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Movement and Cover-type Selection by Fledgling Ovenbirds (*Seiurus aurocapilla*) after Independence from Adult Care

Henry M. Streby[1,2,3] and David E. Andersen[2]

ABSTRACT.—We used radiotelemetry to monitor movements and cover-type selection by independent fledgling Ovenbirds (*Seiurus aurocapilla*) at two managed-forest sites differing in mature-forest matrix: open-understory deciduous forest and dense-understory mixed-deciduous-conifer forest. Ovenbirds at each site made one to three single-day long-distance movements; those movements were of similar distance at the deciduous site ($\bar{x}$ = 849 ± 159 m) and the mixed-deciduous-conifer site ($\bar{x}$ = 1,133 ± 228 m). They also moved similar mean daily distances within stands at the deciduous site ($\bar{x}$ = 101 ± 12 m) and the mixed-deciduous-conifer site ($\bar{x}$ = 105 ± 11 m), and used areas of similar local vegetation density, but denser than that of their nesting habitat. Fledglings in the deciduous study area selected sapling-dominated clearcuts and forested wetlands over mature forest and shrub-dominated clearcuts. Fledglings in the mixed-deciduous-conifer study area generally used cover types in accordance with availability, and tended not to use shrub-dominated clearcuts. Our results suggest regenerating clearcuts may be important areas for independent fledgling Ovenbirds in landscapes that consist of otherwise contiguous open-understory mature forest, but not until saplings establish in those clearcuts, and not necessarily in forests where dense understory and naturally dense areas such as forested wetlands are common. *Received 3 January 2012. Accepted 26 April 2012.*

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Many bird species that nest in mature forest use other cover types during the time between nesting and fall migration, or the post-fledging period (Anders et al. 1998; Pagen et al. 2000; Marshall et al. 2003; Vega Rivera et al. 2003; Vitz and Rodewald 2006; White and Faaborg 2008; Streby et al. 2011a, b). The post-fledging use of regenerating clearcuts and forested wetlands by mature-forest species (species that breed and nest primarily in mature forest) has been linked to denser vegetation and greater food availability in those cover types (Vitz and Rodewald 2007, McDermott and Wood 2010, Streby et al. 2011a). Survival of fledgling Ovenbirds (*Seiurus aurocapilla*) is positively associated with use of dense understory vegetation and woody debris (King et al. 2006, Streby 2010, Vitz and Rodewald 2010). Ovenbirds from nests near sapling-dominated clearcuts use those stands within days of fledging and experience increased survival compared to fledglings from nests near shrub-dominated clearcuts or in core mature forest

(Streby and Andersen 2011). Fledgling songbird survival is usually lowest during the first few days after fledging (Anders et al. 1997, Berkeley et al. 2007, Rush and Stutchbury 2008, Moore et al. 2010) and variation in fledgling survival can influence population growth as much or more than nest productivity (Streby and Andersen 2011). However, telemetry and banding studies demonstrate use of non-nesting cover types by fledgling mature-forest birds occurs primarily after birds reach independence from adult care (Anders et al. 1998, Vitz and Rodewald 2010, Streby et al. 2011b), a period of relatively high fledgling survival (King et al. 2006, Streby and Andersen 2011).

Most studies describing non-nesting cover type use by mature-forest songbirds have used mist nets to capture birds in regenerating clearcuts and/or forested wetlands (Pagen et al. 2000; Marshall et al. 2003; Vitz and Rodewald 2007; McDermott and Wood 2010; Streby et al. 2011a, b), and relatively few have used radiotelemetry to track movements of individual birds (Anders et al. 1998, Mitchell et al. 2010, Vitz and Rodewald 2010). However, capture data are limited in their utility for estimating the proportion of fledglings that move from mature forest to other cover types, how far birds move to access those stands, how long birds spend in those stands, and whether birds are selecting other cover types over mature forest (i.e., use them disproportionately relative to availability). We used radiotelemetry to monitor movements and cover-type selection by fledgling Ovenbirds after independence from adult care in managed forests of northern Minnesota. Our objectives were to: (1) assess how many fledglings used forested wetlands and regenerating clearcuts of different seral stages (shrub-dominated and sapling-dominated), (2) learn how far birds moved to access those stands, and (3) whether use was in accordance with availability of cover types on the landscape. We conducted this study at two sites similar in landscape cover-type composition, but differing considerably in mature-forest understory density, and assessed whether availability of dense understory vegetation affected use of clearcuts and forested wetlands.

METHODS

Study Area.—We studied Ovenbirds in 2007 and 2008 at two sites in the Chippewa National Forest in north-central Minnesota. Both sites consisted of forested wetlands, lakes, and regenerating clearcuts of different ages interspersed within a matrix of mature forest >50 years of age. The two sites were separated by 25 km, and mature forest stands differed considerably in structure and species composition between the sites; one site was deciduous and the other was mixed-deciduous-conifer forest. Mature forest at our deciduous site was primarily open-understory deciduous forest dominated by sugar maple (*Acer saccharum*), American basswood (*Tilia americana*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), big-tooth aspen (*P. grandidentata*), and red maple (*A. rubrum*). Mature forest at our mixed-deciduous-conifer site ranged from stands dominated by red pine (*Pinus resinosa*) to stands of mixed red pine and deciduous trees. The mature-forest understory at the mixed-deciduous-conifer site was: (1) dominated by dense sugar maple and hazel (*Corylus* spp.), (2) denser than the open understory of the deciduous site, and (3) similar in density to forested wetlands and sapling-dominated clearcuts at both sites (Fig. 1).

Field Procedures.—We attached radio transmitters to nestling Ovenbirds in mature-forest stands at each site and tracked fledglings throughout the post-fledging period. We monitored nests in randomly selected 10-ha nest-search plots, and attached transmitters to 1–2 nestlings in each brood that survived to within 2 days of its expected fledge date. We attached transmitters using a figure-eight harness design for songbirds modified from Rappole and Tipton (1991). Transmitters were 4.3–4.9% of nestling mass at time of attachment, and as low as 3.0% of fledgling mass before fledglings reached independence from adult care. Detailed nest-monitoring, transmitter-attachment, and ground-based telemetry methods are provided in Streby and Andersen (2011). We continued to monitor all fledglings that survived beyond independence from adult care until either the birds were depredated or their transmitters failed. We assumed all birds were independent from adult care 25 days after fledging (Streby and Andersen 2011). A few birds ($n = 3$) were accompanied by adults 26–28 days after fledging but we did not observe them being fed by those adults. The 23 fledglings we monitored were from 23 separate broods, and we assumed their movements were independent of each other. We monitored each fledgling daily (i.e., one location per day) using ground-based telemetry methods. We located birds that moved beyond the range of

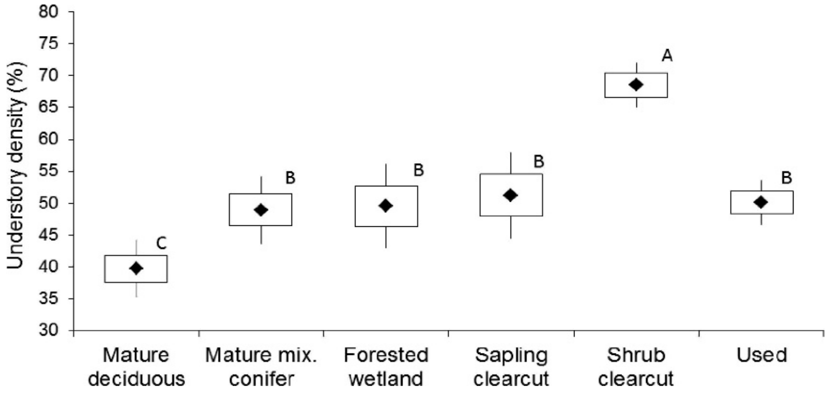

FIG. 1. Understory vegetation density in mature deciduous forests, mature mixed-deciduous-conifer forests, forested wetlands, sapling-dominated clearcuts, shrub-dominated clearcuts, and locations used by Ovenbird fledglings after independence from adult care in northern Minnesota. Density (percent of board obscured) was measured using a profile board at 50 random locations within each cover type and 58 fledgling locations. Diamonds, boxes, and whiskers represent mean, SE, and 95% CI, respectively. Letters represent significantly different groups at $\alpha = 0.05$.

our ground-based telemetry capabilities using a fixed-wing aircraft following standard aerial telemetry methods (Mech 1983). We located birds from the air and communicated those locations via cellular text message (upon landing) to a ground crew, which continued tracking the bird on foot. We ceased monitoring each fledgling when the fledgling died, the transmitter fell off, or the signal was lost and could not be found for 3 days from the ground and after one telemetry flight. We assumed transmitter signals lost during this period were due to transmitter expiration because they were near expected battery expiration dates; we were usually able to recover transmitters after predation events (Streby and Andersen 2011).

We recorded cover type at each fledgling daily location and recorded the location with a hand-held global positioning system (GPS) unit (100 points averaged to improve accuracy). Ovenbird post-fledging habitat use and survival have been associated with use of areas with denser understory vegetation than that of their nesting locations (King et al. 2006), and the fledglings we monitored were within 2-m of the ground during nearly all observations. We used a profile-board method modified from MacArthur and MacArthur (1961) to estimate understory vegetation density at fledgling locations every fourth day (based on logistical constraints) and at random locations within each used cover type. We used a 2×0.25-m board divided into eight, 0.25×0.25-m squares. One investigator held the board vertically (ground to 2 m above ground) while a second investigator stood 10 m in a random direction (azimuths chosen consecutively from an electronically produced list of random numbers between 1 and 360) and estimated the percent of each square obscured by vegetation. We turned the board 90 degrees and repeated the process. We used the mean of 16 estimates (8 from each direction) as a single estimate of understory vegetation density at each location.

We measured straight-line distances between subsequent daily fledgling locations using global information system (GIS) software. We used aerial photographs and cover-type layers (U.S. Forest Service, Chippewa National Forest) in GIS software to measure the proportional availability of cover types within a 5-km radius from the center of each study site. Space available to individual animals is difficult to accurately assess for wild populations (Aebischer et al. 1993). However, increasing or decreasing the radius of our study areas by 1 km, and moving the center of each study area 1 km in each cardinal direction, had little effect ($<2\%$ change for all cover types) on cover-type composition. This method assumes all locations within the study area are available to each individual on all days of the study. Some birds monitored moved ~3 km within 2 days of independence from adult care, and all cover types were present <1 km from any location in our study area, suggesting all cover types were similarly accessible by all birds on all days of the study.

Data Analysis.—We reclassified cover types delineated in U.S. Forest Service cover-type layers into five categories: (1) mature forest, (2) forested wetlands, (3) sapling-dominated clearcuts

TABLE 1. Availability and use of cover types by fledgling Ovenbirds after independence from adult care in sites dominated by open-understory deciduous forest and dense-understory mixed-deciduous-conifer forest in northern Minnesota.

Cover type	Deciduous		Mixed deciduous conifer	
	Available (%)	Used (%)	Available (%)	Used (%)
Mature forest	69	31	58	62
Forested wetland	5	29	27	28
Sapling-dominated clearcut	17	40	7	9
Shrub-dominated clearcut	9	0	8	1

(typically 7–20 yrs after harvest), (4) shrub-dominated clearcuts (typically 1–6 yrs after harvest), and (5) open wetlands and lakes. We did not include open wetlands and lakes in selection analysis because we assumed those cover types were not available to fledgling Ovenbirds. We compared mean daily distances moved by birds at each site with Student's *t*-tests. We compared cover-type use by fledglings to cover-type availability within each study site using compositional analysis (Aebischer et al. 1993) with Program COMPANA in the ADEHABITAT package (Calenge 2006) for Program R. We report the compositional analysis test statistic Λ for random use and associated *P*-value for each test with $P < 0.05$ representing non-random use, or cover-type selection. We compared understory vegetation density among cover types and fledgling locations using Student's *t*-tests. We used a χ^2 test of independence to compare proportions of birds at each site that moved to each cover type in their first long-distance independent movement. Values are presented as ranges or as means ± SE. We considered statistical tests significant at $\alpha = 0.05$.

RESULTS

We tracked 23 independent fledgling Ovenbirds (each from a different nest) from 25 days after fledging (mean age of independence) to 27–51 ($\bar{x}$ = 37) days after fledging. Each fledgling was observed once per day. All fledglings originated from nests in mature forest. We recorded 2–21 ($\bar{x}$ ≈ 11) locations for 12 birds at the deciduous site and 3–16 ($\bar{x}$ ≈ 9) locations for 11 birds at the mixed-deciduous-conifer site. All fledglings we tracked for ≥5 days (n = 20) made 1-day movements ranging from 300 m to 3 km ≤5 days after leaving adult care. Stands occupied after those initial long-distance movements were of different cover types between the two study sites ($\chi^2 = 6.38$, $P = 0.04$). Five (50%) birds at the deciduous site moved to sapling-dominated clearcuts, four (40%) moved to forested wetlands, and one (10%) moved to mature deciduous forest after the first long-distance move. One (10%) bird at the mixed-deciduous-conifer site moved to a sapling-dominated clearcut, three (30%) moved to forested wetlands, and six (60%) moved to mature mixed-deciduous-conifer forest after the first long-distance move. Birds spent 1–10 ($\bar{x}$ = 5) days in these stands following the first long-distance movements before making a second 1-day long-distance movement ranging from 300 m to 6.1 km to subsequent areas where they spent 1–10 ($\bar{x}$ = 4) days before making a third long-distance move. Birds made similar mean long-distance movements at the deciduous site ($\bar{x}$ = 849 ± 159 m) and the mixed-deciduous-conifer site ($\bar{x}$ = 1,133 ± 228 m; $t_{18} = 1.00$, $P = 0.33$). Birds also moved similar mean daily distances within stands at the deciduous site ($\bar{x}$ = 101 ± 12 m) and the mixed-deciduous-conifer site ($\bar{x}$ = 105 ± 11 m; $t_{18} = 0.22$, $P = 0.83$). Only two (10%) birds we tracked for ≥5 days were not observed using sapling-dominated clearcuts or forested wetlands, both at the mixed-deciduous-conifer site.

Birds at the deciduous site selected among cover types ($\Lambda = 0.048$, $P < 0.001$) using sapling-dominated clearcuts and forested wetlands more than mature forest and shrub-dominated clearcuts. Fledglings at the deciduous site used sapling-dominated clearcuts more than twice as much, forested wetlands six times as much, and mature forest less than half as much as expected based on availability (Table 1). Birds at the mixed-deciduous-conifer site also selected among cover types ($\Lambda = 0.272$, $P = 0.005$) using mature forest, sapling-dominated clearcuts, and forested wetlands more than shrub-dominated clearcuts. That result was affected by the disproportionately low use of shrub-dominated clearcuts and, if we excluded that cover type from our analyses, birds at the mixed-deciduous-conifer site generally used all other cover types in accordance with availability ($\Lambda = 0.812$, $P = 0.353$). We observed only one bird on 1 day (0.8% of observations) in a shrub-dominated clearcut at either site despite that cover type constituting 8–9% of the landscape at each site. All fledglings used areas of vegetation density similar to that of forested wetlands, sapling-dominated clearcuts, and mixed-conifer-deciduous forest understory, all of which were denser than the understory of the mature deciduous forests we studied (Fig. 1).

We observed evidence of predation of two (9%) fledgling Ovenbirds that had been independent from adult care for 2 and 10 days, respectively. We attributed both mortalities to Broad-winged Hawks (*Buteo platyperus*) because we tracked and found one fledgling's transmitter in a Broad-winged Hawk nest, and we observed the other fledgling being carried by a Broad-winged Hawk the last day we received a transmitter signal (i.e., we chased the signal distances >500 m several times and each time the signal stopped moving we caught up with the perched hawk). We could not identify the locations of those fledglings when they were initially captured by hawks, but both were observed in mature forest with open understory the day before they were depredated.

DISCUSSION

Independent fledgling Ovenbirds we tracked used non-mature-forest stands as in previous studies (Pagen et al. 2000, Marshall et al. 2003, Vitz and Rodewald 2006). Fledgling Ovenbirds moved long distances (≤ 6.1 km) between areas used during the independent post-fledging period (after independence from adult care but before migration), likely explaining why nestlings banded in mature forest adjacent to clearcuts are rarely among the fledglings captured in those clearcuts (Streby et al. 2011b). Our results are consistent with those of Vitz (2008) who reported that independent fledgling Ovenbirds in Ohio did not use clearcuts more than expected based on availability, but rather used riparian areas, treefall gaps, and mature-forest with dense understory vegetation. Similarly, independent fledgling Blackpoll Warblers (*Setophaga striata*) and Yellow-rumped Warblers (*S. coronata*) moved through riparian areas of river valleys in landscapes where regenerating clearcuts were available (Mitchell et al. 2010). Vitz (2008) suggested regenerating clearcuts may be more heavily used by fledgling Ovenbirds in areas with even-age open-understory mature forest. Fledglings we tracked in deciduous forest with relatively open understory selected sapling-dominated clearcuts and forested wetlands substantially more than mature forest. Birds at our deciduous sites spent several days in and made considerable 1-day movements (≤ 6.1 km) between sapling-dominated clearcuts and/or forested wetlands, apparently moving through mature forest. Birds at the mixed-deciduous-conifer site, where mature-forest understory was relatively dense, made movements of similar distance to those at the deciduous site, but used cover types in accordance with their availability on the landscape with the exception of under using shrub-dominated clearcuts. This suggests resources available in forested wetlands and sapling-dominated clearcuts also are available in mature forests with a dense understory. We observed only one independent fledgling Ovenbird in a recently harvested, shrub-dominated clearcut, consistent with low mist-net capture rates in those stands, which may be related to low food availability despite very dense vegetation (Streby et al. 2011a).

It is important to consider that selection of any cover type over another only suggests relative importance, and information about survival and food availability in those cover types is necessary to make conclusions about their relative value to birds that use them. Survival and food availability in our investigation of habitat use and survival of fledgling Ovenbirds still dependent on adult care were highest in sapling-dominated clearcuts and forested wetlands (Streby 2010). Survival of independent fledglings was too high to compare rates among cover types with our sample size, although the only two mortalities we recorded apparently occurred in mature forest. Regenerating clearcuts can be important areas for fledgling Ovenbirds during the independent post-fledging period, but not until saplings establish, and not necessarily in landscapes in which dense mature-forest understory or forested wetlands are common.

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