NOTES

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NESTING SUCCESS AND PRODUCTIVITY OF FLORIDA SANDHILL CRANES ON NATURAL AND DEVELOPED SITES IN SOUTHEAST FLORIDA

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The Florida Sandhill Crane *(Grus canadensis pratensis) is* most frequently associated with prairies and pastures interspersed with emergent palustrine wetlands dominated by pickerel weed *(Pontederia lanceolata)* and maidencane *(Panicum hemitomon)* (Nesbitt 1996, Stys 1997). Sandhill Cranes require freshwater wetlands for nesting and roosting, while adjacent upland prairies, improved pasture, croplands, and open pine forests are utilized for feeding (Layne 1981, 1983). Water depth and seasonal food availability are the most important factors influencing seasonal shifts in habitat use (Bennett 1992). Loss of habitat through urbanization and intensive agricultural conversions has resulted in an increasing number of Florida Sandhill Cranes using suburban and urban landscapes (Stys 1997). As a result, Sandhill Cranes can be found inhabiting such areas as airports, residential subdivisions, golf courses, and farms (Toland 1991, Stys 1997).

Much of the mitigation for development-related impacts to wetlands consists of onsite creation or enhancement of wetlands, including excavation of retention/detention ponds, lakes, and created littoral shelves or fringe wetlands. Often the documented presence of nesting or roosting Florida Sandhill Cranes in artificial wetlands is cited as an indicator of successful habitat mitigation. The results of this study suggest that nesting success and productivity of Florida Sandhill Cranes in sites associated with development are significantly lower than cranes inhabiting undisturbed native wetland habitats. The mere presence of roosting or nesting Florida Sandhill Cranes in created or enhanced artificial wetlands associated with development is not necessarily indicative of suitable habitat quality or quantity. In reality, these disturbed habitats may be reproductive sinks for Florida Sandhill Cranes inhabiting development-related landscapes.

I monitored Florida Sandhill Crane nests in Martin, St. Lucie, Indian River, Okeechobee, Osceola, and southern Brevard counties from 1987 through 1994. Each wetland was searched for signs of paired cranes with 10 × binoculars. I categorized nest sites as either natural (undisturbed habitat) or developed (suburban residential or commercial developments). When a Sandhill Crane nest was located, I recorded the stage of nesting, nesting substrate, distance to the nearest upland vegetation, and distance to the nearest human development. Subsequent visits were made to each nest site to document the fate of each nesting attempt. I used an average 30-day incubation period and a 10-week fledging period to estimate nesting dates (Tacha et al. 1992, Nesbitt 1996). Nesting success was defined as the percentage of all nesting attempts to fledge at least one young. Annual production was calculated as the number of fledglings that survived to independence at approximately 9 to 10 months of age (Tacha et al. 1992, Nesbitt 1996, Stys 1997).

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The two most important habitats to Florida Sandhill Cranes are shallow wetlands dominated by pickerelweed and maidencane, interspersed with grasslands or transitional pine flatwoods. In southeast Florida, Sandhill Cranes nested in isolated wetlands adjacent to either pastures/prairies or pine flatwoods. All crane nests that were categorized as natural sites were found in these landscapes. Sandhill Cranes also nested in the littoral zones of man-made residential ponds, lakes, and retention/detention ponds in suburban developments. Most of these artificial wetlands received run-off from adjacent golf courses, streets, and lawns, facilitating encroachment by cattails *(Typha spp)* and woody plants. I categorized all nests in these landscapes as developed sites.

A total of 73 nesting attempts was documented during this study, including 42 in natural habitats and 31 in developed areas. The mean incubation initiation date for cranes nesting in natural habitats was February 26, the mean hatching date was March 28, and the mean fledging date was June 6 (Table 1).

Nesting phenology for Florida Sandhill Cranes in natural habitats in this study was similar to those reported by Walkinshaw (1982) for nests on the Kissimmee Prairie (mean nest initiation date = 23 February, range = 7 January to 21 April). In this study, Sandhill Crane pairs in natural habitats nested more than a month earlier than those pairs nesting in developed sites (Table 1). Nesting cranes in optimal habitat may accumulate endogenous resources necessary for reproduction sooner and therefore nest earlier than cranes in less suitable, disturbed lands. Conversely, later nesting by cranes in developed sites may be related to the higher frequency of human-related disturbances and the time required for each nesting pair of cranes to acclimate. Selection of suboptimal and marginal nest sites by Florida Sandhill Cranes may be indicative of young, inexperienced, or subordinate nesting pairs (Nesbit pers. comm., Toland 1991).

Irregular or threatening sources of disturbance may cause interrupted incubation (Toland 1991) or flush adults from the nest site (Stys 1997). Sandhill Cranes flush in response to human intruders at a distance of from 10 to 250 feet (3 to 75m) from the nest (Stys 1997, Toland, pers. observ.). Subsequent to flushing, adult cranes may remain off the nest for 15 minutes to three hours (Walkinshaw 1985, Dwyer and Tanner 1992). These behavioral responses can significantly delay crane nesting attempts or even cause nest abandonment (Toland l 991, Toland 1993, Stys 1997).

Florida Sandhill Cranes in natural habitats were more successful breeders and produced more fledglings per pair than did those pairs nesting in developed sites (Table 2). Other studies in natural habitats in Florida reported smaller brood sizes of 1.42 (Layne 1982) and 1.26 (Bishop and Collopy 1987). Nesbitt (1992) reported an annual production rate of 0.51 for known breeding pairs of cranes in north-central Florida. Sandhill crane nesting success was significantly higher in natural habitats (67%, 28 of 42 nests) than in developed sites (26%, 8 of 31 nests) (χ^2 = 17.17, P<0.01, df = 1).

Table 1. Nesting phenology of Florida Sandhill Cranes in natural habitat versus developed sites, 1987-1994.

Nesting Stage	Natural Sites (n = 42)	Developed Sites (n = 31)
Incubation initiation	Mean: February 26 Range: Jan. 5-Apr. 30	Mean: April 3 Range: Feb. 8-May 29
Hatching	Mean: March 28 Range: Feb. 4-May 30	Mean: May 3 Range: Mar. 10-June 29
Fledging	Mean: June 6 Range: Apr. 15-Aug. 1	Mean: July 16 Range: May 20-Sept. 7

Table 2. Nesting success and productivity of Florida Sandhill Cranes in natural versus developed sites in southeastern Florida, 1987-1994.

Nesting variable	Natural sites	Developed Sites
Nests (*n*)	42	31
Mean clutch size	1.93	1.84
Mean brood size	1.57	1.19
Mean fledgling production[1]	0.86	0.32
Mean annual production[2]	0.45	0.16

[1]Young >10 weeks old.
[2]Independent young.

Although some Sandhill Cranes may adapt to development-modified landscapes in close proximity to humans, the overall nesting productivity of Sandhill Cranes nesting in altered sites such as golf courses, lawns, intensive agricultural areas, and suburban or urban created wetlands is usually reduced (Nesbitt 1996). Cranes nesting in developed sites probably face a wider range of nest disturbances than those pairs in natural habitats. Both habitat quantity and quality are important factors regulating Florida Sandhill Crane populations by influencing nesting effort, nesting success, and survival of young (Tacha et al. 1992). Not only do these suburban cranes face typical "natural" limiting factors such as inclement weather, fluctuating water levels, and native predators, they also encounter domestic pets, automobile traffic, maintenance equipment, power lines, fences, pedestrian intruders, and environmental contaminants (Tacha et al. 1992, Nesbitt 1996). If the amount or condition of either wetland or upland habitat is not adequate to support a family of cranes, they will leave the defended territory to forage elsewhere for extended periods (Nesbitt and Williams 1990). This additional energy expenditure may reduce endogenous resources needed for egg production or cause complete nest abandonment. Individual pairs of cranes react to human disturbances differently (Stys 1997), but even more subtle perturbations may extend incubation enough to significantly lower hatchability or nestling survival rates (Toland 1991, Stys 1997).

Long-term viability of the Florida Sandhill Crane in southeast Florida is in question due to the increasing rate of habitat loss and modification due to commercial and residential development. Wetland filling, draining, or degradation, and upland habitat fragmentation have forced more Florida Sandhill Cranes to roost or nest in suboptimal habitats and travel greater distances to find adequate foraging sites. As a result, an expanding component of the Florida Sandhill Crane population in southeast Florida is now using suburban and urban areas.

This study suggests that the mere presence of nesting Florida Sandhill Cranes in mitigation wetlands on developed lands may be misleading with regard to long-term population viability. These apparently suboptimal, man-made habitats may simply provide nest sites for young, inexperienced, subordinate, or surplus Florida Sandhill Cranes to attempt to breed with success rates and annual productivity too low to compensate for natural and human-related mortality rates. Therefore, these development-related habitats may function as reproductive sinks, reducing thc overall breeding fitness of Florida Sandhill Crane populations in southeast Florida. Long-term statewide surveys of Florida Sandhill Cranes in natural versus artificial landscapes are needed to determine how increased use of suboptimal habitat may influence the demography of the Florida population of this subspecies.

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