American Kestrel Use of Pine Regeneration Stands in South Carolina

Amanda Allen Beheler
John B. Dunning, Jr.
Department of Forestry and
Natural Resources.
Purdue University
West Lafayette, IN. 47907

The American Kestrel (*Falco sparverius*) is widely distributed across most of the United States and is one of the most abundant of all North American raptors. Two subspecies of kestrels occur in the southeast, F. s. sparverius and the rarer *F. s. paulus*. The southern subspecies (*F. s. paulus*), often known as the Southeastern American Kestrel, has historically been documented throughout Florida, the southern half of Georgia, and southeast and central South Carolina west to Aiken County (Sprunt and Chamberlain 1949, Palmer 1988, Breen *et al.* 1995). Both subspecies have been reported in South Carolina, although *paulus* individuals are reportedly rare and their occurrence remains poorly documented throughout the state (Sprunt and Chamberlain 1949, Hunter 1990). However, Breen *et al.* (1995) and Breen and Parrish (1997) report that Southeastern American Kestrels are successfully breeding at Fort Gordon Military Base, Richmond County, and a few other localities in Georgia.

During the summer of 1995, we observed a small population of kestrels using pine regeneration stands at the Savannah River Site (SRS), a 770 km² Department of Energy facility in Aiken, Allendale, and Barnwell Counties, South Carolina. Although Norris (1963) described evidence of breeding kestrels at the site in 1956, and classified them as a fairly common summer and very common winter resident on the SRS in the 1950's, very little is actually known about the extent of the local kestrel population.

The U.S. Forest Service manages the SRS for timber production and conservation of biodiversity. Pine stands of various ages make up a complex landscape pattern across the entire site (Dunning *et al.* 1995). While early successional stands are ephemeral (existing only until the pines mature and form a closed canopy from 5 to 7 years of age), active clearcutting creates new openings yearly, supplying kestrels with a potentially steady source of open habitat. Declines of kestrel populations in the southern United States have been

attributed to the lack of both nesting and foraging habitat (Bohall-Wood and Collopy 1986, Hunter 1990). The SRS appears to be a possible source of both of these limiting resources and offers a landscape in which to study how this species responds to timber management practices. The main objectives of this research were 1) to determine the abundance and distribution of American Kestrels during the breeding season at the Savannah River Site, and 2) to investigate possible patterns of kestrel use of pine regeneration habitat.

Study Area and Methods

During the summer of 1996, we surveyed all longleaf (*Pinus palustris*) and loblolly pine (*P. taeda*) regeneration stands ranging in age from zero (*i.e.* newly harvested stands) to three years (N = 90 stands) for the presence of American Kestrels (Table 1). Two newly harvested stands were unplanted at the time of surveying. Three survey rounds were undertaken. These surveys covered the approximate range for known breeding dates within the southeast region (Round 1: 17 May - 11 June; Round 2: 12 June - 5 July; Round 3: 9 July - 20 July). All stands were surveyed once per round. Post and Gauthreaux (1989) report that egg dates for South Carolina kestrel nests range from 7 April - 30 May. Shuford (1997) and Breen and Parrish (pers. comm.) report that kestrels in southern Georgia fledged between 10 June and 29 June in 1996 and between 10 May and 13 June in 1997.

Habitat age classes were chosen based on previous observations of kestrel use of regeneration stands (A. Allen, pers. obs.) and because, in overall aspect, these young pine stands often mimic the open fields and pastures that are well documented as kestrel habitat (Roest 1957, Bohall-Wood and Collopy 1986, Smallwood 1988). Study stands were widely distributed across the entire SRS and ranged in area from 2.4 to 48.0 ha.

Surveys were conducted in the morning (05:45-11:00 EDT), when kestrels, like other diurnal raptors, are more active. Surveyors slowly walked the perimeter of each stand, visually and aurally searching for falcons. By walking the stand edge, surveyors had a clear view of the entire stand and had an increased likelihood of discovering a perched kestrel or a nest cavity tree. Special attention was given to snags as possible breeding sites and live trees within and along the edges of stands which, as the tallest structures in the area, would be attractive perches. All snags were individually checked for possible nesting cavities. Upon finding a kestrel, exact locations were mapped and perch trees flagged. This gave us a reference point for nest searches. Sex, determined by wing and back color, and age (HY or AHY) of individuals were recorded when possible. Breeding pairs were defined when an adult male and female were resident in a single stand.

Stands with resident kestrels were revisited every one to three days through the end of July to make behavioral observations, search for nest cavities, and to ensure that all kestrels at the site were located and that individuals were not being double-counted at adjacent stands. In order to make comparisons of site and landscape characteristics which might lead to preferential use of habitat, a variety of data were collected for each stand including dominant tree species (longleaf pine, loblolly pine, unplanted), age (zero, one, two, or three years since replanting), area (ha), number of standing snags, distance to transmission power line right-of-ways, and distance to nearest occupied (*i.e.* with resident kestrels) stand.

Results

Twenty-four adult American Kestrels were located at the SRS between 17 May and 20 July 1996. Eight breeding pairs were identified, and three nest cavities were found, all located in dead pine snags. Seven fledglings were found. We feel that this is an accurate estimate of the actual population because of the intensity of surveys (over 640 man hrs.) across a wide variety of habitat types covering most of the SRS. Location of new individuals, including fledglings, was greatest during Round 2 (total number of new birds located during each round: Round 1: 9 individuals; Round 2: 18 individuals; Round 3: 4 individuals). This probably reflects the secretiveness of adults after initial courtship and during incubation early in the season. Adults were more conspicuous after the fledging of their vocal, and extremely active, young. All fledglings were located after 13 June.

Of the 90 regeneration stands surveyed, 12 had resident adult kestrels. Three kestrel locations were not associated with regeneration stands, including three adult birds found together at a complex of storage buildings. Four kestrels were repeatedly found only along transmission power line right-of-ways. The kestrels used these as foraging perches. Area of stands occupied by kestrels ranged from 9.1 to 46.8 ha. While both longleaf and loblolly stands were occupied as newly harvested stands, only longleaf stands were occupied one or two years after replanting. No three year old stands were occupied (Table 1). Two of the two year old stands with breeding pairs had also been occupied by breeding pairs during the 1995 breeding season, one year after planting (A. Allen, pers. obs.).

Occupied stands were often clustered together. Most kestrels were located within the south-central portion of the SRS. Eight occupied stands occurred in this area, and six of them within 1.5 km of each other. Another cluster of three occupied stands was located in the central part of the SRS. Of the 12 occupied stands, seven were immediately adjacent to transmission power line right-of-ways. The three nesting cavities were all within 100 m of the stand edge. Two

kestrel nest trees also had active Northern Flicker (*Colaptes auratus*) nest cavities. One pair of kestrels nested and successfully fledged young from a pine snag in a newly harvested, unplanted stand directly adjacent to an inactive reactor. The kestrels from this stand were observed almost daily perching on, and hunting from, the extensive sets of power lines emerging from the abandoned reactor.

The mean number of snags per stand dropped between two year old stands and three year old stands ((x + SD total snags per stand: newly harvested (N = 31): 49.48 + 31.7; one year old (N = 2): 60.0 + 28.3; two year old (N = 32): 55.31 + 28.6; three year old (N = 25): 27.84 + 21.4). Excluding the one year old stands from analysis due to low sample size, three year old stands had significantly fewer snags than newly harvested or two year old stands (ANOVA: $F = 7.29$, $df = 2$, $P = 0.001$), suggesting that snags left during initial harvesting decayed and fell within this time frame.

Discussion

Previous sightings of American Kestrels indicate a small, relatively unknown resident kestrel population at SRS. C. Eldridge (pers. comm.) documented two kestrel nestlings found on the ground near two different buildings by SRS personnel during 1994, and in 1995, a single fledgling was observed being fed by adults. In the summer of 1995, during surveys of over 200 longleaf and loblolly pine stands of various ages (from 0 to >80 years after planting) for a separate study at SRS, we located only 8 kestrels, even though we actively searched for them. The 1996 population represents a significant increase in the number of American Kestrels known to reside at the Savannah River Site during the breeding season. Throughout the three months of surveys we discovered a total of 31 individuals, including at least four successful breeding pairs that produced a total of seven known fledglings. The secretiveness of breeding adults increases the difficulty in getting actual population estimates without intensive survey methods. Kestrel nest boxes placed along transmission power line right-of-ways in 1991 have failed to attract any kestrels, although they are occupied by a variety of other cavity nesting birds (A. Allen, pers. obs.).

While kestrels do utilize a variety of habitats at the SRS, including buildings and transmission power line right-of-ways, they seem to prefer young pine regeneration stands. Nine of the known kestrel sites were in longleaf pine regeneration stands that were less than three years of age. Low samples sizes and a lack of available loblolly pine regeneration stands (N = 25) in comparison to longleaf pine stands (N = 63), especially one year old stands, prevent further statistical analysis of kestrel choice of pine type; however, general trends in use can still be seen.

Managed pine stands at the SRS undergo a characteristic vegetational succession following harvest as both planted pines and understory grasses and shrubs develop. These structural changes may inhibit the suitability of older (greater than three years old) regeneration stands for kestrel occupancy. Stands immediately post harvest are generally devoid of most ground vegetation. By the next year, dominant vegetation includes broomsedge (*Andropogon virginicus*), blackberry (*Rubus* sp.), and scattered forbs and grasses. Stober (1996) reports significant differences in dominant vegetation between stands less than three years old and stands four to six years since replanting. Younger stands were dominated by grasses, forbs, young pine trees, and shrubs, while older stands were dominated by planted pines, shrubs, and deciduous trees. Young (newly harvested to two year old) pine regeneration stands appear to mimic the open fields and pastures frequently used by kestrels in other regions. Increased vegetation structure also has been correlated with an increase in insects, a prey item on which breeding kestrels often specialize (Heintzelman 1964, Palmer 1988). However, whereas increased vegetation structure may imply greater prey resources, vegetation may eventually become so dense that it impairs the ability of kestrels to locate and capture prey (Hoffman and Collopy 1988).

During the breeding season, kestrels may be limited by the availability of nesting sites (Bohall-Wood and Collopy 1986). Under current management practices, regeneration stands at the SRS are dispersed throughout the site and have an abundance of pine snags that may serve as nest cavities. Three of the known successful breeding pairs nested in snags. The structural change in the number of snags between newly harvested and three year old stands, along with an increase in vegetation density during succession from initial harvest, may reduce the window of suitability of older regeneration stands for kestrel occupancy.

Overall, the SRS supports a successful breeding population of American Kestrels. Kestrels nested and foraged in managed pine regeneration stands, which appear to have both abundant prey and nest site resources. The extensive network of transmission power line right-of-ways and relatively undisturbed reactor areas also offer a mosaic of foraging habitats and perch sites. The general trends of kestrel use of longleaf pine regeneration stands less than two years since harvest seen in 1996 warrant further investigation of those stand characteristics (especially age and species classes) which influence the suitability of pine regeneration stands for kestrel occupancy.

Acknowledgments

Our sincerest thanks are given to Heather Galloway and Carrie Hamilton, who helped conduct stand surveys. John Blake, Beth LeMaster, Bill Jarvis, and

Ed Olson (of the Savannah River Natural Resource Management and Research Institute) provided logistical support and the encouragement to proceed with this research. We also thank Carol and Larry Eldridge, Dave Bowne, Deb Wohl, and Chris Beck. O. E. Rhodes, Jr. and J. Parrish provided insightful comments on early drafts of the manuscript. Financial support for field research was provided from the U.S. Environmental Protection Agency (grant CR 820668-01-0) through J. B. Dunning, Jr. and an Andrews Fellowship from Purdue University to A. Allen. This research was supported by Financial Assistance Award Number DE-FC09-96SR18546 from the U.S. Department of Energy to the University of Georgia Research Foundation. Logistic support was provided through the Department of Energy-SROO (Biodiversity Program) of the Savannah River Institute. The Savannah River Site is a National Environmental Research Park.

Literature Cited

Bohall-Wood, PG and MW Collopy. 1986. Abundance and habitat selection of two American Kestrel subspecies in north-central Florida. Auk 103: 557 - 563.

Breen, TF and JW Parrish, Jr. 1997. American Kestrel distribution and use of nest boxes in the coastal plains of Georgia. Florida Field Naturalist 5:129-138.

Breen, TF, JW Parrish, K Boyd, and B Winn. 1995. Southeastern American Kestrel nests in Bulloch, Evans, and Columbia Counties, Georgia. Oriole 60:33 - 36.

Dunning, JB, Jr., R Borgella, K Clements, and GK Meffe. 1995. Patch isolation, corridor effects, and colonization by a resident sparrow in a managed pine woodland. Cons. Biol. 9:542 - 550.

Heintzelman, DS. 1964. Spring and summer sparrow hawk food habits. Wilson Bull. 76:323 - 330.

Hoffman, ML and MW Collopy. 1988. Historical status and nest-site selection of the American Kestrel (*Falco sparverius paulus*) in Florida. Wilson Bull. 100:91 - 107.

Hunter, WC. 1990. Handbook for Nongame Bird Management and Monitoring in the Southeast Region. US Fish and Wild. Service. Atlanta, Georgia. 198 pp.

Norris, RA. 1963. Birds of the AEC Savannah River Plant Area. The Charleston Museum. Charleston, South Carolina. 78 pp.

Palmer, RS (ed.) 1988. Handbook of North American birds. Vol. 5. Diurnal raptors (Part 2). Yale Univ. Press. New Haven, Connecticut. 465 pp.

Post, W and SA Gauthreaux, Jr. 1989. Status and distribution of South Carolina birds. The Charleston Museum. Charleston, South Carolina. 83 pp.

Roest, A I. 1957. Notes on the American Sparrow Hawk. Auk 74: 1-19.

Shuford, WR. 1997. Nest box use, reproductive success, and nestling growth of American Kestrels (*Falco sparverius*) nesting along the coastal plain of Georgia. M.S. Thesis, Georgia Southern University, 75 pp.

Smallwood, JA. 1988. The relationship of vegetative cover to daily rhythms of prey consumption by American Kestrels wintering in south-central Florida. J. Raptor Res. 22: 77 - 80.

Sprunt, A Jr. and EB Chamberlain. 1949. South Carolina Bird Life. Univ. of South Carolina Press, Columbia, South Carolina. 575 pp.

Stober, JM. 1996. Territory dynamics and basic biology of the Bachman's Sparrow (*Aimophila aestivalis*) at the Savannah River Site, South Carolina. M.S. thesis, Univ. of Georgia, Athens, Georgia.

CAROLINABIRDS

Carolinabirds is an Internet e-mail discussion group about birds and birding in the Carolinas. Subscribers frequently post sightings to it similar to those found in Briefs for the Files, but unusual behavior receives more attention. Subscriptions are free. To subscribe, address an e-mail message to <majordomo@acpub.duke.edu>. Don't fill in the subject line. As your message, simply put, "subscribe carolinabirds" (without the quotes). You will receive a confirmation and more information shortly. Submissions for Briefs for the Files should be sent directly to Ricky Davis.