5-1995

Maintaining Bird Diversity in Western Larch/Douglas-fir Forests

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in W. C. Schmidt and K. J. McDonald (compilers) Ecology and management of Larix forests: a look ahead. USDA For. Serv. Gen. Tech. Rep. INT-GTR-319, Ogden, UT.

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Abstract—Bird occurrences were evaluated under four stand conditions in western larch/Douglas-fir forests: clearcut, partial cut, unlogged (fragmented), and contiguous forest. Frequencies were noted for foraging guilds, tree gleaners, flycatchers, nesting guilds, tree drillers, and primary cavity nesters. Managers should consider a diversity of habitat conditions if maintaining habitat for bird species is an objective.

We studied the influence of tree harvests on the community of birds inhabiting a western larch (*Larix occidentalis*)/Douglas-fir (*Pseudotsuga menziesii*) forest on Coram Experimental Forest in northwestern Montana (Tobalske and others 1991). We evaluated bird occurrences under four stand conditions: clearcut, partial cut, unlogged (fragmented), and contiguous forest. There were five clearcuts ranging from 14 to 35 acres (6 to 14 ha). The largest partial cut unit was 70 acres (28 ha), and eight others ranged between 5 and 40 acres (2 and 16 ha). Fragmented forest consisted of 330 acres (134 ha) interspersed with the clearcuts and partial cuts. Contiguous forest was 837 acres (339 ha) in the Coram Research Natural Area.

The most recent harvest, a seed-tree and overstory removal, occurred in the winter of 1988 to 1989. The cut units were initially harvested from 1942 to 1944. Based on guidelines for the management of cavity-nesting birds in McClelland and Frissell (1975), snags of all tree species, along with living paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and black cottonwood (*P. trichocarpa*), were retained in the cutting units during the recent harvest.

During the breeding season, between June 1 and July 7 each year (1989-1991), the senior author of this paper censused bird populations with fixed-point counts, 328 ft (100 m) in radius. Counts were performed at 10 randomly selected points within each of the four stand conditions in the study area. Each point was visited 3 days each year. Counts were done between one-half hour after sunrise and 10 a.m., for ten minutes each. Species detections were by sight or sound, including birds in flight over the plot.

The guidelines of the Ocular Method in Hahn and Jensen (1987) for sampling vegetation were followed. Tobalske sampled vegetation once each year during July at 10 points in each stand condition selected for bird censusing. Tobalske observed 56 bird species. For analysis, species were grouped into guilds (Diem and Zeveloff 1980) based upon shared nesting or foraging habits (table 1). To test the effect of stand condition and year upon the relative abundance of each guild, we used two-way analysis of variance (ANOVA) (SPSS Inc. 1990). Likewise, two-way ANOVA was used to examine variance in vegetation components (table 2). Statistical significance in all tests was $P < 0.05$, employing the Bonferroni adjustment to control for experiment-wise error rate (SPSS Inc. 1990). Differences among means were tested for significance using the Scheffe method (SPSS Inc. 1990).

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RESULTS

Among foraging guilds, foliage foragers were less abundant in clearcuts than in other stand conditions (table 1). Tree gleaners were least abundant in clearcuts and partial cuts. In contrast, flycatchers were most abundant in clearcuts, and ground foragers were most abundant in clearcuts and partial cuts. Among nesting guilds, conifer-tree nesters were significantly less abundant in clearcuts. The ground nesting guild was most abundant in harvested areas.

In spite of their dependence upon trees for foraging and nesting, the abundance of tree drillers and primary cavity nesters (essentially woodpeckers) did not differ among stand conditions. Keeping cutting units relatively small and reserving western larch snags along with living paper birch and quaking aspen (McClelland and Frissell 1975) appeared to mitigate the effects of extensive tree removal for at least one woodpecker in these guilds: the red-naped sapsucker (*Sphyrapicus nuchalis*) (Tobalske 1992).

Several vegetation components differed among stand conditions (table 2). Tree cover was least in clearcuts, intermediate in partial-cut units, and highest in contiguous forest. Tree basal area and average d.b.h. was least in harvested areas. Total shrub cover was least in clearcuts and partial cuts. Total forb cover was highest in contiguous forest.

MANAGEMENT RECOMMENDATIONS

If maintaining habitat for bird species is a management objective in western larch/Douglas-fir forest, we suggest that diversity in habitat conditions will promote diversity of bird species because patterns of relative abundance vary among guilds (table 1) and among species within guilds (Tobalske and others 1991).

Tree-dependent bird species, such as foliage foragers and conifer-tree nesters may be most sensitive to clearcutting. The foliage foraging guild is the largest within

Table 1—Mean number of birds, by guilds, counted per census point within the four stand conditions at Coram Experimental Forest, 1989-1991.

		Stand condition				
Guild[1]	**Number of species**	**Clearcut[2]**	**Partial cut[2]**	**Fragmented forest**	**Contiguous forest**	**Probability[3]**
Foraging						
Foliage forager	26	2.4[A]	5.2[B]	4.8[B]	5.1[B]	0.001
Flycatcher	5	0.9[A]	0.3[B]	0.1[B]	0.0[B]	.001
Tree driller	4	0.8	0.6	0.7	1.1	.242
Tree gleaner	5	0.6[A]	1.1[AB]	1.5[BC]	2.0[C]	.001
Ground forager	15	3.7[A]	3.0[AB]	1.8[BC]	1.6[C]	.001
Total	55					
Nesting						
Conifer tree	10	0.9[A]	2.6[B]	2.5[B]	2.8[B]	.001
Conifer or broadleaf tree	11	1.7	2.4	2.1	2.2	.859
Shrub or small tree	10	1.6[A]	1.6[AB]	1.0[AB]	0.8[B]	.001
Primary cavity	5	1.0	0.8	0.8	1.3	.154
Secondary cavity	10	1.4	1.2	1.5	2.0	.110
Ground	9	1.7[A]	1.7[A]	0.9[B]	0.5[B]	.001
Total	55					

[1]Guilds adapted from Diem and Zeveloff (1980).
[2]Snags of all species and living paper birch left standing where possible.
[3]Low probability values indicate significantly different means among stand conditions, Bonferroni adjusted to control for experimentwise error; superscript letters group similar means for each guild (SPSS Inc. 1990).

Table 2—Estimates of vegetation components within each of the four stand conditions at Coram Experimental Forest, 1989-1991.

	Stand condition				
Vegetation component	**Clearcut[1]**	**Partial cut[1]**	**Fragmented forest**	**Contiguous forest**	**Probability[2]**
Tree basal area (ft^2/acre)	7[A]	35[A]	111[B]	104[B]	0.001
Tree d.b.h. of dominant tree (inches)	3[A]	7[A]	14[B]	15[B]	0.001
Tree total cover (percent)	2[A]	24[B]	59[C]	66[C]	0.001
Pole and larger (percent)	1[A]	19[B]	45[C]	49[C]	0.001
Sapling (percent)	1[A]	5[A]	13[B]	13[B]	0.001
Seedling (percent)	0	1	2	3	0.240
Shrub total cover (percent)	17[A]	40[AB]	44[B]	44[B]	0.001
Tall[3] (percent)	0[A]	8[AB]	9[AB]	12[B]	0.000
Mid[3] (percent)	13[A]	25[B]	28[B]	18[AB]	0.012
Low[3] (percent)	3[A]	7[AB]	12[B]	13[B]	0.001
Graminoid total cover (percent)	9	10	4	4	0.288
Forb total cover (percent)	19[A]	16[A]	35[AB]	44[B]	0.001

[1]Tree snags of all species and living paper birch trees were left standing where possible.
[2]Low probability values indicate significantly different means among stand conditions, Bonferroni adjusted to control for experimentwise error (SPSS Inc. 1990); superscript letters group similar means for each vegetation component.
[3]Tall shrub, >10 ft (3 m); midshrub, 2 to 10 ft (0.6 to 3 m); low shrub, <2 ft (0.6 m) (Hahn and Jensen 1987).

the community of western larch/Douglas-fir forest birds, accounting for 47 percent of the total number of species we observed. Therefore, this guild may be of particular interest to forest managers. If it is desirable to maintain habitat for foliage-foraging birds within harvested stands, we recommend using partial cuts rather than clearcuts (table 1).

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Siberian Larch (*Larix sibirica* Ledeb.): a Successful Exotic in Finland

Anneli Viherä-Aarnio and Teijo Nikkanen

Native tree species in Finland number low because of the harsh climatic conditions and the relatively late cessation of the glacial period in Northern Europe. Only a few economically important species exist: Scots pine (*Pinus sylvestris* L.), Norway spruce (*Picea abies* L. Karst.), and the birches, European white birch (*Betula pendula* Roth), and pubescent birch (*Betula pubescens* Ehrh.).

Siberian larch (*Larix sibirica* Ledeb.) has been introduced to provide more variation to this scanty species composition, and it is the best known and the most promising exotic in Finland. Although it has been cultivated for more than a hundred years, it has not reached a commercially significant scale.

European larch (*Larix decidua* Mill.) has also been cultivated in Finland. However, this species is usually more susceptible to larch canker and its stem quality is worse than its Siberian relative.

NATURAL RANGE OF SIBERIAN LARCH

The natural range of Siberian larch is wide, covering Northeastern Russia and Western Siberia. The western most natural stands of Siberian larch grow only about 200 km to the east of Finland. Within its natural range Siberian larch contains a lot of geographical variation. For instance, populations growing to the west of the River Ob are sometimes regarded as a separate species, *L. sukaczewii* Dylis.

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THE FAMOUS RAIVOLA PROVENANCE

Larch timber used to be a highly desired raw material for shipbuilding. When creating the Russian navy, Czar Peter the Great decided to establish larch stands in Karelia, close to St. Petersburg. During the subsequent reign of Czarina Anna, the Raivola larch forest was indeed started, in 1738. This famous forest became the most magnificent stand in Northern Europe and one of the most remarkable forest cultures in the whole of Europe. The volume of the stand in some places exceeded 1,000 m^3 per ha, and many trees were more than 40 m high.

The seed used for the Raivola stand originated from Archangel, Northeastern Russia. Supplementary planting and seeding was done with seed from Ufa, in the southern part of the Ural Mountains. Thus, seed collected today from the Raivola stand is probably of provenance hybrid origin.

The Raivola provenance has been the most successful of all Siberian larch provenances tested in both the southern and northern parts of Finland. In addition, it has even proved to be the best in reforestation trials in Northeastern Iceland, thus showing a surprisingly wide ecological tolerance.

CULTIVATION IN FINLAND

The good growth and quality of the Raivola stand inspired foresters to plant Siberian larch in Finland at the end of the 19th century. As a result, several promising stands were created in different parts of the country. Larch stands were subsequently established in the 1930's. Interest in the cultivation of larch arose again in the 1950's, especially in Northern Finland. However, a considerable number of the stands established at that time failed because seed of unsuitable origin from Krasnojarsk had been