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HABITAT USE BY FLORIDA SANDHILL CRANES IN THE OKEFENOKEE SWAMP, GEORGIA

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Abstract: Habitat selection by Florida sandhill cranes (Grus canadensis pratensis) in the Okefenokee Swamp was studied 1985-87. Wetland habitats were used exclusively. Herbaceous emergent marsh was the only habitat selected throughout the year. Although composing only 12.6% of the Swamp, such marsh received 54.8% use. Use of macrophyte emergent marsh (aquatic bed) peaked during summer and averaged 24.2% throughout the year. Shrub-scrub marsh, used for nesting, received 14.2% use. Habitat selection by adults and subadults (1-3 year-olds) was similar. Significant differences occurred only in spring when adults utilized Carex sp. and shrub-scrub marsh for nesting. Water depths in the marshes and seasonal food preferences were the primary factors controlling seasonal habitat use. During the summer dry season cranes were able to exploit all marsh habitat types. When water depths exceeded 30 cm (normally fall and winter), cranes were limited to the drier cover types and floating peat batteries.

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The Florida sandhill crane is a nonmigratory subspecies occurring in the Okefenokee Swamp in southeastern Georgia to southern Florida (Walkinshaw 1973). Most of the existing information on Florida sandhill crane ecology is based on studies of populations in Florida at Kissimmee prairie (Walkinshaw 1976, 1981) and Loxahatchee National Wildlife Refuge (Thompson 1970). Information on the Okefenokee Swamp population is limited to individual sightings of birds (Wright & Harper 1913; Hebard 1941), and a brief description of nesting habitat (Walkinshaw 1947).

This research was to determine seasonal habitat preferences of Florida sandhill cranes in the Okefenokee Swamp and was funded via U.S. Fish and Wildlife Service contract 14-16-0009-1551, Endangered Species Research Program, and the Cooperative Fish and Wildlife Research Units Center. I thank Okefenokee National Wildlife Refuge personnel for their cooperation in this study. L.A. Bennett provided field assistance and M.J. Van Den Avyle and S. Anthony provided logistical support.

STUDY AREA

The Okefenokee Swamp is a protected wetland wilderness (as a National Wildlife Refuge and National Wilderness Area) in southeastern Georgia, comprising 1,890 km². It is a peat-filled depression with water chemistry and biology influenced by low pH (Bossman 1981). The vegetation is characterized as a swamp-marsh complex comprised of a mosaic of freshwater wetland types including aquatic macrophyte and emergent marshes, Sphagnum beds, shrub swamps, swamp forests and lakes. Water levels, fire and underlying stratigraphy determine the spatial distribution of plant communities and pathways of succession (Cypert 1972; Rykiel 1977).

Several marshes overlay topographic depressions and have been marshes since the beginning of peat deposition (Cohen 1973; Rich 1979). More recent marshes have been formed by fires which burned away layers of peat and created openings in formerly wooded swampland (Cypert 1961; Hamilton 1982). Those shallow marshes are locally called “prairies” (Cypert 1972), and have well defined boundaries and long established names (Fig. 1). The Okefenokee exhibits a long hydroperiod (Rykiel 1977) and water depths average 50 cm under normal hydrologic conditions. Climate is humid subtropical and annual precipitation varies from 100 to 150 cm.

METHODS

Color infrared aerial photographs at scales of 1:10,000 and 1:30,000 were used to identify and map open water marshes. Vegetation types were identified through photo-interpretation per Gammon & Carter (1979) and classified according to Cowardin et al. (1979). Cover type species com-
position was determined using field checks and vegetation sampling. The minimum mapping unit size was 2 ha, and smaller areas were grouped with adjacent vegetation types. Marsh size and composition of vegetation types was estimated according to Golet & Larson (1974). Cranes were captured by rocket netting using methods similar to those described by Wheeler & Lewis (1972). During handling, cranes were classed as subadults (1-3 years) or adults (> 3 years) based on wing molt pattern (Nesbitt 1987), banded with size 9 USFWS aluminum leg bands and color marked with white plastic neckbands (Sladen 1973) and/or white plastic leg bands (Drewien & Bizeau 1978). Twenty-six individuals were instrumented with radio transmitters attached to plastic leg bands (Melvin et al. 1983). Radio-equipped cranes were monitored with Telonics TRC-1 receivers and directional 4- and 8-element Yagi antennae mounted in boats. Locations were obtained by triangulation and plotted in the field on 1:10,000 scale aerial photographs and later transferred to a vegetation cover type map. Most triangulations were obtained at distances of 1 km or less and we estimated (using field trials) accuracy to be within 1.2 ha. Radio locations were obtained on average of 3 days/week between 0600 and 2200 hours, 12 months/year. No more than 5% of the locations were made on the same day for any 1 crane and these were ≥ 3 hours apart. Visual observations were used to supplement telemetry data.

Frequency of occurrence of cover types was determined from vegetation maps prepared for the study area and Chi-square analysis was used to determine if cover types received proportionate use. Relative preference indices were computed for each cover type by dividing percent utilization by percent availability minus 1. Positive values indicated preference, negative values between 0 and 1 indicated nonpreference, and -1 indicated no use. Analysis of variance was used to compare habitat use between different age and social groupings of cranes.

Feeding behavior and food habits information was collected via 40-60x spotting scopes and through examining feces, probe holes and feeding sites.

Airboat and helicopter nest surveys were conducted throughout the nesting season (1 March - 31 May) at 7 and 20 days intervals, respectively. Nest search patterns were systematic and designed to cover all available habitat within the survey unit. Data recorded on initial visits to each nest included cover type, dominant vegetation, nest dimensions, nest composition and water depth within 1 m of the nest.

Habitat variables measured at roost sites included water depth, vegetation cover type, vegetation height and linear distance to nearest shrubs or trees. Observation blinds were constructed near roost sites to study crane behavior and duration of use.

RESULTS & DISCUSSION

Habitat Availability

Approximately 220 km² of open marsh habitat (non-forested emergent wetland) was identified in the Okefenokee Swamp. Three major emergent marsh cover types were identified:

1. **Aquatic macrophyte marsh** (aquatic bed) is vegetated primarily by water lily (*Nymphaea odorata*), neverwet (*Orontium aquaticum*), pipewort (*Eriocaulon compressum*), floating heart (*Nymphoides peltata*), pickerel-weed (*Pontederia cordata*) and hardhead (*Xyris smalliana*). Masses of bladderworts (*Utricularia* spp.) and green algae are common submergents. Scattered throughout are stands of trees or shrubs known locally as "houses" or "heads". These knolls of peat rise above the surrounding prairie and range in size from 0.1 to 10 ha. "Houses" can compose up to 40% of the area within this cover type. While the surface of peat in the macrophyte marsh is normally flooded by 25-50 cm of water throughout the year, floating masses of peat, known locally as "batteries," occur throughout this type. Trapped gases within the peat layers cause "batteries" to periodically rise and sink. Those that remain afloat for several years are colonized by vegetation and eventually develop into shrub or tree-houses (Cypert 1972). Macrophyte cover type composed 50.3% of the Okefenokee marshes and was the dominant vegetation type in marshes > 10 km².

2. **Herbaceous marsh** (emergent wetland) is dominated by emergent graminoids, primarily maidencane grass (*Panicum hemitomon*), broom sedge (*Andropogon virginicus*) and sedge (*Carex spp.*). Other species found include chain-fern (*Woodwardia virginica*), red root (*Lacananthes caroliniana*), water loosestrife (*Decodon verticillatus*), hardhead (*Xyris smalliana*), pitcherplant (*Sarracenia minor*) and iris (*Iris caroliniana*). Sphagnum moss (*Sphagnum spp.*) is the dominant floating and
submerged species. This type occurs on areas slightly higher in elevation than the herbaceous mats and gradually encroaches over the open water areas of lakes and macrophyte marsh. Herbaceous marsh is distributed in large continuous blocks but more commonly occurs as a fringe or band around “houses” and on peat “batteries” in the macrophyte marsh. Chain-fern and red root are intolerant of water depths that exceed 30 cm (Cohen et al. 1984) and are consistent indicator species of this vegetation type. In mapping the herbaceous prairie type, continuous stands of Carex were delineated from the mixed-grass association and classified as a subtype. Cyper (1961) reported that Carex colonized recently burned areas and Cohen et al. (1984) suggested that Carex stands may be relatively ephemeral and occur only briefly after fire or other disturbances. Shrubs and trees can compose up to 30% of the coverage within the herbaceous covertype, the dominant species being hurrach bush (Lyonia lucida), tifi (Cyrilla racemiflora), Virginia willow (Itea virginica), button bush (Cephalanthus occidentalis), lobilly bay (Gordonia lasianthus), pond cypress (Taxodium ascendens), red maple (Acer rubrum) and slash pine (Pinus elliottii). Herbaceous cover type composed 26.1% of the marsh habitat.

3. Shrub-scrub marsh consists of shrub-scrub swamp interspersed with patches of marsh (either macrophyte or herbaceous) or in which marsh is obvious beneath the canopy. Trees and shrubs are dominant within this type and may compose up to 70% of the area. Most existing shrub-scrub marsh in the Okefenokee is the product of recent fires which, depending on their intensity, have arrested the process of succession or partially converted cypress swamp into open marsh. The spotty nature of severe burns results in a mosaic of openings and diverse vegetation communities. Shrub-scrub marsh also develops through primary succession as woody plants colonize herbaceous marsh and eventually dominate a site. Shrub-scrub cover type composed 23.5% of the marsh available.

A water depth gradient occurs along the transition zones between forested or shrub swamp, herbaceous marsh and macrophyte marsh. Water depths were greatest in the macrophyte marsh and decreased by an average of 65% within herbaceous marsh and 76% within forested and shrub-scrub marsh. This water depth gradient is most evident along the outer margins of marshes and on the edges of wooded “houses”.

Seasonal Habitat Selection

A sample of 3,160 locations of radio-tagged cranes was obtained between April 1985 and November 1987 with sightings and a visual classification of cover type obtained on 30% of the locations. Differences in habitat designations obtained by triangulations and sightings were not significant (P > 0.01), so both were combined for analysis.

All habitat use by sandhill cranes was confined to the wetland cover types described above. None of the radio-tagged cranes visited upland islands within the Swamp or traveled to upland pine forests or agricultural pasture and cropland which occurs within 3 km of the Swamp nor did they make use of closed canopy swamp forest or shrub swamp. The mixed-grass herbaceous marsh cover type was the only wetland habitat selected by cranes throughout the year. This cover type composed only 13% of the study area but received 55% of the use throughout the year (Table 1). Mixed-grass herbaceous cover type was of greatest importance in fall and winter when it accounted for 62 and 72% of all use, respectively. The Carex-herbaceous cover type received little to no use by cranes except in spring and early summer when it was used for nesting.

The tubers of red root are probably the major plant food item in the diet of cranes in the Okefenokee Swamp. Red root is intolerant of shade or prolonged flooding (Cohen et al. 1984) and reaches its peak growth and abundance in the mixed-grass herbaceous marsh cover type. The density of tubers in extensive beds or red root can attain 300-400 tubers/m² (S. Mizer pers. comm.). During fall and winter, pairs of cranes commonly fed for several months on a single “battery” of red root. Other important aquatic emergent plants in the diet of cranes were arrowhead (Sagittaria graminea), nutgrass (Cyperus sp.) beakrush (Rynchospora inundata) and grasspink (Calopogon pulchellus), all of which are primarily associated with the herbaceous cover type.

The shrub-scrub marsh cover type was used by cranes in spring and winter (29 and 20%, respectively) but received almost no use during summer and fall. Use exceeded availability only in spring (Table 1), when used for nesting. Use of shrub-scrub peaked after heavy rainfall and abrupt increases in water depths. On 3 occasions water depths in marshes rose by 40-50 cm within a 6 week period. In most such instances cranes responded by abandoning the macrophyte and herbaceous cover types in favor of the drier shrub-
scrub marsh. In comparison to the herbaceous cover type, plant food resources in shrub-scrub marshes are relatively limited due to shading and competition with woody vegetation.

The macrophyte cover type comprised over one-half of the available habitat within the study area, but received only 24% of the annual crane use. Use increased in late spring and peaked (45%) in summer. This cover type received almost no use by cranes during winter. Water levels were of greatest significance in the availability and use of this cover type.

With the exception of nesting, cranes were never observed entering water > 30 cm deep. Assuming that a 30 cm water depth is the tolerance threshold for crane use, macrophyte prairie is only available to cranes an average of 7 months each year. During the remainder of the year, water depths average 48 cm and can attain 100 cm. Macrophyte marsh is of greatest importance as feeding habitat during the spring and summer when cranes are predominately carnivorous. In the Okefenokee Swamp, littoral and epibenthic food resources reach their highest abundance in the macrophyte marshes.

Two major prey items in the summer diet of cranes were frogs (Acris gryllus, Rana gryla and R. utricularia) and katydid grasshoppers (Tettigoniidae). Cranes also were observed taking small snakes, topminnows (Fundulus spp.), sirens (Siren spp.), amphiuman (Amphiura mears) and crayfish (Procambarus spp.). When prey populations declined in late summer, use of the macrophyte cover type for feeding diminished, but was often used for loafing and travel between "houses" or blocks of herbaceous vegetation.

Habitat selection by adults and subadults was similar throughout the year (Table 2). Significant differences (P < 0.05) occurred only in spring when adults utilized Carex herbaceous and shrub-scrub cover types while nesting. Subadults made almost no use of these cover types in spring, remaining in the mixed-grass herbaceous cover type until summer.

The importance of the mixed-grass herbaceous cover type was evident in the distribution and density of the crane population in the Okefenokee Swamp. A high correlation (r=0.93; P < 0.001) exists between crane density and the occurrence of herbaceous cover types (Bennett 1988). Low crane density in large deepwater marshes such as Chase, Territory, Floyds and Honey Island was, therefore, probably due to low volumes of herbaceous plant cover types. These marshes were almost entirely composed of Nymphaea-Xyris macrophyte vegetation which may be perpetuated by constant fluctuation of the peat substrate. Emergent herbaceous vegetation, which requires shallow and relatively stable water levels, is unable to colonize these marshes. Peat cores taken from Chase and Floyds prairies revealed that the macrophyte community has remained unchanged from near the beginning of peat formations in the Okefenokee (Cohen et al. 1984).

Habitats used by sandhill cranes in the Okefenokee differ from those used by populations in Florida. Cranes there spend much of the year feeding in uplands consisting of improved pasture with scattered cabbage palm (Sabal palmetto) and live oak (Quercus virginiana) hammocks, open pine forests and agricultural croplands (Walkinshaw 1949, 1973; Layne 1981, 1983). On the Kissimmee Prairie, much of the best crane habitat occurs on large cattle ranches (Layne 1981), but sandhill cranes at the Loxahatchee National Wildlife Refuge use wetlands similar to the Okefenokee prairies in spring (Thompson 1970), although they leave the refuge by mid-summer and spend the remainder of the year in cattle pastures, sod farms and cropland fields (B. Neely pers. comm.). In Mississippi, sandhill cranes use pine flatwoods and savannahs for feeding during spring and summer, and use grazed pastures and croplands during the fall and winter (Valentine & Noble 1970; Valentine 1981).

**Nesting Habitat and Nests**

Cranes nested in each of the 3 major vegetation cover types. The herbaceous cover type accounted for 48% of all nests, and was the only cover type selected (P < 0.05) with respect to availability. However, nesting habitat selection was strongly influenced by water levels during the nesting season (Table 3). During 1985, a dry year, most cranes nested in the macrophyte cover type; all of the shrub-scrub and most of the herbaceous cover type lacked surface water during 1985.

Cranes made very little use (13%) of the macrophyte cover type for nesting during high water conditions in 1986 and 1987, selecting nest sites in the drier herbaceous and shrub-scrub cover types. Yearly fluctuations in water levels, which are characteristic of the Okefenokee Swamp (Rykiei 1977), create a shifting pattern of habitat use and often prevent cranes from occupying the same nesting area each year.

Sedge and chain-fern were the dominant plant species at 38 and 23% of the crane nests, respec-
vatively (Table 4). Both are widely distributed in the Okefenokee prairies and provide a large amount of residual cover in spring. Crane nests were constructed of material available near the nest and consisted of the dominant vegetation. Mean diameter of nests was 86.4 cm (r=40-145 cm) and the mean height of the nest bowl above water was 7.7 cm (r=0-17.5 cm). Nest size normally corresponded to the water depth and volume of construction material available, with the smallest situated on floating "batteries" lacking emergent cover, and the largest in deeply flooded stands of sedge.

Mean water depth at nests was 13.5 cm (r=0-39.4 cm). Surface water was absent at an average of 30% of the nests. The use of dry sites was highest during the drought season of 1985 but also occurred during high water years. The scarcity of shallow water nest sites during high water conditions suggested that cranes were selecting floating mats and "batteries" for nesting during 1986 and 1987. No nests were placed in water exceeding 49 cm in depth.

The proximity of nests to wooded cover (defined as a continuous stand of trees or shrubs) was closely related to water levels and cover type selection. Nests were situated nearest wooded cover in 1987 (x distance 18.3 m) and the farthest in 1985 (x distance in 31.5 m). In the shrub-scrub cover type, nests averaged 6.2 m from wooded cover and were commonly constructed in clumps of shrubs or at the bases of trees and stumps. Nests in the herbaceous and macrophyte cover types were farther from wooded edges, but normally were near shrubs or under the partial canopy of cypress and pine.

Sandhill crane nest site characteristics vary widely (Walkinshaw 1981) and reflect the diverse array of wetland habitats used throughout the species' range. In the Okefenokee Swamp, they select drier nest sites (> 50%) nearer wooded cover than reported for Florida populations at Kissimmee Prairie (Walkinshaw 1981) and Loxahatchee National Wildlife Refuge (Thompson 1970). Nest sites in the Okefenokee most closely resemble "swamp edge" nesting habitat described for sandhill cranes in Mississippi (Valentine 1981).

Roosting Habitat

Thirty-six overnite roost sites were examined. Roost site selection was primarily dependent upon seasonal water levels. When water depths within the prairies were 30 cm or greater, cranes roosted on floating "batteries" of peat and during periods of low water they selected shallow regions within the macrophyte marsh.

"Battery" roost sites accounted for 26 (72%) of the roosts identified and averaged 123 m² (r=2-360 m²). Seventeen (65%) lacked surface vegetation, and on those that supported emergent vegetation, the average height was 8 cm. Water depths adjacent to the roost "batteries" averaged 41 cm and water depths on them varied from 0 to 7.0 cm. Cranes would either roost on "dry" ground near the center of the battery or walk to the edge of the battery and stand in shallow water (8-15 cm). On large "batteries", cranes would seek out those areas with a shallow gradient and stand in the same location each night.

Roost sites averaged 24 m from wooded vegetation, but proximity of trees and shrubs did not appear to influence roost site selection. Several roosts were on the edge of "houses" and were partially under the canopies of cypress and bay trees. The 10 roost sites located in macrophyte prairie, and not associated with a "battery" contained floating and emergent vegetation averaging 40 cm in height and consisting primarily of neverwet, pipewort, hard head and water lily. Water depth at roost sites averaged 16 cm and was always shallower than in the surrounding marsh.

Individual cranes were observed using the same roost sites for up to 6 weeks. Shifts in roost locations most commonly followed subsidence of existing "batteries" or the emergence of new ones nearer feeding areas. During low water, when cranes were not restricted to "battery" sites, roost locations changed more frequently.

The physical characteristics of roost sites resembled those described for eastern greater sandhill cranes (G. c. tabida) on breeding and staging areas (Bennett 1978; Lovvorn & Kirkpatrick 1981). In Mississippi, sandhill cranes roost in shallow ponds during the breeding season and in estuarine marshes during fall and winter (Valentine 1981). Walkinshaw (1973) characterized sandhill crane roost sites as having standing water 10-30 cm deep and surrounded by deeper water or large expanses of marsh. Despite their entirely aquatic existence, cranes in the Okefenokee select drier sites for roosting than those reported for other populations. The use of floating "batteries" for roosting may afford security from alligator (Alligator mississippiensis) and other nocturnal aquatic predators.
LITERATURE CITED


Table 1. Seasonal habitat preference by resident Florida sandhill cranes in the Okefenokee Swamp, 1985-87.

<table>
<thead>
<tr>
<th>Season</th>
<th>Macrophyte cover type</th>
<th>Herbaceous cover type</th>
<th>Shrub-scrub cover type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>used</td>
<td>avail.</td>
<td>%</td>
</tr>
<tr>
<td>Spring (Mar-Apr)</td>
<td>395</td>
<td>15.0</td>
<td>50.3</td>
</tr>
<tr>
<td></td>
<td>45.1</td>
<td>12.6</td>
<td>2.58</td>
</tr>
<tr>
<td>Summer (May-Sept)</td>
<td>1,386</td>
<td>44.6</td>
<td>50.3</td>
</tr>
<tr>
<td></td>
<td>40.0</td>
<td>12.6</td>
<td>2.17</td>
</tr>
<tr>
<td>Fall (Oct-Nov)</td>
<td>640</td>
<td>34.6</td>
<td>50.3</td>
</tr>
<tr>
<td></td>
<td>61.8</td>
<td>12.6</td>
<td>3.90</td>
</tr>
<tr>
<td>Winter (Dec-Feb)</td>
<td>739</td>
<td>2.7</td>
<td>50.3</td>
</tr>
<tr>
<td></td>
<td>72.4</td>
<td>12.6</td>
<td>4.75</td>
</tr>
<tr>
<td>x</td>
<td>3,160</td>
<td>24.2</td>
<td>50.3</td>
</tr>
<tr>
<td></td>
<td>54.8</td>
<td>12.6</td>
<td>3.35</td>
</tr>
</tbody>
</table>

Positive values indicate preference, negative values between 0 and 1.0 indicate preference, and -1.0 indicates no use.

Table 2. Comparison of seasonal habitat use by adult and subadult Florida sandhill cranes in the Okefenokee Swamp, 1985-87.

<table>
<thead>
<tr>
<th>Season</th>
<th>Age class</th>
<th>Macrophyte</th>
<th>Herbaceous</th>
<th>Shrub-scrub</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>used</td>
<td>%</td>
<td>avail.</td>
</tr>
<tr>
<td>Spring (Mar-Apr)</td>
<td>Adults</td>
<td>14.9</td>
<td>40.1</td>
<td>10.8</td>
</tr>
<tr>
<td></td>
<td>Subadults</td>
<td>19.2</td>
<td>76.9</td>
<td>3.8</td>
</tr>
<tr>
<td>Summer (May-Sep)</td>
<td>Adults</td>
<td>35.6</td>
<td>49.1</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td>Subadults</td>
<td>48.5</td>
<td>39.4</td>
<td>11.6</td>
</tr>
<tr>
<td>Fall (Oct-Nov)</td>
<td>Adults</td>
<td>33.7</td>
<td>62.6</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Subadults</td>
<td>37.2</td>
<td>59.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Winter (Dec-Feb)</td>
<td>Adults</td>
<td>2.0</td>
<td>83.6</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Subadults</td>
<td>1.3</td>
<td>88.6</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Table 3. Nest placement by Florida sandhill cranes with respect to vegetation cover type, Okefenokee Swamp, 1985-87.

<table>
<thead>
<tr>
<th>Year</th>
<th>Water level</th>
<th>N</th>
<th>Macrophyte cover type</th>
<th>Herbaceous cover type</th>
<th>Shrub-scrub cover type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>-23</td>
<td>32</td>
<td>22 (68.7%)</td>
<td>10 (31.2%)</td>
<td>0</td>
</tr>
<tr>
<td>1986</td>
<td>+26</td>
<td>46</td>
<td>4 (8.7%)</td>
<td>27 (58.7%)</td>
<td>15 (32.6%)</td>
</tr>
<tr>
<td>1987</td>
<td>+37</td>
<td>50</td>
<td>9 (18.0%)</td>
<td>24 (48.0%)</td>
<td>17 (34.0%)</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>128</td>
<td>35 (27.3%)</td>
<td>61 (47.6%)</td>
<td>32 (25.0%)</td>
</tr>
</tbody>
</table>

1Mean water depth during the nesting season expressed in cm below (-) or above (+) normal.

Table 4. Dominant vegetation within 10 m of Florida sandhill crane nests in the Okefenokee Swamp, 1985-87.

<table>
<thead>
<tr>
<th>Species</th>
<th>N nests</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedge (Carex sp.)</td>
<td>48</td>
<td>37.8</td>
</tr>
<tr>
<td>Chain fern (Woodwardia virginica)</td>
<td>29</td>
<td>22.8</td>
</tr>
<tr>
<td>Neverwet (Orontium aquaticum) - water lily (Nyphaea odorata)</td>
<td>16</td>
<td>12.6</td>
</tr>
<tr>
<td>Broomsedge (Andropogen virginicus)</td>
<td>11</td>
<td>8.7</td>
</tr>
<tr>
<td>Maidencane (Panicum hemitomon)</td>
<td>9</td>
<td>7.1</td>
</tr>
<tr>
<td>Sedge-shrub</td>
<td>9</td>
<td>7.1</td>
</tr>
<tr>
<td>Shrub (numerous species)</td>
<td>5</td>
<td>3.9</td>
</tr>
</tbody>
</table>
Figure 1. Distribution of marshes in the Okefenokee Swamp, Georgia.