed in a highly selective manner on the growing leaders of spruce (Pendergast and Boag 1970), even in areas dominated by lodgepole pine (Herzog 1978, McCourt et al. 1973). McLachlin (1970, not seen in the original) also found that mature spruce trees were often selected by female spruce grouse throughout incubation, yet this forest type comprised only 4 percent of the study area habitat and was clumped mainly in wet areas where past fires had not penetrated. Spruce regeneration consisting of small trees were rarely used for feeding at this time and specific spruce trees appeared to be defended by incubating adult females as feeding sites (Herzog 1978). This selection during the incubation period may have a nutritional basis and be linked to the relatively high calcium content of new spruce leaders (Pendergast and Boag 1971). Such trees may be an important component of a female's territory, but the selection of particular food items by grouse could also reflect preference and not need (Zwickel and Bendell 1972).

A significant amount of forested canopy appears to be required, and a fairly contiguous canopy coverage of greater than 60-70% with conifers could be essential (Ratti et al. 1984, Bendell pers. comm., and Keppie *in* Alexander and Chipman). The conifer component of this canopy closure is particularly important, and throughout most of the year spruce grouse avoid contiguously forested deciduous habitats or nonforested areas. In the autumn, however, they may traverse stands of deciduous growth during periods of dispersal and migratory movements. At this time, though, they continue to avoid nonforested areas, except for rivers and streams, which they fly across rapidly (Boag and Schroeder 1992).

Although a canopy closure of greater than 60% appears to be needed, small openings in the forest are also probably essential (Ammann 1963, Robinson 1980, Szuba and Bendell 1983, Alexander and Chipman undated). The use of these openings may vary by season and sex, however, with females and broods utilizing sites in the spring and summer that are less dense than those used by males (Allan 1985). At this time, dietary requirements have shifted from the winter consumption of conifer needles to more fruits, seeds, insects and ground vegetation (Pendergast and Boag 1973), resulting in the females and broods occupying more open-canopied areas with ground vegetation (Allan 1985). Robinson (1980) recommends that the size of these openings be a few hundred square feet and that they be dispersed frequently throughout the forested habitat. This is consistent with the opinion of Szuba and Bendell (1983) that habitat consisting of dense, highly-stocked, monotypic coniferous stands is inferior to those places where natural tree mortality has created small openings in the canopy. If the openings are too large, however, it is likely they will be avoided by spruce grouse (Boag and Schroeder 1992, Laughlin 1988).

Live branches which are close to the ground have been consistently identified as an essential spruce grouse habitat component

(Johnsgard 1973 and 1983, Robinson 1980, Ratti et al. 1984, Alexander and Chipman undated). These branches are utilized for feeding, breeding, and roosting activities, as well as providing for escape cover.

The presence of shrubs and forbs in the understory also provides essential food and cover and appears to be a necessary component of spruce grouse habitat (Robinson 1980, Szuba and Bendell 1983, Ratti et al. 1984, and Naylor and Bendell 1989). The leaves and berries of several species of Vaccinium are consistently cited in research, for example, as being an especially important food item found in the understory (Crichton 1963, Jonkel and Greer 1963, Ellison 1966, Pendergast and Boag 1970, Zwickel et al. 1974, Robinson 1980, Johnsgard 1983, DeFranceschi and Boag 1991). Schroeder and Boag (1991) have noted that increased shading in maturing second growth reduces herbaceous forbs, which could be detrimental to insect production and nesting cover, thereby adversely affecting spruce grouse populations.

Various authors have also reported that downed hard-snags elevated above the ground are utilized for reproduction, cover, and feeding (Maser et al. 1979, Johnsgard 1973, Keppie and Herzog 1978, Ratti et al. 1984). Dead trees, however, may receive only seasonal use, such as for the enhancement of visibility during male courtship displays (Allan 1985), or for overhead cover by nesting females. Keppie and Herzog (1978) reported that nests are sometimes found under horizontal logs, which they theorized may provide enhanced protection from inclement weather and concealment from predation. They found that nesting success was greater for nests that were well-hidden than for nests that were very exposed, and that older females occupied better sheltered sites. They did not, however, confirm the need for nest protection from inclement weather. It is unknown if this is also true for Southeast Alaska, where rainfall may exceed 160 inches/year and ground nesting birds are not nearly so common as in drier climates.

Insects such as arthropods and caterpillars are seasonally important during the summer months, and are particularly essential for the development of chicks (Jonkel and Greer 1963, Pendergast and Boag 1970, Robinson 1980). Additionally, three juveniles of less than one week old were found to have consumed *only* arthropods (Pendergast and Boag 1970).

Other habitat components, such as fungi, for example, are also utilized by spruce grouse (Ellison 1966, DeFranceschi and Boag 1991), but it is difficult to ascertain their overall importance. The ingestion of grit, however, is essential (Pendergast and Boag 1970), and a supply of mineral-rich gravel is beneficial (Robinson 1980). Calcareous grit or terrestrial snails might even be sought after by females during the egg laying period (Herzog 1978). Calcium, for example, is reported to be of vital physiological importance to pheasant hens during the reproductive season and pheasants were found to be most abundant on areas that contained high amounts of calcareous grit (McCann 1939 and 1961, in Harper 1964). Wild hens were not only able to select calcareous grit from noncalcareous grit, but they also exhibited the ability to selectively and disproportionaly ingest calcium-rich limestone

(Harper 1964). Interestingly, the general distribution of Franklin's grouse in Alaska appears to be roughly correlated with the general occurrence of karst, or calcium carbonate, although this may simply be a coincidence.

POTENTIAL PATTERNS OF HABITAT USE

The above referenced aggregate habitat components would be available in Southeast Alaska mostly in old-growth and in young (about 10-25 years old) second-growth prior to canopy closure. These components, however, would be mostly unavailable in new clearcuts and closed-canopied second-growth (Figure 2). Additionally, some types of old-growth would probably provide better types of habitat than others. For example, Volume Class 4 (8-20 mmbf/acre), with its mixed coniferous stands may, theoretically, be utilized disproportionately, at least seasonally, in relation to other types of old-growth. Franklin's grouse, however, could utilize a variety of forest habitat types and small openings within their range, and may even have seasonal or other requirements which necessitate their movements among various habitat types. Females with broods, for example, are sometimes observed on gravel roads adjacent to muskegs and fairly open low-volume forests on Prince of Wales Island during the months of June and July. Such observations could be due to a greater potential seasonal abundance of arthropods and a ground cove height and density suitable for the rearing of young chicks. This would appear consistent with past research elsewhere which has documented the use of more open-canopied areas with ground vegetation by adult females with broods at this time of year (Allan 1985).

One of the other potentially utilized habitats, young second-growth of about age 10-25 years, which has not yet achieved closed-canopy conditions, is quite ephemeral in nature. After a relatively short period of time, approximately 15 years, it is replaced by closed-canopied pole-sapling stands comprised of small-diameter pre-commercial timber. Based upon previous research elsewhere, it would seem that, after the understory and lower branches die-out, second-growth would be poorly suited to Franklin's grouse for meeting most of their habitat requirements. If these stands were extensive enough, this could lead to the isolation of family groups and the fragmentation of a fairly continuous population.

In some places, particularly in fire ecosystems, Franklin's grouse appear to reach maximum densities following the regrowth of pine forests after fires. In Alberta, for example, climax stands of spruce-fir, which are usually the wetter sites that don't normally burn, are apparently used as secondary habitats that may form refuges where birds survive during the fire cycle (Boag, pers. comm.). Although the old-growth of Southeast Alaska may also not be optimal habitat for Franklin's grouse it is, however, a stable environment, and could be important for both maintaining the population and providing corridors which can be utilized by individual dispersers. Although densities appear to be low in Southeast Alaska, and various habitats may be utilized, old-growth may still be the best and most stable habitat available to Franklin's grouse, and may be essential to maintaining the population or subpopulations in the long-term. An important unanswered question is, "How extensive of an area of suitable

habitat is needed for maintaining a viable population?" Also, are populations in large tracts of old-growth, where barriers to dispersal could be minimal, less susceptible to local extinctions than populations in smaller, managed stands or short strings of unaltered riparian areas?

CONSERVATION CONCERNS

Franklin's grouse in Alaska appear to be living in highly isolated populations of potentially low densities. Because of relatively small home ranges and an absence of long-distance migrations, their ability to disperse "quickly" over barriers, especially major waterbodies or the Coast Range, would seem to be limited. Because the Alaska population appears to be small, scattered, and isolated, its continued viability and distribution could become a future concern if habitat losses and/or other expanding encroachments become extensive enough.

Populations of spruce grouse have been reported to be extremely vulnerable near settlements, especially those with extensive interconnected road systems, where they can easily suffer extirpations through human-induced mortalities (Gabrielson and Lincoln 1959). Numerous authors have reported that this species can disappear rapidly with the advance of new settlements and that it is now gone from most southern parts of its former range where encounters with man are frequent (Godfrey 1986). Ellison (1974) found that on the Kenai Peninsula in Alaska more than 90% of the spruce grouse taken by hunters are shot along gravel roads where the birds apparently seek grit. Road densities on Prince of Wales and adjacent islands are typical of heavily-logged areas and, in conjunction with habitat loss, may present an additional vulnerability factor. According to one analysis of Forest Service records, more than 3,500 miles of roads have already been built by the Forest Service on Prince of Wales Island (Ingle 1994). As the Forest Service is currently less than 40% of the way through their first rotation, these road building figures are anticipated to increase significantly during the next century (USDA-Forest Service 1991). Additionally, unpublished preliminary figures obtained from State Forest Practices Act notifications and records from the Alaska Department of Natural Resources, Division of Forestry, indicate that at least several hundreds of miles of new roading have also been built on privately-owned or Nation Corporation lands on the island alone. An example of cumulative end-of-the-rotation road densities planned for Prince of Wales Island is shown by Figure 3 (USDA-Forest Service 1988).

Habitat loss is commonly cited as a primary cause of extirpation. Weeden and Ellison (1968) cautioned that populations are at risk if brood rearing areas, feeding places, or roosting sites are lost because of changes in habitat. Boag and Rolstad (1991) cite the vulnerability of grouse populations to environmental degradation, and state that grouse are among the first species to disappear as habitat becomes adversely affected by various aspects of timber harvest. Boag and Schroeder (1992) have also reported that in places outside of Alaska, modern industrial forestry, with its creation of open clear-cuts and subsequent single species plantations, reduces spruce grouse populations locally and often eliminates them entirely. Boag (pers. comm.), though, discounts

natural predation as a cause of extirpation unless a population were made abnormally vulnerable by other factors. Johnsgard (1973) discusses viability concerns of D. c. canadensis as a result of population declines in Michigan (where hunting was last permitted in 1914 in an area with previously abundant spruce grouse populations), Minnesota (where populations may have, at one time, come close to extirpation), Wisconsin (also with past historical declines), Ontario (with localized population declines), and Nova Scotia (where it is protected). Lumsden and Weeden (1963) have reported that the extinction of spruce grouse has occurred on Prince Edward Island. In 1988 the State of Vermont listed the species as endangered (Quinn 1989), where its range has been greatly reduced and there is concern that logging practices have isolated populations to small "islands." Also in Vermont, it was found that the remaining birds appear to not cross either open land or hardwood stands to reach the spruce "islands." In New York, the species is listed as "threatened," where its habitat has also reportedly been greatly reduced by timber harvest (Laughlin 1988). Also in New York, Fritz (1979) studied spruce grouse demographic parameters in relation to small insular populations resulting from the creation of patchy forested habitats and predicted average extinction times of less than 6 years in habitats with $\leq$ 3 female spruce grouse/$\leq$ 100 ha. Locally, in Southeast Alaska, the Forest Service designated spruce grouse as a "Wildlife Species of Special Concern" in the "Final Environmental Impact Statement; LPK Timber Sale Plan for the 1984-89 Operating Period" (USDA-Forest Service 1983).

If this species requires the primary habitat components which have been reported in past research to be important, then it would appear that Franklin's grouse in Alaska may also be utilizing habitat-types that are declining in abundance. Figure 4, for example, shows how land-use allocations in Southeast Alaska have disproportionately protected the mainland and northern Southeast Alaska. The protected habitats within the Tongass are obviously not well-distributed geographically, and the majority of the protected areas are outside of the range of the Franklin's grouse (Figure 1). Much of this known range distribution is currently scheduled for intensive timber harvest under the Tongass Land Management Plan Revision Supplement to the DEIS. In a recent Final Environmental Impact Statement for the Central Prince of Wales project area, for example, the Forest Service estimated that it would harvest 94% of the commercial forest lands (CFL) within this 321,866 acre project area (USDA-Forest Service 1993). About 12,500 acres, or 6% of the CFL in the project area would be reserved from timber harvest. Although there are now Congressionally mandated buffer zones in the riparian areas of anadromous streams and their fish-bearing tributaries, many of these areas were already significantly impacted on Prince of Wales and the adjacent islands prior to the Tongass Timber Reform Act. In the Staney Creek watershed, for example, 88.5% of these riparian buffers have already been lost due to previous timber harvest (USDA-Forest Service 1993). Timber harvest levels on the nearby privately-owned lands are thought to be even more intensive. The density of Franklin's grouse, or even their occurrence, in reserve areas on Prince of Wales and the adjacent islands is currently undetermined.

In an attempt to assess the Franklin's grouse in Alaska for viability and distribution concerns, it was evaluated using the 17 criteria in Suring et al. (1993). Utilizing this procedure, Franklin's grouse received a total score of 139 out of 174 possible points, or 80% (Figure 5). In this evaluation, species with greater than 60% of the total possible points were considered in need of a conservation assessment. Viability concerns for this species would seem to fall within the range of recommendations which seek a more detailed analysis.

RESEARCH NEEDS

In view of the high degree of endemism found in the area of the Queen Charlotte Islands and the Alexander Archipelago, it may be surprising to some biologists that this grouse population has not been previously examined. In comparison to other areas, though, very little biological research has occurred on the islands of southern Southeast Alaska and some of the best attempts to conduct comprehensive species inventories were, in fact, accomplished during the Alexander Expeditions of 1907 and 1909. Consequently, field studies are necessary to determine the specific habitat requirements of Franklin's grouse in Southeast Alaska. Basic life-history questions about such aspects as food-habits, habitat-use, and movements in the forested landscape need to be answered to progress toward a better understanding of this species. Research is also needed regarding densities, population trends and the consequences of both current and cumulative habitat modifications. To accomplish this, long-term studies need to be designed in areas where the habitat can be manipulated after a number of years of study (e.g. 10 years), followed by another period of post-manipulation research.

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LITERATURE CITED

Alaska Department of Fish and Game. 1978. Alaska's wildlife and habitat, Vol. II. State of Alaska.

Alexander, C.E. and R.B. Chipman. Undated. Model habitat management guidelines for spruce grouse (Dendragapus canadenis) in Vermont. Vermont Fish and Wildlife Dept. Unpubl. Rept.

Allan, T.A. 1985. Seasonal changes in habitat use by Maine Spruce Grouse. Can. J. Zool. 63:2738-2742.

Ammann, G.A. 1963. Status of spruce grouse in Michigan. J. Wild. Manage. 27:591-593.

Armstrong, R.H. 1984. Guide to the birds of Alaska. Alaska Northwest Publishing Company, Anchorage, Alaska. 332pp.

Boag, D.A. and M.A. Schroeder. 1987. Population fluctuations in Spruce Grouse: what determines their number in spring? Can. J. Zool. 65:2430-2435.

Boag, D.A. and J. Rolstad. 1991. Workshop summary: Aims and methods of managing forests for the conservation of tetraonids. Ornis. Scand. 22:225-226.

Boag, D.A. and M.A. Schroeder. 1992. Spruce grouse. In the birds of N. Ameri., No. 5 (A. Poole, P. Stettenheim and F. Gill, Eds.) Philadelphia: The Acad. of Nat. Sci.; Washington DC: Ameri. Ornith. Union.

Campbell, W.R. et al. 1990. The birds of British Columbia, Vol. II. Royal British Columbia Museum, Victoria, B.C. 636pp.

Crichton, V. 1963. Autumn and winter foods of Spruce Grouse in central Ontario. J. Wild. Manage. 27:597.

DeFranceschi, P.F. and D. A. Boag. 1991. Summer foraging by Spruce Grouse: implications for galliform food habits. Can. J. Zool. 69:1708-1711.

Ellison, L.N. 1966. Seasonal foods and chemical analysis of winter diet of Alaskan Spruce Grouse. J. Wild. Manage. 30:729-735.

Ellison, L.N. 1974. Population characteristics of Alaskan Spruce Grouse. J. Wild. Manage. 38:383-395.

Ellison, L.N. 1975. Density of Alaskan Spruce Grouse before and after fire. J. Wild. Manage. 39:468-471.

Fritz, R.S. 1979. Consequences of insular population structure distribution and extinction of Spruce Grouse populations. Oecologia 42:57-65

Gabrielson, I.N. and F.C. Lincoln. 1959. Birds of Alaska. The Wildl. Mgmt. Inst. 922pp.

Godfrey, W.E. 1986. The Birds of Canada. National Museums of Canada, Ottawa, Canada. 595pp.

Gustafson, J.E. 1993. The Franklin's spruce grouse in Alaska. Unpubl. Rept. 9pp.

Harper, J.A. 1964. Calcium in grit consumed by hen pheasants in east-central Illinois. J. Wildl. Manage. 28:264-270.

Herzog, P.W. 1978. Food selection by female Spruce Grouse during incubation. J.Wild. Manage. 42:632-636.

Hohf, R.S., J.T. Ratti, and R. Croteau. 1987. Experimental analysis of winter food selection by Spruce Grouse. J. Wild. Manage, 51:159-167.

Ingle, M. 1994. Wolves of the islands. Defenders Mag. 69:2;25-31.

Johnsgard, P.N. 1973. Grouse and quails of N. Ameri. Univ. Nebraska Press, Lincoln, Nebraska. 533pp.

Johnsgard, P.N. 1983. The grouse of the world. Univ. Nebraska Press, lincoln, Nebraska. 413pp.

Jonkel, C.J. and K.R. Greer. 1963. Fall food habits of Spruce Grouse in northwest Montana. J. Wildl. Manage. 27:593-596.

Keppie, D.M. and P.W. Herzog. 1978. Nest site characteristics and nest success of Spruce Grouse. J. Wild. Manage. 42:628-632.

Laughlin, S.B. 1988. Unpubl. letter, Vt. Inst. Nat. Sci. to Vt. Agency Nat. Res. 3pp.

Lumsden, H.G. and R.B. Weeden. 1963. Notes on the harvest of Spruce Grouse. J.Wild. Manage. 27:587-591.

Maser, C., R.G. Anderson, K. Cromack Jr., J.T. Williams, and R.E. Martin. 1979. Dead and down woody material. In USDA-Forest Service; Wildlife habitats in managed forest, the Blue Mountains of Oregon and Washington. U.S. Dept. Agric. Handbook No. 553. pp78-95.

McCann, L.J. 1939. Studies of the grit requirements of certain upland game birds. J. Wild. Mgmt. 3(1):31-41.

McCann, L.J. 1961. Grit as an ecological factor. Am. Midland Naturalist 65(1):187-192.

McCourt, K.H., D.A. Boag, and D.M. Keppie. 1973. Female Spruce Grouse activities during laying and incubation. Auk 90:619-623.

McLachlin, R.A. 1970. the spring and summer dispersion of male Franklin's Grouse in lodgepole pine forest in southwestern Alberta. M.Sc. thesis, Univ. Alberta, Edmonton.

Naylor, B.J. and J.F. Bendell. 1989. Clutch size and egg size of Spruce Grouse in relation to spring diet, food supply, and endogenous reserves. Can. J. Zool. 67:969-980.

Osgood, W.H. 1903. Smith. Inst. Archives, Rec. Ut. 7176, Bx. 13, Fld. 17. U.S. Fish and Wild. Ser. 1860-1961.

Osgood, W.H. 1905. In Alaska's rain belt. Condor. 7:68-71.

Pendergast, B.A. and D.A. Boag. 1970. Seasonal changes in the diet of Spruce Grouse in central Alberta. J. Wildl. Manage. 34:605-611.

Pendergast, B.A. and D.A. Boag. 1971. Nutritional aspects of the diet of Spruce Grouse in central Alberta. Condor 73:437-443.

Pendergast, B.A. and D.A. Boag. 1973. Seasonal changes in the internal anatomy of Spruce Grouse in Alberta. Auk 90:307-317.

Potapov, R.L. 1985. Fauna of the USSR:birds. Vol. III. Order Galliformes, family Tetraonidae. Science Institute, Leningrad. (in Russian).

Quinn, E. 1989. Spruce grouse project status report-1988. Unpubl. Rept. Vt. Dept. Fish and Wildlife.

Ratti, J.T., Mackey, D.L. and J.R. Alldredge. 1984. Analysis of spruce grouse habitat in North-central Washington. J. Wildl. Manage. 48(4):1188-1196.

Ridgway, R. and H. Friedmann. 1941-46. The birds of North and Middle America U.S. Natl. Mus. Bull. 50 parts 9-10.

Robinson, W.L. 1980. Fool Hen: the Spruce Grouse on the Yellow Dog Plains. Univ. Wisconsin Press, Madison.

Schroeder, M.A. and D.A. Boag. 1991. Spruce Grouse populations in successional lodgepole pine. Ornis Scand. 22:186-191.

Short, L.L., Jr. 1967. A review of the genera of grouse (Aves, Tetraoninae). Amer. Mus. Novit. 2289:1-39.

Suring, L.H., D.C. Crocker-Bedford, R.W. Flynn, C. Hale, G.C. Iverson, M.D. Kirchhoff, T.E. Schenck, II., L.C. Shea, and K. Titus. 1993. A proposed strategy for maintaining well-distributed,viable populations of wildlife associated with old-growth forests in Southeast Alaska. Unpublished Report, USFS/ADFG/USFS interagency Committee, Juneau, Alaska. 278pp.

Swarth, H.S. 1911. Birds and mammals of the 1909 Alexander Alaska Expedition. Univ. California Publ. Zoo., 7:9-172.

Szuba, K.J. and J.F. Bendell. 1983. Population densities and habitats of Spruce Grouse in Ontario, pp. 199-213 *in* Resources and dynamics of the boreal zone, Proceedings of a Conference, Thunder Bay, Ont., August 1982. (R.W. Wein, R.R. Riewe, and I.R. Methuen, Eds.). Association of Canadian Universities for Northern Studies, Ottawa.

Thomson, R. E. 1981. Oceanography of the British Columbia Coast. Can. Spec. Publ. Fish. Aquat. Sci. 56 : 291p.

U.S. Dept. of Agric. - Forest Service. 1983. Final environmental impact statement: LPK timber sale plan for the 1984-89 operating period, Tongass National Forest, Alaska. Alaska Region Report Number 170.

U.S. Dept. of Agric. - Forest Service. 1984. Final environmental impact statement: Chugach National Forest Plan. Alaska Reg. Ad. Doc. No. 127A.

U.S. Dept. of Agric. - Forest Service. 1988. 1989-94 operating period for the Ketchikan Pulp Company long-term sale area: draft environmental impact statement. R-10-MB 43a.

U.S. Dept. of Agric. - Forest Service 1991. Tongass land management plan revision. Supplement to the draft environmental impact statement. R-10-MB-145.

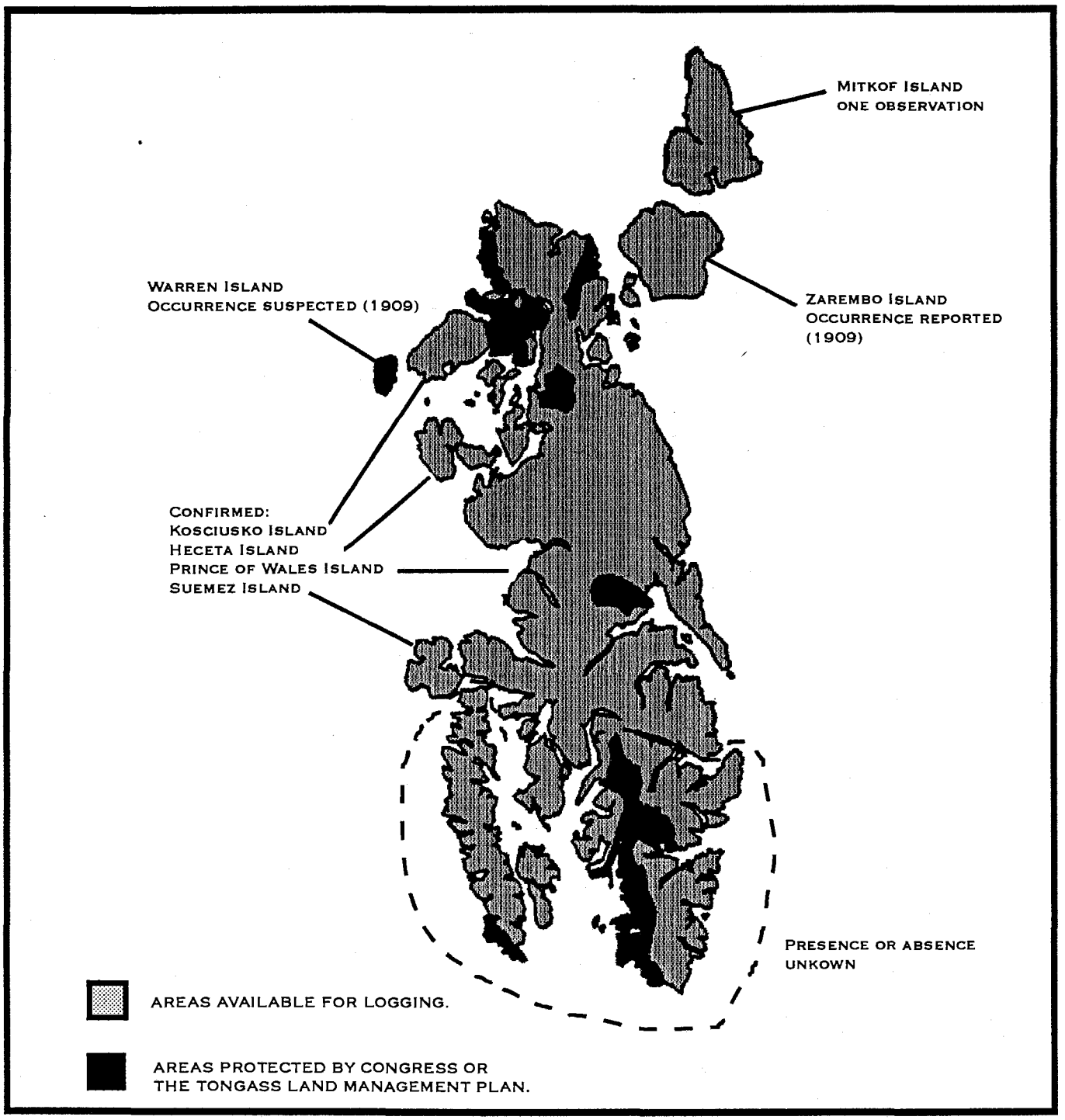
U.S. Dept. of Agric. - Forest Service 1993. Central Prince of Wales final environmental impact statement; Ketchikan Pulp Company long-term timber sale contract. R-10-MB-229a.

Weeden, R.B. and L.N. Ellison. 1968. Upland gamebirds of forest and tundra. Wildl. Booklet Series No. 3., Alaska Dept. Fish and Game, Anchorage, AK.

Zwickel, F.C. and J.F. Bendell. 1972. Observations on food habitats of incubating female blue grouse. Condor 74(4):493-494.

Zwickel, F.C., D. A. Boag, and J.H. Brigham. 1974. The autumn diet of spruce grouse: A regional comparison. Condor 76:212-214.

OCCURRENCE OF FRANKLIN'S GROUSE IN SOUTHEAST ALASKA AND EXISTING LAND-USE DESIGNATIONS*



*FRANKLIN'S GROUSE ARE NOT KNOWN TO OCCUR IN ALL OF THE AREAS SHOWN. THEY MAY BE ABSENT FROM SIGNIFICANT PORTIONS OF ANY OF THE MAPPED AREAS.
THE SPECIES COULD ALSO OCCUR ON OTHER NEARBY ISLANDS NOT SHOWN ON THIS MAP.

Figure 2. Potentially important habitat components for Franklin's grouse and their availability in various forest-types found in Southeast Alaska.

POTENTIAL HABITAT COMPONENTS	Availability in Specific Forest Types			
	Old-Growth	Clearcuts (~1-10 yrs.)	Young Second Growth (~10-25 yrs.)	Close-Canopied Second Growth (~25-150+ yrs.)
Sitka spruce and/or shore pine	X		X	X
>60-70% canopy coverage w/conifers	X		X	X
Structural diversity	X			
Small openings in forest	X		X	
Live branches close to ground	X		X	
Forbs and shrubs in understory	X		X	
Large, undecomposed, downed trees	X	X	X	
Abundant insects	X		X	

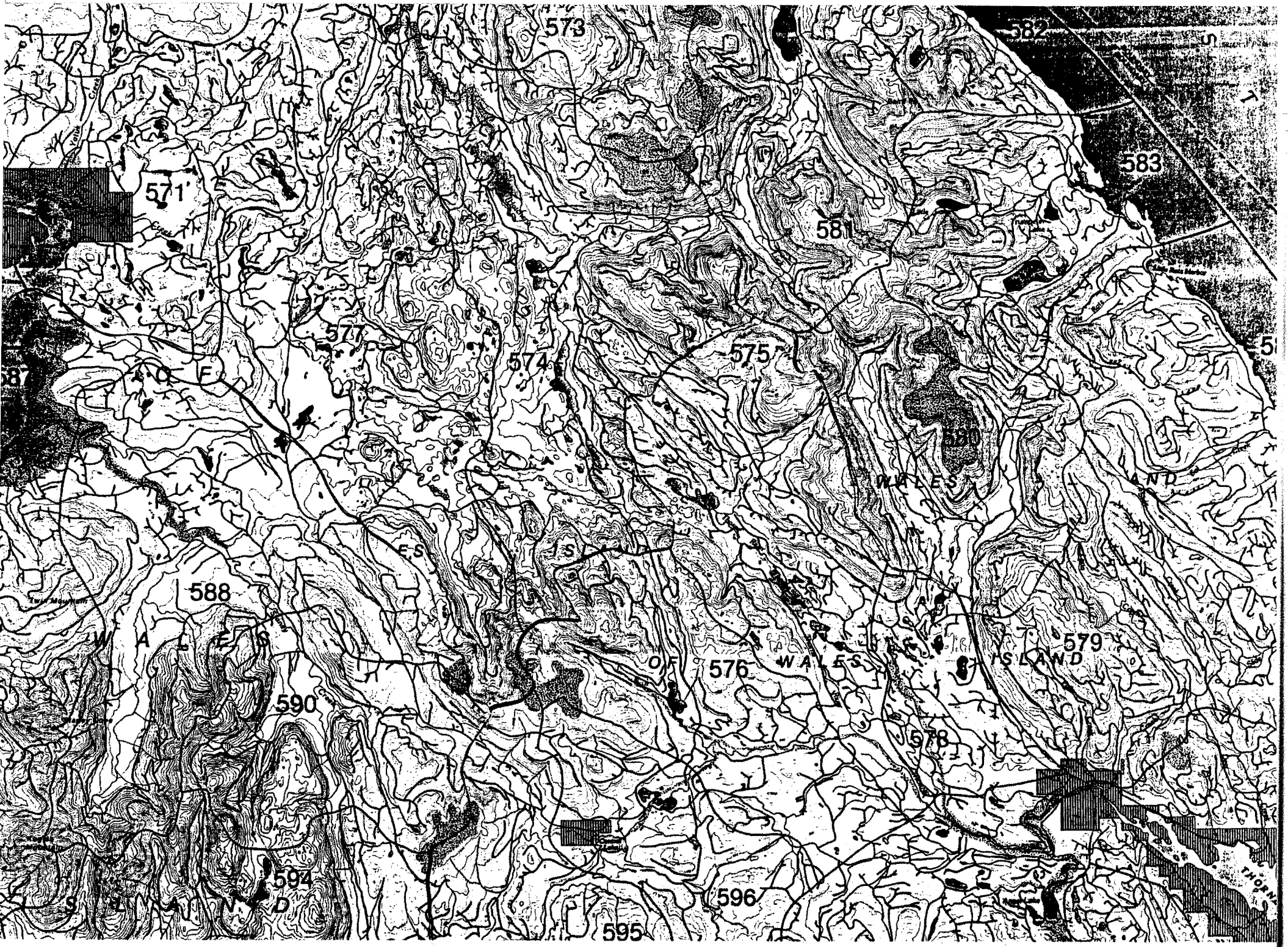


Figure 3. Anticipated cumulative Forest Service roading on a portion of central POWI.

Figure 4.

LAND DESIGNATIONS IN SOUTHEAST ALASKA

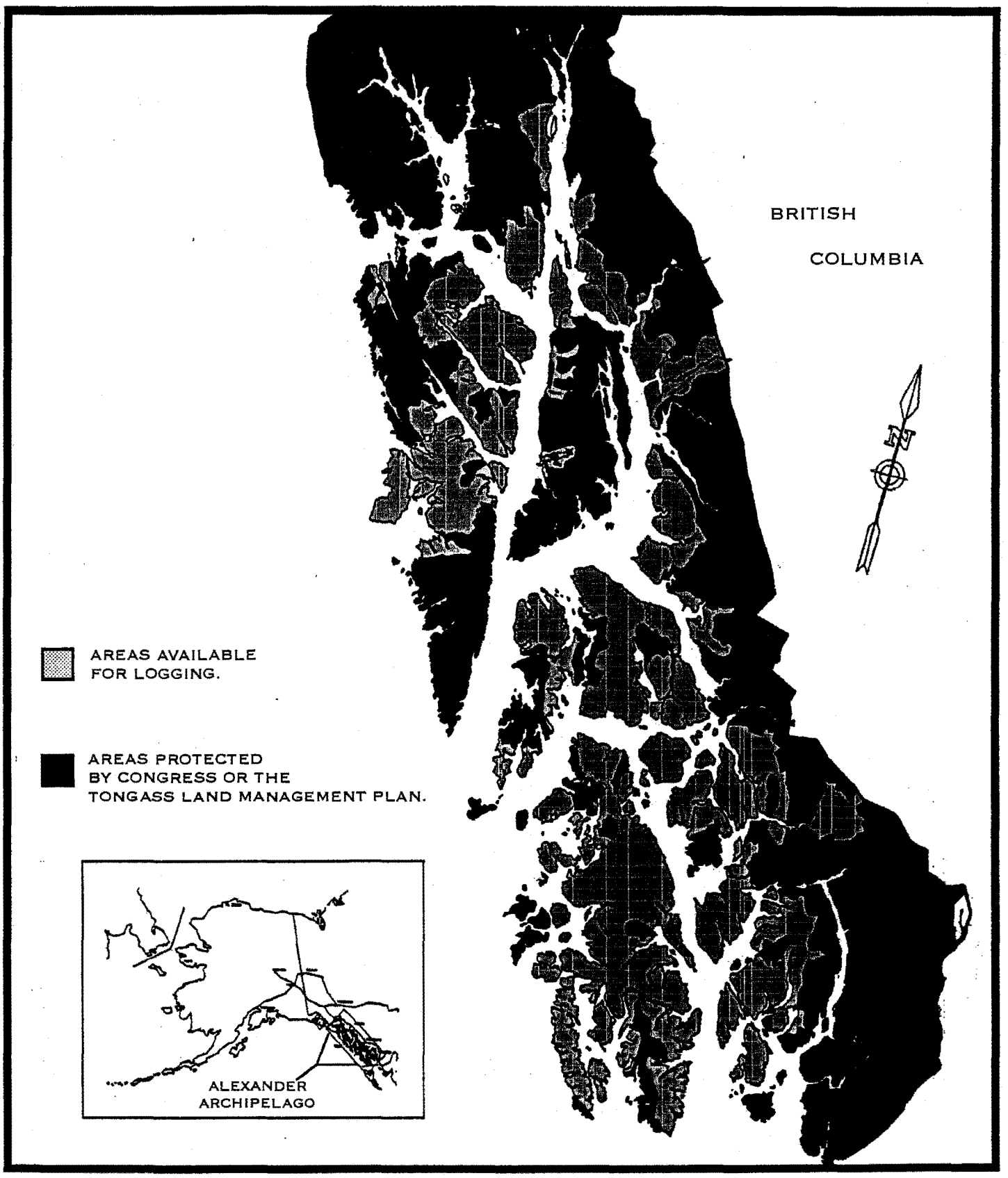


Figure 5.

An Evaluation of Franklin's Spruce Grouse
for Viability and Distribution Concerns in Southeast Alaska

Criteria	Level of[a] Concern	Weighting[b] Factor	Numerical Value of Concern
1. Breeding habitat occurs in Southeast Alaska	M	1	2
2. Winter range occurs in Southeast Alaska	M	3	6
3. Migratory range occurs in Southeast Alaska	N	2	0
4. Habitats are vulnerable to modification as a result of land management activities	-	4	8
5. Habitats are vulnerable to catastrophic events	-	4	8
6. Potential exists for inbreeding depression	H	5	15
7. High potential exists for local extirpation	H	5	15
8. Capability to disperse is limited or barriers to dispersal exist	H	5	15
9. Geographic distribution is limited within Southeast Alaska	H	4	12
10. Geographic distribution is limited to Southeast Alaska	M	3	6
11. Geographic distribution is limited outside Southeast Alaska	H	2	6
12. Level of knowledge about the species in Southeast Alaska is limited	H	3	9
13. Demographic characteristics of the species (e.g., natality and mortality rates) indicate slow rates of increase in the population	-	3	6
14. Size of the population in Southeast Alaska is low	H	3	9
15. Size of the population outside Southeast Alaska is low	-	4	8
16. Population trend in Southeast Alaska is down	-	3	6
17. Population trend throughout the species range is down	-	4	8
		Total =	139 (80%)

[a] H = high concern (3)
M = moderate concern (2)
L = low concern (1)
N = no concern (0)
- = information not adequate for a rating (2)

[b] Suring, L.H., et al. 1993. A Proposed Strategy for Maintaining Well-Distributed, Viable Populations of Wildlife Associated with Old-Growth Forests in Southeast Alaska. Unpublished Report, USFS/ADF&G/USFS Interagency Committee, Juneau, Alaska. 96pp.

DEPARTMENT OF
FISHERIES AND WILDLIFE

8 April 1994

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Dear Jack:

I wanted to thank you for the presentation of your paper "Information Regarding a `Franklin-Like' Spruce Grouse from the Alexander Archipelago of Southeast Alaska" at the recent Forest Grouse Symposium. The technical papers were well-received by the audience, and your contribution was most appreciated and served to establish the quality of the symposium. Both your paper and participation were appreciated. Hopefully, some additional lines of communication on these birds were opened during the meeting.

Regrettably, my illness prevented me from meeting with you and hearing your paper. I apologize; it was my loss. Again, thank you, and best regards.

Sincerely,

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