Lightning-Season Burning: Friend or Foe of Breeding Birds?

By Jim Cox & Brent Widener

Tall Timbers Research Station & Land Conservancy

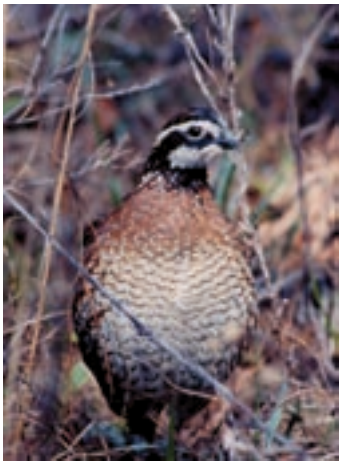
Tall Timbers Research Station Miscellaneous Publication 17

Ron Masters

USFWS

Loggerhead Shrike

Shane Wellendorf



Northern Bobwhite

Ross McGregor

Bachman's Sparrow

USFWS

Wild Turkey

Contents

Suggested citation:

Cox, J. and B. Widener. 2008. Lightning-season burning: friend or foe of breeding birds? Miscellaneous Publication 17, Tall Timbers Research Station, Tallahassee, FL. USA.

The Power of Flight Program created by the Southern Company and the National Fish and Wildlife Foundation protects birds through habitat and species restoration and environmental education. The program focuses on southern birds, such as Bobwhite Quail, the endangered Red-cockaded Woodpecker, American Swallow-tailed Kite, and Bachman's Sparrow. The program has improved quail habitat on more than 37,000 acres across the region as well as habitat for endangered Mississippi Sandhill Cranes, beach-nesting shorebirds, waterfowl, and wading birds. Southern Company has committed $3.3 million in matching funds to the program over 10 years in support of projects that benefit southern birds and their habitats.

Nothing can be more destructive to ground nesting game birds than summer fires…

– Stoddard 1931

(Summer fires)*…are key in restoring and maintaining the herbaceous vegetation so crucial to brood-rearing for species like bobwhite quail and wild turkey.*

– South Carolina Department of Natural Resources 2006

Rose Rodriguez

Summary

For decades, the prescribed fires needed to maintain suitable habitat conditions for pineland birds were applied early in the calendar year (i.e., before April) when cooler temperatures and steady winds prevailed. More recently, some land managers have shifted to burning areas dominated by native forbs and grasses later in the year (e.g., after April) both to increase the acreage treated with fire each year and also in consideration of ecological observations. The shift to burning later in the year has led to concerns about the effects such burns may have on nesting birds.

We reviewed recent research on the effects of "lightning-season" burning on the breeding birds associated with southern pine forests. The threat posed to nesting birds generally is not as severe as perceived, though additional research is needed for several species. Many ground-nesting birds that might be affected by burns prefer to nest in areas that have been burned recently (i.e., within the past 18-24 months), so the number of nests located in areas typically scheduled for lighting-season burns will be small relative to the total number of nests constructed each year. Birds also frequently re-nest following the loss of a nest, and improved habitat conditions created through the application of prescribed fire may improve adult and juvenile survival and effectively offset the loss of a nest. Burns set in May also provide time for nests of some species to fledge but also are early enough to avoid peak nesting activity for Northern Bobwhite. Late-season burning does not pose a threat to nesting birds when it is included as part of a comprehensive burn program and is used to achieve the fire frequencies required to maintain suitable habitat conditions for many pineland birds on large managed areas. For several pineland species that are experiencing steep population declines, the preferred fire frequency is burning every two-to-three years.

Fire: The Force Shaping Southern Forests

Prescribed fire is as important as sunlight, air, and rain for southern pine forests. The slow-moving fires used to manage southern pine forests clear brush, recycle nutrients, and create open conditions where native forbs and grasses flourish. Prescribed fires allow grassland and forest elements to merge in a beautiful park-like setting (Fig. 1) and create conditions where species like Northern Bobwhite, Bachman's Sparrow, and Red-cockaded Woodpecker thrive.

For decades, prescribed fires (Fig. 2) needed to maintain open pinewoods were applied early in the calendar year when cooler temperatures and steady winds prevailed. More recently, some land managers have shifted to burning later in the year – sometimes as late as August -- because research suggests this may have been the time of year when Mother Nature liked to burn.

Some evidence supporting this approach lies in the prolific flowering responses that dominant plants exhibit when fires are conducted after late April in areas with natives forbs and grasses (Fig. 3). Additional evidence comes from the burn scars found on ancient pine stumps (Huffman 2006). These scars recorded fire events prior to extensive European settlement and suggested the fires burning from 1670-1830 occurred later in the calendar year. Finally, wildfires ignited by lightning in Florida from 1995-2001 (Freeman 2004) took place nearly exclusively from May to August, not February to April.

Jim Cox

Figure 1. Southern pine forests that have been burned frequently using a one-to-three year fire interval have a majestic park-like look. This picture shows the Wade Tract, a longleaf pine research area in southwest Georgia.

Ron Masters

Figure 2. A prescribed fire clearing ground vegetation.

More practical considerations also have led some managers to look carefully at *lightning-season burning* (definitions provided to right). First, lightning-season fires can be more effective in restoring grass and forb ground cover in areas where hardwood shrubs and saw palmetto have become a nuisance (Glitzenstein et al. 1995). Second, lightning-season burns create good conditions for natural pine seedling establishment in fall and winter (Hermann et al. 1998; Fig. 4). Seed production for longleaf pine in particular is variable from year to year, and years with good seed crops can be difficult to discern very early in the calendar year. Lightning-season fires also provide the open ground-cover conditions that improve longleaf germination and establishment. Finally and perhaps most important, lightning-season fires provide a broader window within which burns can be conducted, and this could lead to a much-needed increase in the acreage burned each year.

Jim Cox

Figure 3. Wiregrass with flower stalks emerging.

Jim Cox

Figure 4. Established longleaf pine seedlings.

What About Nesting Birds?

Interest in lightning-season burning has not come without controversy (Hermann et al. 1998, Sisson and Speake 1994, Tucker et al. 2004). Prescribed fires set anytime after late February coincide with the nesting season of one or more pineland breeding birds, and bird nests built of dried grasses and twigs (Fig. 5) and placed in shrubs or directly on the ground obviously are no match for fire. At first glance, lightning-season fires appear capable of destroying scores of nests, and concerns about the effect that fires set during the breeding season may have on breeding birds have surfaced on several fronts (Tucker et al. 2004, Tyler 2006).

The situation for breeding birds is much more complex than lightning-season burning being bad or good. In any given year, many nests are lost to snakes, ants, raccoons, heavy rains, drought, cats, opossums, deer, coyotes, dogs, foxes, mice, and heavy equipment -- not fires. Lightning-season burns destroy some nests and obviously have a direct effect on nesting activity, but, unlike the other threats that nesting birds face, lightning-season fires provide clear benefits that have the potential to offset losses in a big way. For example, if lightning-season burns provide a 5% increase in the survival of adults and juveniles as a result of habitat improvements, these increases could offset a 15% reduction in nest productivity attributable to burning.

Season of Fire Terminology

The terms used to describe the season of burning can be confusing. Phrases such as warm and cool season, summer and winter, growing and dormant season, and lightning and non-lightning season are used, but dates defined by these phrases depend on latitude and local conditions. The phrase "lightning-season burning" describes the underlying rationale for burning later in the calendar year because it focuses on natural ignition that can take place when lower humidity and higher thunderstorm activity coincide. In north Florida, for example, the requisite combination of increased thunderstorm activity and low humidity is common in late spring and early summer (Komarek 1964). Further north, appropriate conditions occur at different times and may be bimodal. Because the lightning-season is defined by local weather, appropriate times may stretch from late April to September.

Several recent studies have concluded that the threat posed by lightning-season burning is not as dire as once presumed (Cox and Jones 2007, Tucker et al. 2004). Many ground-nesting birds prefer to nest in areas that have been burned within the past two years, ***not*** areas that have lain fallow for three years (often called "three-year roughs"). Scheduling a lightning-season burn for a three-year rough potentially affects only a small percentage of the ground nests constructed

Jim Cox

Figure 5. Bachman's sparrow nest.

in a given year. Many birds also re-nest quickly when a nest is lost, and benefits such as improved late summer and fall brood habitat, improved fall and winter food resources, and improved nesting success in subsequent years also can offset losses to lightning-season burning.

This booklet reviews some of the benefits of lightning-season burns that have emerged from recent research in hopes of providing balance to the debate regarding the threats such fires may pose to breeding birds. Land managers will always need to burn during the dormant season, and most may want to burn primarily during this time, but lightning-season burning provides more burning opportunities during the calendar year, and more frequent burning that is integrated into a comprehensive burn program provides benefits that can outweigh short-term impacts to nesting birds.

Birds of Management Concern

Over 100 species of birds occur in southern pinelands throughout the year (Engstrom 1993), and approximately one third of these may nest and forage on or near the ground where the effects of lightning-season burning will be most pronounced (Engstrom et al. 1996). Among these ground-dwelling species are several with declining population trends based on recent reviews conducted by fish and wildlife agencies throughout the southeastern U.S. (Table 1). Wildlife agencies have adopted the term *Species of Greatest Conservation Need* (Table 1) to describe species with severe population declines, and we review recent research relating to the effects of lightning-season burning on six rapidly declining species (Table 1) as well as the Wild Turkey because of its importance as a game species.

Table 1. Pineland species of management concern as determined by wildlife agencies in the southeastern U.S. The effects of lightning-season burning on species listed in italics are discussed at length below.

SPECIES	TOTALS	AL	AR	FL	GA	LA	MS	OK	NC	SC	TX	VA
Red-cockaded Woodpecker	11	√	√	√	√	√	√	√	√	√	√	√
Bachman's Sparrow	11	√	√	√	√	√	√	√	√	√	√	√
Henslow's Sparrow	11	√	√	√	√	√	√	√	√	√	√	√
Loggerhead Shrike	10		√	√	√	√	√	√	√	√	√	√
Northern Bobwhite	9		√		√	√	√	√	√	√	√	√
Brown-headed Nuthatch	9		√	√		√	√	√	√	√	√	√
Grasshopper Sparrow	8		√		√	√	√		√	√	√	√
Prairie Warbler	7		√				√	√	√	√	√	√
Southeastern American Kestrel	5	√		√	√				√		√	
Field Sparrow	5					√			√	√	√	√
Eastern Meadowlark	5			√					√	√	√	√
Common Ground-Dove	3			√			√			√		
Red-headed Woodpecker	3			√				√			√	
Florida Sandhill Crane	2			√	√							
Eastern Wood Peewee	2									√		√
Eastern Kingbird	2								√			√
Cooper's Hawk	1								√			
Sharp-shinned Hawk	1								√			
Common Nighthawk	1								√			
Florida Grasshopper Sparrow	1			√								


Shane Wellendorf

Figure 6. Northern Bobwhite on the wing.

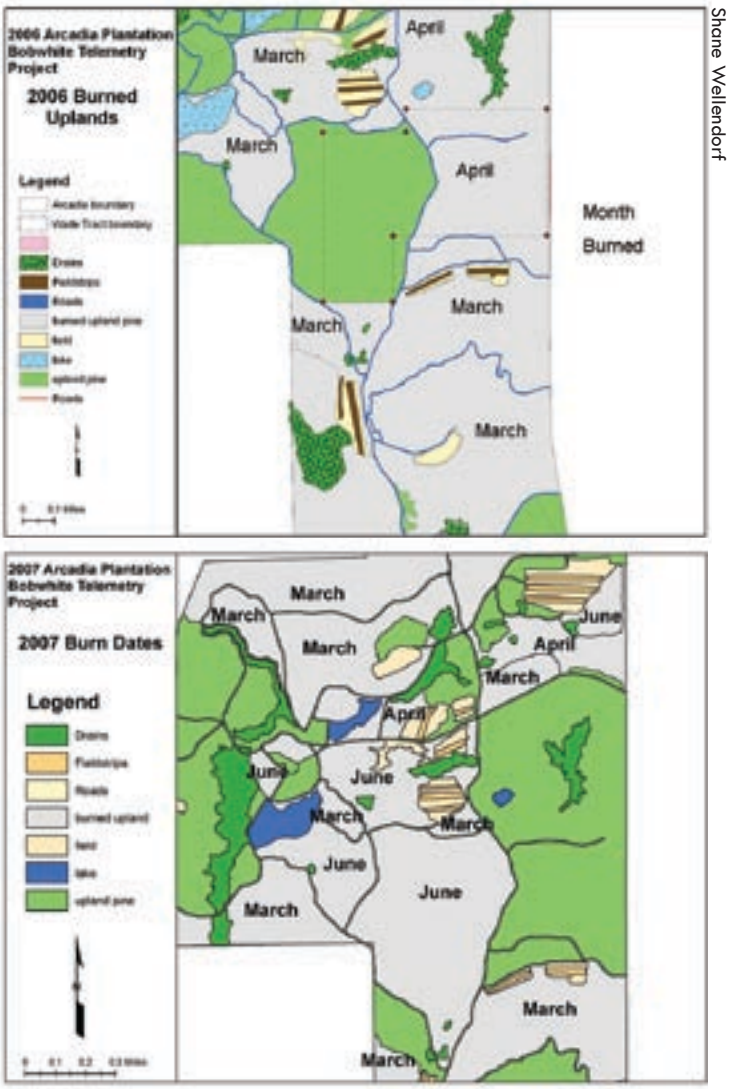
Northern Bobwhite

Potential benefits of lightning-season burning in comparison to exclusive dormant-season burning include (1) reduced mortality, (2) improved habitat structure and habitat diversity, and (3) improved brooding-rearing habitat for August to October broods. In addition, the peak nesting period in many areas may not occur until June, so a mid-May burn applied to a three-year rough affects very few nests and provides better hardwood control and improved brood-rearing habitat.

Management for Northern Bobwhite (Fig. 6) has shaped the prescribed burning performed in southern pinelands for decades. Quail hunting ends early in March, while the earliest quail nests do not appear until late April or early May (though nests in south Florida may be initiated in March). These considerations have focused traditional prescribed burning to a few months in late winter and early spring, and they also probably have shaped many opinions regarding the impacts of lightning-season burning on breeding birds.

The vegetation structure preferred by Northern Bobwhite includes a mix of forbs and woody shrubs with ample bare ground. This structure is ephemeral, and populations quickly decline within less than three years post fire as vegetation grows and becomes thick at ground level. While prescribed fires in other seasons may create the preferred vegetation structure, fires set during the early part of the lightning season (late April and May) maintain the structure longer than fires set during the dormant season. Lightning-season fires in May provide preferred vegetation structure that persists as much as six months longer than the structure created by dormant-season burning.

Studies at Tall Timbers Research Station examined the impacts of dormant-season versus lightning-season burns on quail more directly and found that seasonal effects were insignificant at the population level (Brennan et al. 1997, 1998, Carver et al. 1997). The specific month burns are conducted is important because nesting activity varies considerably within the lightning season. Nesting activity peaked in June in these studies, so burns conducted in mid May when <10% of the hens were incubating can provide many of the benefits of lightning-season burning without posing a threat



Shane Wellendorf

Figure 7. Study area and month of burn for Power of Flight research project.

to the majority of nests. In addition, because quail often nest preferentially in areas burned within the past two years, a lightning-season burn applied to a three-year rough actually threatens very few nests.

Lightning-season burning also may improve adult survival during the late-winter period (February to April). In a study conducted by Tall Timbers Research Station and supported by the Power of Flight Bird Conservation Program, quail were monitored on Arcadia Plantation (GA) where the acreage of

habitat burned early versus late in the season varied over two years. In 2006, approximately 75% of the 700-acre study area was burned by mid April. In the following year, 75% of the area was burned again, but a 200-acre block was not burned until June (Fig. 7). It should be noted that the study area was dominated by native ground cover that burns readily during summer months.

Adult survival was higher in 2007 when the burning was spread out among many months, March to June, instead of burning only during March and April (Fig. 8). March is a time when migratory hawks are abundant, and extensive burning within a three-to-four week period in March may expose quail to these and other predators. In contrast, by extending burns over a broader window of time, more cover is provided because burns conducted later in the year take place after the vegetation burned early in the year has recovered. In addition, vegetation recovery following an early season burn takes place slowly in comparison to recovery from a burn conducted later in the year, so exposure to predators following a dormant-season burn extends over a longer time period. Large-scale burning at one time can be detrimental to bobwhite populations, and populations benefit when burns are extended over several months rather than burning as much as possible within a few weeks. Again, these recommendations apply primarily to areas where the flammability of ground cover has not been altered by past land management or fire suppression. It is difficult to burn some altered lands outside a narrow window early in the year, and fires must be applied to these areas when the fires will be most successful.

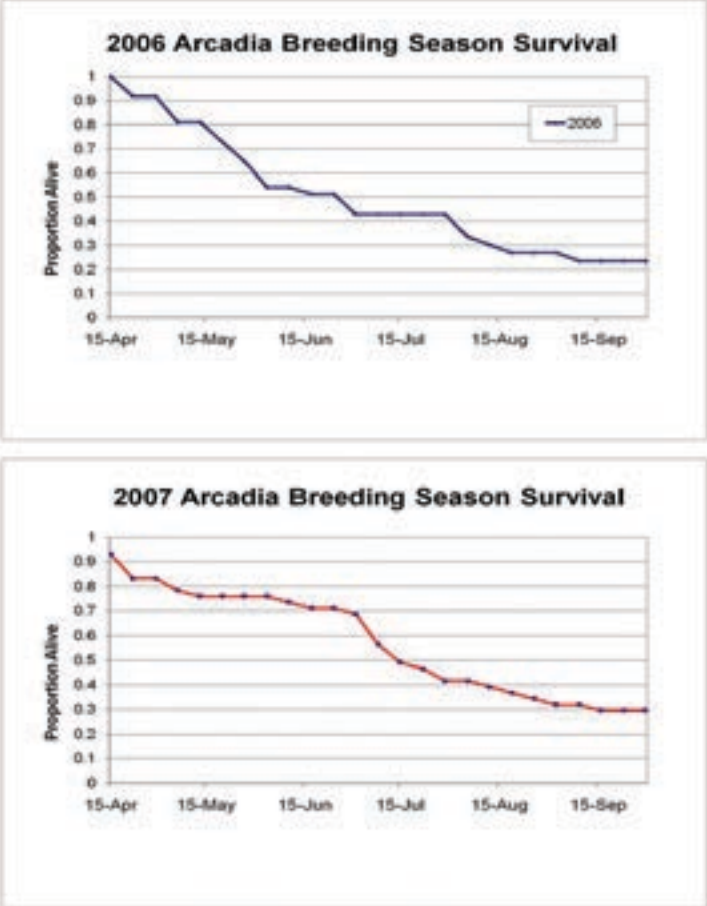


Figure 8. Survival recorded for Northern Bobwhites under different burn regimes in 2006 and 2007.

Quail also re-nest readily unless burns are conducted very late in the season, and lightning-season burning may provide additional benefits during re-nesting and brood rearing. Burning at different times of the year provides diversified patterns of plant growth and seed and insect abundances and also exposes seeds on the forest floor. Grasshoppers and other insects increase significantly following lightning-season burning (Provencher et al. 1998), and lightning-season burns may provide a greater abundance of insects throughout brood-rearing months in comparison to fires set early in the season (Brennan et al. 1995, 1997).

Wild Turkey

Potential benefits include (1) improved habitat conditions in subsequent breeding seasons and (2) improved brood-rearing habitat. More research is needed.

Wild Turkeys are not as tightly linked to southern pine forests as many of the other species treated here, but wild turkeys benefit from lightning-season burning if the burns help to achieve consistent two-to-three-year fire frequencies on managed areas. Wild Turkeys prefer to forage in southern pinelands burned within the past two years (Palmer and Hurst 1998, Sisson et al. 1990, Juhan 2003), and maintaining a two-to-three-year fire frequency may be easier to accomplish when some acreage is burned in May and early June in addition to the acreage burned earlier in the year.

Lightning-season fires applied to areas that have not been burned recently also are not likely to threaten many nests. Sisson et al. (1990) found that 62% of all nests occurred in mature pine forests that had been burned within the past two years. Moore et al. (2005) monitored 22 hens in areas subjected to lightning-season fires and found only 2 nests destroyed by the burns, and one of these hens re-nested. Similarly, for 64 turkey nests monitored in Mississippi (National Wild Tur-

"The use of prescribed fire during the growing season is a win-win situation for wild turkeys," according to Dr. James Earl Kennamer, National Wild Turkey Federation senior vice president for conservation programs. "I hope this will ease the minds of turkey hunters the next time they smell the smoke of a growing-season fire."

key Federation 2006), only four were located in areas scheduled to be burned and only two nests were actually destroyed by lightning-season fires. Allen et al. (1996) also found that areas not burned within the past two years were almost entirely avoided by hens.

Lightning-season burns also may improve brood-rearing habitats by diversifying plant growth and seed and insect abundances (Provencher et al. 1998). The average number of insects on sites treated with lightning-season fires exhibits a sharp increase in the first year after burning (Hardy 2003). Jones (2001) suggested the availability of good brood-rearing habitat might limit turkey populations on large, unbroken expanses of mature pine forest, and the grasses and forbs favored by lightning-season burns could lead to higher insect abundances for poults. Native legumes important to Wild Turkey also are promoted by lightning-season burning, and Komarek (1969) noted that Wild Turkeys frequently foraged in areas soon after prescribed burns were conducted. Sisson and Speake (1994), on the other hand, found little benefit in terms of food resources when lightning-season fires were applied to small (10-acre) plots.

Red-cockaded Woodpecker

Potential benefits include (1) improved habitat conditions through better midstory hardwood control and (2) potentially improved foraging conditions through increases in favored prey items. More research is needed.

Lightning-season burning is considered integral to restoring habitat for Red-cockaded Woodpeckers (Fig. 9; Titus 2006, Walters 1997). Hardwood encroachment has become a problem on many areas where prescribed fire has not been applied at two-to-three frequencies (Conner et al. 1996, Rudolph et al. 2002, Titus 2006). If hardwood trees reach the height of woodpecker cavities, woodpeckers may abandon territories. Hardwood encroachment also has been linked to changes in foraging behavior (Rudolph et al. 2002) and may lead to increases in nest-site competitors (Conner et al. 1996). Lightning-season burning improves the control of hardwood mid-story and brush, while dormant-season burning encourages re-sprouting of top-killed hardwood saplings in native plant communities.

Some research suggests lightning-season fires also may improve food resources for this endangered species. Arthropods typically consumed by Red-cockaded Woodpeckers disperse from the ground cover into the canopy (Hanula and Franzeb 1998), and prey biomass improves with the increased herbaceous and grass vegetation and decreased hardwood midstory vegetation created by lightning-season burning (Collins et al.

Todd Engstrom

Figure 9. Red-cockaded Woodpecker at cavity entrance.

2002, Hess et al. 1998). James et al. (1997) also suggested fire frequency and season might influence essential nutrients (such as calcium) that are important during the nesting season because clutch size increased in the year following burns in their study. Studies suggesting improved food resources also are consistent with data showing that some of the smallest home ranges observed for this endangered species come from an old-growth forest where roughly 50% of the acreage was burned each year during the lightning season (Engstrom and Sanders 1997).

Brown-headed Nuthatch

Lightning-season fires are beneficial to this declining species. Nuthatches nest early each year, and dormant-season burns destroy scores of nests. Dormant-season burns also may lead to lower adult survival.

Lightning-season fires are decidedly beneficial to Brown-headed Nuthatches (Fig. 10) when compared to prescribed fires conducted early in the calendar year. The nuthatch breeding season commences in early March when ambient temperatures generally are cool. Nuthatches excavate nesting cavities in dead trees close to the ground (Fig. 10), and dormant-season burns set in March may destroy scores of nests, while lightning-season burns occur well after most nesting is completed.

Jim Cox

Figure 10. Brown-headed Nuthatch at a nest.

Long-term studies conducted at Tall Timbers Research Station suggest the loss of early nests can be detrimental to the health of nuthatch populations. The nesting cycle requires more than a month to complete (Withgott and Smith 1990), and female nuthatches incubate eggs and brood young almost exclusively during early stages. The low nests constructed by nuthatches are susceptible to predatory snakes. If an early nest is lost to a dormant-season burn, nuthatches re-nest later in spring when predatory snakes have emerged from hibernation thanks to warmer ambient temperatures. Incubating females are regularly killed by snakes (Cox and Slater 2007), and higher female mortality will harm nuthatch populations more than the small percentage of nests that might be lost to lightning-season burns.

Loggerhead Shrike

Lightning-season fires may be beneficial because they (1) do not occur in the primary nesting season, (2) improve prey availability, and (3) reduce woody vegetation that hinders foraging. More research is needed.

Loggerhead Shrike is one of the first species to disappear when fire is not used frequently in southern pine forests (Engstrom et al. 1984). Lightning-season burns will be beneficial if they help land managers achieve appropriate burn frequencies (ca. two- to three-year return intervals). In addition, much like the Brown-headed Nuthatch, Loggerhead Shrikes nest early in the calendar year (in February in some areas; Yosef 1996), and nests located in shrubs may be destroyed by dormant-season burns.

Low reproductive success has been implicated in population declines in some areas and may be linked to food shortages (Gawlik 1988). Provencher et al. (1998) found that many preferred food items, especially grasshoppers (Yosef 1996), increased by more than 90% when lightning-season burns were conducted in longleaf pine forests. Shrikes also require open ground-cover conditions for successful foraging and use recently burned sites extensively (Komarek 1969). Lightning-season burning may improve foraging conditions by reducing woody shrubs, though Hands et al. (1989) warn that high-frequency burning also can eliminate shrubs used as foraging perches.

Bachman's Sparrow

Bachman's Sparrow prefers areas burned recently (within past three years), so lightning-season fires applied to long unburned areas disturb only a small percentage of the nests initiated. The nesting season also spans many months (late March to August), and re-nesting is common when nesting is disrupted by fire. Potential benefits include (1) improved wintering and (2) improved nesting habitat after burns are conducted.

Ross McGregor

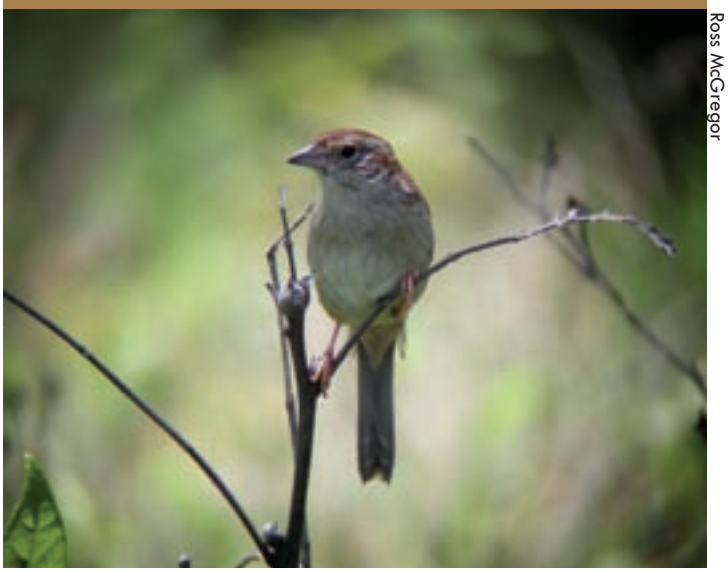


Figure 11. Bachman's Sparrow.

Bachman's Sparrow, an endemic songbird (Fig. 11), figures prominently in the debate about lightning-season burning because it is declining in portions of its range and, much like quail and Wild Turkey, forages and nests (Fig. 12) exclusively on the ground (Dunning 1993). Although these traits would appear to make this species susceptible to lightning-season burning, Bachman's Sparrow appears to be well adapted to life in a fire-dependent ecosystem.

In recent research sponsored by the Southern Company and the National Fish and Wildlife Foundation through the Power of Flight initiative in partnership with the Florida Fish and Wildlife Conservation Commission and Georgia Department of Natural Resources, over 250 Bachman's Sparrows

Jim Cox

Figure 12. Bachman's Sparrow nest with four eggs.

were individually marked and followed for five years on a 400-acre site (Cox and Jones 2007). Half the site received a lightning-season burn during each year of study and half was not burned. Sparrows did not abandon territories on areas that were burned any more frequently than sparrows holding territories on unburned areas. Several re-nesting attempts also were documented during an extensive nesting season that spanned six months (from late March through early September). Burns conducted in May allowed time for initial nests to fledge but also allowed sufficient time afterwards for re-nesting attempts to be completed.

Most (>85%) nests located during this study were constructed in areas burned the previous growing season, not the three-year rough often treated with a lightning-season burn. Lightning-season burns also appeared to improve winter habitat conditions because winter sparrow counts were consistently higher in areas burned the previous growing season (Fig. 13). The prolific flowering of forbs and grasses that

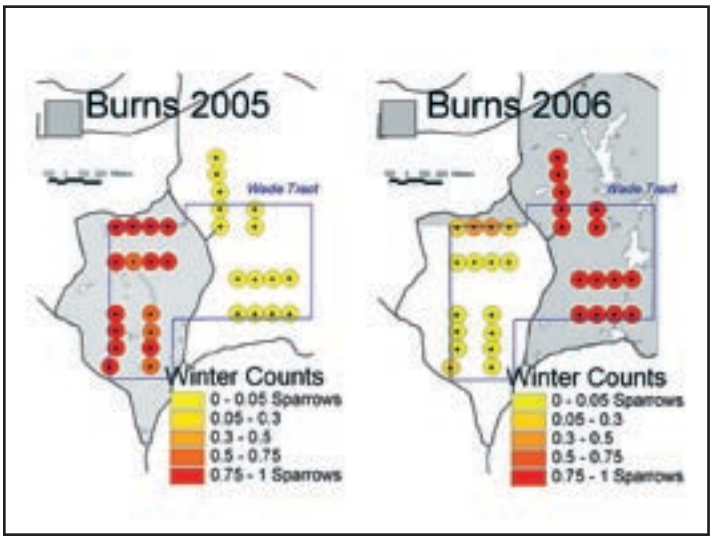


Figure 13. Average winter sparrow counts on Power of Flight study area.

takes place following lightning-season burns could improve winter food resources in combination with the documented increases in insect abundances (Provencher et al. 1998) that take place following lightning-season burning. A combination of lightning-season and dormant-season burning also could provide a larger quantity of preferred nesting habitat the following breeding season, so positives associated with lightning-season burning can outweigh negatives when measured over several years.

Henslow's Sparrow

Henslow's Sparrows spend the winter in southern pinelands, so dormant-season fires eliminate wintering habitat and can be more detrimental than lightning-season fires. Additional potential benefits of lightning-season fires included (1) improved winter habitat and (2) higher winter survival rates.

Ross McGregor

Figure 14. Henslow's Sparrow.

Henslow's Sparrows (Fig. 14) spend the winter in southern pinewoods but breed in grasslands well to the north (Fig. 15). Wintering Henslow's Sparrows typically arrive in late September and occupy wintering grounds until late March and early April. Early season (February and March) prescribed burns eliminate the winter ground cover needed by this species (McNair 1998). Because vegetation recovers slowly following dormant-season burns, early season burns essentially eliminate wintering habitat for Henslow's Sparrows, while lightning-season burns affect areas after Henslow's Sparrows have returned north.

Lightning-season fires also may provide better winter habitat conditions. Thatcher et al. (2006) found that winter survival for Henslow's Sparrow was better in areas burned within the previous 12 months. They also found evidence of higher winter survival and higher winter abundances in sites burned during the previous lightning-season. These results may stem from increased food resources and/or improved vegetation structure at ground level.

Figure 15. Distribution map for Henslow's Sparrow

Impacts to Other Breeding Birds

Ten additional pineland species are considered *Species of Management Concern* by one or more state wildlife agencies in the southeastern U.S. (Table 1). Although these species are not considered here at length, lightning-season fires can be beneficial to many of these species in a manner similar to that discussed above for other species. In addition, species such as American Kestrel, Swallow-tailed Kite, Red-headed Woodpecker, Common Nighthawk, and Eastern Wood Peewee have been shown to be attracted to sites as they are burned (Komarek 1969).

In 2005, researchers at Tall Timbers Research Station monitored breeding birds before and after a lightning-season prescribed burn was conducted in mid June. Counts of shrub and ground-nesting birds declined dramatically after the burn, as expected, but also returned to pre-burn levels within six weeks (Fig. 16). Re-nesting was common within the burned area and took place quickly for some species. Three days after the burn, several nests of the Common Nighthawk were discovered. Seven days after the burn, a Northern Cardinal was found incubating five eggs. Twelve days later, a Blue Grosbeak was observed incubating four eggs in another leafless shrub. Re-nesting is common when lightning-season burning is conducted early in the year (e.g., by early June), and loss of early nests to fire can be offset by improved adult survival or improved nesting success after a fire. Engstrom et al. (1996) also compared the effects of lightning-season versus dormant-season burning on bird communities in longleaf forests. A total of 73 species was observed, and avian communities on lightning-season burns were indistinguishable from the communities associated with dormant-season burns. In other field studies in Florida and North Carolina, no differences in songbird numbers have been observed when comparing plots burned during the dormant-season with plots burned during the lightning-season (Brennan et al. 1998).

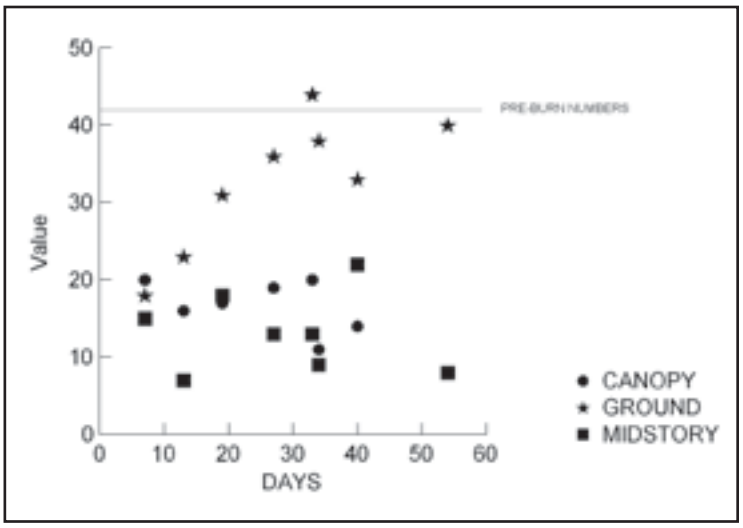


Figure 16. Return of shrub and brush species in comparison to species that use the mid-story and canopy.

Although movements of individual birds were not followed in the studies mentioned above, research conducted elsewhere suggests that species that nest above the ground often remain on burned sites despite the dramatic changes brought about by fire (Bendell 1974). Emlen (1970) found little immediate effect of burns conducted in South Florida. He concluded that attachments to home ranges and familiar foraging areas transcended the changes in habitat brought about by fire.

As suggested for several species discussed in the previous section, improvements in habitat created by lightning-season burning may improve nesting success in the subsequent breeding season. Raftovich (1998) compared nesting success for six shrub- and ground-nesting songbirds associated with (1) a one-year-old, lightning-season burn and (2) a one-year-old, dormant-season burn. The season of burning had no effect on the nesting success of four species, but for two species (Yellow-breasted Chat and Northern Cardinal), nesting success was better on areas burned during the lightning season.

There are also other potential benefits that have not been thoroughly investigated. Prescribed fires recycle nutrients (James et al. 1997) whose availability may improve the physiological conditions needed for nesting. Frequent use of prescribed fire also may influence the predator communities associated with southern pine forests (Jones et al. 2004). Populations of some nest predators (e.g., raccoons and gray rat snakes) have been shown to change in relation to the use of prescribed fire (Jones et al. 2004) and also in relation to the changes in vegetation structure and composition that take place with frequent burning.

Conclusions

Birds associated with southern pinelands have faced the benefits and perils of fire for eons. If lightning-season fires were as common historically as data suggest (Huffman 2006), pineland birds could survive *only* if they developed methods for adjusting to the temporary set-backs created by fire.

The most direct impact of lightning-season burning typically is loss of a nest, but recent studies suggest the number of nests potentially affected by lightning-season burning is smaller than many believe. Among the studies considered here, lightning-season fires destroyed less than 10% of the nests of ground-nesting species that were monitored. Loss of a nest to fire also is similar to the losses created by predators and bad weather, and few long-term consequences are likely to occur for nesting birds when lightning-season burns are incorporated into a comprehensive burn program on large managed areas. Many benefits also can be shown that include improved breeding habitats in subsequent years, increases in fall food availability, potential improvements to adult and juvenile survival, and decreases in woody shrubs, saw palmetto, and ground-level clutter.

In addition, declining birds that are associated with southern pinelands are heavily dependent on prescribed fire for their continued existence. Northern Bobwhite, Bachman's Sparrow, and Loggerhead Shrike disappear if fire is suppressed for three or more years (Engstrom et al. 1984), and the steep population declines these animals are experiencing on many public lands are directly linked to the absence of prescribed fire (Brennan et al. 1997). To halt these declines, the application of prescribed fire must increase on conservation lands. The lightning season may not be the primary season in which most of this acreage is treated, but chances of achieving appropriate fire intervals of one to three years are greatly improved if the season of burning is expanded beyond a six-week period from March to early April.


Rose Rodriguez

Finally, southern pinelands are part of a complex of fire-maintained communities that are highly imperiled within United States (Noss et al. 1995). Scores of other species benefit from increased burning, while fire exclusion and infrequent fire frequencies both lead to degraded conditions that can be difficult to restore. Maintaining a three-year fire interval for a 20,000-acre tract requires burning approximately 7,000 acres each year. To meet this need, we must be ready to apply fire at varied seasons with an emphasis on late spring and early summer at scales that are both practical and also based on the long-term ecological needs of pineland species.

Recommendations

First and foremost, it is important to remember that compliance with all federal, state, and local laws, regulations, and ordinances relating to open air burning, including air quality regulations, is critical. It is advisable to contact the local state forestry agency and environmental health department for more information on prescribed burning and air quality regulations, permit applicability, and any required notifications to adjacent landowners. This is necessary from a legal regulatory standpoint, but it is also very important as a courtesy to neighboring landowners and land managers.

Burning conducted in mid to late May provides many of the desired effects (e.g., hardwood control and improved grass and forb response) while also allowing sufficient time for many species (e.g., Bachman's Sparrows) to complete initial nests or to re-nest afterwards. Early May burns also avoid peak nesting times for Northern Bobwhite, and late-season cold weather fronts that occur regularly in May can bring the predictable weather conditions that many like to have for burning.

Caution is needed when attempting to introduce lightning-season burning to areas not burned regularly. Lightning-season burns can kill over-story pines under heavy fuel loads and may compromise other restoration objectives. Lightning-season burning during periods of prolonged droughts also poses a similar threat to over-story pines. To gain experience with the potential impacts, it may be best to introduce lightning-season burns initially on sites with one- or two-year roughs rather than three-year or older roughs. Sites with a history of fire-exclusion should be treated with dormant-season, fuel-reduction burns for several intervals before lightning-season burns are attempted.

In habitat types altered by past land management or fire suppression, the reduced flammability of fuels also can be a barrier to burning during the lightning-season. Old-field pinelands and recently-thinned pine plantations in upland areas are often dominated by forbs and non-flammable hardwood species instead of grasses, making them difficult to burn well under conditions of high humidity (Robertson and Ostertag 2007). Also, fire-excluded upland areas dominated by hardwood trees and broadleaf litter may not burn well in the late spring and summer months. Management practices to reduce hardwood density and shift the dominance to grasses may be necessary before such areas will burn in the lightning-season. Otherwise, fires should be lit when they have the greatest chance of success, given that maintaining a high fire frequency (one-to-three year interval) is the most important goal for providing appropriate habitat conditions for many declining pineland birds.

Literature Citations

Allen, A.W., Y.K. Bernal, and R.J. Moulton. 1996. Pine plantations and wildlife in the southeastern United States: an assessment of impacts and opportunities. Information and Technology Report 3, U.S. Department of the Interior, Washington, D.C.

Bendell, J.F. 1974. Effects of fire on birds and mammals. In: Kozlowski, T.T. and C.E. Ahlegren (Eds.). Fire and Ecosystems. Academic Press, Inc., New York, New York.

Brenan, L.A., J. M. Lee, and S. Wellendorf. 1995. The new bobwhite initiative at Tall Timbers: first-year progress report. Pages 21-28 in L.A. Brennan, K.C. Gainey, and T.L. Pruden (Eds.). Proceedings of the Tall Timbers Game Bird Seminar. Tall Timbers Research Station, Tallahassee, FL.

Brennan, L.A., J.M. Lee, E. Staller, S. Wellendorf, and R.S. Fuller. 1997. Effects of seasonal fire applications on bobwhite brood habitat and hunting success. Quail IV: Fourth National Quail Symposium. Program Abstract. Tall Timbers Research Station, Tallahassee, FL

Brennan, L., R.T. Engstrom, W.E. Palmer, S.M. Hermann, G.A. Hurst, L W. Burger, and C.L. Hardy. 1998. Whither wildlife without fire? Transactions of the North American Wildlife and Natural Resource Conference 63: 402-414.

Brunjes, J.H. 1998. The effects of prescribed winter burning on avian communities in mature pine habitats. M. Sc. thesis, University of Georgia, Athens, GA.

Carver, A.V., L.W. Burger, and L.A. Brennan. 1997. Bobwhite brood ecology in relation to fallow field management techniques and prescribed fire regime. Quail IV: Fourth National Quail Symp. Program Abstract.

Collins, C.S., R.N. Conner, and D. Saenz. 2002. Influence of hardwood midstory and pine species on pine bole arthropods. Forest Ecology and Management 164:211-220.

Conner, R N., D.C. Rudolph, D. Saenz, and R.R. Schaefer. 1996. Red-cockaded Woodpecker nesting success, forest structure, and southern flying squirrels in Texas. Wilson Bulletin 108:697-711.

Cox, J. and C. Jones. 2007. Home range and survival characteristics of male Bachman's Sparrows in an old-growth forest managed with breeding season burns. Journal of Field Ornithology 78:263–269.

Cox, J., and G. Slater. 2007. Cooperative breeding in the Brown-headed Nuthatch. The Wilson Journal of Ornithology 119:1-8.

Freeman, D.L. 2004. Lightning-ignited wildfire occurrences in a central-Florida landscape managed with prescribed fire. M. Sc. thesis, University of Florida, Gainesville, FL.

Dunning, J.B. 1993. Bachman's Sparrow (*Aimophila aestivalis*). Birds of North America. No. 38.

Emlen, J.T. 1970. Habitat selection by birds following a forest fire. Ecology 51:343-345.

Engstrom, R. T. 1993. Characteristic mammals and birds of longleaf pine forests. Tall Timbers Fire Ecology Conference 18:127-138.

Engstrom, R.T. and F. Sanders. 1997. Red-cockaded Woodpecker foraging ecology in an old-growth longleaf pine forest. Wilson Bulletin 109:203-217.

Engstrom. R.T., R. Crawford, and W. Baker. 1984. Breeding bird populations in relation to changing forest structure following fire exclusion: a 15-year study. Wilson Bulletin 96:437-450.

Engstrom, R.T., D.B. McNair, L.A. Brennan, C.L. Hardy and L.W. Burger. 1996. Influence on birds of dormant versus lightning-season prescribed fire in longleaf pine forests: experimental design and preliminary results. Transactions of the North American Wildlife and Natural Resource Conference 61:200-207.

Gawlik, D. 1988. Reproductive success and nesting habitat of Loggerhead Shrikes and relative abundance, habitat use, and perch use of Loggerhead Shrikes and American Kestrels in South Carolina. M. Sc. thesis, Winthrop College, Rock Hill, SC.

Glitzenstein, J.S., W.J. Platt, and D.R. Streng. 1995. Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas. Ecological Monographs 65:441-476.

Hands, H.M., R.D. Drobney, and M.R. Ryan. 1989. Status of the Loggerhead Shrike in the north central United States. U.S. Fish & Wildlife Service Cooperative Fish and Wildlife Research Unit, Columbia, Missouri. 15 pages.

Hardy, C. 2003. Flora and fauna community response to seasonal prescribed fire treatments in longleaf pine forests of the North Carolina sandhills. Ph. D. dissertation, Mississippi State University, Starkville, MS.

Hanula, J.L. and K. Franzreb 1998. Source, distribution, and abundance of macroarthropods on the bark of longleaf pine: potential prey of the Red-cockaded Woodpecker. Forest Ecology and Management 102: 89-102.

Hermann, S., T.V. Hook, R.W. Flowes, L.A. Brennan, J.S. Glitzenstein, D.R. Streng, J.L. Walker, and R.L. Myers. 1998. Fire and biodiversity: studies of vegetation and arthropods. Transactions North American Wildlife and Natural Resource Conference 63:384-401.

Huffman, J. 2006. Historical fire regimes in southeastern pine savannas. Ph. D. Dissertation. Louisiana State University, Baton Rouge, LA.

Hess, C.A. and F.C. James. 1998. Diet of the Red-cockaded Woodpecker in the Apalachicola National Forest. The Journal of Wildlife Management 62: 509-517.

James, F.C., C.A. Hess, and D. Kufrin. 1997. Species-centered environmental analysis: indirect effects of fire history on Red-cockaded Woodpeckers. Ecological Applications 7:118-129.

Jones, B.C. 2001. Wild Turkey reproductive ecology on a fire-maintained national forest in Mississippi. M. Sc. thesis, Mississippi State University, Starkville, MS.

Jones, D.D., L.M. Conner, T.H. Storey, and R.J. Warren. 2004. Prescribed fire and raccoon use of longleaf pine forests: implications for managing nest predation? Wildlife Society Bulletin 2004, 32:1255-1259.

Juhan, S.M. 2003. Influences of forest cover type and structure on seasonal and daily habitat use of Wild Turkeys in southern Georgia. M. Sc. thesis, University of Georgia, Athens, GA.

Komarek, E.V. 1964. The natural history of lightning. Tall Timbers Fire Ecology Conference 3: 139-148.

Komarek, E.V., Sr. 1969. Fire and animal behavior. Tall Timbers Fire Ecology Conference 9: 161-207.

Louisiana Department of Wildlife and Fisheries. 2006. Wild Turkey poult production survey. On-line version: http://www.wlf.louisiana.gov/pdfs/hunting/programs/turkey/poultsurvey2005final.pdf

Main, M.B. and L.W. Richardson. 2002. Response of wildlife to prescribed fire in southwest Florida pine flatwoods. Wildlife Society Bulletin 30:213-221.

McNair, D.B. 1998. Response of Henslow's Sparrows and Sedge Wrens to a dormant-season prescribed fire. Florida Field Naturalist 26:46-47

Moore, W.F., J.C. Kilgo, W.D. Carlisle, and M B. Caudell. 2005. Chapter 6. Wild Turkey. Pages 359-366 in Kilgo, J.C. and J.I. Blake (Eds.). Ecology and management of a forested landscape. Island Press, Washington, DC.

National Wild Turkey Federation. 2006. Spring fire is good for wild turkeys. On-line version: http://www.nwtf.org/nwtf_newsroom/press_releases.php?id=11901

Noss, R., E. LaRoe and J. Scott. 1995. Endangered ecosystem of the United States: a preliminary assessment of loss and degradation. U.S. Geological Survey, Washington, D.C

Palmer, W.E. and G.A. Hurst. 1998. Prescribed burning effects on Wild Turkey hens during preincubation. Tall Timbers Fire Ecology Conference 20:102-106

Provencher, L., N.M Gobris, H.L. Rodgers, D.R. Gordon and J.P McAdoo. 1998. Scientific coordination and adaptive management and experimental restoration of longleaf pine community structure, function, and composition. Annual Report 3 (Dec 97-30 Mar 98). University of Florida, Gainesville, FL.

Raftovich, R.V., Jr. 1998. Effects of management for Red-cockaded Woodpeckers on avian communities in mature pine stands in the Georgia Piedmot. M.Sc. thesis, University of Georgia, Athens. 76 pp.

Robertson, K.M. and T.E. Ostertag. 2006. Effects of land use on fuel characteristics and fire behavior in pinelands of southwest Georgia. Tall Timbers Fire Ecology Conference Proceedings 23:181-191.

Rudolph, D.C., R.N. Conner, and R.R. Schaefer. 2002. Red-cockaded Woodpecker foraging behavior in relation to midstory vegetation. Wilson Bulletin 114:235-242

Sisson, D.C. and D.W. Speake. 1994. Spring burning for Wild Turkey brood habitat: an evaluation. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 48: 134-139.

Sisson, D.C., D.W. Speake, J.L. Landers, and J.L. Buckner. 1990. Effects of prescribed burning on Wild Turkey habitat preference and nest site selection in south Georgia. National Wild Turkey Symposium 6:44-50.

South Carolina DNR. 2006. Growing season burns a natural process in South Carolina. On-line version: http://www.dnr.sc.gov/news/Yr2006/may08/may8_burns.html

Stoddard, H. L. 1931. The Bobwhite Quail: Its Habits, Preservation and Increase. Scribner's Sons, New York.

Thatcher, B.S., D.G. Krementz, and M.S. Woodrey. 2006. Henslow's Sparrow winter-survival estimates and response to prescribed burning. Journal of Wildlife Management 70:198–206.

Titus, G. 2006. Draft ecological assessment. Apalachicola FY 2007-2011 prescribed burning. U.S. Department of Agricultural, Forest Service, Tallahassee, FL.

Tucker, J.W., Jr., W.D. Robinson, and J.B. Grand. 2004. Influence of fire on Bachman's Sparrow, an endemic North American songbird. Journal of Wildlife Management 68:1114-1123

Tyler, R. 2006. Burning method used by Forest Service devastates wildlife. On-line version: http://www.libertymatters.org/newsservice/2006/faxback/3027_Burning.htm

Walters, J.R. 1997. Population and management studies of Red-cockaded Woodpecker on Croatan National Forest, 1988-1997. Project Final Report. National Forests of North Carolina, Ashville, NC.

Withgott, J.H. and K.G. Smith. 1998. Brown-headed Nuthatch (*Sitta pusilla*). The Birds of North America. No. 349.

Yosef, R. 1996. Loggerhead Shrike (*Lanus ludovicianus*). The Birds of North America. No. 231.

Acknowledgments

Support for this project was provided by the Power of Flight Bird Conservation Program. We thank the Southern Company and the National Fish and Wildlife Foundation for establishing this important program dedicated to conserving southern birds and their habitats. We also thank Leslie Montgomery (Southern Company) and Erin Gibbs, Suzanne Sessine, Mike Slattery, Peter Stangel, and Amelia Wegner (National Fish and Wildlife Foundation) for their timely reviews and administrative help at several points in the process. We appreciate the opportunity provided by Jep and Paddy Wade to study birds on Arcadia Plantation. We also appreciate comments provided by Clark Jones, Carolyn Kindell, Nathan Klaus, James Martin, Ron Masters, Karl Miller, Bill Palmer, Kevin Robertson, Eric Spadgenske, Phil Spivey, Jonathan Stober, and Shane Wellendorf on early drafts. Finally, thanks to Rose Rodriguez for help with layout and production.

SOUTHERN COMPANY
Energy to Serve Your World®

National Fish and Wildlife Foundation

TALL TIMBERS 50 years
Stewards of Wildlife & Wildlands