

# Effects of logging on guild structure of a forest bird community in West Virginia

*Management options which alter vegetative structure will affect all guilds within the bird community*

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## INTRODUCTION

THE SPECIES COMPOSITION of a bird community is dependent upon many factors, and within any given geographic area, vegetation structure may be the most important of these factors. The complexity of vegetation, as determined by horizontal patchiness and vertical stratification, will affect the number and types of birds present. Also, vegetation provides requirements for nesting, shelter, and food procurement, that are necessary for bird survival. It is to be expected, therefore, that changing the vegetation structure will create different survival factors, and cause the bird community composition to alter.

Different types of logging operations cause different kinds of changes in vegetation structure. The alterations may be severe when clearcut methods are employed, and more subtle when selection cuts are used. Even within these two broad categories the degree of vegetation alteration varies. Commercial clearcuts normally leave standing saplings smaller than merchantable size, thus creating a shrub-sapling community. Deforestation-type clearcuts remove essentially all woody vegetation and return the area to earlier stages of secondary succession. Selection cuts vary in percentage of trees removed because there are many criteria for tree removal (e.g., tree diameter, tree species, desired residual tree community composition).

The influence of vegetation structure on bird communities can be studied by comparing areas treated with different logging methods and intensities. One way to study the changes in bird community composition in areas with altered

and different vegetation structure, is to consider foraging guilds. We report here on changes in the guild structure of bird communities inhabiting areas where vegetation structure has been altered by logging.

## STUDY AREAS AND METHODS

BIRDS WERE CENSUSED during the breeding seasons of 1977 and 1978 and their foraging behavior observed in 1978 in the Fernow Experimental Forest, Tucker Co., West Virginia. The area, of approximately 8991 hectares, is maintained by the Forest Service as part of the Parsons Timber and Watershed Laboratory. The entire forest was logged between 1903 and 1911 and has since regrown, with certain areas being experimentally logged by the Forest Service. Six areas were selected for this study. The first, which serves as a control, has been left undisturbed since the early 1900s (No. 5 in Table 1). Four areas (Nos. 1-4) represent post-clearcut stages from an open field with dense herbaceous vegetation to a 20 year-old pole-timber stage. Two of these 4 areas have received herbicide treatments. One area has been extensively treated with herbicides, severely retarding regrowth. This area appears similar to a recent clearcut, but with less exposed slash and more extensive ground vegetation. The other area was also treated with herbicides early in its history but has been left to grow for approximately 8 years. The sixth area studied (No. 6) was an individual tree selection cut, last cut in 1968.

In the early stages of regrowth, trees such as Fire Cherry (*Prunus pensylvanica*), Black Locust (*Robinia pseudoaca-*

*cia*), Sassafras (*Sassafras albidum*), and Staghorn Sumac (*Rhus typhina*) dominated our study areas. The vegetation in these early stages was horizontally homogeneous and had little vertical stratification. Mid-stage areas had the same tree species, with the addition of Red Maple (*Acer rubrum*) and Black Cherry (*P. serotina*). These areas had more vertical stratification and openings, creating a more patchy habitat. The mature forest, dominated by Red Maple, Red Oak (*Quercus rubra*) and American Beech (*Fagus grandifolia*) was more stratified and complex. The selection cut area appeared much like the mature forest except that removal of trees had created a patchy habitat and increased the shrub layer.

Birds were censused using a modified Emlen method (Emlen, J.T. *Auk* 88:323-342, 1971) with a 30m wide belt transect (15m on each side of the transect path). We believe that virtually all birds within this belt were detected either by sight or song and yet the census transect was not so restrictive so as to eliminate uncommon species. Transects were walked at approximately the same time each morning (0600 to 0730 hrs) with approximately the same number of visits (6-8) to each watershed each year. Census data are used as frequency of detection of each species. The foraging behavior observed for a given individual bird was classified according to type (e.g., gleaning, hovering, flycatching), location of act (e.g., trunk of tree, branch, leaf), position in vegetation (e.g., height, distal or proximal to trunk), and tree species group (e.g., oak, maple).

**Table 1. Distribution of species and foraging guilds in 6 areas which received different logging treatments.**

	Area No.	Clearcut regrowth <sup>a</sup>				Mature forest	Selective logging
		1	2	3	4	5	6
<b>Foliage Gleaners</b>							
Cedar Waxwing		- <sup>b</sup>	-	+			
White-eyed Vireo		-	-	+	-		
Prairie Warbler		+	-				
Chestnut-sided Warbler		+	+	+	-		-
Yellow-breasted Chat		-	+				
Canada Warbler				-	-		-
Black-capped Chickadee		-	-	-	+	-	-
Red-eyed Vireo		-	+	+	+	+	+
Kentucky Warbler		-	-	+	+	-	+
Hooded Warbler		-	-	-	+	+	+
Rose-breasted Grosbeak		-	-	+	-	-	-
Solitary Vireo					-	-	+
Black-throated Blue Warbler					+	+	+
Black-throated Green Warbler					-	+	+
Scarlet Tanager					+	+	+
Total species		10	10	9	12	9	10
<b>Flycatchers</b>							
Great Crested Flycatcher			-	-	-	-	-
Acadian Flycatcher				-	+	+	+
Least Flycatcher						-	-
Eastern Wood Pewee			-	-		-	-
Blue-gray Gnatcatcher					-	-	-
American Redstart				-	+	+	+
Total species		0	2	4	4	5	4
<b>Bark Foragers</b>							
Downy Woodpecker				-	-	-	-
Hairy Woodpecker						-	-
White-breasted Nuthatch					-	-	-
Black-and-white Warbler					-	-	-
Total species		0	0	1	3	3	3
<b>Ground Foragers</b>							
Brown Thrasher			-				
Gray Catbird		+	+	+	-		-
Wood Thrush		-	+	+	+	+	+
Veery		-	-	-	+		+
Golden-winged Warbler		+	+	-			-
Common Yellowthroat		+	+				
Ovenbird			-	-	-	+	+
Indigo Bunting		+	+				
American Goldfinch		+	-	-			
Rufous-sided Towhee		+	+	+	+	-	-
Field Sparrow		+	+	-			
Song Sparrow		+	-	-			
Total species		10	12	11	5	3	6
Total species guilds		20	24	25	24	20	23

<sup>a</sup> 1 = 0 years after cutting, 2 = 8 years, 3 = 10 years, 4 = 20 years.

<sup>b</sup> '-' = uncommon (less than 3 singing males per 10 ha), '+' = common, blanks denote absence.

## GUILD COMPOSITION

WE DIVIDED THE BIRD community into 4 groups, or guilds, based on observations of foraging behavior. These guilds were: foliage gleaners, flycatchers, bark foragers, and ground foragers. Species in the foliage-gleaning

guild foraged by picking insects off the foliage and supporting structures of woody vegetation or hovering in the air while removing prey from the substrate. Typical species in this guild were Red-eyed Vireo and Chestnut-sided Warbler. The flycatching guild included species which foraged by capturing insects in

midair. American Redstart and Acadian Flycatchers were typical members of this guild. There was some overlap between flycatchers and foliage gleaners in that some of the flycatching species often used the hover technique described above for foliage gleaners. Assignment to the flycatching guild, however, was dependent on a species having been observed flycatching a majority of the time. The bark-foraging guild included species that gleaned the surface of bark or probed under the bark of trees. Since we only observed 4 such species, the most abundant being Downy Woodpecker, we found it unnecessary to further subdivide the guild into probers and gleaners. The ground-foraging guild was composed of species that foraged by gleaned ground vegetation and litter on the forest floor, or probing beneath the litter in search of food. Rufous-sided Towhee and Wood Thrush were common ground foragers.

The prevalence of each of these guilds was different in each of our study areas (Table 1). Most of the bark foragers and flycatchers were common in only one or two areas. There were several species from the foliage-gleaning and ground-foraging guilds that were found in all of our study areas. The impact of logging on the forest bird community is reflected by the changes in these guilds that are discussed below.

## GUILD DYNAMICS

THERE WERE 2 MAJOR differences in foraging guilds that occurred in the bird communities we studied. First, differences existed in the proportion of each community attributable to each guild (Fig. 1). Second, the precise species composition of each guild was different in each study area. These differences can be related to alterations of the vegetation structure owing to logging and herbicide treatment.

### Changes during clearcut regrowth

By comparing the areas representing stages in clearcut regrowth with the mature forest, some trends were evident. Flycatchers and bark foragers made up a greater proportion of bird communities in late (older) regrowth areas than in early (younger) regrowth stages (Fig. 1). Flycatching species may have been absent in early stages because of lack of perch sites or because the types of insects available in early clearcut regrowth were

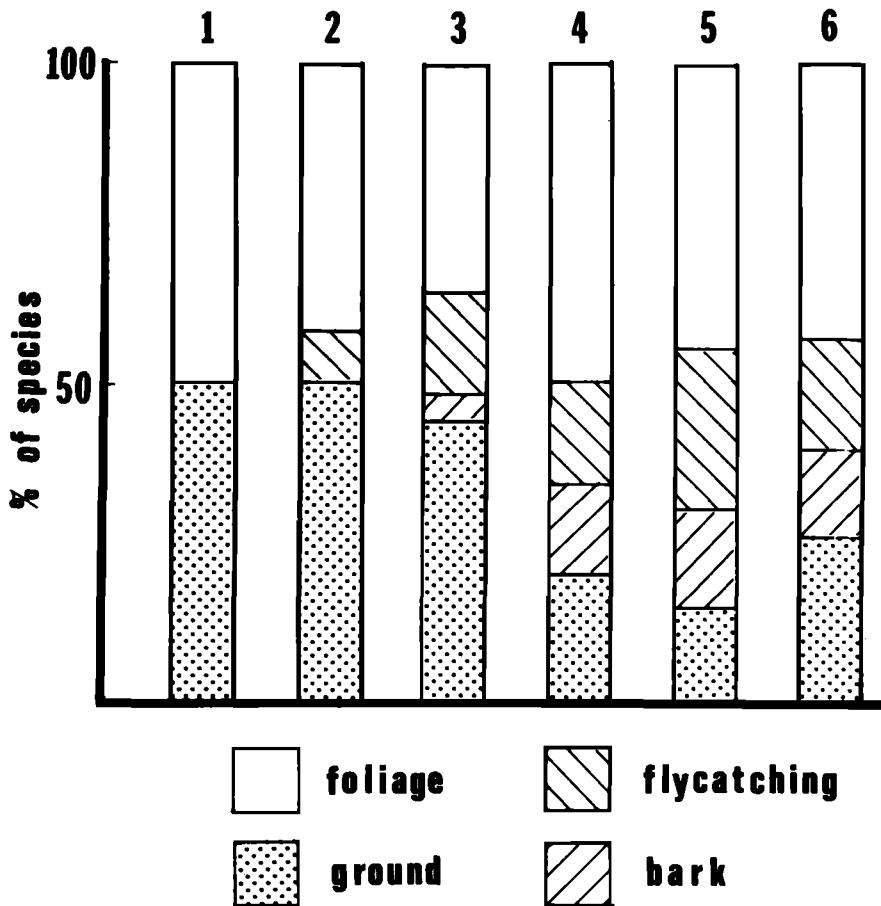


Fig. 1. Percentages of the bird community made up by 4 foraging guilds in 6 forest types. Clear-cut regrowth areas are depicted in bars 1-4 (ages as given in Table 1). Bar 5 represents mature area, bar 6 represents selectively logged area.

unacceptable as prey items. The paucity of bark foragers in early regrowth areas was obviously caused by the lack of larger trees. Percentages of ground foragers decreased with forest age. Apparently, essential habitat requirements were missing in the mature forest.

Different species were found in each guild in each of the study areas. Young regrowth foliage-gleaning species included Prairie Warbler and White-eyed Vireo. In the late stages of regrowth a group of foliage-gleaning species was found that was not present in young regrowth areas. This group included Solitary Vireo and Black-throated Blue Warbler (Table 1). Flycatchers that were found in early regrowth areas were Eastern Wood Pewee and Great Crested Flycatcher, but flycatchers were more common in the mature forest. Downy Woodpecker was the only bark forager encountered in the early regrowth areas. Black-and-white Warbler was present in the pole-timber area but for some reason was not present in the mature forest.

The ground-foraging guild included several species such as Golden-winged Warbler and Field Sparrow that were only found in the early regrowth areas. These species were absent in the forest areas. Ovenbird was the only ground forager that was more abundant in the mature forest than the areas with younger vegetation.

#### Changes due to selective cutting

The differences between the selectively-cut area and the mature forest involved the addition of early-regrowth-adapted species to the mature-forest-adapted species. Three ground-foraging species were present that were not found in the mature forest: Gray Catbird, Golden-winged Warbler and Veery. One bark forager, Black-and-white Warbler, and 2 foliage gleaners, Chestnut-sided Warbler and Canada Warbler, were found in the selective-cut, but not in the mature forest. The percentages of the bird community made up by guilds were

somewhat similar in these 2 areas (Fig.1).

Although several species were added to the bird community in the selection cut area, the number of breeding pairs of all species was lower. In 1977, on 10 hectare plots established in the mature area, there were 102 breeding pairs, and in the selectively cut area there were 86 breeding pairs. It is possible that the early-regrowth-adapted birds found on the selection-cut area were only feeding there, and thus were relatively uncommon and appeared only occasionally in the sample plots.

#### CONCLUSIONS

IN ASSESSING THE IMPACT of habitat alterations on a bird community it is essential to understand what effect altering vegetation structure will have on each functional group within the bird community. As the bird community changes and certain species are lost they are not replaced by new species on a "one for one" basis. Rather as the vegetation structure is altered the relative abundance of each guild in the bird community changes. In addition to inter-guild changes, there are changes intra guilds. Therefore, since purposeful manipulations of the habitat with the intention of favoring a selected species will affect all guilds within the bird community, management options which alter vegetation structure should be assessed from a community perspective.

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