

*Conservation Assessment  
for  
Spruce Grouse (*Falcapennis canadensis*)*



*USDA Forest Service, Eastern Region*

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*This document is undergoing peer review, comments welcome (delete if final)*

*This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.*

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## EXECUTIVE SUMMARY

The spruce grouse (*Falciennis canadensis*) is an inconspicuous resident of northern coniferous forests. Although the species is widely distributed and secure throughout much of their range, it has not been intensively studied due to its retiring nature and generally remote habitat. However, human land-use and development patterns have caused substantial population declines along the southern fringe of spruce grouse range, a region where several Lake States National Forests are located. Spruce grouse continue to persist in each of these Forests, but numbers within most of them are small and population trends are unknown. The lack of information about the species and the general scarcity of observations across the region caused it to be placed on the Regional Forester's Sensitive Species (RFSS) list.

The following report is a conservation assessment of spruce grouse in several Lake States National Forests, including the Superior and Chippewa in Minnesota, the Hiawatha, Ottawa and Huron-Manistee in Michigan, and the Chequamegon-Nicolet in Wisconsin. Spruce grouse occurrence data were reviewed for each Forest and examined in relationship to life history and habitat requirements of the species.

The report documents the current status and distribution of the species and proposes strategies needed for its conservation. Although this document attempts to assess the conservation needs of only a single species within a relatively small region, the challenge of developing recovery plans for a species whose status varies from a game bird to a threatened species, and whose preferred habitat ranges from jack pine to black spruce swamps may become evident to the reader.

## ACKNOWLEDGEMENTS

This assessment has been completed using information published in several reports and documents regarding the biology, status, and management of spruce grouse. The Spruce Grouse Element Stewardship Abstract (Soule 1992) and the species profile from the American Ornithologist's Union's Birds of North America series (Boag and Schroeder 1992) were especially useful as reference sources. Bill Robinson's book, *Fool Hen* (1980) and the USFS Region 9 spruce grouse data record (Paulios 1999) also served as valuable sources of information. The authors would also like to acknowledge and thank personnel from the Minnesota, Michigan and Wisconsin Department of Natural Resources, staff at the Superior and Chippewa National Forests in Minnesota, the Hiawatha, Ottawa and Huron-Manistee National Forests in Michigan, the Chequamegon-Nicolet National Forest in Wisconsin, the North Central Research Station, the Michigan State University Extension, and NatureServe.org.

## NOMENCLATURE AND TAXONOMY

American spruce grouse were historically classified as two separate species in the genus *Canachites*: spruce grouse (*C. canadensis*) and Franklin's grouse (*C. franklinii*). Subsequently Short (1967) relegated *C. franklinii* to subspecific status based upon hybridization between the two species. However, Short also lumped both spruce grouse and blue grouse into the genus *Dendragapus* despite their differences in number of rectrices, presence of inflatable cervical sacs and natal plumage. Potapov (1985) refuted the congeneric status of the two species, however, and instead placed the spruce grouse in the genus *Falciennis*. Boag and Schroeder (1992) believed this classification to be more realistic and the latest American Ornithologists' Union's checklist (AOU 1998) recognized the spruce grouse as *Falciennis canadensis*. The AOU further recognized two groups (formerly subspecies) of spruce grouse, *canadensis* and *franklinii*.

## DESCRIPTION OF SPECIES

Spruce grouse are medium-sized, stocky, dark-colored residents of northern conifer forests. The sexes are dimorphic with the male being larger and having a black throat and breast, a red comb over the eye and a black tail with a broad rufous terminal band. Females also have black tails with brown terminal bands but are paler than males and have a gray-brown or reddish-brown plumage with considerable amounts of white barring on the under-parts (See Appendix, Figure 3).

In the Great Lakes region, the spruce grouse could be confused only with the ruffed grouse, a species of similar size, which can also share the same habitats. The two species can readily be distinguished at close range by tail color (pale with sub-terminal dark band in ruffed grouse but dark with a lighter terminal band in spruce grouse) and by the presence of a crest. Ruffed grouse erect their crown feathers to form a crest when alarmed while spruce grouse do not (See Appendix, Figure 4).

## LIFE HISTORY

### Reproduction

Spruce grouse do not form pair bonds and both sexes were formerly believed to be promiscuous. Females may be monogamous, however, since radio-marked females have been recorded consorting with only one male (Boag and Schroeder 1992). Mating occurs in the spring and territorial tendencies of both sexes peak during that season.

Females are territorial during breeding and nesting, and clearly avoid one another during this period (NatureServe 2003). Males maintain their own territories during the courtship and nesting period, often using the same territory year-round for life (Robinson 1980). Territoriality is also observed, to a lesser extent, during brood rearing for both sexes (Keppie 1987).

Territorial males exhibit a series of characteristic behaviors: erecting many of the body feathers, strutting and tail fanning, drumming and flutter flights. The drumming sound of a spruce grouse results from 1 to 3 rapid wing beats which produces soft thumps audible only for a short distance and are quite unlike the drumming of a ruffed grouse. Flutter flights are short, repetitive flights between the ground and a tree perch. Descent from the perch to ground is accomplished almost vertically and on rapidly beating wings, producing a whirring sound which can be heard up to 100m (Robinson 1980, Keppie 1992). Despite the large repertoire of displays, territorial males also occasionally engage in physical combat with a blow-by-blow account in Robinson (1980). Physical contact has also been observed among female spruce grouse in the spring, with such aggressive interactions being described by Boag and Schroeder (1992). A more common form of agonistic behavior among females is a territorial call or cantus. The cantus is a long series of loud clucks followed by several high-pitched whines. The cantus apparently functions to defend a hen's territory against other females since playbacks of the call cause territorial females to respond aggressively. In a study by Herzog and Boag in Alberta, these aggressive calls by females, during mating and egg laying when they are the most territorial, acted as a spacing mechanism which apparently resulted in evenly spaced female territories (NatureServe 2003).

Females will first breed as yearlings, but yearling males generally do not. In Michigan, 67% to 88% of females had broods each year from 1965 to 1969 (Robinson 1980). 44% of males observed by Szuba and Bendell did not obtain territories until they were adults (third spring) and presumably did not breed until then (NatureServe 2003). Some males were non-territorial for three or more years and only 10% of adult males were considered to be non-territorial, presumably non-breeding. Most of the birds in the report by Szuba and Bendell did not breed more than two seasons.

After mating, hens select a nest site within their territory. Nest sites are variable but are most often located under low branches of a young conifer or against the trunk of a tree. Nests are generally well concealed by surrounding vegetation and the camouflage coloration of the nesting hen (Robinson 1980).

Egg-laying begins about 17 days after the ground becomes 50% snow free (Keppie and Towers 1990), which is mid April to late May in this region. Keppie and Towers also reported that laying may be influenced by plant development, as observed year to year variation in median dates has been shown to be correlated with the first flowers of blueberry and trailing arbutus. Male displays cease soon (within nine days) after the median date of commencement of egg-laying (NatureServe 2003). Clutches generally contain 5-7 eggs but vary depending upon the taxonomic group, age of the hen, and across the range of the species. Average clutch size is greater in the *canadensis* group than the *franklinii* group and adult females lay larger clutches than yearling females (Boag and Schroeder 1992). In a Michigan study, clutches averaged 5.7 eggs and across the entire distribution of spruce grouse, clutch size averages 5.8 eggs (NatureServe 2003).

Incubation lasts 21-23 days and hatching peaks between mid and late June. It takes approximately 30 days from the commencement of laying to hatching and the hen spends over 90 percent of her time on the nest during incubation (NatureServe 2003). The hen leads her brood from the nest as soon as the chicks are dry and broods them all night and occasionally during the day for the first 3 weeks. Chicks generally remain in broods for 70-100 days with males leaving earlier than females (Boag and Schroeder 1992).

## **Ecology**

Although spruce grouse occupy a variety of forest types across their range and even within the same state, the birds use forests that are similarly structured. The key feature appears to be structure of adequate density to protect the birds during their nesting and foraging activities. Boag and Schroeder (1992) reviewed habitat use across the species' range and found that the birds use stands that are dense (2,500 to 3,500 stems per ha), 7-14m in height, with a well-developed middle story. Szuba and Bendell (1983) found that spruce grouse populations in jack pine forests decreased with increasing canopy height. They attributed the decrease to the disappearance of lower tree branches as trees matured and self-pruned. Because spruce grouse apparently thrive in jack pine forests where live tree branches extend all the way to the ground, the birds require young stands or older stands where subdominant spruce are present to provide low cover.

The broad array of forest types providing suitable cover for spruce grouse must also provide an adequate supply of food. The staples of the spruce grouse diet appear to be growing tips, leaves, flowers, and berries of ericaceous plants, especially *Vaccinium* spp., and conifer needles. Across the range, spruce grouse rely heavily on needles of pine as the main, and for some months in the winter, the exclusive food items in their diet (Crichton 1963, Pendergast and Boag 1970, Naylor and Bendell 1989). Needles of other conifers, such as spruce, are taken where pines are not readily available (Ellison 1976). Only short-needled conifers are used with the variety of tree utilized depending upon geographic location and season of year. Pine trees are favored over spruce and white spruce over black spruce, if pine is unavailable (Crichton 1963, Ellison 1976, Pendergast and Boag 1970). Studies have revealed that birds can also show preferences among individual trees of the same species with selectivity linked to nutrient content or ease of browsing (Gurchinoff and Robinson 1972, Ellison 1976). In a Michigan study, spruce grouse were found to select certain trees for winter feeding, and the individual jack pines browsed had higher crude protein, lower crude fat, and higher ash content than the unbrowsed trees. The jack pines selected by the grouse were also older than those not selected with an average age of 36.6 years versus 33.5 years, respectively (NatureServe 2003).

Selective foraging is particularly evident among female spruce grouse during the spring. Studies by Pendergast and Boag (1970) and Herzog (1978) revealed that incubating hens selected growing leaders of white spruce, despite the relative scarcity of those trees within their study areas. Spring diet may be an important factor in female

reproductive success since an Ontario study revealed that clutch size was related to the proportion of arbutus flowers and moss spore capsules in a hen's diet (Naylor and Bendell 1989).

### **Dispersal/Migration**

Spruce grouse are considered year-round residents throughout their range and do not undertake any long-distance migrations. Therefore, they often overwinter in the same region as they nest. However, they may occasionally make local migrations or movements over short distances to utilize different habitat types or different locations during winter months (NatureServe 2003). For example, spruce grouse may move from more open stands to denser stands when snow depths become deep, but then return to open stands as snow melts.

During these movements, birds may traverse stands of deciduous growth, apparently avoiding nonforested areas except for rivers and streams, which are flown across rapidly. In autumn, spruce grouse have been found in deciduous forests many kilometers from the closest conifer habitat (Boag and Schroeder 1992). In Alberta, distances between breeding and wintering sites ranged from 0.5 to 0.9 kilometers and males were less likely to migrate than females, 18% vs. 44% respectively (NatureServe 2003).

In a study by Herzog and Keppie looking at *F. c. franklinii* in southwestern Alberta, migratory movements were not found to be highly synchronized. Winter ranges were abandoned between mid-February and mid-May, with males moving earlier than females. Migrations occurring in autumn were found to be even less synchronized, with arrival on the wintering ranges varying from mid-August to late December. In this case females arrived before the males. With longer migrations, movements were found to be relatively synchronous. Departure from winter ranges occurred between 16 April and 11 May and from breeding ranges between 30 August and 13 October. These migratory movements generally lasted less than seven days (Boag and Schroeder 1992).

Spruce grouse are largely arboreal in the winter, but less so in the summer. They are observed to roost and feed in trees during the winter, but nest and feed on the ground, as well as in trees, in the spring and summer (NatureServe 2003). Descriptions of the habitats used for wintering and breeding ranges can be found below in the section discussing habitat.

As stated above, young spruce grouse generally remain in broods for 70-100 days. After this period, usually referred to as brood break-up, distances between the hen and chicks increase even though overt agonistic interactions are not observed. Evidence from field and captive research have found that brood break-up may occur when brood cohesiveness diminishes to the point that *sreep* and *seer* calls no longer elicit *heep* responses from the hen (Boag and Schroeder 1992). In other research, it has been established that dispersal of young occur in late summer to early fall. According to

Robinson (1991), in Michigan, young birds seem to develop plumage similar to adults in late summer and disperse in September.

### **Obligate Associations**

Favored habitat is dominated by short-needled conifers, usually jack pine, black and white spruce, and tamarack. Spruce grouse have also been known to occur in old spruce growth mixed with other conifers and aspens and in spruce bogs interspersed with pine-covered ridges (Robinson 1991).

Essential habitat components preferred by spruce grouse include relatively young successional stands and, excluding differences in conifer species composition, similarly structured forest (i.e., stands that are relatively dense (2,500 to 3,500 stems per ha), 7-14 meters in height and possess a relatively well-developed middle story) (Boag and Schroeder 1992). Generally, live branches from 0-4 meters above ground level, or sufficient tree density to provide suitable escape cover is best. Jack pine forests need to be young enough that they have not begun to self-prune, usually less than about 12 meters in height (NatureServe 2003). Also, larger population sizes may be found in earlier stages of post-fire succession (Boag and Schroeder 1987). Concerning older successional stands, mature spruce stands are the most suitable to spruce grouse (Robinson 1980), mature fir stands will self-prune and become unsuitable, and mature pine stands will only be utilized when subdominant spruce are also present.

## **HABITAT**

### **Range-wide**

The spruce grouse is a species of northern coniferous forests and, although not always dominated by spruce, these forests always include short-needled trees. Spruce grouse inhabit forest types ranging from very dry jack pine to wet black spruce swamps. Robinson (1980) reviewed habitat use across spruce grouse range and concluded that the birds in the northeast prefer wet lowland forests, but farther west they increasingly preferred more upland habitats. Robinson's generalization may not be wholly accurate, however, since habitat choices in several of those study sites were limited.

Habitat use is dependent upon availability and study results reflect that dependence. For example, studies in northern Minnesota (Anderson 1973, Haas 1974) revealed that spruce grouse activities were restricted to lowlands since no upland habitats were available. But a subsequent study in north-central Minnesota by Pietz and Tester (1982) revealed that all radio-tagged birds preferred jack pine uplands during the winter and moved into black spruce bogs for their summer range and nesting, where both upland and lowland types were available. However, on the Chequamegon-Nicolet National Forest the use of both has been observed. Spruce grouse seem to favor jack pine uplands during the summer and move to black spruce lowlands for their winter range (Eklund

pers. comm., DooLittle pers. comm.). Pietz and Tester also observed that when jack pine stands were used for nesting sites, the ground cover and tree density were similar to that of nesting sites located in black spruce. In other of their studies, where jack pine uplands were not available, spruce grouse would remain in black spruce lowlands for the entire year.

## DISTRIBUTION AND ABUNDANCE

### Range-wide Distribution

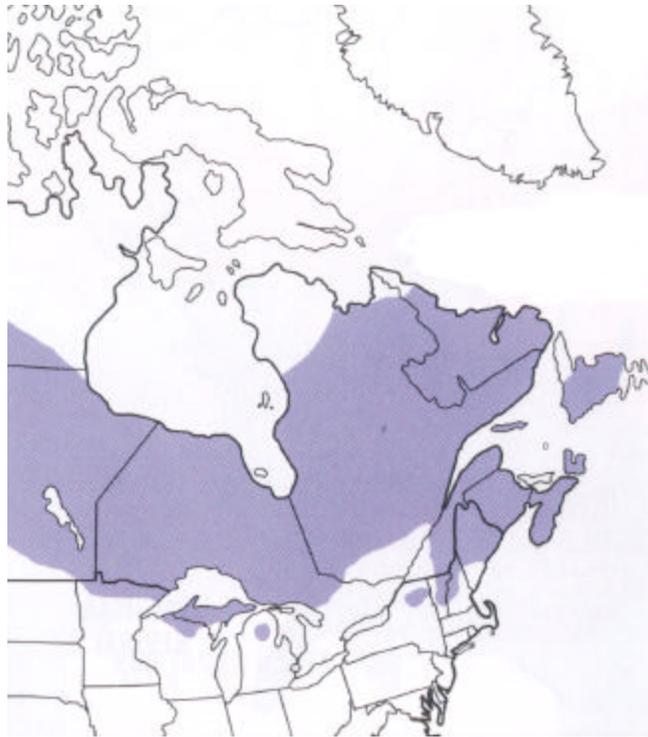
Spruce grouse are distributed in a transcontinental band generally conforming to that of the boreal coniferous forest (Aldrich 1963). Resident (*canadensis* group) from northern Alaska, northern Yukon, northern Mackenzie, southwestern Keewatin, northern Manitoba, northern Ontario, northern Quebec, and Labrador south to coastal and south-central Alaska, central British Columbia, central Alberta, central Saskatchewan, southern Manitoba, northern Minnesota, northern Wisconsin, central Michigan, southern Ontario, northern New York, northern Vermont, northern New Hampshire, and eastern Maine; and (*franklinii* group) from southeastern Alaska (west to base of the Alaska Peninsula), central British Columbia and west-central Alberta south to northern Oregon, central and southeastern Idaho and western Montana (AOU 1998).



**Figure 1.** Year-round range of Spruce Grouse in North America (Boag and Schroeder 1992)

## State and National Forest Distribution

Minnesota has the widest distribution of the species within the Lake States region, extending from Roseau County in the northwest, east through Lake of the Woods, Koochiching, Itasca, St. Louis, Lake and Cook Counties. Formerly, spruce grouse were found regularly as far south as Mille Lacs Lake and Wadena and Carlton Counties (Roberts 1932). Michigan's Breeding Bird Atlas data revealed spruce grouse breeding in 9 Upper Peninsula (UP) counties and one Lower Peninsula (LP) county (Robinson 1991). Despite its occurrence in several UP counties, the species is sparsely distributed, being found on only 6.1% of UP townships during the survey. In Wisconsin, recent sightings indicate that spruce grouse are patchily distributed across 7 northern counties, including Bayfield, Ashland, Sawyer, Price, Vilas, Oneida and Forest. The scarcity of the species in the state is indicated by the results of the recent Breeding Bird Atlas survey, which found the species on only 0.4% of survey blocks.



**Figure 2.** Eastern and Central North American range of Spruce Grouse (Peterson 2002)

## RANGE WIDE STATUS

Spruce grouse are secure across their primary range, which extends from Alaska to Labrador. The species is also secure and legally hunted in some states along the southern fringe of its range, including Washington, Idaho and Montana. In other states along this southern fringe, however, such as New York, Vermont and New Hampshire, the species is very rare and occurs only in small, isolated populations. The Lake States of

Minnesota, Michigan and Wisconsin are also located along the southern periphery of spruce grouse range, but the status of the species shows considerable variation across the region.

In Minnesota, spruce grouse were considered common or abundant in coniferous forests as late as 1880 but disappeared almost completely with the large scale cutting of the forest around the turn of the century (Stenlund and Magnus 1951). Roberts (1932) believed that the species was soon to be extirpated from the state, but by 1940 the forest had grown back and developed a conifer understory, which contributed to a substantial population recovery. This recovery allowed the state to establish a hunting season on the species in 1970.

According to Bonita Eliason, current State Program Coordinator for Minnesota's Natural Heritage and Nongame Research, the spruce grouse is not considered a rare species in Minnesota. As a result, the natural heritage program does not track it. However, the Minnesota Department of Natural Resources survey approximately 2 percent of small game license holders annually to obtain an estimate of spruce grouse harvest, county of harvest, and hunter days for small game hunting. During the 2002 small game hunting season, an estimated 11,969 spruce grouse were harvested from 12 known (Aitkin, Beltrami, Cass, Cook, Crow Wing, Dakota, Hubbard, Itasca, Koochiching, Lake, Pine, and St. Louis) and 1 unknown county (Dexter 2003).

Annual kill surveys indicate that the harvest of spruce grouse ranges from 10,000 to 20,000 and fluctuates in synchrony with the ruffed grouse harvest. No population study has indicated that spruce grouse and ruffed grouse share a similar pattern of cyclic abundance. Fluctuations in spruce grouse harvests are more likely a reflection of change in the number of ruffed grouse hunters afield rather than change in spruce grouse abundance.

Janssen (1987) reported that spruce grouse were most abundant in 2 counties along Minnesota's northern boundary, Koochiching and Lake of the Woods, and in the northern halves of Cook, Lake and St. Louis counties, which encompass the Superior National Forest. Janssen's range map extended south to include the northern portion of the Chippewa National Forest, but a revision of the map published in a recent birder's newsletter included very little of the Chippewa as spruce grouse range.

As in Minnesota, Michigan's spruce grouse population was also impacted by removal of the mature forest during the turn of the century logging boom. Wood (1951) reported the species was formerly common or abundant, but by 1912 was considerably reduced in numbers. Ammann (1963) provided an update on spruce grouse status from a survey of DNR field staff and concluded that the birds, though scarce, were holding their own. Surveys conducted in 1950 and again in 1963 indicated that the species had increased slightly in the Upper Peninsula and had decreased in the Lower Peninsula.

The species has been protected in Michigan since 1915, but some accidental take by hunters is known to occur. Robinson (1991) believed that accidental harvests would

probably not impact sizable populations, but in some areas of the Lower Peninsula where few birds existed in isolated populations, the killing of even a few birds could be a limiting factor to the security of these populations. The most serious threat to spruce grouse in Michigan is probably habitat destruction. Since this species does not disperse long distances, especially through unfavorable habitat, re-colonization of isolated tracts is unlikely. The species is not actively monitored in Michigan. Studies of a population on the Yellow Dog Plains in Marquette County (Robinson 1980), Breeding Bird Atlas surveys (Robinson 1991) and recent surveys of the Raco Plains in Chippewa County (Baetsen 1993) and portions of the Ottawa National Forest (Kaplan and Tischler 2002) have provided some valuable information on spruce grouse in the state. Michigan's Heritage program lists the species as a State Species of Concern.

Spruce grouse status in Wisconsin is less secure than in either of its neighboring Upper Great Lake States. The species is an uncommon resident to northern Wisconsin; regularly present in winter south to Sawyer, Lincoln, and Florence Counties (WDNR 2003). Scott (1943) estimated a total state population of only 500-800 birds in the early 1940's. He reviewed several reports from early observers and concluded that the species had lost much of its original range in the state during the period of lumbering and settlement. He further concluded that the range of the species had continued to shrink since 1900, especially along its southern periphery. The range map prepared by Scott extended south through the northernmost tier of counties (Bayfield to Florence) and into the second tier of counties (Sawyer, Price, Oneida, a small portion of Langlade and a small patch in Taylor County). Robbins (1991) listed a few spruce grouse observations in counties outside the range described by Scott, but reported that nearly all recent sightings continued to fall within the 1943 range.

Despite the fact that ornithologists considered the spruce grouse to be a rare bird in Wisconsin for much of the twentieth century, the species did not appear on the states' first endangered species list (Endangered Species Committee 1973). In a subsequent revision of the list, however, the spruce grouse was categorized as a State Threatened species (Hay et al. 1997). Participants in a recent Breeding Bird Atlas survey found spruce grouse in 0.4% of the blocks surveyed. Only blocks in northern Forest, eastern Vilas, and Oneida Counties had spruce grouse reported in the first four years (1995-1998) of Wisconsin Breeding Bird Atlas work (USDA Forest Service 2004). Currently, no formal surveys are conducted for this species on the Chequamegon-Nicolet National Forest except for on an irregular basis (i.e., Biological Evaluations, etc.). However, relatively few birds were encountered during spruce grouse surveys conducted by Larry Gregg in 1992-93 within the Chequamegon and Nicolet National Forests.

There have been eight observations of the species reported to the Wisconsin Natural Heritage Inventory from 1981 to August 25, 2003. These observations occurred in five counties, which include Ashland (1), Forest (2), Langlade (1), Oneida (1), and Vilas (3) (WDNR/NHI 2004).

Spruce grouse have been protected from hunting in Wisconsin since 1929 but some accidental take by hunters still occurs. In an effort to reduce the risk of accidental harvest, the DNR and USFS have engaged in cooperative efforts to post signs in several known patches of spruce grouse habitat to alert hunters to the presence of the birds.

## **POPULATION BIOLOGY AND VIABILITY**

### Home Range and Habitat Patch Size

Home range sizes can be highly variable among individuals. Ellison, in an Alaskan study, found that home range sizes ranged from 6 to 21 ha for preincubating females, 6 to 155 ha for brood-rearing females, 3 to 20 ha for molting males, 6 to 160 ha for either sex in fall, and 3 to 113 ha in winter (NatureServe 2003). On the Yellow Dog Plains in Upper Michigan, Robinson (1980) reported highly variable range sizes for females with broods, but concluded that 12 to 16 ha would be adequate. According to Boag and Schroeder (1992), individual home ranges average less than 24 ha, but yearling males may range widely. In Alaska, yearling males occupied home ranges up to 346 ha.

Boag and Schroeder also observed that home ranges of females in autumn were also large, but smaller than those occupied during summer months. The data obtained from radio-marked birds indicated home range sizes of males are larger in the winter than in the spring, when only a core area is defended. However, among females, the winter home range expands slightly into defended territory in the spring.

The approximate size of an adequate patch size has yet to be determined, but more than likely varies with habitat type and quality. In a habitat assessment for Vermont, it was concluded that a female spruce grouse needs 5 to 15 ha of habitat, depending on quality, to raise her brood. From this data it was extrapolated that if there were a population of 100 birds, of both sexes, between 250 and 750 ha would be required (NatureServe 2003). In New York, Bouta and Chambers (1990) recorded spruce grouse occupying patches that ranged from 83 to 162 ha and averaged  $117 \pm 32.9$  ha. These patch sizes were based on annual breeding population sizes for four persistent populations that averaged  $4.1 \pm 2.0$ .

### Flock Size

Rarely are “flocks” larger than two individuals in the spring and summer, except for females with broods. Even in the fall and winter, the average flock size (calculated from observations of 268 flocks) was 3.0 birds per flock (NatureServe 2003). The largest flocks were recorded at 6 to 15 birds. Adult males remain quite solitary, even in winter, with juveniles being less solitary. In Michigan, Robinson (1980) found fall flocks of 4 to 12 individuals. These flocks were composed of mixed sexes, ages and family groups.

## Density

Spruce grouse breeding populations generally occur at low densities, with 10-22 birds/km<sup>2</sup> in Ontario. The highest reported densities, also from Ontario, were observed in populations that exceeded 50 birds/km<sup>2</sup> in prime habitat (Szuba and Bendell 1983), while the lowest densities have been reported from sites along the edge of the species' range. Densities of 5-9 birds/km<sup>2</sup> were found in Michigan (Robinson 1980) and 1-10 birds/km<sup>2</sup> in New York (Bouta and Chambers 1990). Szuba and Bendell (1983) compared spruce grouse population and habitat information from several locations across North America and concluded that, with few exceptions, forests having similar features of the canopy held comparable grouse populations.

Population densities will often fluctuate based on movements. These movements may be influenced by conditions in the environment, as well as, by the resident birds in the population. An example can be found in autumn dispersal on the density of wintering populations of a spruce grouse population in New Brunswick. In this case, emigration exceeded immigration causing the number of young birds in the winter population to fall from 18.8 to 8.3 birds per 100 ha (Boag and Schroeder 1992).

## Recruitment

One measure of production is nest success or the percentage of nests hatching at least one egg. Published estimates of nest success have been quite variable, with most ranging between 40% and 80% (Boag and Schroeder 1992). Reported values for populations within the Northern Lake States also fall within that same range, with success rates of 40% in Minnesota (Haas 1974) and 78% in Michigan (Robinson 1980). Most unsuccessful nests are lost to predation, so differences in nest success may be related to variations in available ground cover or the ability of hens to select a secure nest site. Keppie and Herzog (1978) reported that nest site characteristics did have a bearing on success with well-concealed nests being more likely to hatch.

Because chick survival can also vary in addition to that variation in survival of the nest, a better measure of production might be average brood size during the late summer. This recruitment index also varies, however, with estimates ranging from 3.2 to 5.5 chicks per brood across the range (Boag and Schroeder 1992). The only information from the Northern Lake States is from Robinson (1980) who reported Michigan broods to be near the lower end of the production spectrum, at 3.7 chicks per brood. Most species of grouse suffer high mortality of chicks during the early part of the brood period and Robinson (1980) reported a 30% reduction in average brood size during the first month. Although he was unable to document causes of chick mortality, he did find a close relationship between chick survival and June temperatures.

## Survival and Longevity

Survival rates vary widely, but published estimates are considerably higher among the *franklinii* group than among *canadensis*. For example, Keppie (1979, 1987) found mean annual survival rates of 76% for males and 63% for females in an Alberta *franklinii* population, whereas in a New Brunswick *canadensis* population those values were 44% for males and 49% for females. Robinson (1980) reported similar rates of 50% for males and 45% for females and noted that an apparent relationship existed between survival and clutch size across the range, with those populations having the highest adult survival having smaller clutches.

Published information on longevity is strongly influenced by sample size and duration of the study. Robinson (1980) banded 315 birds in his 5-year Michigan study with his oldest bird reaching 7.5 years of age. But a 21-year study in Alberta involving some 2,500 banded birds produced three birds which lived to be at least 13 years old (Boag and Schroeder 1992).

## Population Regulation

Results of several studies of population dynamics of this species have revealed that changes in spruce grouse numbers are influenced by both extrinsic and intrinsic factors (Boag and Schroeder 1992). Extrinsic factors such as weather and habitat conditions have been found to affect population density, primarily through their impact on productivity. But spring densities are not always closely correlated with the previous year's productivity, so there is evidently considerable variation in the proportion of available recruits that enters the breeding population. Some studies have suggested that the number recruited into the spring population is dependent upon the number of resident adults, density thus being regulated by spacing behavior of territorial birds (Boag and Schroeder 1987).

## **POTENTIAL THREATS**

### **Present or Threatened Risks to Habitat**

#### Habitat Loss

Spruce grouse are dependent upon forests of short-needled conifers, and the loss of such habitats has been associated with population declines. Reductions in spruce grouse numbers resulting from removal of pre-Euro-American settlement forests across the northern Lake States have been documented in Michigan (Ammann 1963), Minnesota (Stenlund and Magnus 1951) and Wisconsin (Scott 1943). Forests were removed from the landscape only temporarily during the logging boom, however, and spruce grouse populations have recovered in portions of their range as forests grew back (Stenlund and Magnus 1951).

Since spruce grouse require earlier successional stages, logging per se has not necessarily always been detrimental to this species (NatureServe 2003). However, when logging results in the overall change of forest composition, there is great potential for these changes to have more permanent effects on the regional viability of the species and on ecosystem processes.

In a study conducted by Snetsinger and Ventura (1999), *Land Cover Change In The Great Lakes Region (Minnesota, Wisconsin, and Michigan) From Mid-Nineteenth Century To Present (~ 1990)*, it was reported that substantial changes in the composition and pattern of historic forests have occurred. In fact, a decrease in overall forest cover of 37% from presettlement times was observed. Respective to important spruce grouse habitat, substantial decreases occurred in coniferous lowlands (-15%), spruce-fir/other upland conifers (-13%) and jack pine (-6%) when compared to conditions recorded during the original government land surveys (about 1830-1860). However, in relation to the originally small percent of coverage jack pine represents (approximately 8%); compared to the other cover types, an effective 79% decrease in presettlement jack pine forest has occurred. These changes can closely be attributed to the logging history of the region, natural history traits of the tree species, and an alteration of natural disturbance regimes (i.e., policies regarding suppression of natural fires).

Past logging practices in the Adirondack forests of New York have also contributed to reductions in spruce-fir habitats, which Bouta and Chambers (1990) believed to be the major cause of a decline in spruce grouse numbers. Habitat loss can occur as an indirect consequence of timber harvests if resulting forest types are less suitable for spruce grouse. For example, some harvested jack pine stands in Michigan's Yellow Dog Plains have been subsequently replanted to red pine, which is avoided by spruce grouse (Robinson pers. comm.). Also in Michigan, habitat changes (i.e., logging out pine forests, followed by replacement by aspen and oaks) led to declines in the northern Lower Peninsula by early 1900s (NatureServe 2003).

### Declines in Habitat Quality

Spruce grouse prefer relatively young successional stands (Boag and Schroeder 1992) with such habitats being maintained by periodic fires across much of the northern and western boreal forest. Wildfires are less frequent within the more southerly portions of the species' range, however, so the younger stands that spruce grouse need are more likely a product of timber harvests. As stated above, although logging has contributed to a loss of spruce grouse habitat in some areas, it is critical to the maintenance of high quality habitats within other portions of the species' range.

Several studies (Schroeder and Boag 1991, Szuba and Bendell 1983) have revealed that spruce grouse numbers declined as pine forests matured. Robinson (1969), likewise, reported that spruce grouse in Michigan did not favor mature stands, whether comprised of jack pine or spruce. In the Yellow Bogs of Vermont, Keppie and Beaudette

observed that not many spruce grouse were found in conifer stands (spruce, fir, pine) in which tree height was greater than 15 m and live-crown was less than 50% of the total height (NatureServe 2003). Results of these studies were in agreement that habitat quality declined when low tree branches and shrub cover became scarce as trees matured and canopies closed.

Although loss of habitat represents the greatest threat to spruce grouse populations, habitat fragmentation and isolation of populations are important concerns along the fringe of the species' range. Habitat fragmentation caused by human development patterns has been detrimental in the southeastern portion of spruce grouse range (NatureServe 2003). Those spruce grouse populations, which occupy habitat patches, appear to be at risk of extirpation. Fritz (1985) reported on the disappearance of spruce grouse from 7 previously occupied patches in New York and suggested that dispersal was inadequate to produce recolonization.

### **Disease or Predation**

According to Boag and Schroeder (1992), many parasites have been reported but none have been implicated as a serious cause of mortality. However, Boag and Schroeder also noted that certain diseases and conditions may be of great consequence under some circumstances. Examples given included, *Aspergillus fumigatus*, a fungus that usually infects lung tissue, which may cause death, especially during winter months, and renal gout which was found, by Herzog in 1979, to cause the death of four radio-marked grouse during periods of prolonged heavy precipitation. Robinson (1980) found that survival rates of spruce grouse with parasites and without parasites did not differ.

Predation is assumed to be the major cause of mortality in spruce grouse populations. Particularly at the egg stage of development, the average rate of nest loss ranges from 19% in *F. c. canadensis* to 70% in *F. c. franklinii*. The loss of entire clutches seems to be the most common, usually the result of mammalian predation, however, corvids are also suspected. In another study, most of the chick mortality occurred during the first two weeks of life (76% in a population of *F. c. franklinii*) with a second period of loss during the first autumn or winter (Boag and Schroeder 1992). Robinson (1980) observed that most of the predation on yearlings and adults appeared to be by raptors, especially the Northern Goshawk (*Accipiter gentilis*). In northern Michigan, Robinson identified the red squirrel (*Tamiasciurus hudsonicus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), weasels (*Mustela* spp.), Northern Goshawk, and Barred Owl (*Strix varia*) as major predators for the spruce grouse. More examples include red squirrels, coyotes, mustelids, and raptors in southwestern Alberta, and Sharp-shinned Hawks (*Accipiter striatus*), Northern Harriers (*Circus cyaneus*) and lynx (*Lynx canadensis*) in Ontario. Boag and Schroeder also made note that most of the mammalian predators (i.e., canids and mustelids) take eggs and birds, whereas raptors (i.e., hawks and owls) tend to only take birds.

## **Inadequacy of Existing Regulatory Mechanisms**

In Minnesota, spruce grouse are considered common and abundant, especially in the most northern part of the state. A hunting season was established in 1970 and each year hunters harvest between 10,000 and 20,000 spruce grouse without affecting the population. No other species specific management for spruce grouse is currently occurring in Minnesota. For Michigan, spruce grouse have been a fully protected species since 1915 and, because they are rare, are listed on the Special Concern list. No hunting season has been established or will be in the near future according to the Michigan Department of Natural Resources. This species has no specific management objectives and is not actively monitored. Any management that may occur is minimal and usually a byproduct of other activities (i.e., spruce grouse in Michigan are primary benefactors of jack pine and Kirtland's warbler management). In Wisconsin, spruce grouse are less secure and more uncommon than in Minnesota and Michigan. As a result it was categorized as a State Threatened Species in 1997. Hunting has been prohibited since 1929.

## **Other Natural or Human Factors**

Several early writers (Bent 1932, Roberts 1932, Scott 1943) attributed historical spruce grouse declines to human settlement and the killing of these unwary birds by humans. Although there is no evidence that hunting has affected populations in any state where the species' is a legal target, accidental kills may have exacerbated the decline of small, disjunct populations in New York (Bouta and Chambers 1990). Accidental hunting kills are also known to occur in both Michigan and Wisconsin and such mortality could also represent a threat to the maintenance of small and/or isolated populations within those states. However, Robinson (1980) believed that accidental shooting represented only a minor source of mortality for birds residing in the Yellow Dog Plains and even proposed a limited hunting season in the UP of Michigan (1 bird per day, 2 per season). He suggested that such a season would reduce waste, provide an opportunity to collect information and have negligible effect on spruce grouse populations. The degree of threat posed by hunting varies among different areas, but overall, threat is low region-wide as a result of the vastness of potential habitat, association with wet forest types, and inaccessibility of much of the species range (NatureServe 2003).

As stated above under Declines in Habitat Quality, habitat fragmentation caused by human development patterns has been detrimental in the southeastern portion of spruce grouse range (NatureServe 2003). Land development has caused an increase of habitat fragmentation and isolation of populations along the fringe of the species' range. The populations that occupy these habitat fragments (patches) appear to be at risk of extirpation. It has been suggested that these isolated patches lend themselves to extirpating resident populations because dispersal of spruce grouse may become inadequate to produce recolonization (Fritz 1985). Other concerns with land development, particularly recreational and residential in spruce-jack pine areas along lake

shores, is the reduction of food and cover, and the increased disturbance by dogs, cats, and humans (Robinson 1991).

According to the Forest Service North Central Research Station (NCRS), across the U.S., 2,450 acres of open space are developed every day. However, at this point, no comprehensive research program is in place for the North Central Region (Minnesota, Wisconsin, Michigan, Indiana, Illinois, Missouri, and Iowa) to answer questions such as, how fast is the change occurring and what spatial form will it take, and how will these changes affect forest management for biodiversity? In an attempt to look into these problems, NCRS and the University of Wisconsin – Madison conducted a joint-study to assess housing density across the North Central U.S. from 1940-2000. The study focused on low density development (i.e., development that most often affects forests and agricultural lands). These low density areas are often found at the leading edge of development, in which both land use and land cover are altered.

In 1940, housing density was found to be highest in urban and very low in rural areas (Stewart et al. 2003). However, by 2000, there were more low and middle density housing areas across the landscape. Throughout the time range evaluated in the study, development and housing density steadily increased into the southern fringe of spruce grouse range. This “built” environment of housing development directly affects environmental quality (i.e., habitat, ecosystems, wildlife, water and air quality, global climates, and noise) by such things as increased homes and roads, and through its influence on mobility and travel decisions, has created additional indirect effects on environmental quality (eg. vehicle miles driven, congestion, and increased accessibility). These housing developments, along with the other associated changes described above, transform land cover, drainage patterns, and habitat important to spruce grouse and all other wildlife.

## **NATIONAL FOREST SPECIFIC ISSUES**

### **Superior National Forest**

The Superior is a large Forest (>1.5 million ha) having extensive coniferous cover types, and thus contains a sizeable amount of potential spruce grouse habitat. But bird monitoring programs conducted within the Forest during past years have provided little information on the species. For example, only 2 spruce grouse were recorded on surveys conducted throughout the Superior during 1991-1994 (Hawrot et al. 1994) and a summary of findings from the Breeding Bird Survey (BBS) for Minnesota (Niemi et al. 1995) failed to mention the species. Despite the scarcity of spruce grouse observations on routine bird surveys, the species is known to be abundant in portions of the Superior. An area near Isabella in Lake County is widely known among the birding community as a place to see spruce grouse and some consider it the most reliable and consistent spot in the United States to find the bird. A recent article in *The Loon*, Minnesota’s magazine of birds, reported the sighting of a flock of 27 birds in this location in February 1999.

The Superior contains a great combination of uplands and lowlands, with some lowland associated peatlands. According to Ed Lindquist (elec. comm.) very little lowland black spruce is harvested but when harvest does take place, the stand is regenerated back to black spruce. Also, there are no known locations in which active peatland harvest is occurring. According to the new Superior Forest Plan, management will progress toward the range of natural variation found in the landscape ecosystems on the Forest. This will provide spruce/fir and jack pine, as well as other conifers, in greater proportions than what is currently present. Lindquist also mentioned that the new Forest Plan should provide for more pine forests, a better range of age classes and less fragmentation of stands (i.e., larger harvest units, etc.) which, when done with spruce grouse in mind, should provide for better future habitat.

Because the spruce grouse is a legal game bird and its habitat appears to be abundant on the Superior, there has been some reluctance among managers to treat the bird as a Sensitive Species. It currently is not designated as Regional Forester Sensitive on the Superior.

### **Chippewa National Forest**

The Chippewa is only a fraction of the size of the Superior and is dominated by deciduous forest types, thus providing far less potential spruce grouse habitat. It is quite probable that the species is less secure here than on any of the other Lake States Forests. As a result, it is designated as Regional Forester Sensitive. Most biologists consider spruce grouse to be rare on the Forest, but estimates of population status are not based upon any specific survey information. Bill Berg, recently retired DNR grouse biologist, believes that very few birds presently reside within the Forest. Casson (pers. comm.) considered spruce grouse to be rare within southern portions of the Forest, but was aware of 2 sightings in that area over the past few years. Cable (pers. comm.) likewise considers spruce grouse as rare to uncommon within the northern portion of the Chippewa and estimates that fewer than 5 observations have occurred there over the past several years.

Birds have been reported using a variety of forest types in the Forest, but observations have been too scarce to document preferred habitat types. Lack of information on forest types used by spruce grouse on the Chippewa makes it difficult to assess future habitat availability. Although habitat loss was deemed the greatest threat to the species in some parts of the Forest, hunting harvest was also considered a threat since the birds exist in small and isolated populations.

### **Ottawa National Forest**

Spruce grouse are considered uncommon on the Ottawa National Forest (Evans pers. comm.). It is not designated as Regional Forester Sensitive, but results of past survey efforts confirm the scarcity of the species. Michigan's Breeding Bird Atlas survey

(Robinson 1991) resulted in only three townships within the Forest having spruce grouse sightings. A subsequent survey conducted specifically for spruce grouse (Kaplan and Tischler 2002) produced only two or three (one possible repeat) sightings.

Spruce grouse appear to be much less common in the western UP than in the central and eastern portions of the UP, which may be a reflection of habitat scarcity within the former region. Kaplan and Tischler (2002) identified six forest types as potentially suitable habitat for spruce grouse on the Ottawa and those types accounted for 20% of the land area in the Forest. But the species' preferred forest types of jack pine and black spruce accounted for only 3% of total forest area.

Despite the scarcity of spruce grouse habitat on the Ottawa, existing habitat appears to be secure. No vegetative treatments are planned for black spruce habitats and potential impacts on spruce grouse populations are taken into account whenever treatments are proposed in jack pine types (Evans pers. comm.).

### **Hiawatha National Forest**

Spruce grouse are believed to be secure on the Hiawatha (Sjogren pers. comm.) and are not designated as Regional Forester Sensitive. The birds are seen fairly regularly on the Forest, especially on the Sault Ste. Marie District. The spruce grouse population on the Hiawatha is believed to be considerably larger than that on the Ottawa, despite a small difference in the number of birds observed during the statewide Breeding Bird Atlas survey. Although only five townships within the Forest had spruce grouse sightings during that survey (Robinson 1991), another survey of a small portion of the Raco Plains, mostly Jack Pine stands, (Baetsen 1993) resulted in the finding of 18 individual birds.

Nearly all of the birds found by Baetsen were located in jack pine stands and Sjogren felt that mid-successional jack pine stands were the primary habitat for spruce grouse on the Forest. Habitat is believed to be stable and there is considerable interest in managing jack pine succession on the Forest to benefit an array of birds, including sharp-tailed grouse, Kirtland's warblers and spruce grouse. The general trend toward conversion of jack pine stands to red pine probably represents the largest threat to spruce grouse habitat on the Forest.

### **Huron-Manistee National Forest**

Spruce grouse are designated as Regional Forester Sensitive on the Huron-Manistee. Their status is unknown (Ennis elec. comm.), but is judged to be secure based on current and predicted habitat conditions and occasional observations. Suitable habitat exists and is broadly distributed across the Forest. Patch size and availability has diminished from historical conditions (155,000 acres to 71,000 acres), with gaps being smaller in size.

Spruce grouse are infrequently observed in Oscoda and Ogemaw counties on State lands each year. Several occurrences have been documented on the western half of the Huron in the last few years. Observations of the species are usually associated with Kirtland's warbler census efforts conducted in jack pine stands. Ennis stated that the spruce grouse are felt to be on the southern edge of their range on the Huron-Manistee, and the availability of lowland conifer forest types is limited.

Habitat for spruce grouse is considered to be secure. Jack pine forest types are likely to increase, with management for Kirtland's warbler habitat ensuring age class diversity into the foreseeable future. The current Forest Plan for the Huron-Manistee identifies approximately 93,000 acres of potential habitat, 81,000 acres in jack pine and 12,000 acres in lowland conifer. Ennis further identified three forest types especially relevant to spruce grouse which include short lived conifer (115,626 total Forest acres), short lived oaks (156,300 acres) and lowland conifer (30,832 acres).

No specific monitoring or surveying programs are currently in place for this species. As indicated above, most observations have occurred during Kirtland's warbler census efforts; therefore specific numbers have not been documented. Locations have been in jack pine stands that are in their late stage of Kirtland's warbler occupancy (15-30 years old). No trend information is available, but habitat availability and populations are likely to continue to increase due to habitat created through the Kirtland's warbler recovery efforts.

The current Forest Plan for the Huron-Manistee does not identify any conversions of jack pine to red pine. It is, in fact, more likely that areas currently planted in red pine will be converted to jack pine in the future. The annual harvest goal of approximately 1,100 acres of jack pine is expected to increase to approximately 1,600 acres in the revised Forest Plan. These treatments, however, will re-establish jack pine as the desired forest type. The establishment of spruce in or adjacent to these areas to provide additional winter habitat has also been considered. In addition, no harvesting of lowland conifer types is occurring or expected to occur. Current plans are to maintain these types into the foreseeable future.

### **Chequamegon-Nicolet National Forest**

Spruce grouse are uncommon on the Chequamegon-Nicolet and have been designated as Regional Forester Sensitive. However, they have been observed in a number of sites within the Forest in recent years. There is an established breeding population on the Great Divide District (mostly Ashland and Sawyer Counties). There are other sparse reports on the Forest, including three known locations on Lakewood/Laona, two on Eagle River/Florence, and one on the Park Falls District (USDA Forest Service 2004). The species is patchily distributed across the Forest, being rare on the Washburn District and probably absent from the Medford District. The relative importance of National Forest lands for spruce grouse in Wisconsin is evidenced

by the results of the recent Breeding Bird Atlas survey, with 6 of the 15 blocks where the species was observed being located within the Forest. The survey resulted in no sightings on the Chequamegon or western side of the Forest, however, despite their presence in a number of sites.

The major share of spruce grouse sightings from the Breeding Bird Atlas survey occurred in lowland conifer forests, especially black spruce. Similarly, most of the 15 spruce grouse found during surveys conducted by Larry Gregg during 1992-93 were residing within or close to extensive black spruce swamps. On the Chequamegon-Nicolet, the total amount of habitat available to spruce grouse is estimated at 254,000 acres (including lowland conifer). Approximately 182,744 acres are composed of lowland conifer forests and of that, an estimated 59,047 acres are black spruce swamp. 72,500 acres are currently composed of jack pine, balsam fir, and upland spruce (white and black) (USDA Forest Service 2004).

Spruce grouse are dependent upon short-needled conifers, and the loss of such trees from the Forest probably represents the greatest threat to the continued presence of the species. Black spruce-tamarack bogs, which comprise the majority of spruce grouse habitat, are of low economic value, and unsuitable for development. As a result, they are likely to remain unchanged over time according to the Chequamegon-Nicolet National Forest Final Environmental Impact Statement (2004). But spruce grouse also occupy jack pine (approximately 33,450 acres) and mixed conifer-hardwood forests, which may no longer be suitable after harvesting. When jack pine stands are converted to red pine or when mixed stands regenerate to hardwoods, spruce grouse occupancy ceases or is reduced.

Because spruce grouse populations on the Forest are relatively small and patchily distributed, accidental harvest by ruffed grouse hunters is a potential, but probably minor threat. A sizable portion of past records of spruce grouse involved birds that were accidentally shot, but such kills are not believed to represent a sizable portion of overall mortality. In an effort to reduce accidental kills, several known patches of spruce grouse habitat have been posted with signs alerting hunters to the presence of the species. No effort, however, has been undertaken to gauge their effectiveness.

## **SUMMARY OF EXISTING MANAGEMENT ACTIVITIES**

The spruce grouse is listed as a Regional Forester Sensitive Species (RFSS) on the Chippewa, Huron-Manistee, and Chequamegon-Nicolet National Forests. Designating a species as RFSS on Forest Service lands help create management objectives and practices which avoid impacts that trend toward Federal listing as threatened or endangered.

## **RESEARCH AND MONITORING**

### **Existing Surveys, Monitoring, and Research**

No specific monitoring of spruce grouse populations is being done on any of the Lake States National Forests. Although a considerable amount of bird monitoring effort has taken place on these forests (Hanowski and Niemi 1994, Hawrot et al. 1994), such surveys were not designed to detect spruce grouse so the species was rarely documented.

### **Survey Protocol**

Playbacks of recorded female calls are an effective method for conducting a census of spruce grouse and the technique has been successfully employed on both the Hiawatha and Chequamegon-Nicolet National Forests. Initiation of surveys utilizing this technique will be needed in order to effectively monitor spruce grouse populations and status within Lake States Forests. Any attempt to monitor spruce grouse populations must overcome problems in designing a proper sampling system, since the typical roadside or point count methodology would not be appropriate. But concern about a sampling strategy should not preclude efforts to initiate a monitoring program.

### **Research Priorities**

In developing a program to survey spruce grouse populations, priority should be given to those Forests where the species ranks high in evidence of management concern and yet exists in sufficient numbers that surveys could be productive. Surveys within the Chequamegon-Nicolet in Wisconsin, for example, where the species can still be found in several locations and yet has been included on the state's list of threatened species, should receive priority over any monitoring efforts in the Chippewa in Minnesota where the species is rare but remains on the state's list of harvestable birds.

Surveys should be habitat specific and target those sites most likely to hold birds. Based upon historical sightings within the various Forests, an adequate number of potential survey sites certainly exist within the Superior, the Hiawatha and the Chequamegon-Nicolet. Survey results could be related to available forest type data in order to provide information on habitat area requirements, habitat connectedness, and the effects of timber harvest on spruce grouse occupancy.

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APPENDIX



*Figure 3. Male (top) and female spruce grouse.*



*Figure 4. Male ruffed grouse (WVDNR 2002) (left) and male spruce grouse (James Bay Islands Bird Survey 1995) (right).*

## **LIST OF CONTACTS**

**Information Requests**

**Review Requests**