SPRUCE GROUSE RESPONSES TO TIMBER HARVEST IN MINNESOTA

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SUMMARY OF FINDINGS

We completed the first season of a 2-year study to examine spruce grouse (*Falcipennis canadensis*) responses to harvest of jack pine (*Pinus banksiana*) and black spruce (*Picea marina*) stands, their preferred habitat in Minnesota. Eighteen spruce grouse were marked with VHF radiotransmitters during the winter 2019-2020 capture season. Additionally, we surveyed 25 timber stands for spruce grouse and their pellets to examine use of stands before harvest. During this first winter of the study, 18 study stands were harvested, including 13 black spruce and 5 jack pine stands. We will continue to capture and track spruce grouse through fall 2021 to examine survival and movements before, during, and after timber harvest.

INTRODUCTION

Spruce grouse (*Falcipennis canadensis*) occupy forest stands with a variety of coniferous tree species including spruce (*Picea* spp.), fir (*Abies* spp.), pine (*Pinus* spp.), hemlock (*Tsuga* spp.), and tamarack (*Larix lariana*), and habitat selection varies with the forest community in various portions of spruce grouse range (Boag and Schroeder 1992, Lycke et al. 2011, Anich et al. 2013). In the Great Lake States, spruce grouse prefer areas of black spruce (*Picea marina*) with some jack pine (*Pinus banksiana*) interspersed, but they have also been reported using balsam fir (*Abies balsamea*), tamarack, eastern hemlock (*Tsuga canadensis*), and northern white cedar (*Thuja occidentalis;* Robinson 1969, Pietz and Tester 1982, Anich et al 2013). In Wisconsin, spruce grouse used closed canopy coniferous uplands near lowland conifer swamps, especially mature black spruce-tamarack swamps and jack pine 16–29 years old (n=55 birds, Anich et al. 2013). Similarly in Minnesota, but with a more modest sample size (n=15), spruce grouse used lowland conifers with black spruce and mixed bogs during the breeding season, and used jack pine during winter (Pietz and Tester 1982). Various successional stages are used throughout spruce grouse range, including early (Boag and Schroeder 1992), mid-successional (Ross et al. 2016), and mature forest (Anich et al. 2013). Forest structure is probably more important than stand age (Schroeder et al. 2020). Lycke et al. (2011) reported that both forests >30 years and <30 years old were used by spruce grouse in Québec. Various forest management practices in different regions likely produce favorable structure in different aged stands throughout the spruce grouse range, explaining the differences among studies.

Spruce grouse responses to timber harvest have been studied in Québec, which is more centrally located within the spruce grouse range than Minnesota (Turcotte et al. 1994, 2000; Potvin and Curtois 2006, Lycke et al. 2011). Logging in Québec during these studies had some similarities to logging practices in Minnesota (e.g., commercial thinning) and some differences (e.g., clearcutting 150–250 ha blocks with residual 60–100 m buffer strips). Following clearcuts, spruce grouse moved to other forested areas nearby (<200 m), usually overlapping with their previous home range (Turcotte et al. 1994, 2000), which is only possible when residual forest is

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nearby. Home ranges (23–41 ha) during logging were similar to those before logging (13–33 ha), but survival was higher before logging than after (S=0.75 vs 0.44). Lower survival was primarily due to predation, which reduced the density of birds by 60% (Turcotte et al. 2000). In another study, spruce grouse had more extensive movements and lower survival in buffer strips and uncut forest patches after clearcutting (Girard 1999 and Strobel 1999 [in French] as cited in Potvin and Curtois 2006, Turcotte et al. 2000). Potvin and Courtois (2006) studied spruce grouse use of residual strips after clearcutting and documented that home ranges were slightly larger in residual forest strips than in contiguous forest. Survival was also lower in residual strips (S=0.52 vs 0.73). Moreover, strips used by spruce grouse were located more distantly from contiguous forest (719 vs 417 m), perhaps indicating that spruce grouse abandon these strips if large residual patches of forest are nearby. In British Columbia, survival was positively related to connectivity, and areas of low connectivity acted as population sinks, but densities of spruce grouse were similar in areas of low and medium connectivity (Harrison 2001). Spruce grouse responses to commercial thinning have also been examined (Lycke et al. 2011). Thinning adversely impacted grouse based on substantially lower use of thinned stands than uncut stands in Québec, which was attributed to the loss of dense understory vegetation (Lycke et al. 2011).

Spruce grouse responses to timber harvest in Minnesota have not been investigated, but it is likely that the impact varies depending on the landscape context, availability of residual forest nearby, and logging practices. We aim to study spruce grouse responses to timber harvests of various sizes and in various landscapes to address this information gap. In Minnesota, black spruce harvest occurs in winter and jack pine harvest usually occurs in summer. Birds will be marked and monitored to capture responses to timber harvest during different periods of their life cycle. During winter, spruce grouse contrast strongly against the snow, which may make them vulnerable to predation when crossing areas that lack cover. During summer, female spruce grouse have broods that may constrain behavioral responses. By monitoring spruce grouse responses during both winter and summer, we will gain a more complete understanding of how birds immediately respond to habitat loss at different times of year, and whether loss of habitat within a substantial portion of the home range results in higher mortality relative to that in unharvested stands. We will determine if spruce grouse move to the nearest conifer forest stand, or farther, and whether there is a mortality cost of moving and occupying a new stand.

OBJECTIVES

1. We will examine spruce grouse use of jack pine and black spruce stands before and after timber harvest.
2. We will examine spruce grouse responses to timber harvest by marking spruce grouse with radiotransmitters to monitor movements and survival before and after timber harvest.
3. We will determine whether responses (i.e., movements and survival) to timber harvest in winter differ from responses in summer.

STUDY AREA

We have 2 focal areas for our study, one based out of Red Lake Wildlife Management Area (RLWMA) in Lake of the Woods and Roseau Counties, and one based out of Big Falls in the Littlefork DNR Forestry work area in Koochiching County (Figure 1). We identified stands scheduled for harvest by working with wildlife managers and foresters in regions where spruce grouse surveys indicated comparatively high spruce grouse populations in the state (Roy et al. 2019). Eighteen black spruce stands (11–145 ac, 4–59 ha) and 17 jack pine stands (9–43 ac, 4–17 ha) were identified for harvest near RLWMA (C. Tucker, pers. comm.). An additional 43 black spruce stands (3–221 ac, 1–89 ha) were identified in the Littlefork Forestry area (B. Feldt

and J. Rengo, pers. comm.), along with 87 black spruce stands (0.1–79 ac, 0.04–32 ha) and 10 jack pine stands (1.6–11 ac, 0.6–4.5 ha) identified by Koochiching County Land and Forestry (N. Heibel, pers. comm.). A few additional red pine (n=4) and white spruce or mixed spruce (n=13) stands were identified as planned for harvest but given a lower priority than black spruce and jack pine stands in the study. Some of the stands planned for harvest will not be harvested during the study because loggers have 3 years to complete harvest and thus may harvest some of these stands after the study concludes.

METHODS

We used multiple methods to locate birds for capture in or near timber stands scheduled for harvest. We drove roads to find birds coming in for grit near stands close to roads. We solicited the help of volunteers with trained pointing dogs to search stands and the adjacent areas. We looked for fecal pellets in winter when pellets are obvious against the snow (Roy et al. 2020). We broadcast the cantus call, a female call, during spring to locate males and females (Fritz 1979, Boag and McKinnon 1982, Schroeder and Boag 1989, Whitcomb et al. 1996, Lycke et al. 2011, Roy et al. 2020). We captured spruce grouse primarily with noose poles (Zwickel and Bendell 1967, as used by Anich et al. 2013, Ross et al. 2016). We also tried setting mirror traps and walk-in traps baited with various lures; blueberries, grit, rose hips, and red hummingbird-food-dyed corn. Four capture seasons were planned; winter 2019-2020, spring 2020, winter 2020-2021, and spring 2021.

Once captured, we recorded capture time, capture method (noose or trap type), sex, age, any injuries during capture or other notable findings, and release time. We attached 12.0 g necklace-style VHF A-3950 transmitters from Advanced Telemetry Systems to spruce grouse (Roy et al. 2016). We also collected a feather sample for genetics, banded the bird with an aluminum band and color band, weighed birds with a pesola spring scale, and measured the tarsometarsus length with calipers.

At each capture location, we recorded GPS coordinates, stand type, the capture tree species (or tree nearest the capture location when the bird was captured on the ground), capture tree circumference, distance to the nearest tree, nearest tree species and circumference, and the number of live trees in a 3.6 m radius of the capture tree (40.7 m^2 plot), which is similar in size to the 1/100-ac fixed radius plot as is used in Cooperative Stand Assessment Field Procedures (MNDNR 2001). At 3.6 m from center in the 4 cardinal directions, we took densiometer readings (Fiala et al. 2006, Paletto and Rosi 2009, Baudry et al 2014) and measured shrub density in 1-m^2 plots. We selected these habitat measurements based on vegetation attributes that differed between stands where spruce grouse were observed and where they were not observed (Potvin and Courtois 2006), or other attributes that predicted spruce grouse presence or occupancy including stem density, shrub cover, basal area, and canopy cover (Huggard 2003, Ross et al. 2016).

We used homing techniques to obtain GPS coordinates of bird locations twice weekly. We tried to track birds more intensively (i.e., multiple times a day through triangulation) immediately before, during, and after timber harvest to characterize changes in movements to new areas. Marked birds in stands that were not harvested served as controls. At each bird location we collected the same habitat attributes as collected at capture locations.

Additionally, to locate spruce grouse for capture and to examine spruce grouse use of timber stands scheduled for harvest before we could capture birds in them, we surveyed transects in stands for spruce grouse pellets. We determined transect lengths based on timber stand area and sampled at a rate of 10 m/ac (25 m/ha). We placed transects systematically through timber harvest areas with a starting point on the harvest boundary. We set up transects to run north-south (0° or 180°) or east-west (90° or 270°) so that we could walk a compass direction from

one edge of the stand (i.e., the boundary) to the other side. The transect traversed the timber harvest area capturing both edge and interior portions. We spaced transects ≥150 m apart (Evans et al. 2007). We searched 1 m on either side of the transect for spruce grouse pellets (Evans et al. 2007, Schroeder and Vander Haegen 2014, Roy et al. 2020) and also recorded grouse observed, tracks, and ruffed grouse pellets (Huggard 2003) both on and off transect. Every 100 m along the transect, we measured habitat characteristics in a habitat plot (Huggard 2003), collecting the same data as collected at capture sites and telemetry locations to characterize habitat in the stand. Pellet surveys were conducted when it had not snowed for >3 days, unless harvest was imminent and a survey had to be completed earlier. When imminent harvest did not preclude completion of 3 surveys, we surveyed each stand ≥3 times (Huggard 2003).

RESULTS AND DISCUSSION

During the first winter capture season, Nov 2019–Mar 2020, we marked 18 spruce grouse; 13 females and 5 males. At the Red Lake WMA study site, we marked 2 adult females (AF) and 5 juvenile females (JF), and at the Big Falls study site we marked 5 JF and 1 AF and 4 juvenile males (JM) and 1 adult male (AM). Males allowed us to find females that were grouped up in winter flocks for capture. Four birds (3 JF and 1 JM) were caught in mirror traps and 14 were noosed on the ground (8) or in trees (6). One additional JF died after being captured on the ground with a noose, likely related to handling stress. These 18 birds were located via triangulation 211 times (80 locations at Norris Camp, 131 locations at Big Falls). Three birds at the Big Falls site were depredated, with sign at the kill site consistent with fox depredation but inconclusive.

Spring 2020 capture efforts were interrupted due to the COVID-19 pandemic and the Stay at Home Order beginning Mar 28 by Governor Walz. Based on our earlier research (Roy et al. 2020), early April is when spruce grouse are most responsive to the cantus call in Minnesota, and responsiveness gradually drops off through the end of May. Capture and tracking efforts resumed on May 8 after the Commissioner authorized fieldwork for a limited number of staff on the study. The Commissioner authorized remaining staff to resume work on the study on May 27.

We conducted pellet surveys in 14 timber stands at the RLWMA study area and 11 stands in the Big Falls study area. In the RLWMA study area, we detected spruce grouse sign on a transect in 1 stand, and off transect in 3 additional stands. In the Big Falls study area, spruce grouse sign was detected both on and off transect in 2 stands. Nine stands were harvested during the first winter at the RLWMA study area, consisting of 5 jack pine and 4 black spruce stands. During the same period, 9 black spruce stands were harvested at the Big Falls study area. We plan to continue fieldwork through fall 2021.

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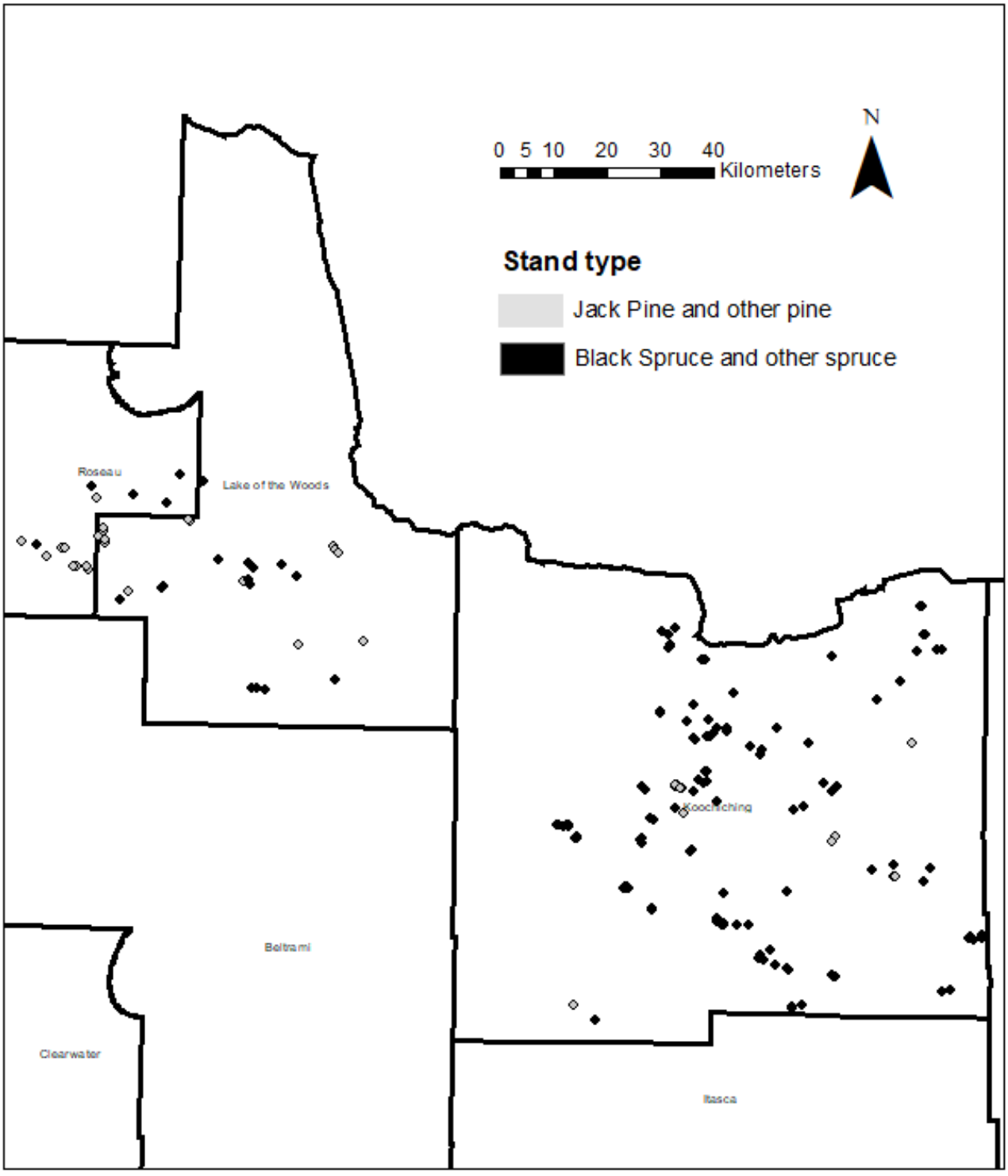

Figure 1. The spruce grouse study area in northern Minnesota with 2 focal areas, one in Lake of the Woods and adjacent Roseau County with more jack pine than black spruce stands scheduled for harvest and another centered on Big Falls in Koochiching County which had more black spruce than jack pine stands scheduled for harvest. The study is planned for winter 2019–fall 2021.