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Locating Nests of Birds in Grasslands From a Mobile Tower Blind

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ABSTRACT -- Locating nests of grassland passerines can be difficult, labor intensive, and disruptive to birds and vegetation. We developed a mobile tower blind for observing adult bird behavior and used it to locate nests in a western Montana grassland. We compared nest-search efficiency of behavioral observations from the tower versus the ground. Nests of savannah sparrow (*Passerculus sandwichensis*) were found in a higher proportion of territories searched from the tower (13/16 = 82%) than from the ground (4/13 = 31%). Average search time for each nest found was lower from the tower (44 min) than from the ground (127 min). Both were lower than when we used drags made of rope or cable and chain (411 min), but nests were found earlier in the nesting cycle when we used drags. Adult birds were agitated and reluctant to approach and reveal their nests whenever an unconcealed observer was present in or near their territory. In contrast, normal behavior resumed within a few minutes after an observer entered the tower, even when the tower blind was within 10 m of the nest. Observing behavioral cues from a tower blind provides substantial advantages for locating nests of savannah sparrows and probably other grassland birds, but effectiveness of the approach likely varies among species and habitats.

Key words: behavioral cue, grassland bird, nest search, savannah sparrow, tower blind.

Locating nests is essential to many studies of avian breeding biology and demography, but studies of passerines nesting in grasslands often have been limited by an inability to locate adequate samples of nests (Vickery et al. 1992). Methods used to locate nests in grasslands include walking areas systematically (Roseberry and Klimstra 1970) or in haphazard paths (Winter 1999) and pulling a drag made of rope (Labisky 1957) or cable and chain (Higgins et al. 1969). However, these methods require considerable labor (Johnson and Temple 1990) and may disturb birds or

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damage nests or grassland vegetation (Vickery et al. 1992, Dale et al. 1997). Cable-chain drags require motorized tow vehicles, and tracks from these vehicles may persist for several years. In addition, dragging may not be feasible in areas of brush, trees, or wetlands (Klett et al. 1986).

Most grassland passerines nest on the ground, and ground nests often are difficult to locate (Warner 1992, Martin and Geupel 1993). Researchers in forested habitats typically locate nests by following movements of adults and observing behavioral cues (nest building, incubation recesses, feeding of nestlings, etc.), but many birds are intolerant of nearby observers and behave abnormally while disturbed (Martin and Geupel 1993). Concealment for observers is more limited in most grasslands than in forests, but concealment for birds and ground nests often is greater. Finding a nest in grassland often is difficult even after the location is known to within a few meters. We reasoned that an observer in a concealed and elevated position could avoid detection by birds, see birds moving along the ground (Lanyon 1957), and observe nest locations precisely. Consequently, we developed a mobile tower blind (henceforth, tower) and used it to search for nests in grasslands by observing behavioral cues of adults. Our objectives were to test for differences in nest-search efficiency between behavioral observations from the tower versus the ground for savannah sparrow (*Passerculus sandwichensis*), the most common passerine species on our study area (Fondell 1997), and to compare search efficiency between behavioral searches and dragging for nests. We also compared search methods relative to stage in the nesting cycle at which nests were found.

STUDY AREA and METHODS

We conducted research in the Mission Valley in west-central Montana on the Flathead Indian Reservation. Gently rolling glacial topography and high densities of wetlands characterized the area (Lokemoen 1962). Tame, cool season grasses dominated the 64 ha site studied in 1997; common grasses included smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and timothy (*Phleum pratense*). The site had been grazed heavily by cattle in previous years, but plentiful moisture and the absence of grazing in 1997 resulted in the growth of dense, tall stands during the breeding season. Vegetation visual obstruction readings (Robel et al. 1970) on ungrazed tame grasslands in the area are typically 1.4 to 1.8 dm (Fondell 1997).

We developed the tower (Fig. 1) to provide concealment, an elevated vantage point, and reasonable portability. Construction was of tubular steel, with three legs supporting a hexagonal floor, a swivel seat providing a 360^0 range of view from a height of 2.7 m above the ground, and a camouflage canopy. The canopy was relatively opaque so that the observer could not be detected by birds. The tower weighed 40 kg and could be moved on two bicycle wheels within a field by a lone

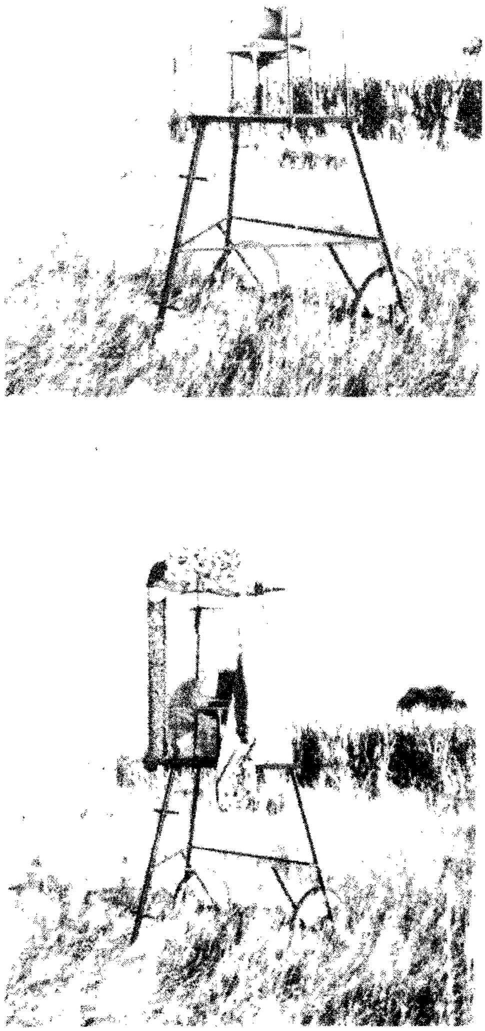

Figure 1. A mobile tower blind for nest searching. Details on materials and construction are available from the Montana Cooperative Wildlife Research Unit.

observer. Materials cost about $250, and details on materials and construction are available through the Montana Cooperative Wildlife Research Unit.

We conducted field work from 26 May to 12 July 1997. We mapped territories of all savannah sparrows early in the breeding season by walking around the site, observing behavior of territorial males, and mapping their locations (Ralph et al. 1993). To minimize *a priori* knowledge of territories by nest searchers, most mapping was conducted by other observers. Territories ranged from about 1.2 to 1.6 ha and covered virtually the entire site except for wetlands. The site was equally divided between two nest searchers; both had more than two seasons of experience locating nests of ground-nesting passerines. We then randomly assigned search method (tower search or ground search) to each territory, thereby controlling for any differences among territories (habitat, behavior of individual birds, nesting stage, etc.). We used the assigned search method for each territory throughout the breeding season and accumulated the knowledge gained during each visit. We moved around a territory to optimize our position for observing behavioral cues, but did not systematically search for nests. We typically remained stationary during searches until behavioral cues indicated the general location of the nest, then moved as close to the nest as possible without adversely affecting adult behavior. We often attempted to conceal ourselves during ground searches by kneeling or lying in tall grass. Search time during each visit to a territory was limited to one hour unless we were actively gaining information about the nest location. If no nest was found, we revisited the territory one to seven days later, depending on information gained during the previous visit. Elapsed time for each visit to a territory was summed over all visits to that territory to calculate total search time.

We used a one-tailed full factorial analysis of variance (general factorial GLM ; Norusis 1996) to determine whether conducting searches from a tower decreased total search time required to find a nest. We evaluated potential differences between searchers (and, hence, between separate search plots) by testing for effects due to searcher and an interaction term (searcher x search method). Total search time was log transformed to meet assumptions of normality and homogeneity of variance. To be conservative, we included in our analysis only territories where nests were eventually found.

We had also searched for nests of all ground-nesting bird species in 1993 through 1996 by hand-dragging a rope with attached cans and chains and by using 4-wheeled all-terrain cycles to pull a cable-chain drag (Higgins et al. 1969); we searched numerous sites in the Mission Valley, including the 1997 experimental site. Species composition of vegetation was similar to the 1997 site, and vegetation ranged from tall and dense at ungrazed sites to short and sparse at heavily grazed sites (Fondell 1997). Here we consider search efficiency of dragging only for those sites where savannah sparrow densities were similar to the 1997 site (± 0.3 birds per point count station). Dragging crews consisted of two drivers or rope-pullers and one or two observers following behind the drag. For each site, we calculated a mean search time for each savannah sparrow nest found by multiplying the time required to search a site by the number of crew members, divided by the number of nests found on the site. We used χ^2-tests to compare the frequency distributions of the stage in the nesting cycle during which nests were found by behavioral observations versus dragging.

RESULTS

We used behavioral cues to search 29 savannah sparrow territories in 1997 and found 17 nests; nests were found in a higher proportion of territories with tower searches (13 nests/16 territories = 81.3%) than with ground searches (4 nests/13 territories = 30.8%). Effects due to searcher ($F = 0.37$, $df = 1,14$, $P = 0.55$) and the interaction of searcher by search method ($F < 0.001$, $df = 1,14$, $P = 0.98$) were not significant, so we removed this main effect and interaction from the model. In the final model, mean total search time per nest for tower searches ($\bar{x} = 44$ min, 95% CI 30 to 65 min) was lower ($F = 7.38$, $df = 1,14$, $P = 0.009$) than for ground searches ($\bar{x} = 127$ min, 95% CI 66 to 246 min).

During 1993 through 1996, we found 11 savannah sparrow nests ($\bar{x} = 565$ min/nest, SD = 204) with a rope drag and 72 ($\bar{x} = 377$ min/nest, SD = 237) with a cable-chain drag ($t = 1.5$, $df = 20$, $P = 0.16$). Overall average search time per savannah sparrow nest found by dragging was 411 min/nest (SD = 238).

The stage at which savannah sparrow nests were located did not differ between tower and ground searches using behavioral cues ($\chi^2 = 0.01$, $df = 2$, $P = 0.97$) or between searches using a cable-chain drag versus a rope drag ($\chi^2 = 0.06$, $df = 2$, $P = 0.97$) so we combined the two variations of methods in each case. Nests found during building and laying, incubation, and nestling stages comprised 0.0%, 28.0%, and 72.0% of 25 nests found by using behavioral cues versus 11.3%, 71.4% and 17.3% of 133 nests found by dragging ($\chi^2 = 33.2$, $df = 2$, $P < 0.001$).

We also located nests of vesper sparrow (*Pooecetes gramineus*), grasshopper sparrow (*Ammodramus savannarum*), and western meadowlark (*Sturnella neglecta*) by using both behavioral cues observed from a tower and dragging, and nests of clay-colored sparrow (*Spizella pallida*) by using behavioral cues only.

DISCUSSION

Searching for savannah sparrow nests by using behavioral cues was considerably more efficient from a tower than from the ground, relative to both nests found per territory searched (tower = 2.64 × ground) and search time per nest (tower = 0.35 × ground). The latter comparison is conservative because we considered search times only for territories where a nest was found, and search times tended to be longest in territories where a nest was never found. We suggest that increased efficiency from a tower was due primarily to two factors. First, all species and most individual birds seemed agitated by the presence of an unconcealed observer in their territory but returned to apparently normal behavior within a few minutes after the observer entered a tower. This transition was striking, and occurred even in cases where a tower was placed within 10 m of a nest. Conversely, most birds remained agitated and reluctant to approach their nest until an observer on the ground moved outside of, and sometimes well beyond, the territory boundary. Second, the elevated viewing height provided by a tower often allowed an observer to ascertain the nest location to within a 20 cm radius. In contrast, preliminary locations ascertained from the ground (whether through behavioral cues or dragging) often were greater than 2 m from the nest. This difference had a substantial effect on secondary search time, on whether the nest was eventually found, and on damage to vegetation around the nest. We also noted that wariness of birds seemed to increase markedly after an observer approached the nest site. Consequently, whenever possible, the suspected site should not be approached until the observer is virtually certain of the exact nest location.

Our data suggested that nest-search efficiency was greater when we used behavioral cues than when we used dragging, but our comparison was informal and should be interpreted cautiously. Estimates per nest of search time using behavioral cues did not include territories where no nest was found. Even when including all territories, search times using the tower ($\bar{x}$ = 63 min) were substantially less than when using dragging. However, search times for dragging included time spent locating nests of other species. The comparison also was based largely on different areas and years, and we could not control for these differences.

Finding nests early in the nesting cycle is advantageous in most studies. We presume that nests were found earlier in the nesting cycle when we used dragging than when we used behavioral cues because dragging was most efficient during the incubation stage when adults spend the most time on the nest and behavioral searches were most efficient during the nestling stage when adults made the most trips to and from the nest (see Martin and Geupel 1993). Dragging also may be advantageous in studies where species such as upland-nesting ducks or shorebirds, which take infrequent incubation breaks and do not feed their young, are of interest.

Nests of savannah and clay-colored sparrows seemed relatively easy to find with behavioral cues because adults usually landed within a few dm of the nest and male clay-colored sparrows carried food to incubating females. In addition, dragging to locate nests of clay-colored sparrow was not possible because it nests in shrub habitat. Conversely, western meadowlark, vesper sparrow, and grasshopper sparrow, though they seemed to behave normally in the vicinity of a tower, usually walked along the ground for several meters when approaching their nests. This behavior likely made their nests relatively difficult to find with behavioral cues, though we suspect that observations from a tower would still provide considerable advantage. Following the movements of western meadowlark was also complicated by their relatively large territories (Lanyon 1994). Careful study of species-specific behavioral cues might substantially increase search efficiency (Martin and Geupel 1993).

Overall, we suggest that nest searching for passerine nests in grasslands by observing behavioral cues has considerable potential. The technique was especially appropriate in situations where an individual observer worked alone, where shrubs or other obstructions made dragging difficult or inappropriate (Klett et al. 1986), or where damage or excessive disturbance of vegetation was of special concern. Furthermore, we concluded that observations from a tower were considerably more efficient than observations from the ground. Although our study design did not allow us to evaluate the contribution of an elevated viewing point versus observer concealment to nest-finding efficiency, we suggest that both were important.

The tower described here worked reasonably well on our study site but its mass made moving it moderately difficult for some individuals, even in gentle terrain. The bicycle tires left tracks in grassland, though we judged the damage temporary and minimal. Mass could be reduced by using aluminum tubing in construction, albeit at increased cost. The large size of the tower made it roomy and comfortable during long observation sessions, but long sessions seldom proved necessary in nest searching. A smaller and more portable tower (perhaps based on a commercial three-legged ladder designed for picking fruit) likely would suffice in many situations.

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