Big Cypress Fox Squirrel

Sciurus niger avicennia

Photograph by Mike Landwehr.

Species Overview

Status: Listed as Threatened on Florida's Threatened and Endangered Species List.

Current Protections

- 68A-27.003(2)(a), F.A.C. No person shall take, possess, or sell any threatened species included in this subsection or parts thereof or their nests or eggs except as authorized by Commission rule or by permit from the Commission.
- 68A-27.001(4), F.A.C. Take – to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct. The term "harm" in the definition of take means an act which actually kills or injures fish or wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. The term "harass" in the definition of take means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering.

Biological Background

A species' biological background provides context for conservation measures and permitting guidelines. It focuses on the habitats that support essential behavioral patterns, threats to the species, and what may constitute significant disruption of essential behavioral patterns.

The Big Cypress fox squirrel (BCFS) was originally described in 1919 as a subspecies of the eastern fox squirrel on the basis of its coloration, smaller size, and restricted range in southwest Florida. The BCFS is 1 of 4 eastern fox squirrel subspecies occurring in Florida. The BCFS is smaller than Sherman's fox squirrel (SFS; S. n. shermani), another Florida subspecies whose range is close to that of BCFS (Howell 1919, Moore 1956, Humphrey and Jodice 1992, Turner and Laerm 1993).

The BCFS is considered a tree squirrel (Koprowski 1994), but individuals spend a large proportion of their time on the ground. The BCFS inhabits natural, rural, and urbanized habitats (see Habitat Features). Optimal habitat conditions for BCFS are dependent upon the availability of appropriate trees for nest sites, abundant year-round food resources, and an open understory with little or no bushes or shrub layer present (Humphrey and Jodice 1992, Eisenberg et al. 2011).

Food availability significantly influences the area used by BCFS, especially by females. Ditgen (1999) reported mean male home range of 70.8 ha (radius = 475 meters) and mean female home range of 10.1 ha (radius = 179 meters) in urbanized habitat. Kellam et al. (2016), working in natural habitats, reported mean male home range of 75.6 ha (radius = 490 meters), mean female home range of 10.4 ha (radius 182 m), and a core female range of just 1.25 ha (radius = 63 meters). The relatively large home ranges of male BCFS are likely influenced by long-distance movements to find females, who may occur in widely spaced nesting areas (Koprowski 1994, Ditgen 1999, Kellam et al. 2016).

Gestation is about 6 weeks and young are weaned about 12 weeks after they are born (Koprowski 1994).

Ditgen (1999) reported BCFS having 2 breeding seasons in an urbanized area, and observations by Kellam et al. (2013) are consistent. The winter (dry season) breeding season lasts from December–April. The summer (wet season) breeding season lasts from July–October. Mating chases (i.e., one or more males chasing a female) may be observed prior to or early in the breeding season and can be an indicator that juveniles may soon be present in natal or brood nests (Koprowski 1994, Ditgen et al. 2007).

In Big Cypress National Preserve, Kellam et al. (2016) found the majority (98%) of BCFS nests were bromeliad and cypress bark nests, with sizes that ranged from 25-50 cm in diameter. Nests were typically located in cypress trees, in the upper third of the canopy, 8 m or more above ground. In an urbanized area, Ditgen et al. (2007) located 11 nests, of which 5 were in cavities in cypress trees, 3 in bromeliads in pine trees, 2 in cabbage palms and 1 in a queen palm; all nests were located in mixed stands containing cypress, slash pine, and cabbage palm trees. Both Ditgen et al. (2007) and Kellam et al. (2013) note the importance of large, epiphytic bromeliads (Tillandsia spp.) as substrates for BCFS nests in the trees where they occurred.

Big Cypress fox squirrels eat many different food items that vary in availability seasonally. Scatter hoarding of some foods such as pine cones, cypress cones, and queen palm fruits has been reported in urbanized areas (Jodice and Humphrey 1992, Ditgen et al. 2007) but not in natural habitats (Kellam et al. 2013).

As reported by multiple sources (Jodice and Humphrey 1992, Ditgen et al. 2007, Kellam et al. 2013), food items consumed by BCFS in either natural or urbanized areas include:

- java plums (*Syzygium cumini*)
- bischofia (*Bischofia javanica*) berries
- red maple (*Acer rubrum*) seeds
- silk oak (*Grevillea robusta*) flower
- thistle (*Cirsium* spp.) seeds
- cabbage palm (*Sabal palmetto*) fruit
- queen palm (*Syagrus romanzoffiana*) fruit
- hog plum (*Ximenia americana*) fruit
- cocoplum (*Chrysobalanus icaco*) berries
- cypress (*Taxodium* spp.) seeds
- figs (*Ficus* spp.)
- acorns (*Quercus* spp.)
- bottlebrush (*Callistemon citrinus*) flower
- bromeliad (Bromeliaceae) buds
- pond apple (*Annona glabra*) fruit
- holly (*Ilex* spp.) fruit
- saw palmetto (*Serenoa repens*) fruit
- wax myrtle (*Morella cerifera*) berries
- pine (*Pinus* spp.) seeds
- insects and fungi

Habitat Features that Support Essential Behavioral Patterns

BCFS are known to use a range of habitats including tropical hardwood forest, live oak forest, mangrove forest, cypress swamp, pine flatwoods, and suburban habitats, especially golf courses (Williams and Humphrey 1979). In natural habitats, BCFS prefer areas where cypress dome swamp habitat is interspersed among pine flatwoods forest habitat in a mosaic (Williams and Humphrey 1979, Ditgen et al. 2007, Kellam et al. 2016). BCFS rely on cypress domes for nest sites, as well as food, while foraging widely in the pine flatwoods. Areas of pasture where large trees, cypress dome wetlands, and food sources occur may serve a similar function as the pine flatwoods for BCFS. The extent to which BCFS use other natural habitats where they have been reported (e.g., hardwood forests, coastal broadleaf evergreen hammocks, and mangrove swamps) is not well

Photograph by Ralph Arwood.

understood. In urbanized areas, BCFS are found most frequently in parks and golf courses when large trees and food sources are retained and the groundcover is open and low (Digten 1999, Ditgen et al. 2007, Eisenberg et al. 2011). Eisenberg et al. (2011) reported that BCFS in urbanized areas were most likely to occur on sites with minimal understory growth, less than 50 cm in height and that no BCFS were found in areas with understory more than 1 m high; that pattern of habitat use is supported by Ditgen et al. (2007). In urbanized areas, patches of suitable habitat exist as islands surrounded by developed areas that constrain BCFS movement and home ranges. Even on golf course properties, BCFS primarily use stands of trees and areas without trees or ground cover (i.e., the course of play itself) limit BCFS movements (Ditgen et al. 2007).

BCFS use multiple nests. Within any given BCFS territory, multiple nests can be used for breeding or sheltering. A large majority of BCFS nests are located in bald cypress (*Taxodium distichum*) trees. Some BCFS nests have been found in slash pine (*Pinus elliottii*) and cabbage palm trees (Ditgen et al. 2007, Kellam et al. 2013). Both Ditgen et al. (2007) and Kellam et al. (2013) noted the importance of large, epiphytic bromeliads (*Tillandsia* spp.) as substrates for BCFS nests in the trees where they occurred. A BCFS nest contains woven grass, strips of cypress bark, or other inserted plant materials. BCFS regularly use nests with no fresh plant materials as well as those with fresh plant materials. Thus, it is important to recognize that nests that might seem inactive are used regularly as refuges and their presence should be seen as an indicator of habitat that is potentially occupied by BCFS. After BCFS stop using a nest and the nest deteriorates to the point that it no longer provides effective shelter, that nest may be considered abandoned and no longer a BCFS nest.

Threats

The main threats to the BCFS are loss, degradation, and fragmentation of suitable habitat that have resulted mostly from development and conversion to other uses, especially on the western periphery of the species' range. In western Lee and Collier counties, rapid urbanization has isolated local BCFS populations within fragmented habitat patches. In other parts of the species' range, habitat has been lost as pastures are converted. Improper or insufficient management, especially lack of prescribed fire, has led to degradation of potentially suitable habitats on some conservation lands. In developed areas the loss of large trees for nest sites and sheltering reduces habitat quality. In natural areas, BCFS avoid roads and developed sites (Kellam et al. 2016). In urbanized areas, increased mortality from roads, pets, and other causes (e.g., inappropriate human foods provided to squirrels or toxic substances introduced into the environment) may make those areas "ecological traps or attractive [population] sinks" (Eisenberg et al. 2011). Native bromeliads (used as nest sites) are vulnerable to loss from a non-native weevil, potentially reducing nest site availability in otherwise suitable habitat; this and squirrel diseases are further threats to BCFS (Kellam et al. 2013).

Potential to Significantly Impair Essential Behavioral Patterns

Habitat use by Big Cypress fox squirrels is primarily related to the availability and location of seasonal food items, but cypress domes and pines forests are the natural habitats used most frequently on a year-round basis (Ditgen et al. 2007, Kellam et al. 2016). Ditgen (1999) reported that individual BCFS showed clear preferences for sites where 2 tree species were codominant, rather than sites where individual tree species dominated (e.g. slash pine/cypress dominated sites and slash pine/cypress/cabbage palm dominated sites). Kellam et al. (2016) found that cypress domes interspersed in a matrix of slash pine forest is an important ecosystem for BCFS. Plant species that are important food sources for BCFS include: oaks (*Quercus* spp.), pines (*Pinus* spp.), red maple (*Acer rubrum*), pond apple (*Annona glabra*), cabbage palm (*Sabal palmetto*), holly (*Ilex* spp.), queen palm (*Syagrus romanzoffiana*), saw palmetto (Serenoa repens), hog plum (Ximenia americana), and cocoplum (*Chrysobalanus icaco*). The photographs below show that construction of the 2 most common BCFS nest types documented within Big Cypress National Preserve by Kellam et al. (2013) is much different than that of bird nests.

Stick nest with stripped cypress bark (left), photograph by Dennis Giardina. Bromeliad nest with stripped cypress bark (right), photograph by Ralph Arwood.

Open, fire-maintained pine forests with interspersed cypress domes that have long, natural hydroperiods appear to provide the habitat conditions that BCFS favor (Kellam et al. 2016). Thus, actions that alter the acreage or natural hydrology of cypress dominated wetlands or restrict the ability of fire to maintain pine forests will reduce habitat quality, and impair essential behaviors, and is likely to cause take of individual BCFS. Big Cypress fox squirrels are dependent on both cypress domes for nest sites and the surrounding upland pine matrix for diverse, year-round food sources. Actions that isolate cypress domes from upland pine forests can therefore be expected to impair essential behaviors and are likely to cause take. BCFS are known to avoid improved roads and developed sites, so actions that fragment available habitat by creating such features also reduce the quality and amount of available habitat, which impairs essential behaviors of breeding and feeding. Activities that reduce the abundance and diversity of plants known to provide food for fox squirrels will reduce food availability, which impairs essential behaviors of individuals in the population, likely causing take and reducing population size. In urbanized areas, the removal of cypress, palms, oaks, or other trees during land clearing or similar activities can remove food sources, reduce food availability, and impair essential behaviors, likely causing take of BCFS. Abundant food resources may be essential to maintain viable BCFS populations in urbanized areas where there are relatively small populations largely confined to islands of suitable habitat within the developed landscape, and rates of mortality may be higher than in natural areas. Ditgen et al. (2007) reported more reproduction in the summer, when food from exotic plant species supplemented the limited availability of native foods.

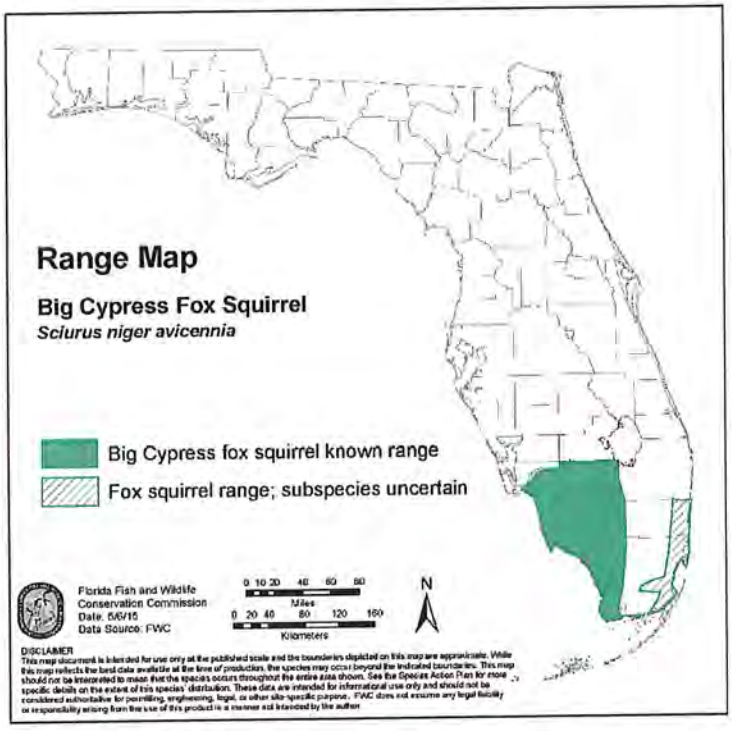
Activities resulting in loss or degradation of BCFS habitat can significantly impair essential behavioral patterns. BCFS home ranges are often extremely large (Kellam et al. 2016), and habitat use is strongly influenced by the availability of food resources, especially for females (Ditgen 1999, Kellam et al. 2013). Activities that degrade suitable forested habitats within 175 m (575 ft) of a BCFS nest are expected to cause take by significantly impairing essential behavioral patterns. Activities known to degrade suitable habitat include land conversion, removal or clearing of trees, or intensification of existing land use activities. Additionally, removal of plants known to provide food to BCFS can significantly impair feeding in otherwise suitable habitat. Similarly, actions that degrade suitable natural wetlands through changes in timing, quantity, or quality of available water in areas where BCFS nest and forage can result in significant impairment of essential behavioral patterns. Because resource abundance varies among sites, it is difficult to designate the threshold of habitat degradation at which take occurs. However, in general, take is expected to occur when activities within a 175 m (575 ft) radius of a BCFS nest alter hydrology in wetlands, fragment the

area, or otherwise remove or degrade 25% of plants providing food resources, or remove 10% of trees providing other potential nest sites. 175 m (575 ft) corresponds to the estimated radius of the mean female BCFS home range in both urbanized habitats and natural habitats reported by Ditgen (1999) and Kellam et al. (2016). Some activities are expected to cause take but incur a reduced level of habitat disturbance, specifically those that remove or degrade no more than 10% of plants providing food resources, with no loss of potential nest trees and no other significant disturbance. For these limited activities, a minimum buffer distance of 60 m from BCFS nests is recommended. The 60 m distance corresponds to the estimated radius of the mean female BCFS core range reported by Kellam et al. (2016).

Distribution and Survey Methodology

The range map (below) represents the presumed current geographic range of the Big Cypress fox squirrel. This map is for informational purposes only and is not for regulatory purposes.

Counties: Collier, Hendry, Lee, Miami-Dade, Monroe.



Recommended Survey Methodology
Surveys are not required but can be used to determine if fox squirrels are present in a given area. If survey methodologies for fox squirrels follow the recommendations below and no squirrels are detected, then no further action may be required. However, wildlife surveys to locate BCFS that are conducted more than 60 days before on-site project activities begin should not be considered a reliable measure of whether fox squirrels are present at a site.

Camera-based survey protocols are the most reliable method for determining occupancy and presence/absence of fox squirrels, and developing relative abundance estimates. Predator avoidance behaviors and the cryptic coloration of fox squirrels cause observation-based survey methods to be unreliable (Greene et al. 2017). Greene et al. (2017) compared multiple survey methods and found that camera traps detected fox squirrels about 2.5 times more frequently than live trapping and that line-transect surveys did not detect fox squirrels at all. Greene et al. (2017) concluded that camera trapping is "the most effective survey method for assessing the presence and distribution of southeastern fox squirrels." Based on data from Greene and McCleery (2017), Greene et al. (2017), and D. U. Greene (2017 personal communication), the following survey methods are recommended for BCFS:

- Conduct camera-trap surveys within 60 days prior to the start of on-site project activities (to account for birth and dispersal of juveniles).
  - Use appropriate bait to attract squirrels to the traps (e.g., cracked pecans). Avoid the use of baits like peanut butter which may attract fire ants.
  - Separate trap stations by 250 m, setting traps across all suitable habitats on the site.

  - Survey a given site for a minimum of 8 days using methods from Greene, 2017, with traps rebaited after 4 days as necessary.
- Surveys should be conducted by personnel knowledgeable about fox squirrels and fox squirrel nests, as BCFS can be difficult to locate. Because they will use nests without fresh vegetation (Kellam et al. 2016), each BCFS nest should be protected from disturbance or take until there is strong assurance that BCFS have abandoned that nest. This is especially important because BCFS can have an extended breeding season, or 2 breeding seasons per year (Ditgen 1999, Ditgen et al. 2007, Kellam et al. 2013). Absence of detected nests alone should not be considered evidence that BCFS are not present.
- Although live-trapping can be conducted and may be effective in detecting BCFS, this method is not recommended. Any live trapping requires an FWC Scientific Collecting Permit and documented experience showing appropriate skills in mammal trapping.
- Transect-based, observational survey methods, especially methods such as meandering pedestrian transects may be reliable for some purposes but are not recommended for determining occupancy, presence/absence, or distribution of fox squirrel populations.
- Incidental BCFS sightings should be recorded and reported to FWC at Imperiled@MyFWC.com.

Recommended Conservation Practices

Recommendations are general measures that could benefit the species but are not required. No Florida Fish and Wildlife Conservation Commission permits are required for these activities.

- BCFS range overlaps that of the Florida panther, Florida bonneted bat, and Sherman's short tailed shrew. Measures that will benefit the BCFS, particularly those focused on maintaining connectivity across the landscape, will also benefit other species.
- Maintain mature hardwood trees wherever possible along fencerows, hedgerows or other potential habitat corridors, giving preference to a uniform distribution of those trees, to enhance connectivity (movement by individual squirrels) among patches of potentially suitable natural habitat within the site and offsite among conservation areas.
- In urbanized and agricultural areas, to increase habitat suitability for BCFS, retain large trees for nest sites, cover and food resources (see above). When landscaping, use plants that provide food sources for fox squirrels, where possible.
- Continue, or implement, recommended prescribed fire management activities using appropriate fire return intervals to maintain or increase habitat suitability for BCFS.
- Avoid altering natural hydrology.
- FNAI's Guide to the Natural Communities of Florida: 2010 Edition is an excellent source of information on each community's natural processes, with associated management considerations and desired future conditions.

Measures to Avoid Take

Avoidance Measures that Eliminate the Need for FWC Take Permitting

The following measures will eliminate the need for an FWC take permit.

- Avoid killing or injuring BCFS when they are observed, especially on or near roads.
- Avoid take of BCFS nests and destroying or removing trees containing BCFS nests.
- Avoid habitat conversion and removal of food resource trees within a 175 m (575 ft) radius of identi-fied BCFS nests. See Habitat Features for details on suitable habitat and plant species that provide appropriate food resources.

- A 175 m (575 ft) buffer avoids significant impairment of essential behaviors because it avoids impacts to the nesting and foraging habitat in the individual squirrels' home ranges.
- Retain appropriate food sources within otherwise suitable habitat, within a 175 m (575 ft) radius of identified BCFS nests. Removing food-providing plants will increase the likelihood of take through impairing the essential behavioral pattern of feeding.
- Activities within a 175 m (575 ft) radius of a BCFS nest are expected to cause take if they alter hydrology in wetlands, fragment the area, or otherwise remove or degrade more than 25% of plants providing food resources, or remove more than 10% of trees that provide potential nest sites.

Examples of Activities Not Expected to Cause Take

This list is not an exhaustive list of exempt actions. Please contact FWC if you are concerned that you could potentially cause take.

- Activities that restore natural hydrology in habitat that is otherwise suitable for BCFS.
- Prescribed fires and other approved or recommended natural resource management activities.
- Approved aversive conditioning methods (see page 14) as described in FWC's policy on Aversive Conditioning of State Listed Species.
- Activities that follow the Florida Forestry Wildlife and Silvicultural BMP's.
- Removal of abandoned nests.

Florida Forestry Wildlife BMPs and Florida Agricultural Wildlife BMP's

- These Best Management Practices do not include the Big Cypress fox squirrel and therefore do not apply.

Other Authorizations for Take

- As described in Rule 68A-27.007(2)(c), F.A.C., land management activities (e.g., prescribed fire) that benefit wildlife and are not inconsistent with FWC Management Plans are authorized and do not require a permit authorizing incidental take.
- In accordance with local, state, and federal regulations (including, but not limited to, Federal Electric Reliability Council (FERC) Electric Reliability Standard FAC-003-3, National Electrical Safety Code (NESC) section 218, and Florida Public Service Commission (FPSC) mandates), routine vegetation maintenance activities within existing power line right of ways that will avoid heavy equipment operation within 175m (575 ft) of known or visibly apparent BCFS nests (i.e., the nest trees) do not require a permit authorizing incidental take.
- In cases where there is an immediate danger to the public's health or safety, including imminent or existing power outages that threaten public safety, or in direct response to an official declaration of a state of emergency by the Governor of Florida or a local governmental entity, power restoration activities and non-routine removal or trimming of vegetation within linear right of way in accordance with vegetation management plan that meets applicable federal and state standards does not require an incidental take permit from FWC.

Coordination with Other State and Federal Agencies

The FWC participates in other state and federal regulatory programs as a review agency. During review, FWC identifies and recommends measures to address fish and wildlife resources to be incorporated into other agencies' regulatory processes. The FWC provides recommendations for addressing potential impacts to state listed species in permits issued by other agencies. If permits issued by other agencies adequately address all of the requirements for issuing a Species of Special Concern or State-Threatened species take permit under 68A-27.007, F.A.C., the FWC will consider these regulatory processes to fulfill the requirements

of Chapter 68A-27, F.A.C., with minimal additional application process. This may be accomplished by issuing a concurrent take permit from the FWC, by a memorandum of understanding with the cooperating agency, or by a programmatic permit issued to another agency. These permits would be issued based on the understanding that implementation of project commitments will satisfy the requirements of 68A-27.007, F.A.C.

Review of Land and Water Conversion projects with State-Listed Species Conditions for Avoidance, Minimization and Mitigation of Take

- FWC staff, in coordination with other state agencies, provides comments to Federal agencies (e.g., the Army Corps of Engineers) on federal actions, such as projects initiated by a federal agency or permits being approved by a federal agency.
- FWC staff works with landowners, local jurisdictions, and state agencies such as the Department of Economic Opportunity on large-scale land use decisions, including long-term planning projects like sector plans, projects in Areas of Critical State Concern, planned unit developments, master planning unit developments, and large-scale comprehensive plan amendments.
- FWC staff coordinates with state agencies such as the Department of Environmental Protection (DEP) and the five Water Management Districts on the Environmental Resource Permitting (ERP) program, which regulates activities such as dredging and filling in wetlands, flood protection, stormwater management, site grading, building dams and reservoirs, waste facilities, power plant development, power and natural gas transmission projects, oil and natural gas drilling projects, port facility expansion projects, some navigational dredging projects, some docking facilities, and single-family developments such as for homes, boat ramps, and artificial reefs.
- During the ERP process, the FWC staff will provide guidance on avoidance, minimization, and mitigation measures for Big Cypress fox squirrel.
- The FWC staff will also work with DEP, water management districts, and the applicants during the ERP process so that ERP mitigation will satisfy the applicant's responsibilities under Chapter 68A-27, F.A.C., and associated rule enforcement policies (see FWC Incidental take Permitting Process).
- Conservation benefit as defined under Rule 68A-27, F.A.C. can be accomplished through avoidance, minimization, and mitigation measures outlined in the ERP permit. The existing ERP requirements for wetland mitigation include replacement of functional loss from impacts to wetlands. The mitigation includes provisions for perpetual conservation and management. Mitigation achieved through the ERP process could be considered a conservation benefit when mitigation sites include suitable wetlands where natural hydrology is maintained.
- Management practices and management zones established along streams or other water bodies to protect habitats and water quality can benefit the Big Cypress fox squirrel.
- These guidelines are based on current information and may change as new information is acquired.

FWC Permitting: Incidental Take

As defined in Rule 68A-27.001, F.A.C., "incidental take" is take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Activities that result in impacts to Big Cypress fox squirrels can require an Incidental Take Permit from the FWC (see above for actions that do not require a permit). Permits may be issued when there is a scientific or conservation benefit to the species and only upon showing by the applicant that the permitted activity will not have a negative impact on the survival potential of the species. Scientific benefit, conservation benefit, and negative impacts are evaluated by considering the factors listed in Rule 68A-27.007(2)(b), F.A.C. These conditions are usually accomplished through a combination of avoiding take when practicable, minimizing take that will occur, and mitigating for the permitted take. This section describes the minimization measures and mitigation options available as part of the Incidental Take Permit

process for take of Big Cypress fox squirrel. This list is not an exhaustive list of options.

Minimization Measure Options

The options below are intended to address the evaluation factors required for consideration when issuing an incidental take permit. These options can lessen the impact of activities, and ultimately may reduce what is needed to achieve a conservation or scientific benefit (see below).

Seasonal, Temporal, and Buffer Measures

- Minimize disturbances within 575 feet (175 meters) around nest trees year-round.
- In urbanized areas, BCFS may become habituated to human disturbance. Buffer distances to avoid and minimize take could be less than 575 feet, on a case-by-case basis, depending on behaviors exhibited by individual squirrels.

Design Modification

- Maintain mature hardwood trees wherever possible along fencerows, hedgerows or other potential habitat corridors to enhance connectivity (movement by individual squirrels) among patches of potentially suitable natural habitat.
- Retain large trees for nest sites and to provide cover and food resources in urbanized and agricultural areas to increase habitat suitability for BCFS.
- Concentrate developed areas within a site (and across sites when possible) to maximize connectivity, provide buffers from disturbance, and retain unfragmented natural areas.
- Focus development away from areas that encompass because the highest quality habitat for BCFS (those areas that provide abundant foraging opportunities, nesting sites, and support other essential behaviors).
- Minimize take resulting from vehicles by providing informational signs and establishing slow speed zones where appropriate.
- Emphasize use of BCFS-friendly landscaping practices, especially in Species Focal Areas. Use native plants for landscaping outside of urbanized areas and incorporate BCFS forage species where practical. In urbanized areas, use native plants when possible, retain large trees and native food plants. When landscaping with ornamental non-native plants, incorporate plant species that provide food sources for BCFS like fig and queen palm.

Method Modification

- When clearing in advance of development, take steps to identify BCFS nests and use selective thinning instead of clear cutting to avoid take of nest trees.
- Bromeliads are known to be important substrates for BCFS nests, especially in cypress trees. Flag trees with bromeliads, and maintain these trees. In cases where the trees cannot be retained on site, harvest non-listed bromeliads and relocate to trees that remain in other areas. If diseased bromeliads are observed, take steps to avoid spread of pathogens to healthy bromeliads through work activities.
- On sites where BCFS are observed or BCFS nests occur, inform people onsite about BCFS, the importance of avoiding disrupting their behavior, and the need to pause activities when necessary to allow any observed BCFS to move safely away from an area where work is occurring.

Mitigation Options

Mitigation is scalable depending on the impact, with mitigation options for take that significantly impairs or disrupts essential behavioral patterns. The DEP's ERP process forms a basis of mitigation for loss or degradation of BCFS breeding, feeding and sheltering habitat. Following the ERP process, the FWC will review the resulting wetland mitigation to assess whether the mitigation meets the definition of conservation

benefit for BCFS. In most cases, wetland mitigation through the ERP process will satisfy the applicants' responsibilities under Chapter 68A-27, F.A.C., and associated rule enforcement policies. However, under certain circumstances, the FWC may require mitigation specific for take of BCFS to ensure a conservation benefit. Potential options for mitigation are described below. This list is not an exhaustive list of options.

Scientific Benefit

This section describes research and monitoring activities that provide scientific benefit, per Rule 68A-27.007, F.A.C. Conducting or funding these activities can be the sole form of mitigation for a project.

- Research on methods for reducing impacts to native bromeliads from the Mexican bromeliad weevil (*Metamasius callizona*), an invasive non-native species decimating Florida's native bromeliad populations.
- Studies to determine the extent to which BCFS use natural habitat associations beyond the cypress-pine flatwoods matrix and clearly identify preferred habitat types. Big Cypress fox squirrels have been documented inhabiting live oak woods, tropical hardwood forests, coastal broadleaf evergreen hammocks, and mangrove swamps, but there is very limited information on the extent to which those habitats are used, or preferred by BCFS.
- Studies to better understand BCFS movements, demography, and habitat use within the urbanized landscape.
- Studies to determine the extent to which potentially discrete BCFS populations in Species Focal Areas and urbanized areas are connected by the movements of individual squirrels.

Habitat

Species Focal Areas (SFAs) for the BCFS are identified in the Species Action Plan. These areas support high-priority habitats for the BCFS, with an emphasis on conservation on public lands. The map below shows approximate locations of recommended BCFS SFAs. Locations are shown only as a reference for sites identified in the BCFS SAP. Loss or degradation of high priority habitats within SFAs could negatively impact the survival potential of the BCFS. Conversely, mitigation actions that occur in the SFAs or improve connectivity between SFAs, could have greater benefits than equivalent actions applied elsewhere.

Species Focal Areas identified in the Species Action Plan for the Big Cypress Fox Squirrel: 1) Big Cypress – Fakahatchee Area, 2) Corkscrew – CREW Area, 3) OK Slough Area, and 4) Six Mile Slough Area. Aerial image copyright Google Earth 2015.

- The acquisition option is one way to provide mitigation. Both fee simple and less-than-fee approaches can produce beneficial habitat protection measures, as can partnerships between governmental agencies and private landowners. Such partnerships may include those that advance the restoration, enhancement, management, or repopulation of priority habitats on state lands. Conservations easements, land protection agreements, and non-state funded tools such as rural land stewardship areas and sector planning should be used, where

appropriate, to help increase benefits for environmentally sensitive lands. Direct purchase or establishment of conservation easements within the Species Focal Areas meets the definition of conservation benefit under Rule 68A-27.007, F.A.C. The establishment of conservation or mitigation banks provides another potential mechanism that may result in a net increase in conservation benefits for wildlife in Florida. The acquisition option includes wetland mitigation through the ERP program. FWC will review the ERP mitigation to evaluate whether it meets the definition of conservation benefit for Big Cypress fox squirrel.

- The management option includes wetland preservation, enhancement, or creation through the ERP program. High quality mitigation sites would include fire-maintained pine forest (stands of South Florida slash pine that exist as a matrix surrounding a mosaic of codominant pond cypress dome swamps connected to similar habitat on conservation lands such as Big Cypress National Preserve (Kellam et al. 2016). BCFS are dependent on both cypress domes (for nest sites) and the intervening upland pine matrix (for year-round sources of food). There would be greater benefits on sites where the habitat mosaic provides a diverse assemblage of plants that provide suitable food resources. Kellam et al. (2016) said that open, fire-maintained pine forests with interspersed cypress domes that have long, natural hydroperiods appear to provide the habitat conditions that BCFS favor.
- Manage sites within Collier, Hendry, Lee, Miami-Dade, and Monroe counties within the expected range of the Big Cypress fox squirrel that encompass potentially occupied habitats.
- Manage sites that are adjacent to, or increase connectivity of (ability of individual animals to move between) existing conservation lands. Such sites have a high value and meet the definition of conservation benefit under Rule 68A-27.007, F.A.C.
- Apply prescribed fire in appropriate habitats following recommended methods, including fire return intervals, for those habitats and allow fires to go through ecotones.
- Conduct habitat restoration activities as appropriate to enhance or restore habitat quality for BCFS. Such activities would include: restoring natural hydrology, particularly of cypress swamp; planting cypress and forage plant species, etc.

Funding

- No funding option has been identified at this time. A funding option may be appropriate in circumstances where ERP mitigation does not satisfy the FWC's definition of conservation benefit for the Big Cypress fox squirrel. Funds can be used to support activities identified in the Species Action Plan for the Big Cypress fox squirrel (SAP) or in the information and habitat options within the permitting guidelines.

Information

- FWC approved research projects consistent with actions in the SAP.
- Conduct studies of BCFS in live oak woods, tropical hardwood forests, coastal broadleaf evergreen hammocks, and mangrove swamps to better understand occupancy, relative abundance, and demography in those habitats. Data should be provided to FWC. Emphasize species focal areas identified in the SAP.
- Conduct studies of BCFS on sites located between SFAs that support potentially suitable habitats to obtain data on BCFS movements, demography, and habitat use to better understand the extent to which potentially discrete BCFS populations in SFAs and urbanized areas are connected and what processes might limit movements or survival of BCFS outside those core areas. Data should be provided to FWC.
- The information option may be appropriate in circumstances where ERP mitigation does not satisfy the FWC's definition of conservation benefit for the Big Cypress fox squirrel.

Programmatic Options

- No programmatic options have been identified at this time.

Multispecies Options

- BCFS is known to, or expected to, coexist with other listed species including mammals such as the Everglades mink, Sherman's short-tailed shrew, Florida bonneted bat (*Eumops floridanus*), and Florida panther (*Puma concolor coryi*). Whenever possible, applicants should develop multispecies habitat management or restoration actions that will benefit the Everglades mink, the Florida bonneted bat and Florida panther.
- Activities that restore natural hydrology of freshwater wetlands, or other habitats potentially occupied by BCFS would be expected to also benefit other birds, mammals, reptiles, and amphibians dependent upon those habitats.

FWC Permitting: Intentional Take

Intentional take is not incidental to otherwise lawful activities. Per Chapter 68A-27, F.A.C., intentional take is prohibited and requires a permit. For state-Threatened species, intentional take permits may only be considered for scientific or conservation purposes (defined as activities that further the conservation or survival of the species taken). Permits are issued for state-Threatened species following guidance in Rule 68A-27.007(2)(a), F.A.C.

Risks to Property or People

Intentional Take for Human Safety

Permits will be issued only under limited and specific circumstances, in cases where there is an immediate danger to the public's health or safety, including imminent or existing power outages that threaten public safety, or in direct response to an official declaration of a state of emergency by the Governor of Florida or a local governmental entity. Applications submitted for this permit must include all information that is required from any other applicant seeking a permit, along with a copy of the official declaration of a state of emergency, if any. This permit process may be handled after the fact or at least after construction activities have already started. An intentional take permit may be issued for such purposes.

Aversive Conditioning

Prior to using approved aversive conditioning methods, landowners should make all practicable attempts to resolve the issue without aversive conditioning, including:

- No permit will be required for FWC-approved aversive conditioning activities for human safety. In urban areas, fox squirrels can become acclimated to human presence and may pose a safety issue in some situations.
- Documented intervention measures must take place before aversive conditioning can occur. Intervention measures may include posting signs to discourage people from feeding BCFS, having community meetings to address living with wildlife, and removing feeders.

In accordance with the FWC's policy on Aversive Conditioning of State Listed Species, no permit is required when using approved aversive conditioning techniques described below. Aversive conditioning may be used to discourage a BCFS that exhibits behavior that presents or potentially presents a human safety hazard or causes, or is about to cause, property damage. Please note that no aversive conditioning methods are approved within 61 m (200 ft) of a BCFS nest without a permit. If applicants wish to use these methods within 61 m (200 feet) of a nest, that may constitute harassment and could constitute intentional take. Approved aversive conditioning methods for BCFS

include:

- Spraying a low-pressure spray of water in a manner unlikely to cause harm.
- Motion-activated sprinklers.
- Use of loud noises, such as air horns, or vehicle horns.
- Visual deterrents.
- Chasing BCFS by foot in a manner that does not result in physical contact with the squirrel.

Permits Issued for Harassment

- Any attempt to discourage a BCFS that presents or potentially presents a human safety hazard or causes, or is about to cause, property damage that does not comply with the approved aversive conditioning methods specified above is considered harassment and is prohibited without a permit. Examples include, but are not limited to, use of pyrotechnics or aversive conditioning within 61 m (200 ft) of a nest.

Scientific Collecting and Conservation Permits

Scientific collecting permits may be issued for the Big Cypress fox squirrel using guidance found in Rule 68A-27.007(2)(a), F.A.C. Activities requiring a permit include any research that involves capturing, handling, or marking wildlife; conducting biological sampling; or other research that may cause take.

Considerations for Issuing a Scientific Collecting Permit:

1) Is the purpose adequate to justify removing the species (if the project requires this)?
   - Permits will be issued if the identified project is consistent with the goal of the Species Action Plan for the Big Cypress Fox Squirrel (i.e., improvement in status that leads to removal from Florida's Endangered and Threatened Species List), or addresses an identified data gap important for the conservation of the species.
2) Is there a direct or indirect effect of issuing the permit on the wild population?
3) Will the permit conflict with program intended to enhance survival of species?
4) Will purpose of permit reduce likelihood of extinction?
   - Projects consistent with the goal of A Species Action Plan for the Big Cypress Fox Squirrel or that fill identified data gaps in species life history or management may reduce the likelihood of extinction. Applications should clearly explain how the proposed research will provide a scientific or conservation purpose for the species.
5) Have the opinions or views of other scientists or other persons or organizations having expertise concerning the species been sought?
6) Are applicant expertise, facilities, and other resources adequate?
   - Applicants must have prior documented experience with this or similar species; applicants should have met all conditions of previously issued permits; and applicants should have a letter of reference that supports their ability to handle the species.

Relevant to All Scientific Collecting for the Big Cypress Fox Squirrel

- Permits may be issued to display a taxidermy specimen for educational or scientific purposes as specified in 68A-12.004, F.A.C., if the specimen was obtained originally via a rehabilitation facility or was encountered dead.
- Applications must include a proposal that clearly states the objectives and scope of work of the project, including a justification of how the project will result in a scientific or conservation purpose for the species. The proposal also must include a thorough description of the project's methods, time frame, and final disposition of all individuals. Permit amendment and renewal applications must be "stand alone" (i.e., include all relevant information on objectives and methods).

- Permits may be issued for captive possession (removal from the wild) if the individual is deemed non-releasable.
- Trapping and handling protocols, and a justification of trapping methods, must be included in the permit application and should identify measures to lessen stress for captured Big Cypress fox squirrel.
- Methodologies for any collection of tissues, such as blood, should be clearly spelled out, including measures taken to reduce stress/injury to the animals.
- Disposition involving captive possession for any period of time must include a full explanation of whether the facility has the appropriate resources for accomplishing the objectives and for maintaining the animals in a safe and humane manner.
- Any mortality should be reported immediately to the FWC at the contact information below. The FWC will provide guidance on proper disposal of specimens.
- A final report should be provided to the FWC in the format specified in the permit conditions.

Additional information

Information on the economic impacts assessment of the Species Conservation Measures and Permitting Guidelines for the Big Cypress fox squirrel can be found at http://myfwc.com/wildlifehabitats/imperiled/management-plans/

Contact

For more species-specific information or related permitting questions, contact the FWC at (850) 921-5990 or WildlifePermits@myfwc.com. For regional information, visit http://myfwc.com/contact/.

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