Improving Woody, Early Successional Habitat Patches for Shrubland Birds

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Numbers of birds that breed in early successional forest and shrubland habitats (hereafter referred to as "shrubland birds") have declined substantially in recent decades. Because of these declines, some shrubland birds, such as the prairie warbler and northern bobwhite, are now considered high conservation priority species in North America. Loss of woody, early-successional habitats in the last half-century has been the primary cause of the decline. In many agricultural regions, shrubland has declined as farming practices have changed to create "cleaner" landscapes with less weedy or scrubby vegetation.

Federal and state government sponsored habitat conservation programs have been implemented on private agricultural land across the United States to create habitat for declining wildlife species. Many programs additionally address water quality protection and prevention of soil erosion. As an example, conservation programs associated with the federal Farm Bill have restored millions of acres of farmland to wildlife habitat (Hohman and Halloum 2000). Some program practices, such as the CP33 practice in the Conservation Reserve Program, specifically create and maintain early successional habitat for wildlife. Other practices, such as the CP22 practice, are meant to create mature forest habitat but also provide early succesional habitat in the first 7-15 years of their enrollment period. The habitat created by these programs is critical for conservation of shrubland birds.

Although these conservation programs are widely available and can help improve bird habitat on private lands, the characteristics of the individual habitats created on each property (hereafter, "habitat patches") can vary extensively, and it is likely that not all habitat patches will provide high quality habitat for shrubland birds. The quality of any habitat patch may be influenced by many factors, including its vegetation structure, size and shape, and the quality of the habitat in the surrounding landscape (Moorman and Riddle 2009). The specific way that these factors influence shrubland bird habitat use and breeding productivity within a patch is not well understood. For example, we know that nest predation—an important component of breeding productivity—of many forest and grassland songbirds is often higher at habitat edges, but this phenomenon has not been well-studied for shrubland birds.

To clarify the influence of these factors, we studied shrubland bird habitat use and breeding productivity in habitat patches enrolled in North Carolina's Conservation Reserve Enhancement Program (CREP). This program converts environmentally sensitive cropland and pastureland back to native vegetation. Various conservation practices can be used in the program, including filter strips, riparian buffers, hardwood plantings, and wetland restoration. Though land can be enrolled in this program for long periods (up to 30 years or as a permanent easement), we studied habitat patches still in early successional stages, which have the greatest potential for shrubland bird use.

Our objectives were (1) to determine how patch size, shape, and extent of forest cover in the surrounding landscape affect shrubland bird use of a habitat patch and (2) to determine how shrubland bird nest predation is influenced by habitat patch size, shape, vegetation structure, and extent of agricultural land cover surrounding a patch. Our overall goal was to determine what characteristics of restored, early successional habitat patches might provide the most benefits to shrubland bird populations.

Methods

In 2007 and 2008, we studied CREP habitat patches in 6 northeastern North Carolina counties. All were enrolled as forested riparian buffers (CP22 practice) and had been planted 4 to 7 years prior to our study. The patches were planted with rows of loblolly pine, generally in a 10' x 10' grid. Various species of hardwood trees, most commonly oaks, also were planted in some of the patches but never constituted more than 20% of the total patch area. Patches were generally situated between mature forest habitat and cropland.

To determine shrubland bird habitat use, we surveyed 35 and 43 habitat patches in 2007 and 2008, respectively, for presence-absence of 9 shrubland birds (Fig. 1). The patches ranged in size from 0.7 to 61.5 acres (average = 15.1 acres). For some species, we modeled individual patch occupancy probability (the probability that a species will be found within a given patch) relative to a patch's size, shape, and % forest cover within 1 km of that patch. This allowed us to first determine whether these factors affect a species' occupancy and then which patch sizes, shapes, and landscapes are optimal for those species. If species were area-sensitive (i.e., where occupancy deceases with decreasing patch size), we estimated a minimum patch size requirement (where chance the patch will be occupied = 50%) and an optimal patch size (where chance the patch will be occupied = 90%).

To study nest predation, we monitored nests of five shrubland bird species during the 2007 and 2008 breeding seasons in a subset of 12 habitat patches, ranging in size from 5.4 to 61.5 acres (average = 18.4 acres; Fig. 1). We located and monitored 300 nests in the two years, and we determined whether each nest fledged young or was destroyed by predators. We used this information to model how nest predation rates (measured as daily nest predation [DNP]) differed among nests at variable distances from habitat edges. This information is helpful to determine which patch sizes and shapes will minimize negative edge effects, like increased nest predation near edges. Also, we modeled the effects of % bare ground visible within a patch, a measure of the thickness of the vegetation in the understory, and % agricultural cover types within 2.5 km of a patch, a landscape metric previously demonstrated to influence forest songbird nest predation. We conducted this analysis for nests of all species combined, for field sparrow nests only, and for indigo bunting nests only.

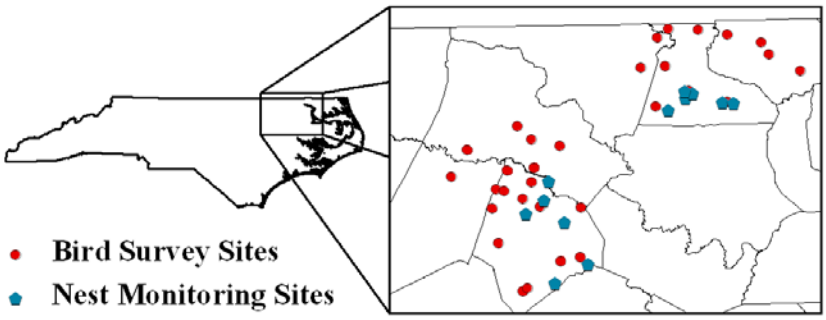

Figure 1. Location of Conservation Reserve Enhancement Program habitat patches studied in northeastern North Carolina (2007 and 2008).

Results

Patch Occupancy

Indigo bunting, field sparrow, and common yellowthroat were present in nearly all patches and brown thrasher was absent from almost all patches, so we did not include any of these species in the patch occupancy analysis. Patch occupancy of two species, prairie warbler and yellow-breasted chat, was lower in smaller patches, indicating that they are area-sensitive. We estimated a minimum patch size requirement and optimal patch size of 5.7 acres and 10.9 acres, respectively, for yellow-breasted chat and 2.7 acres and 13.6 acres, respectively, for prairie warbler (Fig. 2). Patch occupancy of a third species, blue grosbeak, also was lower in small patches that were irregular- or linear-shaped. Shape alone and % forest cover within 1 km of a patch did not appear to influence patch occupancy for any of the species of shrubland birds we studied.

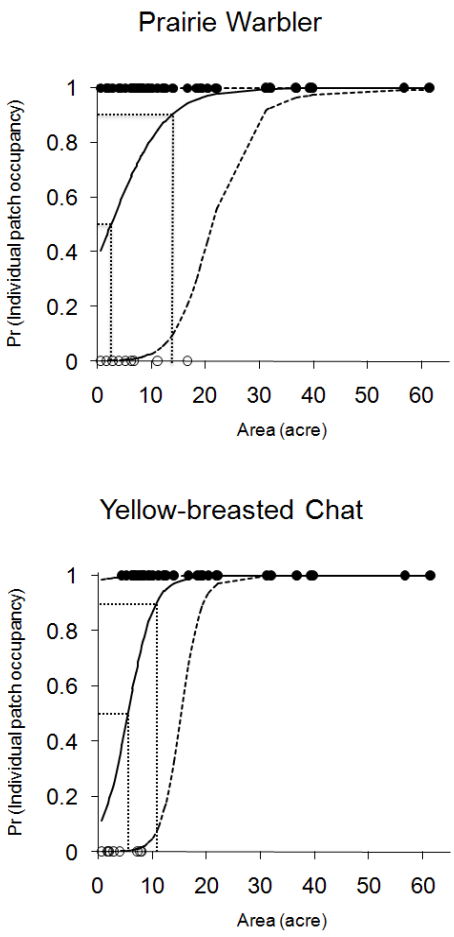

Figure 2. Probability of individual patch occupancy for prairie warbler and yellow-breasted chat (solid lines) and 95% confidence intervals (dotted lines) relative to patch area. Also shown are occurrence data (closed dots = present, open dots = absent) and estimates of minimum patch size requirement (Pr = 0.5) and optimal patch size (Pr = 0.9).

Nest Predation

For all nests combined (regardless of species) nest predation was higher closer to cropland edges. Our model estimates of daily nest predation (DNP) decreased by 25% at 365 ft from the cropland edge (Fig. 3). DNP of all species combined also was higher in patches with higher % bare ground cover and taller saplings, especially in the second year of our study when trees were 12-20 feet tall (i.e., 3.6 to 6 m tall, Fig. 4). We documented little evidence that a nest's distance to mature forest edge or the % of agricultural cover within 2.5 km of a patch influenced nest predation.

Nest predation of field sparrow nests was lower in patches with higher % agricultural cover within 2.5 km. Distance to cropland or mature forest edge and % bare ground cover did not appear to have a strong influence on field sparrow nests, but the trends were similar to those

seen in the all species combined analysis. Predation of indigo bunting nests, though not strongly influenced by any of the variables we modeled, also had trends similar to those in the all species analysis.

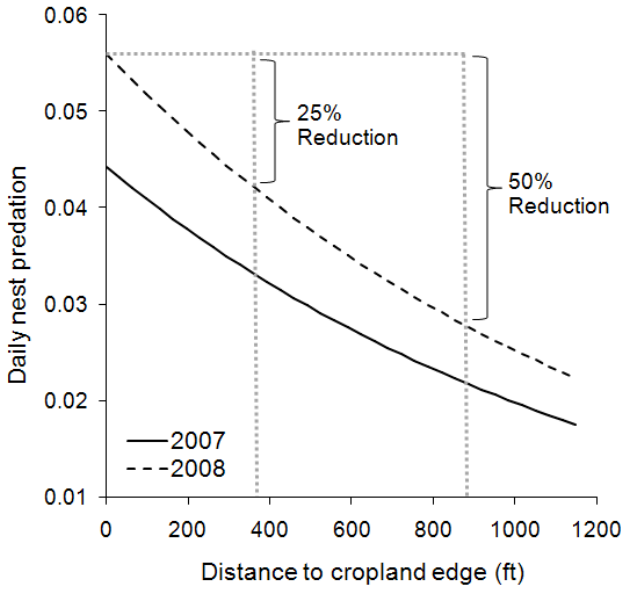

Figure 3. Predicted daily nest predation at varying distances from the cropland edge for 5 shrubland bird species in North Carolina (2007 and 2008).

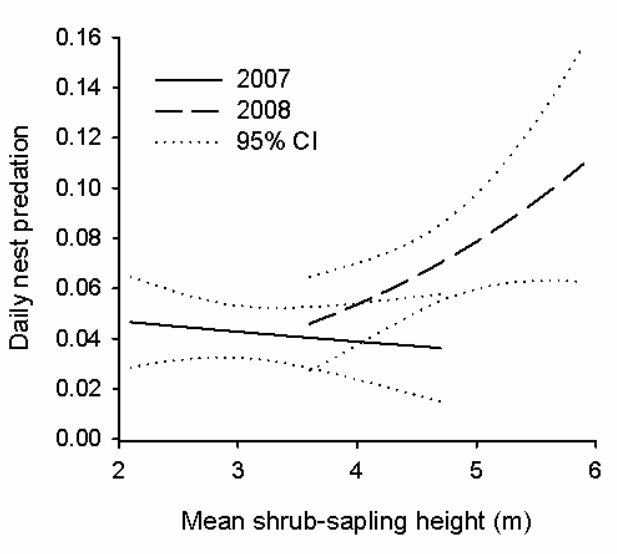

Figure 4. Predicted daily nest predation for 5 shrubland bird species nesting in habitat patches with varying mean shrub-sapling height in North Carolina (2007 and 2008). Conversions from metric: 2 m = 6.56 ft, 4 m = 13.12 ft, and 6 m = 19.68 ft.

Conclusions

The size of a restored habitat patch had a clear effect on use by some shrubland bird species. Two species, prairie warbler and yellow-breasted chat, appear to be area-sensitive, avoiding the smallest patches we studied. Although they will occupy patches as small as 5 acres, the two species are most likely to occupy patches at least 10 acres. The shape of a restored habitat patch also may influence use by blue grosbeaks, which are less likely to occupy small, linear patches.

Predation of shrubland bird nests located further from cropland edges is likely to be lower than those near the edge. We observed an estimated 25% decline in nest predation at approximately 350 ft from cropland edges. The movement and activity patterns of the primary predators of shrubland bird nests in our study area may explain the increased predation at cropland edges. Some species of snakes, medium-sized mammals (e.g., raccoons and opossums), and corvids (e.g., American crows and blue jays)—all common predators of shrubland songbird nests—often concentrate activity and movement along these kinds of habitat edges.

Also, we observed a substantial increase in shrubland bird nest predation in patches where planted trees were getting tall (15-20 ft) and shading out understory grass and herbaceous vegetation. A decrease in understory vegetation likely results in less concealment and alternative nest sites for shrubland bird nests, making them more detectable to nest predators and thus, more readily depredated.

The landscape surrounding a habitat patch did appear to affect predation of field sparrow nests. The cause of this decrease in nest predation in landscapes with higher agricultural cover is unclear, but likely related to differences in relative abundance of certain nest predators in different landscapes. However, because this effect was not equally strong in the other analyses, this result is inconclusive regarding shrubland birds as a whole.

Recommendations for Management of Habitat Patches for Shrubland Birds

Our management recommendations below are for managers and landowners interested in providing high quality habitat for a wide variety of shrubland birds. These recommendations apply best to early successional habitats with woody shrubs or saplings created with the various habitat restoration programs mentioned above. However, they also may be applicable to other woody, early successional habitats of the southeastern United States, like clearcuts or recently burned forests. Some of these recommendations must be planned for when designing the habitat restoration or timber harvest, while others require management actions after the habitat has been created.

To maximize the diversity of shrubland birds using a habitat patch, we recommend that managers:

- Create habitat patches 15 acres or larger. If this is not possible, patches should be at least 6 acres to improve the likelihood that they will be used by shrubland bird species of conservation concern, such as the prairie warbler.

- Avoid habitat patches that are narrow and linear-shaped or that have many irregular edges, especially if they are less than 10 acres.

To reduce nest predation and increase shrubland bird breeding productivity, we recommend that managers:

- Create habitat patches that are sufficiently wide to avoid increased nest predation near cropland edges. For habitats adjacent to cropland, we recommend that patches be at least 350 ft wide.

- Maintain habitat patches with a dense and diverse growth of grasses, herbaceous plants, and low, woody vegetation (e.g., shrubs, tree saplings, and blackberries). For habitats planted with trees, like forested riparian buffers in CREP, consider thinning trees to allow more light into the understory and maintain early successional conditions longer. For some tree species, such as longleaf pine, prescribed fire may be an appropriate tool to maintain early successional conditions for longer periods.

Although more research is necessary to clarify how landscapes influence bird habitat use and breeding productivity, the initial indication from our study and another recently completed in eastern North Carolina is that in these relatively forest-dominated landscapes (usually comprised of only 25-50% cropland), shrubland birds have higher nest success in areas with greater cropland extent.

Though we did not include them in this analysis, northern bobwhite quail might benefit from these patches. Because they use larger areas, bobwhite quail numbers are more influenced by landscape features than by individual patch characteristics. Generally, increasing early successional habitat in a landscape is better for bobwhite quail. However, at the patch level, our recommendation for maintaining dense and diverse ground vegetation is very important for bobwhite quail, because they nest on the ground and need ample cover for their nests and chicks. In addition, diverse plant communities may contain more beneficial food plants (e.g., ragweed, legumes) and higher numbers of insect prey, crucial for chick development.

We acknowledge that these recommendations may not be feasible or desired for all habitat restoration programs, especially for those with primary objectives other than creating habitat for early successional wildlife. For example, a key objective of the CREP forested riparian buffers we studied was to reduce inputs of nonpoint source pollutants. This objective can be achieved by buffers that are much narrower (Osmond et al. 2002) than our recommendation, so this can lead to potential design standard conflicts when deciding between maximizing the protection of more stream miles from upland runoff and providing optimum early successional wildlife habitat.

References

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