

Study Links Big Cypress Fox Squirrel To Golf Courses

By Patrick G.R. Jodice and James R. Snyder

The Big Cypress fox squirrel (*Sciurus niger avicennia*) is one of the distinctive animals of Florida's Big Cypress National Preserve (BICY). One of 10 subspecies of fox squirrel, the Big Cypress fox squirrel (BCFS) is endemic to southwest Florida, with a large portion of its range occurring in and around BICY. Although fox squirrels as a species have been well studied since the early 1900s, southeastern fox squirrels have received little attention. Howell (1919) first described the BCFS, and Moore (1956, 1957) published short accounts of its natural history. Williams and Humphrey (1979) conducted a field survey based on interviews with local residents and found that densities of BCFS were very low.

Concern over the animal's status was sufficient for Florida to prohibit hunting in the 1970s and place it on the state's threatened and endangered species list. A resource inventory and analysis done soon after creation of BICY (Duever et al. 1979) expressed optimism that elimination of fox squirrel hunting and improved law enforcement would allow the BCFS population to increase. Unfortunately, in the 1980s some well known local populations disappeared and the number observed in the Preserve did not increase. The animal is currently a candidate for federal listing.

Squirrel Project Funded

In 1988 BICY received funding for rare and endangered species research, developed a statement of work for a fox squirrel study, and contacted Dr. Stephen R. Humphrey of the Florida Museum of Natural History, U/FL. He developed a proposal to study the distribution and habitat use of the BICY by the squirrels. The project also planned to recommend methods for a monitoring program and management actions that would benefit fox squirrels in the Preserve. Field surveys were to be conducted over a 1 year period and data on population locations, density, diet, and habitat use were to be collected.

The senior author (Jodice) arrived in south Florida as a graduate research assistant in January 1989, to carry out field work. He began surveying a large system of pinelands in the BICY interior. Within a few weeks he located one fox squirrel at a pineland/cypress ecotone, but although the site was visited daily for the next few weeks, the squirrel was not seen again. Surveys continue throughout BICY, but it was several weeks before the next squirrel was sighted. Densities seemed low indeed!

Mercury Threatens

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food chain levels, Everglades NP and vicinity. South Florida Environmental Project. Ecol. Rpt. No. DI-SFEP-74-16. NTIS PB-235-359.

Reelke, M.E., D.P. Schultz, C.F. Facemire, S.S. Sundlof, and H.E. Royals. 1992. Mercury contamination in Florida panthers. Draft Rpt. of Florida Panther Tech. Subcomm. to the Florida Panther Interagency Comm.

Segal, M., R.A. Pielke, R.W. Armit, M.D. Moran, C.H. Yu, and D. Henderson. 1986. Southern Florida air pollution climatology study and selected episodic impacts. NPS Air Qual. Div., Contract Rpt. NA81RAH00001 to Colo. State Univ.

Simons, J.N. 1991. Mercury in the Everglades: what is the role of agriculture. Florida Naturalist. Spring:7-9.

Swain, E.B. 1989. Assessment of mercury contamination in selected Minnesota lakes and streams. Exec. Summ. Minnesota Pollution Control Agency Rpt. St. Paul.



Bromeliad clumps like this one, on the trunk of a cypress tree, are the temporary nest sites of choice for fox squirrels. (Photo by Jim Snyder.)

It became apparent that field surveys would not yield the quantity or quality of data needed. Surveying for squirrel leaf nests, a proven technique for locating squirrels elsewhere, also was unsuccessful. After 4 months we had little more information than when we started and less than 8 months to go before the end of the allotted field time.

Golf Courses Eyed

We began to focus on other populations of BCFS. We knew there were fox squirrels living on and around golf courses in the rapidly developing Naples area 50 km west of BICY. The animals were easy to locate and observe, and preliminary surveys raised interesting issues. For instance, only certain golf courses in town had fox squirrels. Golf courses also seemed to supply a wide variety of food (mostly in the form of exotic plantings) not available in BICY. We saw the golf courses as an opportunity to gain valuable natural history information on mating, daily and seasonal activity, and diet.

We decided to invest some time in the golf course populations. By spending 1 or 2 days a week on the golf courses we hoped to supplement our knowledge of BCFS and gather information on an important segment of the subspecies. Time constraints and lack of natural history knowledge led us to focus on squirrel activity patterns and diet at just 4 well-populated courses.

In the summer of 1989 another opportunity presented itself. A Naples resident was complaining about a group of fox squirrels living around her yard and eating her bird seed. She asked if the Florida Game and Fresh Water Fish Commission could remove them. Aware of our ongoing research, the state contacted us and we decided to relocate the squirrels to suitable habitat within BICY. We trapped, radio-collared, and released 5 squirrels over 3 months. We hoped this

translocation would (1) lead us to other fox squirrels, and (2) provide insight to habitat use and diet.

Ranges Expanded

Near the end of our scheduled field season a modest increase in funding made it possible to collect a full year of golf course data and 8 months of radiotelemetry data. Results from the translocation showed that fox squirrels could cover large distances in short time periods. They traveled both on the ground and through the trees. Much of this movement may be due to the squirrels' relocation; nevertheless it demonstrated their ability for extensive areal coverage.

Although comparisons with other studies are complicated by differences in methods of estimating home range size and the fact that these squirrels were translocated, it seems that *avicennia* may be using a larger home range than fox squirrels in other areas. The mean of 2 translocated BCFS home ranges was 59.6 ha (conservative estimate). This is greater than any other home ranges reported for all subspecies of fox squirrel. We feel that the habitat mosaic of BICY (predominantly pine, cypress, and mixed-swamp forests) presents a sparser food source for BCFS than for fox squirrels in typical pine/hardwood habitat. This could cause home-range sizes and movements of BCFS to be greater than those of fox squirrels in other habitats (Jodice 1990).

Habitat use of translocated fox squirrels varied among seasons. The translocated fox squirrels used wetter habitats (cypress and mixed-swamp forests) until water levels receded in mid-January. As water levels decreased, fox squirrels foraged predominantly on the ground.

From mid-January through mid-April (the termination of telemetry studies), fox squirrels were often observed digging shallow pits at the base of pine trees, indicating that they were obtaining hypogeous fungi, an important winter and early spring food item for southeastern fox squirrels (Weigl et al. 1989). Few other foods are available in these months. Pine seeds, a staple summer food, are not available until early June.

Nesting Behavior

Perhaps the most important information obtained from the telemetry project dealt with fox squirrel nesting behavior. Translocated fox squirrels rarely used leaf or cavity nests, but instead nested in cabbage palm crowns and in clumps of bromeliads (tropical epiphytes in the pineapple family) growing on cypress trees. The latter two nest types require little or no construction. This may allow fox squirrels to range over large areas without the need to build nests on a daily basis (an activity that could take up to 2 hours). Squirrels (both fox and gray) often strip bark from cypress trees for incorporation into the cabbage palm or bromeliad nest (Jodice 1990). Surveying areas for stripped cypress trees will become a useful technique for locating squirrel activity in BICY.

One translocated male fox squirrel did lead us to a "native" fox squirrel. In mid-March we located our radio-collared fox squirrel pursuing a female in a previously unsurveyed area. We located 2 nests and observed the female trying to raid a bluebird nest. We were unsuccessful in trapping that female for telemetry, but we gained valuable information and developed new ideas for trapping.

The above data from translocated fox squirrels may

provide insight into habits of resident fox squirrels. Habitat use and home range size of resident Big Cypress fox squirrels still are unknown. However, should this information become available, even a qualitative comparison between resident and translocated fox squirrels would shed valuable light on the feasibility of future translocation projects.

Adaptability Demonstrated

The results of the golf course project indicated how readily fox squirrels have adapted to a situation very different from their natural habitat. There were seasonal differences in the amount of time golf course squirrels spent foraging or inactive, but the differences were not correlated with seasonal changes in either diet or weather. These results indicate that food may not be seasonally limiting to fox squirrels on golf courses that have mixtures of native and exotic plant species.

We speculate that the seasonal shift in time spent foraging may relate to the breeding cycle, specifically young-rearing. Copulation was observed in early and mid-July 1989. The 42-day gestation period of fox squirrels would have placed births in mid-August through early September and lactation through November. During lactation, energy requirements of female fox squirrels increase, resulting in increased foraging time (Weigl et al. 1989) as we observed in the early fall.

The golf courses we studied in southwestern Florida, with their exotic species and artificially maintained habitats, provided fox squirrels with relatively stable food sources ... unusual both in its diversity within seasons and its uniformity among seasons. Unlike fox squirrels in natural habitats in the southeastern U.S., fox squirrels on golf courses did not rely on any single food item for a season (Jodice and Humphrey in press). Instead, they relied on various planted fig species throughout the year. Exotic queen palms and bottlebrush also were important food items.

Native food items of importance were pine seeds (July-September) and cabbage palm fruits (December and January). Cypress cones, a primary food item for fox squirrels in BICY, were rarely observed being eaten on golf courses. Cypress may not be a preferred food, but one consumed only when little else is available (as seems the case in many areas of BICY in the autumn months).

Questions Remain

Questions remain about the long-term viability of golf course populations of fox squirrels. It is possible that existing populations are taking advantage of natural habitat still existing on undeveloped lands adjoining the golf courses, and it is certain that continuing development will greatly reduce the availability of this natural and semi-natural habitat to urban squirrels. S.R. Humphrey has submitted a grant proposal to the Florida G&FWF Commission's Nongame Wildlife Program to address this issue.

Given the low density of BCFS in BICY we recommend that a more extensive study of fox squirrel distribution be carried out opportunistically. In addition to reporting fox squirrel sightings, field biologists working in red-cockaded woodpecker colonies or searching for panther sign also can look for stripped bark on cypress trees and gnawed pine cones in the summer months.

Capture and radio-collaring of some of the elusive resident fox squirrels will be necessary for adequate study of habitat use, food habits, and population biology in the Preserve. In the meantime, the Preserve's aggressive prescribed fire program is likely to enhance

habitat quality by maintaining open, healthy pinelands.

Jodice was a graduate research assistant with the U/FL Dept. of Wildlife and Range Sciences; he is now a Regional Nongame Biologist with the Florida Game and Fresh Water Fish Commission. Snyder is NPS Research Biologist at BICY.

Literature Cited

- Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunder-
son, L.A. Riopelle, T.R. Alexander, R.F. Myers, and D.P. Spangler.
1979. Resource inventory and analysis of the Big Cypress Na-
tional Preserve. Final report to the NPS. National Audubon Soci-
ety Ecosystem Research Unit and Center for Wetlands, U/FL,
Gainesville.
- Howell, A.H. 1919. Notes on the fox squirrels of the southeastern
United States, with description of a new form from Florida. *J. Mam-
mal.* 1:36-38.
- Jodice, P.G.R. 1990. Ecology and translocation of urban popula-
tions of Big Cypress fox squirrels (*Sciurus niger avicennia*). Un-
publ. M.S. Thesis, U.FL, Gainesville.
- Jodice, P.G.R. and S.R. Humphrey. In press. Activity and diet of an
urban population of Big Cypress fox squirrel. *J. Wildl. Mgt.*
- Moore, J.C. 1956. Variation in the fox squirrel in Florida.
Am. Midl. Nat. 55:41-65.
- Moore, J.C. 1957. The natural history of the fox squirrel, *Sciurus*
niger shermani. *Bull. Amer. Mus. Nat. Hist.* 113:1-71.
- Weigl, P.D., M.A. Steele, L.J. Sherman, J.C. Ha, and T.S. Sharpe.
1989. The ecology of the fox squirrel in North Carolina: implica-
tions for survival in the Southeast. Tall Timbers Research Station
Publ. No. 24. Tallahassee, FL 93pp
- Williams, K.S. and S.R. Humphrey. 1979. Distribution and status of
the endangered Big cypress fox squirrel in Florida. *FL Acad. Sci.*
42:201-205.