Response of Bird Communities to Natural Disturbance

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In addition to providing numerous important ecological functions, bottomland hardwoods provide important habitat for many wildlife species (Harris 1989), particularly many forest interior birds (Hamel and others 1996). National monitoring efforts showed nationwide declines for many forest bird species, including forest-dependent neotropical migrants (Johnston and Hagan 1992). However, our understanding of how these birds respond to natural disturbance is limited.

In forested habitats, canopy gaps created by dying and down trees are conspicuous features that contribute to the natural heterogeneity of forested systems. Microhabitats found in canopy gaps may support greater insect abundance due to increased foliage density and temperature gradients created by higher light intensity (Blake and Hoppes 1986, Smith and Dallman 1996). Some studies have shown that canopy gaps support a higher diversity of bird species than nongap areas (Blake and Hoppes 1986, Levy 1988, Martin and Karr 1986, Schemske and Brokaw 1981). The combination of increased insect abundance (food resources), greater foliage density (increased foraging opportunities, nesting sites, cover from predators), and more extreme temperature regimes (may reduce thermoregulatory costs) (Smith and Dallman 1996) suggests that canopy gaps may be important features affecting avian community abundance, composition, and distribution in forested systems (Blake and Hoppes 1986, Levy 1988, Martin and Karr 1986, Schemske and Brokaw 1981, Smith and Dallman 1996). Yet, conversely, many forest species are sensitive to disturbance (Johnston and Hagan 1992, Martin and Finch 1995). Determining how birds respond to natural disturbance enables production of models of avian response to increased disturbance patterns, such as those created by human activity. These models may help provide management guidelines for timber production and restoration in bottomland hardwood systems.

This study focused on four basic questions about relationships between avian species and canopy gaps in bottomland hardwoods: (1) How does the distribution of canopy gaps affect the abundance, composition, and distribution of breeding and wintering birds on the three study areas for the Southern Forested Wetland Initiative? (2) How does the potential value of canopy gaps as resource patches differ among insectivorous birds that use different foraging strategies (foliage gleaners, aerial flycatchers, and trunk foragers)? (3) To what extent are differences in gap suitability for bird use explained by variations in gap size, age, or structure? and (4) How do avian responses to canopy gaps change seasonally?

Turkey nest in the mixed-oak community.

A sampling grid was established at each of the three Southern Forested Wetlands Initiative study sites, with point-count surveys done at 250-m intervals (Antrobus and others 2000). Repeated count surveys of bird communities were conducted in the breeding and wintering seasons during 1996 through 1998. At each grid point, other pertinent habitat information, e.g., tree species diversity, density and basal area of trees, and canopy cover, was also collected in 0.04-ha circular plots (James and Shugart 1970). Eventually, avian abundance and species diversity metrics will be correlated with the number and distribution of canopy gaps on all three sites.

Figure 2.7 represents a model of the research strategy being used to determine avian community/canopy gap relationships. Community level analyses (fig. 2.7A) are being performed on all three study areas and include correlation analyses of avian community metrics gathered from point-count surveys of canopy gap distribution. Population- (fig. 2.7B) and individual- (fig. 2.7C) level analyses are being performed only on the Cache River study area. The research strategy illustrated in figure 2.7 incorporates issues of scale and allows hypotheses to be tested at the three scales discussed. For example, if a positive correlation with canopy gaps is observed for a focal species based on point-count

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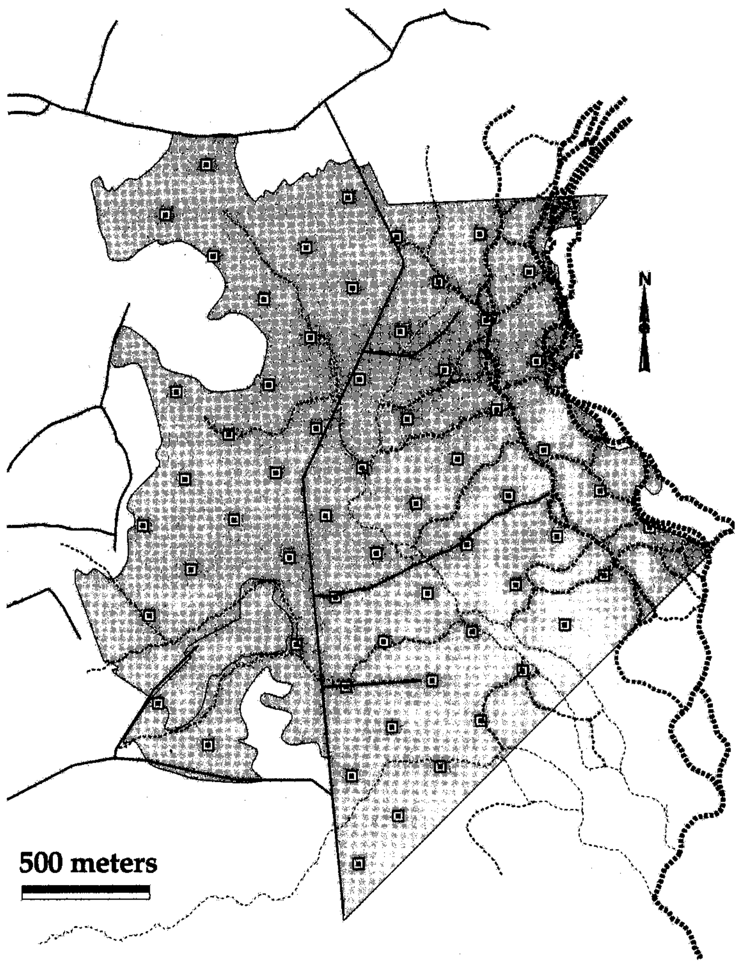

Figure 2.6—The 250-m-interval grid system established on the Coosawhatchie Bottomland Ecosystem Study site.

Table 2.2—Breeding and wintering birds detected on the Coosawhatchie Bottomland Ecosystem Study and two other Southern Forested Wetlands Initiative sites in 1996

Bird species	Coosawhatchie River, SC[a]	Cache River, AR[b]	Iatt Creek, LA[c]	Total observations
Wintering				
Nearctic, migrant	13[d] (452)	16 (111)	15 (307)	19 (870)
Resident	24 (831)	20 (1,413)	20 (757)	28 (3,001)
Total	37 (1,283)	36 (1,524)	35 (1,064)	47 (3,871)
Breeding				
Neotropical, migrant	19 (478)	16 (549)	19 (301)	23 (1,328)
Resident	21 (415)	19 (442)	19 (337)	26 (1,194)
Total	40 (893)	35 (991)	38 (638)	49 (2,522)
Total species	60 (2,176)	54 (2,515)	57 (1,702)	75 (6,393)

[a] 60 sampling points.
[b] 47 sampling points.
[c] 44 sampling points.
[d] Numbers represent total detections of species; numbers in parentheses represent total detections of individuals.

data, one can test the hypothesis that activity area distributions will be correlated with canopy gap distributions at the population level. Furthermore, one can hypothesize that if activity areas are distributed with canopy gaps, individual birds will spend proportionately more time in canopy gaps and will achieve a higher foraging success rate in canopy gap versus nongap areas. Such a research design can test the hypothesis that canopy gaps provide sources of prey refuges important for some bird species, and thus are important in predicting how these species are distributed throughout bottomland hardwood systems.

Community-wide relationships may show positive or negative correlations of avian community metrics with canopy gaps, providing insights into how communities and species respond to natural disturbance. However, positive or negative associations with canopy gaps do not show how birds use gaps or whether gaps are used at all. Using focal species, determining how these species are distributed, and quantifying use of gap and nongap areas can attain a more comprehensive view of avian community/canopy gap relationships. Preliminary analyses indicate that species utilizing a foliage-gleaning foraging strategy tend to use gaps more than nongap areas. Other focal species tend to avoid gap areas and may be sensitive to disturbance. The research design directly addresses issues of scale (*sensu* Wiens 1989) and may provide insights into why specific distribution patterns are observed.

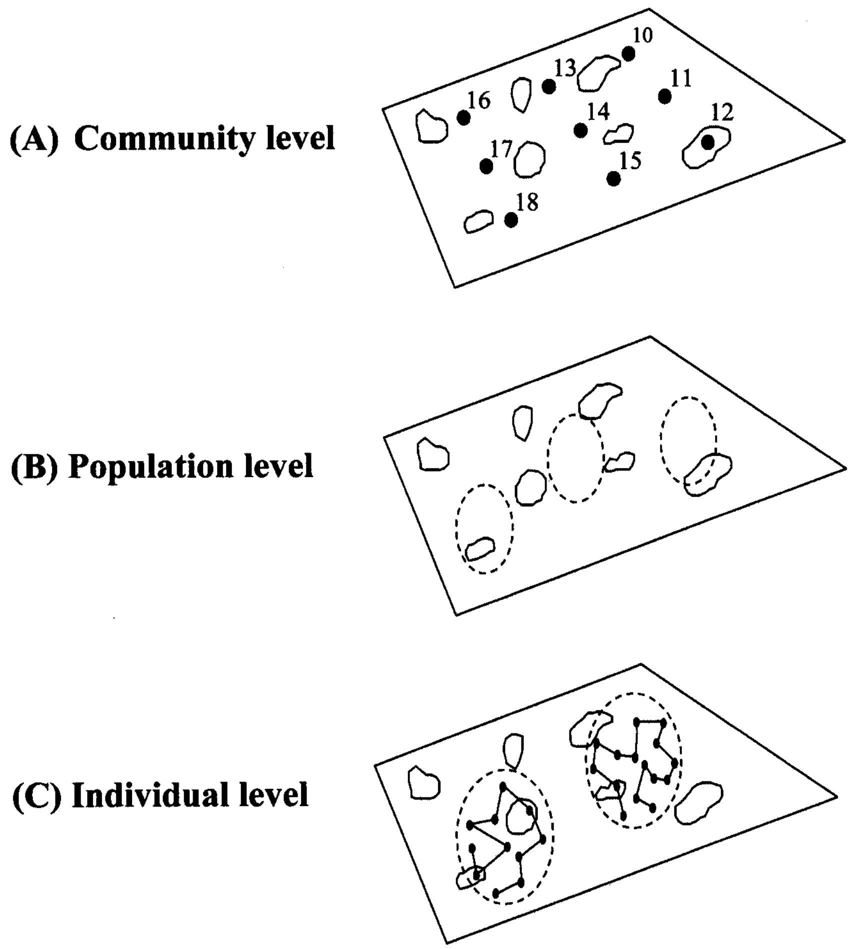

Figure 2.7—Model of the research strategy being used to determine avian community/canopy gap relationships in southern bottomland hardwood forests. In the (A) community level, a hypothetical distribution of gaps (irregular shapes), and site grid points (numbered). In the (B) population level, the hypothetical distribution of gaps is compared with the potential distribution of avian-use areas (dashed ovals). In the (C) individual level, the hypothetical movements of focal-avian species (connected solid lines) within activity-use areas distributed among canopy gaps are compared.