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Donna Creek Forestry/ Biodiversity Project (Phase II): Breeding Bird Monitoring 2006-2007 Final Report

Nathan T. Hentze and John M. Cooper
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**Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave.
3rd Floor, Prince George B.C. V2L 3H9**

Website: www.bchydro.com/pwcp/

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Author(s): Nathan T. Hentze¹ and John M. Cooper²
Address(es): ¹ Manning, Cooper, and Associates Ltd., #211 – 154 Quebec St., Prince George, B.C. V2L 1W2
² Manning, Cooper, and Associates Ltd., Box 646, 1799 Swayne Rd., Errington, B.C. V0R 1V0

EXECUTIVE SUMMARY

The Donna Creek Forestry/Biodiversity Project was initiated by the Peace/Williston Fish and Wildlife Compensation Program (PFWWCP) in 1990. Its objective was to experimentally test the long-term effects of alternative stand-level forest harvesting practices on breeding bird communities and cavity-dependent wildlife (birds and furbearers).

The Donna Creek study area is located in north-central British Columbia approximately 240 km north of Prince George and 80 km northwest of Mackenzie. The study area included 6 cutblocks and 3 old-growth stands (Old-growth Controls; OG) within Engelmann Spruce-Subalpine Fir forests of the Donna Creek drainage. The cutblocks were harvested between 1988 and 1992. Three cutblocks were harvested using traditional clearcut harvesting methods (Clearcut Controls; CC). The remaining 3 cutblocks were partitioned into 4 units characterized by either 1) 3-m high stumps (stubs) retained at 5 to 10 stubs/ha (Stub Treatment; SB); 2) tree islands (~1/4-ha leave-patches) retained at about 1 island per 8 ha (Tree Island treatment; TI); 3) stubs and tree islands (Stubs-and-Islands Treatment; SI); or 4) neither stubs nor islands (Clearcut Treatment; CT). Stubs were both spread throughout the treatment (dispersed stubs) and clustered around the perimeter of tree-island patches (perimeter stubs).

Point-count breeding bird surveys and cavity-nest searches were first undertaken in 1995 and 1996 (early seral; Phase I). Follow-up point-count surveys and cavity-nest searches were conducted in 2006 and 2007 (shrub seral; Phase II). Surveys in 2006 and 2007 aimed to replicate the Phase I surveys, determine the treatment effects on bird communities as forest succession advanced, and to reassess the effectiveness of the alternative forest-harvesting practices that were conducted.

For most comparisons between and among treatments and controls, and the stub and tree-island factors, analyses of bird detection densities for the different years and decades were conducted using ANOVAs and repeated measures testing, as per the Phase I analyses. Cluster and principal component analyses were used to determine bird community assemblages.

The abundance of most bird species recorded in both survey decades was greatest during the 2000s. Twenty-eight percent more birds were detected in 2006 than 2007, but only 2.7% more birds were detected in the 2000s than the 1990s. In total 89 species were tallied within the study area between 1995 and 2007. Within each decade, bird detection densities were highest in the first year of surveying. Where block was a significant factor, densities appeared to be greatest at Block 5516.

There was no group effect between CC controls and CT treatments in the 2000s. When both decades were considered together, 13 of 16 species analysed using singing detections had no difference between CC and CT areas. No species analysed using all detections had any difference between CC and CT. Thus, Clearcut Treatments and Clearcut Controls can be considered ecologically equivalent for the bird community present in the Donna Creek study area.

Few (4 of 22) bird species showed a preference for the experimental treatments in the 2000s. With both decades combined, 11 of 28 species showed significant factor differences. Only the Yellow-rumped Warbler was associated with the SB treatment. Chipping Sparrows and Warbling Vireos were associated with the SI treatments, and 5 species were associated with the TI treatments. Shrub-nesting species and habitat generalists were detected more often in the experimental treatments than in the OG controls, yet some warblers, woodpeckers, wrens and chickadees were only associated with the OG controls.

All but 6 species did not show a shift in habitat preference for the treatments from the 1990s to the 2000s. Five species showed a positive shift in their preference for treatments between the survey decades. Swainson's Thrush and Wilson's Warbler preferred all treatments; MacGillivray's Warblers shifted preferences to CT, TI, and SI treatments; Chipping Sparrow showed stronger preferences for CT, SB, and TI treatments; and Savannah Sparrow preferred CT and SB treatments. A negative shift in habitat preference was observed for Hammond's Flycatcher, which had no preference for any treatment in the 1990s and negative associations for all treatments in the 2000s.

Species richness (number of bird species) was greatest in tree islands and OG controls in the 1990s, and highest for CT, SB, and harvested areas within TI and SI treatments in the 2000s. TI treatments had the greatest number of species whereas the actual tree-island

patches within the same treatment had the fewest. Species richness was highest in OG controls and lowest in CT treatments when data from both decades were combined. Changes in the distribution of bird-rich areas were attributed to a reduced tree-canopy cover within OG controls and tree islands, and increased shrub-layer cover and forest regeneration within harvested regions. Bird community assemblages stratified into 2 main groups: OG controls and treatments. There was a further separation between decades, but the decade effect was less than the overall group effect.

ESSF landscapes of north-central British Columbia do not host many bird species of conservation concern (i.e., species at risk). Barn Swallow, Cape May Warbler, Common Nighthawk, and Olive-sided Flycatcher were the 4 species at risk that were observed in the Donna Creek study area over both decades. Only the Olive-sided Flycatcher was detected in both decades. The Cape May Warbler was not expected to occur at this location, as it is mainly found east of the Rocky Mountains. The Olive-sided Flycatcher, which was recently designated as nationally *threatened*, was often encountered in tree islands and showed a preference for this habitat over other habitats present in the study area.

Stubs and tree islands of the type found in this study do not provide valuable habitat components for birds of the ESSF forests of north-central British Columbia. Stubs may have provided a few nesting opportunities to birds in the early-seral stage (Phase I), but based on monitoring data at the shrub-seral stage (Phase II), the retention of stubs at a density of 5-10/ha does not constitute a meaningful return on the operational investment. Similarly, the size (~0.25 ha) of tree islands retained in this study is too small to be used as nesting habitat for a number of species that may otherwise utilize tree islands for nesting. Future stubbing creation exercises should focus on trees that have pre-existing rot, noticeable scarring, or cavities. Tree islands should be created that are of larger size, and that capture as much canopy and structural diversity as possible within the site.

Old-growth stands have higher bird diversity than harvested stands, and provide habitat for some species that do not use harvested stands. Managers should consider species responses to harvesting practices, conservation concerns for species at risk, and bird community objectives when designing harvesting plans for large spatial scales.

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1.0 INTRODUCTION

Current forestry practices that rely mainly on clearcut harvesting do not emulate natural disturbances. In higher elevation forests in central British Columbia (e.g., forests in the Engelmann Spruce – Subalpine Fir biogeoclimatic zone), natural disturbances are rare, small (usually much less than 250 ha), and mainly the result of wind-throw, insects, and disease (BC Ministry of Forests 1995). The primary cause for the disparity between natural and forest-harvesting disturbances is the lack of structural diversity present after logging operations (Cody 1985, Wiens 1989, Lance and Phinney 2001, Thompson et al. 2003). Standing dead-wood, patches of retained timber, and varying intensity levels and time intervals of disturbance events are characteristic of natural disturbances. Standing dead-wood and tree retention patches add structural diversity to the landscape which supports increased biodiversity, in part by providing important foraging and nesting opportunities for many wildlife species.

In an effort to retain biodiversity on the landscape, various habitat-retention methods have been proposed and conducted in attempts to make harvested forests more closely resemble forests that are subjected to natural disturbance processes (e.g., Hunter 1993, Swanson et al. 1993, Attiwill 1994, Bennett 1994, Morgan et al. 1994, BC Ministry of Forests 1995, Bunnell 1995, Fule et al. 1997, Angelstam 1998, Bergeron et al. 1999, Cissel et al. 1999, Bergeron et al. 2002, Harvey et al. 2002). In British Columbia, it was recognized that many species use dead and dying trees (wildlife trees) during parts of their life cycle, and many species (predominantly cavity nesters) are dependent on wildlife trees (Fenger et al. 2006). However, up to the mid-1990s, dead or decayed trees greater than 3 m tall were considered hazardous to forestry workers, thus they were required to be felled during forestry operations (Backhouse 1993). Stubbing, which is cutting some trees at about 3 m in height, was recommended as a method to retain wildlife trees in harvested landscapes while complying with Worker's Compensation Board regulations (Dawson et al. 1992). Another method recommended for retaining structures important for wildlife was the retention of wildlife-tree patches (i.e., forested areas that contain wildlife trees and/or other important wildlife habitat; Wildlife Tree Committee 1994). The retention of wildlife-tree patches is now an integral component of provincial forest management practices (BC Ministry of Forests 1995).

In an attempt to understand how current forestry practices affect bird populations, the Peace/Williston Fish and Wildlife Compensation Program (PFWWCP) initiated the Donna Creek Forestry/Biodiversity Project in 1990. The objective of the project was to test the

effects of alternative stand-level forest harvesting practices on breeding birds and cavity-dependent wildlife (birds and furbearers; Dawson et al. 1992). Preliminary bird surveys were conducted in 1993 (Gyug and Summers 1995). Baseline point-count breeding bird surveys and cavity-nest searches were first undertaken in 1995 and 1996 during the early seral stage after harvesting (Phase I; Gyug 1997, Gyug 2002). Follow-up point count surveys and cavity-nest searches were conducted in 2006 and 2007 to describe the bird communities during the shrub seral stage (Phase II). The hypotheses approached in this report were: 1) Clearcut Controls are equivalent to Clearcut Treatments in species richness and breeding bird densities; 2) breeding bird densities and species richness will be greatest where structural diversity is highest (Stub Treatment, Tree Island Treatment, or Stub-and-Island Treatment; 3) treatments will have a higher species richness than Old-growth controls, but more generalist species; 4) bird communities in 1995 and 1996 will be more similar to each other than either is to 2006 and/or 2007; 5) bird communities will be more similar within treatments or controls than between them; and 6) vegetation communities in the 2000s will be different than in the 1990s within treatments. Surveys in 2006 and 2007 were intended to replicate the 1995 and 1996 surveys as closely as possible. Future surveys are planned with similar methodologies approximately every 10 years for about 60-100 years, as forest succession progresses (F. Corbould, PFWWCP, personal communication).

This report details the results of the 2006 and 2007 breeding bird surveys (collectively referred to as the 2000s) and compares these data to data collected in 1995 and 1996 (the 1990s), thus providing an assessment of how bird communities have changed as forest succession has progressed. We also provide an assessment of the effectiveness of the alternative forest-harvesting practices employed on this project. A separate report provides greater detail on cavity-nesting birds in the study area (Hentze and Cooper 2009).

2.0 STUDY AREA

The Donna Creek study area is located in north-central British Columbia, approximately 240 km north of Prince George and 80 km northwest of Mackenzie (Fig. 1). It is west of the Williston Reservoir, south of the Wolverine Range of the Omineca Mountains, and is in the Sub-boreal Interior Ecoprovince (Gyug 1997).

The study area is situated within the moist-very cold Engelmann Spruce-Subalpine Fir biogeoclimatic subzone (ESSFmv3), which is typically characterized by coniferous forests with understories of dense moss, sparse herbs, and ericaceous shrubs (MacKinnon et al. 1990). Lodgepole pine (*Pinus contorta*) is the dominant regenerating tree species, while

Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) are the dominant climax species.

The study area ranges from 996 m to 1,341 m elevation above sea level. Physical characteristics of the study sites, including timber-harvesting and silviculture information, are found in Gyug and Corbould (2002). Study sites (3 experimental cutblocks, 3 clearcut-control cutblocks, and 3 old-growth areas) were aligned in a linear spatial orientation on the northeast side of Solomon Creek (Fig. 2). Detailed maps of the study sites are in Appendix A.

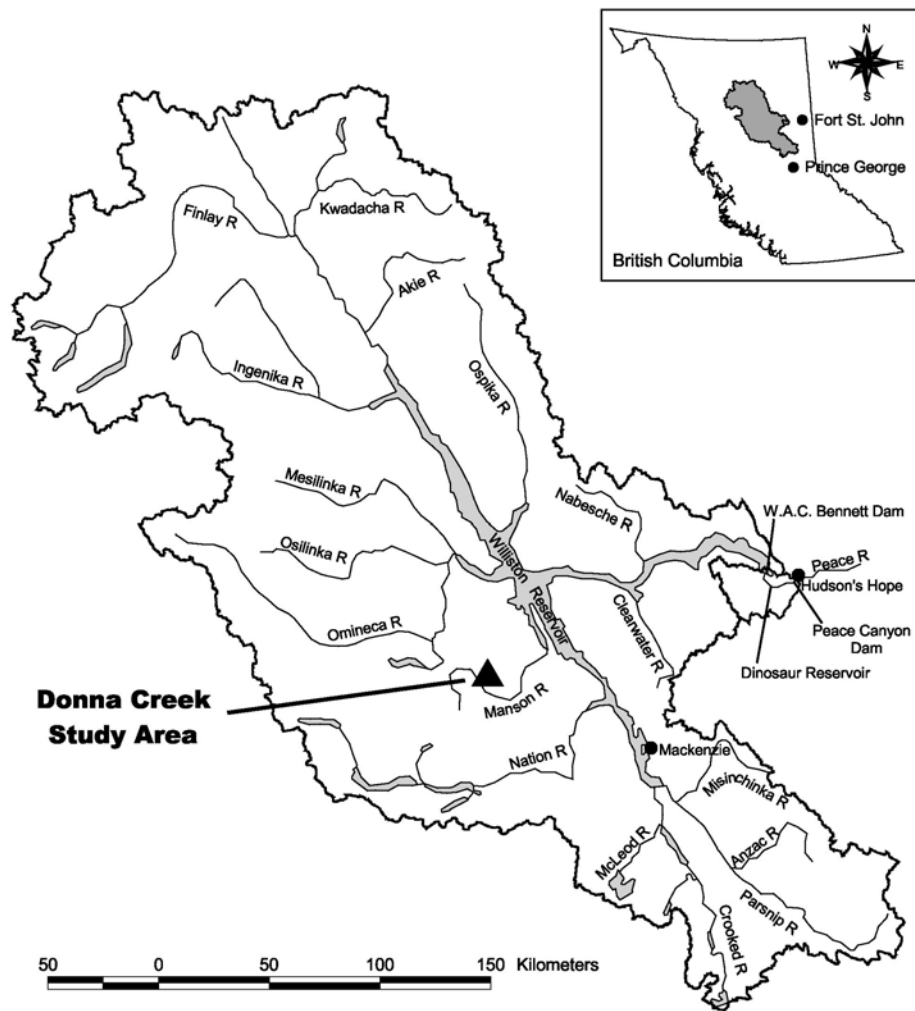


Figure 1. Location of the Donna Creek study area in the Williston Reservoir watershed, north-central British Columbia.

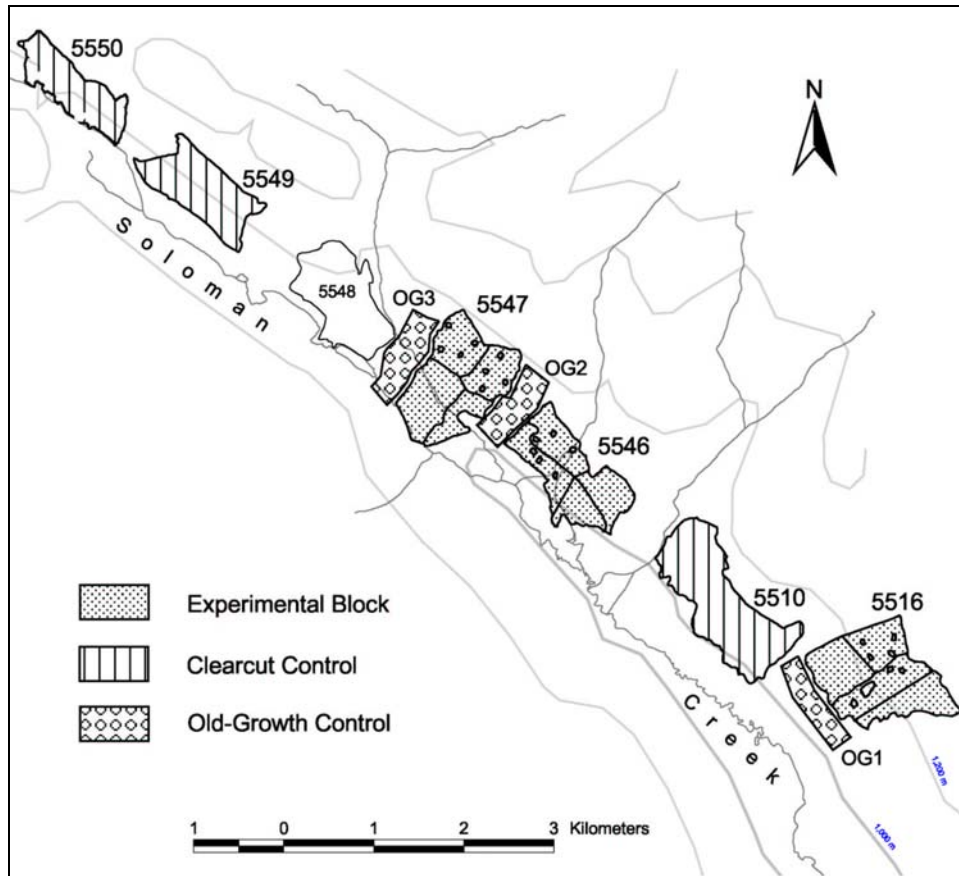


Figure 2. Locations and arrangement of experimental cutblocks (Blocks 5516, 5546 and 5547), clearcut control cutblocks (Blocks 5510, 5549 and 5550) and Old-growth Control areas (OG1, OG2 and OG3) within the Donna Creek study area, north-central British Columbia.

3.0 METHODOLOGY

3.1 Study Design

The study was designed following a randomized block two-factor ANOVA method using 2 levels of each between-subjects factor (Gyug 1997). The 2 factors were 1) the retention of stubs and 2) the retention of mature-forest patches (tree islands). The study design was to have stubs either absent or present at densities of 8-10 stems/ha. Actual stub densities ranged from 0 to 0.3 stems/ha in “absent” areas and 4.7 to 9.5 stems/ha in “present” areas (Gyug and Corbould 2002). The stub factor refers to dispersed stubs (i.e., those distributed evenly over the harvested area), though a ring of “perimeter stubs” was also present at the outer edge of all but 1 tree island. Tree islands ranged from 0.18-0.41 ha in

size, with the exception of a 1.4-ha island in Block 5516 that was retained due to slope stability concerns. Excluding this lone larger island, the average tree island size was 0.26 ha (Gyug and Corbould 2002).

The combination of 2 factors and 2 levels of each resulted in 4 treatment combinations. These treatments were 1) Clearcut (**CT**) - no dispersed stubs and no tree islands; 2) Stub (**SB**) - dispersed stubs present but no tree islands; 3) Tree Island (**TI**) - tree islands present but no dispersed stubs; and 4) Stub-and-Island (**SI**) - dispersed stubs and tree islands present. Each treatment combination of about 25 ha was randomly assigned in each of 3 experimental cutblocks (Blocks 5516, 5546, and 5547; Figure 2, Figure 8). Thus, there were 3 replicates of each treatment. In addition to the treatments, 6 control areas were established. Clearcut Controls (**CC**) were established in 3 conventional cutblocks (Blocks 5510, 5549 and 5550; Figure 2 and Appendix A) to discount the possibility of any “neighbour effects” of adjacent treatments on the CT treatment. Old-growth Controls (**OG**) were located in the forest areas adjacent to Blocks 5516, 5546 and 5547 (Figure 2, Appendix A). The OG controls permitted comparisons of bird communities within experimental cutblocks to those of intact old coniferous forest.

3.2 Point-count Surveys

3.2.1 Point-count Stations

Permanent breeding-bird survey stations (n = 149) were established in 1995 at all treatment and control sites. Each control replicate (OG and CC areas) and CT and SB treatments were assigned 7 survey stations each. Between 10 and 12 stations were placed in each TI and SI treatment, with 7 stations in the harvested portion and a station in each of the tree islands, except for the large island in Block 5516 which had 2 stations. Stations were placed to give relatively even coverage of each unit (Joy and van den Dreissche 1995). For stations not within a tree island, they were placed at least 100 m apart and at least 50 m from any tree island. A single station was placed near the centre of each tree island, except for the large island in Block 5516 which had 2 stations spaced >100 m apart.

The centre point of each station was geo-referenced using a Global Positioning System in 1996 and marked with angle iron stakes, spray paint and flagging tape. Routes between stations and the perimeter around stations (50 m radius) were also flagged.

3.2.2 Survey Method

Point-count surveys in the 2000s mainly followed methodologies used in the 1990s (Gyug 1997) and followed current standards for forest and grassland songbirds (RISC 1999). A survey was defined as an individual point count at an individual station. All birds detected (song, call or visual observation) within a 50 m radius were recorded. Data were also collected for distances beyond 50 m (in intervals of 50-75 m, and >75 m) at point-count stations, but this data was not analysed. Sampling took place within a 4-hr period starting at dawn and ending around 0930 hours. Surveys were not conducted during periods of rain (>drizzle) or high wind (>3 on the Beaufort Scale). For all point-count surveys, the observer recorded environmental conditions (ceiling, cloud cover, wind speed, precipitation, and temperature) at the station for the survey period.

Three differences in survey methodology occurred between the 2 study periods. In the 1990s, all birds detected within a 10 minute interval were recorded. Surveys of 5 to 8 minutes have proven to be adequate and comparable to 10-minute surveys (RISC 1999); therefore, all 2006 and 2007 surveys were 8 minutes in duration, with intervals recorded for 0-3, 3-5, and 5-8 minutes. The second difference involved non-OG and non-TI stations. The 1990s surveys began upon reaching the edge of these point-count stations to include any birds that flushed during the observer's approach (van den Driessche and Joy 1998). However, understory vegetation and tree growth often obscured visibility at point count stations in 2006 and 2007, so fleeing birds could not easily be observed. Current RISC (1999) standards require a 1-minute waiting period after arrival at a survey point to allow birds to resettle after the observer arrived at a station. This procedure was followed in 2006 and 2007. Lastly, although each of the 149 stations was surveyed once per replicate during both survey periods, 7 replicates were conducted in the 1990s and 5 replicates were conducted in the 2000s. We did not feel that the difference in the number of replicates was a concern because bird detection densities were pooled and averaged across replicates. Some rarer species may have been more likely detected with 7 replicates, but these less-abundant species would still likely not have enough detections to be included in any analyses. Replicates for both periods were spaced between late May and early July each year to ensure representative sampling of birds during the breeding season, as per current RISC (1999) standards. This spacing was important as the first replicates may have captured migrating individuals. Migrating birds may sing on their way to breeding grounds and there was no way to differentiate migrants from breeding birds early in the season.

Due to the small size of tree islands (SI and TI treatments), the 50 m radius of the survey area often extended beyond the island boundary. At these stations, birds were recorded as being either “in” or “out” of the island.

Survey teams were comprised of 2 to 3 skilled bird surveyors, with a single observer conducting individual point counts. Unless logistically infeasible, observers alternated stations between replicates. Station survey chronology was reversed whenever possible, such that a station surveyed at dawn for one replication was subsequently surveyed at the end of the station order on the next replication. Prior to initiating the annual surveys, surveyors conducted quality-control training in the study area for bird identification and distance estimations.

3.2.3 2006-2007 Sampling Chronology

Point-count surveys were conducted from 26 May to 1 July, 2006, and 30 May to 3 July, 2007 (Table 1). Each point-count station was surveyed 5 times in both years. With 2 observers, an early dawn, and closely spaced stations, an average of 30 point counts were completed per morning, with a maximum of 36. Due to stand regeneration in the cutblocks and blow-down in tree islands and old-growth areas, movement on foot by observers was likely not as expedient as the 1990 surveys.

In 2006, surveys were conducted on consecutive days except for a break of 7 days between the second and third replicates, and 4 days between the fourth and fifth replications while cavity-nest searches were conducted. Weather was not a significant problem in 2006, although surveys were abandoned during the second replicate on 2 days due to high winds. Higher than preferred winds were often present at Block 5516 stations and fog delayed point counts at stations in Blocks 5549 and 5550 on 1 morning.

In 2007, there was a break in continuous surveys of 4 days each between 8 and 11 June and 21 and 24 June. When possible, all points within a replicate were completed as close to each other as possible. Due to weather events and scheduled crew shifts, this was not always possible. For example, all points in replicate 2 were completed between 3 June and 7 June except for Block 5510, which was completed on 12 June. Unlike 2006, weather posed a greater challenge to point-count completion during 2007. On 5 June heavy rains caused road washouts within the region, which prevented access to the study area until 7 June. Poor weather conditions prevented surveys on 27 June, and delayed or forced abandonment of counts on 5 other dates between 15 June and 1 July.

Table 1. Timing of breeding-bird point-count surveys conducted in the Donna Creek study area, 2006 and 2007.

Replicate	2006		2007	
	Start date	End date	Start date	End date
1	26 May	31 May	30 May	03 Jun
2	29 May	07 Jun	03 Jun	12 Jun
3	15 Jun	18 Jun	12 Jun	17 Jun
4	19 Jun	22 Jun	18 Jun	28 Jun
5	27 Jun	01 Jul	28 Jun	03 Jul

3.3 Statistical Analyses

Point-count stations and survey rounds (non-statistical replicate) were not treated as independent samples. Each station and round for a given group¹ (i.e., treatment or control) at a given site (cutblocks or Old-growth control) was a sub-sample within the group replicate. The point counts for all rounds at a particular site were averaged for the given group. This average was the true replicate. Therefore, there were 3 statistical replicates for each treatment and control.

Bird densities were calculated based on the number of bird detections recorded and the area sampled. Thus, all relevant detections of a species within a treatment or control in a replicate was summed and divided by the total area sampled within that group. The total area sampled was the number of point-counts multiplied by the number of survey rounds and the area sampled at each point. In this method, the total area surveyed differs between the 1990s and 2000s, as the number of rounds differed between these survey periods. A 50 m radius served as the area for most point counts, but not all stations had an equal sampling area. Point counts in tree islands (TI and SI treatments) differed in sample area because tree-island size varied. Only birds detected within the tree islands were included in the tree-island analyses and density calculations. Mean density is the mean for an entire treatment or control, and is written as number of detections per hectare.

Analyses were separated by “singing” and “all” detections. Singing detections included only those individuals detected by their song, whereas all detections included individuals detected by song, call or visual observation. Singing detections were used for

¹ In statistical terms, a “group” would normally be termed a “treatment”. However, since the term treatment is an integral component of the study design nomenclature (e.g., Stub Treatment, etc.), *group* is used to represent the treatments and controls collectively for statistical purposes.

analyses of songbirds when >20 singing detections per species occurred. All detections were used for species that: 1) were not frequently detected by song (e.g., Mountain Chickadee, Pine Siskin), 2) do not sing (e.g., Red-breasted Nuthatch, Gray Jay), or 3) only had 12-20 singing detections in total for a given survey period (year or decade).

All analyses followed Gyug (1997), unless otherwise noted, and were conducted using Statistica 5.0 (StatSoft Inc., Tulsa, OK) (CT to CC comparison; treatment comparisons; OG to CC and tree islands comparison; and species richness), SYSTAT 11 (SYSTAT Software Inc., 2004) (OG to treatment comparisons; and bird community analyses), and SPSS 15.0 (SPSS Inc., Chicago, IL) (vegetation analyses). All statistical results were considered significant at $\alpha \leq 0.05$ unless otherwise indicated.

3.3.1 Clearcut Treatment to Clearcut Control Comparisons

Neighbour effects of adjacent treatments in experimental cutblocks could influence the bird use of CT areas. To test if any such influences occurred, CT was compared to CC. Bird-density data were compared between 2006 and 2007, with CT and CC areas as the group and year as the repeated measure. For species that showed a significant year-by-group interaction, a 1-way ANOVA was performed for each year individually to test for group effects. Bird-density data for the CT and CC were compared between the 1990s and 2000s using a repeated measures ANOVA, with CT and CC as the groups and decade as the repeated measure.

3.3.2 Stub and Tree-island Factor Comparisons

To determine whether the presence of stubs and/or tree islands had an effect on the breeding bird community, analyses for each factor were performed. Bird density data for the 2 factors were compared using the treatment data: CT (stubs = no, islands = no), SB (stubs = yes, islands = no), TI (stubs = no, islands = yes), and SI (stubs = yes, islands = yes). Densities were compared between years (2006 vs. 2007) using a split-plot ANOVA design in time. In this analysis, block was considered a random factor, and group and year were considered fixed effects. Thus, for example, any stub effect compared the 2 treatments containing stubs (SB and SI) with the treatments where stubs were absent (CT and TI). The SI treatment effect, if present, compared that treatment (both stubs and islands) against all others. For species that showed a significant year-by-group interaction, a split-plot analysis in time was performed for each year individually to determine factor effects. Densities were compared between decades (1990s vs. 2000s) using repeated measures ANOVA. Stubs and tree islands were the factor effects, and decade was the repeated measure.

3.3.3 Treatment to Old-growth Control Comparisons

Breeding bird densities in OG were compared to those of the 4 experimental treatments (CT, SB, TI and SI) to determine how the treatments differed from a pre-harvest state (e.g., old coniferous forest). Bird densities in OG controls were compared to densities in treatments using Dunnett's Procedure, which compared treatment means individually to the OG mean using the Mean Square Error from the 1-way ANOVA. This test is more powerful than other multiple-means comparisons for a given level of significance because fewer total comparisons are made (Zar 1999). This procedure uses a joint significance level which was set at $\alpha = 0.05$. Analyses are presented for all species with >25 detections in total, or at least 10 detections in the Old-growth Control.

Treatments and OG were compared between years (2006 vs. 2007) and between decades (1990s vs. 2000s) using repeated measures ANOVAs to investigate time-by-group effects. For species that showed a significant year-by-group interaction, a 1-way ANOVA was performed for individual years.

Where a significant decade-by-OG interaction occurred for species analysed in both decades, the treatment trends were compared between decades (or years where appropriate) by directly comparing the individual results between each decade/year and the overall trend. Results were gathered from the analyses presented in this report as well as Gyug 1997 (for some of the 1990s data). For example, where treatments showed positive relationships relative to OG for a species in the 1990s, but negative relationships in the 2000s, that species could be said to have decreased in the treatments relative to OG between the 1990s and 2000s.

3.3.4 Tree Islands, Clearcut Treatment, and Old-growth Control Comparisons

Tree islands, from both TI and SI, were compared with OG and CT to determine how islands influenced bird densities on the landscape. Tree islands in these cases were designated by the acronym "IS", referring generally to tree islands, and exclusive of a particular treatment that also contained islands (i.e., TI or SI). Bird densities in OG, CT, and tree islands were compared between years (2006 vs. 2007) and between decades (1990s vs. 2000s) using repeated measures ANOVAs. Data were adjusted for area sampled as described for the 1990s data (Gyug 1997). For species that showed a significant year-by-group interaction, a 1-way ANOVA for each year was performed individually to test for group effects by year. In each case, the difference between groups was investigated using a Tukey's Test when there was a significant group effect. Where there were multiple

comparisons, alpha was adjusted by the number of comparisons ($0.05 / \text{number of comparisons}$) to compensate for experiment-wise error.

3.3.5 Species Richness

Bird species richness was quantified by the number of species present in a treatment or control for a given time period (year or decade). Richness comparisons among treatments and controls were analyzed as follows: CT vs. CC; OG, CT, SB, and harvested portions of TI and SI (i.e., data collected outside of tree islands); OG, CT, SB, and tree islands of TI and SI (i.e., data collected inside tree islands); and outside (harvested areas) vs. inside tree islands within TI and SI treatments.

Bird species richness was compared between years (2006 vs. 2007) using a repeated measures ANOVA for the CT vs. CC comparison, and a split-plot ANOVA (where site was a random effect and group and year were fixed effects) for the rest of the comparisons. Bird species richness was compared between decades (1990s vs. 2000s) using repeated measures ANOVA.

Some analyses required that species richness be compared among sampling areas of different sizes. This was an issue for comparisons across decades because different total areas were sampled due to the different number of survey rounds completed (i.e., 7 rounds in 1990s and 5 rounds in 2000s). Similarly, for some of the 2006-2007 comparisons, the total number of hectares of tree islands surveyed in each block was different because of the differences in individual tree-island size. For these analyses, species richness was standardized for the area sampled (species richness / area sampled). Using this technique, instead of using area as a covariate as described for the 1995-1996 comparisons (Gyug 1997), meant that the variables decade and year could remain in the analysis. Significant treatment effects were investigated using Scheffé's test. Where there were multiple comparisons, alpha was adjusted by the number of comparisons ($0.05 / \text{number of comparisons}$) to compensate for experiment-wise error.

3.3.6 Bird Communities

Cluster analysis (i.e., simple averaging hierarchical clustering using Euclidean distance) was used to describe similarities of species composition between the treatments (CT, SB, TI, SI) and OG. Bird species occurring in less than 3 replicates were omitted.

Principal components analysis (PCA) was used to summarize and interpret bird community patterns among treatment replicates (CT, SB, TI, SI), OG replicates, and survey

decades. This analysis used density measurements calculated from singing detections only. Bird species occurring in less than 3 replicates were omitted.

3.3.7 Vegetation and habitat characteristics

A repeated-measures ANOVA was used to determine whether vegetation and ground cover and snag densities differed across treatments and between decades. Vegetation data was collected once per decade, in 1996 and again in 2007. The following variables were tested: percent tree-canopy cover of lodgepole pine, Engelmann spruce, and subalpine fir; total tree-canopy cover; low (<2 m) and high (2-10 m) deciduous and coniferous shrub cover; total low and high shrub cover; percent cover of grass, fireweed, other herbs, moss, downed wood, bare soil, and rock; and density of snags (number of snags >15 cm dbh per hectare). Decade (1990s or 2000s) was incorporated into the analysis as a two-factor within-subjects effect, and treatment was incorporated as a between-subjects effect. There were a total of 8 groups: 2 were controls (CC and OG) and the others (CT, SB, TI, and SI) were within the experimental cutblocks, with tree islands within SI and TI areas considered as 2 separate categories (SIi and TIi, respectively). A full-factorial analysis was performed, and when the interaction term between treatment and decade was significant, an additional analysis was conducted for 2000s data only; 1990s data was provided by Table 11 in Gyug 1997. When a significant group effect was observed for a vegetation or ground-cover variable, significant differences among treatments were explored using Tukey's HSD post-hoc tests.

4.0 RESULTS

Total bird detections for the 2006 and 2007 surveys were 9,465, with 2007 having 28% more detections than 2006 (Table 2). This combined total was only slightly greater (2.7% increase) than the 9,216 detections observed during the 1995 and 1996 surveys. There were 64 species observed during point-count surveys in the 2000s, and 69 during the 1990s (Appendix L). Eighty-nine species in total were observed in the Donna Creek study area (Appendix L).

The most frequently detected species during the different decades were generally similar, but the top 2 species for the 1990s were Lincoln's Sparrow and Dark-eyed Junco, versus the Wilson's Warbler and Swainson's Thrush for the 2000s (Table 2, Appendix L). Common species with the greatest decadal differences in abundance were Lincoln's Sparrow (1990s > 2000s), Wilson's Warbler (2000s > 1990s), Dark-eyed Junco (1990s > 2000s), and Swainson's Thrush (2000s > 1990s). Savannah Sparrows (1990s > 2000s), Alder

Flycatchers (2000s > 1990s), Warbling Vireos (2000s > 1990s), and Orange-crowned Warblers (2000s > 1990s) all had differences of an order of magnitude between decades. Also, Pine Siskins were not detected as frequently in 2006 as they were in the other years.

Table 2. The most frequently detected bird species recorded during breeding-bird point-count surveys in the Donna Creek study area, north-central British Columbia, in 1995, 1996, 2006 and 2007. Data for 1995 and 1996 from PFWWCP (unpublished data).

Species	1995		1996		2006		2007		Overall	
	rank	detections	rank	detections	rank	detections	rank	detections	rank	detections
Lincoln's Sparrow	1	1,014	1	686	5	251	7	249	3	2,200
Dark-eyed Junco	2	950	2	669	2	464	6	302	1	2,385
Pine Siskin	3	556	8	190	15	86	3	415	5	1,247
American Robin	4	434	4	352	7	182	8	233	6	1,201
Yellow-rumped Warbler	5	258	5	328	14	97	14	113	8	796
Savannah Sparrow	5	258	7	195	24	24	32	17	11	494
Chipping Sparrow	7	241	6	223	3	429	4	390	4	1,283
Wilson's Warbler	8	224	3	395	1	799	1	790	2	2,208
Townsend's Warbler	9	159	9	127	12	103	10	218	9	607
Swainson's Thrush	10	100	11	100	4	363	2	571	7	1,134
Golden-crowned Kinglet	11	910	10	107	16	66	29	22	15	286
Alder Flycatcher	28	16	23	15	6	189	5	331	10	551
Warbling Vireo	34	12	23	15	8	129	9	229	13	385
MacGillivray's Warbler	17	54	13	64	10	126	12	173	12	417
Orange-crowned Warbler	31	14	28	11	8	129	11	176	14	330
Total for species listed		4,381		3,477		3,437		4,229		15,524
Total for all species		5,142		4,077		4,155		5,310		18,684

4.1 Block Comparisons

Within the 2006 and 2007 survey period, none of the 17 common species analysed showed a block preference (Table 5, Appendices E, F). Fox Sparrow and Golden-crowned Sparrow had the most detections in Block 5516.

Seven of 25 species plus the all detections category showed differences in block preference when both decades were considered (Table 6, Appendix G). Of these, all species had greater densities in Block 5516 except for Warbling Vireo, which was most numerous in Blocks 5546 and 5547.

4.2 Clearcut Treatment to Clearcut Control Comparisons

In the 2000s, there was no group effect between CC and CT areas for any species analysed (Table 3 and Appendix B). Seven species, plus the singing- and all-detections categories had year as a significant factor. In all cases, except Pine Siskin, more birds were detected in 2006 than 2007. A further 3 species had significant year-by-group interaction

effects. When analysed separately by year, group was not a good predictive variable for any species. Only 1 of these 3 species was found more often in a specific group in a given year: Yellow-rumped Warbler in CT in 2007 ($P = 0.01$; Appendix C).

Thirteen of 16 bird species showed no difference between CC and CT when singing detections for both decades were combined (Appendix D). The 3 species that showed a difference were Lincoln’s Sparrow, Warbling Vireo, and White-crowned Sparrow, and the singing detections category (Table 4). No species analysed using all detections showed a difference between CC and CT.

Analysis of the 1990s and 2000s data separately indicated that there were no group effects, but each had a significant year effect, with more birds being detected in the first year of its respective survey period (Table 4, Appendices B, D). More birds were detected in the 2000s than the 1990s for both areas. For individual species, detection-densities for most species were greater in the 2000s than the 1990s, except for Savannah and Lincoln’s sparrows. Despite some minor differences, CC and CT areas were not distinct from one another, so were considered ecologically equivalent. All further analyses excluded CC data and used CT data as per Gyug (1997).

Table 3. Common bird species that showed a significant difference between Clearcut Controls (CC) and Clearcut Treatments (CT) based on average singing and all detection densities^a for the 2000s (2006-2007), Donna Creek study area.

Species	Year effect ^b			Year x group effect ^b		
	MSE	F	<i>p</i>	MSE	F	<i>p</i>
SINGING DETECTIONS						
Chipping Sparrow	5099.4	12.7	0.02			
Dark-eyed Junco	2039.1	7.8	0.05			
Dusky Flycatcher				186.4	12.1	0.03
Lincoln's Sparrow				533.8	11.3	0.03
Swainson's Thrush	4239.2	21.5	0.01			
Yellow-rumped Warbler	158.8	18.0	0.01	70.6	8.0	0.05
All Singing Detections	100581	106.4	0.00			
ALL DETECTIONS						
American Robin	1509.7	18.5	0.01			
Gray Jay	398.1	36.1	0.00			
Pine Siskin	4377.1	21.1	0.01			
All Detections	153433	650.1	0.00	6538.6	27.7	0.01

^a Densities are averaged by group type (CC, CT) and study decade (1990s, 2000s).

^b Repeated-measures ANOVA test statistics (mean square error [MSE], F statistic, and *p*-value) are shown for year effects, and year effects on groups.

Table 4. Common bird species that showed a significant difference between Clearcut Controls (CC) and Clearcut Treatments (CT) based on average singing and all detection densities^a for 1990s (1995-1996) and 2000s (2006-2007), Donna Creek study area. Data for 1995 and 1996 were from Gyug (1997).

Species	Group effect ^b			Decade effect ^b		
	MSE	F	p	MSE	F	p
SINGING DETECTIONS						
Alder Flycatcher				4551.9	36.2	0.00
Chipping Sparrow				5720.8	20.6	0.00
Lincoln's Sparrow	1854.9	8.0	0.02	16150.6	38.1	0.00
MacGillivray's Warbler				1362.8	10.9	0.01
Orange-crowned Warbler				3245.1	31.9	0.00
Savannah Sparrow				9566.1	16.1	0.00
Warbling Vireo	876.0	9.8	0.01	2129.4	25.4	0.00
White-crowned Sparrow	205.1	5.5	0.05			
Wilson's Warbler				51390.6	69.0	0.00
All Singing Detections	15616.0	12.5	0.01	245629	46.7	0.00
ALL DETECTIONS						
Pine Siskin				2319.5	17.0	0.00
All Detections				281801	43.0	0.00

^a Densities are averaged by group type (CC, CT) and study decade (1990s, 2000s).

^b Repeated-measures ANOVA test statistics (mean square error [MSE], F statistic, and p-value) are shown for group effects, and decade effects.

4.3 Stub and Tree-island Factor Comparisons

Within the 2000s, 4 out of 22 species or detection-groupings had significant associations with an experimental factor (Table 5, Appendix E). Alder Flycatchers and all bird detections were negatively associated with stubs. Olive-sided Flycatchers had a positive relationship to tree islands, while the Orange-crowned Warblers had positive relationships to tree islands and the combination of both stub and island factors.

Ten of 20 bird species, plus all singing and all detections, had a significant year effect between 2006 and 2007 (Table 5, Appendix E). All species were more abundant in 2006, except Pine Siskin. Where interaction terms between year and factor arose, separate year analyses indicated only 2 species had a significant factor effect, both related to stubs: White-crowned Sparrow in 2006 (P = 0.02) and American Robin in 2007 (P = 0.01) (Appendix F).

Eleven of 28 species or detection-groupings showed significant factor differences when comparing data from both decades (Table 6, Appendix G). Only the Yellow-rumped Warbler had a significant positive association with the stub factor. Five species and all bird

detections had significant positive factor effects for tree islands (Table 6, Appendix G). The 5 species were Olive-sided Flycatcher, Warbling Vireo, Wilson's Warbler, Black-backed Woodpecker, and Red-breasted Nuthatch. Only the Dark-eyed Junco had a significant negative factor effect for tree islands. The combination of stub and island factors (i.e., SI treatment) had a significant positive effect on the detection densities of Chipping Sparrows and Warbling Vireos.

Decade effects occurred for 18 of 26 species analysed (Tables 7, Appendix G). There were significantly higher detection-densities in the 2000s compared to the 1990s for 13 of those species, as well as for all singing detections and all bird detections. Only Lincoln's Sparrow, Savannah Sparrow, and Black-backed Woodpecker had higher densities in the 1990s. The stub factor varied by decade for Alder Flycatcher and all singing detections. Olive-sided Flycatchers were detected more often and were positively associated with tree islands in the 2000s; there were too few individuals in the 1990s to indicate a trend. Conversely, Black-backed Woodpeckers were more abundant and strongly associated with tree islands in the 1990s. The interaction of decade by stubs and islands showed significant results for Golden-crowned Sparrow, Wilson's Warbler, all singing birds, and all bird detections.

Table 5. Common bird species that showed a significant effect to block and habitat factors (stub [S] and tree islands [I]^a) and survey years (2006 and 2007) based on average singing and all detection densities^b in the Donna Creek study area.

Species	Overall effects ^c	F	p	Year effects ^c	F	p
SINGING DETECTIONS						
Alder Flycatcher	S	18.3	0.05			
American Robin				Year	18.1	0.00
				Year x S	9.1	0.02
				Year x S x I	5.1	0.05
Chipping Sparrow				Year	53.1	0.00
				Year x S x I	5.3	0.05
Dark-eyed Junco				Year	35.4	0.00
Lincoln's Sparrow				Year	7.1	0.03
Orange-crowned Warbler	I	18.9	0.05			
	S x I	23.0	0.04			
Olive-sided Flycatcher	I	421.5	0.00			
Ruby-crowned Kinglet				Year	6.8	0.03
Swainson's Thrush				Year	19.4	0.00
Warbling Vireo				Year	5.1	0.05
White-crowned Sparrow				Year x S	5.8	0.04
Wilson's Warbler				Year	25.0	0.00
All Singing Detections				Year	60.0	0.00
ALL DETECTIONS						
Gray Jay				Year	10.1	0.01
Pine Siskin				Year	34.5	0.00
All Detections	S	23.8	0.04	Year	43.5	0.00

^a Stub-factor data (S) included data from treatments that contained stubs: Stub Treatments and Stub-and-Island Treatments. Tree island-factor data (I) included data from treatments that contained tree islands: Tree Island Treatments and Stub-and-Island Treatments.

^b Densities were averaged for each treatment by study year.

^c ANOVA test statistics (F-statistic and p-value) are shown for overall effects and for decade effects on treatment factors.

Table 6. Common bird species that showed a significant effect to block and habitat factors (stub [S] and tree islands [I]^a) and survey decades (1990s [1995-1996] and 2000s [2006-2007]) based on average singing and all detection densities^b in the Donna Creek study area.

Species	Overall effects ^{a, c}	F	p	Decade effects ^{a, c}	F	p
SINGING DETECTIONS						
Alder Flycatcher				Dec	41.6	0.00
				Dec x S	5.2	0.05
Blackpoll Warbler				Dec	7.7	0.02
Chipping Sparrow	S x I	5.3	0.05	Dec	75.9	0.00
Dark-eyed Junco	I	9.9	0.01	Dec x I	0.4	0.53
Dusky Flycatcher				Dec	52.8	0.00
Fox Sparrow	Block	17.6	0.00	Dec	23.3	0.00
Golden-crowned Sparrow	Block	21.0	0.00	Dec x S x I	6.9	0.03
Lincoln's Sparrow				Dec	109.8	0.00
MacGillivray's Warbler				Dec	42.8	0.00
Orange-crowned Warbler				Dec	67.8	0.00
Olive-sided Flycatcher	I	17.8	0.00	Dec	9.6	0.01
				Dec x I	9.6	0.01
Pine Siskin	Block	6.1	0.03			
Ruby-crowned Kinglet	Block	5.4	0.03	Dec	7.6	0.03
Savannah Sparrow	I	3.4	0.10	Dec	31.7	0.00
Swainson's Thrush				Dec	48.4	0.00
Warbling Vireo	Block	20.4	0.00	Dec	142.6	0.00
	I	6.6	0.03			
	S x I	5.4	0.05			
White-crowned Sparrow	Block	14.1	0.00			
	S	19.4	0.00			
Wilson's Warbler	I	5.5	0.05	Dec	345.7	0.00
				Dec x S x I	7.1	0.03
Yellow-rumped Warbler	S	5.7	0.04			
All Singing Detections				Dec	446.7	0.00
				Dec x S	6.3	0.04
				Dec x S x I	10.6	0.01
ALL DETECTIONS						
Black-backed Woodpecker	I	6.8	0.03	Dec	25.8	0.00
				Dec x I	5.6	0.05
Gray Jay				Dec	18.2	0.00
Red-breasted Nuthatch	Block	25.6	0.00			
	I	34.0	0.00			
All Detections	Block	9.8	0.01	Dec	138.6	0.00
	I	12.0	0.01	Dec x S x I	6.5	0.03

^a Stub-factor data (S) included data from treatments that contained stubs: Stub Treatments and Stub-and-Island Treatments. Tree island-factor data (I) included data from treatments that contained tree islands: Tree Island Treatments and Stub-and-Island Treatments.

^b Densities were averaged for each treatment by study decade and by study block (5516, 5546 and 5547).

^c ANOVA test statistics are shown for overall effects and for decade effects on treatment factors.

4.4 Old-growth Control to Treatment Comparisons

During the 2000s survey period, 9 out of 30 species and detection-groupings analysed showed preferences for OG over all treatment types (Table 7, Appendix G). A further 2 species (Lincoln's Sparrow and Wilson's Warbler) preferred all treatments over OG, while the rest had either neutral relationships to habitat, or mixed associations (preferring some treatment types over others). Six species plus singing detections and all detections had entirely neutral habitat preferences for each treatment. In contrast to these 17 species (plus the singing detections and all detections groupings), 28 species or detection-groups during the 1990s showed entirely positive, negative, or neutral associations (based on Table 8 in Gyug 1997). Eleven of 30 species, including singing- and all-detections showed a significant year effect during the 2000s. When analysed individually by year, 6 of these had at least one change in habitat association relative to OG (Table 8, Figure 8).

For the 43 species and detections-groupings analysed for both decades combined, 17 species preferred OG over all treatments and 1 species (Lincoln's Sparrow) showed preferences for all treatments over OG controls (Table 9, Appendix I). A total of 27 species (including the 18 above) showed consistent positive, negative, or neutral associations relative to OG for all treatment types for both decades combined (Appendix I).

There was a decade effect present for 20 of the 39 species between the 1990s and 2000s (Table 9, Appendix I). Thirteen of the species or detections-groupings that were analysed separately by decade, and that showed a significant interaction between decades were investigated further to determine where the habitat shift occurred (Table 10). MacGillivray's Warbler showed a preference for CT, TI, and SI treatments over OG in the 2000s compared to neutral associations in the 1990s. Chipping Sparrow showed preferences for CT, SB, and TI treatments in the 2000s compared with neutral associations in the 1990s. Swainson's Thrush went from a negative association with all treatment types in the 1990s to no preference for any habitat in the 2000s. Wilson's Warblers, which had negative or neutral associations with all 4 treatments in the 1990s showed positive associations for each in the 2000s. Hammond's Flycatcher had negative associations with the treatments when both decades were combined, while during the 1990s was neutral to each habitat. Although Gray Jays preferred OG in both decades overall, during 2007 they seemed to be more neutral in habitat preference. In the 1990s, both all singing detections and all detections were more prevalent in OG, while in the 2000s there was a neutral relationship between all singing detections and all 4 treatment types. Many species did not differ in habitat preference between the 1990s and 2000s (Tables 9, 10). Twenty-one species showed no significant differences in trend between decades. Most of these were species that preferred OG. A

further 4 species had no habitat preferences, while the Lincoln’s Sparrow was the only species to show a positive association to all treatments for both decades.

Table 7. Common bird species that showed significant difference using Dunnett’s Test between Old-growth Control (OG) and treatments (CT, SB, TI, SI) within the Donna Creek study area, based on average singing and all detection densities in the 2000s (2006 and 2007).

Species	Difference in mean density relative to Old-growth ^a				Year x OG effect ^b		
	CT	SB	TI	SI	MSE	F	p
SINGING DETECTIONS							
Chipping Sparrow	+	+	o	+	680.3	9.7	0.01
Golden-crowned Kinglet	-	-	-	-	25.4	428.7	0.00
Townsend's Warbler	-	-	-	-	192.3	170.7	0.00
Varied Thrush	-	-	-	-	18.6	8.2	0.01
Wilson's Warbler	+	+	+	+	1248.1	5.0	0.04
Winter Wren	-	-	-	-	34.5	27.3	0.00
ALL DETECTIONS							
Gray Jay	o	o	o	o	44.6	20.9	0.00
Hammond's Flycatcher	-	-	-	-	32.0	12.5	0.00
Mountain Chickadee	-	-	o	-	9.0	16.1	0.00
Pine Siskin	o	-	o	o	944.8	17.0	0.00
Red-breasted Nuthatch	-	-	-	-	51.3	47.2	0.00

^a Symbols indicate whether the average detection densities for the treatment type are significantly ($p \leq 0.05$) less than (“-”) or greater than (“+”) than densities for OG controls; no difference is indicated with a “o”.

^b Statistics for repeated-measures ANOVAs are provided: mean square error (MSE), and F statistic, and p-value.

Table 8. Common bird species that showed a significant interaction between year and OG effect within the Donna Creek study area based on average singing and all detection densities in 2006 and 2007.

Species	Year	Difference in mean density relative to Old-growth ^a				MSE ^b
		CT	SB	TI	SI	
SINGING DETECTIONS						
Chipping Sparrow	2006	+	+	+	+	426.0
	2007	o	o	+	o	118.0
Golden-crowned Kinglet	2006	-	-	-	-	12.2
	2007	-	-	-	-	7.9
Townsend's Warbler	2006	-	-	-	-	149.2
	2007	-	-	-	-	209.0
Varied Thrush	2006	-	-	-	-	17.7
	2007	-	-	-	-	2.7
Wilson's Warbler	2006	+	+	+	+	1018.5
	2007	+	+	+	+	335.9
Winter Wren	2006	-	-	-	-	43.2
	2007	-	-	-	-	0.0
ALL DETECTIONS						
Gray Jay	2006	-	-	-	-	38.2
	2007	o	o	o	o	3.4
Hammond's Flycatcher	2006	o	-	-	-	55.0
	2007	-	-	o	o	2.8
Mountain Chickadee	2006	o	o	o	o	1.7
	2007	-	-	-	-	9.0
Pine Siskin	2006	o	o	o	o	22.5
	2007	-	-	o	-	473.4
Red-breasted Nuthatch	2006	-	-	-	-	55.6
	2007	o	o	o	o	8.3

^a Symbols indicate whether the average detection densities for the treatment type are significantly ($p \leq 0.05$) less than ("-") or greater than ("+") than densities for OG controls; no difference is indicated with a "o".

^b Statistics for repeated-measures ANOVAs are provided: mean square error (MSE).

Table 9. Common bird species that showed significant difference using Dunnett's Test between Old-growth Control (OG) and treatments (CT, SB, TI, SI) within the Donna Creek study area, based on average singing and all detection densities across both decades (1995-1996 and 2006-2007).

Species	Difference in mean density relative to Old-growth ^a				Decade x OG effect ^b		
	CT	SB	TI	SI	MSE	F	p
SINGING DETECTIONS							
Alder Flycatcher	+	o	+	o	222.4	8.8	0.01
Blackpoll Warbler	-	-	-	-	121.3	256.0	0.00
Chipping Sparrow	+	+	o	+	562.8	4.9	0.04
Dusky Flycatcher	+	o	+	o	26.0	10.6	0.00
Golden-crowned Kinglet	-	-	-	-	59.1	36.4	0.00
Hammond's Flycatcher	-	-	-	-	5.3	12.3	0.00
Lincoln's Sparrow	+	+	+	+	863.0	10.7	0.00
MacGillivray's Warbler	+	o	+	o	181.7	9.3	0.01
Orange-crowned Warbler	+	o	o	+	134.5	21.1	0.00
Olive-sided Flycatcher	o	o	o	o	1.8	5.6	0.03
Pine Grosbeak	-	-	-	-	4.6	18.6	0.00
Ruby-crowned Kinglet	-	-	-	-	36.3	23.7	0.00
Savannah Sparrow	+	+	o	o	317.2	5.4	0.03
Swainson's Thrush	o	o	o	-	551.8	6.4	0.02
Warbling Vireo	o	o	+	o	120.3	16.2	0.00
Wilson's Warbler	o	o	+	o	2457.6	30.2	0.00
Yellow-rumped Warbler	-	-	-	-	134.8	36.6	0.00
All Singing Detections	o	-	o	o	18565.4	74.0	0.00
ALL DETECTIONS							
Gray Jay	-	-	-	-	62.1	38.3	0.00
Spruce Grouse	-	-	-	-	9.3	13.8	0.00
All Detections	-	-	o	o	19229.4	76.3	0.00

^a Symbols indicate whether the average detection densities for the treatment type are significantly ($p \leq 0.05$) less than (“-”) or greater than (“+”) than densities for OG controls; no difference is indicated with a “o”.

^b Statistics for repeated-measures ANOVAs are provided: mean square error (MSE), and F statistic, and p-value.

Table 10. Common bird species that had a significant interaction between decade and Old-growth effect and that were analysed individually in both decades within the Donna Creek study area, based on average singing and all detection densities. Data for 1995 and 1996 were from Gyug (1997).

Species	Survey period	Difference in mean density relative to Old-growth ^a			
		CT	SB	TI	SI
Blackpoll Warbler	Overall	-	-	-	-
	2000s	-	-	-	-
	1990s	-	-	-	-
Golden-crowned Kinglet	Overall	-	-	-	-
	2000s	-	-	-	-
	1990s	-	-	-	-
Gray Jay	Overall	-	-	-	-
	2007	-	-	-	-
	2006	-	-	-	-
	1990s	o	o	o	o
Hammond's Flycatcher	Overall	-	-	-	-
	2007	-	-	-	-
	2006	-	-	-	-
	1990s	-	-	-	-
Lincoln's Sparrow	Overall	-	-	o	o
	2000s	o	-	-	-
	1996	o	o	o	o
	1995	-	-	-	-
	Overall	-	-	o	o
MacGillivray's Warbler	Overall	+	+	+	+
	2000s	+	+	+	+
	1990s	+	+	+	+
Pine Siskin	Overall	+	o	+	+
	2007	+	o	+	o
	2006	+	o	+	+
	1990s	+	o	+	+
Ruby-crowned Kinglet	Overall	o	o	o	o
	2000s	-	-	o	o
	1990s	-	-	o	o
Swainson's Thrush	Overall	-	-	o	-
	2000s	o	o	o	o
	1990s	o	o	o	o
Wilson's Warbler	Overall	-	-	-	-
	2000s	-	-	-	-
	1990s	-	-	-	-
All Singing Detections	Overall	o	-	o	o
	2000s	o	o	o	o
	1990s	o	o	o	o
All Detections	Overall	-	-	o	o
	2000s	-	-	o	o
	1990s	o	o	o	o

^a Symbols indicate whether the average detection densities for the treatment type are significantly ($p \leq 0.05$) less than ("-") or greater than ("+") than densities for OG controls; no difference is indicated with a "o".

4.5 Old-growth Control, Clearcut Treatment, and Tree Island Comparisons

In the 2000s, 15 of 27 species, all singing detections, and all detections showed differences among OG, CT and tree islands (Table 11, Appendix J). The response to the treatments and control were varied, with some detection densities being significantly higher in CT than either tree islands (SI and/or TI) or OG (e.g., Alder Flycatcher), and some being higher in tree islands than either CT or OG (e.g., American Robin and Ruby-crowned Kinglet). Other responses were more complicated. For example, Chipping Sparrows favoured CT over OG, but there was no difference in their use between CT and tree islands, while Wilson's Warblers showed fairly equal preference for both tree islands and CT, and largely avoided OG. Seven of the 15 species that had a group effect also had significant year effects (Tables 11, 12). Of these, the Golden-crowned Kinglet, Townsend's Warbler, and Winter Wren were found significantly more often in OG compared to CT and tree islands in both 2006 and 2007. Yellow-rumped Warblers and Pine Siskin were found significantly more often in tree islands in this time period, as were Olive-sided Flycatchers in 2007. There were more Olive-sided Flycatcher detections within tree islands during 2006 as well, but it was not statistically significant.

When both decades were analysed together, 28 of 39 species and detection-groupings had significant treatment effects (Table 13, Appendix L). Of these species, 7 had significant differences using Tukey's pair-wise comparisons. Although responses varied (as with the 2000s analysis), 5 of those 7 species had significantly higher detection densities in OG. Sixteen of 39 species also had significant decade-by-group interaction effects. Six of these were either not analysed by Gyug in the 1990s (due to absence or small sample size), or they had an insignificant treatment effect (Table 9, Gyug 1997). A further 4 were not analysed or were insignificant in the 2000s. Within the remaining 6 species with the decade interaction effect, American Robins, Lincoln's Sparrows, and Yellow-rumped Warblers all had the same group associations in the 1990s and 2000s (Table 13). Where decade was significant, mean bird densities were greater in the 1990s for 11 of the 20 species (Table 13).

Table 11. Common bird species that showed significant group, year (2006 and 2007), and interaction effects and the results of Tukey's Tests relative to each group based on average singing and all detection densities in the Donna Creek study area.

Species	Group effect ^{a, c}			Year effect ^{a, c}			Year x Group effect ^{a, c}			Tukey's Tests - p			Explanation of Tukey's results ^b
	MSE	F	p	MSE	F	p	MSE	F	p	CT/I	CT/OG	I/OG	
SINGING DETECTIONS													
Alder Flycatcher	1820.5	19.2	0							0.008	0.003	0.56	CT > I = OG
American Robin	476.8	22.9	0							0.003	0.971	0.003	I > CT = OG
Chipping Sparrow	1786.5	11.1	0.01	768.7	8.8	0.03				0.637	0.01	0.029	CT = I > OG
Golden-crowned Kinglet	1780.7	53.1	0	179.2	67.7	0	129.4	48.9	0				
Lincoln's Sparrow	1695.4	5.9	0.04				131.5	14.5	0.01				
Olive-sided Flycatcher	1643.6	73.2	0	241.6	8.8	0.02	283.8	10.4	0.01				
Ruby-crowned Kinglet	1310.3	116.6	0							0	0.068	0	I > CT = OG
Townsend's Warbler	17796.2	28.6	0	487.5	28.1	0	348	20.1	0				
Varied Thrush	200.7	8.5	0.02							0.975	0.031	0.024	OG = CT = I
Wilson's Warbler	25762.8	25.2	0	6632.1	11.6	0.01				0.162	0.007	0.001	I = CT > OG
Winter Wren	811.5	21.4	0				209.1	5.5	0.04				
Yellow-rumped Warbler	3107.5	59.3	0				170.2	7.2	0.03				
ALL DETECTIONS													
Gray Jay				757.4	11.6	0.01							
Hammond's Flycatcher	417.1	5.4	0.05							0.04	0.217	0.419	OG = CT = I
Pine Siskin	40481.2	61	0	63697	70.4	0	16658	18.4	0				
All Bird Detections	8.50E+05	16.9	0							0.014	0.394	0.004	I = CT > OG*

^a Where group, decade, and decade by treatment effects were significant, alpha was ≤ 0.05 . For Tukey's tests, p -values were considered significant when $p \leq 0.0125$ due to multiple testing.

^b Clearcut Control (CC), Old-growth Control (OG), and tree island (I) habitats (I = tree islands from TI and SI).

^c ANOVA statistics (MSE, F, p) shown for each species across decades

*The p -value for the CT/IS Tukey's Test comparison is almost significant; there were many more birds detected in IS compared with CT.

Table 12. Common bird species that showed significant year by group effects in the 2000s analysed individually by year (2006 and 2007), and the results of Tukey's Tests relative to each group, based on average singing and all detection densities in the Donna Creek study area.

Species	Year	Group effect ^{a, c}			Tukey's Tests - p^a			Explanation of Tukey's results ^b
		MSE	F	p	CC/I	CC/OG	I/OG	
SINGING DETECTIONS								
Golden-crowned Kinglet	2006	1433.7	62.5	0	0.874	0	0	OG > CC, I
	2007	476.4	36	0	1	0.001	0.001	OG > CC, I
Lincoln's Sparrow	2006	590.3	6	0.04	0.183	0.032	0.402	
	2007	1236.6	6.3	0.03	0.049	0.049	0.049	
Olive-sided Flycatcher	2006	281	7.2	0.03	0.039	1	0.039	
	2007	1646.4	153.7	0	0	0.895	0	I > CC, OG
Townsend's Warbler	2006	11558.1	40.7	0	0.812	0.001	0.001	OG > CC, I
	2007	6586.1	18.5	0	0.938	0.004	0.006	OG > CC, I
Winter Wren	2006	19186.8	18	0	1	0.011	0.011	OG > CC, I
	2007	7830.8	15	0	0.483	0.001	0.003	OG > CC, I
Yellow-rumped Warbler	2006	968.6	49.4	0	0	0.124	0.001	I > CC, OG
	2007	2309	41	0	0	0.022	0.005	I > CC, OG
ALL DETECTIONS								
Pine Siskin	2006	2638.4	53	0	0	0.575	0.001	I > CC, OG
	2007	5.45E+04	35.9	0	0.001	0.239	0.002	I > CC, OG

^a Where group effect was significant alpha was ≤ 0.05 . For Tukey's tests, p -values were considered significant when $p \leq 0.0125$ due to multiple testing.

^b Clearcut Control (CC), Old-growth Control (OG), and tree island (I) habitats

^c ANOVA statistics (MSE, F, p) shown for each species across decades

Table 13. Common bird species that showed significant group, decade (1990s [1995-1996] and 2000s [2006-2007]), and interaction effects and the results of Tukey's Tests relative to each group based on average singing and all detection densities in the Donna Creek study area.

Species	Group effect ^{a, b}			Decade effect ^{a, b}			Decade x Group effect ^{a, b}			Tukey's Tests - p			Explanation of Tukey's results ^{c, a}
	MSE	F	p	MSE	F	p	MSE	F	p	CT/I	CT/OG	I/OG	
SINGING DETECTIONS													
Alder Flycatcher	1341.0	18.7	0.00	953.4	15.6	0.00	564.2	9.2	0.00				
American Robin	3165.7	29.5	0.00	864.0	6.5	0.03	644.4	4.8	0.03				
Blackpoll Warbler	3438.4	24.1	0.00	736.6	6.4	0.03	2117.2	18.4	0.00				
Brown Creeper	94.1	11.9	0.00							1.00	0.00	0.00	OG > CT, I
Chipping Sparrow	14151.6	19.4	0.00	2334.6	6.6	0.02	9181.3	25.9	0.00				
Dark-eyed Junco	2986.1	10.9	0.00	3855.4	14.8	0.00	1230.0	4.7	0.03				
Dusky Flycatcher				1031.0	5.3	0.04							
Golden-crowned Kinglet	6762.2	106.5	0.00	445.6	9.4	0.01	510.4	10.8	0.00				
Hammond's Flycatcher	77.7	4.3	0.04							0.06	0.07	0.98	OG = CT = I
Lincoln's Sparrow	17705.5	20.6	0.00	36547.2	36.9	0.00	12014.6	12.1	0.00				
MacGillivray's Warbler							882.8	6.9	0.01				
Northern Waterthrush	59.0	5.0	0.03							0.95	0.03	0.06	OG = CT = I
Orange-crowned Warbler	554.9	5.3	0.02	1497.2	19.3	0.00	351.1	4.5	0.03				
Olive-sided Flycatcher	1186.0	66.2	0.00	560.4	27.8	0.00	526.8	26.1	0.00				
Pine Siskin	1917.3	17.6	0.00							0.00	0.81	0.00	I > CT = OG
Ruby-crowned Kinglet	1585.4	6.1	0.02							0.01	0.11	0.47	OG = I > CT
Savannah Sparrow	3043.2	11.0	0.00	3290.0	20.4	0.00	1677.3	10.4	0.00				
Swainson's Thrush				3719.7	6.2	0.03							
Tennessee Warbler				4388.2	14.3	0.00							
Townsend's Warbler	40259.2	275.5	0.00							0.25	0.00	0.00	OG > CT = I
Varied Thrush	327.5	5.4	0.02							0.97	0.03	0.05	OG = CT = I
Warbling Vireo	1909.1	4.2	0.04	3846.9	6.7	0.02				0.62	0.18	0.04	OG = CT = I
White-crowned Sparrow	130.1	4.5	0.04							0.30	0.03	0.36	OG = CT = I
Wilson's Warbler	77228.4	31.8	0.00				16380.6	24.5	0.00				
Winter Wren	1555.5	16.0	0.00							0.79	0.00	0.00	OG > CT = I
Yellow-rumped Warbler	24574.2	79.3	0.00	16232.4	37.9	0.00	6074.3	14.2	0.00				
All Singing Detections	700000.0	16.8	0.00	120000.0	10.2	0.01	170000.0	15.1	0.00				
ALL DETECTIONS													
Three-toed Woodpecker	232.1	4.2	0.04	350.6	5.2	0.04				0.04	0.16	0.69	OG = CT = I
Black-backed Woodpecker	3065.2	24.8	0.00	3046.1	34.9	0.00	2508.5	28.7	0.00				
Boreal Chickadee	132.2	6.1	0.01							0.17	0.01	0.30	OG > CT = I
Gray Jay	1156.6	8.4	0.01							0.02	0.01	0.84	OG > CT = I
Spruce Grouse				83.3	4.7	0.05							
All Bird Detections	3700000.0	40.9	0.00	480000.0	43.3	0.00	550000.0	49.4	0.00				

^a Where group, decade, and decade by treatment effects were significant, alpha was ≤ 0.05 . For Tukey's tests, p -values were considered significant when $p \leq 0.0125$ due to multiple testing,

^b ANOVA statistics (MSE, F, p) shown for each species across decades

^c Clearcut Control (CC), Old-growth Control (OG), and tree island (I) habitats

Table 14. Common bird species that showed significant (P -values $\leq 0.0125^a$) group^b effects in both the 1990s and 2000s survey periods based on average singing and all detection densities in the Donna Creek study area. Data for 1995 and 1996 were from Gyug (1997).

Species	Survey period	
	1990s	2000s
American Robin	I > CC, OG	I > CC, OG
Chipping Sparrow	I > CC, OG	CC > OG; CC = I; I = OG
Lincoln's Sparrow	CC > I, OG	CC > I, OG*
Wilson's Warbler	I > CC, OG	CC = I > OG
Yellow-rumped Warbler	I > CC, OG	I > CC, OG
All Detections	I > CC, OG	I > OG; I = CC; OG = CC

^a For Tukey's tests, p -values were considered significant when $p \leq 0.0125$ due to multiple testing,

^b Groups are Clearcut Control (CC), Old-growth Control (OG), and island (I) factors from both TI and SI treatments.

4.6 Species Richness

Species richness was very similar for the study area (64 and 60 species in 2006 and 2007 respectively; Appendix M) and within individual study sites in 2006 and 2007 (Table 15). Within this survey period, TI had the greatest mean number of species (24.8 ± 5.6 SD), whereas the actual tree islands within this treatment had the fewest (16.8 ± 5.8 SD) (Table 15). Clearcut Controls had 2 more species detected compared to Clearcut Treatments. There was no difference in species richness between OG and treatments, including or excluding tree islands. For both TI and SI, there was a greater diversity of birds outside of tree islands than within tree islands. Differences in the number of species per site between the 2 years were minor, and year as a variable was not significant in any of the comparisons (Table 16).

For treatment and control areas, OG had the highest mean number of species (30.3 ± 2.7 SD) when both decades were combined, and CT had the least (19.0 ± 5.5) (Table 17). The average species richness was higher in the 2000s than in the 1990s for all areas except for OG controls, SI treatments, and tree islands in TI and SI treatments (Table 17). Also when both decades were combined, there was no significant difference between the number of species found in CC and CT areas (Table 18). OG had a greater number of species compared to treatments excluding and including tree islands. The tree islands in both TI and SI had a greater diversity of birds compared to their surrounding habitats.

Table 15. Species richness (number of species detected) for the experimental treatments in the Donna Creek study area in 2006 and 2007.

Block	Treatment groups																Control groups			
	Clearcut		Stub		Tree island						Stub-and-island						Old-Growth		Clearcut ^a	
	2006	2007	2006	2007	Outside		Inside		Total area		Outside		Inside		Total area		2006	2007	2006	2007
5516	21	17	18	15	23	21	23	25	30	33	20	21	15	21	24	26	21	17	18	15
5546	19	19	21	20	17	20	12	11	19	24	22	19	22	19	25	21	19	19	21	20
5547	21	18	20	18	20	15	16	14	23	20	19	14	19	14	23	23	21	18	20	18
Mean ± SD	19.2 ± 1.6		18.7 ± 2.2		19.3 ± 2.9		16.8 ± 5.8		24.8 ± 5.6		19.2 ± 2.8		17.5 ± 3.6		23.7 ± 1.8		19.2 ± 1.6		18.7 ± 2.2	

^a Data for Clearcut Controls from Blocks 5510, 5549, and 5550, respectively, rather than Blocks 5516, 5546, and 5547 as for all other factors.

Table 16. Species richness statistical comparisons between treatments and controls in the Donna Creek study area, 2006 and 2007. ANOVA statistics (Effect Tested, F statistic, *p*-value) shown for each comparison.

Comparison made	Effect tested	F	<i>p</i>
Clearcut treatment to clearcut control	Year x treatment effect	1.9	0.24
	Control to treatment effect	14.3	0.02
Old-growth and treatments outside islands	Year x treatment effect	0.5	0.76
	Old-growth to treatment effect	1.8	0.23
	Block effect	0.4	0.66
Old-growth and treatments including islands	Year x treatment effect	1.4	0.32
	Old-growth to treatment effect	2.4	0.14
	Block effect	0.2	0.87
TI(out) to TI(in)	Year x treatment effect	0.4	0.58
	Habitat effect	27.2	0.03
SI(out) to SI(in)	Year x treatment effect	0.6	0.48
	Habitat effect	158	0.01

Table 17. Species richness (number of species detected) for the experimental treatments in the Donna Creek study area in the 1990s and 2000s.

Block	Treatment groups																		Control groups			
	Clearcut		Stub		Tree island						Stub-and-island						Old-Growth		Clearcut ^a			
	2006	2007	2006	2007	Outside		Inside		Total area		Outside		Inside		Total area		2006	2007	2006	2007		
5516	15	24	23	19	19	27	30	32	32	39	21	24	29	24	35	31	32	33	19	28		
5546	14	23	17	24	15	24	19	16	16	25	16	25	23	19	28	27	29	27	14	27		
5547	13	25	13	23	16	23	25	22	14	19	14	19	23	25	26	28	33	28	11	28		
Mean ± SD	19.0 ± 5.5		19.8 ± 4.3		20.7 ± 4.8		24 ± 6.2		24.2 ± 9.8		19.8 ± 4.4		23.8 ± 3.3		29.2 ± 3.3		30.3 ± 2.7		21.2 ± 7.6			

^a Data for Clearcut Controls from Blocks 5510, 5549, and 5550, respectively, rather than Blocks 5516, 5546, and 5547 as for all other factors.

Table 18 Species richness statistical comparisons between treatments and controls in the Donna Creek study area, in the 1990s and 2000s. ANOVA statistics (Effect Tested, F statistic, *p*-value) shown for each comparison.

Comparison made	Effect tested	F	<i>p</i>
Clearcut treatment to clearcut control	Decade x treatment effect	6.4	0.04
	Control to treatment effect	3.4	0.1
Old-growth and treatments outside islands	Decade x treatment effect	5.5	0.01
	Old-growth to treatment effect	22.6	<0.01
	OG > CT, SB, TI, SI		
Old-growth and treatments including islands	Block effect	3.4	0.08
	Decade x treatment effect	4.6	0.02
	Old-growth to treatment effect	22.9	0
	OG > CT, SB, TI, SI		
TI(out) to TI(in)	Block effect	3.7	0.06
	Decade x treatment effect	1.1	0.36
	Habitat effect	966.6	<0.01
SI(out) to SI(in)	Decade x treatment effect	0.6	0.48
	Habitat effect	2634	<0.01

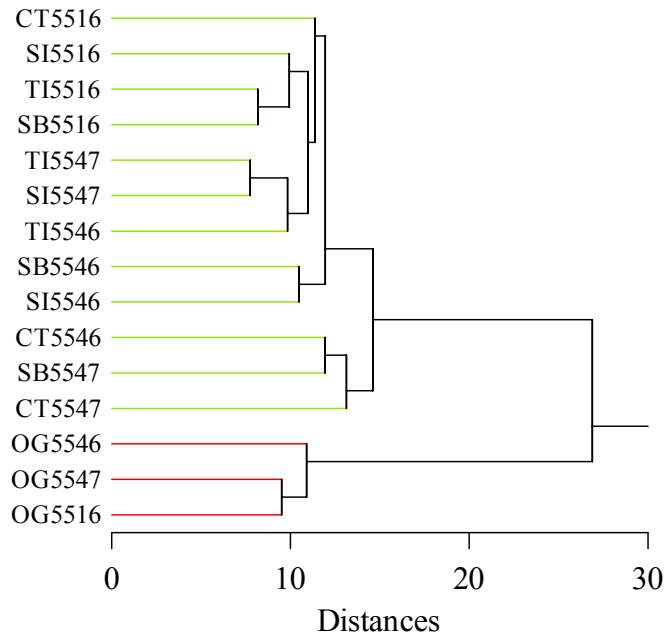
4.7 Bird Communities

Forty bird species had sufficient data to be included in both the cluster and PCA analyses. There were 2 main clusters distinguishing OG replicates from treatment replicates for both the 2000s data alone and for the 2 survey decades combined (Figures 3, 4). No apparent pattern was evident among clusters for the different experimental treatments. However, both cluster analyses, using singing detection densities, placed CT and SB replicates in Blocks 5546 and 5547 closest to OG replicates in terms of bird community compositions.

PCA for singing detection densities within treatment and OG replicates demonstrated a primary distinction between the compositions of bird communities in treatments vs. OG controls (Figure 4; Axis 1). There was a secondary distinction between bird community compositions for treatments in relation to sampling decade. Bird communities in treatments were more influenced by decade effects (1990s vs. 2000s) than by treatment type. This was evident based on the strong degree of overlap within decades, as illustrated by the two distinct clusters along Axis 2. PCA axes 1 and 2 accounted for a total of 40.6% of the variation in the data set.

Thirty bird species showed a notable positive or negative correlative relationship with the treatment or decade effects (Table 19). Species with the strongest affinity to OG (i.e., greatest PCA axis 1 value) were Golden-crowned Kinglet and Townsend's Warbler. Species that were more prominent in treatment habitats (i.e., lowest PCA axis 1 value) were Chipping Sparrow and Dusky Flycatcher. Sampling decade was positively correlated with the densities of 13 of 15 species (Table 19). Wilson's, Orange-crowned and Tennessee Warblers had the greatest affinity to treatments in the second survey period (2000s). In contrast, bird communities in the 1990s had greater densities of Savannah and Lincoln's Sparrows.

a) 2006 and 2007 data



b) 1990s and 2000s data

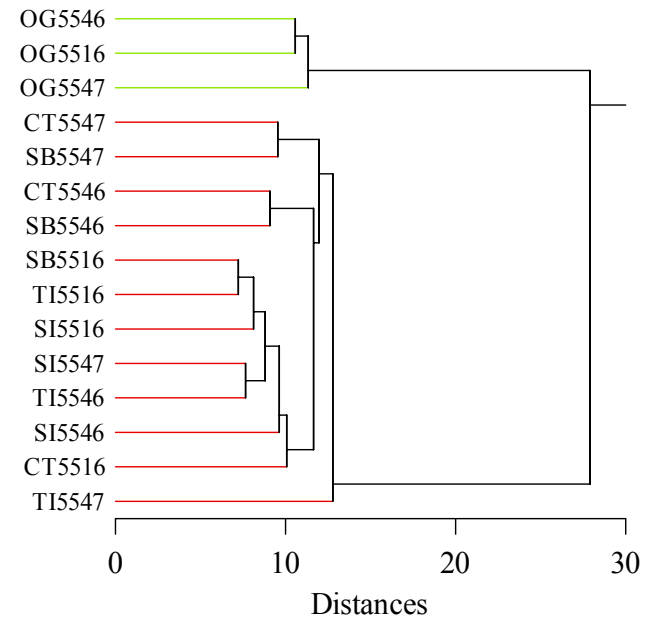


Figure 3. Simple average cluster-analysis dendrograms using Euclidian distance song-only bird detection densities for (a) 2006-2007 data and (b) all data (1990s and 2000s), Donna Creek study area.

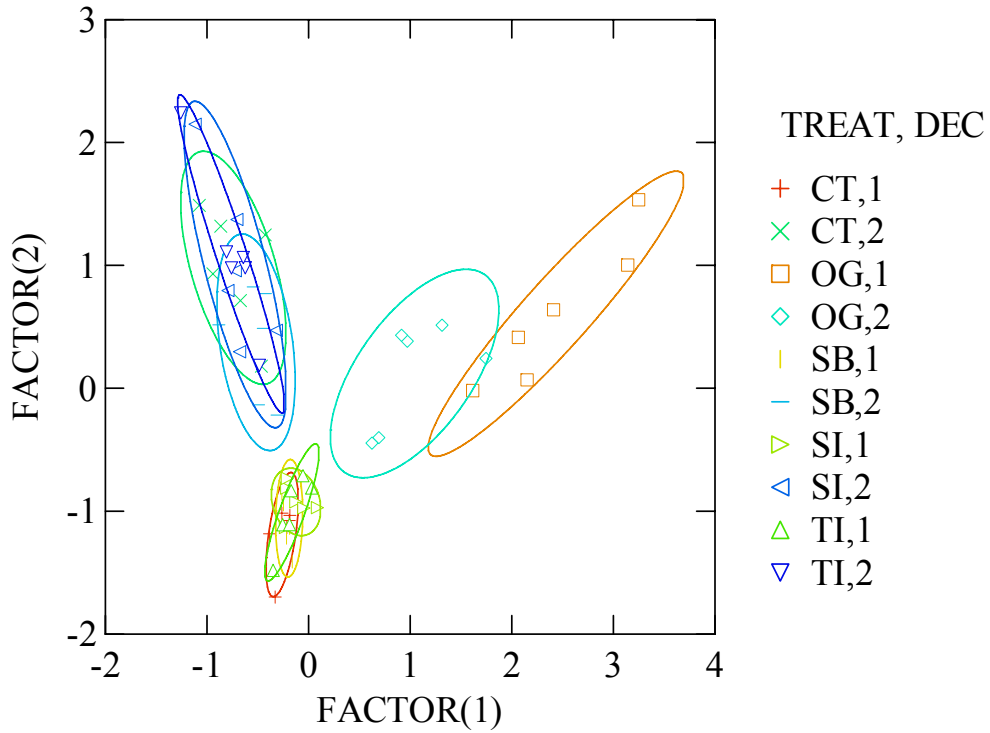


Figure 4. Principal components analysis using singing bird detection densities within treatment (CT, SB, TI, SI) and Old-growth Control (OG) replicates in the Donna Creek study area. Replicates are grouped by treatment or control type (TREAT) and by survey decade (DEC: 1 = 1990s [1995-1996], 2 = 2000s [2006-2007]) using 68.5% confidence ellipses.

Table 19. Pearson correlation coefficients for bird species based on the 2 axes of a PCA performed on singing-only bird detection densities within treatment and Old-growth Control replicates. Only correlations ≥ 0.30 ($R^2 \geq 0.1$) are shown; “-“ and “+” indicate negative and positive correlations, respectively.

Species	Group influence ^{a,c}	Decade influence ^{b,d}
Alder Flycatcher	-0.461	0.592
American Redstart		0.311
Blackpoll Warbler	0.835	
Brown Creeper	0.758	
Cedar Waxwing	0.375	
Chipping Sparrow	-0.508	0.538
Dusky Flycatcher	-0.504	0.693
Fox Sparrow	-0.317	0.354
Golden-crowned Kinglet	0.890	
Hammond's Flycatcher	0.697	
Lincoln's Sparrow	-0.401	-0.588
MacGillivray's Warbler	-0.470	0.582
Northern Waterthrush	0.707	
Olive-sided Flycatcher		0.513
Orange-crowned Warbler	-0.459	0.715
Pine Grosbeak	0.629	
Pine Siskin	0.531	
Red-breasted Nuthatch	0.823	
Ruby-crowned Kinglet	0.816	
Savannah Sparrow		-0.625
Swainson's Thrush		0.655
Tennessee Warbler		0.627
Townsend's Warbler	0.890	
Varied Thrush	0.669	
Warbling Vireo	-0.391	0.665
Western Wood-Pewee	0.337	
White-throated Sparrow		0.358
Wilson's Warbler	-0.458	0.784
Winter Wren	0.743	
Yellow-rumped Warbler	0.863	
Total variation explained	25.3%	15.3%

^a Positive value indicates positive correlation with OG controls

^b Positive value indicates positive correlation with the 2000s survey period.

^c (treatments to OG) (PCA Axis 1)

^d (PCA axis 2)

4.8 Vegetation and Physical Characteristics

In 2007 there were significant group effects for most variables tested where the overall analysis found a significant decade by treatment interaction effect (Tables 20, 21). The coniferous tall shrub cover was the only variable found not to differ between groups. There was no specific trend between the variables and group responses during 2007. For example, total tall shrub cover did not differ between tree islands and OG, but did differ between CT and TI, and between the TI and SI treatments. In the case of total low-shrub cover, OG differed from CT, but not from CC or tree islands, despite the fact that tree islands themselves did not differ from the CT. Stub density was not a test variable in the analyses, as stub retention remained fairly high to 2007 (>94%; Juelfs and Corbould in prep.), and thus did not differ greatly from stub densities in 1996 (Gyug 1997).

With both decades considered there were significant differences between groups for 15 out of 18 habitat variables (Table 22). The snag density and the canopy covers of Engelmann spruce and subalpine fir in the tree islands (TI and SI treatments) and OG did not differ between groups. ANOVA analyses showed OG had the greatest total canopy cover, but there were no differences between OG and tree islands using Tukey's post-hoc analysis. OG and tree islands had the highest percent covers of tall shrubs, low shrubs, and moss, but the lowest percent covers of grass, fireweed, total herbs, grass, bare soil, and rock relative to the other groups.

Habitat variables differed significantly within a group between 1996 and 2007. Only downed wood and snag density did not differ, though downed wood was nearly significant at $p=0.054$. Canopy cover in tree islands and OG declined from 1996 to 2007, while tall-shrub covers, low-shrub covers, and all ground variables increased in all groups from the 1990s to the 2000s.

Table 20. Habitat variables tested for interaction effects with decade. Mean percent cover for vegetation and physical characteristics, and mean snag density surveyed at point-count stations in the Donna Creek study area, 1996 and 2007. ANOVA statistics (MSE, F statistic, *p*-value) shown for each comparison.

Test variable	Decade		MSE	F	<i>p</i>	Decade * Treatment
	1996	2007				<i>p</i>
Canopy Tree % Cover³						
Lodgepole Pine	3.87	1.84	13.75	5.65	0.022	0.456
Engelmann Spruce	6.55	4.11	20.24	5.53	0.024	0.923
Subalpine Fir	13.75	9.22	53.33	7.26	0.010	0.718
Total	24.26	14.58	107.16	16.51	0.000	0.728
Tall Shrub % Cover (2-10m)						
Deciduous	1.86	10.57	61.91	83.60	0.000	0.017
Coniferous	4.95	12.71	76.19	54.22	0.000	0.000
Total	6.80	23.24	127.51	145.15	0.000	0.000
Low Shrub % Cover (<2m)						
Deciduous	7.63	17.71	117.39	59.00	0.000	0.002
Coniferous	2.12	2.84	4.18	8.57	0.004	0.197
Total	9.74	20.55	122.95	64.85	0.000	0.001
Ground Cover (%)						
Grass	0.76	1.31	114.00	21.63	0.000	0.001
Fireweed	11.81	22.95	367.90	23.00	0.000	0.006
Other Herb	10.21	16.06	122.37	19.08	0.000	0.001
Total Herb and Grass	25.01	46.11	349.77	86.70	0.000	0.102
Moss	24.41	56.58	402.04	175.44	0.000	0.000
Downed Wood	12.77	14.01	27.91	3.78	0.054	0.000
Bare Soil and Rock	4.11	57.50	370.99	531.68	0.000	0.000
Snag Density (per ha)³						
	94.16	96.81	2870.40	0.05	0.824	0.511

Table 21. Mean percent cover for vegetation and physical characteristics, and mean snag density surveyed at point-count stations in the Donna Creek study area, 2007 data only, where significant decade by interaction effects occurred in Table 20.

Test variable	Treatment and control type ^{1,2}								ANOVA test statistics		
	CC	CT	SB	TI	SI	Tli	Sli	OG	MSE	F	p
Tall Shrub % Cover (2-10m)											
Deciduous	14.23 ^{ab}	6.52 ^{ab}	4.94 ^b	14.27 ^{ab}	7.19 ^{ab}	17.58 ^a	13.59 ^{ab}	6.44 ^{ab}	126.09	3.18	0.004
Coniferous	15.09	8.67	15.6	17.18	10.07	11.17	11.77	11.29	132.68	1.38	0.218
Total	29.32 ^{ab}	15.19 ^a	20.54 ^{ab}	31.45 ^b	16.91 ^a	28.75 ^{ab}	25.36 ^{ab}	17.73 ^{ab}	223.35	3.55	0.002
Low Shrub % Cover (<2m)											
Deciduous	20.98 ^{ab}	8.40 ^a	12.84 ^{ab}	17.98 ^{ab}	13.20 ^{ab}	20.63 ^{ab}	21.18 ^{ab}	25.03 ^b	213.94	2.85	0.008
Coniferous	-	-	-	-	-	-	-	-	-	-	-
Total	23.56 ^{ab}	9.50 ^b	14.70 ^b	19.69 ^{ab}	15.32 ^{ab}	25.58 ^{ab}	25.27 ^{ab}	29.01 ^a	226.99	3.78	0.001
Ground Cover (%)											
Grass	11.27 ^{ab}	9.48 ^a	12.81 ^{ab}	24.72 ^b	11.15 ^{ab}	0.92 ^a	1.59 ^a	0.41 ^a	231.47	5.24	0
Fireweed	45.10 ^b	30.21 ^b	29.00 ^b	33.29 ^b	43.72 ^b	0.34 ^a	2.84 ^a	0.16 ^a	431.88	14.47	0
Other Herb	8.76 ^a	24.83 ^b	12.67 ^{ab}	10.05 ^a	13.56 ^{ab}	17.5 ^{ab}	17.77 ^{ab}	22.64 ^b	171.69	4.01	0
Total Herb and Grass	-	-	-	-	-	-	-	-	-	-	-
Moss	26.02 ^a	57.57 ^b	62.81 ^{bcd}	53.00 ^{bc}	37.86 ^{ab}	63.25 ^{bcd}	70.91 ^{cd}	83.65 ^d	630.78	10.26	0
Downed Wood	9.60 ^{ac}	8.62 ^a	9.38 ^{ac}	10.00 ^{ac}	8.26 ^a	24.42 ^b	27.73 ^b	14.48 ^c	32.64	24.26	0
Bare Soil and Rock	39.79 ^a	73.14 ^b	71.32 ^b	76.28 ^b	55.37 ^{ab}	56.47 ^{ab}	36.49 ^a	51.30 ^{ab}	760.15	5.37	0
Snag Density (per ha)	-	-	-	-	-	-	-	-	-	-	-

¹ Means followed by like superscripts not significantly different at $\alpha = 0.05$ using Tukey's test when ANOVA significant ($p < 0.05$).

² CC = Clearcut Control; CT = Clearcut within experimental treatment; SB = Stub Treatment; TI = Tree-island Treatment; SI = Stub-and-Island Treatment; Tli = Tree-islands within TI treatment; Sli = Tree-islands within SI treatment; OG = Old-Growth.

Table 22. Mean percent cover for vegetation and physical characteristics, and mean snag density, by group type, surveyed at point-count stations in the Donna Creek study area, 1996 and 2007.

Test variable	Treatment and control type ^{1,2}								ANOVA test statistics		
	CC	CT	SB	TI	SI	Tli	Sli	OG	MSE	F	p
Canopy tree cover³ (%)											
Lodgepole pine	-	-	-	-	-	0.89 ^b	2.13 ^{ab}	5.55 ^a	41.54	4.38	0.019
Engelmann spruce	-	-	-	-	-	4.01	4.88	7.11	43.48	1.83	0.174
Subalpine fir	-	-	-	-	-	12.55	9.46	12.55	127.18	0.55	0.583
Total	-	-	-	-	-	17.54	16.15	24.57	165.66	3.81	0.031*
Tall-shrub [2-10 m] cover (%)											
Deciduous	7.14 ^{ab}	3.27 ^a	2.59 ^a	7.25 ^{ab}	3.59 ^a	11.69 ^b	8.92 ^{ab}	5.25 ^{ab}	73.40	4.10	0.000
Coniferous	7.97 ^a	4.34 ^a	7.85 ^a	8.67 ^a	5.09 ^a	10.54 ^{ab}	11.23 ^{ab}	14.94 ^b	75.11	6.02	0.000
Total	15.11 ^{abc}	7.62 ^c	10.44 ^{bc}	15.91 ^{ab}	8.51 ^{bc}	22.23 ^a	20.15 ^a	20.19 ^a	123.22	8.91	0.000
Low Shrub % Cover (<2m)											
Deciduous	12.6 ^{ab}	6.83 ^a	9.37 ^{ab}	13.3 ^{ab}	9.6 ^{ab}	14.73 ^{ab}	19.52 ^b	15.39 ^{ab}	165.72	3.07	0.005
Coniferous	1.86 ^a	1.34 ^a	1.71 ^a	1.58 ^a	1.52 ^a	3.98 ^b	4.11 ^b	3.72 ^b	6.13	7.64	0.000
Total	14.46 ^{ab}	8.17 ^a	11.08 ^a	14.88 ^{ab}	11.12 ^a	18.7 ^b	23.64 ^b	19.11 ^b	174.22	4.66	0.000
Ground Cover (%)											
Grass	8.38 ^{ab}	7.92 ^{ab}	7.78 ^{ab}	13.83 ^b	7.51 ^{ab}	0.96 ^a	1.02 ^a	0.26 ^a	199.85	3.89	0.001
Fireweed	28.68 ^b	26.40 ^b	22.84 ^b	25.15 ^b	34.25 ^b	0.18 ^a	1.44 ^a	0.09 ^a	311.25	21.73	0.000
Other Herb	9.46	17.40	10.90	9.45	14.25	11.92	16.41	15.30	170.58	2.11	0.046*
Total Herb and Grass	45.62 ^b	52.09 ^b	39.61 ^b	44.06 ^b	55.52 ^b	13.06 ^a	18.87 ^a	15.65 ^a	579.26	16.69	0.000
Moss	14.75 ^a	29.28 ^{ab}	32.69 ^b	27.17 ^{ab}	23.28 ^{ab}	55.42 ^c	63.86 ^{cd}	77.51 ^d	481.91	35.90	0.000
Downed Wood	8.43 ^a	8.92 ^a	10.74 ^a	9.71 ^a	8.85 ^a	20.5 ^{bc}	23.73 ^b	16.24 ^c	45.51	22.31	0.000
Bare Soil and Rock	23.21 ^a	38.51 ^b	40.61 ^b	42.29 ^{bc}	29.46 ^{abc}	28.30 ^{abc}	18.4 ^a	25.65 ^{ab}	511.07	5.23	0.000
Snag Density (per ha)	-	-	-	-	-	100.88	89.71	95.86	3720.94	0.19	0.826

¹ Means followed by like superscripts not significantly different at $\alpha = 0.05$ using Tukey's test when ANOVA significant ($p < 0.05$).

² CC = Clearcut Control; CT = Clearcut Treatment; SB = Stub Treatment; TI = Tree Island Treatment; SI = Stub-and-Island Treatment; Tli = tree islands within TI treatment; Sli = tree islands within SI treatment; OG = Old-growth Control.

³ ANOVA tested within tree islands (SI and TI treatments) and Old-Growth only.

* Indicates statistical significance using ANOVA, but lack of difference using Tukey's test due to differences in test structure.

4.9 Species at Risk

Two bird species of conservation concern were detected during the 2006 and 2007 surveys. The Olive-sided Flycatcher was detected fairly regularly during point-count surveys (66 detections for 2006-2007; Appendix M). Individuals were detected in most treatment and control areas, but they were detected most often in tree islands. The Olive-sided Flycatcher was also detected during the 1990s, but much less than in the 2000s; tree islands and OG controls had 3 detections each (Gyug 1997).

The other species at risk was the Cape May Warbler. Two individuals were detected in the OG adjacent to Block 5516 in 2007. On 2 June, one individual was heard singing from point-count station 16OG06, and a second individual was heard singing from 16OG05; they were different individuals as both were subsequently heard at the same time while walking between stations. At least one of these birds was heard in the vicinity until 17 June.

For both survey decades combined, only 2 other species at risk were detected in the Donna Creek study area; the Common Nighthawk and Barn Swallow. The Common Nighthawk was detected only in 1995 and involved 1 detection in the harvested area of the TI in Block 5547 (Gyug 1997). The Barn Swallow was observed flying around the roadway near Block 5547 on one occasion, but was not recorded during a point-count survey.

5.0 DISCUSSION

Bird communities in the Donna Creek study area were influenced by treatment and decade effects. Old-growth controls were different than the treatments in species compositions and detection densities of many birds, especially between decades. The shrub-seral stage of this community was also noticeably different than the early-seral stage. Bird assemblages shifted between decades, resulting in species specific differences in detection-densities and habitat association.

A total of 233 species have been reported in the Williston and Dinosaur Reservoir Watersheds (PFWWCP 2000). About 83 (~36%) of these would be expected to occur in the Donna Creek study area as residents, breeding species, or occasional migrants, based on the species habitat use and/or dispersal tendencies (Campbell et al. 1990, 1997, 2001), and the characteristics of the habitat in the study area. In total, 89 species were recorded between the

1990s and 2000s (Phase I and Phase II of this study respectively); 79 during the 1990s and 69 in the 2000s. Few species of provincial or national conservation concern are expected to occur in the Donna Creek area.

The north-central region of British Columbia, and in particular its ESSF landscapes such as the Donna Creek drainage, is not known for having many bird species of conservation concern (COSEWIC 2007, BC CDC 2008). Three Species At Risk would be expected to occur based on provincial and national designations, but only 1 of these, the Barn Swallow, was designated prior to completion of field-work in the 2000s. In total, 4 Species At Risk were detected, including the provincially Red-listed Cape May Warbler, Blue-listed Barn Swallow, and the COSEWIC-designated threatened Common Nighthawk and Olive-sided Flycatcher. Olive-sided Flycatchers prefer forest edge and clearings with tall standing trees as perch sites (Campbell et al. 1997, Altman and Sallabanks 2000), a preference which is accommodated by the tree islands in the study area. The Olive-sided Flycatcher is the only Species At Risk expected to breed within the study area and they will probably continue to occur in the area until a “climax” forest type is again reached within the treatments. The Olive-sided Flycatcher’s recent designation was the result of a 79% decline in their Canadian-wide population over the past 40 years, and a nearly 30% decline since 1996 (COSEWIC 2007).

The Common Nighthawk, while widespread, is usually encountered at lower elevations than those typified by the study area (Campbell et al. 1990). The nesting habitat for the Common Nighthawk includes logged areas and unused roadways (Campbell et al. 1990), such as those found at Donna Creek during the 1990s surveys when this detection occurred, but the cutblock regeneration in the study area by the 2000s surveys has effectively precluded any future nesting opportunities.

Barn Swallows also are widespread, but their strong nesting association with human-made structures (e.g., bridges and barns) will likely exclude them from the study area as anything other than passage visitors. The Barn Swallow detection happened during the 2000 survey period, and involved a bird seen flying around our parked truck.

The occurrences for Cape May Warblers involved 2 males using the OG Control adjacent to Block 5516 in 2007. One male was a potential breeder as it remained in the area until at least mid-June. This species typically resides in the tree canopy (Campbell et al. 2001), which makes them extremely difficult to view, so it is unknown if a female was present. Cape May Warblers are known breeders in the Fort Nelson area and Peace

Lowlands, but are not known to breed west of the Rocky Mountains (Campbell et al. 2001). These individuals were observed in a mature spruce stand, which is their typical nesting habitat (Campbell et al. 2001). Mature spruce stands are plentiful in the Mackenzie Forest District, and the recent westward expansion of some “eastern” species (i.e., east of the Rocky Mountains; Campbell et al. 2001) indicates that this species may become more abundant in the Donna Creek study area in the future.

Old-growth had a unique composition of birds that included species rarely or never detected within the treatments. Most of the species detected within the treatments were habitat generalists, or benefited from opening up of forest stands either naturally (e.g., fire, tree-fall gaps, etc.) or artificially (clearcuts). Species representative of mature forest were present in the Old-growth controls, along with some of the generalist species, giving OG high species richness relative to the treatments. This distinction weakened in the 2000s, likely due to changes in habitat variables. Species that preferred OG were distributed among genera and foraging and nesting guilds, including warblers, kinglets, flycatchers, thrushes, wrens, chickadees, and woodpeckers. The habitat requirements for these species are varied as well, indicating that it is not one particular aspect of the OG control that is important for maintaining healthy populations of these species. Old growth consistently was clumped together in most attributes, including detection-densities of bird species within and between decades. Also consistent was the clustering of all treatments. Within the treatments there were no further groupings based on singing detection-densities of bird species, indicating their overall similarity to each other relative to the OG controls. Cutblocks may lack the structural complexity found in mature forest. Habitat variables such as canopy structure (both horizontal and vertical structure), basal area, and foliage height are correlated with bird richness, diversity and abundance (Karr and Roth 1971, Balda 1975, Catt 1991, Davis et al. 1999). The vegetation data from this study show that such habitat variables were greater in mature forest, and that tree islands share similar characteristics. The greater richness within tree islands of both the Tree Island and Stub-and-Island treatments than surrounding cut portions of those treatments, but lower overall richness than Old-growth Controls may reflect the intermediate vegetative characteristics of that factor.

As structural diversity in the treatments increases with forest succession, the differences between Old-growth Controls and the treatments will weaken. This effect may already be witnessed, as species richness between Old Growth and treatments was not significantly different in the 2000s. Species abundances will also begin to approximate each other between OG and treatments over time. The change in avian communities will be most pronounced within the treatments, however, as the Old-growth Controls will likely not shift

in habitat characteristics so drastically. In this study, bird communities in the treatments were more influenced by the decade factor than by treatment type, indicating a greater shift of habitat characteristics in those habitat types. Species richness was overall higher in the 2000s than the 1990s, probably also due to the increased structural diversity in cut sections of the study area in later years. Tree islands and Old-growth Controls did not show an increase in richness because habitat variables did not change as greatly. Davis et al. (1999), in a study in the ESSF zone of East Central British Columbia, found that bird communities did not significantly differ between early-, mid-, and late-seral forests, with mid- and late-seral forests being very similar. This is in contrast to our study, which finds that there are significant differences in bird communities between early-seral and shrub-seral stages. Nonetheless, Davis et al. (1999) found certain species did have distinct preferences for particular stand types (e.g., Winter Wren in late-seral, Lincoln's Sparrow in early-seral), that are consistent with our findings. Most differences between decades can be explained by habitat changes, but some, especially differences between consecutive years, may be due in greater part to random effects or overall bird population trends. For example, surveys in 2006 recorded higher densities of birds than 2007. A late spring and cold, rainy conditions during 2006 may have resulted in reduced breeding success and fewer returning birds during 2007. Alternatively, bird song may have continued for longer in 2006 due to multiple nesting attempts, fewer females, or any number of unexplored variables, and thus were simply recorded more throughout the breeding season. It is not possible to deduce the cause behind these population variations without the employment of more detailed studies, but it is also important to note their existence as contributing factors in our results.

Some bird species were associated with certain treatments or factors likely based on the habitat characteristics present. The tree island factor, as well as Old-growth Control both had more species associations than the surrounding cutblocks (Figure 5). Species that were strongly associated with OG were almost exclusively found in that control. The one exception (Northern Waterthrush) is not an old-growth specialist (Campbell et al. 2001) but in this study was likely associated based on a few site-faithful birds that were present in riparian stretches of the control. In contrast to OG, tree islands had species that were found predominantly in the islands (e.g., Black-backed Woodpecker), as well as generalist species that were present in all treatments (e.g., Wilson's Warbler). Associations with tree islands may be due in part to characteristics of the island such as greater vegetation cover (this study) or greater concealment from predators or weather events (Newton 1998), but the edges of the islands may also have been attractive displaying perches due to the greater vertical strata within islands. Thus, some of the generalist species may be over-represented in their association with tree islands, and may not be reliant on tree islands for nesting or foraging.

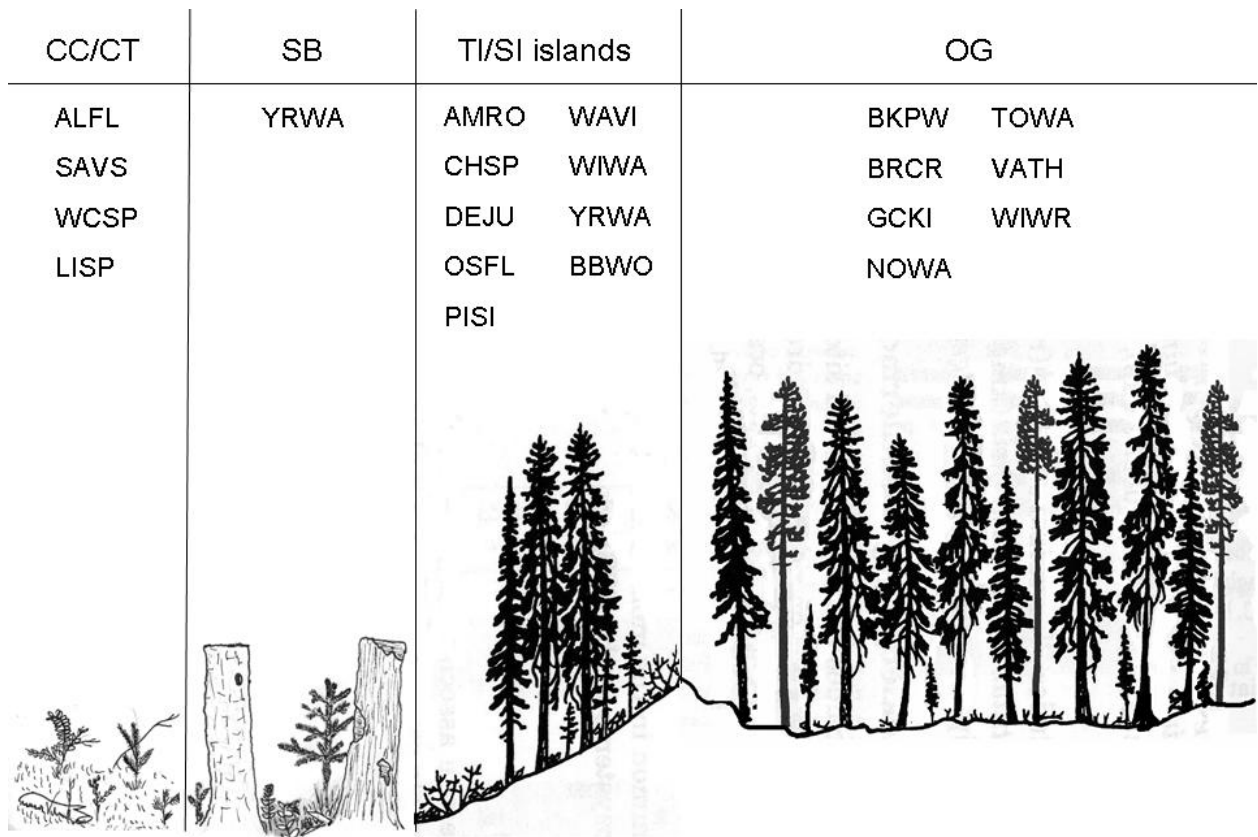


Figure 5. Significant bird species associations for each treatment and control type when survey data was combined for both decades (1990s and 2000s), Donna Creek study area. Species are listed by their unique code (see Appendix A). Clearcut Control (CC) and Clearcut Treatment (CT) are lumped together, as are tree islands from the Tree Island (TI) and Stub-and-Island (SI) treatments.

Stubs did not appear to be an important habitat element when taken in isolation. Only the Yellow-rumped Warbler had a significant positive association with Stub treatment when both decades were considered. In the 1990s, this was the only species found to be positively affected by the presence of stubs using the ANOVA analysis; however, our observations are consistent with Gyug’s (1997) that this species was found in all treatment types in all blocks, and does not depend on stubs as a habitat element. The only other species to have a near-significant association with the stub factor when both decades were combined was Chipping Sparrow ($P = 0.07$), although this may have been driven by its positive association with the Stub-and-Island treatment. Where species relationships do occur, they may be due to vegetative characteristics or landscape-level variables (Vernier and Pearce 2007), and a lack

of habitat association can arise where generalist species are concerned, or where sample-size inadequacies limit statistical inference (Vernier and Bunnell 2007).

Species diversity in the study area may decline as forest succession progresses to the pole-sapling stage. This will be due to the increased canopy cover in the regenerating areas, and a reduction of tree-island canopy cover from blow-down. Densities of early-seral species will probably decline as well. The divergence between OG bird communities and those of the treatments may begin to weaken as canopy height and cover increases in the regenerating areas, although this may not be evident until later seral stages.

6.0 MANAGEMENT IMPLICATIONS

Within the Donna Creek Study area, the increased structural diversity from tree island and stub creation increased bird diversity and maintained some bird species compared to conditions that are created after traditional clearcut practices. However, the influences of the various treatment effects are not homogeneous. Stubs did not positively influence either bird densities or species richness. Stubs may benefit some cavity-nesting birds in the short-term (e.g., Mountain Bluebird, Tree Swallow, and Black-backed Woodpecker in the 1990s), but the few cavity nests present in the 2000s indicates that these stems may have characteristics that provide poor cavity-nesting value after about 15 years. Stubs may not be decaying, or may not be decomposing at a fast enough rate, limiting their potential as nesting and/or foraging locations for a broad range of species. Greater than 85% of these stubs were identified as stable in 2007 (Juelfs and Corbould in prep). A study in south-central British Columbia found birds continuing to nest in stubs 10 years after stub creation (Harris 2001); however, it also noted that no new excavations took place as all nesting attempts were in previous cavities. Furthermore, stubs that were sound when cut were still sound after a decade, though sap-rot was forming in some stubs (Harris 2001). In order to have good excavation potential for primary cavity nesters, stubs will need to already have heart-rot decay present at the time of stubbing (T. Manning, Manning, Cooper and Associates, personal communication), or other obvious defects (e.g., scars, or pre-existing cavities) (Harris 2001, Fenger et al. 2006). Stubs may provide other important biological roles in a regenerating forest (e.g., future coarse woody debris), but benefits to the bird community will be limited in the short-term to providing perches, foraging sites, and some nesting opportunities. Stubs do not appear to provide the necessary returns on the operational investment utilizing their current creation methods. Stubs should be much taller and selected based on the presence of pre-existing decay, scarring, or cavities to be of value. Without

such provisions, stubbing does not appear to provide a worthwhile habitat component to ESSF bird communities.

Tree islands appeared to be of relatively little importance to the Donna Creek bird community. Most of the species that were associated with tree islands were habitat generalists. Tree islands may provide nesting habitat for some species (e.g., chickadees) which can breed in relatively small habitat patches (breeding territories of 5-10 ha) (Fenger et al. 2006). However, tree islands of <0.40 ha found in this study were likely too small to hold breeding territories of many species found in the study area, based on most birds' territory sizes (Campbell et al. 1990, 1997, 2001). This supports Gyug's (1997) statement that tree islands of 0.2-0.4 ha are of little breeding value to many of the forest bird species present. Though tree islands may have future ecological benefits, such as adding to coarse woody debris levels, they are currently of minimal use for birds in the ESSF zone of north-central BC. Increasing the patch size and selecting specific characteristics of the tree islands would likely increase their ecological value. For example, moist wildlife-tree patches held greater songbird diversity and abundance compared with drier patches in the Prince George Timber Supply Area (MCA 2007). Retaining tree patches with a more diverse canopy-tree diversity and greater percentage of standing live trees within moist sites may increase their utility for bird communities.

The importance of old-growth retention is illustrated by the fact that old-growth stands had the highest mean number of species compared to any treatments. In addition, 17 of 43 species showed a preference for old-growth stands versus any treatments. Some species were found only in old-growth controls. Conversely, several species were found only in treatments, or preferred treatments over old-growth; but these were all species that prefer more open habitats than usually found in old-growth ESSF stands. Harvested landscapes with old-growth retention provide higher species diversity than unharvested landscapes or harvested landscapes without old-growth retention. Managers should consider species responses to harvesting practices, conservation concerns of Species At Risk, and overall bird community objectives when designing harvesting plans for large spatial areas.

7.0 LITERATURE CITED

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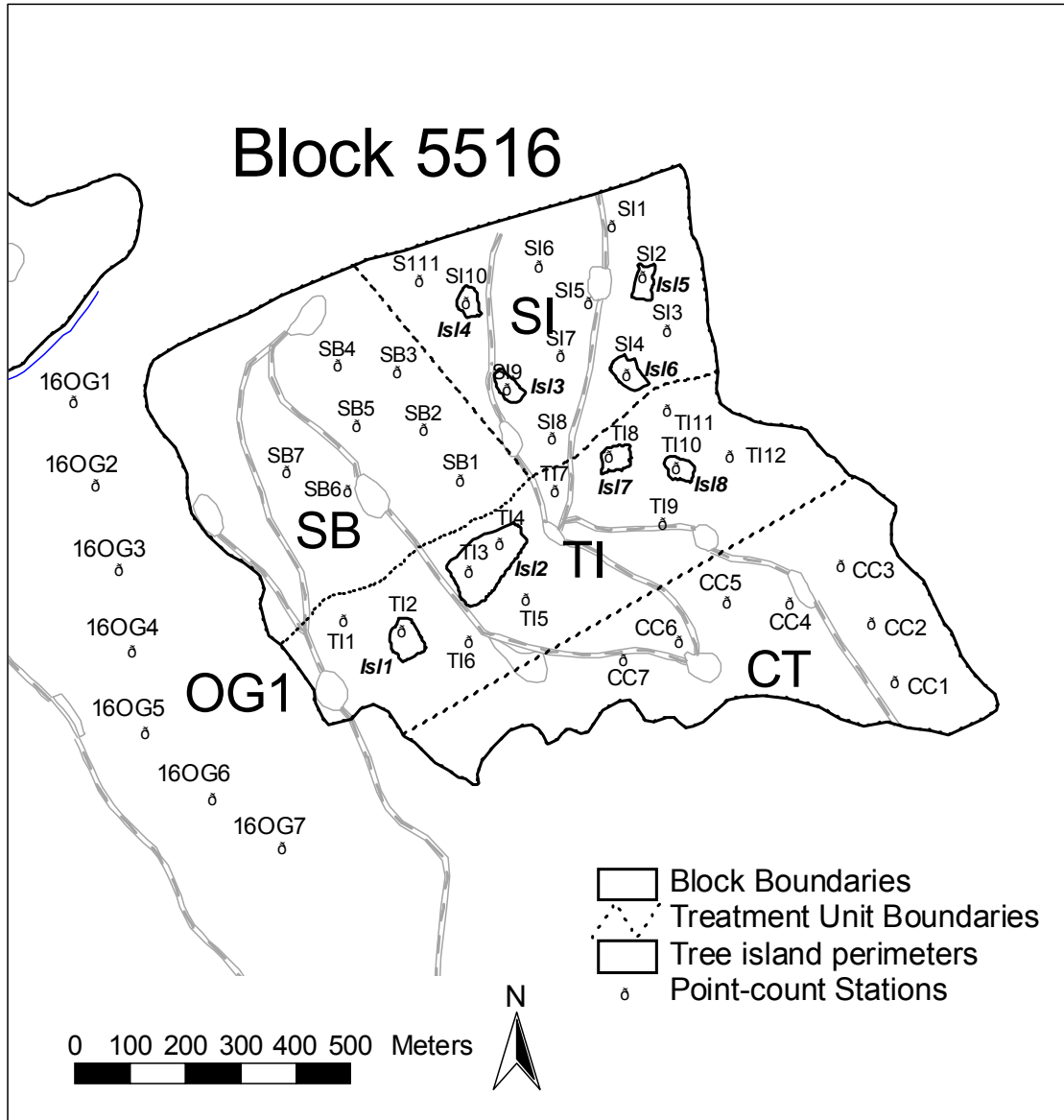
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APPENDICES

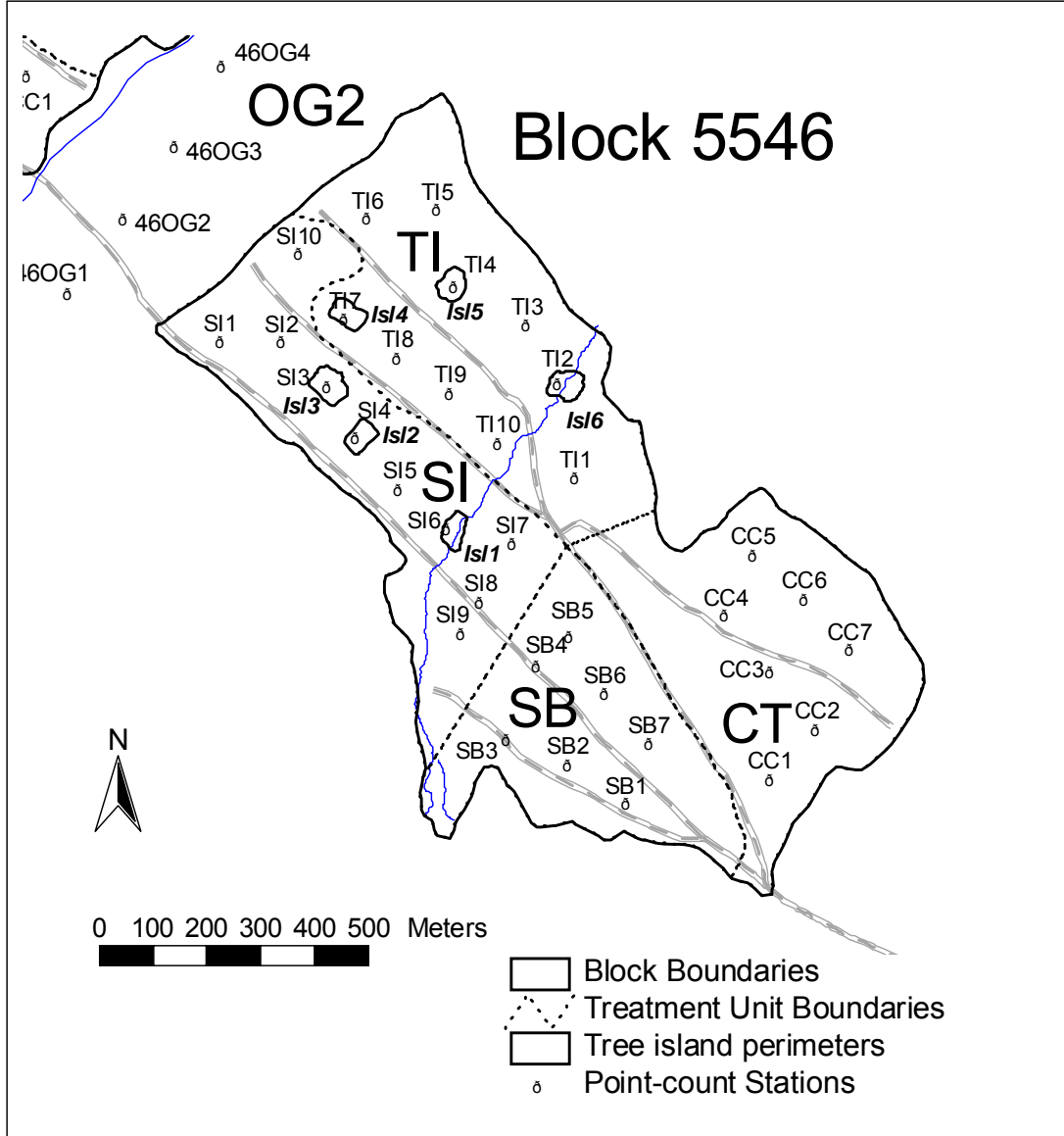
Appendix A. Maps showing the locations of point-count stations in the 3 experimental cutblocks (Blocks 5516, 5546, and 5547), 3 Clearcut Control cutblocks (Blocks 5510, 5549, and 5550), and 3 Old-Growth areas (OG1, OG2, and OG3), Donna Creek Forestry/Biodiversity Project (from Gyug and Corbould 2002).

Experimental cutblock Block 5516 and Old-Growth area OG1



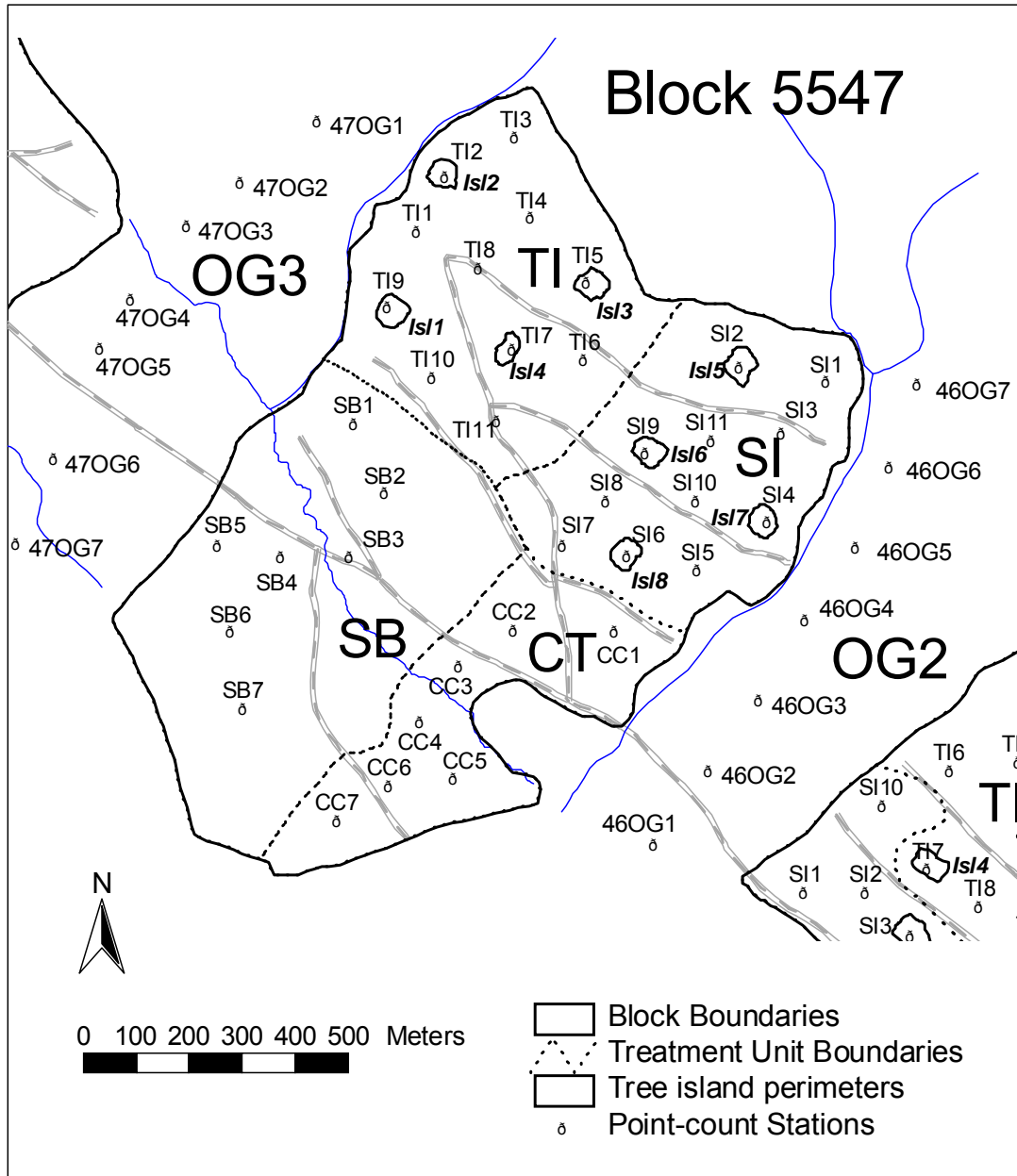
Note: For map legibility, the first 2 numbers referencing the block number have been omitted from each point-count station (e.g., SB6 = 16SB6) and tree-island (e.g., Isl 6 = Isl 16-6) label.

Experimental cutblock Block 5546



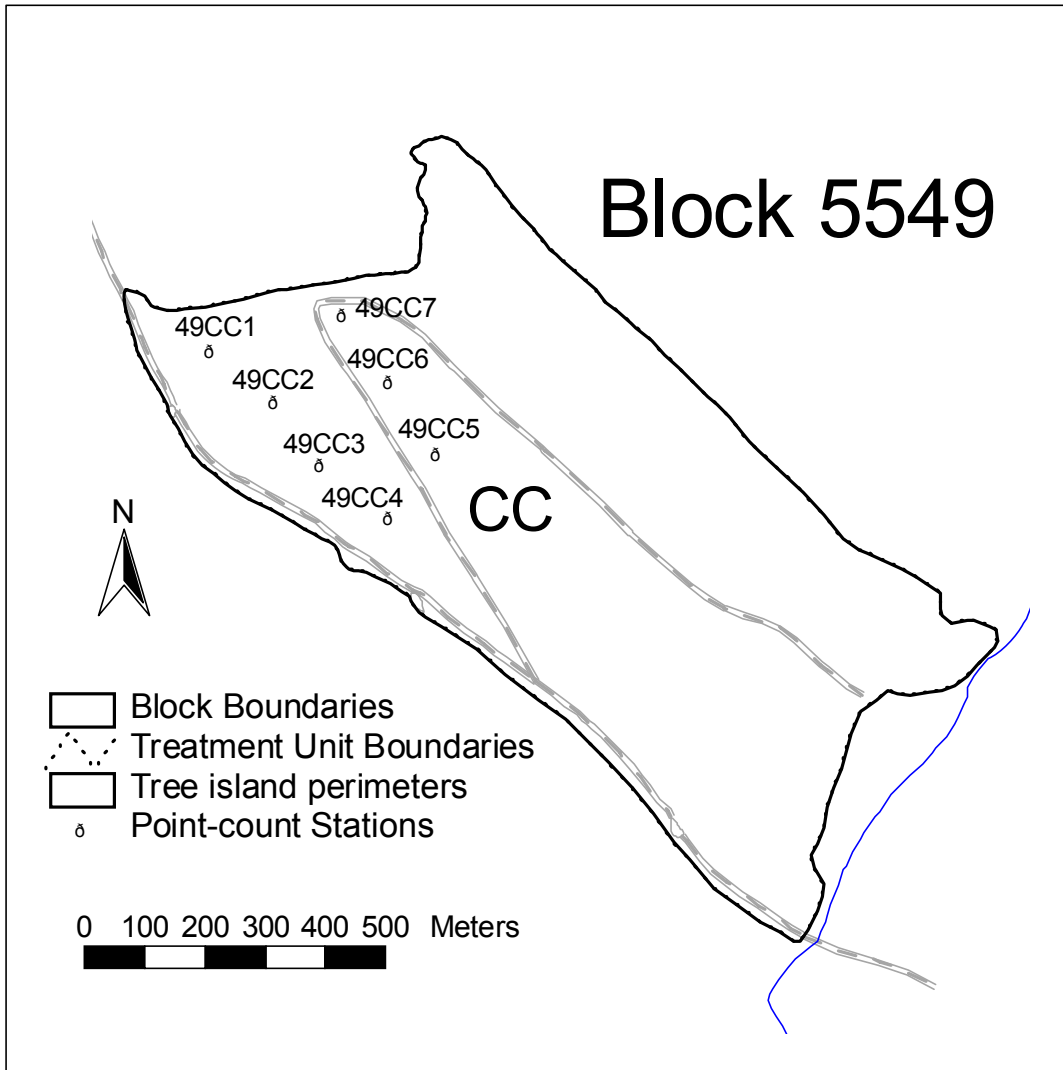
Note: For map legibility, the first 2 numbers referencing the block number have been omitted from each point-count station (e.g., SB6 = 46SB6) and tree-island (e.g., Isl 6 = Isl 46-6) label.

Experimental cutblock Block 5547 and Old-Growth areas OG2 and OG3

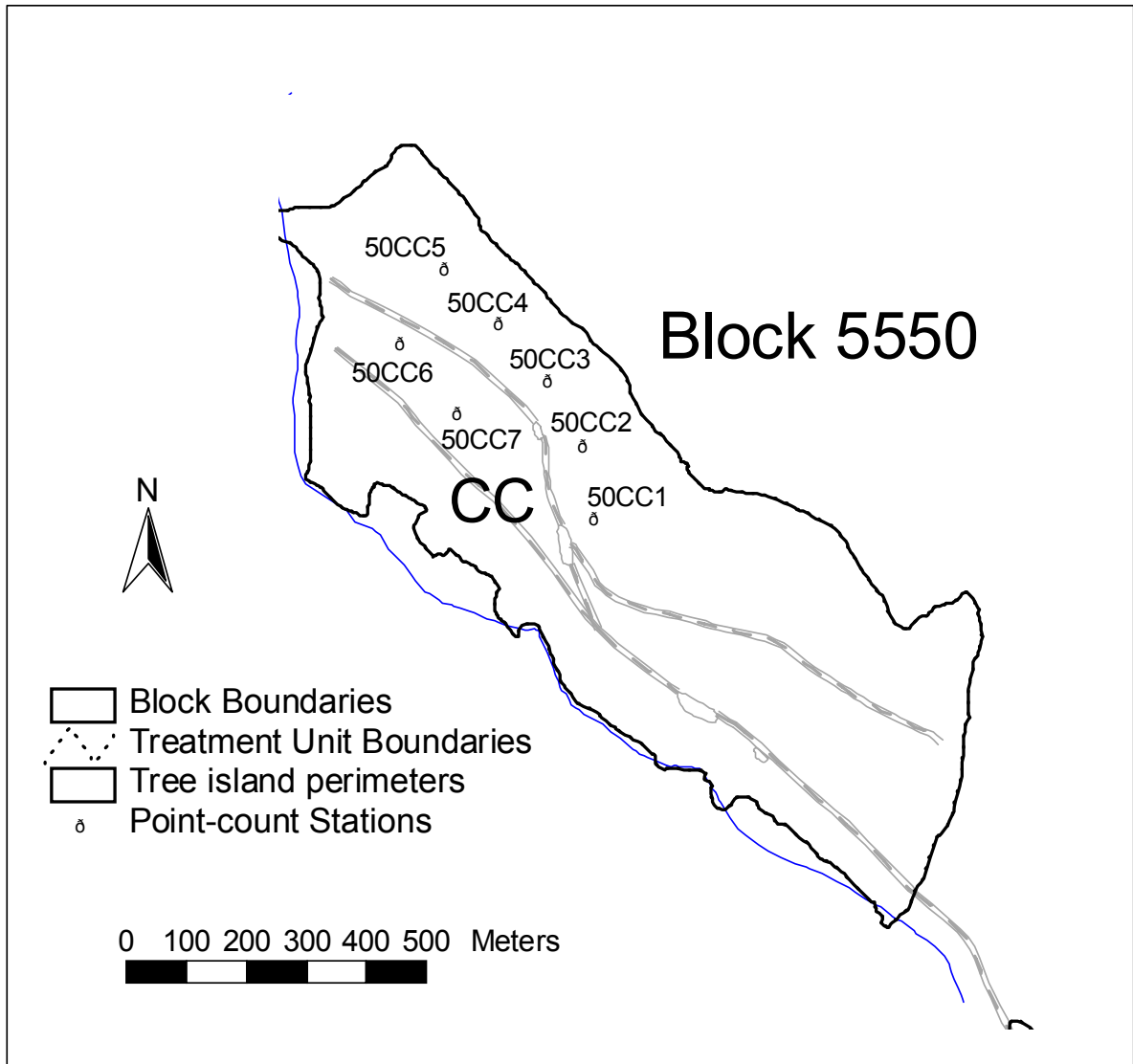


Note: For map legibility, the first 2 numbers referencing the block number have been omitted from each point-count station (e.g., SB6 = 47SB6) and tree-island (e.g., Isl 6 = Isl 47-6) label.

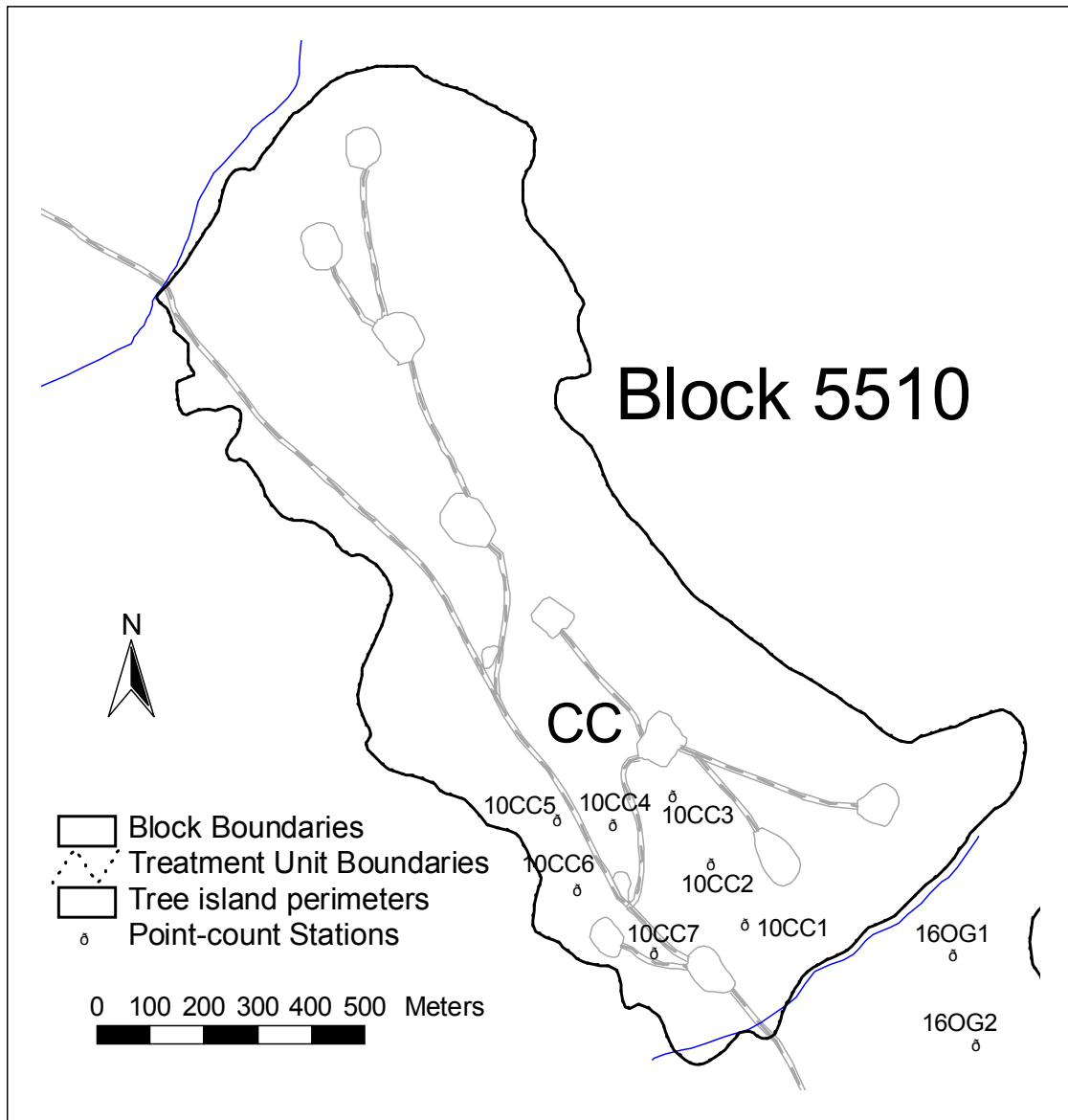
Clearcut Control cutblock Block 5549



Clearcut Control cutblock Block 5550



Clearcut Control cutblock Block 5510



Appendix B. Common bird species and average bird densities used in repeated measures ANOVA between Clearcut Controls (CC) and Clearcut Treatments (CT) for the 2000s (2006 and 2007), Donna Creek study area.

Species	Mean density of detections (100 ha) ^a				ANOVA test statistics ^b								
	Clearcut control		Clearcut treatment		Group effect			Year effect			Year x group effect		
	2006	2007	2006	2007	MSE	F	<i>p</i> ^c	MSE	F	<i>p</i> ^c	MSE	F	<i>p</i> ^c
SINGING DETECTIONS													
Alder Flycatcher	26.70	40.00	25.50	32.70	54.00	0.20	0.67	318.70	5.00	0.09	27.60	0.40	0.55
Chipping Sparrow	57.00	29.10	77.60	23.00	158.80	0.40	0.56	5099.40	12.70	0.02	533.80	1.30	0.31
Dark-eyed Junco	41.20	21.80	60.60	27.90	486.30	1.10	0.36	2039.10	7.80	0.05	133.40	0.50	0.52
Dusky Flycatcher	10.90	24.30	10.90	8.50	186.40	0.60	0.48	89.30	5.80	0.07	186.40	12.10	0.03
Lincoln's Sparrow	27.90	35.20	36.40	17.00	70.60	0.10	0.76	110.30	2.30	0.20	533.80	11.30	0.03
MacGillivray's Warbler	19.40	14.60	19.40	36.40	357.30	1.20	0.33	110.30	0.80	0.43	357.30	2.50	0.19
Orange-crowned Warbler	23.00	23.00	23.00	29.10	27.60	0.40	0.58	27.60	0.10	0.76	27.60	0.10	0.76
Swainson's Thrush	34.00	10.90	65.50	13.30	864.60	2.10	0.22	4239.20	21.50	0.01	635.20	3.20	0.15
Tennessee Warbler	23.00	15.80	27.90	7.30	9.90	0.00	0.89	583.40	4.10	0.11	133.40	0.90	0.39
Warbling Vireo	38.80	23.00	14.60	8.50	1129.30	5.10	0.09	357.30	6.10	0.07	70.60	1.20	0.33
Wilson's Warbler	131.00	83.70	129.70	93.40	54.00	0.00	0.87	5250.50	5.30	0.08	89.30	0.10	0.78
Yellow-rumped Warbler	12.10	0.00	8.50	6.10	4.40	0.20	0.69	158.80	18.00	0.01	70.60	8.00	0.05
All singing detections	509.30	351.70	538.40	329.80	40.00	0.00	0.93	100581.00	106.40	0.00	1945.00	2.10	0.22
ALL DETECTIONS													
American Robin	31.50	10.90	31.50	7.30	9.90	0.10	0.79	1509.70	18.50	0.01	9.90	0.10	0.74
Fox Sparrow	3.60	1.20	9.70	9.70	158.80	0.80	0.42	4.40	0.30	0.64	4.40	0.30	0.64
Gray Jay	15.80	0.00	9.70	2.40	9.90	1.10	0.35	398.10	36.10	0.00	54.00	4.90	0.09
Pine Siskin	3.60	37.60	4.90	47.30	89.30	0.30	0.62	4377.10	21.10	0.01	54.00	0.30	0.64
White-crowned Sparrow	25.50	7.30	1.20	7.30	441.10	1.10	0.35	110.30	1.20	0.33	441.10	4.90	0.09
All bird detections	825.80	552.90	715.40	536.00	12158.50	1.30	0.31	153432.90	650.10	0.00	6538.60	27.70	0.01

^a Densities are averaged by group type (CC, CT) and study year (2006 and 2007).

^b Repeated-measures ANOVA test statistics (mean square [MS], F statistic, and *p*-value) are shown for group effects, year effects, and year effects on groups.

^c *p*-values ≤ 0.05 are shown in bold.

Appendix C. Common bird species and average bird densities used in repeated measures ANOVA between Clearcut Controls (CC) and Clearcut Treatments (CT) where Year x Group Effect was significant in Appendix B.

Species	Year	Mean density of detections (100 ha) ^a		Group effect ^b		
		Clearcut control	Clearcut treatment	MSE	F	<i>p</i> ^c
SINGING DETECTIONS						
Dusky Flycatcher	2006	10.9	10.9	0.00	0.00	1.00
	2007	24.3	8.5	372.75	1.63	0.27
Lincoln's Sparrow	2006	27.9	36.4	108.08	0.32	0.60
	2007	35.2	17.0	496.27	1.32	0.31
Yellow-rumped Warbler	2006	12.1	8.5	19.85	0.64	0.47
	2007	0.0	6.1	55.14	25.00	0.01
ALL DETECTIONS						
All bird detections	2006	825.8	715.4	1270.00	0.53	0.51
	2007	552.9	536.0	714.60	0.21	0.67

^a Densities are averaged by group type (CC, CT) and study year (2006 and 2007).

^b Repeated-measures ANOVA test statistics (mean square [MS], F statistic, and *p*-value) are shown for group effect.

^c *P*-values ≤0.05 are shown in bold.

Appendix D. Common bird species and average bird densities used in repeated measures ANOVA between Clearcut Controls (CC) and Clearcut Treatments (CT) for the 1990s and 2000s, Donna Creek study area. Data for 1995 and 1996 from Gyug (1997).

Species	Mean density of detections (100 ha) ^a				ANOVA test statistics ^b								
	Clearcut control		Clearcut treatment		Group effect			Year effect			Year x group effect		
	2006	2007	2006	2007	MSE	F	p ^c	MSE	F	p ^c	MSE	F	p ^c
SINGING DETECTIONS													
Alder Flycatcher	7.4	33.3	0.0	29.1	202.1	1.7	0.23	4551.9	36.2	0.00	14.6	0.1	0.74
American Robin	5.6	4.9	3.5	4.9	7.0	0.3	0.62	0.6	0.0	0.86	7.0	0.4	0.53
Chipping Sparrow	16.9	43.0	14.7	50.3	39.2	0.1	0.74	5720.8	20.6	0.00	133.7	0.5	0.51
Dark-eyed Junco	40.3	31.5	37.2	44.3	141.2	0.6	0.47	4.5	0.0	0.92	372.8	0.9	0.36
Dusky Flycatcher	0.0	17.6	0.0	9.7	-	-	-	-	-	-	-	-	-
Golden-crowned Sparrow	5.2	2.4	0.9	6.7	0.0	0.0	0.99	13.8	0.2	0.64	110.3	1.9	0.21
Lincoln's Sparrow	96.1	31.5	65.8	26.7	1854.9	8.0	0.02	16150.6	38.1	0.00	972.7	2.3	0.17
MacGillivray's Warbler	11.3	17.0	3.5	27.9	14.6	0.1	0.76	1362.8	10.9	0.01	525.0	4.2	0.07
Orange-crowned Warbler	1.7	23.0	0.9	26.1	7.0	0.1	0.77	3245.1	31.9	0.00	22.8	0.2	0.65
Savannah Sparrow	52.8	7.3	35.5	1.2	820.4	1.1	0.33	9566.1	16.1	0.00	190.2	0.3	0.59
Swainson's Thrush	0.0	22.4	0.0	39.4	-	-	-	-	-	-	-	-	-
Tennessee Warbler	0.0	19.4	0.0	17.6	-	-	-	-	-	-	-	-	-
Warbling Vireo	4.8	30.9	0.0	11.5	876.0	9.8	0.01	2129.4	25.4	0.00	321.4	3.8	0.09
White-crowned Sparrow	3.5	9.7	0.9	0.6	205.1	5.5	0.05	53.6	2.0	0.19	63.3	2.4	0.16
Wilson's Warbler	26.4	107.3	7.4	111.6	329.1	0.3	0.60	51390.6	69.0	0.00	814.3	1.1	0.33
Yellow-rumped Warbler	0.0	6.1	3.9	7.3	10.8	0.4	0.52	4.1	0.1	0.74	39.2	1.1	0.32
All singing detections	282.8	430.5	177.1	434.1	15616.0	12.5	0.01	245629.0	46.7	0.00	17922.0	3.4	0.10
ALL DETECTIONS													
Fox Sparrow	0.0	2.4	0.0	9.7	-	-	-	-	-	-	-	-	-
Gray Jay	0.0	7.9	0.0	6.1	-	-	-	-	-	-	-	-	-
Pine Siskin	2.2	20.6	5.2	26.1	108.1	0.8	0.40	2319.5	17.0	0.00	8.8	0.1	0.81
All bird detections	453.8	664.8	394.3	643.0	8806.0	0.8	0.40	281801.0	43.0	0.00	1886.0	0.3	0.61

^a Densities are averaged by group type (CC, CT) and study decade (1990s, 2000s).

^b Repeated-measures ANOVA test statistics (mean square error [MSE], F statistic, and p-value) are shown for group effects, decade effects, and decade effects on groups.

^c "-" indicates no variation within a decade (all densities zero) and/or insufficient data for statistical analysis. p-values ≤ 0.05 are shown in bold.

Appendix E. Common bird species and average densities (100 ha) for ANOVA tests showing effects to block and habitat factors (stub [S] and tree islands [I]^a) and survey years (2006 and 2007), Donna Creek study area.

Species	Sample	Block	CT ^b		SB ^b		TI ^b		SI ^b		Overall effects ^{a,c,d}	Year effects ^{a,c,d}				
			2006	2007	2006	2007	2006	2007	2006	2007		F	p	F	p	
Alder Flycatcher	159.0	5516.0	36.4	58.2	18.2	32.7	13.5	47.4	3.5	14.0	Block	0.2	0.81	Yr	3.3	0.11
		5546.0	21.8	18.2	3.6	29.1	10.6	52.8	0.0	21.1	S	18.3	0.05	Yr x S	0.2	0.70
		5547.0	18.2	21.8	0.0	7.3	53.5	14.1	22.5	35.7	I	0.0	0.87	Yr x I	0.0	0.89
American Robin	58.0	5516.0	3.6	3.6	0.0	0.0	7.4	2.3	15.5	0.7	S x I	0.1	0.84	Yr x S x I	0.0	0.84
		5546.0	7.3	0.0	18.2	3.6	3.5	10.6	21.9	1.7	Block	1.6	0.48	Yr	18.1	0.00
		5547.0	10.9	3.6	14.6	7.3	7.0	7.7	12.7	0.0	S	1.6	0.33	Yr x S	9.1	0.02
Chipping Sparrow	353.0	5516.0	58.2	32.7	65.5	36.4	63.9	40.2	76.4	21.7	I	0.6	0.53	Yr x I	0.2	0.67
		5546.0	58.2	14.6	54.6	10.9	50.1	36.8	113.2	45.6	S x I	0.0	0.98	Yr x S x I	5.1	0.05
		5547.0	116.4	21.8	76.4	36.4	43.6	23.2	61.7	21.0	Block	0.0	0.99	Yr	53.1	0.00
Dark-eyed Junco	257.0	5516.0	36.4	29.1	54.6	21.8	33.4	27.1	32.2	18.2	S	0.8	0.47	Yr x S	0.6	0.45
		5546.0	58.2	10.9	43.7	18.2	35.2	17.6	43.0	23.6	I	0.0	0.94	Yr x I	0.7	0.43
		5547.0	87.3	43.7	47.3	32.7	54.8	23.9	46.9	18.2	S x I	1.5	0.34	Yr x S x I	5.3	0.05
Dusky Flycatcher	62.0	5516.0	14.6	14.6	10.9	3.6	4.0	13.5	3.5	7.0	Block	2.5	0.40	Yr	35.4	0.00
		5546.0	10.9	7.3	3.6	7.3	10.6	3.5	3.5	0.0	S	0.7	0.49	Yr x S	0.1	0.72
		5547.0	7.3	3.6	3.6	0.0	22.5	7.0	14.2	15.5	I	5.0	0.15	Yr x I	1.2	0.30
Fox Sparrow	36.0	5516.0	25.5	18.2	3.6	7.3	24.3	4.0	7.0	17.5	S x I	0.5	0.55	Yr x S x I	0.5	0.52
		5546.0	0.0	7.3	0.0	0.0	0.0	0.0	0.0	0.0	Block	1.2	0.39	Yr x S x I	0.3	0.59
		5547.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	S	-	-	Yr	0.3	0.60
Golden-crowned Sparrow	44.0	5516.0	36.4	0.0	18.2	3.6	11.3	3.4	35.0	26.0	I	3.0	0.23	Yr x S	2.9	0.13
		5546.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	S x I	0.0	0.88	Yr x I	0.7	0.43
		5547.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Block	0.9	0.45	Yr x S x I	1.9	0.20
Lincoln's Sparrow	175.0	5516.0	43.7	29.1	47.3	25.5	30.5	30.5	32.9	28.0	S	1.7	0.33	Yr x S x I	0.7	0.42
		5546.0	14.6	3.6	25.5	7.3	14.9	35.2	21.1	17.6	Block	-	-	Yr	7.1	0.03
		5547.0	50.9	18.2	10.9	7.3	38.7	10.6	46.2	21.0	S	0.7	0.48	Yr x S	0.0	0.84
MacGillivray's Warbler	170.0	5516.0	40.0	32.7	32.7	14.6	20.3	30.5	31.5	7.7	I	0.6	0.53	Yr x I	1.3	0.30
		5546.0	18.2	58.2	10.9	3.6	28.2	42.3	35.1	7.9	S x I	0.3	0.66	Yr x S x I	0.6	0.47
		5547.0	0.0	18.2	0.0	18.2	56.2	17.6	24.0	21.7	Block	0.3	0.79	Yr	0.1	0.76
											S	7.3	0.11	Yr x S	1.6	0.24
											I	0.6	0.52	Yr x I	2.1	0.18
											S x I	0.1	0.75	Yr x S x I	0.1	0.81

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Species	Sample	Block	CT ^b		SB ^b		TI ^b		SI ^b		Overall effects ^{a,c,d}	Year effects ^{a,c,d}									
			2006	2007	2006	2007	2006	2007	2006	2007		F	p	F	p						
Orange-crowned Warbler	156.0	5516.0	18.2	40.0	10.9	3.6	25.5	34.5	18.2	25.2	Block	0.2	0.82	Yr	0.2	0.71					
		5546.0	14.6	32.7	7.3	25.5	19.2	21.1	24.6	35.1	S	1.3	0.37	Yr x S	0.1	0.80					
		5547.0	36.4	14.6	10.9	7.3	20.3	10.6	36.5	15.5	I	18.9	0.05	Yr x I	0.2	0.65					
												S x I	23.0	0.04	Yr x S x I	0.0	0.92				
Olive-sided Flycatcher	25.0	5516.0	0.0	0.0	0.0	0.0	0.6	2.3	4.2	3.0	Block	1.0	0.93	Yr	1.0	0.36					
		5546.0	0.0	0.0	0.0	0.0	0.8	1.6	7.0	0.8	S	12.0	0.07	Yr x S	0.5	0.49					
		5547.0	0.0	0.0	0.0	0.0	3.5	0.0	2.3	3.0	I	421.5	0.00	Yr x I	1.0	0.36					
Ruby-crowned Kinglet	28.0	5516.0	7.3	0.0	3.6	0.0	4.7	0.6	1.5	0.0	Block	12.0	0.07	Yr x S x I	0.5	0.49					
		5546.0	3.6	0.0	3.6	3.6	0.0	0.0	1.7	2.5	S	0.5	0.63	Yr	6.8	0.03					
		5547.0	0.0	0.0	0.0	0.0	0.7	0.0	3.8	0.0	I	0.1	0.82	Yr x S	0.7	0.43					
												S x I	0.4	0.59	Yr x I	0.3	0.57				
Swainson's Thrush	222.0	5516.0	32.7	3.6	7.3	0.0	23.8	10.3	21.7	4.2	Block	1.4	0.35	Yr x S x I	0.6	0.47					
		5546.0	94.6	14.6	50.9	32.7	45.8	16.5	28.9	1.7	S	1.8	0.32	Yr	19.4	0.00					
		5547.0	69.1	21.8	101.9	7.3	35.7	8.4	36.0	5.7	I	1.4	0.35	Yr x S	0.1	0.75					
												S x I	2.5	0.25	Yr x I	1.9	0.21				
Tennessee Warbler	102.0	5516.0	21.8	0.0	0.0	0.0	11.3	0.0	7.0	0.0	Block	0.0	0.89	Yr x S x I	0.2	0.68					
		5546.0	18.2	10.9	10.9	29.1	7.8	3.5	14.9	27.1	S	2.6	0.35	Yr	4.5	0.07					
		5547.0	43.7	10.9	7.3	10.9	30.9	0.0	39.5	5.0	I	0.0	0.92	Yr x S	3.4	0.10					
												S x I	1.1	0.41	Yr x I	0.4	0.53				
Warbling Vireo	142.0	5516.0	10.9	7.3	10.9	3.6	23.2	7.4	0.0	0.0	Block	7.7	0.11	Yr x S x I	1.5	0.26					
		5546.0	14.6	7.3	25.5	21.8	21.1	22.7	17.6	14.9	S	2.7	0.23	Yr	5.1	0.05					
		5547.0	18.2	10.9	36.4	10.9	24.5	33.7	43.7	35.2	I	0.1	0.80	Yr x S	0.6	0.46					
												S x I	1.3	0.38	Yr x I	1.5	0.26				
White-crowned Sparrow	25.0	5516.0	0.0	3.6	3.6	7.3	0.0	10.2	14.0	11.2	Block	3.0	0.23	Yr x S x I	0.2	0.71					
		5546.0	0.0	0.0	3.6	0.0	0.0	3.5	7.9	0.0	S	1.7	0.44	Yr	0.4	0.57					
		5547.0	0.0	0.0	14.6	0.0	0.0	0.0	0.0	3.5	0.0	I	14.4	0.06	Yr x S	5.8	0.04				
												S x I	0.4	0.59	Yr x I	0.3	0.60				
Wilson's Warbler	793.0	5516.0	192.8	98.2	90.9	72.8	124.5	67.4	157.0	89.1	Block	0.0	0.89	Yr x S x I	0.3	0.63					
		5546.0	127.3	94.6	145.5	58.2	137.8	113.9	149.8	49.0	S	1.0	0.84	Yr	25.0	0.00					
		5547.0	69.1	87.3	83.7	36.4	141.9	87.9	159.3	99.6	I	5.4	0.14	Yr x S	1.2	0.30					
												S x I	1.1	0.41	Yr x I	0.7	0.44				
Yellow-rumped Warbler	79.0	5516.0	0.0	3.6	0.0	0.0	4.6	9.7	10.7	5.7	Block	1.3	0.37	Yr x S x I	0.2	0.70					
		5546.0	10.9	7.3	18.2	10.9	25.4	0.8	16.6	6.0	S	2.5	0.43	Yr	2.3	0.17					
		5547.0	14.6	7.3	3.6	10.9	3.5	2.1	7.2	3.0	I	0.1	0.76	Yr x S	0.1	0.80					
												S x I	0.0	0.86	Yr x I	1.1	0.33				
																S x I	0.0	0.91	Yr x S x I	0.0	0.85

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Species	Sample	Block	CT ^b		SB ^b		TI ^b		SI ^b		Overall effects ^{a,c,d}	Year effects ^{a,c,d}				
			2006	2007	2006	2007	2006	2007	2006	2007		F	p	F	p	
All Singing Detections	3016.0	5516.0	582.1	385.6	385.6	236.5	446.2	350.4	493.5	285.7	Block	0.0	1.00	Yr	60.0	0.00
		5546.0	480.2	301.9	440.2	301.9	416.0	412.6	525.0	289.6	S	5.0	0.17	Yr x S	0.0	0.53
		5547.0	552.9	301.9	422.0	192.8	555.7	251.5	573.4	310.9	I	3.0	0.25	Yr x I	0.0	0.91
												S x I	5.0	0.15	Yr x S x I	2.0
ALL DETECTIONS																
Gray Jay	39.0	5516.0	10.9	0.0	0.0	0.0	7.5	1.2	0.8	1.5	Block	-	-	Yr	10.1	0.01
		5546.0	14.6	3.6	3.6	3.6	3.5	1.6	11.4	3.5	S	1.2	0.39	Yr x S	2.0	0.20
		5547.0	3.6	3.6	10.9	3.6	7.0	0.0	0.0	0.0	I	2.4	0.26	Yr x I	0.2	0.69
												S x I	0.1	0.75	Yr x S x I	0.2
Pine Siskin	252.0	5516.0	10.9	80.0	0.0	40.0	9.3	74.6	7.7	56.7	Block	10.4	0.18	Yr	34.5	0.00
		5546.0	3.6	32.7	3.6	14.6	12.1	39.7	8.7	16.3	S	13.1	0.07	Yr x S	2.5	0.15
		5547.0	0.0	29.1	0.0	10.9	7.0	46.9	8.0	38.5	I	6.0	0.13	Yr x I	0.2	0.67
												S x I	0.9	0.43	Yr x S x I	0.1
All Bird Detections	4760.0	5516.0	796.7	647.5	651.2	523.8	625.8	662.6	744.0	610.7	Block	-	-	Yr	43.5	0.00
		5546.0	654.8	472.9	629.3	462.0	681.1	621.4	722.9	497.0	S	23.8	0.04	Yr x S	2.6	0.14
		5547.0	694.8	487.5	640.3	312.9	654.8	456.2	751.0	479.0	I	4.7	0.16	Yr x I	1.0	0.34
												S x I	2.7	0.24	Yr x S x I	1.1

^a Stub-factor data (S) included data from treatments that contained stubs: Stub Treatments and Stub-and-Island Treatments. Tree island-factor data (I) included data from treatments that contained tree islands: Tree Island Treatments and Stub-and-Island Treatments.

^b Densities were averaged for each treatment by study decade and by study block (5516, 5546 and 5547).

^c ANOVA test statistics (F-statistic and p-value) are shown for overall effects and for year effects on treatment factors.

^d “-“ indicates no variation within a category and/or insufficient data for statistical analysis. p-values ≤ 0.05 are shown in bold.

Appendix F. Common bird species and average densities for ANOVA tests showing effects to block and habitat factors (stub [S] and tree islands [I]^a) where a significant year by factor effect was found in Appendix E, for survey years in the 2000s (2006 and 2007), Donna Creek study area.

Species	Sample	Block	CT		SB		TI		SI		Overall effects 2006 ^{a,c}		Overall effects 2007 ^{a,c}			
			2006	2007	2006	2007	2006	2007	2006	2007	F	p	F	p		
American Robin	58	5516	3.6	3.6	0.0	0.0	7.4	2.3	15.5	0.7	Block	0.0	0.64	Block	-	-
		5546	7.3	0.0	18.2	3.6	3.5	10.6	21.9	1.7	S	4.0	0.20	S	160.0	0.01
		5547	10.9	3.6	14.6	7.3	7.0	7.7	12.7	0.0	I	0.0	0.61	I	0.0	0.69
Chipping Sparrow	353	5516	58.2	32.7	65.5	36.4	63.9	40.2	76.4	21.7	S x I	6.0	0.13	S x I	2.0	0.26
		5546	58.2	14.6	54.6	10.9	50.1	36.8	113.2	45.6	Block	0.0	0.95	Block	0.0	0.86
		5547	116.4	21.8	76.4	36.4	43.6	23.2	61.7	21.0	S	0.0	0.50	S	0.0	0.92
White-crowned Sparrow	25	5516	0.0	3.6	3.6	7.3	0.0	10.2	14.0	11.2	I	0.0	0.88	I	0.0	0.65
		5546	0.0	0.0	3.6	0.0	0.0	3.5	7.9	0.0	S x I	5.0	0.15	S x I	0.0	0.50
		5547	0.0	0.0	14.6	0.0	0.0	0.0	3.5	0.0	Block	0.0	0.97	Block	7.0	0.06
											S	55.0	0.02	S	0.0	0.88
											I	0.0	0.87	I	2.0	0.27
											S x I	0.0	0.87	S x I	4.0	0.19

^a Stub-factor data (S) included data from treatments that contained stubs: Stub Treatments and Stub-and-Island Treatments. Tree island-factor data (I) included data from treatments that contained tree islands: Tree Island Treatments and Stub-and-Island Treatments.

^b Densities were averaged for each treatment by study year and by study block (5516, 5546 and 5547).

^c ANOVA test statistics (F-statistic and p-value) are shown for overall effects on treatment factors.

Appendix G. Common bird species and average densities for ANOVA tests showing effects to block and habitat factors (stub [S] and tree islands [I]^a) and survey decades (1990s and 2000s), Donna Creek study area. Data for 1995 and 1996 from Gyug (1997).

Species	Sample	Block	CT ^b		SB ^b		TI ^b		SI ^b		Overall effects ^{a,c,d}				Decade effects ^{a,c,d}	
			1990s	2000s	1990s	2000s	1990s	2000s	1990s	2000s	1990s	2000s	F	p	Yr	F
Alder Flycatcher	166	5516	0.0	47.3	0.0	25.5	0.0	30.5	0.0	8.7	Block	0.5	0.65	Yr	41.6	0.00
		5546	0.0	20.0	0.0	16.4	0.0	31.7	1.3	10.5	S	4.1	0.08	Yr x S	5.2	0.05
		5547	0.0	20.0	5.2	3.6	0.5	33.8	0.0	29.1	I	0.0	0.85	Yr x I	0.1	0.73
American Robin	153	5516	6.5	3.6	15.6	0.0	3.5	4.8	6.6	8.1	S x I	0.1	0.81	Yr x S x I	0.0	0.98
		5546	0.0	3.6	3.9	10.9	2.4	7.0	7.5	11.8	Block	0.8	0.49	Yr	0.1	0.73
		5547	3.9	7.3	0.0	10.9	15.0	7.4	10.2	6.4	S	3.2	0.11	Yr x S	0.0	0.93
Blackpoll Warbler	28	5516	0.0	3.6			0.4	0.3	0.3	0.0	I	2.7	0.14	Yr x I	0.1	0.76
		5546			0.0	1.8	0.0	2.6	0.0	12.2	S x I	0.2	0.69	Yr x S x I	0.1	0.78
		5547	0.0	3.6	0.0	3.6	0.0	1.8	0.5	0.4	Block	1.2	0.36	Yr	7.7	0.02
Chipping Sparrow	604	5516	13.0	45.5	15.6	50.9	19.7	52.0	16.4	49.1	S	0.5	0.51	Yr x S	0.3	0.59
		5546	20.8	36.4	22.1	32.7	11.1	43.4	22.8	79.4	I	0.4	0.57	Yr x I	0.1	0.76
		5547	10.4	69.1	13.0	56.4	7.7	33.4	31.9	41.3	S x I	1.1	0.32	Yr x S x I	0.8	0.39
Dark-eyed Junco	632	5516	48.1	32.7	46.8	38.2	34.8	30.2	34.7	25.2	Block	0.0	0.97	Yr	75.9	0.00
		5546	26.0	34.6	26.0	30.9	40.3	26.4	34.1	33.3	S	4.2	0.07	Yr x S	0.0	0.84
		5547	37.7	65.5	26.0	40.0	24.3	39.3	22.4	32.6	I	0.4	0.53	Yr x I	0.0	0.88
Dusky Flycatcher	64	5516	0.0	14.6	0.0	7.3	0.0	8.8	0.0	5.2	S x I	5.3	0.05	Yr x S x I	0.3	0.58
		5546	0.0	9.1	0.0	5.5	0.0	7.0	1.6	1.8	Block	2.5	0.14	Yr	0.3	0.61
		5547	0.0	5.5	0.0	1.8	0.0	14.8	0.0	14.9	S	4.4	0.07	Yr x S	0.0	0.89
Fox Sparrow	38	5516	0.0	21.8	0.0	5.5	0.0	14.1	0.5	12.2	I	9.9	0.01	Yr x I	0.4	0.53
		5546	0.0	3.6							S x I	1.0	0.35	Yr x S x I	0.1	0.80
		5547					0.0	3.5			Block	0.9	0.45	Yr	52.8	0.00
Golden-crowned Sparrow	89	5516	0.0	9.1	0.0	5.5	0.0	7.0	1.6	1.8	S	3.1	0.12	Yr x S	3.6	0.09
		5546	0.0	5.5	0.0	1.8	0.0	14.8	0.0	14.9	I	0.7	0.43	Yr x I	0.3	0.59
		5547									S x I	0.4	0.56	Yr x S x I	0.1	0.75
Lincoln's Sparrow	908	5516	0.0	21.8	0.0	5.5	0.0	14.1	0.5	12.2	Block	17.6	0.00	Yr	23.3	0.00
		5546	0.0	3.6							S	4.3	0.07	Yr x S	4.3	0.07
		5547					0.0	3.5			I	0.0	0.97	Yr x I	0.0	0.90
Lincoln's Sparrow	908	5516	67.6	36.4	54.6	36.4	42.4	30.5	67.2	30.5	S x I	1.6	0.24	Yr x S x I	1.3	0.29
		5546	67.6	9.1	61.1	16.4	69.1	25.0	85.1	19.3	Block	21.0	0.00	Yr	2.3	0.16
		5547	62.4	34.6	59.8	9.1	124.7	24.6	54.0	33.6	S	2.8	0.13	Yr x S	0.0	0.84
Lincoln's Sparrow	908	5516	67.6	36.4	54.6	36.4	42.4	30.5	67.2	30.5	I	0.1	0.79	Yr x I	0.6	0.48
		5546	67.6	9.1	61.1	16.4	69.1	25.0	85.1	19.3	S x I	0.8	0.40	Yr x S x I	6.9	0.03
		5547	62.4	34.6	59.8	9.1	124.7	24.6	54.0	33.6	Block	0.5	0.60	Yr	109.8	0.00
Lincoln's Sparrow	908	5516	67.6	36.4	54.6	36.4	42.4	30.5	67.2	30.5	S	1.2	0.30	Yr x S	0.6	0.47
		5547	62.4	34.6	59.8	9.1	124.7	24.6	54.0	33.6	I	2.2	0.17	Yr x I	1.0	0.35
											S x I	0.0	0.83	Yr x S x I	0.4	0.56

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Species	Sample	Block	CT ^b		SB ^b		TI ^b		SI ^b		Overall effects ^{a,c,d}		Decade effects ^{a,c,d}			
			1990s	2000s	1990s	2000s	1990s	2000s	1990s	2000s	F	p	F	p		
MacGillivray's Warbler	249	5516	9.1	36.4	0.0	23.6	2.0	25.4	0.8	19.6	Block	0.1	0.92	Yr	42.8	0.00
		5546	0.0	38.2	3.9	7.3	11.2	35.2	4.0	21.5	S	3.5	0.10	Yr x S	4.4	0.07
		5547	1.3	9.1	7.8	9.1	8.7	36.9	11.2	22.9	I	1.5	0.26	Yr x I	0.4	0.54
Orange-crowned Warbler	168	5516	0.0	29.1	0.0	7.3	3.5	30.0	0.3	21.7	Block	0.3	0.76	Yr	67.8	0.00
		5546	2.6	23.6	0.0	16.4	0.0	20.2	0.0	29.8	S	1.8	0.22	Yr x S	0.9	0.38
		5547	0.0	25.5	0.0	9.1	0.2	15.4	0.3	26.0	I	1.3	0.29	Yr x I	1.0	0.34
Olive-sided Flycatcher	31	5516	0.0	0.0	0.0	0.0	0.0	1.5	0.5	3.6	Block	0.0	0.99	Yr	9.6	0.01
		5546	0.0	0.0	0.0	0.0	0.0	1.2	0.3	3.9	S	3.7	0.09	Yr x S	1.0	0.35
		5547	0.0	0.0	0.0	0.0	0.0	1.8	0.8	2.6	I	17.8	0.00	Yr x I	9.6	0.01
Pine Siskin	54	5516	0.0	0.0	6.5	1.8	3.6	0.0	3.9	0.0	Block	6.1	0.03	Yr	2.8	0.13
		5546	1.3	0.0	1.3	0.0	0.3	2.8	0.9	0.0	S	3.0	0.12	Yr x S	1.3	0.29
		5547	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.4	I	0.3	0.63	Yr x I	0.0	0.98
Ruby-crowned Kinglet	53	5516	0.0	3.6	0.0	1.8	4.6	2.6	0.8	0.7	Block	5.4	0.03	Yr	7.6	0.03
		5546	0.0	1.8	0.0	3.6	0.0	0.0	0.0	2.1	S	0.2	0.66	Yr x S	1.3	0.28
		5547	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.9	I	0.2	0.64	Yr x I	3.2	0.11
Savannah Sparrow	254	5516	24.7	1.8	11.7	1.8	5.7	3.4	21.0	10.5	Block	2.3	0.16	Yr	31.7	0.00
		5546	67.6	0.0	58.5	7.3	10.3	0.0	11.3	1.8	S	0.1	0.82	Yr x S	0.7	0.42
		5547	14.3	1.8	15.6	0.0	36.2	0.0	15.0	0.0	I	3.4	0.10	Yr x I	4.2	0.08
Swainson's Thrush	246	5516	0.0	18.2	0.0	3.6	2.5	17.1	1.1	13.0	Block	3.4	0.08	Yr	48.4	0.00
		5546	0.0	54.6	0.0	41.8	0.3	31.1	0.6	15.3	S	0.7	0.43	Yr x S	0.6	0.44
		5547	0.0	45.5	0.0	54.6	0.5	22.1	0.8	20.9	I	3.8	0.09	Yr x I	4.8	0.06
Tennessee Warbler	102	5516	0.0	10.9	0.0	0.0	0.0	5.7	0.0	3.5	Block	-	-	Yr	-	-
		5546	0.0	14.6	0.0	20.0	0.0	5.7	0.0	21.0	S	-	-	Yr x S	-	-
		5547	0.0	27.3	0.0	9.1	0.0	15.4	0.0	22.2	I	-	-	Yr x I	-	-
Warbling Vireo	151	5516	0.0	9.1	0.0	7.3	2.3	15.3	0.3	0.0	Block	20.4	0.00	Yr	142.6	0.00
		5546	0.0	10.9	0.0	23.6	0.0	21.9	0.3	16.2	S	0.3	0.61	Yr x S	0.4	0.54
		5547	0.0	14.6	0.0	23.6	0.2	29.1	0.0	39.5	I	6.6	0.03	Yr x I	2.9	0.13
White-crowned Sparrow	40	5516	2.6	1.8	5.2	5.5	1.6	5.1	1.5	12.6	Block	5.4	0.05	Yr x S x I	2.7	0.14
		5546	0.0	0.0	0.0	1.8	0.0	1.8	1.3	3.9	S	19.4	0.00	Yr	3.4	0.10
		5547	0.0	0.0	1.3	7.3	0.2	0.0	1.2	1.7	I	0.7	0.44	Yr x I	1.6	0.24
										S x I	0.2	0.67	Yr x S x I	0.0	0.97	

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Species	Sample	Block	CT ^b		SB ^b		TI ^b		SI ^b		Overall effects ^{a,c,d}		Decade effects ^{a,c,d}			
			1990s	2000s	1990s	2000s	1990s	2000s	1990s	2000s	F	p	F	p		
Wilson's Warbler	1100	5516	13.0	145.5	24.7	81.9	30.4	96.0	17.9	123.1	Block	1.2	0.35	Yr	345.7	0.00
		5546	2.6	111.0	0.0	101.9	23.3	125.8	8.8	99.4	S	1.3	0.29	Yr x S	1.6	0.24
		5547	6.5	78.2	20.8	60.0	18.4	114.9	19.4	129.5	I	5.5	0.05	Yr x I	1.1	0.34
Yellow-rumped Warbler	273	5516	6.5	1.8	11.7	0.0	11.7	7.1	16.0	8.2	S x I	0.7	0.43	Yr x S x I	7.1	0.03
		5546	1.3	9.1	9.1	14.6	4.0	13.1	10.2	11.3	Block	1.7	0.24	Yr	0.1	0.82
		5547	3.9	10.9	7.8	7.3	6.2	2.8	8.7	5.1	S	5.7	0.04	Yr x S	1.4	0.28
All Singing Detections	5571	5516	197.5	483.8	213.1	311.0	183.6	398.3	209.6	389.6	I	2.4	0.16	Yr x I	0.3	0.62
		5546	192.3	391.1	185.8	371.1	174.5	414.3	192.7	407.3	S x I	0.0	0.87	Yr x S x I	0.1	0.83
		5547	141.6	427.4	157.2	307.4	245.5	403.6	180.0	442.2	Block	0.1	0.89	Yr	446.7	0.00
ALL DETECTIONS	84	5516	1.3	0.0	7.8	0.0	8.1	0.3	6.6	0.0	S	1.8	0.22	Yr x S	6.3	0.04
		5546	0.0	0.0	0.0	0.0	2.5	0.0	8.9	0.4	I	1.5	0.25	Yr x I	0.3	0.59
		5547	0.0	0.0	0.0	0.0	2.5	0.0	8.9	0.4	S x I	1.8	0.21	Yr x S x I	10.6	0.01
Black-backed Woodpecker	84	5516	1.3	0.0	7.8	0.0	8.1	0.3	6.6	0.0	Block	2.7	0.13	Yr	25.8	0.00
		5546	0.0	0.0	2.6	0.0	2.1	0.0	4.7	0.0	S	3.9	0.08	Yr x S	3.6	0.09
		5547	0.0	0.0	0.0	0.0	2.5	0.0	8.9	0.4	I	6.8	0.03	Yr x I	5.6	0.05
Gray Jay	60	5516	0.0	5.5	1.3	0.0	0.0	4.3	0.3	1.1	S x I	0.0	0.85	Yr x S x I	0.0	0.84
		5546	0.0	9.1	0.0	3.6	2.8	2.6	1.2	7.4	Block	2.1	0.18	Yr	18.2	0.00
		5547	0.0	3.6	0.0	7.3	3.0	3.5	1.1	0.0	S	1.7	0.23	Yr x S	0.6	0.45
Least Flycatcher	25	5516	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	I	0.1	0.72	Yr x I	3.6	0.09
		5546	1.3	7.3	0.0	16.4	0.0	3.5	0.0	5.3	S x I	0.0	0.91	Yr x S x I	1.2	0.30
		5547	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.3	Block	2.6	0.13	Yr	4.1	0.08
Mountain Bluebird	90	5516	15.6	0.0	9.1	0.0	6.7	0.0	39.2	0.0	S	0.1	0.80	Yr x S	0.2	0.71
		5546	0.0	0.0	11.7	0.0	0.0	0.0	1.6	0.0	I	1.2	0.31	Yr x I	1	0.34
		5547	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	S x I	0.0	0.98	Yr x S x I	0	0.89
Red-breasted Nuthatch	40	5516	0.0	0.0	0.0	0.0	3.2	2.1	2.7	2.1	Block	25.6	0.00	Yr	0.3	0.60
		5546	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	S	0.2	0.69	Yr x S	0.1	0.82
		5547	1.3	0.0	0.0	0.0	0.2	0.0	0.5	0.4	I	34.0	0.00	Yr x I	0.0	0.88
All Bird Detections	10283	5516	415.8	722.1	508.0	587.5	451.9	644.2	520.2	677.4	S x I	1.2	0.31	Yr x S x I	0.0	0.89
		5546	372.9	563.9	398.9	545.7	421.9	651.2	421.3	609.9	Block	9.8	0.01	Yr	138.6	0.00
		5547	324.8	591.1	339.1	476.6	514.8	555.5	442.7	615.0	S	0.2	0.67	Yr x S	3.7	0.09
											I	12.0	0.01	Yr x I	0.7	0.44
											S x I	0.9	0.38	Yr x S x I	6.5	0.03

^a Stub-factor data (S) included data from treatments that contained stubs: Stub Treatments and Stub-and-Island Treatments. Tree island-factor data (I) included data from treatments that contained tree islands: Tree Island Treatments and Stub-and-Island Treatments.

^b Densities were averaged for each treatment by study decade and by study block (5516, 5546 and 5547).

^c ANOVA test statistics (F-statistic and p-value) are shown for overall effects and for decade effects on treatment factors.

^d “-“ indicates no variation within a category and/or insufficient data for statistical analysis. p-values ≤ 0.05 are shown in bold.

Appendix H. Common bird species analysed using Dunnett's Test between Old-growth Control (OG) and treatments (CT, SB, TI, SI) within the Donna Creek study area, based on average singing and all detection densities across the 2000s survey period (2006 and 2007).

Species	Difference in mean density relative to Old-growth				Year x OG effect ^b		
	CT	SB	TI	SI	MSE	F	p
SINGING DETECTIONS							
Alder Flycatcher	+	o	+	o	212.7	1.2	0.29
American Robin	o	o	o	o	44.8	3.3	0.09
Blackpoll Warbler	-	-	-	-	41.6	3.5	0.08
Chipping Sparrow	+	+	o	+	680.3	9.7	0.01
Dark-eyed Junco	+	o	o	o	226.3	0.2	0.70
Dusky Flycatcher	+	o	+	+	24.9	0.3	0.58
Fox Sparrow	o	o	o	o	54.0	0.1	0.82
Golden-crowned Kinglet	-	-	-	-	25.4	428.7	0.00
Golden-crowned Sparrow	o	o	o	o	104.8	1.1	0.32
Lincoln's Sparrow	+	+	+	+	161.8	1.9	0.20
MacGillivray's Warbler	+	o	+	+	179.9	0.0	0.91
Orange-crowned Warbler	+	o	+	+	69.4	0.6	0.46
Olive-sided Flycatcher	o	o	o	+	1.6	0.2	0.69
Ruby-crowned Kinglet	-	-	-	-	18.2	2.2	0.16
Swainson's Thrush	o	o	o	o	750.7	0.1	0.73
Tennessee Warbler	o	o	o	o	157.8	0.0	0.91
Townsend's Warbler	-	-	-	-	192.3	170.7	0.00
Varied Thrush	-	-	-	-	18.6	8.2	0.01
Warbling Vireo	o	+	+	+	111.2	1.3	0.27
White-crowned Sparrow	o	o	o	+	16.8	0.1	0.81
Wilson's Warbler	+	+	+	+	1248.1	5.0	0.04
Winter Wren	-	-	-	-	34.5	27.3	0.00
Yellow-rumped Warbler	-	-	-	-	40.7	1.5	0.24
All Singing Detections	o	o	o	o	12053.4	1.5	0.24
ALL DETECTIONS							
Gray Jay	o	o	o	o	44.6	20.9	0.00
Hammond's Flycatcher	-	-	-	-	32.0	12.5	0.00
Mountain Chickadee	-	-	o	-	9.0	16.1	0.00
Pine Siskin	o	-	o	o	944.8	17.0	0.00
Red-breasted Nuthatch	-	-	-	-	51.3	47.2	0.00
All Bird Detections	o	o	o	o	12453.5	1.3	0.28

^a Symbols indicate whether the average detection densities for the treatment type are significantly ($p \leq 0.05$) less than ("-") or greater than ("+") than densities for OG controls; no difference is indicated with a "o".

^b Statistics for repeated-measures ANOVAs are provided: mean square error (MSE), and F statistic, and p-value.

Appendix I. Common bird species analysed using Dunnett's Test between Old-growth Control (OG) and treatments (CT, SB, TI, SI) within the Donna Creek study area, based on average singing and all detection densities across both decades (1995-1996 and 2006-2007).

Species	Difference in mean density relative to Old-growth ^a				Decade x OG effect ^b		
	CT	SB	TI	SI	MSE	F	p
SINGING DETECTIONS							
Alder Flycatcher	+	o	+	o	222.4	8.8	0.01
American Robin	o	o	o	o	42.8	0.3	0.56
Blackpoll Warbler	-	-	-	-	121.3	256.0	0.00
Brown Creeper	-	-	-	-	4.1	3.5	0.07
Chipping Sparrow	+	+	o	+	562.8	4.9	0.04
Dark-eyed Junco	+	o	o	o	226.3	1.5	0.23
Dusky Flycatcher	+	o	+	o	26.0	10.6	0.00
Fox Sparrow	o	o	o	o	31.4	2.3	0.14
Golden-crowned Kinglet	-	-	-	-	59.1	36.4	0.00
Golden-crowned Sparrow	o	o	o	+	71.1	0.4	0.54
Hammond's Flycatcher	-	-	-	-	5.3	12.3	0.00
Hermit Thrush	o	o	o	o	10.4	0.7	0.40
Lincoln's Sparrow	+	+	+	+	863.0	10.7	0.00
MacGillivray's Warbler	+	o	+	o	181.7	9.3	0.01
Northern Waterthrush	-	-	-	-	5.6	2.1	0.16
Orange-crowned Warbler	+	o	o	+	134.5	21.1	0.00
Olive-sided Flycatcher	o	o	o	o	1.8	5.6	0.03
Pine Grosbeak	-	-	-	-	4.6	18.6	0.00
Pine Siskin	-	o	o	o	7.5	3.1	0.09
Red-breasted Nuthatch	-	-	-	-	28.2	-	-
Ruby-crowned Kinglet	-	-	-	-	36.3	23.7	0.00
Savannah Sparrow	+	+	o	o	317.2	5.4	0.03
Swainson's Thrush	o	o	o	-	551.8	6.4	0.02
Tennessee Warbler	o	o	o	o	123.2	0.1	0.76
Townsend's Warbler	-	-	-	-	192.3	2.3	0.14
Varied Thrush	-	-	-	-	18.6	0.4	0.51
Warbling Vireo	o	o	+	o	120.3	16.2	0.00
White-crowned Sparrow	o	+	o	+	11.4	1.2	0.29
Wilson's Warbler	o	o	+	o	2457.6	30.2	0.00
Winter Wren	-	-	-	-	34.5	0.0	0.87
Yellow-rumped Warbler	-	-	-	-	134.8	36.6	0.00
All Singing Detections	o	-	o	o	18565.4	74.0	0.00
ALL DETECTIONS							
Three-toed Woodpecker	-	-	-	-	7.0	3.0	0.10
Black-backed Woodpecker	o	o	o	o	12.3	0.0	0.93
Boreal Chickadee	-	-	-	-	6.4	2.4	0.14
Evening Grosbeak	-	-	-	-	5.3	-	-
Gray Jay	-	o	-	-	62.1	38.3	0.00
Least Flycatcher	o	o	o	o	24.5	1.1	0.31
Mountain Bluebird	o	o	o	o	64.5	-	-
Mountain Chickadee	-	-	o	o	6.0	-	-
Spruce Grouse	-	-	-	-	9.3	13.8	0.00
Western Wood-pewee	o	o	o	o	2.1	0.8	0.39
All bird detections	-	-	o	o	19229.4	76.3	0.00

^a Symbols indicate whether the average detection densities for the treatment type are significantly ($p \leq 0.05$) less than ("-") or greater than ("+") than densities for OG controls; no difference is indicated with a "o".

^b Statistics for repeated-measures ANOVAs are provided: mean square error (MSE), and F statistic, and p-value.

Appendix J. Density (100 ha) of common bird species compared between clearcut control, old-growth control, and tree island habitats during the 2000s survey period (2006 and 2007), Donna Creek study area.

Species	Clearcut control		Tree islands		Old-growth control		Treatment effect ^c			Year effect ^c			Year x treatment effect ^c			Tukey's tests ^{a,b}		
	2006	2007	2006	2007	2006	2007	MSE	F	p	MSE	F	p	MSE	F	p	CC/IS	CC/OG	IS/OG
SINGING DETECTIONS																		
Alder Flycatcher	26.7	40.0	10.0	3.3	1.2	0.0	1820.5	19.2	0.00	14.9	0.4	0.55	160.4	4.3	0.07	0.008	0.003	0.560
American Robin	6.1	3.6	19.9	21.2	3.6	7.3	476.8	22.9	0.00	3.2	0.0	0.86	14.0	0.2	0.86	0.003	0.971	0.003
Blackpoll Warbler	0.0	3.6	10.1	19.6	8.5	19.4	317.4	1.1	0.39	289.4	4.8	0.07	22.3	0.4	0.70	-	-	-
Chipping Sparrow	57.0	29.1	42.4	29.9	9.7	10.9	1786.5	11.1	0.01	768.7	8.8	0.03	317.9	3.6	0.09	0.637	0.010	0.029
Dark-eyed Junco	41.2	21.8	32.5	30.8	27.9	7.3	392.1	1.5	0.31	867.8	3.5	0.11	169.2	0.7	0.54	-	-	-
Dusky Flycatcher	10.9	24.3	25.3	6.7	0.0	0.0	567.0	0.9	0.45	14.0	0.1	0.76	386.5	2.9	0.13	-	-	-
Golden-crowned Kinglet	0.0	0.0	2.0	0.0	38.8	21.8	1780.7	53.1	0.00	179.2	67.7	0.00	129.4	48.9	0.00	YTE	YTE	YTE
Lincoln's Sparrow	27.9	35.2	11.3	0.0	0.0	0.0	1695.4	5.9	0.04	8.1	0.9	0.38	131.5	14.5	0.01	YTE	YTE	YTE
MacGillivray's Warbler	19.4	14.6	30.0	9.4	3.6	0.0	555.9	1.1	0.38	424.4	0.9	0.37	135.1	0.3	0.75	-	-	-
Orange-crowned Warbler	23.0	23.0	36.0	10.6	4.9	0.0	859.2	4.4	0.07	456.7	3.9	0.10	272.1	2.3	0.18	-	-	-
Olive-sided Flycatcher	1.2	1.2	18.0	41.2	1.2	0.0	1643.6	73.2	0.00	241.6	8.8	0.02	283.8	10.4	0.01	YTE	YTE	YTE
Ruby-crowned Kinglet	6.1	0.0	47.7	14.2	6.1	10.9	1310.3	116.6	0.00	603.5	1.9	0.22	586.7	1.8	0.24	0.000	0.068	0.000
Swainson's Thrush	34.0	10.9	74.4	50.7	43.7	14.6	2772.1	2.1	0.20	2879.0	2.0	0.20	16.5	0.0	0.99	-	-	-
Tennessee Warbler	23.0	15.8	45.4	18.9	20.6	9.7	467.4	0.6	0.57	999.1	2.1	0.20	156.6	0.3	0.73	-	-	-
Townsend's Warbler	0.0	0.0	8.6	5.3	111.6	83.7	17796.2	28.6	0.00	487.5	28.1	0.00	348.0	20.1	0.00	YTE	YTE	YTE
Varied Thrush	1.2	0.0	0.0	0.0	13.3	7.3	200.7	8.5	0.02	26.5	2.6	0.16	15.4	1.5	0.30	0.975	0.031	0.024
Warbling Vireo	38.8	23.0	49.8	40.8	0.0	0.0	3214.5	2.0	0.22	305.6	1.0	0.36	93.8	0.3	0.75	-	-	-
White-crowned Sparrow	15.8	3.6	4.1	2.0	0.0	0.0	147.9	2.4	0.17	101.3	2.9	0.14	63.0	1.8	0.24	-	-	-
Wilson's Warbler	131.0	83.7	177.7	115.8	21.8	15.8	25762.8	25.2	0.00	6632.1	11.6	0.01	1254.8	2.2	0.19	0.162	0.007	0.001
Winter Wren	0.0	0.0	0.0	2.0	30.3	10.9	811.5	21.4	0.00	152.2	4.0	0.09	209.1	5.5	0.04	YTE	YTE	YTE
Yellow-rumped Warbler	7.8	6.1	141.7	50.9	56.7	21.8	3107.5	59.3	0.00	0.6	0.0	0.88	170.2	7.2	0.03	YTE	YTE	YTE
All Singing Detections	509.3	351.7	727.1	551.8	389.2	263.1	150000.0	3.9	0.08	110000.0	3.6	0.10	931.0	0.0	0.97	-	-	-
ALL DETECTIONS																		
Gray Jay	15.8	0.0	19.7	16.0	20.6	1.2	155.9	0.7	0.54	757.4	11.6	0.01	100.6	1.5	0.29	-	-	-
Hammond's Flycatcher	0.0	0.0	20.7	12.5	15.8	3.6	417.1	5.4	0.05	205.2	3.4	0.11	57.3	1.0	0.44	0.040	0.217	0.419
Pine Siskin	3.6	37.6	57.8	294.6	9.7	95.8	40481.2	61.0	0.00	63696.6	70.4	0.00	16657.5	18.4	0.00	YTE	YTE	YTE
Red-breasted Nuthatch	0.0	0.0	0.0	19.0	25.5	4.9	351.9	1.9	0.20	1.3	0.0	0.92	588.0	4.7	0.06	-	-	-
All bird detections	825.8	552.9	1214.2	1246.0	557.8	455.9	850000.0	16.9	0.00	58809.0	2.4	0.17	34963.0	1.4	0.31	0.014	0.394	0.004

^a Where treatment, year, and year by treatment effects were significant, alpha was ≤ 0.05 . For Tukey's tests, p -values were considered significant when $p \leq 0.0125$ due to multiple testing.

^b Clearcut Control (CC), Old-growth Control (OG), and Tree Island (IS) habitats.

^c ANOVA statistics (MSE, F, p) shown for each species across years.

Appendix K. Density (100 ha) of common bird species compared between clearcut control, old-growth control, and tree island habitats during the 2000s survey period (2006 and 2007), Donna Creek study area where a significant year by treatment interaction effect occurred in Appendix J.

Species	Year	Mean density ^b			Treatment effect ^c			Tukey's tests ^a		
		CC	IS	OG	MSE	F	<i>p</i> ^a	CC/IS	CC/OG	IS/OG
SINGING DETECTIONS										
Golden-crowned Kinglet	2006	0.0	2.0	38.8	1433.7	62.5	0.00	0.874	0.000	0.000
	2007	0.0	0.0	21.8	476.4	36.0	0.00	1.000	0.001	0.001
Lincoln's Sparrow	2006	27.9	11.3	0.0	590.3	6.0	0.04	0.183	0.032	0.402
	2007	35.2	0.0	0.0	1236.6	6.3	0.03	0.049	0.049	0.049
Olive-sided Flycatcher	2006	1.2	18.0	1.2	281.0	7.2	0.03	0.039	1.000	0.039
	2007	1.2	41.2	0.0	1646.4	153.7	0.00	0.000	0.895	0.000
Townsend's Warbler	2006	0.0	8.6	111.6	11558.1	40.7	0.00	0.812	0.001	0.001
	2007	0.0	5.3	83.7	6586.1	18.5	0.00	0.938	0.004	0.006
Winter Wren	2006	0.0	0.0	30.3	19186.8	18.0	0.00	1.000	0.011	0.011
	2007	0.0	2.0	10.9	7830.8	15.0	0.00	0.483	0.001	0.003
Yellow-rumped Warbler	2006	0.0	0.0	0.0	968.6	49.4	0.00	0.000	0.124	0.001
	2007	0.0	0.0	0.0	2309.0	41.0	0.00	0.000	0.022	0.005
ALL DETECTIONS										
Pine Siskin	2006	3.6	57.8	9.7	2638.4	53.0	0.00	0.000	0.575	0.001
	2007	37.6	294.6	95.8	54500.3	35.9	0.00	0.001	0.239	0.002

^a Where group, year, and year by treatment effects were significant, alpha was ≤ 0.05 . For Tukey's tests, *p*-values were considered significant when $p \leq 0.0125$ due to multiple testing.

^b Clearcut Control (CC), Old-growth Control (OG), and Tree Island (IS) habitats.

^c ANOVA statistics (MSE, F, *p*) shown for each species across years.

Appendix L. Common bird species compared between Clearcut Control, Old-growth Control, and tree island habitats between the survey decades (1995-1996 and 2006-2007), Donna Creek study area.

Species	Clearcut control		Tree islands		Old-growth control		Treatment effect ^c			Decade effect ^c			Decade x treatment effect ^c			Tukey's tests ^{a,b}		
	1990s	2000s	1990s	2000s	1990s	2000s	MSE	F	p	MSE	F	p	MSE	F	p	CC/IS	CC/OG	IS/OG
SINGING DETECTIONS																		
Alder Flycatcher	7.4	33.3	2.4	6.7	0.0	0.6	1341.0	18.7	0.00	953.4	15.6	0.00	564.2	9.2	0.00	DTE	DTE	DTE
American Robin	5.6	4.9	47.3	20.6	7.4	5.5	3166.7	29.5	0.00	864.0	6.5	0.03	644.4	4.8	0.03	DTE	DTE	DTE
Blackpoll Warbler	0.0	1.8	4.5	14.8	53.3	13.9	3438.4	24.1	0.00	736.6	6.4	0.03	2117.2	18.4	0.00	DTE	DTE	DTE
Brown Creeper	0.0	0.0	0.0	0.0	6.1	3.6	94.1	11.9	0.00	5.9	0.8	0.39	5.9	0.8	0.47	1.000	0.003	0.003
Chipping Sparrow	16.9	43.0	114.8	36.1	6.1	10.3	14151.6	19.4	0.00	2334.6	6.6	0.02	9181.3	25.9	0.00	DTE	DTE	DTE
Dark-eyed Junco	40.3	31.5	75.7	31.6	26.9	17.6	2986.1	10.9	0.00	3855.4	14.8	0.00	1230.0	4.7	0.03	DTE	DTE	DTE
Dusky Flycatcher	0.0	17.6	1.5	16.0	0.0	0.0	306.5	1.7	0.23	1031.0	5.3	0.04	264.7	1.4	0.29	-	-	-
Golden-crowned Kinglet	0.0	0.0	0.0	1.0	52.4	30.3	6762.2	106.5	0.00	445.6	9.4	0.01	510.4	10.8	0.00	DTE	DTE	DTE
Golden-crowned Sparrow	5.2	2.4	9.8	3.9	0.0	0.0	141.1	1.2	0.33	74.6	1.7	0.21	25.8	0.6	0.56	-	-	-
Hammond's Flycatcher	0.0	0.0	2.2	7.0	6.1	2.4	77.7	4.3	0.04	1.4	0.1	0.81	53.8	2.3	0.15	0.055	0.074	0.983
Lincoln's Sparrow	96.1	31.5	132.2	5.7	0.0	0.0	17705.5	20.6	0.00	36547.2	36.9	0.00	12014.6	12.1	0.00	DTE	DTE	DTE
MacGillivray's Warbler	11.3	17.0	46.5	19.7	3.0	1.8	2876.1	3.5	0.06	499.3	3.9	0.07	882.8	6.9	0.01	DTE	DTE	DTE
Northern Waterthrush	0.0	1.2	0.0	2.0	5.6	3.6	59.0	5.0	0.03	1.6	0.1	0.77	13.6	0.8	0.49	0.954	0.034	0.058
Orange-crowned Warbler	1.7	23.0	6.6	23.3	1.7	2.4	554.9	5.3	0.02	1497.2	19.3	0.00	351.1	4.5	0.03	DTE	DTE	DTE
Olive-sided Flycatcher	0.0	1.2	6.4	29.6	1.3	0.6	1186.0	66.2	0.00	560.4	27.8	0.00	526.8	26.1	0.00	DTE	DTE	DTE
Pine Siskin	0.9	0.6	31.8	15.9	5.6	1.2	1917.3	17.6	0.00	423.7	0.9	0.36	197.1	0.4	0.67	0.001	0.807	0.001
Red-breasted Nuthatch	0.0	0.0	17.6	0.0	19.9	0.0	-	-	-	-	-	-	-	-	-	DTE	DTE	DTE
Ruby-crowned Kinglet	0.0	3.0	17.5	30.9	23.8	8.5	1585.4	6.1	0.02	1.3	0.0	0.94	637.4	2.8	0.10	0.013	0.108	0.466
Savannah Sparrow	52.8	7.3	11.8	0.0	0.0	0.0	3043.2	11.0	0.00	3290.0	20.4	0.00	1677.3	10.4	0.00	DTE	DTE	DTE
Swainson's Thrush	0.0	22.4	21.5	62.5	31.6	29.1	2901.4	3.3	0.07	3719.7	6.2	0.03	1434.3	2.4	0.13	-	-	-
Tennessee Warbler	0.0	19.4	0.0	32.1	0.4	15.2	224.7	0.7	0.51	4388.2	14.3	0.00	243.0	0.8	0.48	-	-	-
Townsend's Warbler	0.0	0.0	9.8	7.0	110.9	97.6	40259.2	275.5	0.00	257.8	0.6	0.44	146.3	0.4	0.71	0.247	0.000	0.000
Varied Thrush	0.0	0.6	2.1	0.0	9.1	10.3	327.5	5.4	0.02	0.1	0.0	0.95	9.3	0.5	0.64	0.971	0.030	0.046
Warbling Vireo	4.8	30.9	6.8	45.3	2.6	0.0	1909.1	4.2	0.04	3846.9	6.7	0.02	1332.3	2.3	0.14	0.622	0.179	0.036
White-crowned Sparrow	3.5	9.7	3.3	3.0	0.0	0.0	130.1	4.5	0.04	35.5	1.1	0.32	40.7	1.2	0.33	0.299	0.028	0.357
Wilson's Warbler	26.4	107.3	212.1	146.7	29.4	18.8	77228.4	31.8	0.00	24.0	0.0	0.85	16380.6	24.5	0.00	DTE	DTE	DTE
Winter Wren	0.0	0.0	4.4	1.0	21.2	20.6	1555.5	16.0	0.00	15.9	0.3	0.57	9.7	0.2	0.81	0.790	0.001	0.002
Western Wood-pewee	0.0	0.0	12.6	1.0	1.3	0.0	169.6	3.7	0.06	168.2	4.2	0.06	122.7	3.1	0.08	-	-	-
Yellow-rumped Warbler	7.8	6.1	141.7	50.9	56.7	21.8	24574.2	79.3	0.00	16232.4	37.9	0.00	6074.3	14.2	0.00	DTE	DTE	DTE
All Singing Detections	282.8	430.5	960.8	639.5	492.8	326.2	700000.0	16.8	0.00	120000.0	10.2	0.01	170000.0	15.1	0.00	DTE	DTE	DTE
ALL DETECTIONS																		
Three-toed Woodpecker	0.0	0.0	16.1	1.0	7.8	4.2	232.1	4.2	0.04	350.6	5.2	0.04	188.9	2.8	0.10	0.038	0.157	0.686
Black-backed Woodpecker	0.0	0.0	54.4	2.6	3.5	0.0	3065.2	24.8	0.00	3046.1	34.9	0.00	2508.5	28.7	0.00	DTE	DTE	DTE
Boreal Chickadee	0.0	0.0	0.0	7.3	7.8	5.5	132.2	6.1	0.01	24.8	0.9	0.36	76.2	2.7	0.10	0.172	0.011	0.297
Evening Grosbeak	0.0	0.0	2.9	0.0	6.5	0.0	-	-	-	-	-	-	-	-	-	DTE	DTE	DTE
Gray Jay	0.0	7.9	21.1	17.8	33.3	10.9	1156.6	8.4	0.01	316.0	1.1	0.31	705.7	2.5	0.12	0.018	0.007	0.842
Mountain Bluebird	1.7	0.0	18.9	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	DTE	DTE	DTE
Pine Grosbeak	0.0	1.2	9.4	2.0	4.8	2.4	77.4	1.6	0.24	72.8	4.1	0.06	56.3	3.2	0.08	-	-	-
Spruce Grouse	0.0	0.0	3.8	1.7	8.2	1.2	67.4	3.7	0.06	83.3	4.7	0.05	38.9	2.2	0.16	-	-	-
All bird detections	496.7	689.4	1892.2	1230.1	730.6	506.9	3700000.0	40.9	0.00	480000.0	43.3	0.00	550000.0	49.4	0.00	DTE	DTE	DTE

^a Where group, decade, and decade by treatment effects were significant, alpha was ≤0.05. For Tukey's tests, p-values were considered significant when p ≤ 0.0125 due to multiple testing.

^b Clearcut Control (CC), Old-growth Control (OG), and Tree Island (IS) habitats

^c ANOVA statistics (MSE, F, p) shown for each species across decades

Appendix M. Bird singing detections and all detections for all bird species encountered in the Donna Creek study area, in 1995, 1996, 2006 and 2007. Species observed, but not detected during point-count surveys have their name in bold, * indicates cavity-nesting species.

Species	Code	Singing detections					All Detections				
		1995	1996	2006	2007	Total	1995	1996	2006	2007	Total
PASSERINE DETECTIONS											
Alder Flycatcher	ALFL	14	10	91	145	260	16	15	189	169	389
American Pipit	AMPI	0	0	0	0	0	3	6	0	0	9
American Redstart	AMRE	0	3	8	8	19	0	3	8	10	21
American Robin	AMRO	80	45	60	33	218	434	352	182	82	1050
Blackpoll Warbler	BKPW	62	66	14	37	179	64	79	14	40	197
Bohemian Waxwing	BOWA	0	0	0	0	0	0	0	2	1	3
*Boreal Chickadee	BOCH	1	0	0	1	2	8	10	4	10	32
Brewer's Sparrow	BRSP	0	0	0	0	0	0	0	1	0	1
Brewer's Blackbird	BRBL	0	1	0	0	1	2	8	0	0	10
*Brown Creeper	BRCR	9	5	2	4	20	11	5	2	4	22
Brown-headed Cowbird	BHCO	0	0	0	0	0	0	0	0	0	0
Cape May Warbler	CMWA	0	0	0	3	3	0	0	0	3	3
Cassin's Vireo	CAVI	2	0	1	0	3	3	0	1	0	4
Cedar Waxwing	CEDW	0	3	0	1	4	0	5	8	11	24
Chipping Sparrow	CHSP	172	132	350	161	815	241	225	429	251	1146
Common Raven	CORA	0	0	0	0	0	7	12	1	0	20
Dark-eyed Junco	DEJU	289	241	250	123	903	950	669	464	273	2356
Dusky Flycatcher	DUFL	0	2	52	50	104	0	2	98	67	167
Evening Grosbeak	EVGR	1	1	0	0	2	30	12	1	0	43
Fox Sparrow	FOSP	2	0	24	23	49	2	0	26	25	53
Golden-crowned Kinglet	GCKI	59	63	36	18	176	91	107	66	28	292
Golden-crowned Sparrow	GCSP	23	34	44	18	119	27	49	59	27	162
Gray Jay	GRJA	0	2	1	0	3	36	63	55	9	163
Gray-cheeked Thrush	GCTH	0	0	0	0	0	0	0	0	0	0
Hammond's Flycatcher	HAFI	10	7	4	6	27	13	12	22	9	56
Hermit Thrush	HETH	3	0	13	7	23	7	0	14	11	32
Least Flycatcher	LEFL	0	2	4	20	26	0	2	4	23	29
Lincoln's Sparrow	LISP	621	334	155	109	1219	1016	690	251	170	2127
MacGillivray's Warbler	MACW	54	58	122	103	337	54	64	126	112	356
*Mountain Bluebird	MOBL	6	2	0	0	8	72	46	0	0	118
*Mountain Chickadee	MOCH	0	0	5	4	9	0	0	7	16	23
Northern Waterthrush	NOWA	8	5	4	8	25	8	5	4	9	26
Olive-sided Flycatcher	OSFL	6	3	15	16	40	6	4	40	22	72
Orange-crowned Warbler	OCWA	12	8	111	114	245	23	11	129	130	293
Pacific-slope Flycatcher	PSFL	0	3	0	0	3	0	4	0	0	4
Pine Grosbeak	PIGR	14	3	3	0	20	23	7	5	7	42
Pine Siskin	PISI	39	21	0	8	68	556	190	86	412	1244
Purple Finch	PUIF	0	0	0	2	2	0	0	0	2	2
Red Crossbill	RECR	0	0	0	0	0	6	1	5	1	13
*Red-breasted Nuthatch	RBNU	47	21	0	0	68	58	25	19	15	117
Ruby-crowned Kinglet	RCKI	51	29	34	14	128	62	31	35	16	144
Savannah Sparrow	SAVS	208	151	22	6	387	258	195	24	9	486
Song Sparrow	SOSP	0	0	1	6	7	0	0	2	7	9
Steller's Jay	STJA	0	0	0	0	0	1	4	6	3	14
Swainson's Thrush	SWTH	62	35	273	78	448	100	100	363	193	756
Tennessee Warbler	TEWA	0	1	112	57	170	0	1	119	58	178
Townsend's Warbler	TOWA	154	111	96	71	432	159	128	103	80	470
Townsend's Solitaire	TOSO	0	0	0	0	0	1	1	0	0	2
Varied Thrush	VATH	18	6	13	6	43	30	8	17	6	61
Warbling Vireo	WAVI	12	14	118	87	231	12	15	129	107	263
Western Tanager	WETA	2	0	2	0	4	2	0	2	1	5
Western Wood-pewee	WWPE	14	6	0	1	21	17	7	2	1	27
White-crowned Sparrow	WCSP	11	12	28	16	67	12	21	42	31	106
White-throated Sparrow	WTSP	0	0	7	0	7	0	0	8	0	8
White-winged Crossbill	WWCR	0	0	0	0	0	0	0	12	0	12

Donna Creek Breeding Bird Monitoring

Species	Code	Singing detections					All Detections				
		1995	1996	2006	2007	Total	1995	1996	2006	2007	Total
Wilson's Warbler	WIWA	186	250	691	426	1553	224	397	799	591	2011
Winter Wren	WIWR	20	32	26	10	88	22	34	29	11	96
Yellow Warbler	YEWA	1	1	4	6	12	1	1	4	6	12
Yellow-bellied Flycatcher	YBFL	0	0	0	0	0	1	0	0	0	1
Yellow-rumped Warbler	YRWA	188	155	76	53	472	258	328	97	78	761
All Passerine detections	60	2461	1884	2872	1859	9076	4972	3990	4116	3147	16225
NON-PASSERINES											
*American Kestrel	AMKE	0	0	0	0	0	15	3	0	0	18
Barn Swallow	BNSW	0	0	0	0	0	0	0	0	0	0
*Black-backed Woodpecker	BBWO	0	1	0	1	2	61	35	1	2	99
*Barrow's Goldeneye	BAGO	0	0	0	0	0	0	0	0	0	0
*Boreal Owl	BOOW	1	0	0	0	1	1	0	0	0	1
Common Loon	COLO	0	0	0	0	0	0	0	0	0	0
Common Nighthawk	CONI	0	0	0	0	0	1	0	0	0	1
Dusky Grouse	DUGR	0	1	5	0	6	0	3	5	1	9
Golden Eagle	GOEA	0	0	0	0	0	0	0	0	0	0
*Hairy Woodpecker	HAWO	1	0	0	0	1	13	3	0	0	16
Mallard	MALL	0	0	0	0	0	0	0	0	0	0
Merlin	MERL	0	0	0	0	0	0	0	0	0	0
*Northern Flicker	NOFL	0	0	0	0	0	0	3	2	0	5
Northern Goshawk	NOGO	0	0	0	0	0	0	0	0	0	0
Northern Harrier	NOHA	0	0	0	0	0	0	0	0	0	0
* Northern Hawk Owl	NHOW	0	0	0	0	0	0	1	0	0	1
*Northern Pygmy-owl	NPOW	0	1	0	0	1	0	1	0	0	1
*Pileated Woodpecker	PIWO	0	0	0	0	0	0	0	1	0	1
Red-tailed Hawk	RTHA	0	0	0	0	0	2	0	0	1	3
Ruffed Grouse	RUGR	0	0	0	0	0	1	0	0	0	1
Rufous Hummingbird	RUHU	0	0	0	0	0	0	0	1	0	1
Sharp-shinned Hawk	SSHA	0	0	0	0	0	5	0	1	0	6
Solitary Sandpiper	SOSA	0	1	0	0	1	5	6	0	0	11
Spotted Sandpiper	SPSA	0	1	0	0	1	5	1	0	3	9
Spruce Grouse	SPGR	1	0	0	0	1	15	11	1	2	29
*Three-toed Woodpecker	ATTW	0	0	0	2	2	23	10	1	7	41
*Tree Swallow	TRSW	0	6	0	0	6	45	36	1	0	82
Wilson's Snipe	WISN	4	1	2	0	7	19	2	21	2	44
All non-passerine detections	28	7	6	7	3	23	166	79	34	18	297
GRAND TOTAL	88	2468	1890	2883	1862	9103	5142	4076	4155	3167	16540

Appendix N. Number of all bird detections by species, for each control and treatment replicate, in 2006 and 2007, Donna Creek study area.

Species	Year	Block	Clearcut control		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			Block					Outside	Inside	Outside	Inside
Alder Flycatcher	2006	5510	26	5516	0	11	8	6	0	7	0
		5549	17	5546	1	16	7	8	0	6	1
		5550	20	5547	0	5	11	15	1	7	2
	2007	5510	13	5516	0	19	10	17	0	5	3
		5549	11	5546	0	6	8	15	0	6	0
		5550	17	5547	0	7	2	6	0	10	2
American Kestrel	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
American Pipit	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
American Redstart	2006	5510	1	5516	0	0	0	0	0	0	0
		5549	1	5546	2	0	0	0	0	0	0
		5550	0	5547	0	1	0	0	0	2	1
	2007	5510	4	5516	0	0	0	1	2	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	1	2	0
American Robin	2006	5510	10	5516	5	6	2	8	3	10	3
		5549	8	5546	5	14	16	11	0	11	1
		5550	8	5547	0	6	8	3	0	7	3
	2007	5510	6	5516	0	1	1	1	7	2	3
		5549	2	5546	1	2	2	8	1	1	4
		5550	1	5547	5	3	4	3	1	2	3
Three-toed Woodpecker	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0
	2007	5510	0	5516	2	0	0	0	1	0	0
		5549	0	5546	3	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block				Outside	Inside	Outside	Inside
Black-backed Woodpecker	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	1
Blackpoll Warbler	2006	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	4	0	1	0	2	1	0
		5550	0	5547	3	0	2	0	0	0	0
	2007	5510	2	5516	3	2	0	0	0	0	0
		5549	0	5546	5	0	0	1	0	5	4
		5550	2	5547	10	2	0	1	0	0	1
Boreal Chickadee	2006	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	1
		5550	0	5547	1	0	0	0	0	0	0
	2007	5510	0	5516	4	0	0	1	2	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	2	0	0	0	1	0	1
Boreal Owl	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Bohemian Waxwing	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	4	0	0	0	0	0
	2007	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Brewer's Blackbird	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Brown Creeper	2006	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	3	0	0	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block				Outside	Inside	Outside	Inside
Brewer's Sparrow	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	1	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Cassin's Vireo	2006	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Cedar Waxwing	2006	5510	1	5516	0	0	0	0	0	0	2
		5549	0	5546	0	0	1	0	0	0	0
		5550	0	5547	0	2	1	0	0	0	0
	2007	5510	1	5516	1	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	2	2	0	0	0
Chipping Sparrow	2006	5510	20	5516	4	20	27	23	8	30	7
		5549	27	5546	0	18	20	21	1	35	3
		5550	15	5547	4	35	27	13	4	19	4
	2007	5510	16	5516	7	18	26	18	5	12	3
		5549	19	5546	3	6	6	17	2	24	1
		5550	6	5547	2	15	11	14	8	9	1
Cape May Warbler	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	3	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Common Raven	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Dark-eyed Junco	2006	5510	15	5516	6	21	37	19	11	20	9
		5549	24	5546	11	21	24	26	6	27	3
		5550	34	5547	14	37	29	20	10	21	4
	2007	5510	8	5516	1	19	17	18	6	18	5
		5549	14	5546	4	12	17	13	2	19	4
		5550	12	5547	6	29	14	16	7	13	13

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut control		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			Block					Outside	Inside	Outside	Inside
Dusky Flycatcher	2006	5510	1	5516	0	8	3	1	3	2	0
		5549	8	5546	0	5	4	6	0	4	0
		5550	17	5547	0	5	1	6	4	7	5
	2007	5510	2	5516	0	6	1	7	0	3	0
		5549	8	5546	0	2	2	2	0	0	0
		5550	16	5547	0	1	0	6	0	4	2
Dusky Grouse	2006	5510	0	5516	0	1	0	0	0	0	0
		5549	2	5546	0	0	0	0	0	0	0
		5550	2	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	1	5547	0	0	0	0	0	0	0
Evening Grosbeak	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Fox Sparrow	2006	5510	0	5516	0	8	1	8	1	2	0
		5549	1	5546	0	0	0	0	0	0	0
		5550	2	5547	0	0	0	2	0	0	0
	2007	5510	0	5516	0	6	2	1	1	5	0
		5549	1	5546	0	2	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Golden-crowned Kinglet	2006	5510	0	5516	21	0	0	0	1	0	0
		5549	0	5546	20	0	0	0	0	0	0
		5550	0	5547	22	0	0	1	0	1	0
	2007	5510	0	5516	13	0	0	0	0	0	0
		5549	1	5546	8	0	0	0	0	0	0
		5550	0	5547	6	0	0	0	0	0	0
Golden-crowned Sparrow	2006	5510	0	5516	0	12	7	4	4	15	0
		5549	3	5546	0	0	0	0	0	2	0
		5550	2	5547	0	1	0	2	0	0	0
	2007	5510	0	5516	0	0	1	6	0	13	2
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Gray Jay	2006	5510	5	5516	8	3	0	1	7	0	1
		5549	4	5546	3	4	1	1	0	3	1
		5550	4	5547	6	1	3	2	0	0	0
	2007	5510	0	5516	1	0	0	0	2	0	2
		5549	0	5546	0	1	1	0	2	1	0
		5550	0	5547	0	1	1	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut control		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			Block					Outside	Inside	Outside	Inside
Hammond's Flycatcher	2006	5510	0	5516	0	0	0	0	3	0	0
		5549	0	5546	4	0	0	0	2	0	0
		5550	0	5547	9	1	0	0	0	0	2
	2007	5510	0	5516	0	0	0	0	2	0	1
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	2	0	0	0	1	0	1
Hairy Woodpecker	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Hermit Thrush	2006	5510	0	5516	0	0	0	1	2	1	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	6	0	2	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	1	1
		5549	1	5546	0	1	1	2	0	1	0
		5550	0	5547	1	0	1	0	0	0	0
Least Flycatcher	2006	5510	2	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	1	5547	0	1	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	1
		5549	0	5546	0	4	9	2	0	3	0
		5550	0	5547	0	2	0	0	0	0	1
Lincoln's Sparrow	2006	5510	16	5516	0	22	27	15	0	12	9
		5549	17	5546	0	5	8	11	2	12	0
		5550	29	5547	0	14	4	13	2	23	4
	2007	5510	18	5516	0	12	20	13	0	18	1
		5549	9	5546	0	2	3	12	0	11	0
		5550	23	5547	0	5	4	3	1	6	0
MacGillivray's Warbler	2006	5510	3	5516	1	12	9	6	0	9	0
		5549	7	5546	0	5	3	9	0	11	0
		5550	6	5547	2	0	0	16	5	6	4
	2007	5510	4	5516	0	10	5	10	0	2	1
		5549	5	5546	0	16	1	12	0	2	1
		5550	5	5547	0	6	6	5	0	6	1
Merlin	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0

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Species	Year	Block	Clearcut		Old-growth	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control			Outside	Inside	Outside	Inside
Mountain Bluebird	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Mountain Chickadee	2006	5510	0	5516	0	0	0	0	6	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0
	2007	5510	0	5516	4	0	0	1	5	2	0
		5549	0	5546	2	0	0	0	2	0	0
		5550	0	5547	2	0	0	0	0	0	0
Northern Hawk Owl	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Northern Flicker	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	1	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Northern Waterthrush	2006	5510	1	5516	1	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	1
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	1	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	2	1	0	1	0
		5550	0	5547	4	0	0	0	0	0	0
Northern Pygmy-Owl	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Orange-crowned Warbler	2006	5510	5	5516	1	5	4	8	5	5	1
		5549	6	5546	0	5	2	6	2	7	2
		5550	13	5547	3	11	4	6	4	12	2
	2007	5510	7	5516	0	12	1	12	1	7	2
		5549	8	5546	0	9	8	7	0	11	0
		5550	7	5547	0	5	3	3	2	6	2

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block				Outside	Inside	Outside	Inside
Olive-sided Flycatcher	2006	5510	1	5516	1	0	0	1	7	1	6
		5549	3	5546	0	0	0	1	2	2	0
		5550	1	5547	0	0	5	1	1	0	3
	2007	5510	1	5516	0	0	0	0	5	0	9
		5549	1	5546	0	0	0	0	2	0	1
		5550	0	5547	0	0	0	0	0	0	4
Pine Grosbeak	2006	5510	0	5516	2	0	0	0	1	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	1	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	1	0	0	1
		5549	0	5546	0	0	0	0	0	0	0
		5550	1	5547	2	0	0	0	0	0	0
Pine Siskin	2006	5510	1	5516	0	3	0	1	10	2	1
		5549	2	5546	4	1	1	3	2	2	2
		5550	0	5547	4	0	0	2	0	1	6
	2007	5510	12	5516	20	22	11	17	29	13	15
		5549	6	5546	26	9	4	7	19	2	11
		5550	13	5547	33	8	3	11	2	8	14
Pileated Woodpecker	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	1	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Pacific-slope Flycatcher	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Purple Finch	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	1	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Red-breasted Nuthatch	2006	5510	0	5516	11	0	0	0	0	0	0
		5549	0	5546	8	0	0	0	0	0	0
		5550	0	5547	2	0	0	0	0	0	0
	2007	5510	0	5516	3	0	0	0	7	1	1
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	1

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut control		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			Block					Outside	Inside	Outside	Inside
Ruby-crowned Kinglet	2006	5510	0	5516	0	2	1	0	8	0	2
		5549	3	5546	5	1	1	0	0	0	2
		5550	2	5547	0	0	0	0	1	0	5
	2007	5510	1	5516	3	0	0	0	1	0	0
		5549	1	5546	1	0	1	0	0	0	3
		5550	0	5547	5	0	0	0	0	0	0
Red Crossbill	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	5	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Red-tailed Hawk	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Savannah Sparrow	2006	5510	5	5516	0	0	1	2	0	9	0
		5549	0	5546	0	0	3	0	0	1	0
		5550	5	5547	0	0	0	0	0	0	0
	2007	5510	2	5516	0	1	0	0	0	3	0
		5549	0	5546	0	0	1	0	0	0	0
		5550	1	5547	0	1	0	0	0	0	0
Solitary Sandpiper	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Song Sparrow	2006	5510	2	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	1	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	1	3
		5549	1	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Spruce Grouse	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	2	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	1	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut control		Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			Block					Outside	Inside	Outside	Inside
Spotted Sandpiper	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	2	0	0	0	0
Sharp-shinned Hawk	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	1	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Steller's Jay	2006	5510	0	5516	5	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	2	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	1	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Swainson's Thrush	2006	5510	11	5516	23	10	4	10	10	9	2
		5549	13	5546	13	31	18	21	1	12	1
		5550	11	5547	10	24	36	11	13	14	7
	2007	5510	4	5516	8	2	2	8	15	4	4
		5549	9	5546	10	15	22	10	7	4	5
		5550	3	5547	4	14	7	6	4	4	5
Tennessee Warbler	2006	5510	17	5516	3	6	0	3	3	2	0
		5549	3	5546	8	5	3	2	2	4	3
		5550	1	5547	6	12	2	8	4	10	7
	2007	5510	7	5516	2	0	0	1	0	0	0
		5549	6	5546	1	3	8	1	0	7	3
		5550	0	5547	5	3	3	0	0	1	2
Townsend's Solitaire	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Townsend's Warbler	2006	5510	0	5516	36	0	0	0	1	0	0
		5549	0	5546	23	0	0	0	0	2	0
		5550	0	5547	36	0	0	0	1	0	2
	2007	5510	0	5516	34	0	0	0	1	0	0
		5549	0	5546	17	0	0	0	0	1	0
		5550	0	5547	26	0	0	0	0	0	1

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut control	Block	Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment	Stub and island treatment	Outside	Inside	Outside	Inside
Trumpeter Swan	2006	5510	0	5516	0	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0	0
Unknown Woodpecker	2006	5510	0	5516	4	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0	0
Varied Thrush	2006	5510	0	5516	8	1	0	0	0	0	0	0	0
		5549	1	5546	3	0	0	0	0	0	0	0	0
		5550	0	5547	4	0	0	0	0	0	0	0	0
	2007	5510	0	5516	2	0	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0	0	0
		5550	0	5547	3	0	0	0	0	0	0	0	0
Warbling Vireo	2006	5510	15	5516	0	4	3	6	6	0	0	0	0
		5549	14	5546	0	4	8	8	0	5	0	0	0
		5550	5	5547	0	5	11	6	6	12	7	0	0
	2007	5510	7	5516	0	2	1	2	2	1	0	0	0
		5549	14	5546	0	3	6	9	2	7	1	0	0
		5550	5	5547	0	3	3	13	3	9	5	0	0
White-crowned Sparrow	2006	5510	0	5516	0	1	5	1	0	5	3	0	0
		5549	14	5546	0	0	1	0	0	2	1	0	0
		5550	7	5547	0	0	4	0	0	1	0	0	0
	2007	5510	0	5516	0	6	6	4	0	3	1	0	0
		5549	6	5546	0	0	0	2	0	0	0	0	0
		5550	0	5547	0	0	1	2	0	0	0	0	0
Western Tanager	2006	5510	1	5516	0	0	0	0	0	0	0	0	1
		5549	0	5546	0	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0	0
Wilson's Snipe	2006	5510	5	5516	0	1	4	1	0	0	0	0	0
		5549	2	5546	0	0	0	0	0	0	0	0	0
		5550	1	5547	0	1	0	0	0	2	0	0	0
	2007	5510	2	5516	0	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control			Outside	Inside	Outside	Inside
Wilson's Warbler	2006	5510	42	5516	5	62	35	37	16	51	20
		5549	51	5546	6	37	43	44	10	44	8
		5550	43	5547	7	20	23	41	19	48	14
	2007	5510	18	5516	7	38	40	33	16	42	15
		5549	37	5546	2	31	22	42	9	23	6
		5550	42	5547	6	27	14	28	9	40	9
Winter Wren	2006	5510	0	5516	14	0	0	0	0	0	0
		5549	0	5546	9	0	0	0	0	0	0
		5550	0	5547	5	0	0	0	0	0	0
	2007	5510	0	5516	3	0	0	0	1	0	0
		5549	0	5546	3	0	0	0	0	0	0
		5550	0	5547	4	0	0	0	0	0	0
White-throated Sparrow	2006	5510	1	5516	0	0	1	0	0	1	0
		5549	0	5546	0	0	0	1	0	0	0
		5550	0	5547	0	0	0	2	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Western Wood-Pewee	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	1	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Yellow-bellied Flycatcher	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Yellow Warbler	2006	5510	2	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	1	1
	2007	5510	3	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	1	0	0	0
		5550	1	5547	0	0	0	0	0	0	0
Yellow-rumped Warbler	2006	5510	3	5516	5	0	0	1	3	4	7
		5549	4	5546	7	5	7	7	1	4	3
		5550	3	5547	6	4	1	1	1	1	9
	2007	5510	0	5516	8	2	0	2	10	2	4
		5549	1	5546	6	5	3	0	3	1	4
		5550	0	5547	8	2	5	0	4	0	9

Appendix O. Number of all bird detections by species, for each control and treatment replicate, in the 1990s and 2000s survey periods, Donna Creek study area.

Species	Year	Block	Clearcut		Old-growth		Clearcut		Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	Stub	Tree island treatment	Stub and island treatment	Stub and island treatment		
									Outside	Inside	Outside	Inside
Alder Flycatcher	1990s	5510	21	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	1	0
		5550	0	5547	0	0	7	0	2	0	0	0
	2000s	5510	39	5516	0	30	18	23	0	12	3	3
		5549	28	5546	1	22	15	23	0	12	1	1
		5550	37	5547	0	12	13	21	1	17	4	4
American Kestrel	1990s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	1	1	0	0	0
		5550	0	5547	0	0	0	1	2	0	0	1
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
American Pipit	1990s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	6	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
American Redstart	1990s	5510	2	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	5	5516	0	0	0	1	2	0	0	0
		5549	1	5546	2	0	0	0	0	0	0	0
		5550	0	5547	0	1	0	0	1	4	1	1
American Robin	1990s	5510	29	5516	32	28	62	44	57	40	34	
		5549	26	5546	17	10	35	11	27	29	18	
		5550	30	5547	8	17	8	34	21	33	42	
	2000s	5510	16	5516	5	7	3	9	10	12	6	
		5549	10	5546	6	16	18	19	1	12	5	
		5550	9	5547	5	9	12	6	1	9	6	
Three-toed Woodpecker	1990s	5510	0	5516	2	0	0	0	0	0	4	
		5549	0	5546	10	0	0	0	1	0	0	
		5550	0	5547	6	0	0	0	8	0	2	
	2000s	5510	0	5516	2	0	0	0	1	0	0	
		5549	0	5546	3	0	0	0	0	0	0	
		5550	0	5547	2	0	0	0	0	0	0	

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Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Black-backed Woodpecker	1990s	5510	0	5516	2	1	6	2	27	4	6	
		5549	0	5546	2	0	2	1	3	3	3	
		5550	0	5547	4	0	0	2	0	3	19	
	2000s	5510	0	5516	0	0	0	0	1	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	1	
Blackpoll Warbler	1990s	5510	0	5516	41	0	0	0	2	0	2	
		5549	0	5546	41	0	1	0	0	0	0	
		5550	0	5547	53	0	0	0	1	0	2	
	2000s	5510	2	5516	3	2	0	0	1	0	0	
		5549	0	5546	9	0	1	1	2	6	4	
		5550	2	5547	13	2	2	1	0	0	1	
Boreal Chickadee	1990s	5510	0	5516	9	0	0	0	0	0	0	
		5549	0	5546	7	0	0	0	0	0	0	
		5550	0	5547	2	0	0	0	0	0	0	
	2000s	5510	0	5516	5	0	0	1	2	0	0	
		5549	0	5546	1	0	0	0	0	0	1	
		5550	0	5547	3	0	0	0	1	0	1	
Boreal Owl	1990s	5510	0	5516	1	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Bohemian Waxwing	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	1	0	0	0	0	0	0	
Brewer's Blackbird	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	2	1	0	3	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Brown Creeper	1990s	5510	0	5516	2	0	0	0	0	0	0	
		5549	0	5546	8	0	0	0	0	0	0	
		5550	0	5547	6	0	0	0	0	0	0	
	2000s	5510	0	5516	1	0	0	0	0	0	0	
		5549	0	5546	1	0	0	0	0	0	0	
		5550	0	5547	4	0	0	0	0	0	0	

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Brewer's Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	1	0	0	0	0	0	0
Cassin's Vireo	1990s	5510	0	5516	2	0	0	0	1	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	1	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Cedar Waxwing	1990s	5510	1	5516	1	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	2	5516	1	0	0	0	1	0	0	2
		5549	0	5546	0	0	1	0	0	0	0	0
		5550	0	5547	0	2	3	2	0	0	0	0
Chipping Sparrow	1990s	5510	17	5516	5	18	17	15	35	15	41	
		5549	35	5546	4	20	27	15	16	20	12	
		5550	7	5547	5	17	35	7	33	27	35	
	2000s	5510	36	5516	11	38	53	41	13	42	10	
		5549	46	5546	3	24	26	38	3	59	4	
		5550	21	5547	6	50	38	27	12	28	5	
Cape May Warbler	1990s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	3	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Common Raven	1990s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	1	0	0	0
		5550	0	5547	3	0	0	1	0	1	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Dark-eyed Junco	1990s	5510	58	5516	33	100	125	104	49	81	40	
		5549	93	5546	31	63	64	94	31	85	33	
		5550	56	5547	35	83	85	79	46	81	46	
	2000s	5510	23	5516	7	40	54	37	17	38	14	
		5549	38	5546	15	33	41	39	8	46	7	
		5550	46	5547	20	66	43	36	17	34	17	

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment		
			control	Block control	treatment	treatment	Outside	Inside	Outside	Inside	
Dusky Flycatcher	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	1	1
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	3	5516	0	14	4	8	3	5	0
		5549	16	5546	0	7	6	8	0	4	0
		5550	33	5547	0	6	1	12	4	11	7
Dusky Grouse	1990s	5510	0	5516	0	0	0	1	1	0	0
		5549	1	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	1	0	0	0	0	0
		5549	2	5546	0	0	0	0	0	0	0
		5550	3	5547	0	0	0	0	0	0	0
Evening Grosbeak	1990s	5510	0	5516	6	0	0	0	0	0	0
		5549	0	5546	7	0	1	0	0	0	2
		5550	0	5547	2	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Fox Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	2
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	14	3	9	2	7	0
		5549	2	5546	0	2	0	0	0	0	0
		5550	2	5547	0	0	0	2	0	0	0
Golden-crowned Kinglet	1990s	5510	0	5516	64	0	0	0	1	1	0
		5549	0	5546	73	0	0	0	0	0	1
		5550	0	5547	57	0	0	0	0	0	0
	2000s	5510	0	5516	34	0	0	0	1	0	0
		5549	1	5546	28	0	0	0	0	0	0
		5550	0	5547	28	0	0	1	0	1	0
Golden-crowned Sparrow	1990s	5510	4	5516	0	7	16	8	4	17	12
		5549	1	5546	0	0	0	0	0	0	0
		5550	7	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	12	8	10	4	28	2
		5549	3	5546	0	0	0	0	0	2	0
		5550	2	5547	0	1	0	2	0	0	0
Gray Jay	1990s	5510	0	5516	24	0	1	0	0	0	1
		5549	0	5546	28	0	0	2	1	0	4
		5550	0	5547	25	0	0	1	7	0	4
	2000s	5510	5	5516	9	3	0	1	9	0	3
		5549	4	5546	3	5	2	1	2	4	1
		5550	4	5547	6	2	4	2	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Hammond's Flycatcher	1990s	5510	0	5516	3	0	0	0	1	0	0	
		5549	0	5546	2	1	0	1	1	0	1	
		5550	0	5547	14	1	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	5	0	1	
		5549	0	5546	5	0	0	0	2	0	0	
		5550	0	5547	11	1	0	0	1	0	3	
Hairy Woodpecker	1990s	5510	0	5516	5	0	0	0	0	2	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	1	7	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Hermit Thrush	1990s	5510	0	5516	1	0	0	0	1	0	0	
		5549	0	5546	5	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	1	2	2	1	
		5549	1	5546	1	1	1	2	0	1	0	
		5550	0	5547	7	0	3	0	0	0	0	
Least Flycatcher	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	1	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	1	
	2000s	5510	2	5516	0	0	0	0	0	0	1	
		5549	0	5546	0	4	9	2	0	3	0	
		5550	1	5547	0	3	0	0	0	0	1	
Lincoln's Sparrow	1990s	5510	165	5516	0	89	63	62	14	87	21	
		5549	106	5546	0	93	86	108	30	114	15	
		5550	134	5547	0	93	90	155	55	79	24	
	2000s	5510	34	5516	0	34	47	28	0	30	10	
		5549	26	5546	0	7	11	23	2	23	0	
		5550	52	5547	0	19	8	16	3	29	4	
MacGillivray's Warbler	1990s	5510	13	5516	5	7	0	2	4	0	3	
		5549	12	5546	0	0	3	9	4	2	5	
		5550	2	5547	2	1	6	4	18	7	9	
	2000s	5510	7	5516	1	22	14	16	0	11	1	
		5549	12	5546	0	21	4	21	0	13	1	
		5550	11	5547	2	6	6	21	5	12	5	
Merlin	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	1	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment		
			control	control	treatment	treatment	Outside	Inside	Outside	Inside	
Mountain Bluebird	1990s	5510	0	5516	0	12	7	4	9	28	16
		5549	4	5546	0	0	9	0	0	1	1
		5550	0	5547	0	3	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Mountain Chickadee	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	4	0	0	1	11	2	0
		5549	0	5546	2	0	0	0	2	0	0
		5550	0	5547	3	0	0	0	0	0	0
Northern Hawk Owl	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	1
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Northern Flicker	1990s	5510	0	5516	0	0	0	0	0	0	3
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	1	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Northern Waterthrush	1990s	5510	2	5516	7	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	5	0	0	0	0	0	0
	2000s	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	1	0	2	1	0	1	1
		5550	0	5547	4	0	0	0	0	0	0
Northern Pygmy-Owl	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Orange-crowned Warbler	1990s	5510	5	5516	0	0	1	2	5	0	1
		5549	0	5546	0	3	0	0	0	0	1
		5550	0	5547	4	0	0	0	1	1	1
	2000s	5510	12	5516	1	17	5	20	6	12	3
		5549	14	5546	0	14	10	13	2	18	2
		5550	20	5547	3	16	7	9	6	18	4

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Olive-sided Flycatcher	1990s	5510	0	5516	2	0	0	0	0	0	0	2
		5549	0	5546	0	0	0	0	0	0	0	1
		5550	0	5547	1	0	0	0	0	0	0	4
	2000s	5510	2	5516	1	0	0	1	12	1	15	
		5549	4	5546	0	0	0	1	4	2	1	
5550	1	5547	0	0	5	1	1	0	7			
Pine Grosbeak	1990s	5510	0	5516	8	0	0	0	6	2	4	
		5549	0	5546	2	0	0	0	0	0	0	
		5550	0	5547	1	0	0	0	2	0	0	
	2000s	5510	0	5516	2	0	0	1	1	0	1	
		5549	0	5546	0	1	0	0	0	0	0	
5550	2	5547	2	0	0	0	0	0	0			
Pine Siskin	1990s	5510	2	5516	17	6	21	3	53	11	40	
		5549	1	5546	22	4	6	3	6	1	7	
		5550	2	5547	12	2	4	3	5	3	21	
	2000s	5510	13	5516	20	25	11	18	39	15	16	
		5549	8	5546	30	10	5	10	21	4	13	
5550	13	5547	37	8	3	13	12	9	20			
Pileated Woodpecker	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
5550	0	5547	0	0	1	0	0	0	0			
Pacific-slope Flycatcher	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	1	0	0	0	0	0	0	
		5550	0	5547	3	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
5550	0	5547	0	0	0	0	0	0	0			
Purple Finch	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	1	0	0	0	1	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
5550	0	5547	0	0	0	0	0	0	0			
Red-breasted Nuthatch	1990s	5510	0	5516	16	0	0	0	15	0	10	
		5549	0	5546	21	0	0	0	0	0	1	
		5550	0	5547	16	1	0	0	1	0	2	
	2000s	5510	0	5516	14	0	0	0	7	1	1	
		5549	0	5546	9	0	0	0	0	0	0	
5550	0	5547	2	0	0	0	0	0	1			

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Ruby-crowned Kinglet	1990s	5510	0	5516	18	0	0	0	25	0	5	
		5549	0	5546	25	0	0	0	0	0	0	
		5550	0	5547	20	0	0	0	0	0	0	
	2000s	5510	1,4,2	5516	3	2	1	0	9	0	2	
		5549	O	5546	6	1	2	0	0	0	5	
		5550	O	5547	5	0	0	0	1	0	5	
Red Crossbill	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	5	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Red-tailed Hawk	1990s	5510	0	5516	0	0	1	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Savannah Sparrow	1990s	5510	72	5516	0	21	13	4	4	16	4	
		5549	23	5546	0	68	48	17	1	12	0	
		5550	63	5547	0	17	14	33	4	16	0	
	2000s	5510	7	5516	0	1	1	2	0	12	0	
		5549	0	5546	0	0	4	0	0	1	0	
		5550	6	5547	0	1	0	0	0	0	0	
Solitary Sandpiper	1990s	5510	3	5516	0	0	2	0	0	1	0	
		5549	0	5546	0	0	1	1	0	1	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Song Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	2	5516	0	0	0	0	0	1	3	
		5549	1	5546	0	0	0	0	0	1	0	
		5550	0	5547	0	0	0	0	0	0	0	
Spruce Grouse	1990s	5510	0	5516	11	0	0	1	0	1	2	
		5549	0	5546	2	1	0	0	0	0	0	
		5550	0	5547	6	0	0	0	1	0	1	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	2	1	0	0	0	0	0	
		5550	0	5547	0	0	0	0	1	0	0	

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Spotted Sandpiper	1990s	5510	0	5516	0	0	3	1	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	2	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	2	0	0	0	0	0
Sharp-shinned Hawk	1990s	5510	0	5516	0	0	1	0	0	0	0	0
		5549	0	5546	0	0	0	0	1	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	1	0	0	0	0	0
Steller's Jay	1990s	5510	0	5516	0	0	0	0	4	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	1
	2000s	5510	0	5516	5	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	1	0	0	0	0
		5550	0	5547	0	0	0	0	2	0	0	0
Swainson's Thrush	1990s	5510	0	5516	55	0	0	1	25	0	0	9
		5549	0	5546	54	0	0	0	5	0	0	7
		5550	0	5547	31	0	0	0	4	0	0	7
	2000s	5510	15	5516	31	12	6	18	25	13	6	6
		5549	22	5546	23	46	40	31	8	16	6	6
		5550	14	5547	14	38	43	17	17	18	12	12
Tennessee Warbler	1990s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0	0
	2000s	5510	24	5516	5	6	0	4	3	2	0	0
		5549	9	5546	9	8	11	3	2	11	6	6
		5550	1	5547	11	15	5	8	4	11	9	9
Townsend's Solitaire	1990s	5510	0	5516	0	0	1	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Townsend's Warbler	1990s	5510	0	5516	96	0	0	0	3	0	0	0
		5549	0	5546	106	0	0	0	2	0	0	2
		5550	0	5547	71	0	0	0	2	0	0	3
	2000s	5510	0	5516	70	0	0	0	2	0	0	0
		5549	0	5546	40	0	0	0	0	3	0	0
		5550	0	5547	62	0	0	0	1	0	0	3

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Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Trumpeter Swan	1990s	5510	4	5516	0	0	3	0	2	3	0	
		5549	2	5546	0	0	4	0	0	0	0	
		5550	0	5547	0	0	1	1	5	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Unknown Woodpecker	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	4	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	1	0	0	0	0	0	0	
Varied Thrush	1990s	5510	0	5516	22	1	1	0	2	0	1	
		5549	0	5546	3	0	0	0	0	0	0	
		5550	0	5547	9	0	0	0	0	0	0	
	2000s	5510	0	5516	10	1	0	0	0	0	0	
		5549	1	5546	4	0	0	0	0	0	0	
		5550	0	5547	7	0	0	0	0	0	0	
Warbling Vireo	1990s	5510	11	5516	4	0	0	1	6	0	1	
		5549	0	5546	1	0	0	0	0	0	1	
		5550	0	5547	1	0	0	0	1	0	0	
	2000s	5510	22	5516	0	6	4	8	8	1	0	
		5549	28	5546	0	7	14	17	2	12	1	
		5550	10	5547	0	8	14	19	9	21	12	
White-crowned Sparrow	1990s	5510	3	5516	0	3	4	1	2	1	1	
		5549	6	5546	0	0	0	0	0	1	0	
		5550	3	5547	0	0	1	4	2	1	0	
	2000s	5510	0	5516	0	7	11	5	0	8	4	
		5549	20	5546	0	0	1	2	0	2	1	
		5550	7	5547	0	0	5	2	0	1	0	
Western Tanager	1990s	5510	0	5516	0	0	0	0	0	0	2	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	1	5516	0	0	0	0	0	0	1	
		5549	0	5546	1	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Wilson's Snipe	1990s	5510	2	5516	0	1	7	0	0	2	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	1	0	0	0	0	1	1	
	2000s	5510	7	5516	0	1	4	1	0	0	0	
		5549	2	5546	0	0	0	0	0	0	0	
		5550	1	5547	0	1	0	0	0	2	0	

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Wilson's Warbler	1990s	5510	26	5516	39	14	21	19	59	11	41	
		5549	59	5546	35	5	1	25	35	7	30	
		5550	2	5547	23	6	19	11	65	11	70	
	2000s	5510	60	5516	12	100	75	70	32	93	35	
		5549	88	5546	8	68	65	86	19	67	14	
		5550	85	5547	13	47	37	69	28	88	23	
Winter Wren	1990s	5510	0	5516	27	0	0	0	0	0	0	
		5549	0	5546	9	0	0	0	4	0	0	
		5550	0	5547	16	0	0	0	0	0	0	
	2000s	5510	0	5516	17	0	0	0	1	0	0	
		5549	0	5546	12	0	0	0	0	0	0	
		5550	0	5547	9	0	0	0	0	0	0	
White-throated Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	1	5516	0	0	1	1	0	1	0	
		5549	0	5546	0	0	0	1	0	0	0	
		5550	0	5547	0	0	0	2	0	0	0	
Western Wood-Pewee	1990s	5510	0	5516	0	0	1	0	8	1	7	
		5549	0	5546	0	0	1	0	0	0	0	
		5550	0	5547	3	0	0	0	1	0	2	
	2000s	5510	0	5516	0	0	0	0	1	0	0	
		5549	0	5546	0	1	0	0	0	0	0	
		5550	1	5547	0	0	0	0	0	0	0	
Yellow-bellied Flycatcher	1990s	5510	0	5516	0	0	0	0	0	1	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
	2000s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	0	
		5550	0	5547	0	0	0	0	0	0	0	
Yellow Warbler	1990s	5510	0	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	0	0	0	1	
		5550	0	5547	0	1	0	0	0	0	0	
	2000s	5510	5	5516	0	0	0	0	0	0	0	
		5549	0	5546	0	0	0	1	0	0	0	
		5550	1	5547	0	0	0	0	0	1	1	
Yellow-rumped Warbler	1990s	5510	18	5516	41	12	14	14	63	15	42	
		5549	11	5546	55	11	16	3	23	15	18	
		5550	5	5547	76	8	9	10	30	19	34	
	2000s	5510	3	5516	13	2	0	3	13	6	11	
		5549	5	5546	13	10	10	7	4	5	7	
		5550	3	5547	14	6	6	1	5	1	18	

Appendix P. Number of singing bird detections by species, for each control and treatment replicate, in the 2000s (2006 and 2007), Donna Creek study area.

Species	Year	Block	Clearcut		Old-growth		Clearcut		Stub		Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside			
Alder Flycatcher	2006	5510	7	5516	0	10	5	4	0	1	0			
		5549	8	5546	1	6	1	3	0	0	0			
		5550	7	5547	0	5	0	15	1	6	2			
	2007	5510	11	5516	0	16	9	14	0	4	0			
		5549	9	5546	0	5	8	15	0	6	0			
		5550	13	5547	0	6	2	4	0	10	1			
American Pipit	2006	5510	0	5516	0	0	0	0	0	0	0			
		5549	0	5546	0	0	0	0	0	0	0			
		5550	0	5547	0	0	0	0	0	0	0			
	2007	5510	0	5516	0	0	0	0	0	0	0			
		5549	0	5546	0	0	0	0	0	0	0			
		5550	0	5547	0	0	0	0	0	0	0			
American Redstart	2006	5510	1	5516	0	0	0	0	0	0	0			
		5549	1	5546	2	0	0	0	0	0	0			
		5550	0	5547	0	1	0	0	0	2	1			
	2007	5510	4	5516	0	0	0	1	1	0	0			
		5549	0	5546	0	0	0	0	0	0	0			
		5550	0	5547	0	0	0	0	0	2	0			
American Robin	2006	5510	1	5516	0	1	0	2	1	4	2			
		5549	2	5546	3	2	5	1	0	6	1			
		5550	2	5547	0	3	4	2	0	3	3			
	2007	5510	2	5516	0	1	0	0	4	0	0			
		5549	1	5546	1	0	1	3	0	0	2			
		5550	0	5547	5	1	2	2	1	0	0			
Blackpoll Warbler	2006	5510	0	5516	0	0	0	0	1	0	0			
		5549	0	5546	4	0	1	0	2	1	0			
		5550	0	5547	3	0	2	0	0	0	0			
	2007	5510	2	5516	3	2	0	0	0	0	0			
		5549	0	5546	4	0	0	1	0	5	4			
		5550	1	5547	9	2	0	1	0	0	1			
Boreal Chickadee	2006	5510	0	5516	0	0	0	0	0	0	0			
		5549	0	5546	0	0	0	0	0	0	0			
		5550	0	5547	0	0	0	0	0	0	0			
	2007	5510	0	5516	0	0	0	0	0	0	0			
		5549	0	5546	0	0	0	0	0	0	0			
		5550	0	5547	0	0	0	0	1	0	0			

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Bohemian Waxwing	2006	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Brewer's Blackbird	2006	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Brown Creeper	2006	5510	0	5516	1	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0	0
		5550	0	5547	3	0	0	0	0	0	0	0
Brewer's Sparrow	2006	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Cassin's Vireo	2006	5510	0	5516	1	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Cedar Waxwing	2006	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	1	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
Chipping Sparrow	2006	5510	14	5516	4	16	18	18	5	21	4	
		5549	19	5546	0	16	15	14	1	32	1	
		5550	14	5547	4	32	21	12	2	17	3	
	2007	5510	12	5516	4	9	10	11	5	6	1	
		5549	9	5546	3	4	3	10	2	13	0	
		5550	3	5547	2	6	10	6	3	6	0	

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Cape May Warbler	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	3	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Common Raven	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Dark-eyed Junco	2006	5510	9	5516	5	10	15	9	5	9	1
		5549	7	5546	7	16	12	10	0	12	1
		5550	18	5547	11	24	13	15	3	13	2
	2007	5510	4	5516	1	8	6	8	0	5	1
		5549	8	5546	4	3	5	5	0	6	3
		5550	6	5547	1	12	9	6	4	5	1
Dusky Flycatcher	2006	5510	0	5516	0	4	3	1	1	1	0
		5549	2	5546	0	3	1	3	0	1	0
		5550	7	5547	0	2	1	6	2	3	5
	2007	5510	2	5516	0	4	1	4	0	2	0
		5549	5	5546	0	2	2	1	0	0	0
		5550	13	5547	0	1	0	2	0	4	2
Evening Grosbeak	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Fox Sparrow	2006	5510	0	5516	0	7	1	7	1	2	0
		5549	1	5546	0	0	0	0	0	0	0
		5550	2	5547	0	0	0	2	0	0	0
	2007	5510	0	5516	0	5	2	1	1	5	0
		5549	1	5546	0	2	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Golden-crowned Kinglet	2006	5510	0	5516	13	0	0	0	1	0	0
		5549	0	5546	9	0	0	0	0	0	0
		5550	0	5547	10	0	0	1	0	0	0
	2007	5510	0	5516	8	0	0	0	0	0	0
		5549	0	5546	5	0	0	0	0	0	0
		5550	0	5547	5	0	0	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Golden-crowned Sparrow	2006	5510	0	5516	0	10	5	3	2	10	0
		5549	2	5546	0	0	0	0	0	2	0
		5550	2	5547	0	1	0	0	0	0	0
	2007	5510	0	5516	0	0	1	1	0	7	2
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Gray Jay	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Hammond's Flycatcher	2006	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	1
	2007	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	2	0	0	0	1	0	1
Hermit Thrush	2006	5510	0	5516	0	0	0	1	2	1	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	6	0	1	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	1	5546	0	1	1	2	0	1	0
		5550	0	5547	0	0	0	0	0	0	0
Least Flycatcher	2006	5510	2	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	1	5547	0	1	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	1
		5549	0	5546	0	3	8	2	0	2	0
		5550	0	5547	0	2	0	0	0	0	1
Lincoln's Sparrow	2006	5510	4	5516	0	12	13	9	0	9	2
		5549	6	5546	0	4	7	4	1	6	0
		5550	13	5547	0	14	3	11	0	13	1
	2007	5510	4	5516	0	8	7	9	0	8	0
		5549	8	5546	0	1	2	10	0	5	0
		5550	17	5547	0	5	2	3	0	6	0
MacGillivray's Warbler	2006	5510	3	5516	1	11	9	6	0	9	0
		5549	7	5546	0	5	3	8	0	10	0
		5550	6	5547	2	0	0	15	5	6	4
	2007	5510	3	5516	0	9	4	9	0	2	1
		5549	5	5546	0	16	1	12	0	2	1
		5550	4	5547	0	5	5	5	0	6	1

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Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Mountain Bluebird	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Mountain Chickadee	2006	5510	0	5516	0	0	0	0	4	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	3	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Northern Waterthrush	2006	5510	1	5516	1	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	1
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	1	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	1	1	0	1	0
		5550	0	5547	4	0	0	0	0	0	0
Orange-crowned Warbler	2006	5510	5	5516	1	5	3	7	3	5	1
		5549	2	5546	0	4	2	5	2	7	0
		5550	12	5547	3	10	3	5	4	10	2
	2007	5510	5	5516	0	11	1	10	1	7	1
		5549	8	5546	0	9	7	6	0	10	0
		5550	6	5547	0	4	2	3	0	4	2
Olive-sided Flycatcher	2006	5510	0	5516	1	0	0	0	1	1	1
		5549	1	5546	0	0	0	0	1	2	0
		5550	0	5547	0	0	0	1	0	0	3
	2007	5510	0	5516	0	0	0	0	4	0	4
		5549	1	5546	0	0	0	0	2	0	1
		5550	0	5547	0	0	0	0	0	0	4
Pine Grosbeak	2006	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	1	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Pine Siskin	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	1	0	0	0	0
		5549	0	5546	1	0	0	0	7	0	0
		5550	1	5547	1	0	0	0	0	0	1

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Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Pacific-slope Flycatcher	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Purple Finch	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	1	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Red-breasted Nuthatch	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Ruby-crowned Kinglet	2006	5510	0	5516	0	2	1	0	8	0	2
		5549	3	5546	5	1	1	0	0	0	2
		5550	2	5547	0	0	0	0	1	0	5
	2007	5510	0	5516	3	0	0	0	1	0	0
		5549	0	5546	1	0	1	0	0	0	3
		5550	0	5547	5	0	0	0	0	0	0
Red Crossbill	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Savannah Sparrow	2006	5510	5	5516	0	0	1	2	0	5	0
		5549	0	5546	0	0	3	0	0	1	0
		5550	5	5547	0	0	0	0	0	0	0
	2007	5510	1	5516	0	1	0	0	0	1	0
		5549	0	5546	0	0	1	0	0	0	0
		5550	1	5547	0	1	0	0	0	0	0
Song Sparrow	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	1	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	3
		5549	1	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut control	0 Block	Old-growth control	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
								Outside	Inside	Outside	Inside
Steller's Jay	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Swainson's Thrush	2006	5510	8	5516	21	9	2	6	6	6	1
		5549	10	5546	9	26	14	13	0	8	1
		5550	10	5547	6	19	28	8	11	9	6
	2007	5510	1	5516	4	1	0	2	6	1	1
		5549	7	5546	5	4	9	4	3	0	2
		5550	1	5547	3	6	2	2	2	1	3
Tennessee Warbler	2006	5510	15	5516	3	6	0	3	2	2	0
		5549	3	5546	8	5	3	2	1	4	1
		5550	1	5547	6	12	2	8	4	10	6
	2007	5510	7	5516	2	0	0	0	0	0	0
		5549	6	5546	1	3	8	1	0	7	3
		5550	0	5547	5	3	3	0	0	1	2
Townsend's Solitaire	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Townsend's Warbler	2006	5510	0	5516	35	0	0	0	1	0	0
		5549	0	5546	22	0	0	0	0	0	0
		5550	0	5547	35	0	0	0	1	0	1
	2007	5510	0	5516	30	0	0	0	1	0	0
		5549	0	5546	13	0	0	0	0	0	0
		5550	0	5547	26	0	0	0	0	0	1
Trumpeter Swan	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Varied Thrush	2006	5510	0	5516	6	1	0	0	0	0	0
		5549	1	5546	1	0	0	0	0	0	0
		5550	0	5547	4	0	0	0	0	0	0
	2007	5510	0	5516	2	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	3	0	0	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Warbling Vireo	2006	5510	13	5516	0	3	3	6	5	0	0
		5549	14	5546	0	4	7	6	0	5	0
		5550	5	5547	0	5	10	6	5	11	7
	2007	5510	4	5516	0	2	1	2	1	0	0
		5549	11	5546	0	2	6	6	2	4	1
		5550	4	5547	0	3	3	9	3	9	5
White-crowned Sparrow	2006	5510	0	5516	0	0	1	0	0	4	0
		5549	7	5546	0	0	1	0	0	2	1
		5550	6	5547	0	0	4	0	0	1	0
	2007	5510	0	5516	0	1	2	3	0	3	1
		5549	3	5546	0	0	0	1	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Western Tanager	2006	5510	1	5516	0	0	0	0	0	0	1
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Wilson's Warbler	2006	5510	32	5516	5	53	25	34	16	43	9
		5549	41	5546	6	35	40	38	5	41	7
		5550	35	5547	7	19	23	38	12	43	12
	2007	5510	11	5516	5	27	20	18	11	24	7
		5549	29	5546	2	26	16	31	6	13	4
		5550	29	5547	6	24	10	24	5	27	7
Winter Wren	2006	5510	0	5516	12	0	0	0	0	0	0
		5549	0	5546	9	0	0	0	0	0	0
		5550	0	5547	4	0	0	0	0	0	0
	2007	5510	0	5516	3	0	0	0	1	0	0
		5549	0	5546	3	0	0	0	0	0	0
		5550	0	5547	3	0	0	0	0	0	0
White-throated Sparrow	2006	5510	1	5516	0	0	1	1	0	0	0
		5549	0	5546	0	0	0	1	0	0	0
		5550	0	5547	0	0	0	2	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Western Wood-Pewee	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Yellow-bellied Flycatcher	2006	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2007	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Yellow Warbler	2006	5510	2	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	1	1
	2007	5510	3	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	1	0	0	0
Yellow-rumped Warbler	2006	5510	3	5516	4	0	0	1	2	2	5
		5549	4	5546	7	3	5	7	1	4	3
		5550	3	5547	6	4	1	1	0	1	5
	2007	5510	0	5516	6	1	0	2	5	1	3
		5549	0	5546	6	2	3	0	1	1	3
		5550	0	5547	7	2	3	0	3	0	4
			0	5547	7	2	3	0	3	0	4

Appendix Q. Number of singing bird detections by species, for each control and treatment replicate, in the 1990s and 2000s survey periods, Donna Creek study area.

Species	Year	Block	Clearcut		Old-growth		Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block	control	Block			Outside	Inside	Outside	Inside
Alder Flycatcher	1990s	5510	17	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	1	0
		5550	0	5547	0	0	4	0	2	0	0	0
	2000s	5510	18	5516	0	26	14	18	0	5	0	0
		5549	17	5546	1	11	9	18	0	6	0	0
		5550	20	5547	0	11	2	19	1	16	3	0
American Pipit	1990s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
American Redstart	1990s	5510	2	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	5	5516	0	0	0	1	1	0	0	0
		5549	1	5546	2	0	0	0	0	0	0	0
		5550	0	5547	0	1	0	0	0	4	1	0
American Robin	1990s	5510	3	5516	9	5	12	1	11	4	6	6
		5549	9	5546	7	0	3	1	4	5	4	4
		5550	1	5547	1	3	0	10	10	6	10	10
	2000s	5510	3	5516	0	2	0	2	5	4	3	3
		5549	3	5546	4	2	6	4	0	6	3	3
		5550	2	5547	5	4	6	4	1	3	3	3
Blackpoll Warbler	1990s	5510	0	5516	35	0	0	0	2	0	1	1
		5549	0	5546	39	0	0	0	0	0	0	0
		5550	0	5547	49	0	0	0	0	0	0	2
	2000s	5510	2	5516	3	2	0	0	1	0	0	0
		5549	0	5546	8	0	1	1	2	6	4	4
		5550	1	5547	12	2	2	1	0	0	1	1
Boreal Chickadee	1990s	5510	0	5516	1	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	1	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut			Stub		Tree island treatment		Stub and island treatment	
			control	0	Old-growth control	treatment	treatment	Outside	Inside	Outside	Inside
Bohemian Waxwing	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Brewer's Blackbird	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	1	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Brown Creeper	1990s	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	7	0	0	0	0	0	0
		5550	0	5547	6	0	0	0	0	0	0
	2000s	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	4	0	0	0	0	0	0
Brewer's Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Cassin's Vireo	1990s	5510	0	5516	2	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Cedar Waxwing	1990s	5510	1	5516	1	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Chipping Sparrow	1990s	5510	10	5516	5	10	12	12	25	8	24
		5549	25	5546	4	16	17	7	8	16	9
		5550	4	5547	5	8	10	2	21	20	26
	2000s	5510	26	5516	8	25	28	29	10	27	5
		5549	28	5546	3	20	18	24	3	45	1
		5550	17	5547	6	38	31	18	5	23	3

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut		Old-growth	Clearcut treatment	Stub treatment	Tree island treatment		Stub and island treatment	
			control	Block				control	Block	Outside	Inside
Cape May Warbler	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	3	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Common Raven	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Dark-eyed Junco	1990s	5510	26	5516	25	37	36	25	22	25	13
		5549	36	5546	13	20	20	30	9	26	5
		5550	31	5547	24	29	20	16	17	16	9
	2000s	5510	13	5516	6	18	21	17	5	14	2
		5549	15	5546	11	19	17	15	0	18	4
		5550	24	5547	12	36	22	21	7	18	3
Dusky Flycatcher	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	1	1
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	2	5516	0	8	4	5	1	3	0
		5549	7	5546	0	5	3	4	0	1	0
		5550	20	5547	0	3	1	8	2	7	7
Evening Grosbeak	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	1
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Fox Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	2
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	12	3	8	2	7	0
		5549	2	5546	0	2	0	0	0	0	0
		5550	2	5547	0	0	0	2	0	0	0
Golden-crowned Kinglet	1990s	5510	0	5516	44	0	0	0	0	1	0
		5549	0	5546	49	0	0	0	0	0	0
		5550	0	5547	28	0	0	0	0	0	0
	2000s	5510	0	5516	21	0	0	0	1	0	0
		5549	0	5546	14	0	0	0	0	0	0
		5550	0	5547	15	0	0	1	0	0	0

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Golden-crowned Sparrow	1990s	5510	4	5516	0	2	16	6	4	7	10
		5549	1	5546	0	0	0	0	0	0	0
		5550	7	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	10	6	4	2	17	2
		5549	2	5546	0	0	0	0	0	2	0
		5550	2	5547	0	1	0	0	0	0	0
Gray Jay	1990s	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	1
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Hammond's Flycatcher	1990s	5510	0	5516	3	0	0	0	1	0	0
		5549	0	5546	1	0	0	1	0	0	1
		5550	0	5547	10	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	2	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	3	0	0	0	1	0	2
Hermit Thrush	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	3	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	1	2	1	0
		5549	1	5546	1	1	1	2	0	1	0
		5550	0	5547	6	0	1	0	0	0	0
Least Flycatcher	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	1
	2000s	5510	2	5516	0	0	0	0	0	0	1
		5549	0	5546	0	3	8	2	0	2	0
		5550	1	5547	0	3	0	0	0	0	1
Lincoln's Sparrow	1990s	5510	92	5516	0	52	42	33	12	50	18
		5549	59	5546	0	52	47	50	22	65	12
		5550	71	5547	0	48	46	92	37	40	15
	2000s	5510	8	5516	0	20	20	18	0	17	2
		5549	14	5546	0	5	9	14	1	11	0
		5550	30	5547	0	19	5	14	0	19	1
MacGillivray's Warbler	1990s	5510	13	5516	5	7	0	1	4	0	3
		5549	12	5546	0	0	3	8	4	2	5
		5550	1	5547	2	1	6	4	15	7	9
	2000s	5510	6	5516	1	20	13	15	0	11	1
		5549	12	5546	0	21	4	20	0	12	1
		5550	10	5547	2	5	5	20	5	12	5

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Mountain Bluebird	1990s	5510	0	5516	0	3	0	0	3	0	2
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Mountain Chickadee	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	7	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0
Northern Waterthrush	1990s	5510	0	5516	7	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	5	0	0	0	0	0	0
	2000s	5510	2	5516	1	0	0	0	0	0	0
		5549	0	5546	1	0	1	1	0	1	1
		5550	0	5547	4	0	0	0	0	0	0
Orange-crowned Warbler	1990s	5510	4	5516	0	0	0	2	5	0	1
		5549	0	5546	0	2	0	0	0	0	0
		5550	0	5547	4	0	0	0	1	0	1
	2000s	5510	10	5516	1	16	4	17	4	12	2
		5549	10	5546	0	13	9	11	2	17	0
		5550	18	5547	3	14	5	8	4	14	4
Olive-sided Flycatcher	1990s	5510	0	5516	2	0	0	0	0	0	2
		5549	0	5546	0	0	0	0	0	0	1
		5550	0	5547	1	0	0	0	0	0	3
	2000s	5510	0	5516	1	0	0	0	5	1	5
		5549	2	5546	0	0	0	0	3	2	1
		5550	0	5547	0	0	0	1	0	0	7
Pine Grosbeak	1990s	5510	0	5516	8	0	0	0	3	1	2
		5549	0	5546	2	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0
	2000s	5510	0	5516	1	0	0	0	0	0	0
		5549	0	5546	0	1	0	0	0	0	0
		5550	1	5547	0	0	0	0	0	0	0
Pine Siskin	1990s	5510	1	5516	5	0	5	0	17	1	10
		5549	0	5546	6	1	1	0	1	0	3
		5550	1	5547	2	0	0	0	0	0	6
	2000s	5510	0	5516	0	0	1	0	0	0	0
		5549	0	5546	1	0	0	0	7	0	0
		5550	1	5547	1	0	0	0	0	0	1

Donna Creek Breeding Bird Monitoring

Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Pacific-slope Flycatcher	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	2	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Purple Finch	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	1	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Red-breasted Nuthatch	1990s	5510	0	5516	14	0	0	0	13	0	5
		5549	0	5546	17	0	0	0	0	0	1
		5550	0	5547	15	0	0	0	1	0	2
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Ruby-crowned Kinglet	1990s	5510	0	5516	16	0	0	0	22	0	3
		5549	0	5546	23	0	0	0	0	0	0
		5550	0	5547	16	0	0	0	0	0	0
	2000s	5510	0	5516	3	2	1	0	9	0	2
		5549	3	5546	6	1	2	0	0	0	5
		5550	2	5547	5	0	0	0	1	0	5
Red Crossbill	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Savannah Sparrow	1990s	5510	58	5516	0	19	9	4	4	16	4
		5549	16	5546	0	52	45	8	1	9	0
		5550	48	5547	0	11	12	28	4	12	0
	2000s	5510	6	5516	0	1	1	2	0	6	0
		5549	0	5546	0	0	4	0	0	1	0
		5550	6	5547	0	1	0	0	0	0	0
Song Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	3
		5549	1	5546	0	0	0	0	0	1	0
		5550	0	5547	0	0	0	0	0	0	0

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Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Steller's Jay	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Swainson's Thrush	1990s	5510	0	5516	29	0	0	0	12	0	4
		5549	0	5546	29	0	0	0	1	0	2
		5550	0	5547	15	0	0	0	2	0	3
	2000s	5510	9	5516	25	10	2	8	12	7	2
		5549	17	5546	14	30	23	17	3	8	3
		5550	11	5547	9	25	30	10	13	10	9
Tennessee Warbler	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	1	0	0	0	0	0	0
	2000s	5510	22	5516	5	6	0	3	2	2	0
		5549	9	5546	9	8	11	3	1	11	4
		5550	1	5547	11	15	5	8	4	11	8
Townsend's Solitaire	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Townsend's Warbler	1990s	5510	0	5516	92	0	0	0	3	0	0
		5549	0	5546	99	0	0	0	1	0	1
		5550	0	5547	65	0	0	0	2	0	2
	2000s	5510	0	5516	65	0	0	0	2	0	0
		5549	0	5546	35	0	0	0	0	0	0
		5550	0	5547	61	0	0	0	1	0	2
Trumpeter Swan	1990s	5510	2	5516	0	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	1	2	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Varied Thrush	1990s	5510	0	5516	18	0	0	0	2	0	1
		5549	0	5546	1	0	0	0	0	0	0
		5550	0	5547	2	0	0	0	0	0	0
	2000s	5510	0	5516	8	1	0	0	0	0	0
		5549	1	5546	2	0	0	0	0	0	0
		5550	0	5547	7	0	0	0	0	0	0

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Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Warbling Vireo	1990s	5510	11	5516	4	0	0	1	5	0	1
		5549	0	5546	1	0	0	0	0	0	1
		5550	0	5547	1	0	0	0	1	0	0
	2000s	5510	17	5516	0	5	4	8	6	0	0
		5549	25	5546	0	6	13	12	2	9	1
		5550	9	5547	0	8	13	15	8	20	12
White-crowned Sparrow	1990s	5510	3	5516	0	2	4	1	2	1	1
		5549	4	5546	0	0	0	0	0	1	0
		5550	1	5547	0	0	1	0	1	1	0
	2000s	5510	0	5516	0	1	3	3	0	7	1
		5549	10	5546	0	0	1	1	0	2	1
		5550	6	5547	0	0	4	0	0	1	0
Western Tanager	1990s	5510	0	5516	0	0	0	0	0	0	2
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	1	5516	0	0	0	0	0	0	1
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Wilson's Warbler	1990s	5510	16	5516	25	10	19	17	47	8	30
		5549	43	5546	23	2	0	14	20	2	21
		5550	2	5547	20	5	6	8	34	5	49
	2000s	5510	43	5516	10	80	45	52	27	67	16
		5549	70	5546	8	61	56	69	11	54	11
		5550	64	5547	13	43	33	62	17	70	19
Winter Wren	1990s	5510	0	5516	26	0	0	0	0	0	0
		5549	0	5546	8	0	0	0	3	0	0
		5550	0	5547	15	0	0	0	0	0	0
	2000s	5510	0	5516	15	0	0	0	1	0	0
		5549	0	5546	12	0	0	0	0	0	0
		5550	0	5547	7	0	0	0	0	0	0
White-throated Sparrow	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	1	5516	0	0	1	1	0	0	0
		5549	0	5546	0	0	0	1	0	0	0
		5550	0	5547	0	0	0	2	0	0	0
Western Wood-Pewee	1990s	5510	0	5516	0	0	0	0	7	1	6
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	3	0	0	0	1	0	2
	2000s	5510	0	5516	0	0	0	0	1	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0

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Species	Year	Block	Clearcut	0	Old-growth	Clearcut	Stub	Tree island treatment		Stub and island treatment	
			control	Block	control	treatment	treatment	Outside	Inside	Outside	Inside
Yellow-bellied Flycatcher	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
	2000s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	0
		5550	0	5547	0	0	0	0	0	0	0
Yellow Warbler	1990s	5510	0	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	0	0	0	1
		5550	0	5547	0	1	0	0	0	0	0
	2000s	5510	5	5516	0	0	0	0	0	0	0
		5549	0	5546	0	0	0	1	0	0	0
		5550	1	5547	0	0	0	0	0	1	1
Yellow-rumped Warbler	1990s	5510	10	5516	35	5	9	1	50	6	32
		5549	7	5546	39	1	7	0	14	5	13
		5550	1	5547	57	3	6	2	15	2	23
	2000s	5510	3	5516	10	1	0	3	7	3	8
		5549	4	5546	13	5	8	7	2	5	6
		5550	3	5547	13	6	4	1	3	1	9