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Abstract: An increase of eastern greater sandhill cranes (*Grus canadensis tabida*) stopping over and wintering at the Hiwassee Wildlife Refuge in east Tennessee has led to overcrowding at the refuge, resulting in crane use of private property. Proper management is needed to prevent the cranes from becoming a nuisance, increase the suitability of the refuge for waterfowl, and reduce the likelihood of a disease outbreak. Observations of cranes revealed that cranes spent 83% of their time foraging, alert, or preening. Sandhill cranes foraged primarily in agricultural and grassy fields, whereas mudflats and shallow water were used for preening and loafing. Cranes tended to use grassy fields and mudflats in greater proportion to their availability, whereas agricultural fields and shallow water were underused. The results suggest that management techniques used with sandhill cranes elsewhere will also support crane populations at Hiwassee. The issue of overcrowding at the refuge, however, still needs to be addressed.

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Key words: behavior, *Grus canadensis*, habitat use, Hiwassee Wildlife Refuge, sandhill cranes, Tennessee.

The eastern population of greater sandhill cranes (*Grus canadensis tabida*) breeds in the Great Lakes and Upper Midwest regions of North America and traditionally winters in southern Georgia and peninsular Florida (Meine and Archibald 1996). However, numbers of eastern greater sandhill cranes staging and overwintering at the Hiwassee Wildlife Refuge in eastern Tennessee have sharply increased over the last 30-40 years. During the 1960s and 1970s crane numbers ranged from 2 to 400 (DeVore 1980), and those birds only stayed a few days. More recently, as a result of crop planting (primarily corn) for waterfowl, peak numbers of wintering cranes have reached 14,000 (Fig. 1) with many birds spending most or all of the winter in the area. This increase has led to cranes using nearby agricultural and residential areas. Refuge personnel have received complaints from landowners on neighboring properties who say that cranes eat or trample much of the grain they plant for sale or consumption. Complaints from homeowners regarding the noise level of the cranes on their properties, along with the fecal droppings the birds leave behind, have also been filed. In addition to the human-crane conflicts, the large numbers of cranes may be out-competing waterfowl for food at the refuge and altering their behavior (J. W. Akins, Tennessee Wildlife Resources Agency, personal communication). This may increase pressure on waterfowl populations to find suitable stopover and wintering areas, and it requires state wildlife managers to provide adequate habitat and food for both waterfowl and cranes. Another potential problem that the high density of cranes at Hiwassee poses is the potential for a disease outbreak, such as avian cholera (U.S. Fish and Wildlife Service 1981, Windingstad 1988). While no outbreak has occurred at Hiwassee or other areas frequented by the eastern population, given that approximately half of the eastern crane population may use the refuge, a disease outbreak or similar event could negatively affect the population.

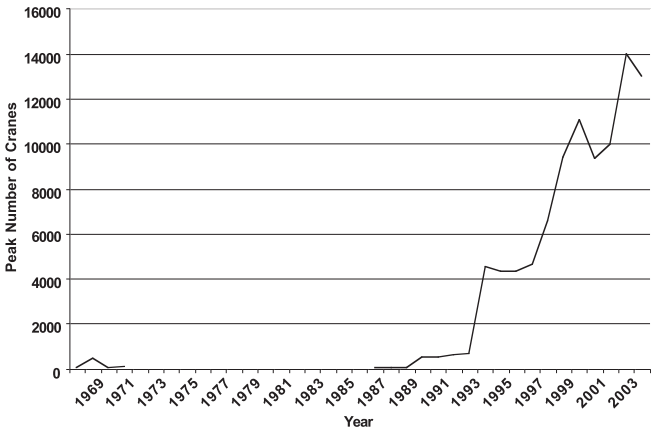

Figure 1. Peak numbers of wintering greater sandhill cranes at Hiwassee Wildlife Refuge, Tennessee. Data were not recorded between 1972 and 1986, but small flocks of sandhill cranes still used the area.

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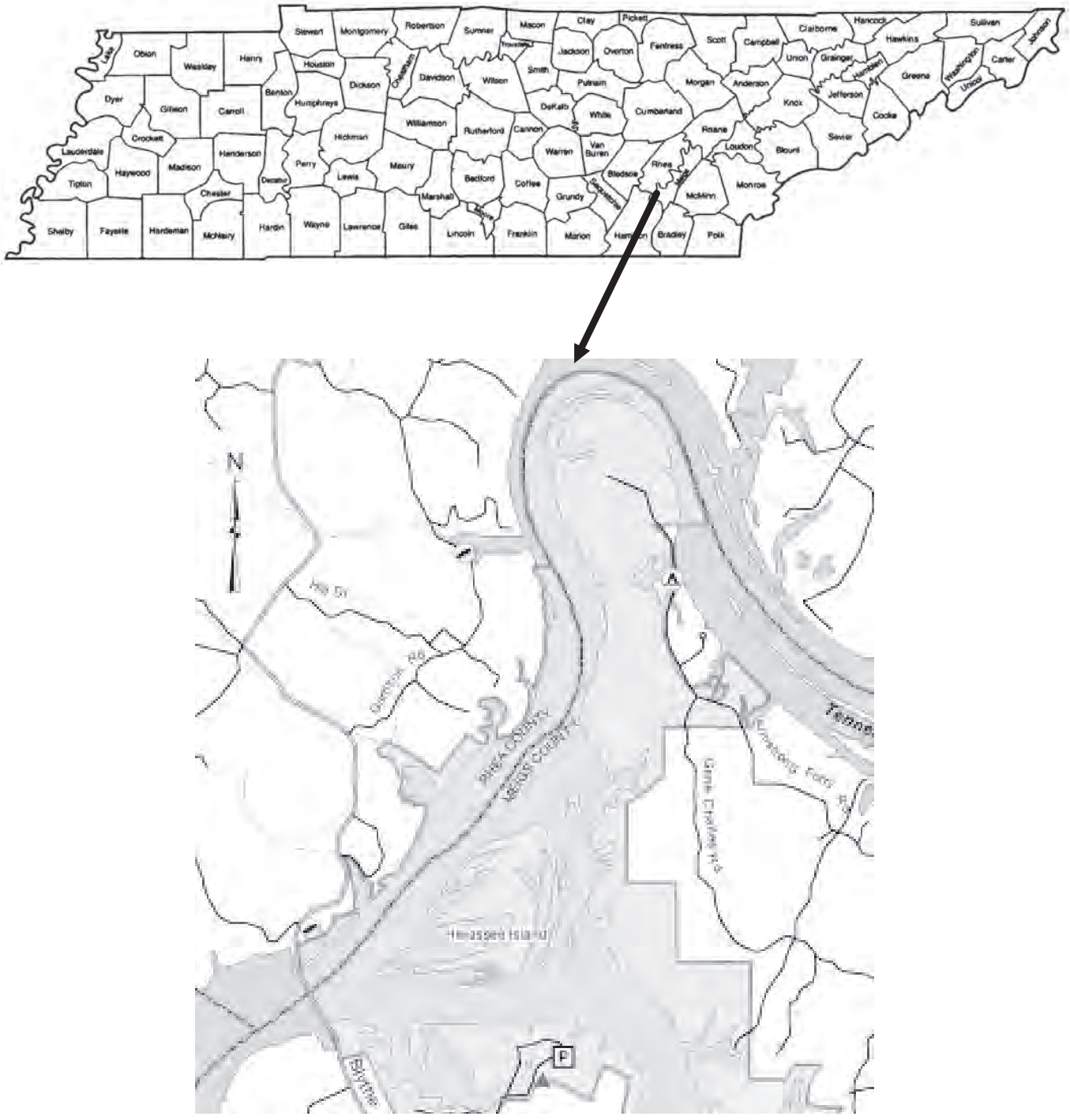

Figure 2. Location of Hiwassee Wildlife Refuge, Tennessee.

In order to find solutions to all these problems, information needs to be gathered on length of stay, local movements, migration patterns, and behavior of cranes at the refuge (Bailey 1984). To date, no comprehensive studies have been carried out on the cranes at Hiwassee. I observed sandhill cranes at Hiwassee Wildlife Refuge to determine their behavior and habitat use. Specifically, I investigated activity

budgets of cranes at Hiwassee, the cranes' habitat use in relation to habitat availability, and their behavior in relation to habitat, flock size, and ambient conditions.

STUDY AREA

The Hiwassee Wildlife Refuge is located in Meigs County, Tennessee (35°24′N, 85°58′W), at the confluence of the Tennessee and Hiwassee Rivers (Fig 2). The refuge consists of 405 ha of open fields, agricultural fields, riverbanks, and ponds. The refuge is bounded by private property, and some property owners plant various cereal crops for sale and consumption.

METHODS

I recognized 4 habitats on the refuge: agricultural field, grassy field, mudflat, and shallow water. I defined agricultural field as any land planted with an agricultural crop. I did not distinguish between the types of crops planted. The predominant crop planted is corn, with lesser amounts of millet and sorghum. Agricultural fields comprised 39% of the habitat at the refuge. Grassy field, which covered 30% of the refuge, was characterized by open land vegetated with grasses and forbs. I defined mudflats as any exposed wet ground between the water and dry land. Mudflats made up 20% of the refuge. The remainder of the refuge (11%) was shallow water, which I defined as any water no more than 0.33 m deep. Habitat availability data were obtained from the Tennessee Wildlife Resources Agency, and availability was constant throughout the study period.

I, along with 4 student assistants, collected behavioral and habitat use data for 4 years from late November to early March 2001-2004. Observations were made during daylight hours (0600-1800 EST) to reduce any temporal bias, although no systematic effort was made to gather a particular number of samples from a given time period. To examine crane behavior, I used focal observations (Altmann 1974) on individual birds. One individual was arbitrarily selected from a flock and observed for 1 minute using a 60× spotting scope. Individual observers, who worked singly and independently, recorded time spent in alert behavior (standing erect and looking around), aggression (see Tacha 1988), courtship (see Tacha 1988), foraging (probing the ground, corn stalks, or water), loafing (standing on 1 leg or with head tucked into feathers), preening (feather maintenance), and vocalizing (contact calls). After the 1-minute period, a crane from a different flock was selected and the procedure was repeated. In addition to the behaviors, the age of the individual being observed (adult or juvenile), the habitat, flock size, total number of cranes present, and weather conditions (temperature, wind direction and speed, cloud cover) were recorded. To assess habitat use, I used scan sampling (Altmann 1974), whereby flocks of cranes were scanned and the numbers of cranes in the different habitats were recorded.

For statistical analyses of the focal observations, I report the percentage of occurrences among the different behaviors. The frequency of the different behaviors was tallied, and a chi-square test was used to identify differences in the frequency of behaviors in relation to habitat. Pearson correlation analyses were used to examine associations between behavior and weather variables, as well as any relationships between behaviors and flock size. A *G*-test was used to analyze the scan samples, looking for differences between habitat use and availability. The significance level for all tests was 0.05.

RESULTS

A total of 353 focal observations were gathered. The cranes exhibited foraging behavior 40% of the time, alert 33%, preening 10%, and loafing 7%. During the remainder of the observation time the cranes were occupied by courtship, aggressive behavior, or vocalizing behavior. There was a significant difference in the frequency of behaviors seen in the different habitats ($\chi^2 = 45.85$, $P < 0.001$) with most of the foraging taking place in agricultural and grassy fields, and most of the loafing occurring on mudflats (Table 1).

To test for a temporal bias in the behavioral observations and diurnal patterns of habitat use, days were divided into 3 4-hour periods from sunrise to sunset. Seventy-six behavioral observations were gathered in the morning (0600-1000 EST), 110 observations were made during midday (1000-1400 EST), and 167 observations were made in the afternoon (1400-1800 EST). There was no difference in the proportion of time spent on different activities during the different time periods ($\chi^2 = 19.08$, $P = 0.09$; Fig. 3). Thirteen flocks were observed in the morning, 23 flocks during midday, and 19 flocks during the

Table 1. Behavior of wintering greater sandhill cranes in different habitats at Hiwassee Wildlife Refuge, Tennessee. Numbers represent the percent of total observation time birds spent exhibiting a behavior in a particular habitat.

	Agricultural field	Grassy field	Mudflat	Shallow water
Forage	15.6	16.1	4.7	3.5
Alert	9.1	11.9	9.2	4.4
Preen	1.9	2.7	3.2	2.4
Loaf	0.7	1.4	3.7	1.2
Aggression	1.2	1.1	0.3	0.0
Courtship	0.4	1.2	0.8	0.0
Vocal	1.9	0.9	0.3	0.2

afternoon. There was a significant difference in habitat use over the course of the day (χ^2 = 14,285.31, P < 0.001). Cranes used agricultural fields and shallow water most extensively during the afternoon, and mudflats most often during the midday.

There were no significant correlations between behavior and flock size, however there was an effect of weather conditions on crane behavior (Table 2). Alert behavior was negatively correlated with temperature and positively correlated with cloud cover. Preening was positively correlated with temperature, while loafing was positively correlated with wind speed. Finally, courtship and aggressive behavior were both positively correlated with temperature and courtship was negatively correlated with wind speed. Because of the disproportionate number of observations on adult birds (332 adult, 21 juvenile), no age-related comparisons were made.

A total of 55 flocks was observed during the study period, and flock size varied from 9 to 3,000 cranes (mean ± SD = 1,788 ± 1,401). There was a significant difference in use of habitats by sandhill cranes at Hiwassee Wildlife Refuge (χ^2 = 10,874.35, P < 0.001). Grassy fields and mudflats were used in greater proportion than their availability, whereas agricultural fields and shallow water were underused (Fig. 4).

DISCUSSION

Sandhill cranes at Hiwassee Wildlife Refuge spent the majority of their time foraging, alert, or loafing, which corresponds well with studies of the behavior of

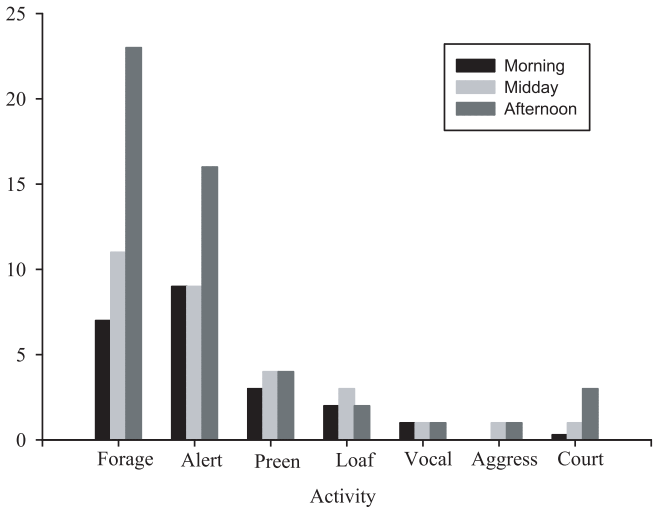

Figure 3. Activity budget of greater sandhill cranes during different time periods at Hiwassee Wildlife Refuge, Tennessee.

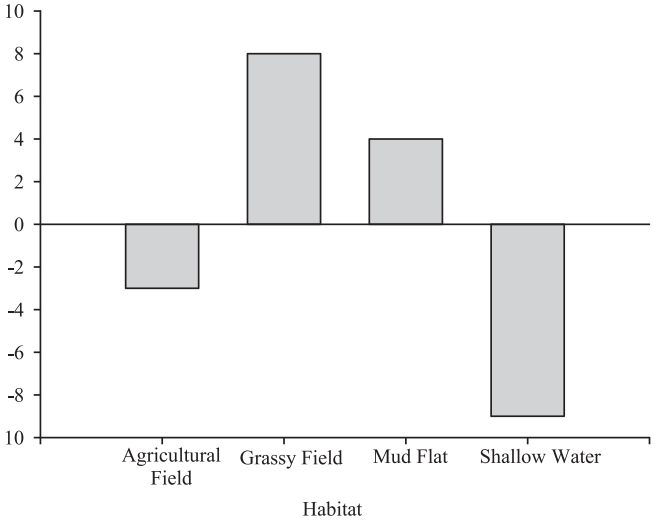

Figure 4. Deviation from expected habitat use by greater sandhill cranes at Hiwassee Wildlife Refuge, Tennessee.

Table 2. Pearson correlation coefficients for the effect of weather conditions and flock size of wintering greater sandhill crane behavior at Hiwassee Wildlife Refuge, Tennessee.

	Alert	Foraging	Loafing	Preening	Vocalizing	Courtship	Aggression
Temperature	-0.105*	-0.036	-0.084	0.197**	0.063	0.119*	0.155**
Wind speed	0.014	-0.029	0.107*	-0.030	0.013	-0.130*	-0.014
Cloud cover	0.116*	-0.039	0.026	0.010	-0.066	-0.070	-0.033
Flock size	-0.012	-0.034	0.038	-0.028	0.100	0.036	0.193

* = $P < 0.05$, ** = $P < 0.001$.

cranes staging along the Platte River, Nebraska (Krapu et al. 1984, Sparling and Krapu 1994). Studies of staging by the mid-continental population of sandhill cranes have also found that birds did most of their foraging in agricultural fields and pastures, alert behavior and loafing were most often seen in grassy areas, and most preening in pastures (Krapu et al. 1984, Krapu 1987, Sparling and Krapu 1994).

The results of habitat use in this study differ in some respects from other studies of eastern sandhill cranes. Cranes at Hiwassee used agricultural fields close to expected, while grassy fields were used much more than would be expected based on habitat availability. A study of habitat use by eastern sandhill cranes at Jasper-Pulaski Fish and Wildlife Area (J-P) in Indiana found that in the fall cranes spent 94% of their time in agricultural fields and 6% in grassy fields (Lovvorn and Kirkpatrick 1982). Although birds at J-P spent much more time in agricultural fields than cranes at Hiwassee, in relation to habitat availability, cranes at J-P were only slightly overusing the agricultural areas and slightly underusing grassy fields. Studies of mid-continental and Rocky Mountain populations also use agricultural fields disproportionately to availability and grassy fields less (Iverson et al. 1987, McIvor and Conover 1994, Sparling and Krapu 1994, Davis 2001). One possible reason why cranes at Hiwassee use grassy fields in greater proportion than has been reported in other populations is the spatial relationship of habitats at Hiwassee. Iverson et al. (1987) found that almost all the variation in the distribution of cranes in Nebraska could be attributed to the arrangement of the habitats. Grassy fields at Hiwassee may therefore receive more use because of their position relative to foraging sites or roosting areas.

The temporal use of habitats at Hiwassee is supported by other studies of sandhill cranes. Sparling and Krapu (1994) found habitat use along the Platte River changed over the course of the day. Riverine habitats, such as mudflats, were used in the early morning. Cranes then used corn fields until about 1000 hr, when they gathered in grasslands. Use of corn fields increased again from approximately 1600 hr until 1800 hr, at which time the birds returned to riverine habitats. McIvor and Conover (1994) also found that cranes in Utah and Wyoming fed heavily in agricultural fields in the morning, used grasslands during midday for loafing, then moved back to agricultural fields in the late afternoon. Despite some of the differences with other populations, sandhill cranes at Hiwassee exhibit the general pattern of foraging in agricultural fields in the morning, loafing in grasslands and mudflats during midday, and then foraging again in agricultural fields in the afternoon, especially in the hours preceding roosting. Some of the differences may be attributable to the fact that the cranes in this study are a mix of staging and overwintering birds, whereas the other studies are strictly staging birds.

Some of the relationships between weather variables and the cranes' behavior are difficult to explain, and given the low correlation values the results may have little biological significance. The negative correlation between loafing and wind speed could indicate that the birds are reluctant to move around when flying conditions are difficult. This may also explain the same relationship between courtship and wind speed. Since sandhill crane courtship sometimes involves leaping and tossing objects into the air (Tacha 1988), high winds may interfere with the proper expression of the behavior. The positive relationship between temperature and preening is likely the result of seasonality. As spring approaches and temperatures warm, the birds may increase preening in preparation for migration.

Given some similarities in behavior and habitat use between eastern greater sandhill cranes at Hiwassee

and mid-continental populations of lesser sandhill cranes, management techniques that have been used successfully with lesser sandhill cranes may be effective with the Hiwassee population. Management of cranes along the Platte River has emphasized maintenance of grain to provide carbohydrates, grasslands to provide more protein and calcium rich foods, and open water and mudflats for roosting (U.S. Fish and Wildlife Service 1981). However, site-specific and population-specific conditions need to be taken into account before an effective management plan can be implemented at Hiwassee. Such information would include differences between wintering versus staging cranes, any differences in the natural history of the eastern population versus other populations or between lesser and greater sandhill cranes, and any differences in landscape context, such as distance to water, spatial arrangement of habitats, or degree of urbanization. Maintenance of existing habitat at Hiwassee will ensure continued use of the area by staging and wintering cranes. Such maintenance, however, will not alleviate the overcrowding at the refuge, and instead will likely exacerbate it. Cranes utilizing Platte River sites have much more area in which to disperse, and only use the area for staging and not for overwintering. The problem at Hiwassee is the supplemental food source attracting cranes and prematurely halting their migration, resulting in too many cranes using a single area. Methods must be found to encourage sufficient numbers of cranes to migrate south to their traditional wintering areas so as not to exceed the capacity of the refuge.

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LITERATURE CITED

Altmann, J. 1974. Observational study of behavior: sampling methods. Behaviour 49:227-265.

Bailey, J. A. 1984. Principles of wildlife management. John Wiley and Sons, New York, New York, USA.

Davis, C. A. 2001. Nocturnal roost site selection and diurnal habitat use by sandhill cranes during spring in central Nebraska. Proceedings of the North American Crane Workshop 8:48-56.

DeVore, J. E. 1980. Status of the sandhill crane in Tennessee. The Migrant 51:45-53.

Iverson, G. C., P. A. Vohs, and T. C. Tacha. 1987. Habitat use by mid-continent sandhill cranes during spring migration. Journal of Wildlife Management 51:448-458.

Krapu, G. L. 1987. Use of staging areas by sandhill cranes in the mid-continent region of North America. Pages 451-460 *in* G. W. Archibald and R. F. Pasquier, editors. Proceedings of the 1983 international crane workshop. International Crane Foundation, Baraboo, Wisconsin, USA.

Krapu, G. L., D. E. Facey, E. K. Fritzell, and D. H. Johnson. 1984. Habitat use by migrant sandhill cranes in Nebraska. Journal of Wildlife Management 48:407-417.

Lovvorn, J. R., and C. M. Kirkpatrick. 1982. Field use by staging eastern greater sandhill cranes. Journal of Wildlife Management 46:99-108.

McIvor, D. E., and M. R. Conover. 1994. Habitat preferences and diurnal use among greater sandhill cranes. Great Basin Naturalist 54:329-334.

Meine, C. D., and G. Archibald, editors. 1996. The cranes–status survey and conservation action plan. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.

Sparling, D. W., and G. L. Krapu. 1994. Communal roosting and foraging behavior of staging sandhill cranes. Wilson Bulletin 106:62-77.

Tacha, T. C. 1988. Social organization of sandhill cranes from midcontinental North America. Wildlife Monographs 99.

U.S. Fish and Wildlife Service. 1981. The Platte River ecology study special research report. U.S. Fish and Wildlife Service, Jamestown, North Dakota, USA.

Windingstad, R. M. 1988. Nonhunting mortality in sandhill cranes. Journal of Wildlife Management 52:260-263.