

Final Report

Small and Medium-Sized Mammal Inventory for Everglades National Park and Big Cypress National Preserve

Cooperative Agreement H5000060106 - Task Agreement J2117062273

Prepared by:

Emily K. Pifer¹, Kristen M. Hart², Kenneth G. Rice³, and Frank J. Mazzotti¹

Prepared for:

Matt Patterson and Kevin Whelan
U. S. National Park Service
South Florida/Caribbean Network
18001 Old Cutler Road, Suite 419
Miami, FL 33157

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¹University of Florida

Fort Lauderdale Research and Education Center
3205 College Ave.
Davie, FL 33314
epifer83@yahoo.com, fjma@ufl.edu

²U. S. Geological Survey

Southeast Ecological Science Center
3205 College Ave.
Davie, FL 33314
kristen_hart@usgs.gov

³U. S. Geological Survey

Southeast Ecological Science Center
7920 NW 71st St.
Gainesville, FL 32653
ken_g_rice@usgs.gov



United States Department of the Interior

South Florida /Caribbean Inventory and Monitoring Network
18001 Old Cutler Road Suite 419
Palmetto Bay, Florida 33157
Phone: (305) 252-0347
Fax: (305) 253-0463



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To Whom It May Concern:

The National Park Service South Florida / Caribbean Inventory and Monitoring Network funded the U.S. Geological Survey and University of Florida through Cooperative Agreement H500006016-J2117062273 to conduct a "Small and Medium-sized Mammal Inventory For Everglades National Park and Big Cypress National Preserve". The resulting products include:

Type	File Name	Description
Project Report	20110829_MammalProjectFinalReport_FINAL_VERSION.pdf	The final project report turned in by the cooperators
Data & Photos	\Data\mammals_geodatabase.mdb	Main project database containing all data
	\Data\mammals.mxd	ArcMap project for displaying species locations on maps
	\Data\Species_Locations_Across_Methods.xlsx	An MS Excel Spreadsheet containing mammals locations combined across the camera traps, live traps, and opportunistic locations. Vegetation data not included. This table is also in the mammals_geodatabase.mdb and is redundant but useful.
	\Data\Folders_with_photos_not_in_database.xlsx	Lists mammal pictures turned in but apparently not entered into database.
	\Data\Photos\BICY*. * \Data\Photos\EVER*. *	Project photos of mammals or other animals. Photos re-named with <i>Park_Taxa_CommonName_Site_photonumber.</i>
	\Nice_Photos*. *	A subset of nice photos from the project
Metadata	mammals_geodatabase.xml BICY_boundary.xml EVER_boundary.xml Florida_boundary.xml Vegetation.xml <species>.xml	Project database metadata BICY Park Boundary metadata EVER Park Boundary metadata Florida shoreline metadata Project Vegetation metadata Individual species layer metadata

The easiest way to access the spatial data provided on this DVD is to open the 'mammals.mxd' document located in the data subfolder. This ESRI ArcMap document provides a quick way to visualize the vegetation, boundary, and shoreline data as well as a point presence file for each mammal species observed during the inventory. Additionally, those more familiar with GIS may find it useful to open the included personal geodatabase (mammals_geodatabase.mdb) directly in ArcCatalog and add individual feature classes.

The 9,302 photos that are included as part of this project can be searched by using Windows Explorer (e.g., press CTRL-F) and simply searching for the common name of the mammal desired. The file directory structure is original to the cooperator. File folders without photos and photos of just vegetation are not included on the DVD.

Cautions

The user of this data is strongly advised to read the project report before using any data associated with this project (20110829_MammalProjectFinalReport_FINAL_VERSION.pdf).

The National Park Service South Florida / Caribbean Inventory and Monitoring Network, while appreciative of the large effort this inventory represents, wished to list a few issues that may be necessary for future use and interpretation of the results:

- The inventory primarily focused on reachable areas within 500m of roads, trails, airboat trails, off-road vehicle trails, shorelines reachable by boats, etc. Thus it is possible that species that were not detected in this effort may still exist in the parks in areas far away from roads and trails. However, as previous mammal work in the parks focused along roads and trails as well, the disappearance of species that were once commonly seen along roads and trails is still likely a concern. Helicopter muskrat lodge surveys were of course not limited to roads and trails and instead followed the sloughs.
- As the report states, the results of the Proportion of Area Occupied (PAO) analysis should be considered exploratory. The PAO results should not be treated as a rigorous monitoring baseline due to the points listed below. This is a method that estimates overall proportion of area occupied within an area based upon estimating the raw overall proportion of sites a species was detected combined with a detection probability based on how frequently a species is detected, if it is at a site, to create an overall PAO estimate. As is appropriate for an inventory, the cooperators were testing different baits and cameras through time, different methodologies (ground baited, mink rafts, squirrel platforms), and different sampling designs (some random, some strategically placed). According to a discussion with the analyst, all these different types of sampling data were simply combined in the analysis without factoring in these differences. In addition such an analysis requires accurate recording of “absence” data as well as “presence” data. For some of the skunk/rabbit, squirrel, and mink camera stations which had no mammal results, it was difficult to reconstruct a sampling history or even a location from the database. As an exploratory test of applying the PAO methodology to monitoring different types of mammals, the results are both interesting and useful. However to create a rigorous monitoring baseline, baits and methodologies would need to be standardized and a sampling design developed to answer the objectives of a monitoring program rather than a multi-species inventory. This caution does not affect the validity of the inventory presence data, i.e. “what was found where,” which is the primary purpose of this project.
- Among the photos that were turned in, there were some photos that had not been entered into database. Thus these photos are not reflected in the overall numbers in the report. These photos show raccoon (3 sites), deer (4 sites), possum (1 site), unknown rats (19 sites), a unknown squirrel (1 site), and a bobcat (1 site) pictures. The unknown rats and unknown squirrel appear to be species already identified in the report (i.e. no additional species). The number of pictures involved are minor compared with the total number of pictures involved with the project. This list is provided as an additional spreadsheet.
- Initially in the database, a record for a domestic cat in the “Opportunistic” table in the database had a comment in the “notes” field that said “NOT DOMESTIC CAT. IT IS DOMESTIC RABBIT BUT NO OPTION TO SELECT FROM”. Date of the record was

3/4/2009. When we pointed this out, the cooperator felt the note in the comments was likely an error and did not include domestic rabbit among the species seen in Big Cypress National Preserve. However, among the opportunistic photos turned in for the project for Big Cypress National Preserve, we found three photos that clearly appear to be a domestic rabbit (see photo) but with a different date (6/18/2008). Unfortunately it is not possible to tie these photos to a specific location. However coupled with the other record on 3/4/2009, it seems that at least 1 domestic rabbit, *Oryctolagus cuniculus*, is likely present in Big Cypress National Preserve. This is not surprising as unwanted pets frequently are abandoned within the parks.



- Caution should be exercised when utilizing the vegetation data associated with this project. This advice is based upon review of the data and interviews with the field technicians.

Again, this project is clearly valuable in documenting what species were detected in what locations and in what habitats. These issues mentioned above are minor but we felt should be mentioned.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Andrea J. Atkinson'. The signature is fluid and cursive, with a large initial 'A'.

Andrea J. Atkinson, Ph.D.
SFCN Quantitative Ecologist

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Executive Summary

Wildlife inventories are important for documenting presence and absence of targeted species in various habitats in order to better manage for their persistence. Here we report on an inventory of small and medium-sized mammals in Everglades National Park (EVER) and Big Cypress National Preserve (BICY) conducted in 2007-2009. These Department of Interior (DOI) lands have not been inventoried since the 1950s, and little information was available about these species in southern Florida on which to base our inventory and sampling efforts. Information on small and medium-sized mammals on DOI lands in South Florida is essential for planning for effective protection and management of these species. Small mammals, in particular rodents, serve as prey items for many predators (Calandriello 1999; Pearson 2000; Riggs 2000). Small mammals also play a role in the dispersal of seeds and mycorrhizal spores and in the alteration of vegetation through herbivory (Pearson 2000). Our focus on EVER and BICY is also timely given that these animals may be affected by Comprehensive Everglades Restoration Plan (CERP), which is a plan to restore the hydrology of South Florida, in particular that of the Everglades.

The purpose of this project was to inventory for presence of mammals in habitats that support small and medium-sized mammals in both EVER and BICY. This project's objectives included the following:

- 1.) Identify small and medium-sized mammal species (excluding bats) that occur in both EVER and BICY.
- 2.) Determine presence of small and medium-sized mammal species in both wet and dry seasons, within selected habitats.
- 3.) Evaluate occurrence of mammals of specific interest, those previously listed as "present" in EVER but not reported for decades (i.e., mangrove fox squirrels, Everglades mink, southern flying squirrels, shrews, armadillos, etc.).
- 4.) Provide baseline data for future monitoring.
- 5.) Use proportion area occupied (PAO) for exploratory investigation of species captured by camera traps.
- 6.) Develop a geographic information system (GIS) data layer for each species.

We sampled selected habitat types for small and medium-sized mammals as well as disturbed habitats in an effort to accurately inventory EVER and BICY. We divided EVER into six natural and two artificial habitats; natural habitats included pineland, marl prairie, tropical hardwood hammock, mangrove forest, cypress dome, and freshwater slough, whereas artificial habitats included exotic vegetation and disturbed habitat. We divided BICY into five natural habitats: cypress, cypress prairie, prairie, hammock, and pineland. During the first year of the project (2007) we stratified sampling by habitat type. During the last two years (2008 - 2009), sampling was species-specific for species not censused by the large-scale sampling and was conducted in habitat suitable for each of the targeted species.

We used camera traps (both temporary and permanent), live traps, and opportunistic sightings as the main methods for detecting mammal species in EVER and BICY. Temporary cameras were placed in one location for two weeks then moved to a

new location. Permanent cameras were placed in one location and checked every three weeks. Permanent cameras stayed where located for the duration of the study unless disturbed by the public. Cameras were baited with call lures, wet cat food, and fatty acid discs. We used Program PRESENCE 2.0 (MacKenzie et al. 2002) to estimate proportion area occupied (PAO) for the species detected by camera. We chose to include only camera data in the PAO analyses, as this method produced more useable (i.e., high-quality, identifiable) mammal observations than any other method including live trapping.

Opportunistic sightings consisted of hiking and night surveys during which we searched for evidence of mammals including tracks and scat. We completed two to four night surveys each month for the duration of the project. During night surveys, we followed set routes and recorded visual encounters of individuals as well as tracks, scat, and foraging marks; these signs including road-killed specimens and owl pellet remains, were recorded as opportunistic sightings. We also completed one to three hiking surveys each month along selected roads and trails in both EVER and BICY. During these surveys, one to three people walked for three to six hours on foot, searching encountered habitat types for opportunistic mammal sightings. We also examined all scat and owl pellets found during these hiking surveys for mammal remains.

During both the first and second years of the project, we sampled small mammals using Sherman live traps. We trapped in hammock and cypress prairie habitats in BICY, and pine, hammock, mangrove, slough, and marl prairie in EVER. We baited live traps with bird seed, placed both in the trap and at the trap entrance.

In total, we conducted 23,344 camera trap nights in EVER and BICY throughout this project. We conducted 7,470 camera trap nights in BICY and 15,874 camera trap nights in EVER. For permanent camera traps, we had a total of 2,218 trap nights in BICY and 1,840 trap nights in EVER. For temporary cameras, we conducted 3,236 trap nights in BICY and 3,178 trap nights in EVER. We conducted 665 trap nights in BICY and 560 trap nights in EVER for the skunk/cottontail cameras. We conducted 1,017 trap nights in BICY and 1,686 trap nights in EVER for flying squirrels (*Glaucomys volans*). In BICY we conducted 334 mink raft trap nights, while in EVER we conducted 8,610 mink raft trap nights. For live trapping, we conducted 1,152 trap nights in BICY and 1,464 trap nights in EVER, totaling 2,616 live trap nights.

We detected 22 targeted mammal species in BICY and 21 in EVER. The opossum (*Didelphis virginiana*) ($n = 950$) was the most frequently-detected species in BICY, whereas the black rat (*Rattus rattus*), an exotic, ($n = 1,376$) was the most detected species in EVER. In BICY, we detected 21 species in hammock habitat, 15 in pinelands, 15 in cypress, 12 in cypress-prairie, and 11 in prairie. We detected the greatest number of native species ($n = 15$) as well as exotic species ($n = 6$) in hammock habitats in BICY. We also observed the highest number of individual native detections ($n = 1,444$) and the highest number of individual exotic detections ($n = 104$) in hammock habitat. In EVER, we detected 17 species in hammock habitat, 17 in marl prairie, 17 in slough, 14 in pinelands, and seven in mangroves. We also observed the highest number of individual native detections ($n = 614$) and the highest number of individual exotic detections ($n = 717$) in hammock habitat. No new exotic mammal species were detected in either BICY or EVER. Literature searches during Phase I of the project suggested the presence of the long-tailed weasel (*Mustela frenata*), striped skunk (*Mephitis mephitis*), eastern mole

(*Scalopus aquaticus*) (one sighting in EVER), southern flying squirrel, Norway rat (*Rattus norvegicus*), and the red fox (*Vulpes vulpes*) which we did not detect in either EVER or BICY. Literature searches also suggested the presence of the eastern spotted skunk (*Spilogale putorius*) and the Everglades mink (*Mustela vison*) which we did not detect in EVER and the least shrew (*Cryptotis parva*) which we did not detect in BICY. Failure to detect these species may be of management concern as these were supported by multiple historical sightings and some were targeted by intensive species-specific surveys in this study. That round-tailed muskrats in EVER were only detected via ongoing concurrent analyses of Burmese python (*Python molurus bivittatus*) gut contents and owl pellets may also be a management concern. Low numbers of marsh rabbits (*Sylvilagus palustris*) and cottontail rabbits (*Sylvilagus floridanus*) were also of concern as these are major prey items for numerous animal species.

Camera trapping and live trapping produced the greatest number of detections of mammal species in this inventory. Not only did the use of cameras enable detection of both nocturnal and diurnal species, but they allowed us to sample many locations with little habitat disturbance for multiple trap nights. Cameras also eliminated the possibility of injury to the animals that may otherwise occur during live trapping. However, it was the broad variety of methods used that allowed us to confirm presence of these species. Opportunistic surveys enabled us to detect the round-tailed muskrat (*Neofiber alleni*), mink, gray fox (*Urocyon cinereoargenteus*), fox squirrel (*Sciurus niger*), short-tailed shrew (*Blarina brevicauda*), armadillo (*Dasypus novemcinctus*), eastern cottontail, and the house mouse (*Mus musculus*). Owl pellet dissections were the most successful method for detecting the least shrew and the short-tailed shrew, whereas analysis of python stomach contents and owl pellets were the only two successful methods of detection of round-tailed muskrats in EVER. Thus, we suggest that cameras and live traps be utilized in future inventories, and be supplemented by day and night surveys, as these opportunistic sightings were important for detecting various species (i.e., round-tailed muskrat, domestic cats and dogs, marsh rabbits, cottontails, and river otters) during this inventory.

Introduction

An inventory is an “extensive point-in-time effort to determine location or condition of a resource” (Fancy 2000). Natural resource inventories provide baseline data for future monitoring, and they are most often used to record presence or absence of endangered or threatened species (Gilbert et al. 2008). Inventories have become essential for conservation and management programs (Glanz and Connery 1996), and many agencies throughout the United States and other countries have conducted taxa-specific inventories (Hutterer et al. 1995; Glanz and Connery 1996; Nolan and Peirce 1996; Passamani et al. 2000; Caro et al. 2001; Voss et al. 2001; Cook and MacDonald 2003; Trolle 2003; Cook and MacDonald 2004a, b; Fellers et al. 2004; Gaines and Beck 2003; Ryberg et al. 2004; Vick 2004; Azlan and Lading 2006; Matthews and Matthews 2006; Abramhov et al. 2007; Drost and Hart 2008; Gilbert et al. 2008).

A priority for the South Florida/Caribbean Inventory and Monitoring Network of the National Park Service has been a small and medium-sized mammal inventory. Small and medium-sized mammals have not been systematically inventoried in South Florida since the 1950's (Schwartz 1952). The Everglades mink (*Mustela vison evergladensis*), mangrove fox squirrel (*Sciurus niger avicennia*), least shrew (*Cryptotis parva*), and southern short-tailed shrew (*Blarina carolinensis*) are considered rare to very rare (Layne 1974). Some of these species are proposed for listing at the state and/or federal level (FFWCC 2010). However, management of these species is difficult due to a lack of quantitative population-level data.

In South Florida, the Department of Interior (DOI) manages several large conservation areas. Two of these areas are Everglades National Park (EVER), established in 1947 and Big Cypress National Preserve (BICY), established in 1974. The National Park Service Inventory and Monitoring Program is responsible for the inventory and long-term monitoring of natural resources of national parks across the nation (National Park Service 2008). Many factors, both natural and anthropogenic, threaten mammal species in EVER and BICY. Changes in hydrology and habitat as well as threats such as direct competition with and predation by invasive species (i.e., Burmese pythons, *Python molurus bivittatus*) may affect populations of small and medium-sized mammals. Schwartz (1952) stated that flying squirrels were found in pinelands, but this species has since become rare in South Florida due to habitat destruction and conversion (Layne 1974). Brown et al. (2006) cited raccoons and marsh rabbits as the most common species found in the Everglades. Marsh rabbits were once frequently sighted in EVER, particularly along the main park road (O.L. Bass, F. Mazzotti, R. Snow, K. Whelan, pers. comm.). It is possible that marsh rabbits have declined due to the recent increase in Burmese python populations in EVER, which take advantage of marsh rabbits as a major prey item (Snow et al. 2007). The round-tailed muskrat (*N. alleni*), a nocturnal rodent restricted to Florida and southeast Georgia (Bergstrom et al. 2000; Lefebvre and Tilmant 1992; Schooley and Branch 2005, 2006a), is dependent on wetlands to survive. Historically muskrat populations in south Florida were documented on Cape Sable in EVER (Howell 1920a) and by Porter (1953) in BICY. Porter (1953) cited the muskrat as being most common in the Everglades region of Florida, where there was an abundance of plant food and ideal wetland habitat over an extensive area. In a study conducted in EVER, Tilmant (1975) found only one muskrat colony in Taylor Slough, but stated that

the species was most abundant in Shark Slough, where he studied four colonies. Schwartz (1952) also referenced numerous muskrat lodges in the area south of Tamiami Trail, in the headwaters of the Shark and Broad Rivers, and a possible colony in Taylor Slough north of Royal Palm (Figure 1). Today the round-tailed muskrat is listed as a “species of special concern” by the Florida Committee on Rare and Endangered Plants and Animals because of presumed statewide population declines related to wetland losses (Lefebvre and Tilmant 1992). The round-tailed muskrat has suffered population losses due to urban development and resulting habitat fragmentation, invasions of exotic vegetation, and water pollution (Layne 1974, Wassmer and Wolfe 1983). The remaining isolated populations are far more vulnerable to fluctuating water levels (Lefebvre and Tilmant 1992). Snow et al. (2007) recently showed that muskrats have also been extensively preyed upon by the invasive Burmese python. However, it is unknown whether the decline in muskrats is mainly due to water level fluctuations, other changes in habitat, predation by the Burmese python, or a combination of these factors.

Prior to this inventory, 29 mammal species were thought to exist in EVER and BICY (Table 1). The results of this inventory can be compared to future inventories in BICY and EVER and serve as a baseline for future monitoring. By providing an inventory of these species, we can ensure that these species will be considered as components within the natural systems that are being affected by the Comprehensive Everglades Restoration Plan (CERP).

The purpose of this project was to inventory habitats that should support small and medium-sized mammals in both EVER and BICY. This project’s objectives included the following:

- 1.) Identify small and medium-sized mammal species (excluding bats) that occur in various habitats in both EVER and BICY.
- 2.) Determine presence of small and medium-sized mammal species in both wet and dry seasons, across all habitats, with the exception of live trapping in pinelands, as Jeffery (2009) completed this.
- 3.) Evaluate occurrence of mammals of specific interest (for example, those previously listed as “present” in EVER but not reported for decades: mangrove fox squirrels, southern flying squirrels, shrews, armadillos, and feral cats).
- 4.) Provide baseline data for future monitoring.
- 5.) Use proportion area occupied (PAO) for exploratory investigation of species captured by camera traps.
- 6.) Develop a geographic information system (GIS) data layer for each species.

This report presents results of our small and medium-sized mammal inventory of BICY and EVER conducted from 2007-2009. We describe in detail the techniques used, present results for each study area, discuss non-detection issues for several species, and use a proportion area occupied (PAO) approach to analyze camera data for the sampled areas. We chose to include only camera data in the PAO, as this method produced more useable (i.e., high-quality, identifiable) mammal observations than any other method; PAO analysis provides a baseline for future monitoring efforts.

Methods

This study consisted of four phases. During Phase I (2007), we identified 29 species thought to be present in BICY and EVER through a thorough review of existing literature, museum records, and Park species-sighting cards. The long-tailed weasel was included in our list as a possible mammal species to be observed based on a record from Collier County (Brown 1972b, Hovis 1993) although there were no records from BICY or EVER. The red fox was also added to the list even though the park records were considered suspect and may have actually been gray foxes. During Phase II (2007-2008), we used several established methodologies to inventory both small and medium-sized mammals. We used a combination of temporary and permanent remote cameras, live trapping, track plates, and a variety of opportunistic methods (i.e., hiking surveys, night surveys, owl pellet analyses) to detect mammal species. During Phase III (2008-2009), we continued with the general inventory, which was supplemented with additional species-specific sampling of species not detected during Phase II of the project. Phase IV (2009-2010) of the project consisted of the analysis of our data.

We collated our data in several electronic databases (Appendix 1). We used Thumbs Plus to store photographs of mammals collected from our camera traps. To store live trap data, opportunistic data, as well as vegetation data, we used Microsoft Access 2003. For the purposes of this study, we considered the detection of a species to be abundant if we detected more than 200 individuals of that species throughout the duration of the study. If we detected 100 – 200 individuals of a species, we classified the species as common. Finally, if we detected fewer than 100 individuals of a given species, we considered that species to be rare.

Habitat selection

2007-2008 (Phase I-II)

We stratified all sampling by major habitat type (Gilbert et al. 2008) and generated random sampling points using the Hawth's Tools extension (Beyer 2004) in ArcMAP 9.1 (ESRI 2005). We designated habitats by aggregating the vegetation classification scheme proposed by Madden et al. (1999) into our broader habitat categories on the University of Georgia vegetation map (Florida International University 2007). Following this approach, we divided EVER into six natural and two artificial habitats; natural habitats included pineland, marl prairie, tropical hardwood hammock, mangrove forest, cypress dome, and freshwater slough, whereas artificial habitats included exotic vegetation and disturbed habitat. In contrast, we divided BICY into five natural habitats: cypress, cypress prairie, prairie, hammock, and pineland. To ensure independence among sampling points and accessibility of points to researchers, we spaced the sampling points at a minimum of 1,000 m apart and within a 500 m buffer around all roads, foot trails, and airboat trails.

Using the above habitat type strata, we selected 300 random points per habitat type. We removed some points from further consideration after evaluation of logistics and accessibility. From those points remaining, we randomly selected approximately 60 points per habitat type for direct sampling.

In BICY, we stratified the first 60 random points by habitat type and then again by state wildlife management unit (Jansen et al. 2005), resulting in approximately six points per habitat per management unit (Figure 2, Appendix 2). We attempted to obtain

equal numbers of points in each management unit; however, habitat types were not equally represented in each management unit. In these cases, we retained all available points for sampling.

In EVER, we obtained marl prairie coverage from an Everglades Physiographic Raster Map (P. Teague, NPS, pers. comm.). We overlaid this coverage on the University of Georgia vegetation map (Florida International University 2007) of the Everglades and selected random points from within each habitat type (Appendix 3). For the mangrove habitat class, we selected points from within 500 m of the coastline, as these were accessible using motorboats.

We sampled selected points in both EVER and BICY using camera traps, live traps, and track plates. If the exact location of the point did not fall within the expected habitat type, we searched the area for the closest patch of the appropriate habitat type and conducted the sampling there.

2008-2009 (Phase III)

Instead of using the stratified sampling approach (described above), we began an intensive effort to detect species not encountered during Phase I sampling (see Species Specific Sampling below). We based habitat selection on the species we were attempting to target, rather than conducting equal sampling effort in each habitat type. Thus, we searched for habitat suitable for each of the targeted species and conducted sampling where appropriate based on our best judgment.

Cameras and Track Plates

Camera traps

To detect both small and medium-sized mammals, we deployed baited camera traps, as this methodology has been used effectively by many researchers (Carthew and Slater 1991, Martorello et al. 2001, York et al. 2001, Silveira et al. 2003, Claridge et al. 2004, Fellers et al. 2004, Pina et al. 2004, Roth et al. 2004, Silver et al. 2004, Swann et al. 2004, Robbins 2005, Azlan and Lading 2006, Gompfer et al. 2006, Gimán et al. 2007, Kaufman et al. 2007b, Gilbert et al. 2008). We used four types of cameras throughout this project: Stealth Cam STC-V450 35mm, TrailMAC Olympus D-435, Moultrie Gamespy I40, and Cuddeback Capture IR. The Stealth Cam STC-V450 used six C batteries and took pictures five to nine m away from the camera. The TrailMAC camera used two AA batteries and two C batteries, and took pictures up to 18 m away. The Moultrie Gamespy I40 was an infrared camera that required six D batteries; this camera took color pictures during the day and black and white photos at night, with a motion sensor detection range of 11 m - 14 m. The Cuddeback Capture IR was also an infrared camera that took color pictures by day and black and white photos at night; this camera required four D batteries and had a detection range of 12 m. On each camera, we set the time, date, and a one-minute delay. We placed the cameras roughly two to three feet off the ground, generally on a tree or other vegetation strong enough to support it. We fastened each camera to the vegetation using either bungee cords or straps included with the camera.

During Phase I of the project (2007 - 2008 above), we placed temporary cameras throughout both EVER and BICY (Figure 3). In both protected areas, temporary cameras were placed in one location for two weeks then moved to a new location. We used the

Stealth Cam STC-V450 35mm camera, the TrailMAC, and the Moultrie Gamespy I40. We used the Stealth Cam 35mm cameras in a pilot study in BICY to test the difference between the camera delays of a 35mm film camera versus the TrailMAC digital camera. In the pilot study, we placed one Stealth Cam 35 mm camera next to a TrailMAC camera facing north (to avoid glare from the sun) at 14 different sites. We baited the cameras with call lures (Appendix 4), wet cat food, and fatty acid discs (F.A.S. Pocatello, Idaho), placed roughly three feet in front of the camera. We also dipped sticks into the lure and spread them around in front of the camera. After the two-week field deployment, we converted the film pictures to digital and downloaded them into the ThumbsPlus database along with the other pictures. During Phase II of the project, we used only a combination of the TrailMAC, Moultrie, and Cuddeback cameras.

Beginning in March 2008 (Phase II-III), we placed permanent cameras (Moultrie and Cuddeback) in both EVER and BICY (Figure 4). Permanent cameras were placed in one location and checked once every three weeks. Permanent cameras remained at their location for the remainder of the study unless disturbed by the public. We placed these cameras along permanent water bodies, along wildlife trails, and at wildlife underpasses where we were likely to encounter a variety of mammal species. We used call lures, wet cat food, and fatty acid predator discs to attract animals to the cameras. We checked the cameras every three weeks, replaced the batteries (if needed) and the secure digital (SD) card, and re-baited the trap. We downloaded all photographs into ThumbsPlus, examined the photographs, and identified all mammals. Unless they were damaged, destroyed, or stolen, permanent cameras remained in the same location for the duration of the project. The number of cameras out per three-week session ranged from one to 10 in both EVER and BICY.

Downloading and organizing photographs

After we downloaded all photographs from temporary and permanent cameras into our ThumbsPlus database, we classified pictures as either useable or non-useable. We considered useable pictures as any picture that contained an animal, even if it was not a mammal. We organized all useable photos and identified species present, though we only used the small and medium-sized mammals for this study. We labeled all pictures under the User Fields tab in ThumbsPlus. For the purpose of this study, we considered animals of the same species captured on photos within one hour of the previous animal to be the same individual; therefore we only counted them once. We selected the best photo out of all photographs of the same individual and labeled the remaining pictures as repeats. We recorded the time of the last useable photo in the ThumbsPlus database. After we identified all mammals, we entered the sightings into a Species Sighted Microsoft Excel spreadsheet. We considered non-useable pictures all pictures of vegetation and setup pictures; non-useable pictures did not contain any animals. After first copying all pictures to a CD, we then deleted all of the non-useable pictures from our ThumbsPlus database. We compiled camera data in Excel where we summarized total number of pictures, total number of animal pictures (i.e., all animals that were not part of the inventory), total number of mammal pictures, and the total number of vegetation pictures.

Track plates

We used 46 cm x 15 cm unenclosed sand and acetate track plates to capture mammal prints as a pilot study during March 2007 and June 2008. Our goal was to compare the effectiveness of track plates versus digital cameras in detecting small and medium-sized mammals. We used unenclosed plates as we assumed that animals may not be as likely to enter an enclosed track plate, and larger animals can not fit in a relatively small enclosure. Therefore we assumed unenclosed track plates would be capable of detecting all of our targeted species.

We placed acetate track plates (Figure 5) at 10 randomly-selected sites within suitable habitat in both EVER and BICY. We followed Connors et al. (2005) methods for preparing the track plates (Appendix 5). Nine of the EVER sites were in pine habitat and the remaining one was in marl prairie. We placed the BICY track plates in pine, prairie, cypress, cypress prairie, and hammock habitats. We placed TrailMAC cameras facing the track plate to capture images of all animals crossing over the plate. We baited the cameras and track plates with oats, fatty acid scent disks, and skunk lure, and left the cameras and track plates in the field for two weeks; after two weeks, we collected cameras and track plates and compared the number and quality of pictures to the prints observed on track plates.

We placed sand track plates in the field along with a TrailMAC camera in EVER and BICY. We spread sand in a one meter by three meter rectangle at a depth of 2.5 cm. We placed the lure (skunk lure) in the center of the track plate, and also used apples (Hamilton 1936, Hooven et al. 1979) as bait at roughly 1/3 of all of the sand plate sites.

Other trapping and surveys

Live trapping

During both Phase II and Phase III of the project, we sampled small mammals using Sherman live traps. We trapped in hammock and cypress prairie habitats in BICY, and pine, hammock, mangrove, slough, and marl prairie in EVER (Figure 6). We conducted live trapping at sites selected as described above. We used 7.6 cm x 8.9 cm x 23.5 cm unventilated Sherman folding traps to trap various species of mice, rats, flying squirrels, and shrews.

We arrayed traps at sampling points in transects because many small mammals occur at low densities and in a patchy distribution across the landscape. For targeting mice, rats, and shrews, we placed three transects at least 250 m apart at each live trap sampling point. Each transect consisted of nine trap stations spaced 10 m apart, and we placed two traps at each station for a total of 18 traps per transect. We baited these traps with bird seed, placed both in the trap and at the trap entrance. Upon capture, we determined the species, sex, age, weight, and standard length of all animals. To recognize recaptures, we marked each animal with permanent marker on their fur before release at the same location (because this was not an intense mark-recapture study, we did not uniquely mark each individual).

We checked traps at dawn. To avoid capturing animals in the heat of the day, we closed the traps immediately after checking and then reopened them later in the afternoon (around 4pm or 5pm). We re-baited traps halfway through the deployment week to ensure that they were still attracting animals and that the bait had not been consumed or washed away by rain. We had 33 total trapping locations.

Night surveys

We completed two to four night surveys each month throughout both years of the project in both EVER and BICY. During night surveys, we followed set routes (roads and trails) (Appendix 6), recording visual encounters of individuals, as well as their tracks, scat, and foraging marks; these signs, including road-killed specimens, are considered opportunistic encounters. Each site was chosen randomly from the available roads and trails within EVER and BICY. We examined and dissected all scat or owl pellets collected for mammal hair and bones. We then identified mammal remains to the species level. If we were unsure of an ID, we took a picture of the sighting and asked another researcher (either University of Florida or National Park Service biologist) for assistance with identification. We began driving surveys at dusk and continued the survey for four to six hours; several other times we started the survey at 2am or 3am and continued driving until dawn. One to three people would participate in the survey, and we surveyed all habitat types in EVER and BICY.

In conjunction with night surveys, we also performed vocalization surveys in an attempt to locate flying squirrels (*G. volans*) (see the Southern Flying Squirrel section below for more details).

Hiking surveys

We completed one to three daytime hiking surveys each month along selected roads and trails (Appendix 6) in EVER and BICY. Each site was chosen randomly from the available roads and trails within EVER and BICY. During these surveys, one to three people walked for three to six hours on foot, searching all habitat types. We used Palm® pilots to record opportunistic sightings (i.e., visual encounters of individuals, tracks, scat, foraging marks, and road kill). We used *A Field Guide to Animal Tracks* (Murie 1974) and *Mammal Tracks and Sign* (Elbroch 2003) to identify tracks and scat. We collected and examined all scat and owl pellets for detection of mammal hair and bones (Appendix 7). We later identified mammal osteological remains down to the species level using our skull and skeleton reference collection, *Kaufman Field Guide to Mammals of North America* (Kaufman et al. 2007a), *Identification of the dorsal guard hairs of some Florida mammals* (Wilkins et al. 1982), *Skull key to adult land mammals of Delaware, Maryland and Virginia* (Ernst 1975), *Mammal remains in owl pellets* (Driver 1949), and *A Field Guide to the Mammals* (Burt and Grossenheider 1976).

Species-specific sampling

Because mink, southern flying squirrel, spotted skunk, striped skunk, eastern cottontail, and round-tailed muskrat were either detected in very small numbers or not at all detected during Phase II of the project, we conducted species-specific sampling to target these species during Phase III of the project. Consultations on historical sightings as well as methodologies were conducted with species-specific experts (Appendix 8). Because there was only one historical record of the weasel from Collier County (Brown 1972b, Hovis 1993), we did not specifically sample for this species.

Mink

Because other methods failed to detect mink, we began utilizing floating mink rafts in September 2008 in an attempt to verify presence of Everglades mink in EVER. We based our raft design on the Game Conservancy Trust Mink Raft model (2007) (Appendix 9) with the additional modification of a wire basket to hold a Moultrie game camera (Figure 7). The Game Conservancy Trust has used these rafts to trap the introduced American mink in the UK. We built 20 rafts with the recommended tunnel and 10 without that were placed in darker, well vegetated areas.

We placed 21 rafts in the sloughs and canals in areas in EVER (Figure 8) where historical sightings of mink occurred (F. Mazzotti, UF, pers. comm; S. Bass and M. Thomson, NPS, pers. comm.). We spaced rafts at least 500 m apart and secured them to the shoreline with rope. We baited all rafts with anal mink lure and sardines. With the use of mink lure, we expected to detect mink within one to three days if they were present (S. Humphrey, UF, pers. comm), however, because our rafts were in locations with previous mink sightings, we did not move the rafts. Humphrey (1982) previously used anal scents to detect mink in Southwest Florida in Fakahatchee Strand State Preserve. We tied sardines either to the raft itself or on vegetation hanging over the raft. Beginning June 2009, we also combined mink lure and sardines with fish or salmon oil for a longer-lasting attractant (Giman et al. 2007). We checked the rafts every three weeks during the wet season and approximately every six weeks in the dry season due to limited access to the sites. During the wet season, we checked cameras by airboat, whereas during the dry season we used helicopters to access the sites. During each visit, we replaced the batteries (if needed) and the SD cards, and re-baited rafts. We downloaded all pictures from the used SD card into our ThumbsPlus database and examined them for mammals.

We also placed 10 cameras without rafts along Old Ingram canal and one Moultrie camera without a raft at the S-12 tower (537991 2849208) in EVER. We selected sites where we observed animal slides or other signs of mammal activity. We also baited these cameras with mink lure and sardines, and beginning in June 2009 combined that with either fish or salmon oil. We checked these cameras every two weeks rather than every three weeks as described above, as we used TrailMac cameras at these locations which had a shorter battery life. Due to lower water levels during the dry season, we replaced two of the Old Ingram cameras with rafts for optimal camera placement.

In April 2009, we placed five mink rafts in slough habitat and canals in BICY (Figure 8) that were suitable mink habitats. We baited these cameras with mink lure and sardines, and beginning in June 2009 combined that with fish or salmon oil. We checked the BICY mink cameras approximately every six weeks, the approximate life of the batteries. We downloaded all pictures into our ThumbsPlus database and identified mammals as described earlier.

Southern Flying Squirrel

Bluebird cavities in the pinelands of Long Pine Key in EVER had previously been searched (G. Slater, Ecostudies Institute, pers. comm) for evidence of the Southern Flying Squirrel. More than 300 cavities had been searched over a ten year period using mirrored poles, yet during that study, no flying squirrels were detected (G. Slater, Ecostudies Institute, pers. comm).

Since the cavity searching method had already been tested, beginning in September 2008, we set cameras and platform feeders (Figure 9) in both pineland and hammock habitats to detect flying squirrels (S. Bass, NPS, pers. comm.) in both EVER and BICY (Figure 10). We constructed platform feeders out of 15.2 cm x 2.5 cm untreated pine trim board. The back of the platform feeder was 30.5 cm in height and the platform itself was 15.2 cm long (Appendix 10). We attached cameras (TrailMAC, Moultrie, or Cuddeback) to trees 1.5 m up from the ground facing a platform feeder, and we placed six feeders in EVER and six in BICY; all were placed in either pineland or hammock habitats, or in areas where the two habitat types intersected. We baited the feeders with squirrel food and occasionally with fruit from surrounding vegetation (i.e., Coco plum). In June 2009 we combined the squirrel food with a squirrel food lure, which we smeared on the platform feeder itself. After cameras were in position for two weeks, we replaced batteries and SD cards, and re-baited the platform feeder. We again downloaded pictures into our ThumbsPlus database and identified animal species. We kept these cameras in the same locations for approximately two to four months before we moved them to new areas.

In conjunction with night surveys (see above), we also performed squirrel vocalization surveys in an attempt to locate flying squirrels, beginning in December 2008. We chose locations based on optimal habitat, which usually included areas with pinelands or hammocks. Twice a month at dusk, we played a CD of flying squirrel calls (downloaded from www.soundboard.com/sb/Jerboa_Sounds_music.aspx) over a FoxPro AR4 game caller or truck speakers. We used an M-Audio Microtrack II recorder and Audio-Technica AT8015 shotgun microphone to record all sounds for ten minutes. After ten minutes, we repeated the playback protocol. If there were no results, we moved to another location to repeat the vocalization playback. We conducted one to two squirrel vocalization surveys each month in both EVER and BICY, and during each survey we visited one to six different locations. We recorded GPS points of all recording locations.

For live trapping flying squirrels, we placed traps in a 500 m transect; each transect consisted of 10 trap stations spaced 50 m apart. At each trap station, we placed two traps on the ground and hooked another to a tree with bungee cords roughly 1.5 m off the ground (Risch and Brady 1996; Loeb et al. 1999; Laves and Loeb 2005; S. Loeb, USFS, pers. comm.). We baited all traps with bird seed and placed traps in areas of historical sightings. We live trapped for flying squirrels in two locations.

Round-tailed Muskrat

Throughout the two-year project, we conducted several surveys for round-tailed muskrats, their lodges, and feeding platforms within areas where this species was previously detected, as well as other areas with similar habitat. Lodges are small, woven spheres of aquatic plants (Figure 11), about 30 cm in diameter, and are built in open slough habitat on top of piles of decaying vegetation or up against mangrove roots and stumps. Inside, they contain a central chamber with typically two exit holes leading into the water below. In addition, muskrats will build a feeding platform, an area of nearby flattened vegetation shaped into a bundle, where they eat and remain vigilant for predators.

We conducted one helicopter flight (totaling 2.5 hours) in BICY during 2007 specifically to search for muskrat lodges and feeding platforms. We covered the area

northeast of the BICY headquarters, north and south of U. S. Highway 41 (approximately 302 km). We also completed two helicopter flight surveys for muskrats in EVER on flight paths covering the entire lengths of Shark Slough and the Old Tamiami Trail (approximately 240 km each). During these flights, we searched for muskrat lodges and recorded GPS waypoints of any that we located. We flew at a speed between 50-100 kilometers per hour at an altitude of 50-75 meters.

During the winter 2008-2009 field season, we conducted three muskrat helicopter flights in BICY and EVER. Our main focus was Shark Slough and Taylor Slough in EVER (approximately 240 km each) and the southeastern edge of BICY (approximately 205 km). We used the same survey protocol as in the 2007-2008 field season.

We also surveyed the Old Tamiami Canal twice by boat in an attempt to locate muskrats (S. Snow pers. comm.). We selected this canal because 20 pythons were detected in this area that contained muskrats in their gut contents (S. Snow, NPS, unpub. data). We searched for any sign of muskrats including lodges, feeding platforms, burrows, and footprints. During regular hiking surveys (described in more detail above) conducted one to three times per month in both EVER and BICY, we also searched for prints, scat, and owl pellets containing evidence of muskrats.

Skunk/Cottontails

Because we anticipated low detection rates for certain mammal species, we also placed temporary cameras in both EVER and BICY to target eastern cottontails (*Sylvilagus floridanus*), eastern spotted skunks (*Spilogale putorius*), and striped skunks (*Mephitis mephitis*). We used a combination of TrailMAC, Moultrie, and Cuddeback cameras as temporary cameras. We used our best judgment to choose habitats that skunks and cottontails most likely used, such as hammocks and sandy areas for skunks and prairie habitats for cottontails. During the dry season we placed these cameras near permanent bodies of water. We baited temporary cameras with either skunk or cottontail lures and deployed them for two-week periods. We also tested apples (Hamilton 1936, Hooven et al. 1979) (once) as bait for cottontails. We set the skunk and cottontail cameras during the spring and summer seasons. As with the permanent camera sessions, the number of cameras set per temporary session ranged from two to 10 due to high water levels and cameras being damaged, destroyed, or stolen. We examined all photographs for mammals, and then moved the cameras to a different location for another two weeks.

Proportion Area Occupied (PAO) analyses using Program PRESENCE 2.0

Collection of habitat data

PAO analysis has been used to determine occupancy rates for key species in several studies on amphibians (Bailey et al. 2004, Rice et al. 2004a, Rice et al. 2004b, Rice et al. 2007). Roth et al. (2004) have used PAO analysis to estimate mammal occupancy from inventory data. PAO analysis provides managers with baseline data for future inventory and monitoring programs. Essentially, PAO analysis provides a way of monitoring site occupancy over time, and therefore a way of monitoring a species' presence over time. PAO results can also be used to examine colonization and extinction rates of species/sites over time. PAO analysis provides managers with baseline data for future inventory and monitoring programs. PAO analysis provides a way of monitoring

site occupancy over time, and therefore a way of monitoring a species over time. PAO results can also be used to examine colonization and extinction rates of species at sites over time (MacKenzie et al. 2002).

Throughout the entire project, we recorded vegetation and habitat data at each camera and live trap location using a Palm® pilot. We observed the area around the camera or live trap site and recorded habitat type, proportion decedent (dead vegetation), canopy height, water presence, number of small saplings, information about fine and coarse woody debris, and the number of live and dead stems observed. We then divided the site into four 15 m quadrants and recorded the dominant low (such as grass species), shrub, and tree species along with estimates of proportions for each quadrant. We uploaded this information from the Palm® into our main Access database as well as an Excel spreadsheet. Definitions of these variables can be found in the Access database (Appendix 1) under the Veg table.

Preparing the input forms

For input into Program PRESENCE 2.0 (MacKenzie et al. 2002), we formatted our data according to the program requirements, which will only accept numerical data. From the Access database, we exported each of our camera sites into Microsoft Excel; we did not use the live trap data in the PAO analysis as has been used in another study by MacKenzie et al. (2002). We used data from temporary and permanent cameras as well as any mink, squirrel, skunk and Florida Bay cameras; however, we did not look at variability between the different camera types. Florida Bay cameras were categorized as mangrove habitat in the input file. We used month as the sampling time unit to record presence and absence, regardless of the number of days the camera was in the field and this was not weighted by sampling effort. We created one Excel sheet for each species to organize the data on species observed at each site during each month of the project. If the species was seen, we inserted a 1; if the species was not seen, we inserted a 0; however, if the camera was not out that month, we inserted a dash (-). Therefore, our Excel sheet contained 28 columns, or months, of presence/absence data. We created two files, one for BICY and one for EVER.

For each site in the database, we formatted the spreadsheet to include previously collected information on habitat and vegetation. We coded each habitat as a number, and designated habitats as either forested or non-forested; forested habitats included hammock, pine, cypress, cypress prairie, and mangrove, whereas non-forested habitats included prairie, slough, and marl prairie. We assigned forested habitats a value of 1 in the PRESENCE input file, whereas we denoted non-forested habitats as 0. We also coded the remaining data for use as variables in Program PRESENCE.

PAO Analysis

For this exploratory analysis, we constructed a set of species-specific models as well as a set of general models suitable for all mammal species sampled. In Program PRESENCE, we ran each of the models through the single-season analysis option, which assumes that sites are closed in terms of occupancy across the study area (MacKenzie et al. 2002; Rice et al. 2007). We used a variety of variables for occupancy, or psi, including habitat and forested/non-forested. The general model set included a combination of these variables, or site covariates. A species may prefer a specific habitat or simply forested

over non-forested habitat for foraging, reproduction, etc. Detection variables (p) included time, water presence, total obstruction (stem abundance), wet/dry season, and season, which were all sampling occasion variables. Water presence may affect detection of a species, as some species may have a higher affinity for water than others. Season and wet/dry season may also affect detection of a species. During the wet season, some species are more difficult to detect due to dispersion. However, during the dry season, detection may be increased due to a limited availability of watering sites. Camera view obstruction (total obstruction) may hinder detection of certain species, particularly small mammals. We ran several models incorporating these expectations using data from all cameras, but ran a different set of models on temporary cameras due to data constraints (i.e., water presence could only be used for temporary cameras since this data was only recorded at set up of permanent cameras) (Appendix 11). Thus, the model $\text{psi}(\cdot)\text{p}(\text{grass density})$ estimated PAO (psi) as a constant and detection (p) as a function of grass density.

During model selection, we assessed model fit by examining $\hat{c}$ values. If $\hat{c}$ was less than two, we assumed model fit and used Akaike's information criterion (AIC) values to determine the best, or most parsimonious, model (Burnham and Anderson 1998). If $\hat{c}$ was greater than two, we calculated quasi-AIC values (QAIC), and used these to determine the model of best fit. In some cases, $\hat{c}$ was unreasonable (over a million), in which case we assumed model fit, similar to the analysis of Rice et al. (2007) with amphibians. From the models we ran on all cameras, we chose the model with the lowest AIC (or QAIC) and highest weight as the best model. Model weight is the "weight of evidence in favor of model k being the...best model for the situation" (MacKenzie et al. 2006). However, we did not disregard other models if they had similar AIC (or QAIC) values and significant (> 0.1000) model weights, as these covariates may also play a role in determining occupancy and detection of species. For those models that we ran on temporary cameras, we examined model fit in the same fashion. Because the temporary camera data was a subset of all cameras, we did not compare the two sets of models. Rather, we examined the temporary camera models to determine what other variables (i.e., water presence, season, bait type) (Appendix 11) might affect occupancy and detection of each species.

Results

Big Cypress National Preserve

From March 2007 through June 2009, we detected a total of 22 species and 2,807 individuals in BICY. The Virginia opossum (*Didelphis virginiana*) ($n = 950$) was the most frequently detected mammal in BICY (Table 2).

Cameras

Camera traps were the most effective method of detecting mammals in BICY where we detected 1,987 individual mammals and 18 mammal species (Table 3). Cameras tended to capture animals for the entire period they were in the field (Figure 12) though it appears that the most detections were observed during the first two days due to fresh bait/lure. We conducted 22 temporary camera sessions (Table 4) providing 827

useable (i.e., high quality) mammal pictures. In four of the temporary camera sessions, we used two to five 35mm film cameras, which produced 123 total pictures in 196 trap nights (Table 5). We conducted 22 permanent camera sessions in BICY (Table 6), providing 531 useable mammal pictures, respectively. We had 3,236 trap nights for the temporary cameras and 2,218 trap nights for the permanent camera sessions.

In seven skunk/cottontail camera sessions in BICY totaling 665 trap nights, we obtained 149 useable mammal pictures (Table 7). Out of the 9,197 total pictures taken during the project in the preserve, useable mammal photos comprised 1.6%, whereas vegetation comprised 75.3%.

In BICY, we conducted 17 squirrel camera sessions totaling 1,017 trap nights, producing 220 useable mammal pictures (Table 8). During these camera sessions, useable mammal pictures comprised 3.7% of all pictures taken, whereas vegetation photos comprised 79.3%.

We conducted two mink camera sessions in BICY in spring 2009, resulting in a total of seven useable mammal pictures (Table 9), comprising only 0.4% of the total pictures taken during those sessions. The two mink sessions totaled 334 trap nights. No mink were detected via this method, though we detected two by opportunistic sightings.

Live trapping

We detected the second highest number of individuals via live trapping, with 392 in BICY. In total, we only detected five mammal species by live trapping in BICY (Table 3). We conducted 13 live trap sessions in BICY totaling 1,152 trap nights (Table 10). The cotton mouse was the most commonly live trapped species in BICY, with 171 individuals captured (Table 3). The house mouse was trapped in BICY, but not in EVER. We did not live trap the least shrew and the black rat in BICY. In a previous study conducting live trapping in the pinelands and prairie habitats of BICY to determine the effects of off-road vehicles on small mammals, only four species were detected: the cotton rat, marsh rice rat, cotton mouse, and the short-tailed shrew (Jeffery 2009). Jeffery (2009) also did not detect the least shrew or the black rat in BICY.

Species-specific results

ORDER CARNIVORA

FAMILY CANIDAE

Canis familiaris

We detected the domestic dog in hammock and prairie habitats (Table 11, Figure 13) in BICY. We detected 10 total individuals: five (5.0%) individuals via live sightings, two (2.0%) by scat, and one (1.0%) each by road kill, prints, and camera traps (Table 3).

Canis latrans

We detected the coyote in all five major habitat types (Table 11, Figure 14) in BICY. Of the 18 total individuals detected, we detected nine (50.0%) via camera traps, four (22.2%) by scat, three (16.7%) by live sightings, and two (11.1%) by prints. We did not detect any coyotes via road kill (Table 3).

Urocyon cinereoargenteus

We detected the gray fox in hammock habitats (Table 11, Figure 15) in BICY. We only detected two individuals: one by live sighting and one via road kill (Table 3).

FAMILY PROCYONIDAE

Procyon lotor

We identified the raccoon in all five major habitat types (Table 11, Figure 16) in BICY. We detected 306 individuals, 216 (70.6%) by camera traps, 45 (14.7%) via live sightings, 23 (7.5%) by road kill, and 22 (7.2%) by prints. We did not detect any individuals via scat (Table 3).

FAMILY MUSTELIDAE

Lutra canadensis

We detected the river otter in pine, hammock, cypress and cypress prairie habitats (Table 11, Figure 17) in BICY. We detected 24 total individuals, eight (33.3%) of these via live sightings, and nine (37.5%) by camera traps and seven (29.2%) by road kill. We did not detect any individuals by prints or scat (Table 3).

Mustela vison

We detected mink in hammock habitats (Table 11, Figure 18) in BICY. We only detected two individuals, both by live sightings (Table 3).

Spilogale putorius

We detected eight eastern spotted skunks in pine, hammock, and cypress habitats in BICY (Table 11, Figure 19). We captured six (75.0%) via camera traps, one (12.5%) by live sightings, and one (12.5%) via road kill. We did not detect spotted skunks by live trap, print, scat, or owl pellet analyses (Table 3).

FAMILY FELIDAE

Felis domesticus

We detected 10 domestic cats in hammock, cypress, and prairie habitats (Table 11, Figure 20) in BICY. We detected seven (70.0%) individuals via live sightings, two (20.0%) by camera traps, and one (10.0%) by road kill. We did not detect cats by live traps, prints, scat, or by owl pellet analyses (Table 3).

Lynx rufus

We detected the bobcat in all five major habitat types (Table 11, Figure 21) in BICY. Of the 161 individuals we detected, 131 (81.4%) were detected via camera traps. We detected 14 (8.7%) individuals by prints, 11 (6.8%) by live sightings, three (1.9%) by road kill, and two (1.2%) by scat. We did not detect bobcats by live trapping or by owl pellet analyses (Table 3).

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

We detected 49 gray squirrels in pine, hammock, cypress, and cypress prairie habitats (Table 11, Figure 22) in BICY. We detected 29 (59.2%) of these individuals by camera traps, 19 (38.8%) via live sightings, and one (2.0%) by road kill. We did not detect gray squirrels by prints, scat, live trapping, or owl pellet analyses (Table 3).

Sciurus niger

We detected 26 fox squirrels in pine, hammock, cypress, and cypress prairie habitats (Table 11, Figure 23) in BICY. Of the 26 individuals detected, we detected 13 individuals (50.0%) with camera traps, ten (38.5%) via live sightings, and three (11.5%) via prints. We did not detect fox squirrels by road kill, scat, live trapping, or owl pellet analyses (Table 3).

FAMILY CRICETIDAE

Neofiber alleni

We detected the round-tailed muskrat in hammock and prairie habitats (Table 11, Figure 24) in BICY. Of the 29 sightings, 26 (89.7%) were lodge clusters via aerial and roadside surveys and three (10.3%) were in owl pellets. We did not detect muskrats by live trapping, camera trapping, prints, scat, road kill, or live sightings (Table 3).

Peromyscus gossypinus

We detected the cotton mouse in pine, hammock, cypress, and cypress prairie habitats (Table 11, Figure 25) in BICY. We detected 476 (73.6%) of the total 647 individuals by camera traps. We detected the remaining 171 (26.4%) by live trapping (Table 3). The cotton mouse was the species we captured the most ($n = 171$) via live traps.

Sigmodon hispidus

We detected the hispid cotton rat in all five major habitat types (Table 11, Figure 26) within BICY. We detected 234 individuals, 118 (50.4%) with live traps, 105 (44.9%) with camera traps, eight (3.4%) by owl pellet analyses, two (0.9%) by live sightings, and one (0.4%) by road kill. We did not detect the cotton rat via prints or scat (Table 3).

FAMILY MURIDAE

Mus musculus

We detected the house mouse in pine, hammock, cypress, and cypress prairie habitats (Table 11, Figure 27) in BICY. We only detected nine individuals, seven (77.8%) via live traps and two (22.2%) by camera traps. We did not detect any by road kill, prints, scat, live sightings, or by owl pellet analyses (Table 3).

Oryzomys palustris

We detected the marsh rice rat in pine, cypress, cypress prairie, and hammock habitats (Table 11, Figure 28) in BICY. We detected 109 individuals, 95 (87.2%) in live traps, 12 (11.0%) by camera traps, and one (0.9%) each by live sightings and road kill. We did not detect the marsh rice rat by prints, scat, or by owl pellet analyses (Table 3).

Rattus rattus

We were only able to detect black rats in pine, hammock, and cypress habitats (Table 11, Figure 29) in BICY. We detected 12 total individuals, 11 (91.7%) of which were detected by camera traps and one (8.3%) by road kill. We did not detect black rats via live trapping, live sightings, prints, scat, or owl pellet analyses (Table 3).

ORDER MARSUPIALA

FAMILY DIDELPHIDAE

Didelphis virginiana

We detected the Virginia opossum in all five major habitat types (Table 11, Figure 30) in BICY. We detected 865 (89.2%) of the 950 total individuals by camera traps. The opossum was the species we captured the most via camera trapping. We detected 47 (4.9%) individuals by live sightings, 32 (3.4%) by road kill, and six (0.6%) by prints. We did not detect the opossum by live trapping, prints, or owl pellet analyses (Table 3).

ORDER LAGOMORPHA

FAMILY LEPORIDAE

Sylvilagus floridanus

We only detected the eastern cottontail in prairie habitats in BICY (Table 11, Figure 31). We detected seven individuals in BICY, all by live sightings (Table 3).

Sylvilagus palustris

We detected the marsh rabbit in all five major habitat types (Table 11, Figure 32) in BICY. We detected 103 total individuals, 47 of these (45.6%) via live sightings, 41 (39.8%) via camera traps, six (5.8%) by prints, six (5.8%) by scat, and three (2.9%) by road kill. We did not detect any individuals by owl pellet analyses or by live trapping (Table 3).

ORDER INSECTIVORA

FAMILY SORICIDAE

Blarina carolinensis

We detected the southern short-tailed shrew in hammock habitats (Table 11, Figure 33) in BICY. We only detected six individuals, four (66.7%) by owl pellet

analyses and one (16.7%) each by camera trapping and live trapping. We did not detect any individuals by live sightings, print, road kill, or scat (Table 3).

ORDER EDENTATA

FAMILY DASYPODIDAE

Dasyus novemcinctus

We detected the nine-banded armadillo in pine, hammock, and prairie habitats (Table 11, Figure 34) in BICY. We detected 75 individuals, 58 (77.3%) of which were via camera traps, 11 (14.6 %) by live sightings, four (5.3%) by road kill, and two (2.7%) by other methods (found dead, but were not road kill). We did not detect any individuals by prints, scat, owl pellet analyses, or live trapping (Table 3).

Results by habitat type

Hammock

We detected 21 species in hammock habitats in BICY (Table 11). Of these 21 species, 15 were native and six were exotic (we grouped coyotes and armadillos with exotics in these summaries although there is some debate on whether they should be considered exotic or new range expansion species (A. Atkins pers. comm.)). We detected 17 species by cameras, five by live traps, 13 by live sightings, five by prints, 13 by road kill, three by owl pellet analyses, and three by scat. Of the 22 total species we detected in BICY, the eastern cottontail was the only species not detected in hammock habitat (Table 11). The Virginia opossum was the species we detected the most ($n = 666$) in hammock habitat.

Pine

We detected 15 species in the pinelands of BICY (Table 11). Of these 15 species, 11 were native and four were exotic. We detected nine species via live sightings, two species by road kill, 13 by cameras, and five by prints. We did not detect any species by live traps, scat or by collecting and analyzing owl pellets in this habitat type. We did not detect the round-tailed muskrat, southern short-tailed shrew, eastern cottontail, gray fox, mink, domestic cat, or domestic dog in pine habitat in BICY (Table 11). The cotton mouse was the species we detected most ($n = 374$) in pine habitat.

Cypress

We detected 15 species in cypress habitats within BICY (Table 11). Of these 15 species, 11 were native and four were exotic. We detected eight species via live sightings, four by live traps, five by road kill, ten by cameras, and two by prints. We did not detect any species by collecting and analyzing scat or owl pellets in this habitat type. We did not detect the nine-banded armadillo, mink, round-tailed muskrat, southern short-tailed shrew, eastern cottontail, gray fox, or the domestic dog in cypress habitats (Table 11). The species we detected the most in cypress habitat was the opossum ($n = 104$).

Cypress-prairie

We detected 12 species in cypress-prairie habitats within BICY (Table 11). Of these 12 species, ten were native and two were exotic. We detected six species via live sightings, four by live traps, four by road kill, seven by cameras, one by scat, and five by prints. We did not detect any species by collecting and analyzing owl pellets in this habitat type. We did not detect the black rat, round-tailed muskrat, southern short-tailed shrew, eastern cottontail, gray fox, mink, domestic cat, domestic dog, Nine-banded armadillo, or the eastern spotted skunk in cypress-prairie habitats (Table 11). The rice rat was the species we detected the most ($n = 37$) in cypress-prairie habitats.

Prairie

We detected 11 species in prairie habitats within BICY (Table 11). Of these 11 species, seven were native and four were exotic. We detected seven of these species via live sightings, two by road kill, seven by cameras, one by scat, and three by prints. We did not detect any species by live trapping or collecting and analyzing owl pellets in this habitat type. We were unable to detect the river otter, cotton mouse, marsh rice rat, black rat, southern short-tailed shrew, gray fox, gray squirrel, house mouse, mink, fox squirrel, or the eastern spotted skunk in prairie habitats (Table 11). The round-tailed muskrat was the species we detected the most ($n = 26$) in prairie habitat.

Everglades National Park

We detected a total of 21 species in EVER. Overall, we detected a total of 3,145 individuals in EVER. The black rat (*Rattus rattus*) ($n = 1,376$) was the species we detected the most in EVER (Table 2).

Cameras

Setting camera traps proved to be the most effective method of detection in EVER, detecting 2,394 individuals and 13 mammal species (Table 12). Cameras tended to capture animals for the entire period they were deployed in the field (Figure 12), and most detections were observed during the first two days, possibly due to the freshness of the bait or lure. We conducted 18 temporary camera sessions (3,178 trap nights), producing 488 useable mammal pictures (Table 13), and 19 permanent camera sessions totaling 1,840 trap nights and producing 436 (0.8%) useable mammal pictures (Table 14). In EVER, we conducted six skunk/cottontail camera sessions, producing a total of 27 useable mammal pictures from 560 trap nights (Table 15). Useable mammals comprised 0.2% of these photos, whereas total vegetation comprised 97.1%. We also conducted 20 squirrel camera sessions, producing 614 useable mammal pictures (Table 16). During these sessions, we had 1,686 total trap nights. Useable mammals comprised only 1.7% of these pictures whereas vegetation comprised 69.8%. We were unable to detect the southern flying squirrel using this method. Finally, we collected 1,116 useable mammal pictures (Tables 17 - 20) from mink camera sessions. All mink camera sessions totaled 8,610 trap nights. Useable mammal pictures only comprised 1.2% of these pictures, whereas vegetation comprised 87.9%. Across all mink cameras, the Shark Valley Tram cameras and Old Tamiami cameras produced the highest number of useable mammal photos ($n = 638$) (Table 20). Despite many camera sessions, we were unable to detect mink in EVER.

Live trapping

We detected 192 individuals via live trapping in EVER. We detected five mammal species using this method (Table 12). We conducted 16 live trap sessions in EVER totaling 1,464 trap nights, including the live trapping for flying squirrels (Table 21). The cotton rat (*S. hispidus*), with 112 individuals captured, and was the most commonly livetrapped species captured in EVER (Table 12). In contrast, *M. musculus* was not trapped in EVER as it was in BICY, while *C. parva* and *R. rattus* were only trapped in EVER.

Species-specific results

ORDER CARNIVORA

FAMILY CANIDAE

Canis familiaris

We detected 34 domestic dogs in pine, hammock, slough, and marl prairie habitats (Table 11, Figure 13) in EVER. We detected 23 (67.6%) individuals via camera traps, four (11.8%) by scat, three (8.8%) by road kill, and two (5.9%) each by live sightings and prints (Table 12).

Canis latrans

We detected the coyote in pine, hammock, slough, and marl prairie habitats (Table 11, Figure 14) in EVER. Of the 39 total individuals detected, we detected 12 (30.8%) via live sightings, 8 (20.5%) via camera traps, eight (20.5%) by prints, nine (23.1%) by scat, and two (5.1%) by road kill (Table 12).

Urocyon cinereoargenteus

We detected the gray fox in pine, hammock, slough, and marl prairie habitats (Table 11, Figure 15) in EVER. We detected nine total individuals, five (55.6%) of which we detected via prints seen during opportunistic sightings. We also detected two (22.2%) each by live sightings and road kill. We did not detect the gray fox by camera trapping or by scat (Table 12).

FAMILY PROCYONIDAE

Procyon lotor

We detected 141 raccoons in the five major habitat types (Table 11, Figure 16) in EVER. We detected 102 (72.3%) of these individuals by camera trapping, 13 (9.2%) by prints, 10 (7.1%) by live sightings, eight (5.7%) by road kill, and eight (5.7%) by scat. We did not detect the raccoon by live trapping (Table 12).

FAMILY MUSTELIDAE

Lutra canadensis

We detected 20 individual river otters in hammock and slough habitats (Table 11, Figure 17) in EVER. We detected 12 (60.0%) of these individuals via live sightings, three (15.0%) each by prints and road kill, and two (10.0%) by scat. We did not detect any river otters using camera traps (Table 12).

FAMILY FELIDAE

Felis domesticus

We detected the domestic cat in hammock and slough habitat (Table 11, Figure 20) in EVER. We detected nine individuals, four (44.4%) by camera traps, three (33.3%) by road kill, and two (22.2%) by live sightings. We did not detect the domestic cat by scat or prints (Table 12).

Lynx rufus

We detected 28 individual bobcats within the five major habitat types (Table 11, Figure 21) in EVER. We detected ten (35.7%) individuals by scat, eight (28.6%) by prints, seven (25.0%) by live sightings, two (7.1%) by camera traps, and one (3.6%) by other methods. We did not detect the bobcat by road kill (Table 12).

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

We detected gray squirrels in pine, hammock, and marl prairie habitats (Table 11, Figure 22) in EVER. Of the 41 individuals, we detected 19 (46.3%) via live sightings, 14 (34.1%) via camera traps, and eight (19.5%) by road kill. We were unable to detect the gray squirrel by live trapping, print, scat, or owl pellet analyses (Table 12).

Sciurus niger

We detected fox squirrels in hammock, slough, and mangrove habitats (Table 11, Figure 23) in EVER. However, we only detected six individuals in EVER, four (66.7%) of which were live sightings and two (33.3%) of which were prints. We were unable to detect the fox squirrel by camera traps, live traps, owl pellet analyses, road kill, and scat (Table 12).

FAMILY CRICETIDAE

Neofiber alleni

We detected 22 muskrats in slough and marl prairie habitats (Table 11, Figure 24) in EVER. We detected 16 (72.7%) via python stomach content analyses through a concurrent University of Florida python diet study and six (27.3%) by owl pellet analyses. We did not detect the muskrat with camera traps, live traps, live sightings, print, scat, or road kill (Table 12). We also did not detect any via aerial or airboat surveys.

Peromyscus gossypinus

We detected the cotton mouse in pine, hammock, slough, and marl prairie habitats (Table 11, Figure 25) in EVER. Of the 290 individuals, we detected 277 (95.5%) individuals via camera traps, eight (2.8%) by live traps, three (1.1%) by live sightings, and two (0.7%) by owl pellet analyses. We did not detect the cotton mouse by road kill, print, or scat (Table 12).

Sigmodon hispidus

We detected hispid cotton rats in all five major habitat types (Table 11, Figure 26) in EVER. We detected a total of 528 individuals, 239 (45.3%) with camera traps, 152 (28.8%) by owl pellet analysis, 112 (21.2%) with live traps, 19 (3.6%) by live sightings, five (0.9%) by road kill, and one (0.2%) by other methods. We did not detect the cotton rat by prints or scat (Table 12). The cotton rat was the species we detected the most via live trapping.

FAMILY MURIDAE

Mus musculus

Although we were unable to detect the house mouse in any of the five major habitat types (Table 11, Figure 27) in EVER, we did find one deceased within disturbed habitat. We did not detect the house mouse via live trapping as we did in BICY.

Oryzomys palustris

We found 400 marsh rice rats in EVER (Table 2), and they were detected in all five major habitat types (Table 11, Figure 28) within the park. Of the 400 individuals, we detected 281 (70.3%) via camera traps, 69 (17.3%) by owl pellet analyses, 42 (10.5%) by live trapping, six (1.5%) by prints, and two (0.5%) by live sightings. We did not detect the marsh rice rat by road kill or scat (Table 12).

Rattus rattus

We identified black rats in all five major habitat types (Table 11, Figure 29) in EVER. Out of the 1,376 individuals we detected, we detected 1,324 (96.2%) by camera traps, 28 (2.0%) by live traps, 10 (0.7%) by live sightings, six (0.4%) by owl pellet analyses, three (0.2%) by road kill, two (0.1%) by prints, and three (0.2%) by other methods. We did not detect the black rat by scat (Table 12). The black rat was the species with the highest number of individuals detected by camera traps.

ORDER MARSUPIALIA

FAMILY DIDELPHIDAE

Didelphis virginiana

We detected opossums in pine, hammock, slough, and marl prairie habitats (Table 11, Figure 30) in EVER. We detected 131 individuals, 100 (76.3%) via camera traps, ten (7.6%) by live sightings, nine (6.9%) by scat, and six (4.6%) each by road kill and prints. We did not detect the opossum by owl pellet analyses (Table 12).

ORDER LAGOMORPHA

FAMILY LEPORIDAE

Sylvilagus floridanus

We detected cottontails in pine, slough, and marl prairie habitats (Table 11, Figure 31) in EVER. We detected 11 individuals, seven (63.6%) of which were detected via camera traps and two (18.2%) detected by both live sightings and road kill. We did not detect the cottontail by live trap, print, scat, or owl pellet analyses (Table 12).

Sylvilagus palustris

We detected the marsh rabbit in hammock, slough, marl prairie, and mangrove habitats (Table 11, Figure 32) in EVER. We detected 21 individuals, 13 (61.9%) of these by camera traps, three (14.3%) by live sightings, two (9.5%) by scat, one (4.8%) by owl pellet analyses, and two (9.5%) more by other methods. We did not detect the marsh rabbit by live trap, road kill, or prints (Table 12).

ORDER INSECTIVORA

FAMILY SORICIDAE

Cryptotis parva

We were able to detect 13 least shrews in pine, hammock, and marl prairie habitats (Table 11, Figure 35) in EVER. We located six (46.2%) of these individuals in owl pellets collected during hiking surveys. We detected three (23.1%) by road kill, two (15.4%) by live trapping, and one (7.7%) each by live sightings and other methods (found dead, but not road kill). We did not detect the least shrew by camera traps, prints, or scat (Table 12).

Blarina carolinensis

We detected the short-tailed shrew in slough and marl prairie habitats (Table 11, Figure 33) in EVER. Of the 21 individuals we detected, we found 19 (90.5%) in owl pellets and two (9.5%) by live sightings. We did not detect the short-tailed shrew via camera trap, live trap, road kill, print, or scat (Table 12).

ORDER EDENTATA

FAMILY DASYPODIDAE

Dasypus novemcinctus

We were only able to detect armadillos in hammock and marl prairie habitats (Table 11, Figure 34) in EVER. We detected four individuals, two via live sightings and two via road kill. We did not detect armadillos using either camera traps or live traps, or by owl pellet analyses, prints, or scat (Table 12).

Mammal species on the islands of Florida Bay

We only detected two mammal species, the raccoon (Figure 16) and the black rat (Figure 29), on the islands of Florida Bay. We did not detect any mammal species on three Keys: Arsenicker Key, Clive Key, and Buchannon Key. Buchannon Key was the southernmost Key we sampled. We detected the black rat on 13 Keys (Table 24) and as far south as Twin Key. We detected the raccoon on eight Keys (Table 24), with Whipray Key being the farthest south. This suggests that black rats and raccoons are able to disperse to islands off the coast of Florida.

Results by habitat type

Hammock

We identified 17 species in hammock habitat within EVER (Table 11). Of these 17 species, 12 were native and five were exotic. We detected 12 species by camera, five by live trap, 12 by live sightings, six by road kill, two by owl pellet analyses, six by scat, and five by prints. Of the total 21 species we detected in EVER, the round-tailed muskrat, southern short-tailed shrew, eastern cottontail, and house mouse were the only species not detected in hammock habitats (Table 11). The black rat was the species we detected the most ($n = 677$) in hammock habitat.

Pine

We detected 14 species in pine habitat (Table 11). Of these 13 species, 10 were native and four were exotic. We detected eight species using cameras, eight by live sightings, one by live trap, three via scat, two by prints, and three by road kill. We did not detect the following species in pine habitat: river otter, nine-banded armadillo, round-tailed muskrat, southern short-tailed shrew, fox squirrel, marsh rabbit, and the domestic cat (Table 11). The cotton rat was the species we detected the most ($n = 75$) in pine habitat.

Slough

We detected 17 species in slough habitat within EVER (Table 11). Of these 17 species, 13 were native and four were exotic. We detected nine species by camera, two by live trap, nine by live sightings, five by road kill, four by owl pellet analyses, three by scat, and six by prints. We did detect a print in slough habitat that we believe could have been a mink, but this is not confirmed. We did not detect the following species in slough habitat: nine-banded armadillo, least shrew, gray squirrel, or the house mouse (Table 11). The black rat was the species we detected the most ($n = 473$) in slough habitat.

Marl prairie

We detected 17 species in marl prairie habitat in EVER (Table 11). Of these 17 species, 13 were native and four were exotic. We detected six by camera, three by live trap, seven by live sightings, five by road kill, three by owl pellet analyses, six by scat, and six by prints. We did not detect the house mouse, fox squirrel, river otter, or the domestic cat in marl prairie habitat (Table 11). The cotton rat was the species we detected the most ($n = 55$) in marl prairie habitat.

Mangrove

We only detected seven mammal species in mangrove habitat (Table 11). Of these seven species, six were native and one was exotic. We detected two species by cameras, four by live sightings, three by prints, one by scat, and three by live trap. We did not detect any species by road kill or by owl pellet analysis. Of the 21 total species detected in EVER, the raccoon, marsh rabbit, bobcat, marsh rice rat, black rat, cotton rat, and the fox squirrel were the only species detected in mangrove habitat (Table 11). The black rat was the species we detected the most ($n = 188$) in mangrove habitat.

Proportion Area Occupied (PAO) Results

Big Cypress National Preserve

ORDER CARNIVORA

FAMILY CANIDAE

Canis latrans

Our naïve calculation, or minimum site occupancy, for coyotes in BICY was 2.0%. Using PAO modeling, we estimated that coyotes actually occur in 14.9% ($\Psi = 0.149$; $SE = 0.14$) of all sites in BICY. We calculated $\hat{c}$ for the most parsimonious model to be greater than one million, so we assumed model fit. The best model was $\psi(.)p(.)$, which had a model weight of 0.43. The second and third best models were $\psi(\text{forested/non-forested})p(.)$ which had a model weight of 0.29, and $\psi(.)p(\text{total obstruction})$ which had a model weight of 0.16 (Table 22). Coyotes may occupy 12.3% of all forested sites and 33.3% of all non-forested sites. Total obstruction may negatively affect detection of the coyote. From our temporary camera data analyses, $\psi(.)p(\text{water})$ was the best model, suggesting that water presence may positively affect detection.

FAMILY PROCYONIDAE

Procyon lotor

Our naïve calculation for raccoons in BICY was 24.1%, however PAO modeling estimated that this species actually occurs in 77.1% ($\Psi = 0.771$; $SE = 0.15$) of all BICY sites. For the most parsimonious model, $\hat{c}$ was 4.0. The best model for raccoons was $\psi(.)p(.)$, with a model weight of 0.39 and a QAIC = 129.0. One model, $\psi(.)p(\text{total obstruction})$, had a similar QAIC and a model weight of 0.27, suggesting that stem abundance, or camera view obstruction, may negatively affect detection. Canopy height and forest may affect occupancy, as those models had weights of 0.18 and 0.15 respectively (Table 22). Temporary camera data analyses showed that water presence may negatively affect detection of raccoons.

FAMILY MUSTELIDAE

Lutra canadensis

Our naïve calculation for the river otter was 1.0%. For the most parsimonious model, $\hat{c}$ was greater than one million, so we assumed model fit. The best model for river otters was $\text{psi}(\text{habitat})\text{p}(\text{total obstruction})$ which had an AIC = 54.5 (Table 22). Occupancy for each habitat type ranged from 0 – 28.9%, with hammock having the highest occupancy (28.9%). Camera obstruction appeared to have affected the detection probability of the river otter. Three other models had similar AIC values and may also be suitable models: $\text{psi}(\cdot)\text{p}(\text{total obstruction})$, $\text{psi}(\cdot)\text{p}(\cdot)$, and $\text{psi}(\text{habitat})\text{p}(\cdot)$. Total obstruction may negatively affect detection of the river otter. Low detection rates of river otters in temporary cameras precluded their inclusion in PAO analysis.

FAMILY FELIDAE

Lynx rufus

Our naïve calculation for bobcats in BICY was 10.6%. PAO modeling estimated that bobcats actually occur in 22.8% ($\text{Psi} = 0.228$; $\text{SE} = 0.05$) of all sites in BICY. For the most parsimonious model $\hat{c}$ was 2.9. The best model for this species was $\text{psi}(\cdot)\text{p}(\cdot)$, with a model weight of 0.47 and a QAIC = 123.8, possibly indicating a common species that may be a habitat generalist. Models with similar QAIC values that may also be suitable include $\text{psi}(\text{forested})\text{p}(\cdot)$ and $\text{psi}(\cdot)\text{p}(\text{total obstruction})$ (Table 22). Bobcats may occupy 4.3% of all forested sites in BICY and 8.4% of all non-forested sites. Total obstruction may negatively affect detection of the bobcat. Our temporary camera data analyses showed that water may negatively affect detection of bobcats.

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

Our naïve calculation showed that gray squirrels occupy 4.3% of sites in BICY. PAO modeling estimated that this species occurs in 31.8% ($\text{Psi} = 0.318$; $\text{SE} = 0.20$) of all sites in BICY. $\hat{c}$ for the most parsimonious model was 5.2. The best model for gray squirrels was $\text{psi}(\cdot)\text{p}(\cdot)$, which had a model weight of 0.42. Three models, $\text{psi}(\text{forested})\text{p}(\cdot)$, $\text{psi}(\text{canopy})\text{p}(\cdot)$, and $\text{psi}(\cdot)\text{p}(\text{total obstruction})$, all had similar QAIC values and significant model weights (Table 22), suggesting that forest, canopy height, and total obstruction may affect occupancy and detection. Total obstruction and canopy height may negatively affect detection of the gray squirrel, while forested habitats positively affect detection. PAO for forested habitats is 35.7% and is 0% for non-forested habitats. We did not have enough temporary camera data to analyze occupancy using Program PRESENCE (all other cameras were used in this analysis).

FAMILY CRICETIDAE

Peromyscus gossypinus

Our naïve calculation for the cotton mouse was 14.9%. For the most parsimonious model, $\hat{c}$ was 0.08, so we assumed model fit. The best model for this species was $\text{psi}(\text{habitat})\text{p}(\text{grass density})$, which had an AIC of 311.0 and a model weight of 0.93

(Table 22). Occupancy of each habitat ranged from 0 - 100%, and grass density may negatively affect the detection probability of the cotton mouse. The cotton mouse may occupy 100% of all hammock and pine sites in BICY. Temporary camera data analyses showed that a combination of habitat, forest, season, total obstruction, and water may all affect occupancy and detection of the cotton mouse. Season and dry season variables may positively affect detection by using cameras, while wet season, water, and total obstruction may negatively affect detection of the cotton mouse.

Sigmodon hispidus

Our naïve, or minimum site occupancy, calculations show that cotton rats occur in 7.6% of all sites in BICY. PAO modeling estimated that this species actually occurs in 84.5% (Psi = 0.845; SE = 0.63) of all sites in BICY. For the most parsimonious model, $\hat{c}$ was 0.52, so we assumed model fit. The best model for cotton rats was $\text{psi}(\cdot)\text{p}(\text{grass density})$, with a model weight of 0.54. The second best model was $\text{psi}(\cdot)\text{p}(\cdot)$ with an AIC of 202.8 and a model weight of 0.14. The model $\text{psi}(\text{habitat})\text{p}(\text{grass density})$ had a similar AIC and a model weight of 0.10 (Table 22), suggesting that habitat may also affect occupancy and that grass density may affect detection. Both models with grass density as a variable showed that it may negatively affect detection of the cotton rat. Analyses of our temporary camera data suggested that water presence may negatively affect detection of cotton rats.

FAMILY MURIDAE

Oryzomys palustris

Our minimum site occupancy (naïve site occupancy) for rice rats in BICY was 3.0%. PAO modeling estimated that rice rats actually occur in 3.70% (Psi = 0.037; SE = 0.01) of all sites in BICY. For the most parsimonious model, $\hat{c}$ was 0.47, so we assumed model fit. The best model for this species was $\text{psi}(\cdot)\text{p}(\text{grass density})$, with a model weight of 0.75. With a model weight of 0.23, $\text{psi}(\text{habitat})\text{p}(\text{grass density})$ was the second best model for rice rats (Table 22). In both models, grass density negatively affected detection of the rice rat, and cypress was the habitat which rice rats occupied most (9.9% of all sites). Analyses of our temporary camera data showed that water presence may also negatively affect detection of rice rats in BICY.

Rattus rattus

Our naïve calculation for this species was 2.0%, but PAO modeling showed that black rats actually occupy 8.5% (Psi = 0.085; SE = 0.07) of all BICY sites. For the most parsimonious model, $\hat{c}$ was greater than one million, so we assumed model fit. The best model for this species was $\text{psi}(\cdot)\text{p}(\text{grass density})$, which had an AIC of 75.3 and a model weight of 0.41 (Table 22). This model shows that grass density may negatively affect the detection probability of this species. The second best model was $\text{psi}(\text{forested/nonforested})$, and forested habitat may positively affect detection, while nonforested habitat may negatively affect detection of the black rat. The third best model was $\text{psi}(\cdot)\text{p}(\cdot)$. Temporary camera data analyses showed that habitat may also affect occupancy while season may affect detection.

ORDER MARSUPIALIA

FAMILY DIDELPHIDAE

Didelphis virginiana

Our naïve calculation showed that opossums occur in 34.7% of all sites in BICY. However, PAO modeling estimated that opossums actually occur in 69.8% (Psi = 0.698; SE = 0.56) of all forested sites and 20.9% (Psi = 0.209; SE = 0.56) of nonforested sites. For the most parsimonious model, $\hat{c}$ was 5.5. The best model for this species was $\text{psi}(\text{forest})p(.)$, with a model weight = 0.45. With a model weight of 0.27, $\text{psi}(.)p(.)$ was the second best model for the opossum (Table 22). Our temporary camera data analyses showed that water presence, may negatively affect detection of this species.

ORDER LAGOMORPHA

FAMILY LEPORIDAE

Sylvilagus palustris

Our naïve calculation showed that the minimum occupancy of this species was 8.3%. PAO estimates showed that marsh rabbits actually occupy 92.8% (Psi = 0.928; SE = 0.52) of all sites in BICY. For the most parsimonious model, $\hat{c}$ was 0.74, so we assumed model fit. The best model was $\text{psi}(.)p(\text{grass density})$, with a model weight of 0.84 (Table 22), suggesting that grass density may negatively affect detection of marsh rabbits. We did not have enough temporary camera data to analyze occupancy using Program PRESENCE.

ORDER EDENTATA

FAMILY DASYPODIDAE

Dasyopus novemcinctus

For the most parsimonious model, $\hat{c}$ was 4.7. Using PAO modeling, we determined that the best model for armadillos in BICY was $\text{psi}(.)p(.)$, which had a model weight of 0.42. The naïve, or minimum site occupancy for this species was 4.3%; however, PAO modeling estimated that armadillos occur in 9.7% (Psi = 0.097; SE = 0.03) of all BICY sites. $\text{Psi}(.)p(\text{grass density})$, $\text{psi}(.)p(\text{total obstruction})$, and $\text{psi}(\text{forested/nonforested})p(.)$ all had similar AIC values (Table 22), suggesting that they may also be suitable models. Armadillos may occupy 9.8% of all forested sites and 9.0% of all nonforested sites. Grass density may negatively affect detection, while total obstruction may actually positively affect detection of the armadillo. Temporary camera data analyses showed that water presence may negatively affect detection of armadillos.

Everglades National Park

ORDER CARNIVORA

FAMILY CANIDAE

Canis latrans

Our naïve calculation for coyotes in EVER was 1.7%. We estimated that coyotes actually occur in 13.0% ($\Psi = 0.13$; $SE = 0.12$) of all sites in EVER using PAO modeling. For the most parsimonious model, $\hat{c}$ was greater than one million, so we assumed model fit. The best model for coyotes in EVER was $\psi(.)p(\text{total obstruction})$, which had a model weight of 0.56. This model showed that total obstruction may negatively affect the detection probability of the coyote. The second best model for coyotes in EVER was $\psi(.)p(.)$, which had an AIC = 70.7 and a model weight of 0.28. The model $\psi(\text{forested/nonforested})p(.)$ was the third best model for coyotes, suggesting that forest may negatively affect occupancy while nonforested sites may positively affect occupancy (Table 23). Low detection rates of coyotes using temporary cameras precluded their inclusion in PAO analysis.

FAMILY PROCYONIDAE

Procyon lotor

For the most parsimonious model, $\hat{c}$ was 2.5. Our naïve calculation was 9.2%, and the best model for raccoons was $\psi(\text{habitat})p(.)$. This model had a QAIC = 83.1 and a weight of 0.69 (Table 23). We estimated occupancy for each habitat type, and results ranged from 0 - 100%. Raccoons may occupy 100% of all mangrove sites. The second best model included total obstruction as a covariate, suggesting that total obstruction (or stem abundance) may negatively affect detection of raccoons. Temporary camera analyses showed that season (spring, summer, fall, winter), wet season, and water presence may all affect detection of raccoons. Wet season and water presence may negatively affect detection while dry season and season may positively affect detection.

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

Our naïve calculation showed that gray squirrels occupy 1.0% of all sites in EVER. PAO modeling, however, estimated that this species actually occurs in 3.3% ($\Psi = 0.033$; $SE = 0.02$) of all EVER sites. For the most parsimonious model, $\hat{c}$ was greater than one million, so we assumed model fit. The best model was again $\psi(.)p(.)$, which had a model weight of 0.42 (Table 23). Three other models, $\psi(\text{avg. canopy height})p(.)$, $\psi(.)p(\text{total obstruction})$, and $\psi(\text{forested/nonforested})p(.)$ all had similar AIC values and significant weights, and therefore may also be suitable models. Forest may positively affect occupancy, while nonforested sites may negatively affect the occupancy probability. Total obstruction may negatively affect detection of the gray squirrel. Low

detection rates of gray squirrels using temporary cameras precluded their inclusion in PAO analysis.

FAMILY CRICETIDAE

Peromyscus gossypinus

Our naïve calculation for this species was 6.1%, and PAO modeling showed that cotton mice actually occupy 36.4% (Psi = 0.364; SE = 0.13) of all sites in EVER. For the most parsimonious model, $\hat{c}$ was 0.25, so we assumed model fit. The best model was $\text{psi}(\cdot)\text{p}(\text{grass density})$ with an AIC of 217.1 and a model weight of 0.43 (Table 23). The model $\text{psi}(\text{habitat})\text{p}(\text{grass density})$ was the second best model, suggesting that habitat may affect occupancy of cotton mice. For both models, grass density may negatively affect the detection probability of the cotton mouse. The third and fourth best models were $\text{psi}(\cdot)\text{p}(\cdot)$ and $\text{psi}(\cdot)\text{p}(\text{total obstruction})$. Total obstruction may positively affect detection of the cotton mouse. Low detection rates of cotton mice using temporary cameras precluded their inclusion in PAO analysis.

Sigmodon hispidus

Naïve calculations show that cotton rats occupy 12.3% of all sites in EVER. PAO modeling estimated that this species actually occurs in 41.0% (Psi = 0.41; SE = 0.09) of all sites in EVER. For the most parsimonious model, $\hat{c}$ was 12.2. The best model for this species is $\text{psi}(\cdot)\text{p}(\cdot)$, with a model weight of 0.42. The second best model was $\text{psi}(\cdot)\text{p}(\text{grass density})$, with a QAIC = 32.8 and a model weight of 0.27 (Table 23), suggesting that grass density may positively affect detection of cotton rats. Psi (forested/nonforested) $\text{p}(\cdot)$ and $\text{psi}(\cdot)\text{p}(\text{total obstruction})$ also had significant model weights and may be suitable models. Cotton rats may occupy 43.8% of all forested sites and 37.9% of all nonforested sites. Total obstruction, or total stem abundance, may positively affect detection of the cotton rat. Temporary camera data analyses showed that habitat and wet season may also affect occupancy and detection of cotton rats. Cotton rats may occupy pine habitats (92.3%) more often than other habitat types. Wet season and water presence may negatively affect detection, while dry season may positively affect detection.

FAMILY MURIDAE

Oryzomys palustris

The naïve, or minimum, site occupancy for the marsh rice rat was 10.9%. For the most parsimonious model, $\hat{c}$ was 0.42, so we assumed model fit. The best model was $\text{psi}(\text{habitat})\text{p}(\cdot)$, which had a model weight of 0.41 (Table 23). Using this model, we estimated occupancy for each habitat type, and results ranged from 0 - 60.3%. Slough had the highest PAO (60.3%). Two models, $\text{psi}(\text{habitat})\text{p}(\text{grass density})$ and $\text{psi}(\text{habitat})\text{p}(\text{total obstruction})$ had similar AIC values and therefore may be suitable models for rice rats in EVER. Grass density may negatively affect the detection probability of the marsh rice rat, while total obstruction may positively affect detection. From our temporary camera data analyses, all three top models had season as a covariate, and suggest that season may negatively affect detection of rice rats.

Rattus rattus

Our naïve calculation of black rats was 22.2%. For the most parsimonious model, $\hat{c}$ was 3.3. The best model for this species was $\text{psi}(\text{habitat})p(\cdot)$, with a QAIC = 199.3 and a model weight of 0.48 (Table 23). We estimated occupancy for each habitat type, and our results ranged from 0 - 100%. Mangrove habitat had the highest PAO (100%), suggesting that black rats may occupy 100% of all mangrove sites. The second best model for this species included stem abundance (total obstruction) as a covariate, and suggests that this may positively affect detection of black rats. Black rats may use areas with greater stem abundance as cover from predators and thus may be detected within these areas. Temporary camera data analyses showed that wet season may negatively affect detection.

Unobserved species

We did not detect the following species in either EVER or BICY: long-tailed weasel (*Mustela frenata*), striped skunk (*Mephitis mephitis*), eastern mole (*Scalopus aquaticus*), southern flying squirrel, Norway rat (*Rattus norvegicus*), and red fox (*Vulpes vulpes*). Further, we were unable to detect the eastern spotted skunk and Everglades mink in EVER, and the least shrew in BICY.

Discussion

Mammal Species in Big Cypress National Preserve

ORDER CARNIVORA

FAMILY CANIDAE

Canis familiaris

We detected few domestic dogs in BICY ($n = 10$) (Table 2). As with cats, domestic dogs can impact native wildlife by displacing wildlife from habitats. Dogs can also potentially spread diseases such as rabies and canine distemper (Lenth et al. 2006). Few domestic dogs may be the result of the remote location of BICY.

Canis latrans

We detected the coyote in all habitats (Table 11), though it appeared most frequently in hammocks. However, we detected few individuals ($n = 18$) (Table 2), suggesting that this species is rare in BICY. In 1990, Wooding and Hardisky suggested that this species has not yet been firmly established in South Florida. However, it currently appears to be a species whose range is naturally expanding and is moving into BICY.

Urocyon cinereoargenteus

We only detected the gray fox in hammock habitat in BICY (Table 11), which supports Lee and Bostelman's (1969) findings. Layne (1974) stated that gray foxes were

not abundant in Florida at the time of his surveys, and we only detected a few individuals ($n = 2$) (Table 2), suggesting this species was rare in BICY in the past few years.

FAMILY PROCYONIDAE

Procyon lotor

We detected the raccoon in all habitat types in BICY (Table 11), confirming Layne's (1974) findings that raccoons are habitat generalists. Layne (1974) stated that the raccoon was the most abundant carnivore in South Florida, and from our results it appears to be abundant throughout BICY ($n = 306$) (Table 2).

FAMILY MUSTELIDAE

Mustela vison

Hamilton (1948), Schwartz (1952), and Layne (1974) previously described the mink as rare in Florida. We only detected the mink in BICY, where we found two individuals via opportunistic sightings (Table 2). Mink may be elusive in nature (Humphrey 1992; Harrington et al. 2007). Humphrey and Setzer (1989), Smith (1980), and Allen and Neill (1952) agreed that mink were common where found, and Humphrey (1992) reported that Everglades mink were easy to attract using anal scent. However, we did not detect any individuals using that method, suggesting that mink are rare in BICY.

Lutra canadensis

We detected few river otters in BICY ($n = 24$) (Table 2), suggesting that they are rare in BICY. However, Layne (1974) found that this species was one of the most abundant carnivores in South Florida. The river otter was difficult to detect during the wet season (Schwartz 1952) presumably due to dispersion, and this may have been the cause of the low numbers of otters in our surveys.

Spilogale putorius

We detected the eastern spotted skunk only in BICY. Though Howell (1920b) found that spotted skunks inhabited prairies, we did not detect any spotted skunks in cypress prairie or prairie habitats (Table 11). This species prefers drier habitats (Layne 1974), and we detected the majority (75%) of individuals in hammocks, which are higher and drier areas. The spotted skunk appears to be rare in BICY ($n = 8$) (Table 2).

FAMILY FELIDAE

Felis domesticus

We detected few individual domestic cats in BICY ($n = 10$) (Table 2). Perhaps this is due to the remote location of BICY with fewer people and thus fewer pets nearby. Presence of domestic cats was a concern because small mammals have been found to comprise 70% of a cat's prey items (Coleman et al. 1997).

Lynx rufus

As a common mammal detected in BICY ($n = 161$) (Table 2), the bobcat occurs in most habitats (Schwartz 1952, Layne 1974). Our results agree with the two previous studies, as we detected the bobcat in all five major habitat types (Table 11). Layne (1974) stated that the bobcat was one of the most common carnivores in South Florida in the 1970s, and our findings suggest that this trend continues today.

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

Schwartz (1952) found that the primary habitat for gray squirrels in the 1950s was hammock, and our results from BICY support this finding. However, gray squirrels appear to be rare in BICY ($n = 49$) (Table 2).

Sciurus niger

Our non-detection of the fox squirrel in prairie habitat (Table 11) may be because they are mainly associated with mangrove forests, cypress swamps, and hammocks in the western Everglades (Schwartz 1952, Layne 1974). However, fox squirrels rarely use the dense interiors of cypress strands and domes (Williams and Humphrey 1979). We detected few individuals in BICY ($n = 26$) (Table 2) though Layne (1974) stated that fox squirrels, though rare in South Florida, were more abundant in southwestern Florida. Layne (1974) also reported that BICY was probably the center of the population; however, fox squirrel numbers are likely declining due to habitat destruction (Kantola and Humphrey 1990).

FAMILY CRICETIDAE

Neofiber alleni

The round-tailed muskrat appeared to be common where located in BICY. We primarily detected the muskrat in prairie habitat. Muskrats tended to be localized and did not always occupy habitat that appeared suitable (Schwartz 1952).

Peromyscus gossypinus

Since the cotton mouse is primarily associated with hammock habitat (Opsahl 1951, Layne 1974, Bigler and Jenkins 1975), it is not surprising that we did not detect this species in prairie habitat (Table 11) in BICY. However, Jeffery (2009) did detect the cotton mouse in pine and prairie habitat. Hammocks provide habitat for cotton mice year-round (Smith 1982). Although the species was most often captured in hammock habitat, cotton mice are habitat generalists and can be found in many habitat types (Calandriello 1999). Layne (1974) found the cotton mouse to be one of the most common small mammals in South Florida in the 1970s, and this species proved to be abundant throughout BICY (Table 2).

Sigmodon hispidus

The cotton rat has been found in almost every major habitat type in South Florida (Opsahl 1951, Schwartz 1952, Layne 1974), though Bigler and Jenkins (1975) indicated that this species preferred sawgrass. Our results disagree with Bigler and Jenkins (1975), as we detected the majority ($n = 171$) of cotton rats in hammock habitat. However, Jeffery (2009) detected the cotton more frequently than any other species within pine habitat in BICY. Layne (1974) stated that the cotton rat was the most ubiquitous mammal in South Florida more than three decades ago, and it appears to be abundant in BICY ($n = 234$) (Table 2). The cotton rat is an important part of the food chain, and is a main source of food for carnivorous animals (Schwartz 1952). The cotton rat is also a major prey item for the Burmese python (Snow et al. 2007).

FAMILY MURIDAE

Mus musculus

The house mouse appears to be rare in BICY ($n = 9$) (Table 2). Since this species tends toward human dwellings, the remote location of BICY may account for the low numbers detected.

Oryzomys palustris

The marsh rice rat was absent from prairie habitats in BICY (Table 11) but was found in hammock, pine, cypress, and cypress prairie. Rice rats are primarily associated with marsh habitats but do move to higher ground during periods of high water (Schwartz 1952, Layne 1974, Kruchek 2004). Rice rats tend to use hammocks during the wet season only (Smith and Vrieze 1979). Jeffery (2009) detected rice rats in both prairie and pine habitats. Rice rats appear to be common in BICY ($n = 109$) (Table 2).

Rattus rattus

The black rat appears to be rare within BICY ($n = 12$) (Table 2). Although the species can occur in a variety of habitats (Layne 1974), most sightings in our study were from hammock habitat ($n = 8$), suggesting it prefers higher, drier areas. Jeffery (2009) did not detect the black rat while live trapping in pine and prairie habitats within BICY. The locations where we have detected the black rat in BICY (Figure 29) are all near human dwellings, possibly because buildings serve as nesting areas or because of an increase in food items from trash thrown out by residents.

ORDER MARSUPIALIA

FAMILY DIDELPHIDAE

Didelphis virginiana

The Virginia opossum is the most abundant mammal we detected in BICY ($n = 950$) (Table 2). Our results agree with Layne (1974) who found opossums inhabited every major habitat type in Florida in his earlier study. Schwartz (1952) stated that this species was most abundant in hammock habitats, and our findings confirm Schwartz' findings; 70.1% of all individuals we detected were found in hammock habitat.

ORDER LAGOMORPHA

FAMILY LEPORIDAE

Sylvilagus floridanus

We detected few individual cottontails only in prairie habitat in BICY (Table 11). This species is limited to drier areas and also has been found to have a limited distribution in South Florida (Layne 1974). Schwartz (1952) stated that cottontails are not common in this area, and our results ($n = 7$) (Table 2) support his statement.

Sylvilagus palustris

We detected the marsh rabbit in all habitat types in BICY (Table 11), and they appear to be common ($n = 103$) (Table 2). Though marsh rabbits are normally associated with wetter areas (Layne 1974), we detected the majority of marsh rabbits in hammock habitat ($n = 59$). This finding contradicts Schwartz (1952) who found that they were entirely absent from pinelands and only slightly frequent hammocks. The discrepancies between the two former studies and our findings may be due to the expansion of the range of the marsh rabbit.

ORDER INSECTIVORA

FAMILY SORICIDAE

Blarina carolinensis

The southern short-tailed shrew appears to be rare in BICY ($n = 6$) (Table 2). In surveys of the 1970s, the shrew was not common in South Florida (Layne 1974) and McCay (2001) found that it avoided the main Everglades habitats. Jeffery (2009) detected four individuals via live traps, all within pine habitats. Perhaps trapping efforts using pitfall traps rather than Sherman traps would have increased our detection ability.

ORDER EDENTATA

FAMILY DASYPODIDAE

Dasypus novemcinctus

Armadillos appear to be rare in BICY ($n = 75$) (Table 2). We detected more individuals in BICY than we did in EVER, perhaps due to inhospitable environments in EVER.

Mammal Species in Everglades National Park

ORDER CARNIVORA

FAMILY CANIDAE

Canis familiaris

We detected few domestic dogs in EVER ($n = 34$) (Table 2), though we detected more in the Park than in BICY. As stated above, domestic dogs can impact native wildlife by displacing wildlife from habitats, and potentially spreading diseases such as rabies and canine distemper (Lenth et al. 2006). We attribute the low numbers of dogs to the remote location of the Park.

Canis latrans

We detected a fairly low number of coyotes ($n = 39$) in EVER (Table 2), suggesting they are rare within the Park. As stated above, Wooding and Hardisky (1990) surmised that this species is not yet fully established in South Florida.

Urocyon cinereoargenteus

We detected few gray foxes in EVER ($n = 9$) (Table 2), supporting the finding by Layne (1974) that gray foxes were not abundant in Florida. Though Layne (1974) found the gray fox was most common in pinelands in EVER, we detected the majority (44.4%) of our individuals in slough habitat.

FAMILY PROCYONIDAE

Procyon lotor

The raccoon appears to be common throughout EVER ($n = 141$) (Table 2), particularly in mangrove habitats, where we detected 52.5% of all individuals. The raccoon is very versatile in habitat preference (Layne 1974) and can be found in all the major habitat types within EVER (Table 11).

FAMILY MUSTELIDAE

Lutra canadensis

We detected few river otters in EVER, suggesting that they are rare in the Park ($n = 20$) (Table 2). The river otter is difficult to detect during the wet season (Schwartz 1952) presumably due to dispersion. This may have been the cause of our low detection rate, in particular that of our camera traps set up in the sloughs and canals. Most of our cameras set up in the sloughs and canals were targeting mink and therefore used mink scent as a lure. This species-specific lure may not attract otters to these locations.

FAMILY FELIDAE

Felis domesticus

We detected few individual domestic cats in EVER ($n = 9$) (Table 2). Cats can significantly impact native wildlife, in particular small mammals (Coleman et al. 1997). Cats do not seem to be common in EVER, and as with BICY, perhaps this is due to the remote location of the park with fewer people and thus fewer pets nearby.

Lynx rufus

Schwartz (1952) and Layne (1974) found the bobcat to be fairly common in EVER. Our results do not support these previous studies, as we detected 28 individuals

and thus classified this species as rare (Table 2). However, we did detect the bobcat in all five major habitat types in EVER (Table 11). Though we detected more individuals within BICY than we did in EVER, EVER files contain records of many bobcat sightings within the Park (Layne 1974).

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

We found hammock to be the primary habitat for gray squirrels in EVER, a result that supports the earlier findings of Schwartz (1952). We detected roughly the same number of individuals in EVER as we did in BICY. The low number of individuals detected suggests that the gray squirrel is rare within EVER ($n = 41$) (Table 2). As with Layne (1974), all of our sightings of gray squirrels were on the eastern half of EVER suggesting that their range has not expanded into the western portion of EVER.

Sciurus niger

Fox squirrels are rare in South Florida (Layne 1974), and do not appear to be common within EVER ($n = 6$) (Table 2). Kantola and Humphrey (1990) stated that the fox squirrel was primarily associated with mature pine forests in southeastern Florida; however, we did not detect any fox squirrels in this habitat type in EVER.

FAMILY CRICETIDAE

Neofiber alleni

In a study conducted in EVER, Tilmant (1975) found only one muskrat colony in Taylor Slough, and about eight in Shark Slough. Schwartz (1952) also referenced numerous muskrat lodges in the area south of Tamiami Trail and in the headwaters of Shark River and Broad River. He also reported a possible colony in Taylor Slough, north of Royal Palm (Schwartz 1952). However, we were unable to find any muskrat colonies within EVER. Most (72.7%) of our sightings from EVER came from a python diet study (Snow et al. 2007), in which muskrats were found in the stomach contents of Burmese pythons. We also found six owl pellets containing evidence of muskrats. This suggests that muskrats still inhabit the Park; however, their lodges are either too small or too obscured by taller vegetation to be observed from helicopter or airboat. Muskrat colonies may also be small and scattered, and thus easily missed. Changes in the hydrology of the Park may have forced muskrats to move to more optimal habitat outside the Park, as the Park is drier now than it was in the past (Walters and Gunderson 1994). Both owls and pythons are highly mobile, so it is possible that some muskrats were consumed outside of the Park boundaries, possibly in Water Conservation Area 3, though it is unlikely that all 23 were consumed outside of the Park.

Peromyscus gossypinus

The cotton mouse appears to be abundant throughout EVER ($n = 290$) (Table 2), in particular within hammock habitat. As Opsahl (1951) and Calandriello (1999)

reported, we also captured the cotton mouse more often in hammock habitat ($n = 188$). However, this species is a habitat generalist (Calandriello 1999), and it can be found in almost all habitat types within EVER (Table 11).

Sigmodon hispidus

The cotton rat appears to be abundant in EVER ($n = 528$) (Table 2), as it was in BICY, which bodes well for those species higher on the food chain. In a study conducted in EVER, Gaines and Beck (2003) detected more individual cotton rats than any other species. In our surveys, we detected the cotton rat in all habitat types (Table 11), whereas Calandriello (1999) found this species primarily in pineland. Though we did detect some individuals in pinelands, we detected 51.7% in hammock habitats, suggesting that hammock is the preferred habitat type of the cotton rat in EVER. Prescribed burning in the pinelands of EVER with resulting lack of cover for animals may cause species such as the cotton rat to move to more suitable habitat (i.e., hammock) with greater cover from predators (Calandriello 1999).

FAMILY MURIDAE

Mus musculus

The house mouse appears to be rare in EVER as we only detected one individual (Table 2). There has only been one previous record of the house mouse in EVER, but it is in close proximity to the Homestead area (Layne 1974). The house mouse appears to be more of an urban rather than a rural species.

Oryzomys palustris

Marsh rice rats appear to be abundant in EVER ($n = 400$) (Table 2), particularly within the slough and hammock habitats. Rice rats tend to use hammock habitats during the wet season, but then disperse into sloughs during the drier season (Smith 1982). Calandriello (1999) detected this species primarily in marshland, which agrees with our findings. Rice rats used the mink rafts we set out in the slough areas within the Park, and many of our pictures of this species came from these rafts.

Rattus rattus

The black rat was the species we detected the most ($n = 1,376$) (Table 2) and thus appears to be abundant in EVER. We detected the black rat more frequently in EVER than in BICY despite using the same baits and lures at our sites. These large numbers came from a variety of cameras, suggesting that they are now widespread within the Park. Large numbers of black rats may out-compete native species for essential resources (Gaines and Beck 2003). In a study at Long Pine Key in EVER, Calandriello (1999) detected the black rat only in disturbed areas; our results suggest that since Calandriello's (1999) work, this species has expanded within the Park.

ORDER MARSUPIALIA

FAMILY DIDELPHIDAE

Didelphis virginiana

We detected the majority (66.4%, $n = 87$) of all individuals in hammock habitats. Schwartz (1952) also found opossums to be most abundant in hammocks, and our results suggest that this trend continues today. We detected more individuals in BICY than we did in EVER, suggesting the species is not as common in the Park, possibly due to less optimal habitat.

ORDER LAGOMORPHA

FAMILY LEPORIDAE

Sylvilagus floridanus

Schwartz (1952) found that the cottontail was not common in South Florida. Our results agree, as we detected few cottontails in EVER ($n = 11$) (Table 2).

Sylvilagus palustris

We detected few individual marsh rabbits within EVER ($n = 21$) (Table 2). Though marsh rabbits were found to be associated with wetter areas (Layne 1974), we detected the majority (61.9%) of marsh rabbits in hammock habitat, similar to our species-specific finding for BICY. Brown et al. (2006) cited raccoons and marsh rabbits as the most common species found in the Everglades; however, our results suggest a decline in marsh rabbit population numbers since Brown et al.'s (2006) work. As stated above, we hypothesize that marsh rabbits have declined due to the increase in Burmese python (*Python molurus bivittatus*) populations in EVER, which take advantage of marsh rabbits as a major prey item (Snow et al. 2007).

ORDER INSECTIVORA

FAMILY SORICIDAE

Blarina carolinensis

We detected very few southern short-tailed shrews in EVER ($n = 21$) (Table 2), a result that agrees with previous findings of Layne (1974). There has been only one record in EVER from 1952, though it has been suggested that the shrew avoids the main Everglades (Layne 1974).

Cryptotis parva

The least shrew appears to be rare in EVER ($n = 13$) (Table 2). In a study conducted in EVER by Opsahl (1951), only two individuals were captured. Opsahl (1951) suggested least shrews prefer open habitats, and so it is not surprising that we detected more individuals ($n = 7$) in marl prairie habitat.

ORDER EDENTATA

FAMILY DASYPODIDAE

Dasyopus novemcinctus

Armadillos appear to be rare in EVER ($n = 4$) (Table 2). An introduced species, they are not as abundant in South Florida as they are in the northern portion of the state (Layne 1974). There is some debate over whether this species should be considered exotic or considered having a natural range expansion. Records from EVER suggest that although armadillos are present, their distribution has been sporadic (Layne 1974).

Habitat Types for EVER and BICY

Hammock

Hammocks are very important habitat types for a variety of species in both BICY and EVER. In both protected areas we detected the black rat, cotton rat, opossum, bobcat, domestic cat, domestic dog, gray squirrel, marsh rabbit, armadillo, and river otter with highest frequencies in hammocks. In EVER alone, we detected the cotton mouse with the highest frequencies in hammock habitats. In BICY we detected the following species the most often in hammocks: raccoon, fox squirrel, house mouse, short-tailed shrew, mink, spotted skunk, coyote and gray fox. In EVER we detected a slightly higher number of species in hammock habitat than in marl prairie and slough. This result could be due to sinkholes which provide water year round or because there is more overstory for greater cover from predators (Duever et al. 1986). This result may also be due to the fact that hammocks are the highest and driest habitat type in the Everglades (Gunderson 1994).

Pine

Pinelands provided habitat for the second highest number of species in BICY. However, the cotton mouse was the only species we detected more often in pineland than any other habitat type. In a live trapping study conducted in the pinelands and prairies of BICY, Jeffrey (2009) captured the cotton rat more frequently in pinelands. Jeffrey (2009) captured southern short-tailed shrews only in pine habitat. Of the five major habitat types in EVER, the pinelands had the fourth fewest number of species. Though we detected many species in the EVER pine habitat, none of these species were mainly detected in pinelands. We detected fewer species in the pinelands of EVER than we did in BICY, a result which may be due to prescribed burning of the pinelands that may cause the loss of cover for some species (Calandriello 1999). The limestone outcrops, sparse understory and shorter hydroperiod (Duever et al. 1986) of BICY may not provide an optimum habitat type for some species. Small fragments and thus isolation of pinelands may also account for the lower number of species in the pinelands.

Cypress

Tall cypress trees and few aquatic plants as understory characterize the cypress habitat. Of the 14 species we detected in BICY in cypress habitats, only one species, the marsh rice rat, was detected most often within this habitat type. Because of the lower elevation of cypress habitats, these habitats are generally inundated with water, providing habitat for the rice rat, whose diet consists of aquatic vegetation and aquatic invertebrates.

Cypress prairie

Within a cypress prairie, there are wide spaces between the cypress trees, and the understory is grassy (Gunderson 1994). Of the 12 species we detected in cypress prairie, not one species was found more frequently within this habitat type. This suggests that cypress prairies are not prime habitat for species in BICY.

Prairie

Prairies are typically devoid of trees and shrubs, consisting instead of aquatic emergent vegetation. In BICY, prairie habitat showed the least small and medium-sized mammal diversity, possibly due to a lack of sufficient cover (Calandriello 1999). Of the 11 species we detected in prairie habitat, only the marsh rabbit and the muskrat were captured more frequently within this habitat type. Jeffrey (2009) captured the rice rat more frequently in prairie habitat, though he did not capture the southern short-tailed shrew in prairie habitat.

Slough

Sloughs are the lowest habitat types in EVER in terms of elevation (Gunderson 1994). Sloughs contain a variety of aquatic plants which provide food and cover for a variety of species. In particular, the sloughs proved to be the favored habitat of the rice rat.

Marl prairie

Marl prairies have a slightly higher elevation and thus a shorter hydroperiod than sloughs (Gunderson 1994). The grasses of marl prairies are short, often less than one meter high (Gunderson 1994). Of all the major habitat types, this habitat was the second highest in species richness in EVER, as we detected 16 species in this habitat (Table 11). Marl prairie habitat was the favored habitat type of coyotes, marsh rabbits, and the least shrew in EVER.

Mangrove

Mangroves provide habitat for a wide range of species in Florida (Odum and McIvor 1990). The raccoon was the only species that appeared to favor the mangroves in EVER. Mangrove habitat is less diverse in terms of vegetation than most other habitat types in Florida (Duever et al. 1986), which is perhaps why we detected only a few mammal species in this habitat type. Mangroves also occur along the coast and near saltwater, thus making these habitats less favorable for mammal species associated with freshwater.

Proportion Area Occupied (PAO)

The most common model of best fit was $\text{psi}(\cdot)\text{p}(\cdot)$ for five species in BICY (raccoon, bobcat, gray squirrel, armadillo, and coyote) and two species in EVER (cotton rat and gray squirrel). This model states that occupancy (psi) and detection (p) are both constant. Four species (cotton rat, rice rat, black rat, and marsh rabbits) in BICY and one (cotton mouse) in EVER all had best models of $\text{psi}(\cdot)\text{p}(\text{grass density})$. These two models appeared most often as the models of best fit. The model $\text{psi}(\cdot)\text{p}(\cdot)$ suggests that these species are common and are habitat generalists. The model $\text{psi}(\cdot)\text{p}(\text{grass density})$ suggests

that grass density may affect detection of several small mammal species. Chances of detecting these species decrease as grass density increases, and thus the results from areas with high grass density may not be as reliable.

Big Cypress National Preserve

ORDER CARNIVORA

FAMILY CANIDAE

Canis latrans

The best model for this species was $\text{psi}(\cdot)\text{p}(\cdot)$, suggesting that the coyote is a common and a generalist species. Particular habitat types do not seem to play a role in determining occupancy of coyotes; however, forested sites negatively affect occupancy whereas nonforested sites positively affect occupancy. Water presence may positively affect detection of this species, possibly due to presence of prey at water sites. Thus, in future inventories, sampling for this species in nonforested areas and in areas with water present may be more beneficial.

FAMILY PROCYONIDAE

Procyon lotor

The raccoon is also one of the most common small mammal species in BICY ($n = 306$) (Table 2). The best model for raccoons was $\text{psi}(\cdot)\text{p}(\cdot)$, suggesting that the raccoon is a habitat generalist. In future inventories, canopy height and forested habitats should be taken into consideration while searching for raccoons, as they are more likely to be found within forested habitats rather than in one particular habitat.

FAMILY MUSTELIDAE

Lutra canadensis

Habitat type affects occupancy estimates of the river otter. In future studies, effort should be put into sampling hammock habitat as well as wetter areas for the river otter, as hammocks showed the highest occupancy estimation. Areas with high stem abundance decrease the chances of detecting the river otter.

FAMILY FELIDAE

Lynx rufus

Bobcats can be found in less than 25% of all sites in BICY. Though PAO analyses did not show that one particular habitat affected occupancy rates, forested habitats in general did positively affect occupancy. This result should be taken into consideration in future inventories by surveying for bobcats within forested habitats.

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

PAO results suggested that the gray squirrel may be found more often in BICY than our field surveys indicate. Though a specific habitat type does not affect site occupancy, forested habitats may positively affect occupancy. PAO analysis showed that gray squirrels may not occupy nonforested sites, thus, the higher the canopy in forested sites, the lower the chances of detecting a gray squirrel.

FAMILY CRICETIDAE

Peromyscus gossypinus

Cotton mouse occupancy appears to be affected by habitat type; the species could be found throughout hammock and pine habitats. Although with a lesser site occupancy, the cotton mouse should be detected within cypress habitat. Because this is a small-bodied mammal, dense grass and camera obstruction may impede visual detection of this species. Chances of detecting this species will be greater during the dry season than the wet season, thus this should be kept in mind for future inventories in which the cotton mouse is a target species.

Sigmodon hispidus

The cotton rat appears to be common within BICY. Habitat appears to affect occupancy, and cotton rats are most likely to be detected in hammock habitat (with a site occupancy estimation of 87.3%). Water presence may negatively affect detection. This may be due to higher and thus drier habitat, as cotton rats prefer drier areas. Cotton rats are least likely to be detected in cypress prairie habitat in BICY.

FAMILY MURIDAE

Oryzomys palustris

PAO results suggested that rice rats may be rare within BICY. Habitat may be a major factor in determining occupancy of rice rats. PAO results show that rice rats would be more often detected in cypress habitats. This is presumably due to the abundance of aquatic invertebrates which are major prey items. Grass density may negatively affect detection of the rice rat, and since these are a small species, dense grass may make it more difficult to detect.

Rattus rattus

With site occupancy of 8.5%, black rats may be more common than our naïve calculation (2.0%) suggested. Grass density may negatively affect detection of this small species, and making it more difficult to detect this species. Future monitoring of BICY should allow managers to assess whether or not non-native black rats are increasing within the Preserve.

ORDER MARSUPIALIA

FAMILY DIDELPHIDAE

Didelphis virginiana

Opossums appear to be one of the most common small mammal species in BICY. Future researchers should concentrate their efforts in forested habitats when attempting to detect the opossum, as the PAO estimates showed that opossums occupy 69.8% of all forested sites and 20.9% of all nonforested sites. Because the opossum is not an aquatic mammal, it makes sense that water presence negatively affects detection.

ORDER LAGOMORPHA

FAMILY LEPORIDAE

Sylvilagus palustris

The only model that had significant weight for the marsh rabbit was one in which occupancy was constant. Thus, unlike most other species in BICY, neither habitat nor forest seemed to affect the occupancy of the marsh rabbit. We suggest that other factors such as predators may play a bigger role in determining occupancy of marsh rabbits. The denser the grass is at a site, the lower the chances of detecting a marsh rabbit. Our PAO estimate for marsh rabbits was 92.8%; however, we only detected 103 individuals. Our low number of detection suggests that our methods may not have been suitable for detecting marsh rabbits in BICY. It is also possible that our baits were not attracting rabbits or our cameras were not adequately placed to detect rabbits.

ORDER EDENTATA

FAMILY DASYPODIDAE

Dasyus novemcinctus

Though forested habitats positively affect occupancy of the armadillo, particular habitat types did not. Thus in future sampling for the armadillo, sampling effort should be concentrated within forested habitat types. Chances of detecting the armadillo decrease as grass density increases.

Everglades National Park

ORDER CARNIVORA

FAMILY CANIDAE

Canis latrans

As in BICY, particular habitat types do not seem to play a role in determining occupancy of coyotes in EVER. However, nonforested habitats in general positively affect occupancy for this species, while forested sites negatively affect occupancy. In future inventories, sampling in nonforested areas may be more beneficial.

FAMILY PROCYONIDAE

Procyon lotor

The top two weighted models both stated that habitat type affect occupancy of the raccoon. Mangrove sites had the highest site occupancy, suggesting that in future efforts, sampling in mangrove habitats will increase the chances of detecting raccoons. Conducting sampling in areas where water is present is not recommended, as water presence negatively affects detection. Sampling for the raccoon during the dry season would increase the chances of detecting this mammal.

ORDER RODENTIA

FAMILY SCIURIDAE

Sciurus carolinensis

The best model for this species was $\psi(\cdot)p(\cdot)$, possibly indicating a common habitat generalist. Canopy height and forested areas tend to positively affect occupancy of the gray squirrel in EVER. Habitat type in particular does not seem to affect whether or not a gray squirrel occupies that site. Therefore, in future inventories, researchers should concentrate on forested areas when targeting the gray squirrel.

FAMILY CRICETIDAE

Peromyscus gossypinus

Habitat appears to be the only factor influencing occupancy of the cotton mouse in EVER. Hammock habitat had the highest site occupancy (47.2%), followed closely by pine (46.4%). Smith (1982) found that cotton mice remained within hammocks year-round. Thus, we recommend that future sampling for the cotton mouse take place within these habitat types. Dense grass should be avoided: as grass density increases, chances of detection decreases for this small mammal.

Sigmodon hispidus

The best model for this species was $\psi(\cdot)p(\cdot)$, possibly indicating a common and generalist species. Unlike in BICY, a particular habitat type does not seem to affect occupancy of the cotton rat in EVER. Rather, forest positively affects occupancy, and, therefore, future inventories should concentrate in forested areas when targeting the cotton rat. As expected since this species prefers drier areas, wet season and water presence negatively affect detection. Thus, if targeting the cotton rat, sampling should take place in the dry season.

FAMILY MURIDAE

Oryzomys palustris

The top three models for the rice rat all indicate that a particular habitat type affects occupancy of this species. Slough habitat had the highest site occupancy and marl prairie had the second highest, indicating that future sampling efforts should concentrate

efforts in these areas. More dense grass decreases the chances of detecting the rice rat, so areas of dense grass should be avoided during future sampling.

Rattus rattus

Habitat type affects occupancy of the black rat in EVER. In order from highest site occupancy to lowest, the black rat may occupy mangrove, slough, and hammock habitat. We recommend that future inventories focus on mangrove habitats in particular when targeting the black rat. Sampling should take place during the dry season, as the wet season negatively affects detection of the black rat.

Unobserved species

Though we were unable to detect the long-tailed weasel (*M. frenata*), striped skunk (*M. mephitis*), eastern mole (*S. aquaticus*), southern flying squirrel (*G. volans*), Norway rat (*R. norvegicus*), red fox (*V. vulpes*), eastern spotted skunk (*S. putorius*), Everglades mink (*M. vison*), and the least shrew (*C. parva*) in one or both study areas, we do not suggest that these species are absent from EVER and BICY. Although we are able to confirm presence of a species, it is very difficult to confirm absence (MacKenzie 2005).

Our methods may have failed to detect these species for several reasons. Individuals could have been somewhere else within their home range (MacKenzie 2005), or these particular species may have very small populations. Still other species may simply be very secretive. Most of our sampling for these species was conducted in areas of historical occurrence; however, environmental changes may have caused these species to move to a more suitable environment. A longer sampling period (more than two-week increments used for temporary cameras) may have enabled us to detect these species (Gompper et al. 2006). Another possibility is that these species are no longer there, or in some cases may never have actually been in EVER or BICY. We compiled an up-to-date list of small and medium-sized mammal species that occur in EVER and BICY (Table 25).

- We did not detect the long-tailed weasel in either BICY or EVER. The long-tailed weasel was included in our list as a possible species based on a record from Collier County (Brown 1972b; Hovis 1993). Barr (1997) found two weasels in two alligator stomachs from Shark Slough. However, Layne (1974) stated that this species is not common in Florida, and it appears to become even less common towards the south. In a checklist of mammals occurring in EVER compiled for the National Park Service, Robertson and Kushlan (2008) listed this as a hypothetical species.

Historical detection: yes in EVER

Current detection: no

Additional species-specific sampling conducted: no

Current presence in either EVER or BICY: highly unlikely

- We did not detect the striped skunk in either BICY or EVER, though Layne (1974) found that this species was more abundant than the spotted skunk, which we were able to detect in BICY using these methods. Thus the methodology (camera trapping using a skunk lure) appears to work. The Everglades has 17 records of the striped skunk from 1949-1965, half of which were from pinelands (Layne 1974). The striped skunk was found to be abundant in farm lands surrounding EVER (Schwartz 1952). As Calandriello (1999) suggested, we hypothesize that due to prescribed burning in the pinelands, the striped skunk may have moved into the farmlands surrounding the park. Thus, this species may occur in very low numbers throughout EVER and BICY or it may be locally extirpated.

Historical detection: 17 records

Current detection: no

Additional species-specific sampling conducted: yes

Current presence in either EVER or BICY: uncertain

- Miami is the southern limit of the range of the eastern mole, though the species may occur sporadically in sandy pinelands southwest to Royal Palm Hammock (Schwartz 1952). The Everglades habitat does not seem optimal for moles (Schwartz 1952) because of the limestone bedrock and the often flooded sloughs. In a checklist of mammals occurring in EVER compiled for the National Park Service, Robertson and Kushlan (2008) listed this as a hypothetical species.

EVER has one record for this species southwest of Royal Palm (Bailey 1930), and because we do not know the exact location of the sighting, we can not be sure that sampling occurred in the same location. Because we only have record of one sighting, it is possible that this species was never present in large numbers. However, it is still possible that this species is present within EVER and BICY in low numbers or it may have also been locally extirpated.

Historical detection: one record (EVER)

Current detection: no

Additional species-specific sampling conducted: no

Current presence in either EVER or BICY: highly unlikely

- Despite trapping in trees and conducting vocalization surveys, we did not detect the southern flying squirrel in either BICY or EVER (Table 11). We conducted 1,017 and 1,686 camera trap nights in BICY and EVER, respectively, within preferred habitat of pinelands and hammocks. A ten year study searching bluebird cavities within the pinelands of EVER also did not result in any southern flying squirrel observations (G. Slater, Ecostudies Institute, pers. comm.). The Everglades has records from 1950,

1951, and 1959 (Layne 1974). Schwartz (1952) found flying squirrels in pine habitats, but Layne (1974) found that due to the destruction of pinelands, this species had become rare in South Florida. With our various methods used (see flying squirrel above) we expected to detect this species if it was present in EVER and BICY.

Historical detection: multiple records in both EVER and BICY

Current detection: no

Additional species-specific sampling conducted: yes

Current presence in either EVER or BICY: uncertain (extensive surveys conducted without success)

- We did not detect the red fox in either BICY or EVER. EVER only has record of two sightings, one from 1950 and the other from 1970 (Layne 1974), though there is some concern that these were actually gray foxes that were misidentified. The red fox tends to avoid swamps, hammocks, and wet prairies (Lee and Bostelman 1969, Sunquist 1989), suggesting that the habitat of the Everglades is not favorable for the red fox.

Historical detection: 2, though they may have actually been gray foxes

Current detection: no

Additional species-specific sampling conducted: no

Current presence in either EVER or BICY: highly unlikely

- We did not detect the mink in EVER despite numerous records of past sightings and conducting 8,610 camera trap nights within preferred habitats. Schwartz (1952) reported a sighting in EVER of a mink crossing Tamiami Trail on 29 October 1949. Layne (1974) reported sightings along Highway 41, and several sightings of mink in Shark Valley and Cape Sable near Flamingo. In a study conducted along U.S. Highway 41, Smith (1980) sighted numerous mink, and Smith and Cary (1982) more recently found that mink were most abundant along the northern edge of EVER. Barr (1997) found two mink inside alligator stomachs from Shark Slough. Though we do not know what may have caused the apparent decline in mink, Smith (1980) suggested that changes in the hydrology of the Everglades could negatively affect this species.

Baited rafts have been used by The Game Conservancy Trust to trap the introduced American mink in the UK. With the use of mink lure, we expected to detect mink within one to three days if they were present (S. Humphrey, UF, pers. comm). Humphrey and Zinn (1982) used anal scents to detect mink in South Florida in Fakahatchee Strand State Preserve. Thus, we felt that these methodologies should have been useful for detecting the mink if it was present in BICY and EVER.

Historical detection: multiple records from both EVER and BICY

Current detection: yes, in BICY only by opportunistic sightings
Additional species-specific sampling conducted: yes
Current presence in either EVER or BICY: yes in BICY (by opportunistic sighting only), but uncertain in EVER (extensive surveys conducted without success)

- Despite numerous live trapping sessions and examination of owl pellets, we were unable to detect the least shrew in BICY. In the last three decades there has been only one sighting of the least shrew in BICY (Lord et al. 1973). Layne (1974) suggested that this species avoids the interior Everglades and that it is restricted to the pineland habitat near Miami. Our live trapping methods were successful at detecting the least shrew within EVER and thus should have been able to detect this species in BICY.

Historical detection: few records for EVER and BICY
Current detection: not found in BICY, but found in EVER
Additional species-specific sampling conducted: no
Current presence in either EVER or BICY: uncertain in BICY, but yes in EVER

- We did not detect the Norway rat in either EVER or BICY despite Goodyear (2000) stating they are introduced yet rare in EVER and BICY. Layne (1974) stated that the Norway rat is rare in South Florida, although specimens have been collected in residential areas of Miami (Schwartz 1952). In a checklist of mammals occurring in EVER compiled for the National Park Service, Robertson and Kushlan (2008) listed this as a hypothetical species.

Historical detection: yes, but rare in EVER and BICY
Current detection: no
Additional species-specific sampling conducted: no
Current presence in either EVER or BICY: uncertain

Camera traps: advantages and disadvantages

Camera trapping has been utilized since the 1920s, and today the literature containing use of this method for animal detection contains over 100 published papers (Rowcliffe and Carbone 2008). Cameras are being used as a major technique for detecting mammals for inventories and other purposes (Drost and Hart 2008, Gilbert et al. 2008, Fellers et al. 2004, Azlan and Lading 2006, Vick 2004, Trolle 2003). One main advantage of this tool is that cameras are less invasive to the habitat than other techniques (Wemmer et al. 1996, Whittaker et al. 1998, Cutler and Swann 1999, Silveira et al. 2003) such as live trapping or even surveying on foot. Cameras are also less costly in the long run, provide permanent data, are ideal for recording both diurnal and nocturnal species, are relatively easy to use, and can be used again in future studies (Cutler and Swann 1999, Silveira et al. 2003). Digital cameras in particular are lightweight, allow for easy

storage of photos, and require fewer batteries (Claridge et al. 2004, Parker et al. 2008). Cameras also allow large areas to be studied by only a few researchers (Wemmer et al. 1996). In contrast, disadvantages are that the cameras and the batteries may fail while in the field making them difficult to repair (Wemmer et al. 1996, Cutler and Swann 1999). Because of the expense of batteries, we recommend using only rechargeable batteries in the future. In addition, the cameras can develop condensation on the inside (Azlan and Lading 2006). Cameras can only be used to identify individuals if animals are either already tagged or have distinctive patterns to their pelage (Wemmer et al. 1996).

Though camera traps were very useful for this project, we encountered several issues with camera traps over the two year field sampling period. Because the project took place in public areas, ~15 of our cameras were stolen. The majority of cameras were taken from EVER rather than BICY, and most were taken during the tourist season. Theft locations included high traffic areas such as levee roads, Old Ingram highway, and canal roads. We recommend good camouflage for the cameras, avoidance of trapping in high-traffic areas, using a locking mechanism when attaching the cameras to the vegetation (Azlan and Lading 2006), and using cameras that do not flash at night (Cuddeback Capture IR).

The Moultrie camera display panel also presented some problems. After getting and staying too wet in the field, the display panel often malfunctioned. In some cases, the panel became completely unreadable, even blank. This made setting the date and time difficult or impossible, in which case we had to replace the camera.

We chose these cameras in order to help maximize the number of pictures produced. Each camera was more technologically advanced than the previous one. The Moultrie camera had a trigger speed within one second while the Cuddeback Capture IR had a trigger speed of less than 1/3 second. These are rapid trigger speeds that should capture animals moving quickly in front of the camera. For one camera session, we calculated catch per camera night for the Stealthcam 35mm, TrailMAC, Moultrie, and Cuddeback cameras (Figure 36). The Cuddeback and Moultrie cameras captured pictures throughout most of the camera session, whereas the TrailMAC camera captured pictures within the first five days.

Issues with track plates, live traps, and mink rafts

We used track plates for a limited time due to the very wet and humid climate of South Florida. The excessive rain and humidity during the wet season ruined track plates and thus did not make them the optimal field technique for this climate type. Loukmas et al. (2003) used enclosed track plates which proved to be weather-resistant as well as very useful for detecting small and medium-sized mammals. We recommend using enclosed track plates in future studies in areas with high humidity and rainfall.

While using the floating mink rafts, we had several problems with vultures, wading birds, and gators stealing the bait (sardines). To solve this, we simply poked holes in the sardine can and hung it over the raft. Though this prevented vultures and wading birds from taking the entire amount, we still had problems with alligators tearing down the sardines. We recommend hanging the sardines higher above the raft so that the oils still drip onto the raft, but the alligators cannot reach them.

Mink rafts also proved to be optimal places for basking animals. Alligators seemed especially attracted to the mink rafts for sunning purposes. Several species of birds, turtles, and snakes also used the mink rafts for sunning. However, most small mammals are active at night, so this should not greatly affect their use of the rafts.

Detection success and suggested improvements

During the second year of the inventory, we searched for species that we had not yet detected in EVER or BICY. During this time period, we used many techniques in an attempt to capture these species. We did not succeed in capturing those species we were targeting (e.g., mink, flying squirrel), though we were able to capture other species using these complementary species-specific methods.

Though we were unsuccessful at attracting mink using floating mink rafts, they proved very useful for capturing other mammal species, in particular marsh rice rats. As mentioned above, the sardines we used as bait seemed to be very attractive to wading birds as well as alligators. The mink lures we used, of which some were also meant to attract muskrats and otters, did not seem to attract any of these species.

Though it did not attract any squirrels, flying squirrel platform feeders baited with squirrel food and squirrel lure proved very useful for attracting cotton mice. Calandriello (1999) found that cotton mice often climbed trees, so this method could be used in future studies to capture cotton mice. We also captured many photos of birds using this method.

The most successful lure we used seemed to be Caven's Gusto lure, which is made to attract the red fox, gray fox, bobcat, and coyote. We used this lure, combined with cat food, at every permanent camera session. This combination seemed to be very effective at capturing a variety of species rather than just the four for which it was designed.

Species sightings in areas near EVER and BICY

Simultaneous observations of target mammals in areas adjacent to our study sites may provide clues as to whether specific species are still present in the general region. Though mink were not detected in EVER during this inventory, two were detected in BICY and one was seen preying on a rabbit in Fakahatchee Strand Preserve State Park in March 2009 (Skip Snow pers. comm.). Round-tailed muskrats have been observed in areas close to EVER and BICY. Muskrats were observed in A.R.M. Loxahatchee National Wildlife Refuge during the time period of this inventory (C. Fury and G. Martin, USFWS, pers. comm.). Southern flying squirrels have also been located in Castellow Hammock Park and Nature Center, a 112-acre mature tropical hardwood forest near Miami (<http://castellowhammock.wordpress.com/animal-species/>).

Vegetation characterization

We chose camera locations based on habitat type. We used NPS and the University of Georgia maps to determine general locations of some of our cameras. These maps were very useful and provided us with a good sense of which habitat type to expect at certain locations. The vegetation characterization of the NPS maps proved to be correct in most cases. However, they were not completely accurate in that they provided the

general habitat type of an area, but in some cases failed to include small habitat types scattered within the main habitat type. Overall, these maps were an excellent planning tool for this inventory and should be utilized in future inventory efforts.

Lessons learned from a large scale study

For inventories of this size, we learned that the general inventory should be separate from the species-specific sampling. The general inventory should be completed first, with the species-specific sampling following as a separate project so that focus is not taken away from either of these projects.

We learned that cameras were a very useful tool for collecting data for this inventory. Using cameras, we were able to continuously sample large areas with little habitat invasion. Cameras were also useful for capturing both diurnal and nocturnal species.

During this inventory, we used Palm pilots for data collection. Though this technology is convenient, the Palms were not always reliable. Palms break easily in the field and sometimes have trouble syncing to the computer. For future inventories, we recommend simply using field notebooks and data sheets to record data.

We also learned that PAO analysis can be used to analyze camera data. However, for species that were not frequently observed, we could not run Program PRESENCE. Thus, Bayesian analyses may be a more useful tool for determining occupancy for species not frequently detected.

In future large-scale studies, we suggest increasing numbers of field personnel in order to adequately sample all habitat types with equal effort. Field sampling teams should include two or more people per team. During this project, we relied upon many people not directly funded by this study to help gather data, and much more effort (Appendix 12) was put into this project than original funding allowed. With the amount of cameras we had deployed, the number of pictures in each session was rather large, making it difficult for one technician to do both the field work and the data entry.

Sampling strategy for future inventories

Camera trapping and live trapping produced more results in this inventory. To supplement these techniques, we recommend conducting day and night surveys as these opportunistic sightings were important for detecting various species (i.e., round-tailed muskrat, domestic cats and dogs, marsh rabbits, cottontails, and river otters) during this inventory. We suggest choosing sites randomly and stratifying by habitat as we did in the first year as this allowed for equal sampling within habitat types. Sampling for species that are known or suspected to be rare should begin immediately to maximize effort, and various sampling techniques should be utilized to detect these species. Follow up studies should also be conducted for future monitoring of the study site.

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Table 1. Species thought to occur in Big Cypress National Preserve and Everglades National Park and papers containing current knowledge of these species.

Common Name	Scientific Name	Study focus	Reference
Cotton rat	<i>Sigmodon hispidus</i>	Population	Bigler and Jenkins 1975
		Life history/ecology	Schwartz 1952; Cameron and Spencer 1981; Layne 1974; Calandriello 1999
		Trapping	Summerlin and Wolfe 1973
Marsh rice rat	<i>Oryzomys palustris</i>	Geographic variation	Humphrey and Setzer 1989
		Habitat use	Kruchek 2004
		Life history/Ecology	Schwartz 1952; Negus et al. 1961; Layne 1974; Wolfe 1982; Calandriello 1999
Black rat	<i>Rattus rattus</i>	Biology and behavior	Ewer 1971
		Life history/Ecology	Blair 1935; Opsahl 1951; Schwartz 1952; Layne 1974; Calandriello 1999; Gaines and Beck 2003
Virginia opossum	<i>Didelphis virginiana</i>	Life history/Ecology	Schwartz 1952; Layne 1974
		Observations	Worth 1950; Lord et al. 1973; Mazzotti et al. 1981; Lotz et al. 1996
Raccoon	<i>Procyon lotor</i>	Scent stations	Nottingham et al. 1989; Smith et al. 1994

		Life history/Ecology	Schwartz 1952; Layne 1974
		Observations	Lord et al. 1973; Mazzotti et al. 1981; Lotz et al. 1996
Bobcat	<i>Lynx rufus</i>	Scent stations	Diefenbach et al. 1994
		Survey methods	Harrison 2006
		Cameras trapping	Heilbrun et al. 2003; Heilbrun et al. 2006
		Life history/Ecology	Schwartz 1952; Layne 1974
		Observations	Mazzotti et al. 1981
Fox squirrel	<i>Sciurus niger</i>	Habitat use	Kantola and Humphrey 1990; Dalrymple 1995; Whittaker and Hamilton 1998
		Distribution	Williams and Humphrey 1979; Wooding 1997
		Life history/Ecology	Schwartz 1952; Layne 1974; Jodice 1990
		Movement patterns	Jodice 1993
		Observations	Kushlan 1972; Mazzotti et al. 1981;
Cotton mouse	<i>Peromyscus gossypinus</i>	Population	Pearson 1953; Bigler and Jenkins

		Trapping	1975; Smith 1982
		Life history/ecology	Whittaker et al. 1998; Loeb et al. 1999
			Opsahl 1951; Schwartz 1952; Layne 1974; Wolfe and Linzey 1977; Calandriello 1999
Domestic cat	<i>Felis domesticus</i>	Impacts on wildlife	Coleman et al. 1997
Domestic dog	<i>Canis familiaris</i>	Impacts on wildlife	Lenth et al. 2006
		Observations	Dalrymple 1995
Eastern gray squirrel	<i>Sciurus carolinensis</i>	Life history/ecology	Schwartz 1952; Layne 1974
House mouse	<i>Mus musculus</i>	Life history/ecology	Schwartz 1952; Layne 1974
Marsh rabbit	<i>Sylvilagus palustris</i>	Habitat use	Warren 2000
		Life history/ecology	Schwartz 1952; Layne 1974
Nine-banded armadillo	<i>Dasypus novemcinctus</i>	Life history/ecology	Layne 1974
River otter	<i>Lutra canadensis</i>	Track surveys	Evans 2006; Evans et al. 2009
		Habitat use	Humphrey and Zinn 1982; Dalrymple 1995
		Scent stations	Robson and Humphrey 1985
		Life history/Ecology	Schwartz 1952; Layne 1974
		Observations	Kushlan 1972; Mazzotti et al. 1981

Southern short-tailed shrew	<i>Blarina carolinensis</i>	Life history/Ecology	Opsahl 1951; Layne 1974; McCay 2001
Round-tailed muskrat	<i>Neofiber alleni</i>	Ecology	Howell 1920a; Porter 1953; Hill 1974; Birkenholz 1972; Bergstrom et al. 2000;
		Life history/ecology	Schwartz 1952; Schwartz 1953; Birkenholz 1962; Birkenholz 1963; Lefebvre and Tilmant 1992
		Description of young	Hamilton 1956
		Population dynamics	Lefebvre 1982
		Distribution	Paul 1968; Wassamer and Wolfe 1983
		Space use/Spatial distribution	Schooley and Branch 2006a; Schooley and Branch 2006b
		Survey techniques	Schooley and Branch 2005
		Habitat use	Tilmant 1975
		Behavior	Webster et al. 1980
Eastern cottontail	<i>Sylvilagus floridanus</i>	Habitat suitability	Allen 1984
		Use of scent stations	Drew et al. 1988

		Life history/Ecology	Schwartz 1952; Layne 1974
Eastern spotted skunk	<i>Spilogale putorius</i>	Habitat use	Howell 1920b; Baker and Baker 1975
		Life history/Ecology	Schwartz 1952; Layne 1974; Kinlaw 1995
Coyote	<i>Canis latrans</i>	Ecology	Gompper 2002
		Range/distribution	Hill et al. 1987; Wooding and Hardisky 1990; Maehr et al. 1996; Main et al. 2000
		Camera trapping	Sequin et al. 2003; Larrucea et al. 2007
		Scent station	Linhart and Knowlton 1975; Main 2000
Mink	<i>Mustela vison</i>	Habitat suitability	Allen 1984
		Habitat use	Humphrey and Zinn 1982
		Mink abundance	Allen and Neill 1952; Harrington et al. 2007
		Feeding ecology	Wise et al. 1981; Dunstone and Birks 1987
		Capturing mink	Eagle and Sargeant 1985

		Life history/ecology	Hamilton 1948; Schwartz 1952; Layne 1974; Humphrey 1992; Lariviere 1999
		Geographic variation	Humphrey and Setzer 1989
		Distribution	Smith 1980; Smith and Cary 1982
Gray fox	<i>Urocyon cinereoargenteus</i>	Habitat	Progulske and Labisky 1997
		Activity	Sunquist 1989; Wassamer 1984
		Life history/Ecology	Schwartz 1952; Layne 1974
		Observations	Dalrymple 1995
Least shrew	<i>Cryptotis parva</i>	Record from Florida Keys	Sasso and Keith 1999
		Life history/Ecology	Opsahl 1951; Schwartz 1952; Layne 1974
		BICY sighting	Lord et al. 1973
Striped skunk	<i>Mephitis mephitis</i>	Life history/ecology	Schwartz 1952; Layne 1974
Red fox	<i>Vulpes vulpes</i>	Distribution	Lee and Bostelman 1969
		Activity	Sunquist 1989
		Life history/Ecology	Layne 1974
Southern flying squirrel	<i>Glaucomys volans</i>	Home range	Bendel and Gates 1987; Fridell and Litvaitis 1991; Taulman and Smith 2004

		Food habits	Harlow and Doyle 1990
		Nesting	Layne and Raymond 1994; Holloway and Malcolm 2007
		Population structure	Laves and Loeb 2005
		Trapping	Risch and Brady 1996; Loeb et al. 1999
		Reproduction	Raymond and Layne 1988
		Life history/Ecology	Schwartz 1952; Layne 1974; Sonenshine et al. 1979; Sawyer and Rose 1985
		Vegetation	Sonenshine and Levy 1981
Norway rat	<i>Rattus norvegicus</i>	Life history/Ecology	Schwartz 1952
Long-tailed weasel	<i>Mustela frenata</i>	Life history/Ecology	Moore 1945; Schwartz 1952; Brown 1972a; Brown 1972b; Sheffield and Thomas 1997
		Observations	Layne 1993
		Distribution	Hovis 1993
Eastern mole	<i>Scalopus aquaticus</i>	Life history/Ecology	Schwartz 1952

Table 2. Number of individuals of each species detected by camera trapping, live trapping, and opportunistic surveys during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park, South Florida, USA from 2007-2009.

Species	Common name	Status	BICY	EVER	Total
<i>Sigmodon hispidus</i>	Cotton rat	Native	234	528	762
<i>Oryzomys palustris</i>	Marsh rice rat	Native	109	400	509
<i>Rattus rattus</i>	Black rat	Exotic	12	1,376	1388
<i>Didelphis virginiana</i>	Virginia opossum	Native	950	131	1081
<i>Procyon lotor</i>	Raccoon	Native	306	141	447
<i>Lynx rufus</i>	Bobcat	Native	161	28	189
<i>Sciurus niger</i>	Fox squirrel	Native	26	6	32
<i>Peromyscus gossypinus</i>	Cotton mouse	Native	647	290	937
<i>Felix domesticus</i>	Domestic cat	Exotic	10	9	19
<i>Canis familiaris</i>	Domestic dog	Exotic	10	34	44
<i>Sciurus carolinensis</i>	Gray squirrel	Native	49	41	90
<i>Mus musculus</i>	House mouse	Exotic	9	1	10
<i>Cryptotis parva</i>	Least shrew	Native	0	13	13
<i>Sylvilagus palustris</i>	Marsh rabbit	Native	103	21	124
<i>Dasyus novemcinctus</i>	Armadillo	New range extension	75	4	79
<i>Lutra canadensis</i>	River otter	Native	24	20	44
<i>Blarina carolinensis</i>	Southern short-tailed shrew	Native	6	21	27
<i>Sylvilagus floridanus</i>	Eastern cottontail	Native	7	11	18
<i>Mustela vison</i>	Mink	Native	2	0	2
<i>Spilogale putorius</i>	Spotted skunk	Native	8	0	8
<i>Neofiber alleni</i>	Round-tailed muskrat	Native	29	22	51
<i>Canis latrans</i>	Coyote	New range extension	18	39	57
<i>Urocyon cinereoargenteus</i>	Gray fox	Native	2	9	11
TOTAL			2,797	3,145	5,942

Table 3. Total number of individuals detected by each method during a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Number detected by camera includes all cameras: temporary, permanent, skunk/cottontail, mink cameras, and squirrel platform feeders. “Other” includes python gut contents and dead (but not road kill) specimens.

Species	Total # of individuals detected	# detected by camera	# Detected by Opportunistic Sightings						# detected by live trap
			Live Sightings	Prints	Road kill	Scat	Owl Pellets	Other	
<i>Sigmodon hispidus</i>	234	105 (44.9%)	2 (0.9%)	0 (0%)	1 (0.4%)	0 (0%)	8 (3.4%)	0 (0%)	118 (50.4%)
<i>Oryzomys palustris</i>	109	12 (11.0%)	1 (0.9%)	0 (0%)	1 (0.9%)	0 (0%)	0 (0%)	0 (0%)	95 (87.2%)
<i>Rattus rattus</i>	12	11 (91.7%)	0 (0%)	0 (0%)	1 (8.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Didelphis virginiana</i>	950	865 (89.2%)	47 (4.9%)	6 (0.6%)	32 (3.4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Procyon lotor</i>	306	216 (70.6%)	45 (14.7%)	22 (7.2%)	23 (7.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Lynx rufus</i>	161	131 (81.4%)	11 (6.8%)	14 (8.7%)	3 (1.9%)	2 (1.2%)	0 (0%)	0 (0%)	0 (0%)
<i>Scurius niger</i>	26	13 (50.0%)	10 (38.5%)	3 (11.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Peromyscus gossypinus</i>	647	476 (73.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	171 (26.4%)
<i>Felix domesticus</i>	10	2 (20.0%)	7 (70.0%)	0 (0%)	1 (10.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

<i>Canis familiaris</i>	10	1 (10.0%)	5 (50.0%)	1 (10.0%)	1 (10.0%)	2 (20.0%)	0 (0%)	0 (0%)	0 (0%)
<i>Scurius carolinensis</i>	49	29 (59.2%)	19 (38.8%)	0 (0%)	1 (2.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Mus musculus</i>	9	2 (22.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (77.8%)
<i>Sylvilagus palustris</i>	103	41 (39.8%)	47 (45.6%)	6 (5.8%)	3 (2.9%)	6 (5.8%)	0 (0%)	0 (0%)	0 (0%)
<i>Dasypus novemcinctus</i>	75	58 (77.3%)	11 (14.6%)	0 (0%)	4 (5.3%)	0 (0%)	0 (0%)	2 (2.7%)	0 (0%)
<i>Lutra canadensis</i>	24	9 (37.5%)	8 (33.3%)	0 (0%)	7 (29.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Blarina carolinensis</i>	6	1 (16.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (66.7%)	0 (0%)	1 (16.7%)
<i>Neofiber alleni</i>	29	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (10.3%)	26 (89.7%)	0 (0%)
<i>Sylvilagus floridanus</i>	7	0 (0%)	7 (100.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Spilogale putorius</i>	8	6 (75.0%)	1 (12.5%)	0 (0%)	1 (12.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Canis latrans</i>	18	9 (50.0%)	3 (16.7%)	2 (11.1%)	0 (0%)	4 (22.2%)	0 (0%)	0 (0%)	0 (0%)
<i>Mustela vison</i>	2	0 (0%)	2 (100.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Urocyon cinereoargenteus</i>	2	0 (0%)	1 (50.0%)	0 (0%)	1 (50.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Totals	2,797	1,987	347	83	54	14	80	15	14

Table 4. Summary of temporary camera sessions during a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	3/8/07 - 3/21/07	13	10	557	497 (89.2%)	1	1 (0.2%)	0	14	6 (1.1%)	8	45
2	3/26/07 - 4/9/07	14	10	1,450	1,346 (92.8%)	38	10 (0.7%)	28	51	28 (1.9%)	23	15
3	4/11/07 - 4/25/07	14	10	2,230	2,195 (98.4%)	28	8 (0.4%)	20	71	39 (1.7%)	32	47
4	4/30/07 - 5/14/07	14	10	983	890 (90.5%)	5	1 (0.1%)	4	53	28 (2.8%)	25	35
5	5/16/07 - 5/31/07	15	10	1,123	1,040 (92.6%)	1	1 (0.1%)	0	39	26 (2.3%)	14	41
6	6/1/07 - 6/15/07	14	10	2,032	1,951 (96.0%)	29	4 (0.2%)	25	31	9 (0.4%)	22	22
7*	6/19/07 - 7/3/07	14	14	1,978	1,721 (87.0%)	14	13 (0.7%)	0	153	58 (2.9%)	93	79
8*	7/5/07 - 7/19/07	14	15	805	687 (85.3%)	22	18 (2.2%)	3	57	19 (2.4%)	38	44
9	7/31/07 - 8/13/07	13	10	892	797 (89.3%)	38	8 (0.9%)	31	6	5 (0.6%)	1	51
10*	8/15/07 -				837	109	22	87	21	11	10	57

	8/29/07	14	12	1023	(81.8%)		(2.2%)			(1.1%)		
11*	8/31/07 - 9/14/07	14	13	231	72 (31.2%)	18	9 (3.9%)	8	61	36 (15.6%)	23	80
12	9/18/07 - 10/2/07	14	10	1,328	1,212 (91.3%)	15	3 (0.2%)	12	43	21 (1.6%)	21	61
13	10/04/07- 10/18/07	14	10	86	27 (31.4%)	3	2 (2.3%)	1	7	7 (8.1%)	0	49
14	10/23/07- 11/6/07	14	10	288	101 (35.1%)	5	5 (1.7%)	0	138	74 (25.7%)	64	44
15	11/7/07 - 11/21/07	14	10	861	583 (67.7%)	65	18 (2.1%)	51	151	67 (7.8%)	83	63
16	11/26/07- 12/10/07	14	9	175	25 (14.3%)	81	15 (8.6%)	67	12	9 (5.1%)	1	58
17	12/11/07- 1/2/08	22	10	1,059	224 (21.2%)	17	13 (1.2%)	6	737	188 (17.8%)	545	81
18	1/8/08 - 1/22/08	14	10	441	196 (44.4%)	97	32 (7.3%)	59	65	36 (8.2%)	26	77
19	1/24/08 - 2/07/08	14	9	592	220 (37.2%)	67	9 (1.5%)	58	184	48 (8.1%)	132	124
20	2/11/08 - 2/26/08	15	8	473	128 (27.1%)	67	10 (2.1%)	57	207	76 (16.1%)	124	67
21	3/27/08 - 4/14/08	18	9	1,172	987 (84.2%)	61	20 (1.7%)	41	86	18 (1.5%)	68	47
22	5/9/2008- 5/23/2008	14	4	275	193 (70.2%)	4	2 (0.7%)	2	22	18 (6.5%)	3	56
	Total	320	223	20,054	15,929 (79.4%)	785	224 (1.1%)	560	2,209	827 (4.1%)	1,356	1,243

* These sessions included some 35 mm film cameras, results of which are included in this table to show all temporary camera results.

Table 5. Summary of film cameras from a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	6/19/07 - 7/3/07	14	4	54	8 (14.8%)	11	11 (20.4%)	0	3	1 (1.9%)	2	32 (59.3%)
2	7/5/07 - 7/19/07	14	5	30	17 (56.7%)	9	8 (26.7%)	0	2	2 (6.7%)	0	3 (10.0%)
3	8/15/07- 8/29/07	14	2	32	1 (3.1%)	15	15 (46.9%)	0	0	0 (0%)	0	16 (50.0%)
4	8/31/07- 9/14/07	14	3	7	1 (14.3%)	4	4 (57.1%)	0	1	0 (0%)	0	1 (14.3%)
	Total	56	14	123	27 (22.0%)	39	38 (30.9%)	0	6	3 (2.4%)	2	52 (42.3%)

Table 6. Summary of permanent camera sessions from a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	3/21/08 - 4/11/08	21	6	724	583 (80.5%)	28	16 (2.2%)	12	89	55 (7.6%)	31	24
2	4/11/08 - 5/2/08	21	6	1,574	1,544 (98.1%)	5	5 (0.3%)	0	21	13 (0.8%)	1	4
3	5/2/08 - 5/23/08	21	6	1,724	1,461 (84.7%)	22	12 (0.7)	10	225	61 (3.5%)	162	16
4	5/23/08 - 6/13/2008	21	6	965	855 (88.6%)	19	16 (1.7%)	3	77	62 (6.4%)	11	14
5	6/19/08 - 7/3/2008	14	6	549	452 (82.3%)	23	21 (3.8%)	2	53	31 (5.6%)	22	21
6	7/4/08 - 7/24/2008	20	6	2,902	2,665 (91.8%)	56	40 (1.4%)	16	34	22 (0.2%)	10	147
7	7/24/08 - 8/14/2008	21	6	1,922	1,858 (96.7%)	30	20 (1.0%)	10	32	22 (1.1%)	9	2
8	8/14/08 - 9/4/2008	21	6	671	620 (92.4%)	25	16 (2.4%)	9	19	5 (0.7%)	14	7
9	9/4/08 - 9/26/2008	22	2	1,333	1,306 (98.0%)	20	16 (1.2%)	4	0	0 (0%)	0	7
10	9/26/08 - 10/19/2008	23	2	1,294	1,258 (97.2%)	9	7 (0.5%)	2	5	5 (0.4%)	0	22
11	10/19/08 - 11/10/08	22	6	1,424	796 (55.9%)	32	16 (1.1%)	16	55	33 (2.3%)	17	541
12	11/10/08 -			2,196	1,887	20	8	12	97	40	53	192

	12/1/08	21	6		(85.9%)		(0.4%)			(1.8%)		
13	12/1/2008- 12/22/2008	21	6	587	468 (79.7%)	15	9 (1.5%)	6	89	54 (9.2%)	34	15
14	12/22/2008- 1/12/2009	21	6	745	664 (89.1%)	7	3 (0.4%)	6	57	26 (3.5%)	26	17
15	1/12/2008- 2/4/2009	23	6	657	553 (84.2%)	0	0 (0%)	0	87	24 (3.7%)	61	17
16	2/4/2009- 2/23/2009	19	6	707	683 (96.6%)	13	2 (0.3%)	11	9	4 (0.6%)	5	2
17	2/23/2009- 3/16/2009	21	6	361	307 (85.0%)	1	1 (0.3%)	0	47	7 (1.9%)	40	6
18	3/16/2009- 4/6/2009	21	6	538	451 (83.8%)	0	0 (0%)	0	87	43 (8.0%)	44	0
19	4/6/2009- 4/30/2009	24	2	1,856	1,813 (97.7%)	2	2 (0.1%)	0	32	19 (1.0%)	13	7
20	4/30/09 - 5/18/09	18	2	0	0 (0%)	0	0 (0%)	0	0	0 (0%)	0	0
21	5/18-6/15/09	28	2	0	0 (0%)	0	0 (0%)	0	0	0 (0%)	0	0
22	6/15/09 - 6/29/09	14	1	513	499 (97.3%)	0	0 (0%)	0	13	6 (1.2%)	7	1
	Total	458	107	23,242	20,696 (89.0%)	327	210 (0.9%)	119	1,128	532 (2.3%)	560	1,062

Table 7. Summary of skunk/cottontail cameras from a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	4/17/08 - 5/1/08	14	8	2,373	1,922 (81.0%)	40	3 (0.1%)	37	235	55 (2.3%)	178	176
2	6/19/08 - 7/3/08	14	6	172	53 (30.8%)	11	7 (4.1%)	4	58	19 (11.0%)	38	46
3	10/6/08 - 10/20/08	14	7	357	286 (80.1%)	30	7 (2.0%)	23	12	5 (1.4%)	3	29
4	10/27/08- 11/10/08	14	5	206	137 (66.5%)	9	9 (4.4%)	0	22	13 (6.3%)	7	38
5	2/09/2009- 2/23/2009	14	6	2,493	2,350 (94.3%)	32	6 (0.2%)	26	91	23 (0.9%)	67	10
6	2/23/2009- 3/16/2009	21	7	348	193 (55.5%)	1	1 (0.3%)	0	128	31 (8.9%)	94	19
7	4/16/2009- 4/30/2009	14	5	3,248	1,983 (61.1%)	48	17 (0.5%)	31	3	3 (0.1%)	0	909
	Total	105	44	9,197	6,924 (75.3%)	171	50 (0.5%)	121	549	149 (1.6%)	387	1,227

Table 8. Summary of squirrel cameras from a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	10/22/08 - 11/3/08	12	6	787	746 (94.8%)	2	1 (0.1%)	0	22	13 (1.7%)	9	26
2	11/3/08 - 11/17/08	14	6	764	465 (60.9%)	0	0 (0%)	0	286	34 (4.5%)	252	13
3	11/17/08 - 12/1/08	14	6	765	579 (75.7%)	12	9 (1.2%)	3	135	42 (5.5%)	94	42
4	12/1/2008-12/15/2008	14	6	482	412 (85.5%)	15	14 (2.9%)	1	41	13 (2.7%)	28	14
5	12/15/2008-12/29/2008	14	6	481	377 (78.4%)	22	16 (3.3%)	6	75	4 (0.8%)	71	7
6	12/29/2008-1/12/2009	14	6	141	106 (75.2%)	13	12 (8.5%)	1	2	2 (1.4%)	0	20
7	1/12/2009-1/21/2009	9	6	101	97 (96.0%)	0	0 (0%)	0	1	1 (1.0%)	0	3
8	2/10/2009-2/23/2009	13	3	121	61 (50.4%)	0	0 (0%)	0	29	20 (16.5%)	9	31
9	2/23/2009-3/9/2009	14	3	161	123 (76.4%)	0	0 (0%)	0	34	15 (9.3%)	19	4
10	3/9/2009-				97	0	0	0	50	19	31	0

	3/23/2009	14	3	137	(70.8%)		(0%)			(13.9%)		
11	3/23/2009- 4/6/2009	14	3	54	46 (85.2%)	0	0 (0%)	0	7	7 (13.0%)	0	1
12	4/6/2009- 4/20/2009	14	3	181	92 (50.8%)	0	0 (0%)	0	86	45 (24.9%)	41	0
13	4/20/2009- 5/4/2009	14	3	15	14 (93.3%)	0	0 (0%)	0	1	1 (6.7%)	0	0
14	5/4/2009- 5/18/2009	14	3	16	9 (56.3%)	0	0 (0%)	0	0	0 (0%)	0	7
15	5/18/2009- 6/3/2009	16	4	286	278 (97.2%)	0	0 (0%)	0	2	2 (0.7%)	0	6
16	6/3/09 - 6/17/09	14	4	758	698 (92.1%)	58	9 (1.2%)	49	2	2 (0.3%)	0	3
17	6/17/09 - 6/29/09	12	5	48	3 (6.3%)	42	24 (50%)	18	0	0 (0%)	0	3
	Total	230	76	5,298	4,203 (79.3%)	164	85 (1.6%)	78	773	220 (4.2%)	554	180

Table 9. Summary of mink cameras from a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	4/6/09 - 5/7/09	31	4	1,509	1,361 (90.2%)	123	47 (3.1%)	76	14	4 (0.3%)	9	11
2	5/7/09 – 6/18/09	42	5	174	134 (77.0%)	20	17 (9.8%)	3	7	3 (1.7%)	2	17
	Total	73	9	1,683	1,495 (88.8%)	143	64 (3.8%)	79	21	7 (0.4%)	11	28

Table 10. Summary of live trapping efforts during a small and medium mammal inventory of Big Cypress National Preserve, South Florida, USA from 2007-2009. Refer to the Access database provided on the CD for a description of habitat type for each trap site.

Session #	Dates	Location
1	3/13 - 3/17/07	Wagon Wheel Road
2	4/2 – 4/6/07	Dade-Collier Airport Area
3	5/7 – 5/11/07	West of Loop Road between Gator Hook Strand and New River Strand
4	6/4 – 6/8/07	Burns Road area
5	7/9 – 7/13/07	Bear Island
6	8/6 – 8/10/07	Loop Road
7	9/24 – 9/28/07	Turner River Road
8	10/8 - 10/12/07	Off 75 near recreation access point
9	11/12 - 11/16/07	NW of Dade-Collier Airport towards Bluebird Trail
10	12/3 - 12/7/07	New River Strand Area
11	1/28 - 2/1/08	Levee 28/Interceptor Canal
12	2/18 – 2/22/08	Kissimmee Billy Strand
13	3/31 – 4/4/08	BICY VC by pole barn

Table 11. Number of individuals detected per habitat type during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park, South Florida, USA from 2007-2009.

	Big Cypress National Preserve Habitat Type						Everglades National Park Habitat Type					
Species	Pine	Hammock	Cypress	Cypress prairie	Prairie	Other	Pine	Hammock	Slough	Marl-Prairie	Mangrove	Other
<i>Sigmodon hispidus</i>	13	171	31	14	3	2	75	190	59	55	10	139
<i>Oryzomys palustris</i>	2	21	49	37	0	0	12	52	226	36	9	65
<i>Rattus rattus</i>	3	8	1	0	0	0	17	677	473	1	188	20
<i>Didelphis virginiana</i>	131	666	104	35	6	8	10	87	21	8	0	5
<i>Procyon lotor</i>	26	157	60	31	18	14	1	30	25	4	74	7
<i>Lynx rufus</i>	35	93	17	9	6	1	3	9	2	8	4	2
<i>Sciurus niger</i>	5	14	5	2	0	0	0	2	2	0	1	1
<i>Peromyscus gossypinus</i>	364	193	67	15	0	8	21	188	78	1	0	2
<i>Felis domesticus</i>	0	8	1	0	1	0	0	8	1	0	0	0
<i>Canis familiaris</i>	0	8	0	0	2	0	4	23	2	2	0	3
<i>Sciurus carolinensis</i>	1	40	5	3	0	0	6	29	0	2	0	4
<i>Mus musculus</i>	2	5	1	1	0	0	1	0	0	0	0	0
<i>Sylvilagus palustris</i>	12	59	7	9	14	2	0	13	2	4	1	1
<i>Dasypus novemcinctus</i>	3	64	0	0	7	1	0	2	0	1	0	1

<i>Lutra canadensis</i>	1	11	5	1	0	6	0	12	5	0	0	3
<i>Blarina carolinensis</i>	0	6	0	0	0	0	0	0	2	2	0	17
<i>Sylvilagus floridanus</i>	0	0	0	0	5	2	1	0	1	7	0	2
<i>Mustela vison</i>	0	2	0	0	0	0	0	0	0	0	0	0
<i>Spilogale putorius</i>	1	6	1	0	0	0	0	0	0	0	0	0
<i>Neofiber alleni</i> *	0	3	0	0	26	0	0	0	1	1	0	20
<i>Canis latrans</i>	3	11	1	1	2	0	6	7	1	20	0	5
<i>Cryptotis parva</i>	0	0	0	0	0	0	1	1	0	7	0	4
<i>Urocyon cinereoargenteus</i>	0	2	0	0	0	0	1	1	4	3	0	0
Total number of species	15	21	15	12	11	9	14	17	17	17	7	18
Total number of exotic species	4	6	4	2	4	1	4	5	4	4	1	4
Total number of native species	11	15	11	10	7	8	10	12	13	13	6	14

*Muskrats were detected in both owl pellets and python gut contents so this may represent the habitat type of the predator, not necessarily the habitat type of the muskrat.

Table 12. Total number of individuals detected by each method during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Number detected by camera includes all cameras: temporary, permanent, skunk/cottontail, mink cameras, and squirrel platform feeders. “Other” includes python gut contents and dead (but not road kill) specimens.

Species	Total # of individuals detected	# detected by camera	# Detected by Opportunistic Sightings						# detected by live trap
			Live Sightings	Prints	Roadkill	Scat	Owl Pellets	Other	
<i>Sigmodon hispidus</i>	528	239 (45.3%)	19 (3.6%)	0 (0%)	5 (0.9%)	0 (0%)	152 (28.8%)	1 (0.2%)	112 (21.2)
<i>Oryzomys palustris</i>	400	281 (70.3%)	2 (0.5%)	6 (1.5%)	0 (0%)	0 (0%)	69 (17.3%)	0 (0%)	42 (10.5%)
<i>Rattus rattus</i>	1,376	1,324 (96.2%)	10 (0.7%)	2 (0.1%)	3 (0.2%)	0 (0%)	6 (0.4%)	3 (0.2%)	28 (2.0%)
<i>Didelphis virginiana</i>	131	100 (76.3%)	10 (7.6%)	6 (4.6%)	6 (4.6%)	9 (6.9%)	0 (0%)	0 (0%)	0 (0%)
<i>Procyon lotor</i>	141	102 (72.3%)	10 (7.1%)	13 (9.2%)	8 (5.7%)	8 (5.7%)	0 (0%)	0 (0%)	0 (0%)
<i>Lynx rufus</i>	28	2 (7.1%)	7 (25.0%)	8 (28.6%)	0 (0%)	10 (35.7%)	0 (0%)	1 (3.6%)	0 (0%)
<i>Scurius niger</i>	6	0 (0%)	4 (66.7%)	2 (33.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Peromyscus gossypinus</i>	290	277 (95.5%)	3 (1.1%)	0 (0%)	0 (0%)	0 (0%)	2 (0.7%)	0 (0%)	8 (2.8%)
<i>Felix domesticus</i>	9	4 (44.4%)	2 (22.2%)	0 (0%)	3 (33.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Canis familiaris</i>	34	23 (67.6%)	2 (5.9%)	2 (5.9%)	3 (8.8%)	4 (11.8%)	0 (0%)	0 (0%)	0 (0%)

<i>Scurius carolinensis</i>	41	14 (34.1%)	19 (46.3%)	0 (0%)	8 (19.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Mus musculus</i>	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100.0%)	0 (0%)
<i>Cryptotis parva</i>	13	0 (0%)	1 (7.7%)	0 (0%)	3 (23.1%)	0 (0%)	6 (46.2%)	1 (7.7%)	2* (15.4%)
<i>Sylvilagus palustris</i>	21	13 (61.9%)	3 (14.3%)	0 (0%)	0 (0%)	2 (9.5%)	1 (4.8%)	2 (9.5%)	0 (0%)
<i>Dasypus novemcinctus</i>	4	0 (0%)	2 (50.0%)	0 (0%)	2 (50.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Lutra canadensis</i>	20	0 (0%)	12 (60.0%)	3 (15.0%)	3 (15.0%)	2 (10.0%)	0 (0%)	0 (0%)	0 (0%)
<i>Blarina carolinensis</i>	21	0 (0%)	2 (9.5%)	0 (0%)	0 (0%)	0 (0%)	19 (90.5%)	0 (0%)	0 (0%)
<i>Neofiber alleni</i>	23	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (27.3%)	16 (72.7%)	0 (0%)
<i>Sylvilagus floridanus</i>	11	7 (63.6%)	2 (18.2%)	0 (0%)	2 (18.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Canis latrans</i>	39	8 (20.5%)	12 (30.8%)	8 (20.5%)	2 (5.1%)	9 (23.1%)	0 (0%)	0 (0%)	0 (0%)
<i>Urocyon cinereoargenteus</i>	9	0 (0%)	2 (22.2%)	5 (55.6%)	2 (22.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Totals	3,145	2,394	124	55	50	44	261	25	190

*One record from Bill Loftus during a different live trapping effort not associated with this inventory.

Table 13. Summary of temporary camera sessions during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Op is defined as opportunistic camera sessions. Both Op and Key sessions were also temporary camera sessions. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database provided on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	3/14/07-3/28/07	14	10	1,461	1,437 (98.4%)	1	Not recorded	Not recorded	10	3 (0.2%)	7	13
2	3/30/07-4/13/07	14	10	1,839	1,776 (96.6%)	9	Not recorded	Not recorded	51	25 (1.4%)	26	3
3	4/19/07-5/3/07	14	10	2,199	1,768 (80.4%)	180	15 (0.7%)	165	17	11 (0.5%)	6	2
4	5/9/07-5/23/07	14	10	1,264	1,196 (94.6%)	4	2 (0.2%)	2	60	23 (1.8%)	36	6
5	5/25/07-6/08/07	14	10	1,386	1,252 (90.3%)	5	1 (0.1%)	4	123	26 (1.9%)	97	5
6	6/11/07-6/25/07	14	10	635	528 (83.1%)	8	1 (0.2%)	7	82	5 (0.8%)	75	19
7	6/30/07-7/16/07	16	10	646	589 (91.2%)	8	5 (0.8%)	3	20	12 (1.9%)	8	29
8	7/19/07-8/2/07	14	7	513	388 (75.6%)	49	16 (3.1%)	33	67	32 (6.2%)	35	9
9	8/7/07- 8/21/07	14	10	302	154 (51.0%)	130	12 (4.0%)	118	11	6 (2.0%)	5	7
10	8/24/07-9/7/07	14	9	1,463	1,427 (97.5%)	6	3 (0.2%)	3	0	0 (0%)	0	30
11	9/11/07-9/25/07	14	9	534	139 (26.0%)	12	2 (0.4%)	9	348	45 (8.4%)	302	42
12	9/27/07-			322	242	66	7	59	4	4	0	10

	10/11/07	14	7		(75.2%)		(2.2%)			(1.2%)		
13	10/15/07- 10/29/07	14	10	868	663 (76.4%)	103	15 (1.7%)	88	1	0 (0%)	0	102
14	10/31/07- 11/14/07	14	10	737	622 (84.4%)	0	0 (0%)	0	77	37 (5.0%)	34	31
15	2/7/08-2/23/08	16	8	597	504 (84.4%)	1	1 (0.2%)	0	45	28 (4.7%)	15	46
16	3/21/08- 5/08	55*	8	1,079	971 (90.0%)	80	26 (2.4%)	53	24	8 (0.7%)	16	8
17	Op Cam Session	14	30	1,959	115 (5.9%)	147	10 (0.5%)	67	12	49 (2.5%)	6	18
18	Keys Sessions	14	23	1,279	420 (32.8%)	70	24 (1.9%)	45	751	174 (13.6%)	581	41
	Total	297	201	19,083	14,191 (74.4%)	879	140 (0.7%)	656	1,703	488 (2.6%)	1,249	421

*The end date of this session was not recorded, so we used May 15th as the last date to calculate trap nights.

Table 14. Summary of permanent camera sessions during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	2/28/08-3/20/08	21	2	1,894	1,883 (99.4%)	8	3 (0.2%)	5	3	2 (0.1%)	1	0
2	3/20/08-4/23/08	34	4	625	606 (97.0%)	18	15 (2.4%)	3	1	1 (0.2%)	0	0
3	4/23/08-5/14/08	22	4	4,225	4,202 (99.5%)	13	10 (0.2%)	3	10	5 (0.1%)	5	0
4	5/14/08-6/5/08	22	4	337	314 (93.2%)	12	10 (3.0%)	2	11	8 (2.4%)	3	0
5	6/5/08-6/26/08	21	3	702	684 (97.4%)	10	6 (0.9%)	4	6	4 (0.6%)	2	2
6	6/26/08-7/23/08	27	2	841	828 (98.5%)	2	1 (0.1%)	1	9	5 (0.6%)	4	2
7	7/23/08-8/21/08	29	3	1,101	592 (53.8%)	65	22 (2.0%)	43	441	12 (1.1%)	429	3
8	10/2/08-10/23/08	21	4	6,142	5,725 (93.2%)	101	52 (0.8%)	49	316	47 (0.8%)	269	0
9	10/23/08-11/13/08	21	7	3,410	3,266 (95.8%)	93	58 (1.7%)	38	40	18 (0.5%)	22	11
10	11/13/08-12/5/2008	22	7	4,776	4,528 (94.8%)	98	49 (1.0%)	49	145	68 (1.4%)	77	5
11	12/5/2008-12/30/2008	25	5	1,530	1,048 (68.5%)	275	63 (4.1%)	212	207	64 (4.2%)	143	0
12	12/30/2008-1/19/2009	20	5	3,593	3,098 (86.2%)	442	82 (2.3%)	360	19	12 (0.3%)	7	33
13	1/19/2009-				1,143	1535	161	1373	2220	41	2179	21

	2/9/2009	21	6	4,919	(23.2%)		(3.3%)			(0.8%)		
14	2/9/2009-3/2/2009	21	6	1,068	701 (65.6%)	285	72 (6.7%)	213	52	13 (1.2%)	39	30
15	3/2/2009-3/23/2009	21	4	568	364 (64.1%)	28	18 (3.2%)	10	176	17 (3.0%)	159	0
16	3/23/2009-4/13/2009	21	5	7,126	7,001 (98.2%)	31	28 (0.4%)	3	93	32 (0.4%)	61	1
17	4/13/2009-5/4/2009	21	4	11,692	10,313 (88.2%)	50	28 (0.2%)	22	801	47 (0.4%)	754	528
18	5/4/2009-5/25/2009	21	4	616	380 (61.7%)	5	3 (0.5%)	2	231	19 (3.1%)	212	0
19	5/25/2009-6/15/2009	21	3	1,621	654 (40.3%)	34	26 (1.6%)	8	920	21 (1.3%)	899	13
	Total	432	82	56,786	47,330 (83.3%)	3,105	679 (1.2%)	2,400	5,701	436 (0.8%)	5,265	649

Table 15. Summary of skunk/cottontail cameras during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	3/13/08 - 3/28/08	15	8	1,063	933 (87.8%)	48	12 (1.1%)	36	82	13 (1.2%)	69	0
2	4/2/08 - 4/23/08	21	7	1,451	1,377 (94.9%)	55	17 (1.2%)	38	19	9 (0.6%)	10	0
3	6/25/08- 7/9/08	14	6	834	775 (92.9%)	52	9 (1.1%)	43	2	1 (0.1%)	1	5
4	8/6/08- 8/17/08	11	5	184	165 (89.7%)	19	7 (3.8%)	12	0	0 (0%)	0	0
5	3/17/09- 3/31/09	14	6	57	12 (21.1%)	45	10 (17.5%)	35	0	0 (0%)	0	0
6	4/20/09- 5/4/09	14	5	8,362	8,344 (99.8%)	12	8 (0.1%)	4	5	4 (0.05%)	1	1
	Total	89	37	11,951	11,606 (97.1%)	231	63 (0.5%)	168	108	27 (0.2%)	81	6

Table 16. Summary of squirrel cameras during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	9/22/08-10/7/08	15	6	516	259 (50.2%)	255	61 (11.8%)	194	0	0 (0%)	0	2
2	10/7/08-10/21/08	14	6	337	287 (85.2%)	49	19 (5.6%)	30	0	0 (0%)	0	1
3	10/21/08-11/6/08	16	6	163	74 (45.4%)	87	23 (14.1%)	62	0	0 (0%)	0	2
4	11/6/08-11/18/08	12	6	116	111 (95.7%)	2	2 (1.7%)	0	0	0 (0%)	0	3
5	11/18/08-12/2/08	14	6	41	14 (34.1%)	10	5 (12.2%)	5	0	0 (0%)	0	17
6	12/2/08-12/16/08	14	6	0	0 (0%)	0	0 (0%)	0	0	0 (0%)	0	0

7	12/16/08-12/30/08	14	6	175	137 (78.3%)	38	2 (1.1%)	36	0	0 (0%)	0	0
8	12/30/08-1/13/09	14	6	80	40 (50.0%)	23	14 (17.5%)	9	0	0 (0%)	0	17
9	1/13/09-1/27/09	14	6	112	104 (92.9%)	8	2 (1.8%)	6	0	0 (0%)	0	0
10	1/27/09-2/10/09	14	6	37	37 (100%)	0	0 (0%)	0	0	0 (0%)	0	0
11	2/10/09-2/24/09	14	6	2455	1888 (76.9%)	203	56 (2.3%)	147	364	64 (2.6%)	300	0
12	2/24/09-3/10/09	14	6	5690	3938 (69.2%)	565	70 (1.2%)	495	1173	95 (1.7%)	1078	14
13	3/10/09-3/24/09	14	6	2767	862 (31.2%)	626	57 (2.1%)	569	1266	89 (3.2%)	1077	13
14	3/24/09-4/7/09	14	6	3357	2793 (83.2%)	173	52 (1.5%)	121	359	45 (1.3%)	314	32
15	4/7/09-4/21/09	14	6	4768	4320 (90.6%)	260	44 (0.9%)	216	187	27 (0.6%)	160	1
16	4/21/09-5/5/09	14	6	3162	2360 (74.6%)	268	22 (0.7%)	246	514	54 (1.7%)	460	20
17	5/5/09-5/19/09	14	6	3500	2663 (76.1%)	455	60 (1.7%)	395	352	27 (0.8%)	325	30

18	5/19/09-6/2/09	14	6	3898	2895 (74.3%)	88	35 (0.9%)	53	903	42 (1.1%)	861	12
19	6/2/09-6/15/09	13	6	2101	759 (36.1%)	19	14 (0.7%)	5	1323	81 (3.9%)	1242	0
20	6/15/09-6/30/09	15	6	2964	1736 (58.6%)	16	14 (0.5%)	2	1200	90 (3.0%)	1110	12
	Total	281	120	36,239	25,277 (69.8%)	3,145	552 (1.5%)	2,591	7,641	614 (1.7%)	6,927	176

Table 17. Summary of Old Ingram mink cameras during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	9/22/08-10/7/08	15	10	78	42 (53.8%)	34	13 (16.7%)	22	2	2 (2.6%)	0	0
2	10/7/08-10/21/08	14	10	74	63 (85.1%)	9	8 (10.8%)	1	1	1 (1.4%)	0	1
3	10/21/08-11/4/08	14	10	89	56 (62.9%)	24	12 (13.5%)	12	9	6 (6.7%)	3	0
4	11/4/08-11/18/08	14	10	49	36 (73.5%)	8	8 (16.3%)	0	4	4 (8.2%)	0	1
5	11/18/08-				39	4	4	0	3	3	0	5

	12/2/08	14	10	51	(76.5%)		(7.8%)			(5.9%)		
6	12/2/08- 12/16/08	14	9	39	18 (46.2%)	11	7 (17.9%)	4	7	6 (15.4%)	1	3
7	12/16/08- 12/30/08	14	9	401	377 (94.0%)	18	7 (1.7%)	11	6	4 (1.0%)	2	0
8	12/30/08- 1/13/09	14	9	34	21 (61.8%)	4	4 (11.8%)	0	1	1 (2.9%)	0	8
9	1/13/09- 1/27/09	14	9	193	179 (92.7%)	4	3 (1.6%)	1	8	6 (3.1%)	2	2
10	1/27/09- 2/10/09	14	9	31	31 (100%)	0	0 (0%)	0	0	0 (0%)	0	0
11	2/10/09- 2/24/09	14	9	298	275 (92.3%)	7	6 (2.0%)	1	3	3 (1.0%)	0	13
12	2/24/09- 3/10/09	14	9	161	154 (95.7%)	5	4 (2.5%)	1	1	1 (0.6%)	0	1
13	3/10/09- 3/24/09	14	9	112	106 (94.6%)	1	1 (0.9%)	0	5	4 (3.6%)	1	0
14	4/7/09- 4/21/09	14	7	51	22 (43.1%)	23	16 (31.3%)	7	6	5 (9.8%)	1	0
15	4/21/09- 5/5/09	14	7	254	250 (98.4%)	0	0 (0%)	0	4	4 (1.6%)	0	0
16	5/5/09- 5/19/09	14	7	151	17 (11.3%)	6	5 (3.3%)	1	8	3 (2.0%)	5	120
17	5/19/09- 6/2/09	14	7	61	58 (95.1%)	2	2 (3.3%)	0	0	0 (0%)	0	1
18	6/2/09- 6/16/09	14	7	51	48 (94.1%)	1	1 (2.0%)	0	2	2 (3.9%)	0	0
19	6/16/09- 6/30/09	14	7	25	9 (36.0%)	1	1 (4.0%)	0	1	1 (4.0%)	0	14
	Total	267	164	2,203	1,801 (81.8%)	162	102 (4.6%)	61	71	56 (2.5%)	15	169

Table 18. Summary of Taylor Slough mink cameras during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	9/25/08-10/16/08	21	3	578	555 (96.0%)	15	6 (1.0%)	9	0	0 (0%)	0	8
2	10/16/08-11/6/08	21	3	155	147 (94.8%)	7	7 (4.5%)	0	0	0 (0%)	0	1
3	11/6/08-12/18/08	42	3	328	314 (95.7%)	13	11 (3.4%)	2	0	0 (0%)	0	1
4	12/18/08-1/8/09	21	3	673	512 (76.1%)	72	18 (2.7%)	54	89	11 (1.6%)	78	0
5	1/8/09-3/27/09	78	3	2,284	2,048 (89.7%)	178	77 (3.4%)	101	18	11 (0.5%)	7	40
6	3/27/09-5/11/09	45	3	1,523	1,346 (88.4%)	139	67 (4.4%)	72	27	22 (1.4%)	5	11
7	5/11/09-8/27/09	108	3	5,137	4,899 (95.4%)	59	62 (1.2%)	125	37	19 (0.4%)	17	10
	Total	336	21	10,678	9,821 (92.0%)	483	248 (2.3%)	363	171	63 (0.6%)	107	71

Table 19. Summary of Blue Shanty and L-67 mink cameras during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	9/25/08-10/16/08	21	6	2,156	2,096 (97.2%)	44	19 (0.9%)	25	0	0 (0%)	0	16
2	10/16/08-11/6/08	21	6	803	754 (93.9%)	28	18 (2.2%)	10	11	7 (0.9%)	4	10
3	11/6/08-11/26/08	20	6	4,030	3,993 (99.1%)	30	19 (0.5%)	11	6	5 (0.1%)	1	1
4	11/26/08 - 12/18/08	22	6	1,998	1,974 (98.8%)	18	13 (0.7%)	5	6	5 (0.3%)	1	0
5	12/18/08-1/8/09	21	6	1,377	858 (62.3%)	10	6 (0.4%)	4	78	24 (1.7%)	54	431
6	1/8/09-1/28/09	20	6	1,332	1,213 (91.1%)	85	19 (1.4%)	66	25	22 (1.7%)	3	9
7	1/28/09-2/19/09	22	6	1,413	1,037 (73.4%)	41	11 (0.8%)	30	315	55 (3.9%)	260	20
8	2/19/09-3/31/09	40	4	2,129*	1,565 (73.5%)	6	6 (0.3%)	0	545	85 (4.0%)	460	13

9	3/31/09-5/20/09	50	6	2,337	1,921 (82.2%)	47	41 (1.8%)	6	346	109 (4.7%)	237	23
10	5/20/09-8/27/09	99	6	3,194	2,764 (86.5%)	156	71 (2.2%)	84	256	47 (1.5%)	195	16
	Total	336	58	20,769	18,175 (87.5%)	465	223 (1.1%)	241	1,588	359 (1.7%)	1,215	539

*Due to low water levels, we could not access L-67 for this session

Table 20. Summary of S-12 Tower, Shark Valley Tram, Upper L-67, and Old Tamiami mink cameras during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Unknown animals/mammals were recorded in the total number of animal/mammal pictures but not in the useable or repeat pictures. Refer to the Access database on the CD for a description of habitat type for each camera.

Camera Session	Session Dates	# Trap nights	# of Camera Stations per Session	Total # Pictures	# Veg Pictures (% of total)	# Other Animal Pictures	# Useable Animal Pictures (% of total)	# Repeat Animals	# Mammal Pictures	# Useable Mammal Pictures (% of total)	# Repeat Mammals	# Other Pictures
1	9/25/08-10/16/08	21	13	6,781	6,620 (97.6%)	126	39 (0.6%)	87	15	7 (0.1%)	8	20
2	10/16/08-11/6/08	21	13	2,896	2,741 (94.6%)	99	55 (1.9%)	44	45	20 (0.7%)	25	11
3	11/6/08-11/26/08	20	13	3,861	3,717 (96.3%)	109	52 (1.3%)	57	24	12 (0.3%)	12	11

4	11/26/08 - 12/18/08	22	13	2,113	1,987 (94.0%)	66	45 (2.1%)	21	25	20 (0.9%)	5	35
5	12/18/08 -1/8/09	21	12	4,372	3,932 (89.9%)	143	67 (1.5%)	76	287	43 (1.0%)	244	10
6	1/8/09- 1/28/09	20	12	2,951	1,345 (45.6%)	174	73 (2.5%)	101	508	93 (3.2%)	415	924
7	1/28/09- 2/19/09	22	12	2,032	1,338 (65.8%)	498	157 (7.7%)	338	116	41 (2.0%)	65	78
8	2/19/09- 3/12/09	21	12	5,277	3,928 (74.4%)	767	232 (4.4%)	543	439	134 (2.5%)	305	143
9	3/12/09- 4/12/09	31	12	7,539	6,901 (91.5%)	241	137 (1.8%)	104	459	103 (1.4%)	356	35
10	4/12/09- 4/23/09	11	12	10,489	10,128 (96.6%)	128	61 (0.6%)	67	172	49 (0.5%)	123	61
11	4/23/09- 5/14/09	21	12	6,693	6,066 (90.6%)	82	39 (0.6%)	43	372	80 (1.2%)	292	173
12	5/14/09- 6/4/09	21	12	2,042	1,437 (70.4%)	119	37 (1.8%)	82	258	29 (1.4%)	229	228
13	6/4/09- 6/25/09	21	12	1,515	1,158 (76.4%)	298	70 (4.6%)	228	18	7 (0.5%)	11	41
	Total	273	160	58,561	51,298 (87.6%)	2,850	1,064 (1.8%)	1,791	2,738	638 (1.1%)	2,090	1,770

Table 21. Summary of live trapping efforts during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009. Refer to the Access database on the CD for a description of habitat type for each trap site.

Session #	Date	Location
1	3/19/07 – 3/23/07	Royal Palm
2	4/23/07 – 4/27/07	Mahogany Hammock Area
3	5/29/07 – 6/1/07	Flamingo Area by Lungs
4	6/18/07 – 6/22/07	Shark Slough
5	7/23/07 – 7/27/07	Aerojet Area
6	8/20/07 – 8/24/07	Park Entrance
7	9/10/07 – 9/14/07	Chokoloskee Bay Area
8	9/24/07 – 9/28/07	Park Entrance Area
9	10/15/07 – 10/19/07	Shark Slough
10	11/5/07 – 11/9/07	Chekika Area
11	1/14/08 – 1/18/08	Levee 30 Area
12	2/4/08 – 3/8/08	Flamingo
13	3/24/08 – 3/28/08	Park Entrance
14	5/27/08 – 5/31/08	Shark Valley
15	6/16/08 – 6/20/08	Long Pine Key
16	8/25/08 – 8/29/08	Royal Palm

Table 22. Proportion area occupied (PAO) results for Big Cypress National Preserve for those species for which Psi could be estimated. These results are for all cameras during a small and medium mammal inventory in Big Cypress National Preserve, South Florida, USA from 2007-2009, and show the results of models with weights ≥ 0.10 .

Big Cypress National Preserve			
Species	Model	AIC or QAIC	Model weight
<i>Sigmodon hispidus</i>	psi(.)p(grass density)	199.5	0.54
	psi(.)p(.)	202.3	0.14
	psi(habitat)p(grass density)	202.8	0.10
<i>Oryzomys palustris</i>	psi(.)p(grass density)	82.4	0.75
	psi(habitat)p(grass density)	84.8	0.23
<i>Rattus rattus</i>	psi(.)p(grass density)	75.3	0.41
	psi(forest)p(.)	76.9	0.19
	psi(.)p(.)	76.9	0.19
<i>Didelphis virginiana</i>	psi(forest)p(.)	118.9	0.45
	psi(.)p(.)	119.9	0.27
<i>Procyon lotor</i>	psi(.)p(.)	129.0	0.39
	psi(.)p(total obstruction)	129.7	0.27
	psi(avg. canopy height)p(.)	130.5	0.18
	psi(forested)p(.)	130.9	0.15
<i>Lynx rufus</i>	psi(.)p(.)	123.8	0.47
	psi(forested)p(.)	124.5	0.32
	psi(.)p(total obstruction)	125.7	0.18
<i>Peromyscus gossypinus</i>	psi(habitat)p(grass density)	311.0	0.93
<i>Sciurus carolinensis</i>	psi(.)p(.)	30.3	0.42
	psi(forested)p(.)	31.5	0.24
	psi(canopy)p(.)	32.3	0.16
	psi(.)p(total obstruction)	32.3	0.15
<i>Sylvilagus palustris</i>	psi(.)p(grass density)	217.9	0.84
<i>Dasyus novemcinctus</i>	psi(.)p(.)	37.1	0.42
	psi(.)p(grass density)	38.4	0.22
	psi(.)p(total obstruction)	38.8	0.18
	psi(forested)p(.)	39.1	0.16
<i>Lutra canadensis</i>	psi(habitat)p(total obstruction)	54.5	0.31
	psi(.)p(total obstruction)	55.2	0.22
	psi(.)p(.)	55.4	0.20
	psi(habitat)p(.)	55.7	0.17
<i>Canis latrans</i>	psi(.)p(.)	77.1	0.43
	psi(forested)p(.)	77.9	0.29

Table 23. Proportion area occupied results for Everglades National Park for those species for which Psi could be estimated. These results are for all cameras during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009 and show the results of models with weights ≥ 0.10 .

Everglades National Park			
Species	Model	AIC or QAIC	Model weight
<i>Sigmodon hispidus</i>	psi(.)p(.)	31.9	0.42
	psi(.)p(grass density)	32.8	0.27
	psi(forested)p(.)	33.9	0.16
	psi(.)p(total obstruction)	33.9	0.15
<i>Oryzomys palustris</i>	psi(habitat)p(.)	399.1	0.41
	psi(habitat)p(grass density)	399.6	0.32
	psi(habitat)p(total obstruction)	400.9	0.17
<i>Rattus rattus</i>	psi(habitat)p(.)	199.3	0.48
	psi(habitat)p(total obstruction)	200.0	0.34
	psi(habitat)p(grass density)	201.3	0.18
<i>Didelphis virginiana</i>	psi(avg. canopy height)p(.)	166.0	1.00
<i>Procyon lotor</i>	psi(habitat)p(.)	83.1	0.69
	psi(habitat)p(total obstruction)	84.8	0.30
<i>Peromyscus gossypinus</i>	psi(.)p(grass density)	217.1	0.43
	psi(habitat)p(grass density)	218.4	0.23
	psi(.)p(.)	219.6	0.12
	psi(.)p(total obstruction)	219.7	0.12
<i>Sciurus carolinensis</i>	psi(.)p(.)	53.6	0.42
	psi(canopy)p(.)	55.1	0.20
	psi(.)p(total obstruction)	55.3	0.18
	psi(forested)p(.)	55.5	0.16
<i>Canis latrans</i>	psi(.)p(total obstruction)	69.3	0.56
	psi(.)p(.)	70.7	0.28
	psi(forested)p(.)	72.1	0.14

Table 24. Universal Transverse Mercator coordinates (UTMs) showing locations of black rats and raccoons on the islands of Florida Bay during a small and medium mammal inventory in Everglades National Park, South Florida, USA from 2007-2009.

Species	UTME	UTMN	Key
Black rat	521308	2772786	Jim Foot
	539077	2772291	Manatee Key
	549112	2781532	Nest Key
	505775	2776982	Murray Key
	525781	2761437	Twin Key
	511860	2776952	Palm Key
	533365	2775714	Club Key
	525980	2771020	Whipray Key
	527797	2775914	End Key
	509033	2776256	Frank Key
	536611	2777254	Black Betsy 2
	546312	2785212	Deer Key
	536122	2779720	Black Betsy 1
Raccoon	539548	2784387	Eagle Key
	530669	2778195	Samphire Key
	536122	2779720	Black Betsy 1
	533365	2775714	Club Key
	536611	2777254	Black Betsy 2
	539077	2772291	Manatee Key
	525980	2771020	Whipray Key
	527797	2775914	End Key

Table 25. Current checklist of small and medium-sized mammals detected during a small and medium mammal inventory in Everglades National Park and Big Cypress National Preserve, South Florida, USA from 2007-2009.

Species	EVER	BICY
Opossum	X	X
Short-tailed shrew	X	X
Least shrew	X	Hypothetical
Nine-banded armadillo	X	X
Marsh rabbit	X	X
Eastern cottontail	X	X
Gray squirrel	X	X
Fox squirrel	X	X
Rice rat	X	X
Cotton mouse	X	X
Cotton rat	X	X
House mouse	X	X
Round-tailed muskrat	Hypothetical	X
Gray fox	X	X
Domestic dog	X	X
Domestic cat	X	X
Raccoon	X	X
Everglades mink	Hypothetical	X
Eastern spotted skunk	Hypothetical	X
River otter	X	X
Bobcat	X	X
Coyote	X	X

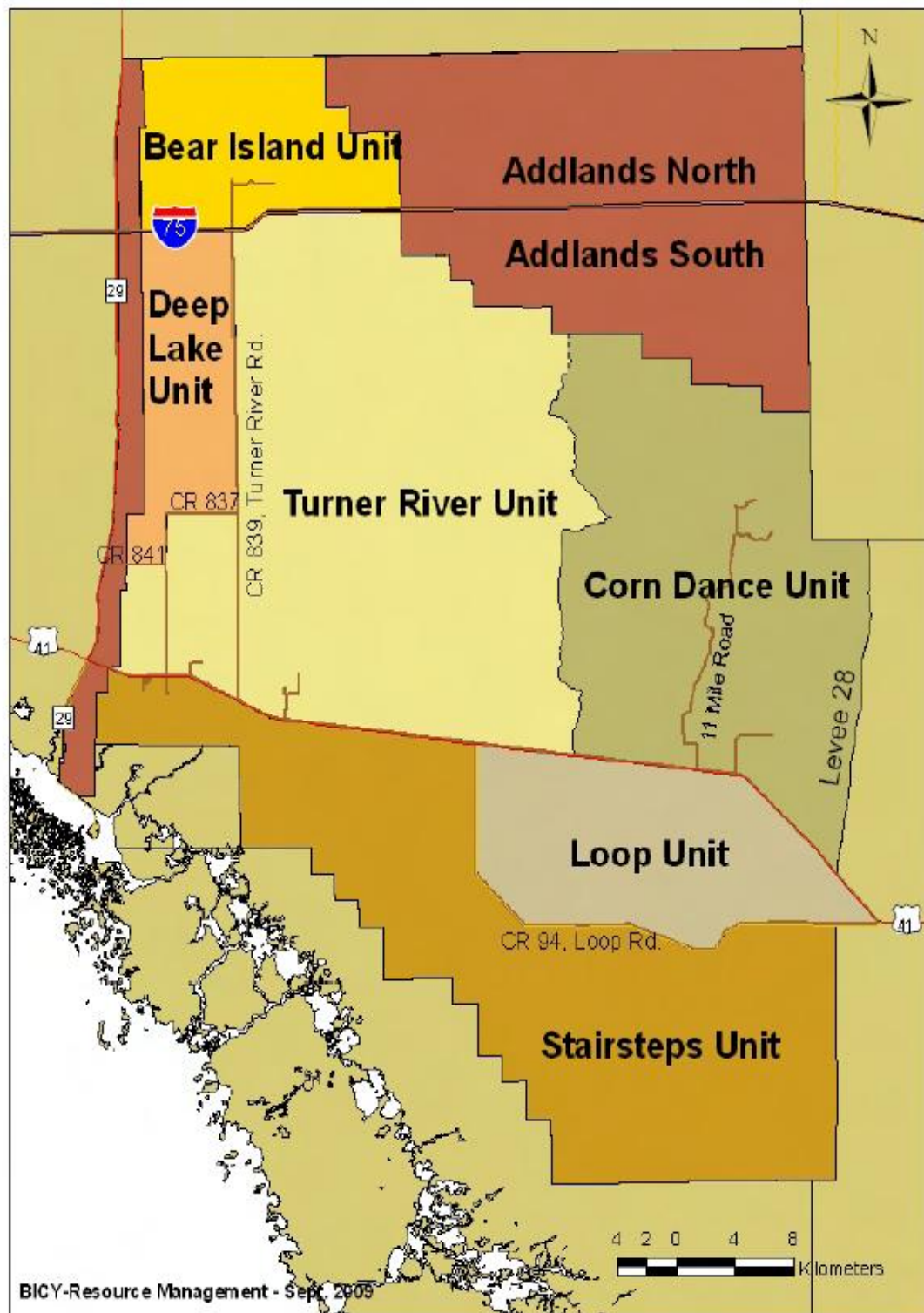


Figure 2. Big Cypress National Preserve management units (from Jansen et al. 2005).

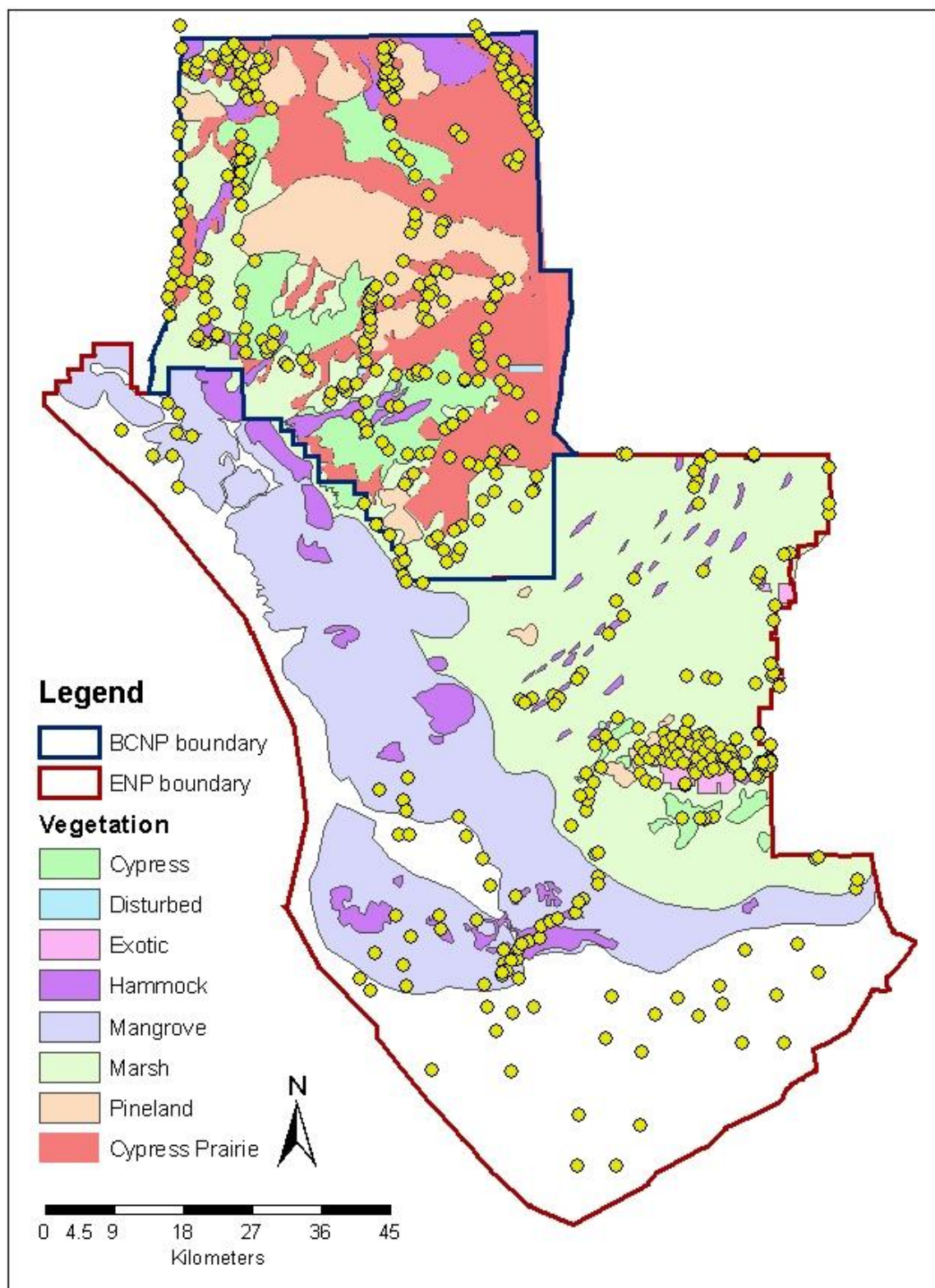


Figure 3. Temporary camera locations during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

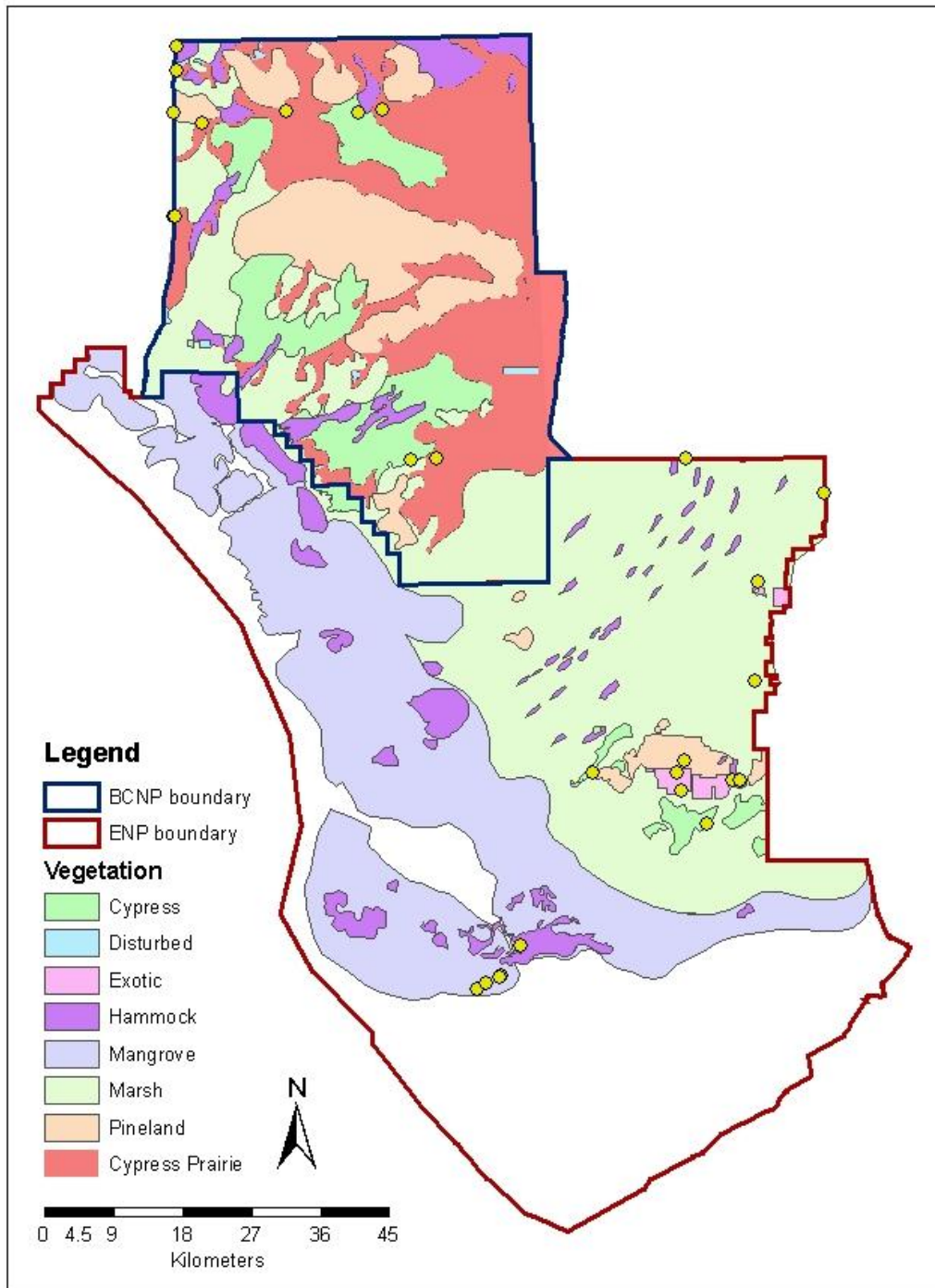


Figure 4. Permanent camera locations during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.



Figure 5. Acetate trackplate used during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

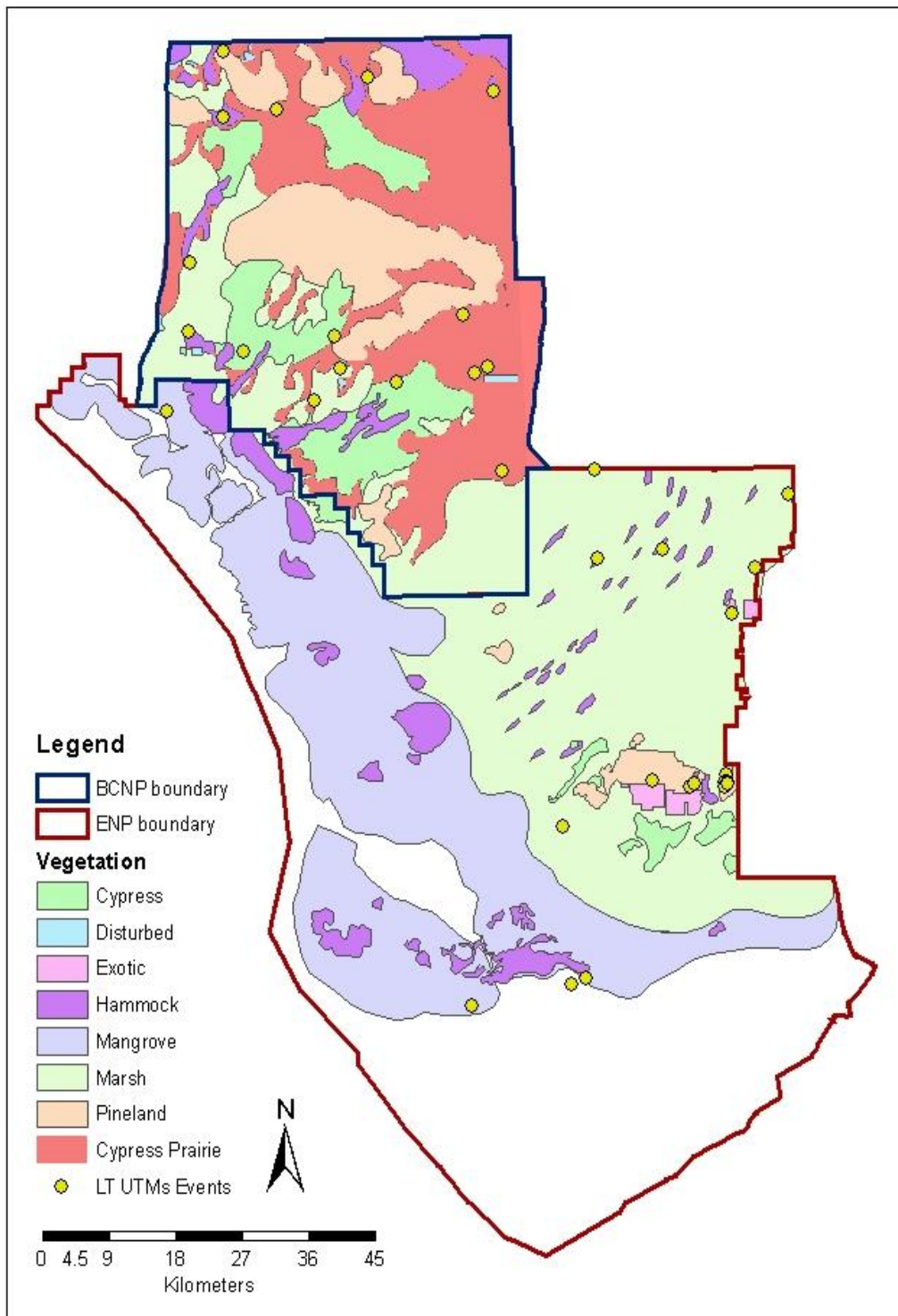


Figure 6. Live trap locations during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.



Figure 7. Floating minke raft with tunnel used during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009. Photo credit: Emily K. Pifer

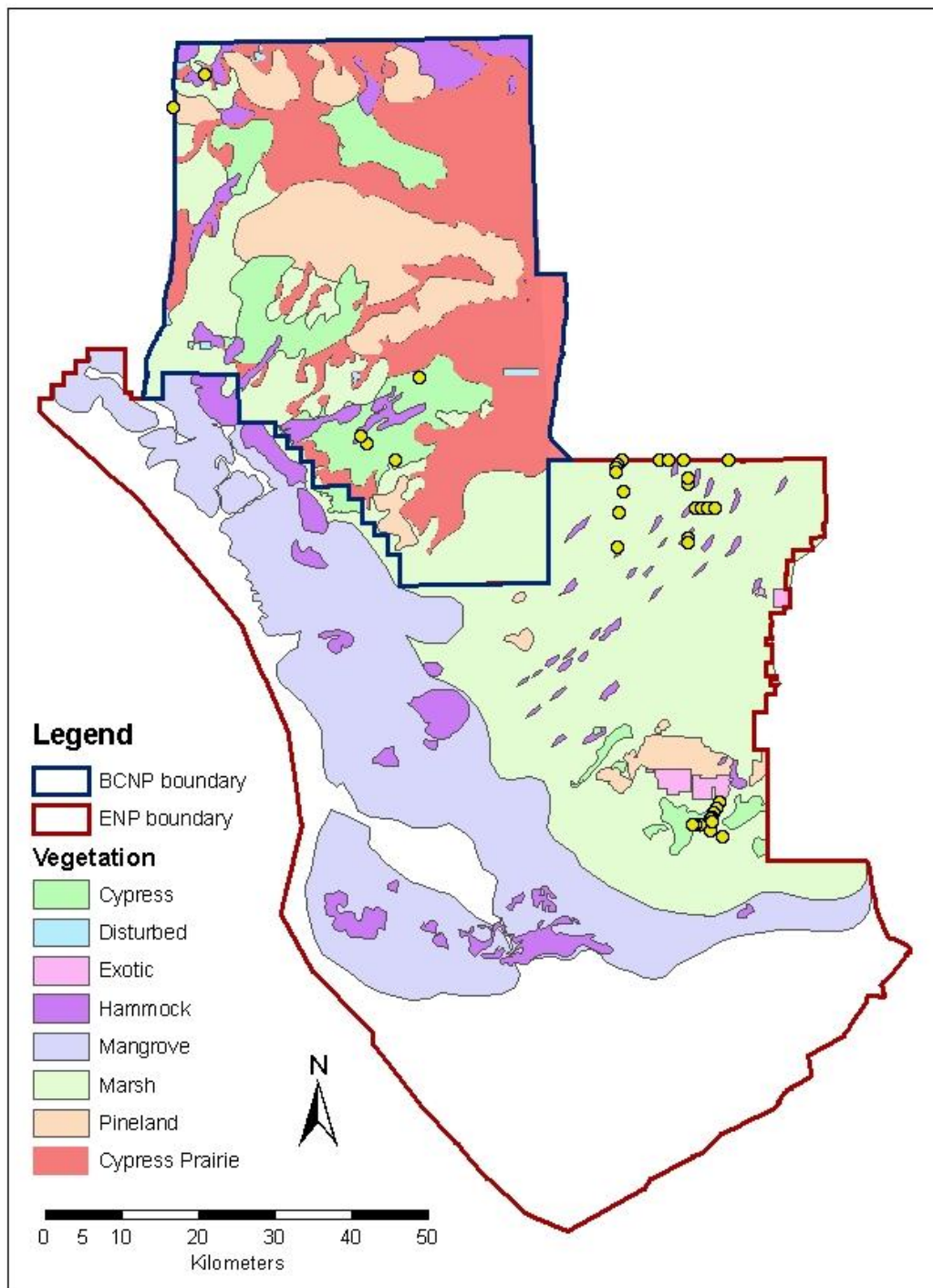


Figure 8. Mink raft locations during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.



Figure 9. Flying squirrel feeder platform used during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

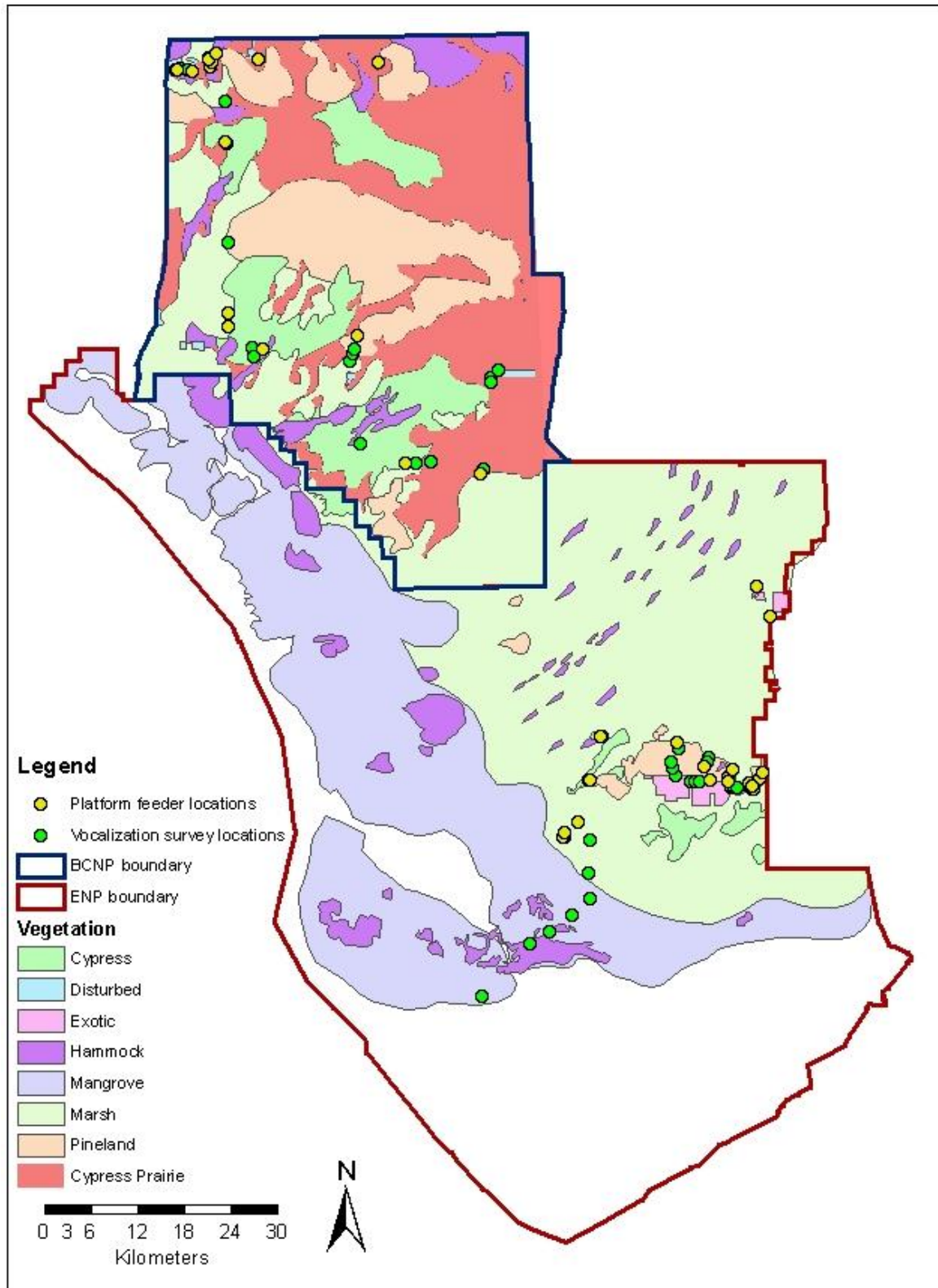


Figure 10. Flying squirrel platform feeder and vocalization survey locations during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.



Figure 11. Round-tailed muskrat lodge detected during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

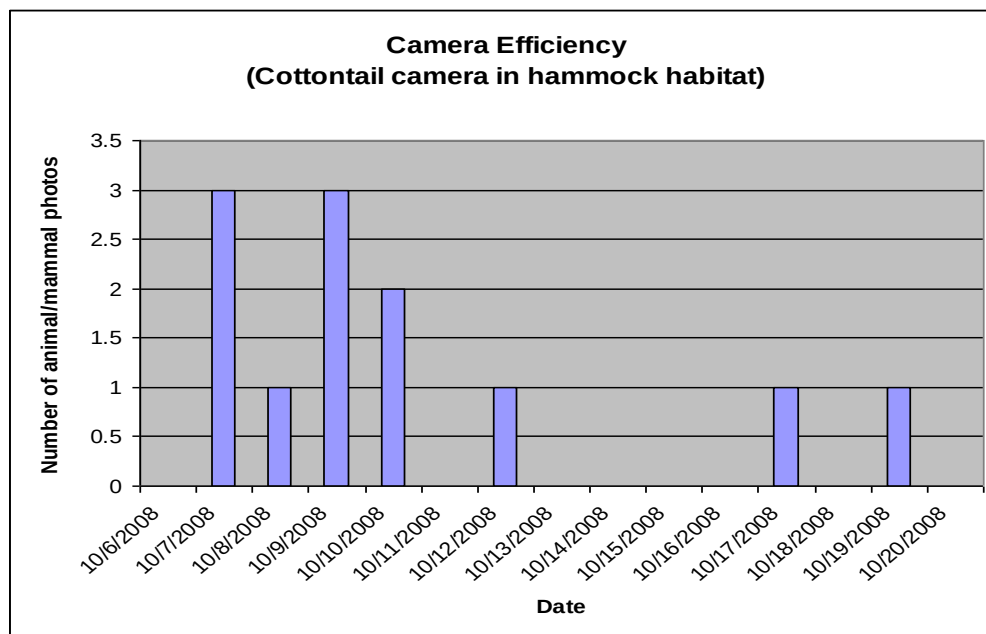
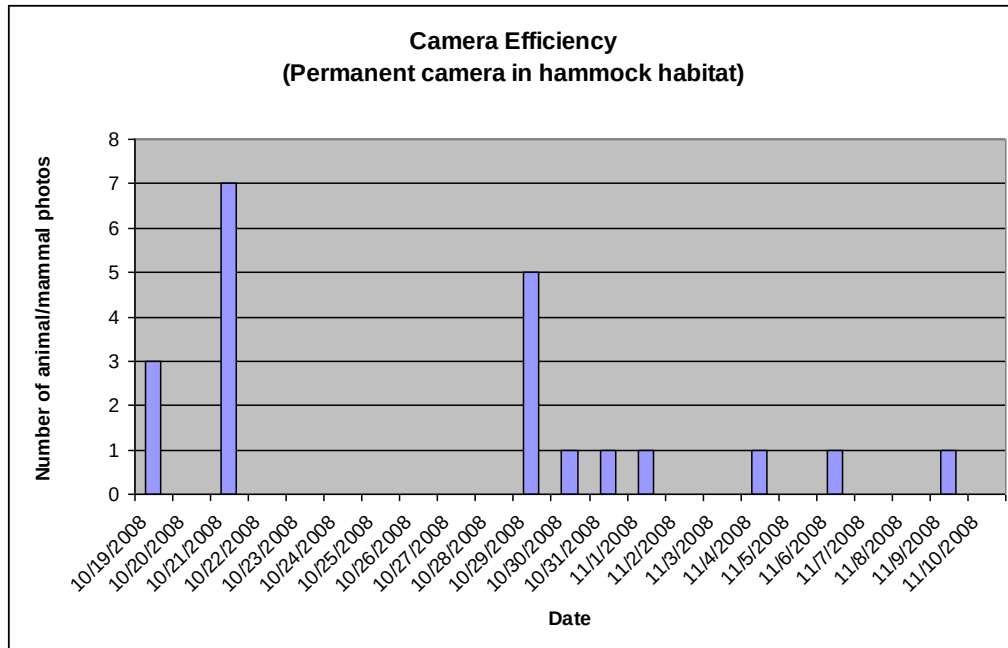


Figure 12. Camera efficiencies of one permanent, cottontail, squirrel, and mink camera during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009. These show the number of other animals as well as mammals captured throughout the entire camera session. Most cameras did capture animals throughout the entire session.

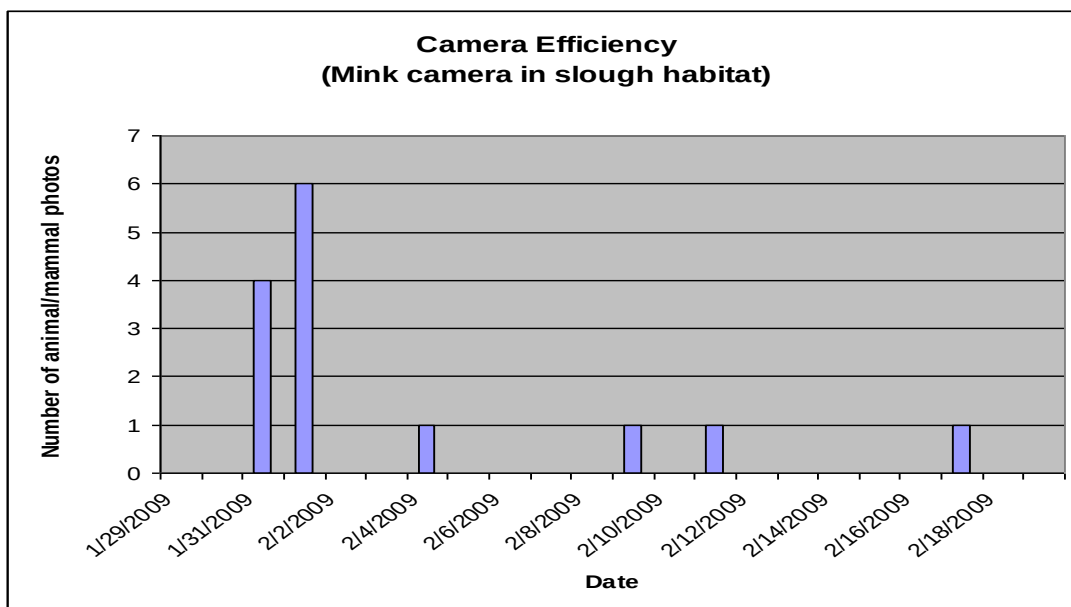
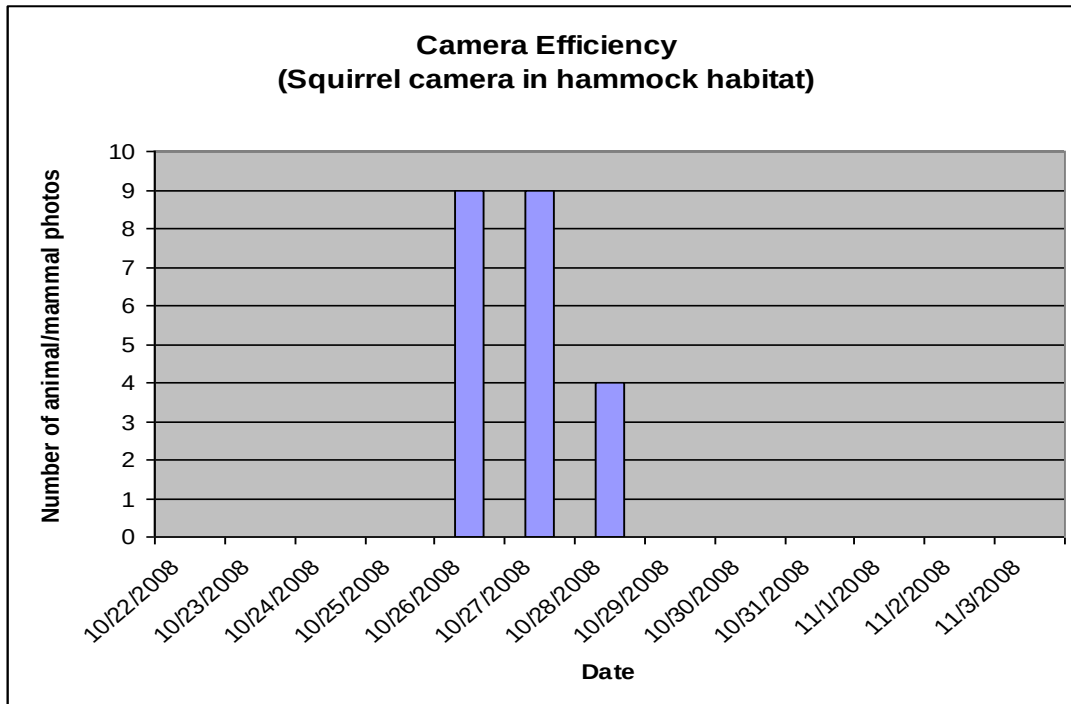


Figure 12 (continued). Camera efficiencies of one permanent, cottontail, squirrel, and mink camera during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009. These show the number of other animals as well as mammals captured throughout the entire camera session. Most cameras did capture animals throughout the entire session.

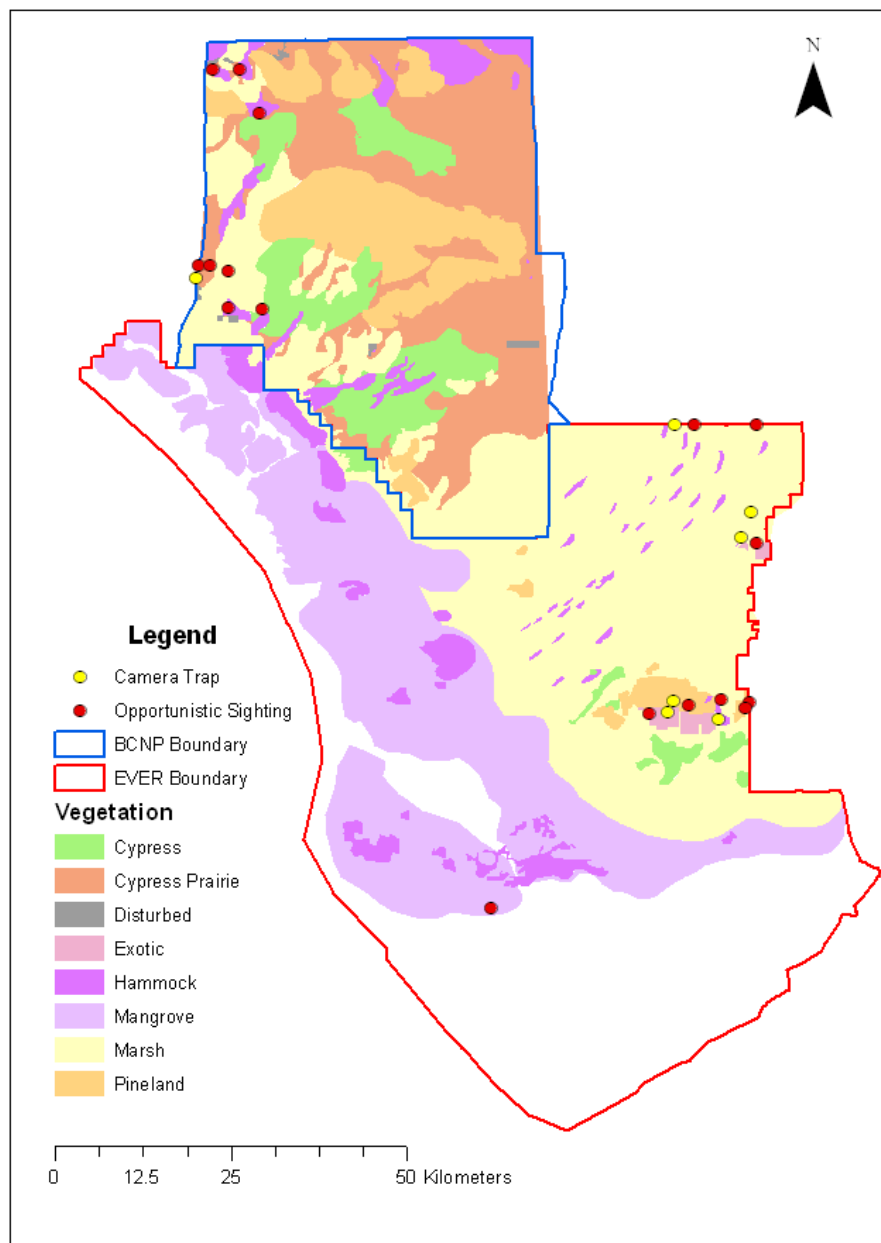


Figure 13. Locations of detected domestic dogs (*Canis familiaris*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

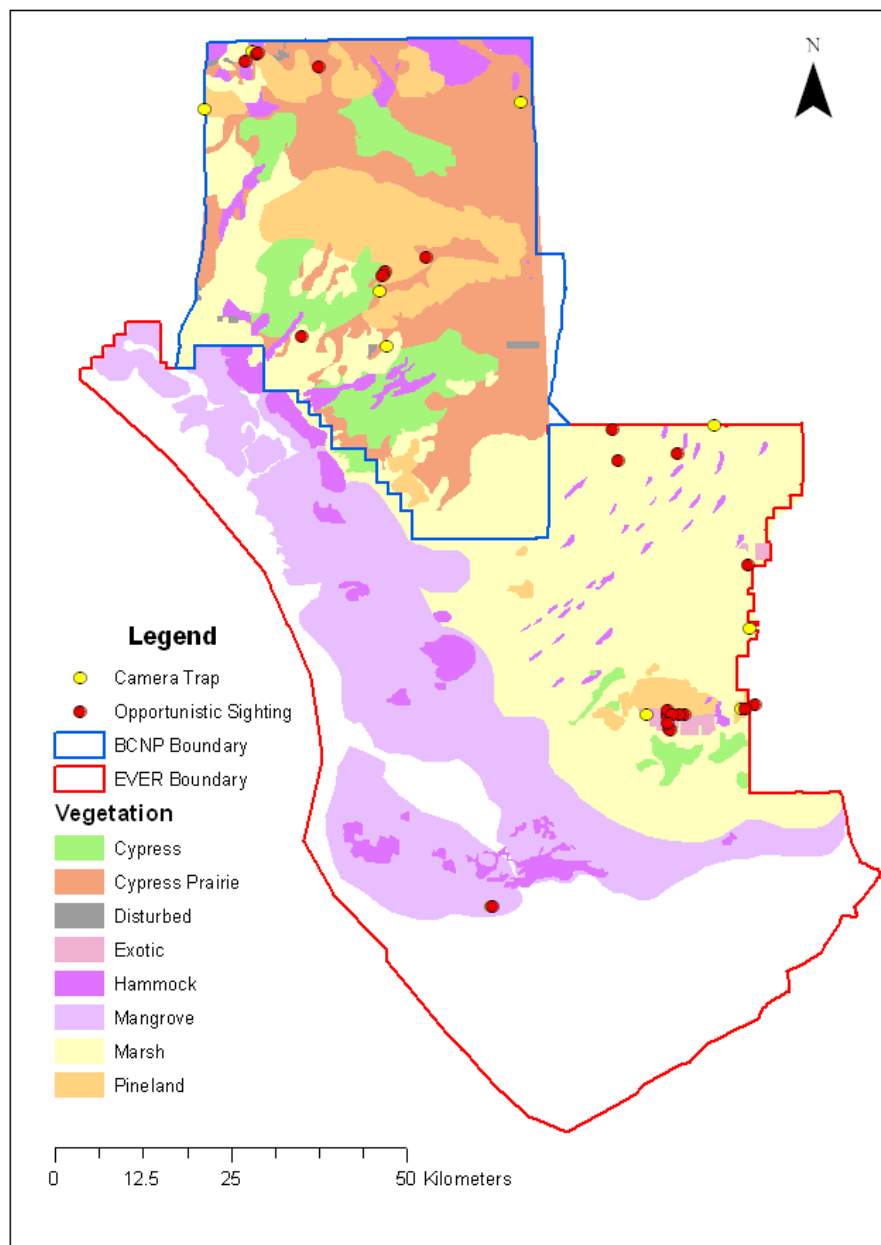


Figure 14. Locations of detected coyotes (*Canis latrans*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

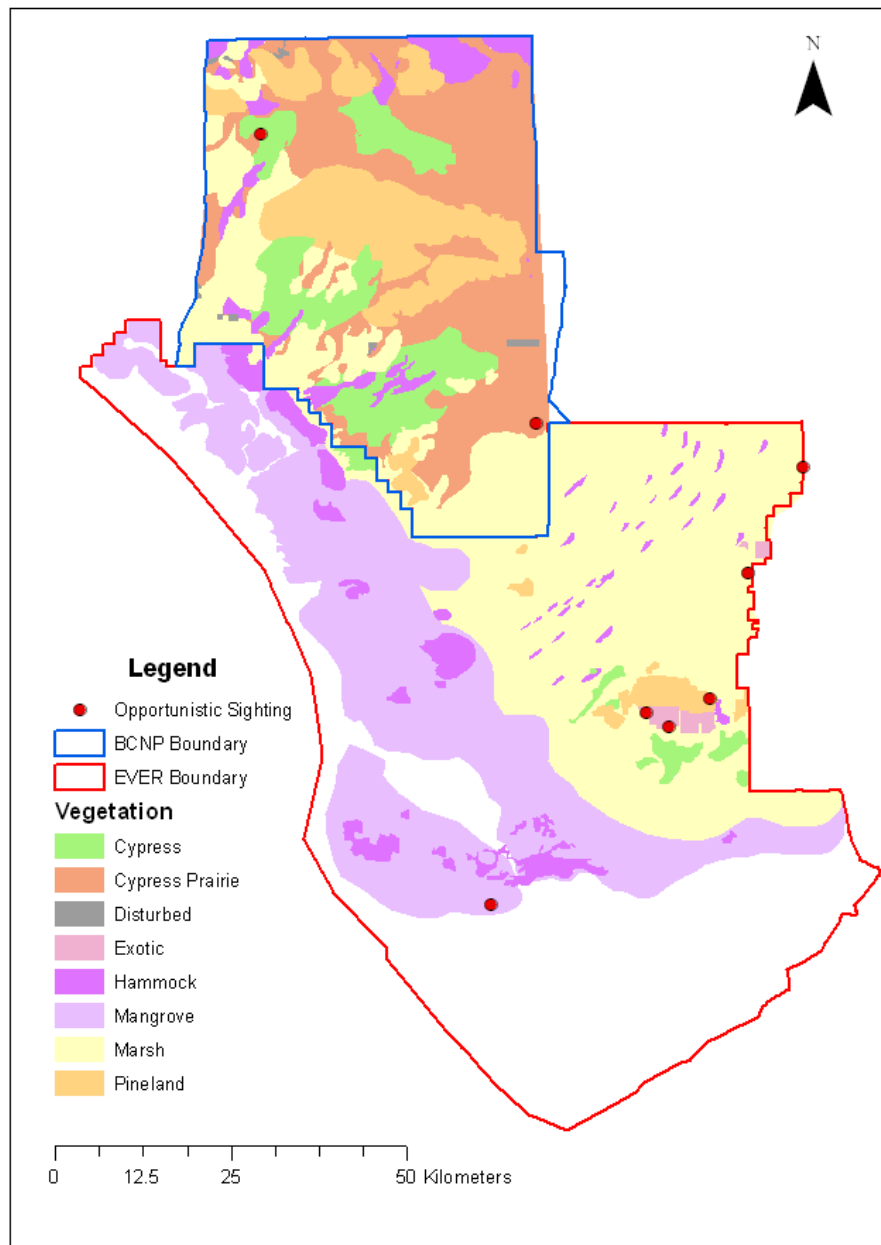


Figure 15. Locations of detected gray foxes (*Urocyon cinereoargenteus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

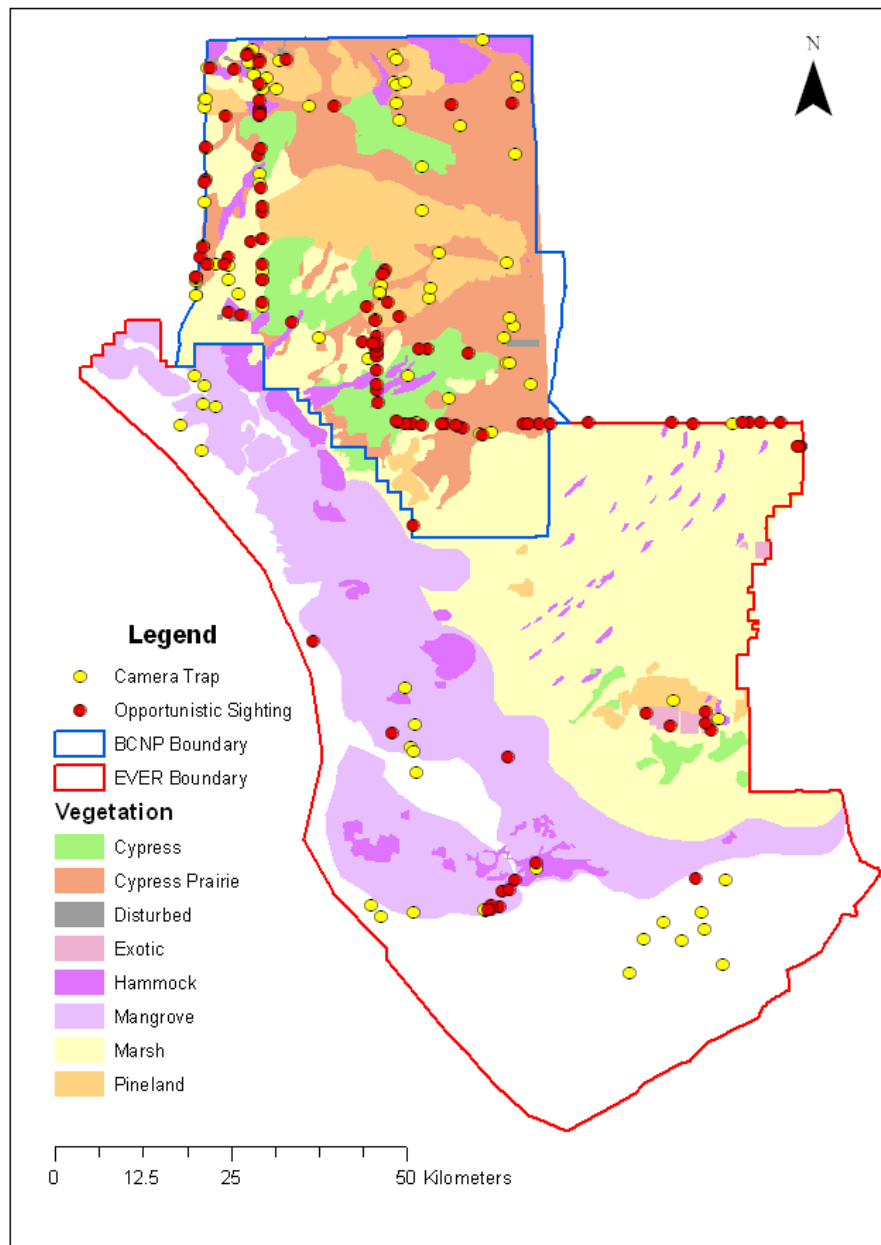


Figure 16. Locations of detected raccoons (*Procyon lotor*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

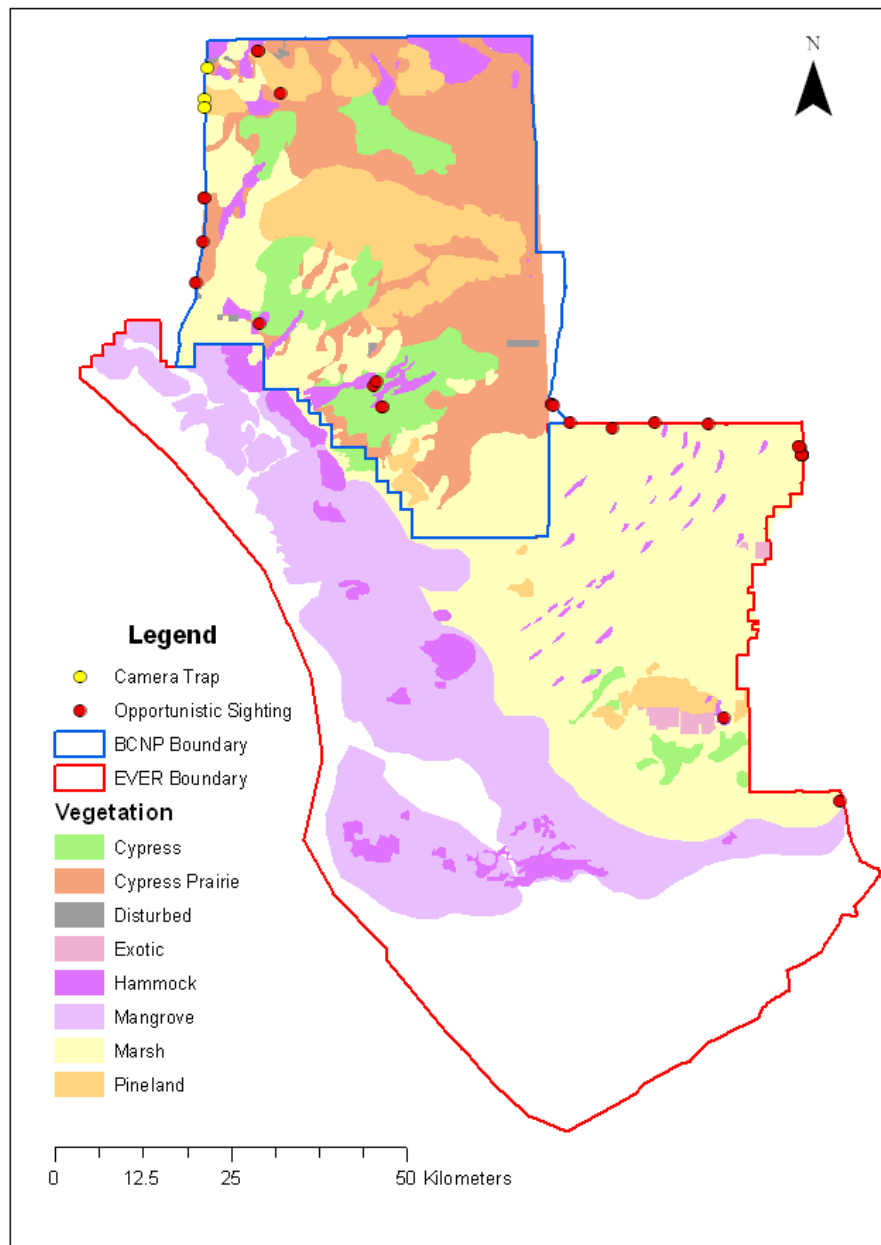


Figure 17. Locations of detected river otters (*Lutra canadensis*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

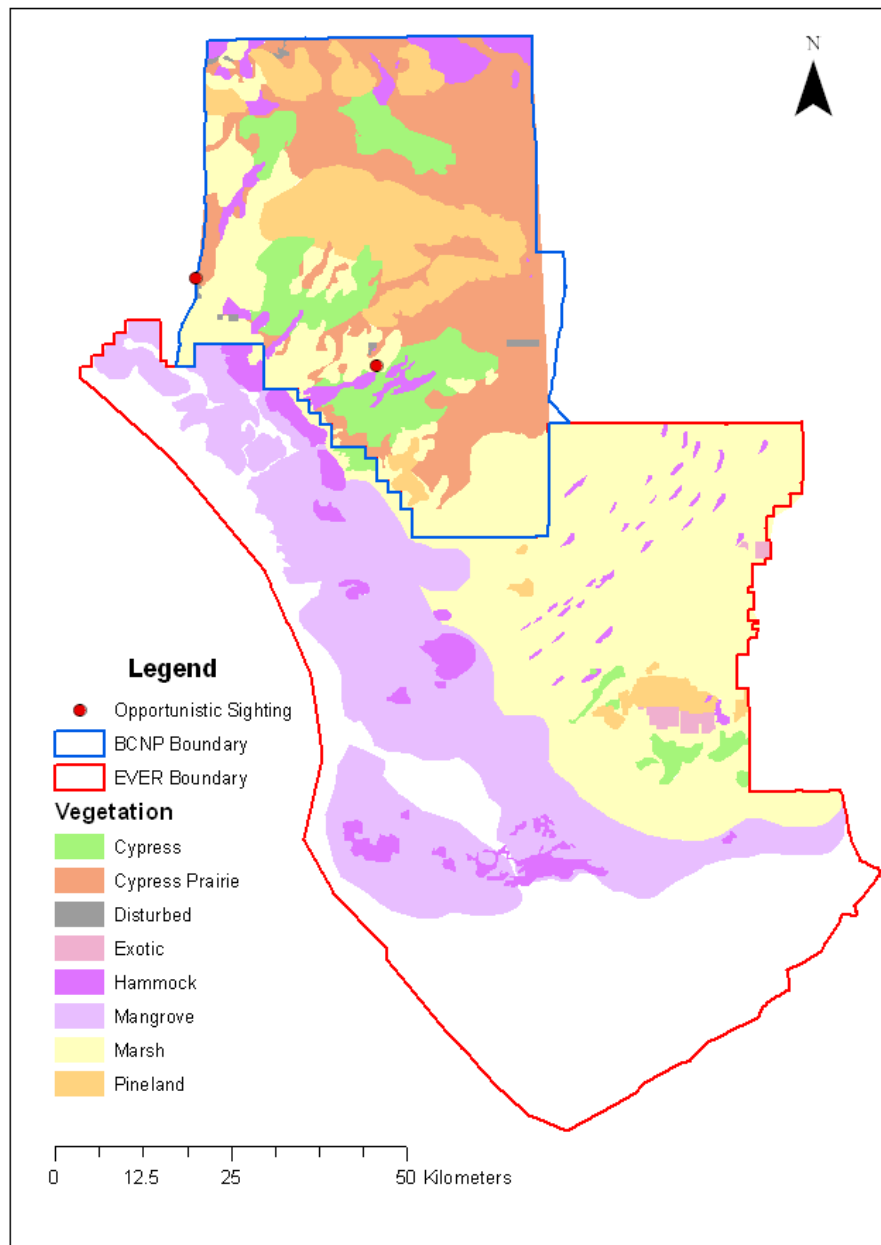


Figure 18. Locations of detected mink (*Mustela vison*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

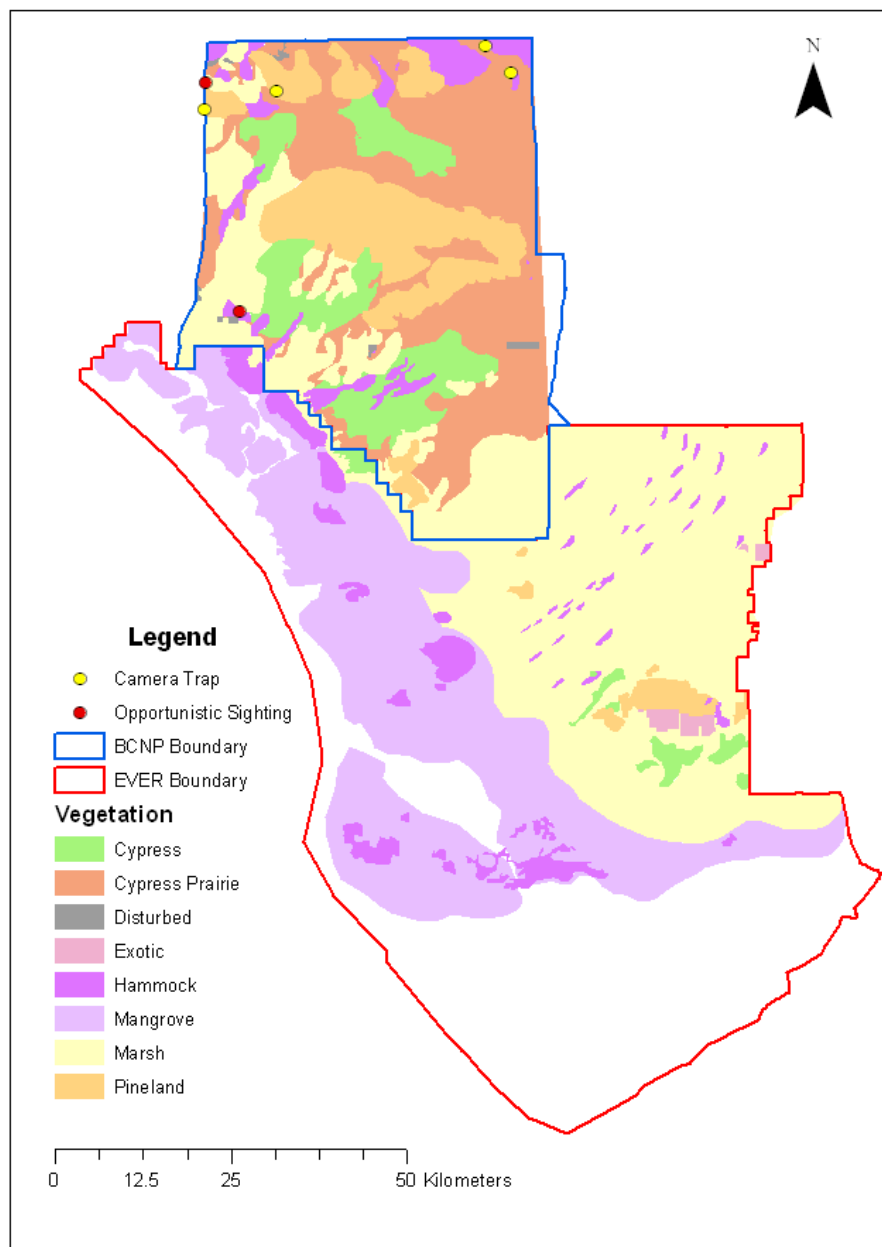


Figure 19. Locations of detected eastern spotted skunks (*Spilogale putorius*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

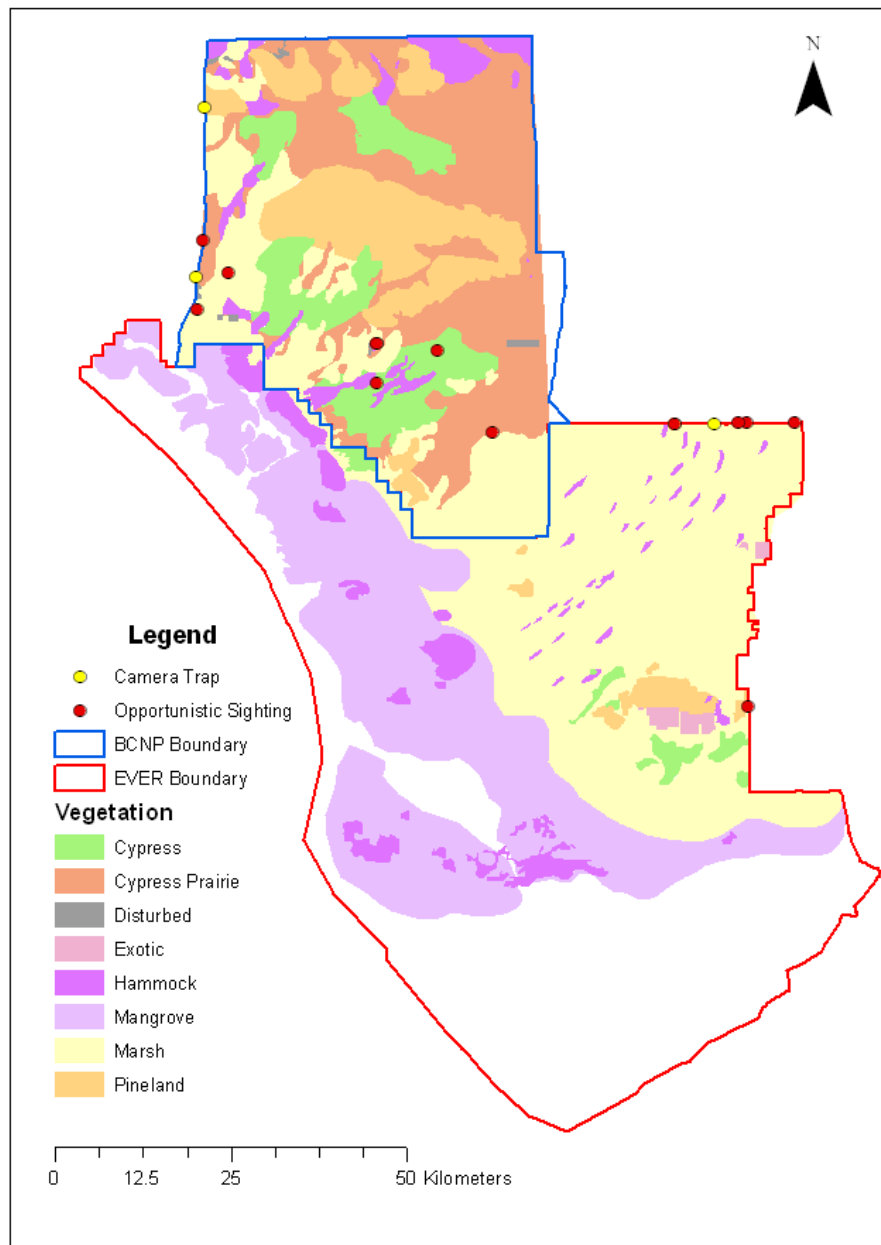


Figure 20. Locations of detected domestic cats (*Felis domesticus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

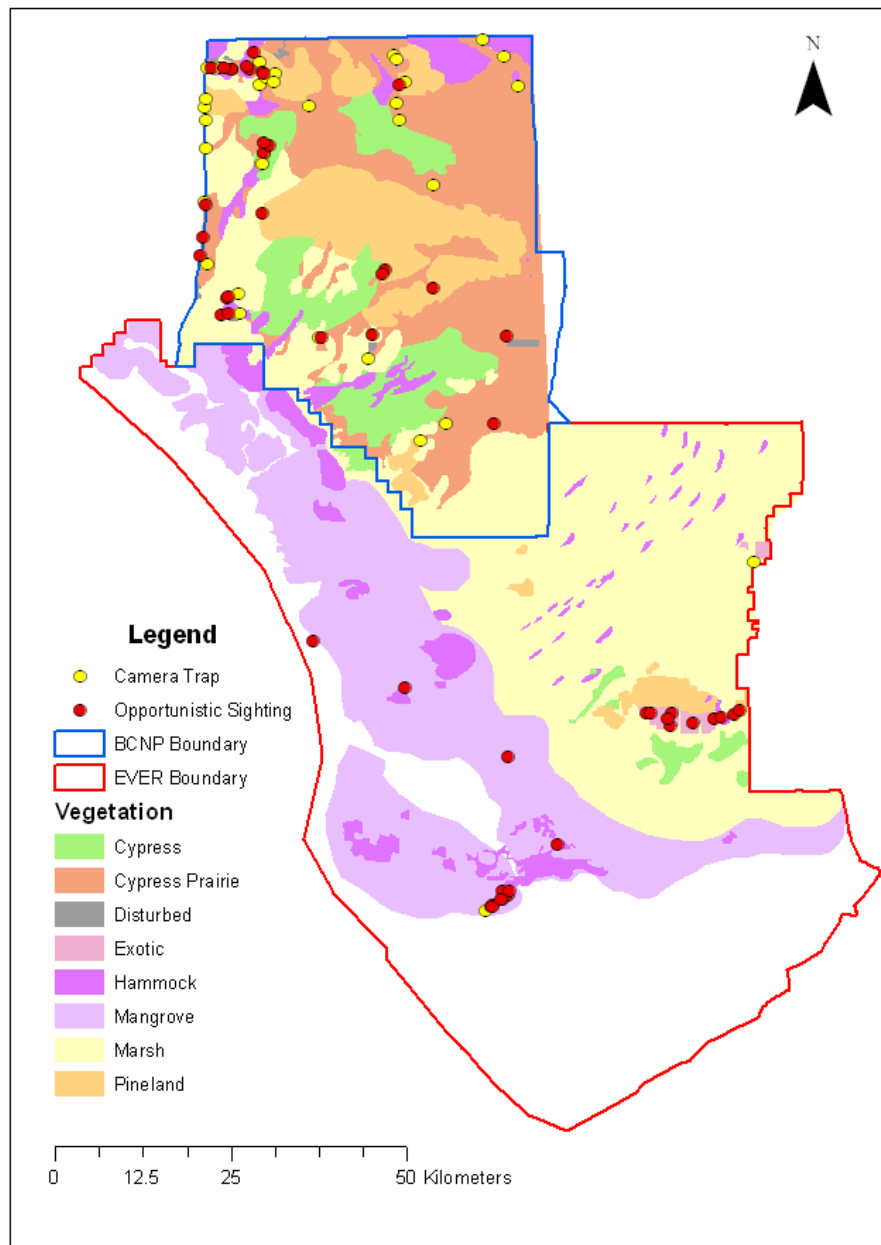


Figure 21. Locations of detected bobcats (*Lynx rufus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

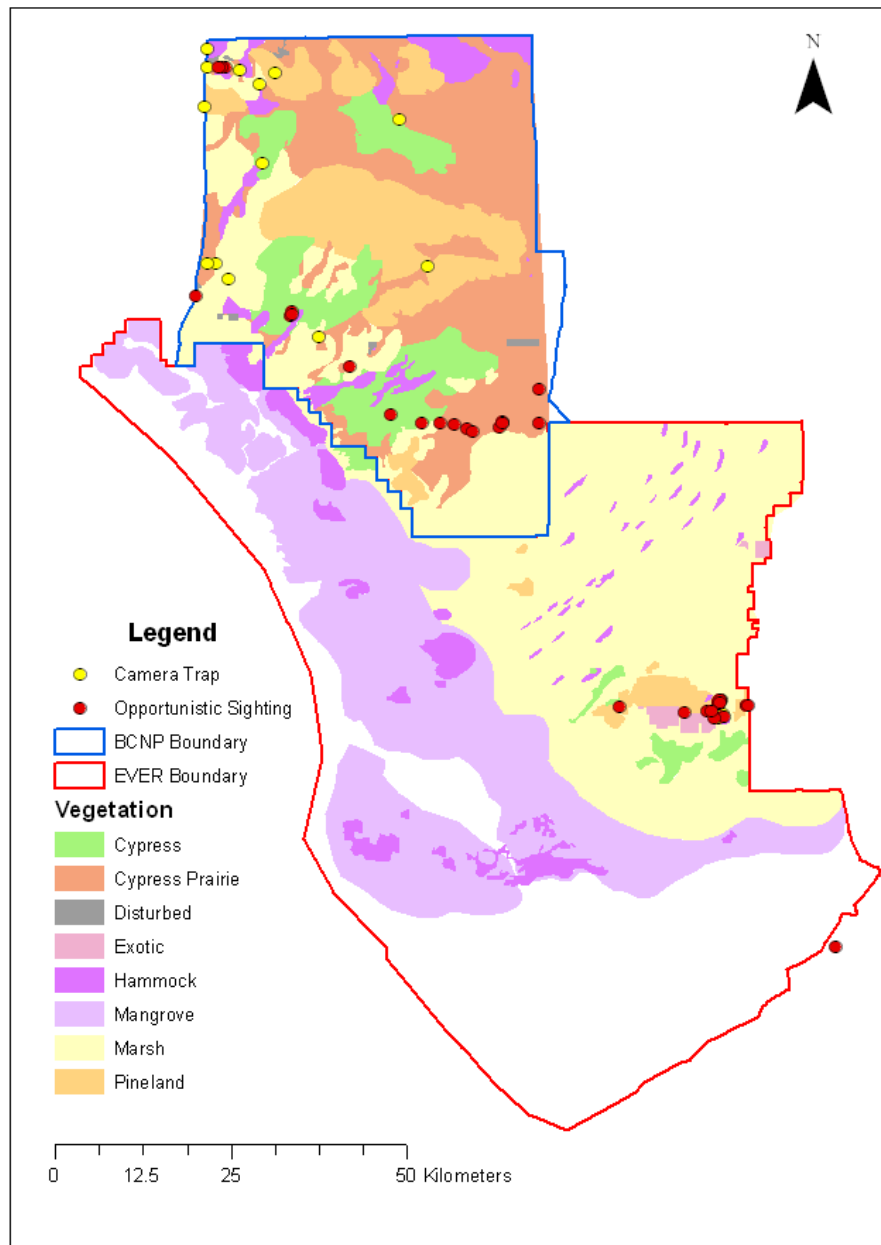


Figure 22. Locations of detected eastern gray squirrels (*Sciurus carolinensis*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

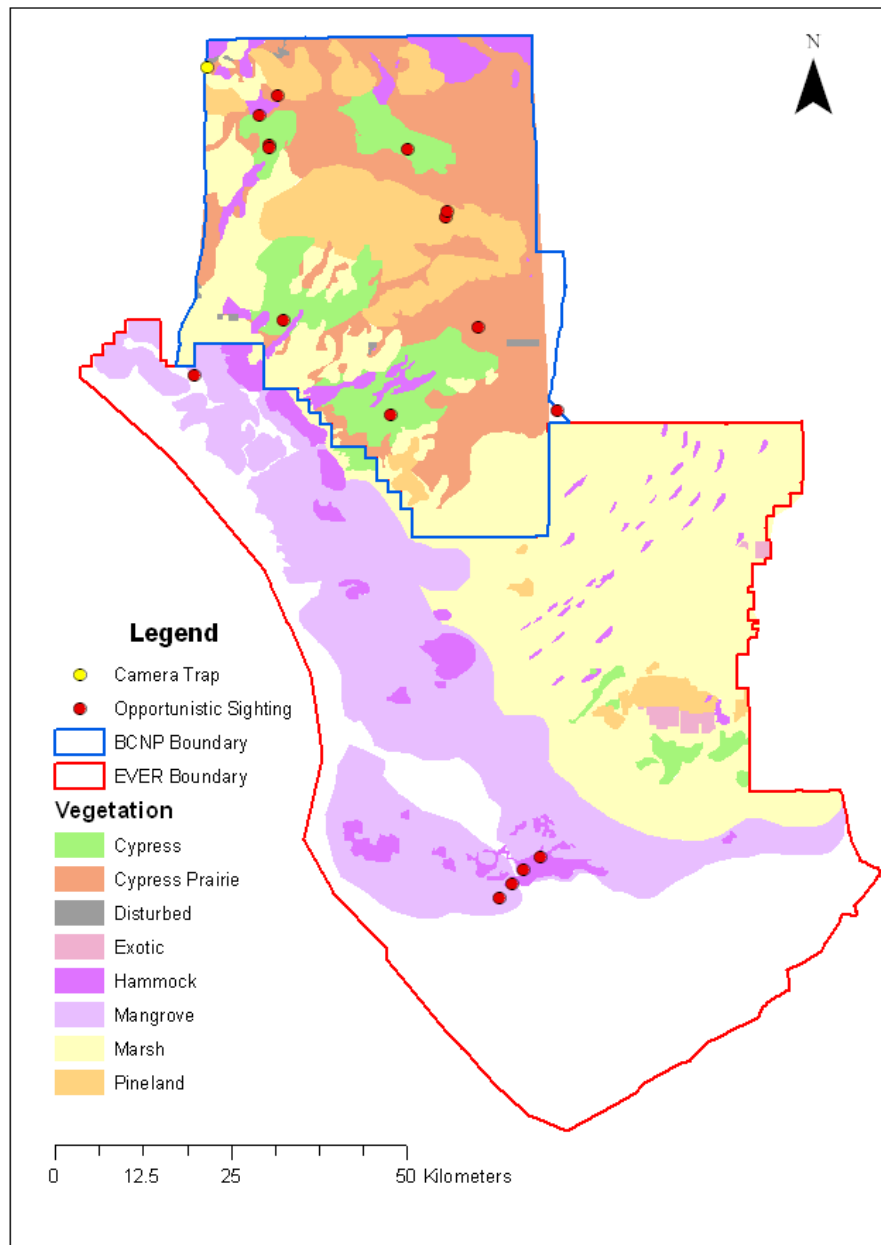


Figure 23. Locations of detected fox squirrels (*Sciurus niger*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

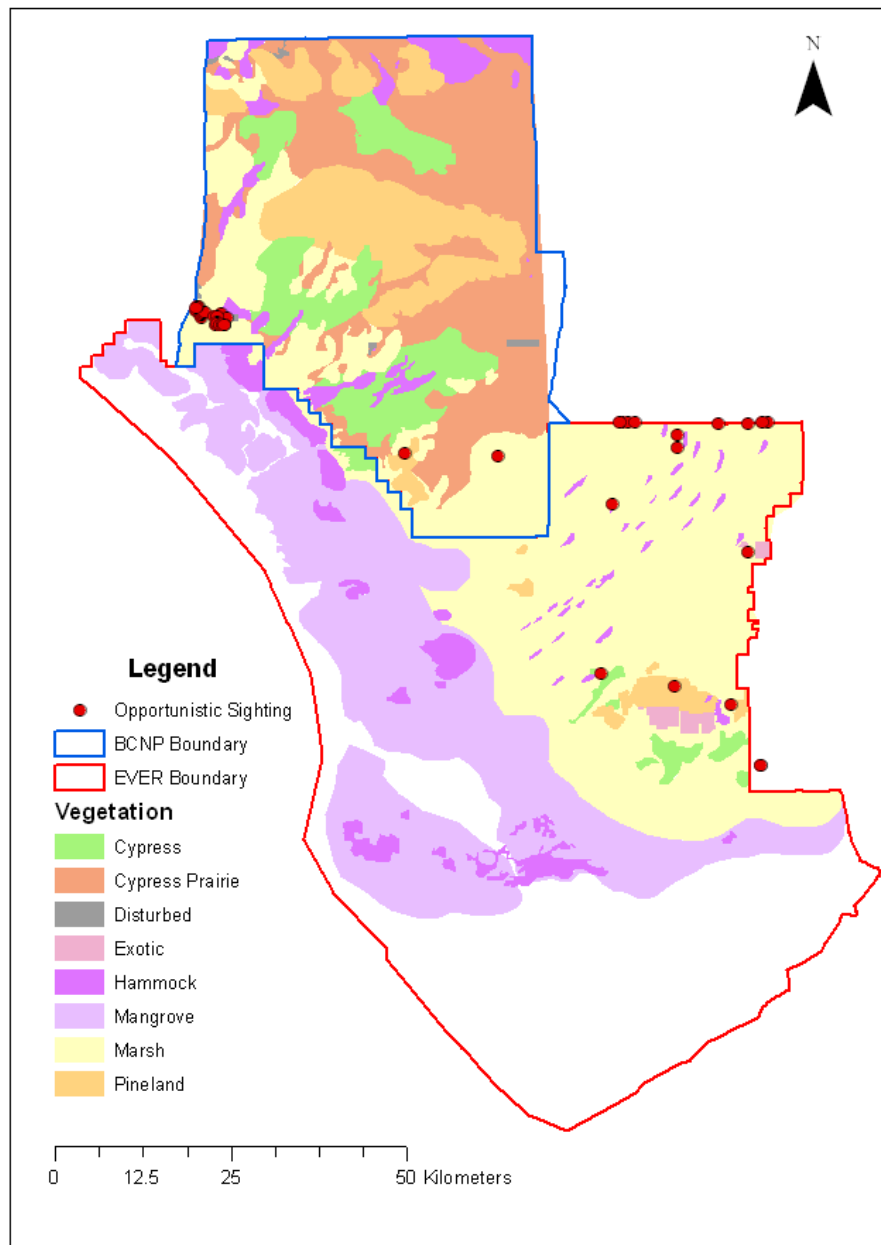


Figure 24. Locations of detected round-tailed muskrats (*Neofiber alleni*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009. These locations denote lodges and locations where pythons and owl pellets containing muskrat remains were detected. In Everglades National Park, all detections were from either owl pellets or python gut contents.

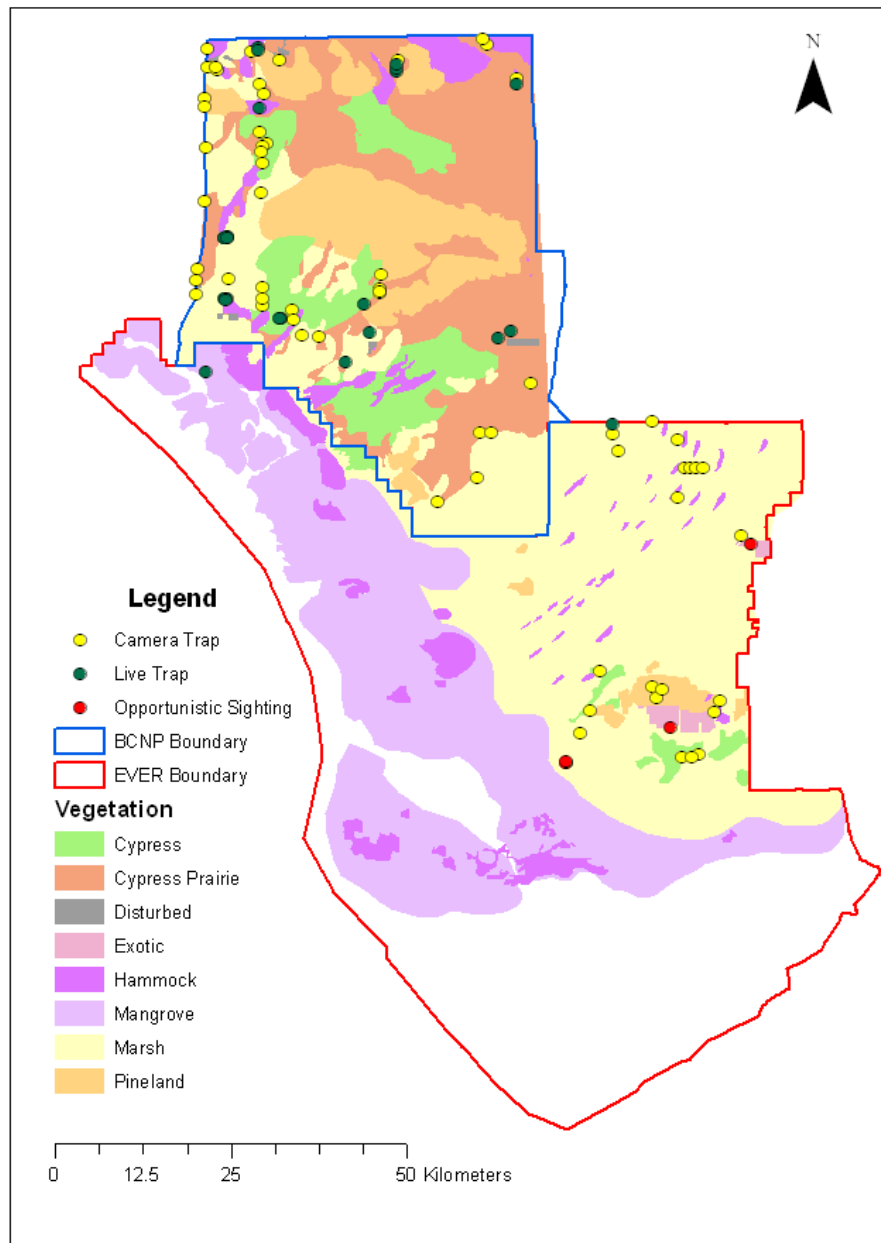


Figure 25. Locations of detected cotton mice (*Peromyscus gossypinus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

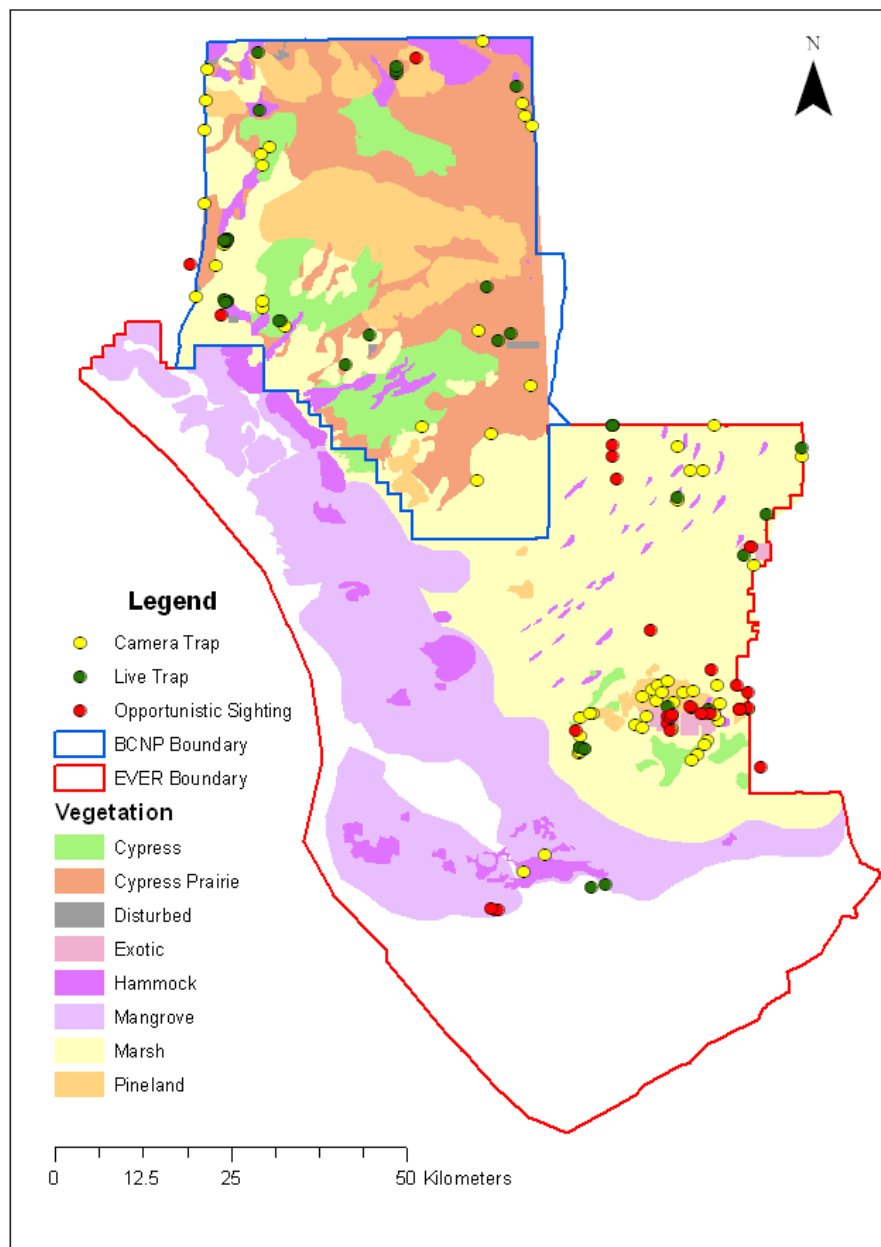


Figure 26. Locations of detected hispid cotton rats (*Sigmodon hispidus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

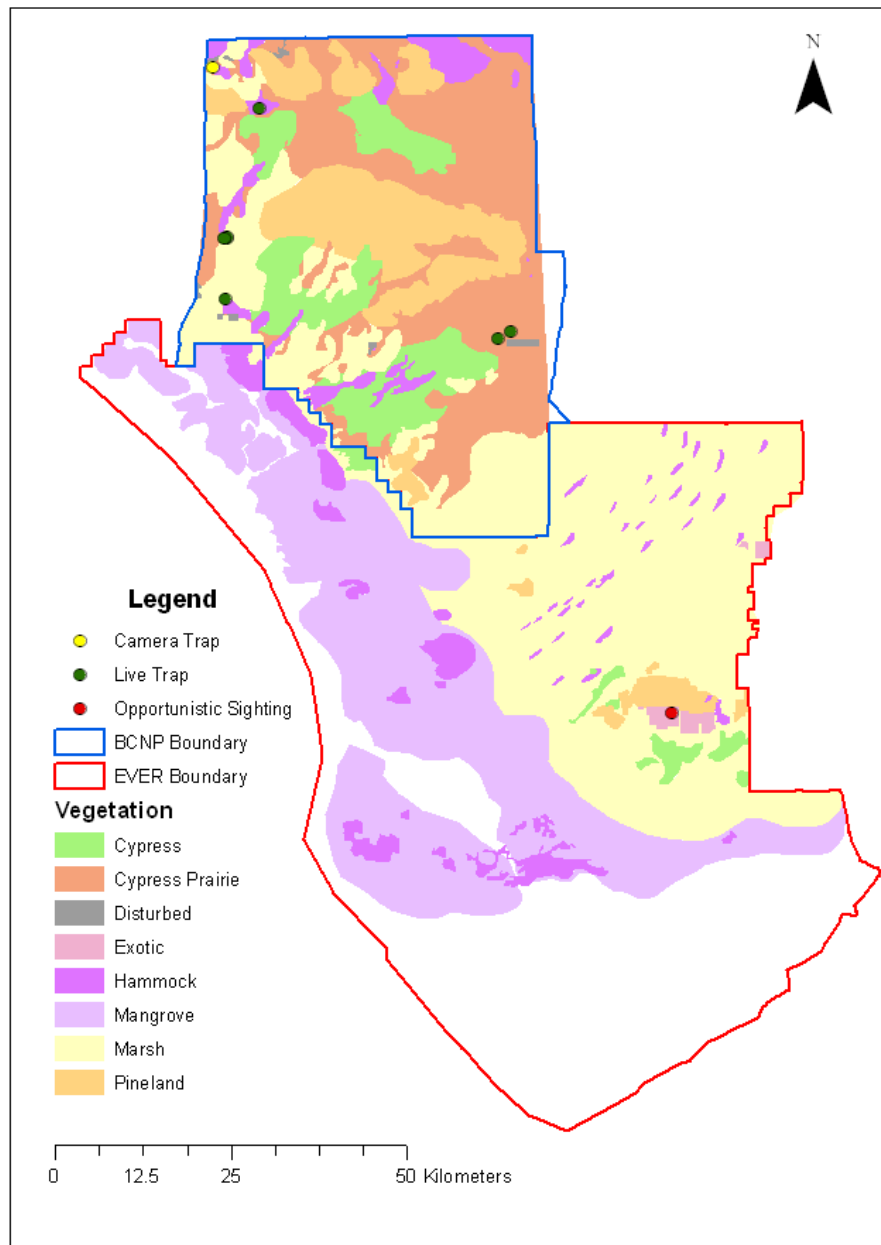


Figure 27. Locations of detected house mice (*Mus musculus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

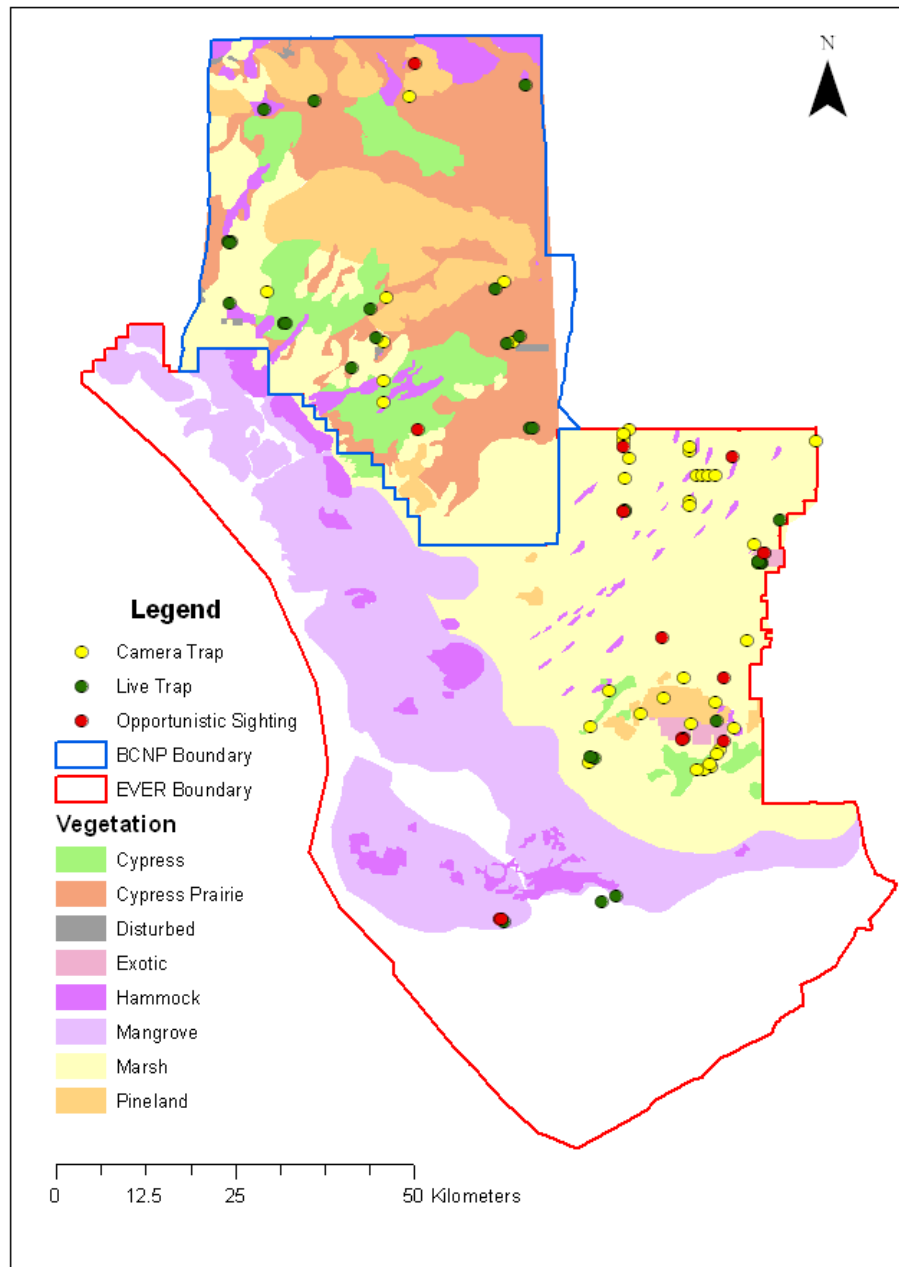


Figure 28. Locations of detected marsh rice rats (*Oryzomys palustris*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

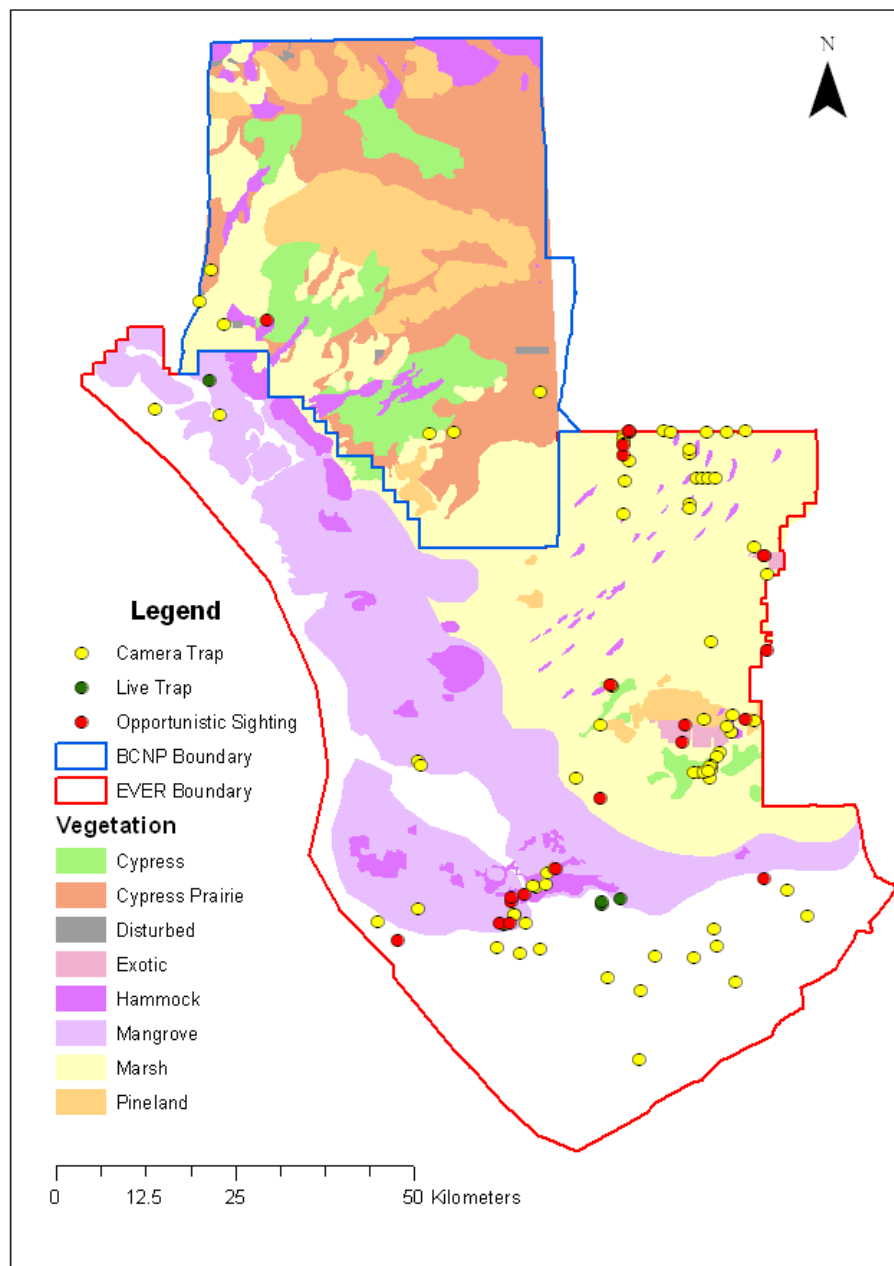


Figure 29. Locations of detected black rats (*Rattus rattus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

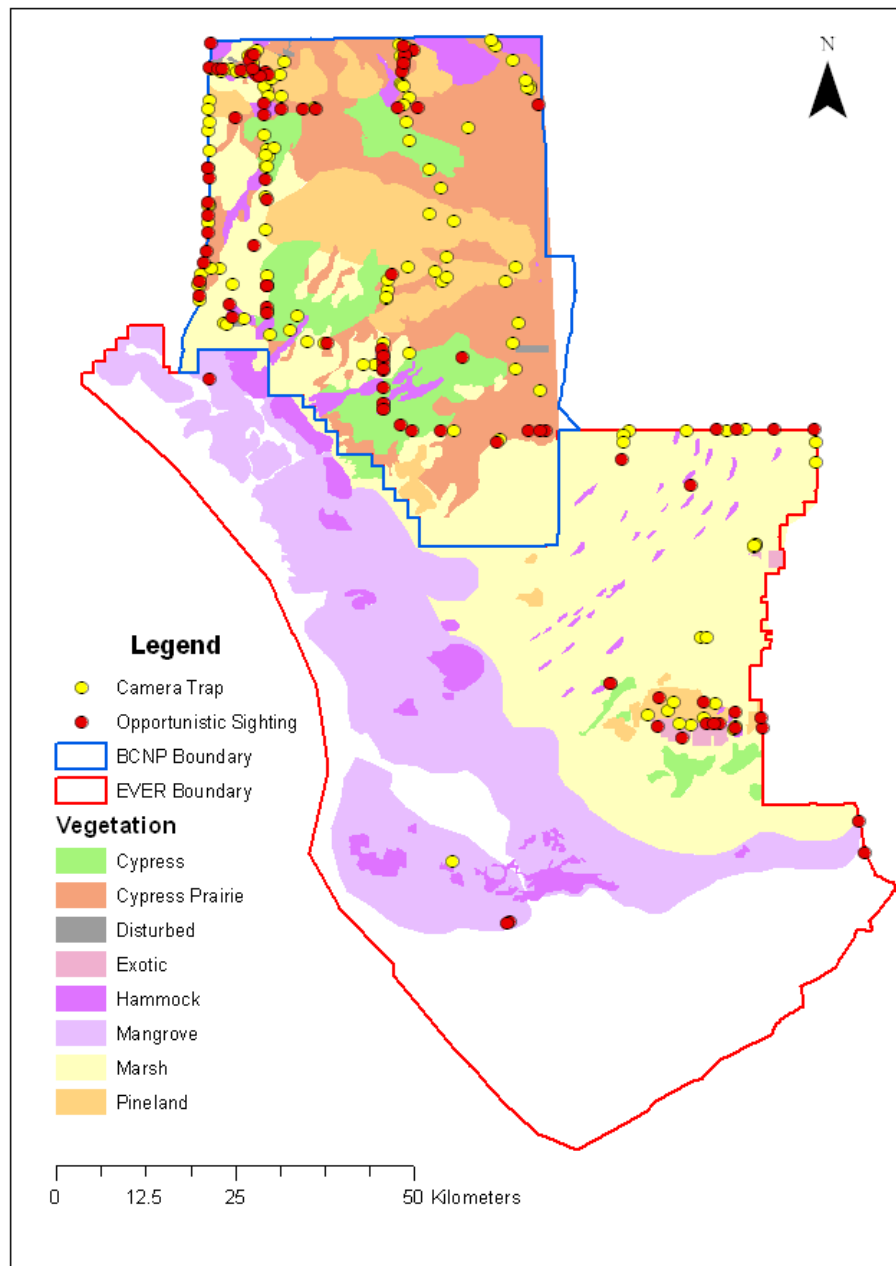


Figure 30. Locations of detected Virginia opossums (*Didelphis virginiana*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

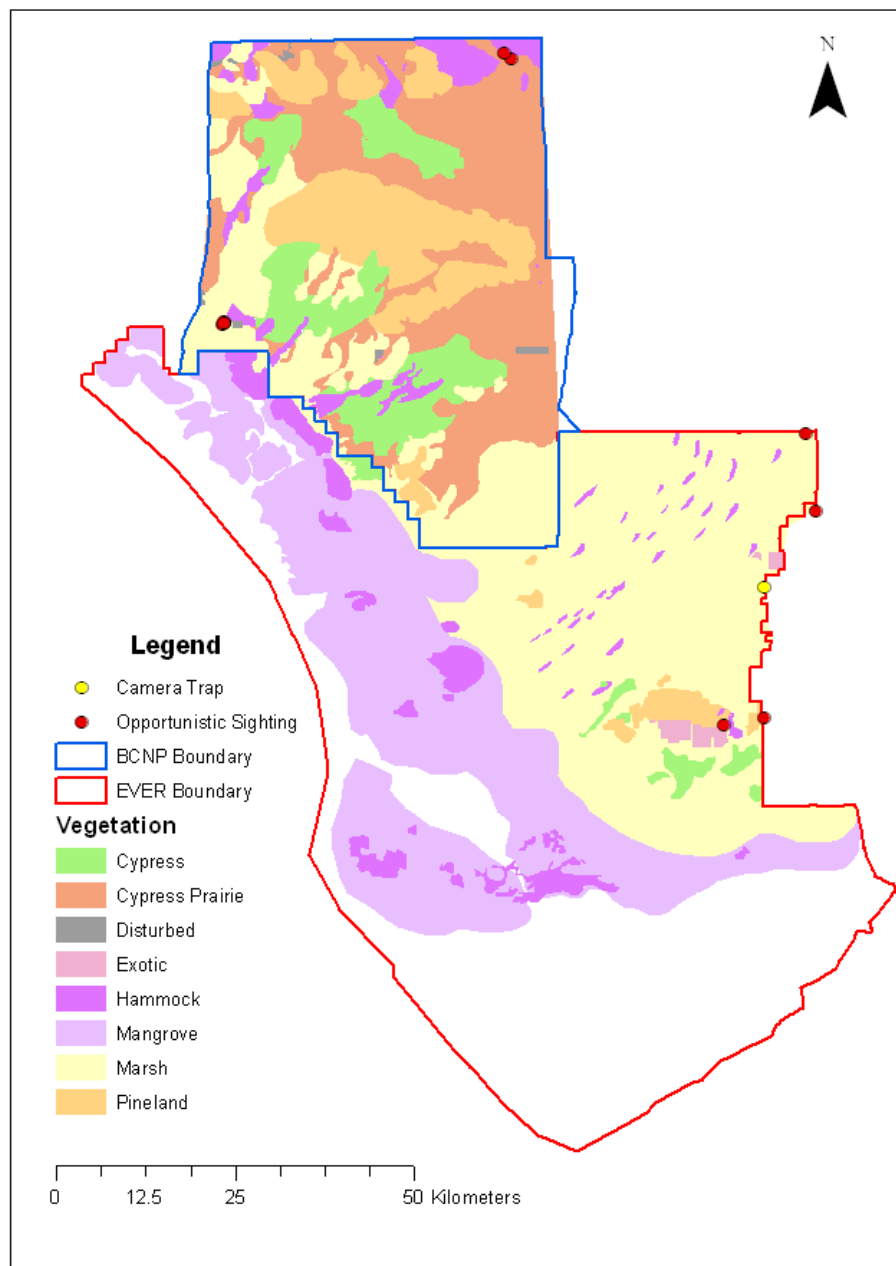


Figure 31. Locations of detected eastern cottontails (*Sylvilagus floridanus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

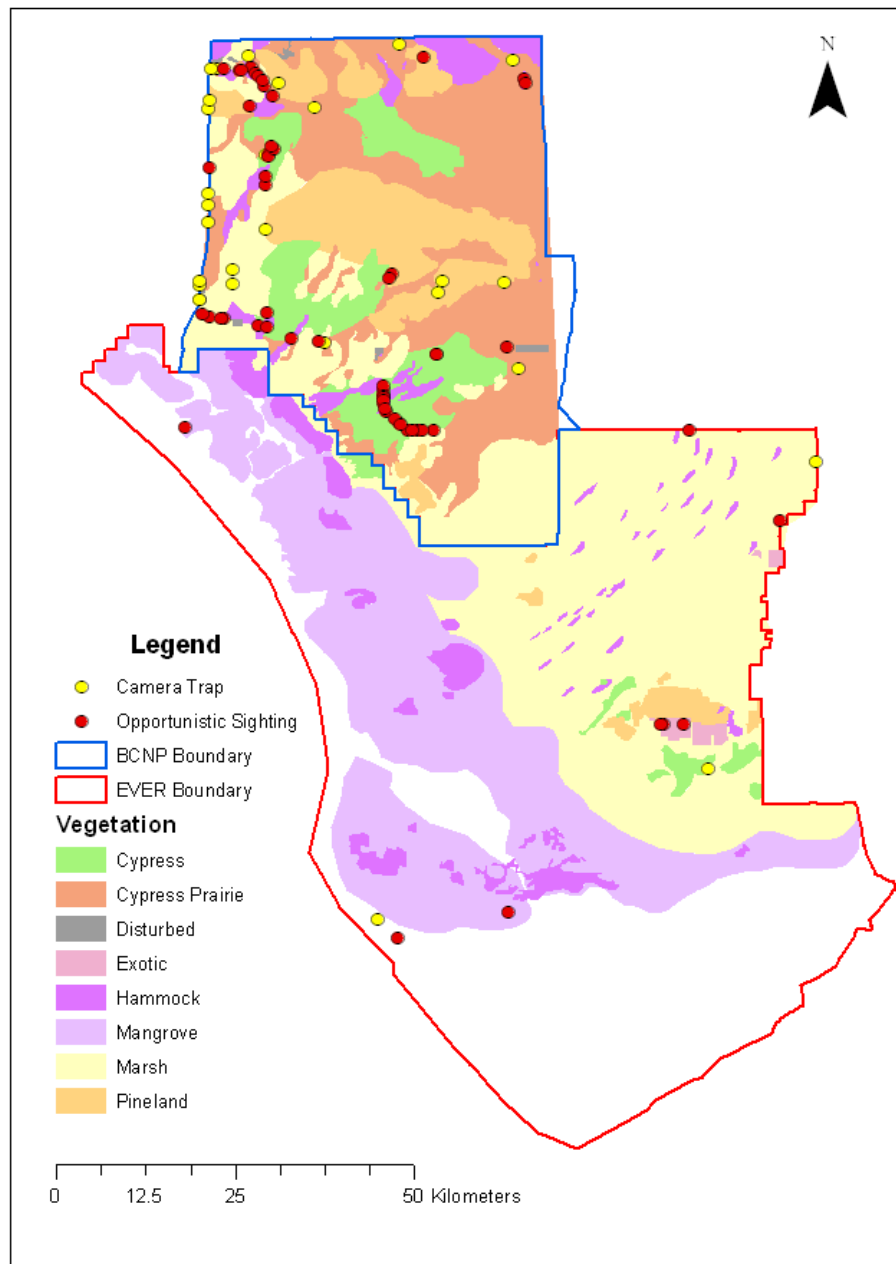


Figure 32. Locations of detected marsh rabbits (*Sylvilagus palustris*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009. Though it appears that two observations were from the islands of Florida Bay, this is just an artifact of the map.

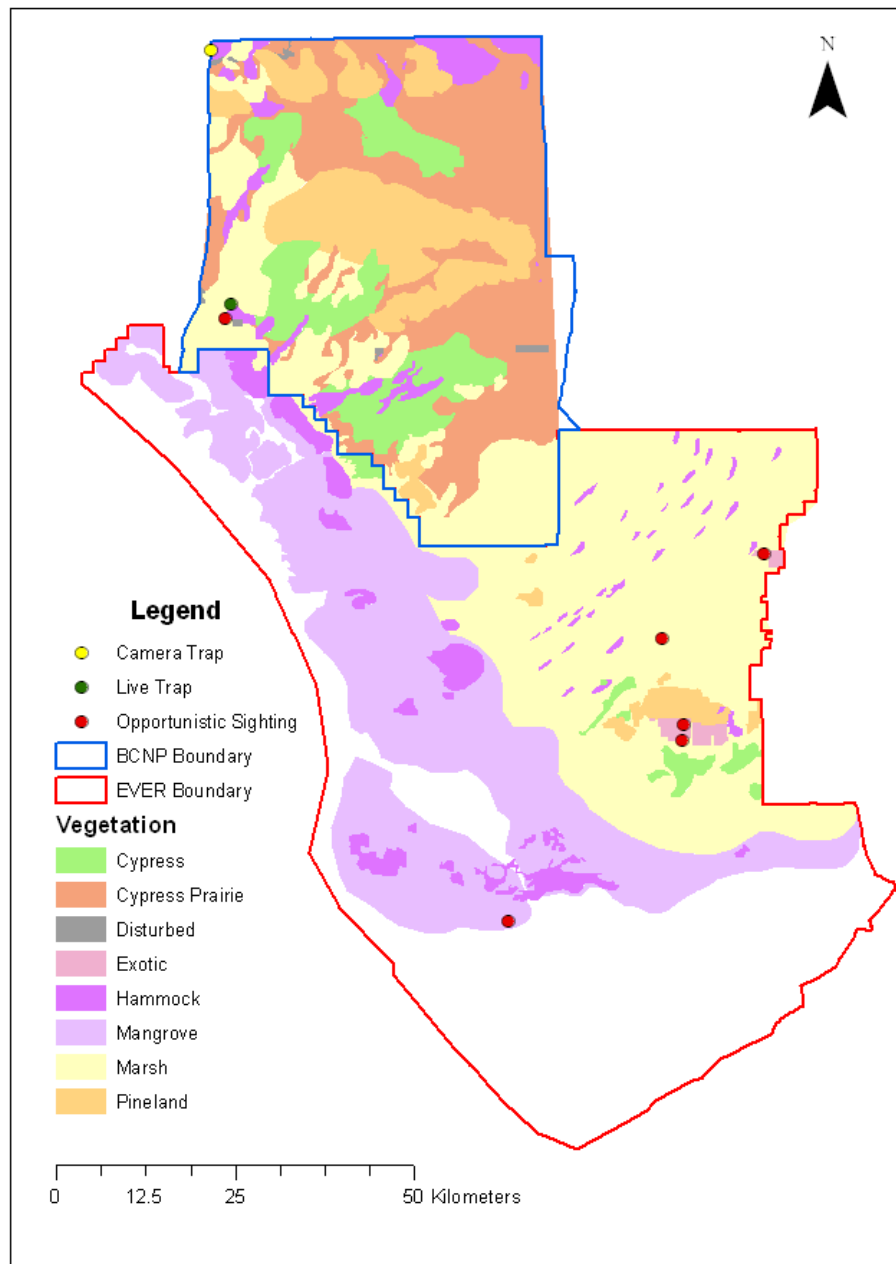


Figure 33. Locations of detected southern short-tailed shrews (*Blarina carolinensis*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

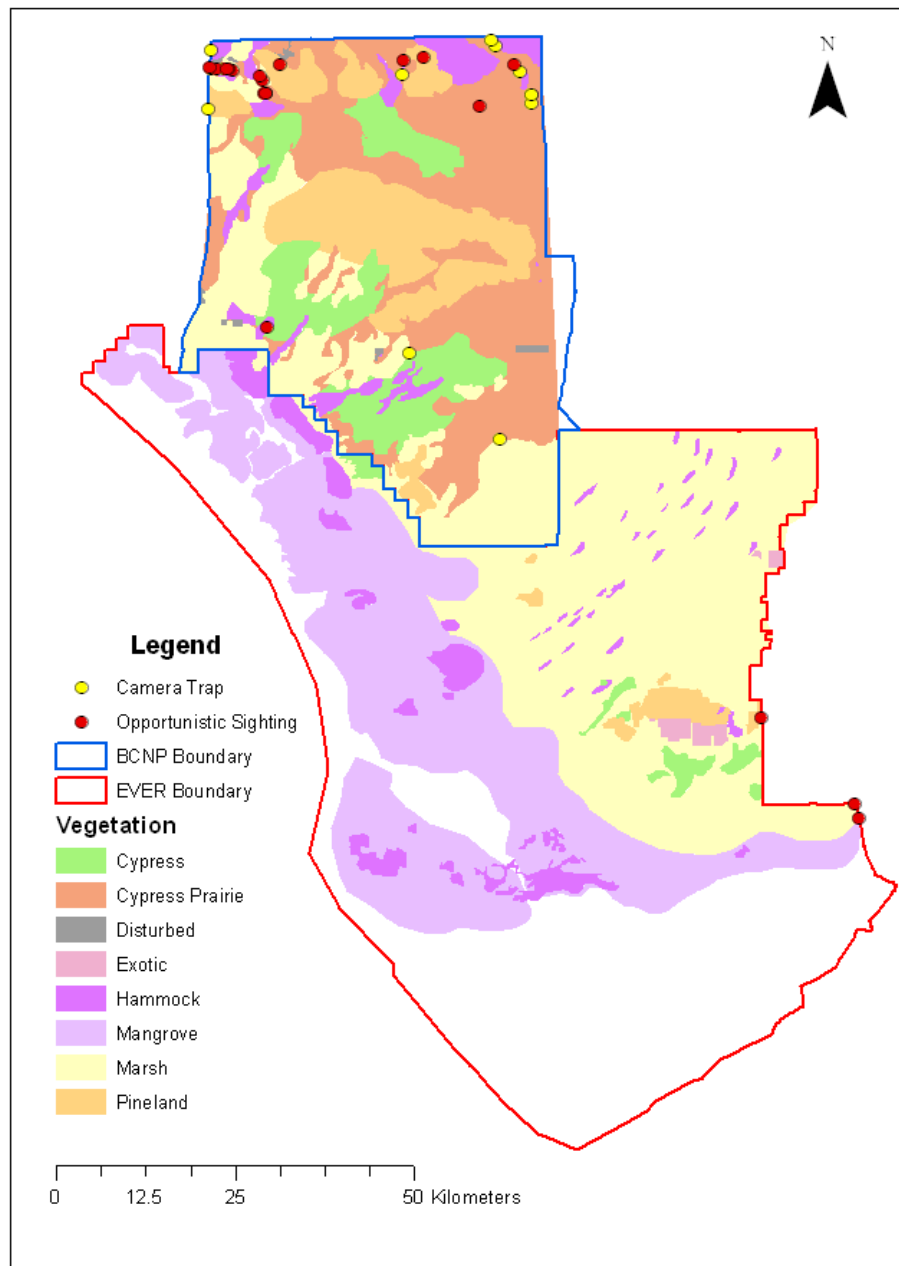


Figure 34. Locations of detected armadillos (*Dasypus novemcinctus*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

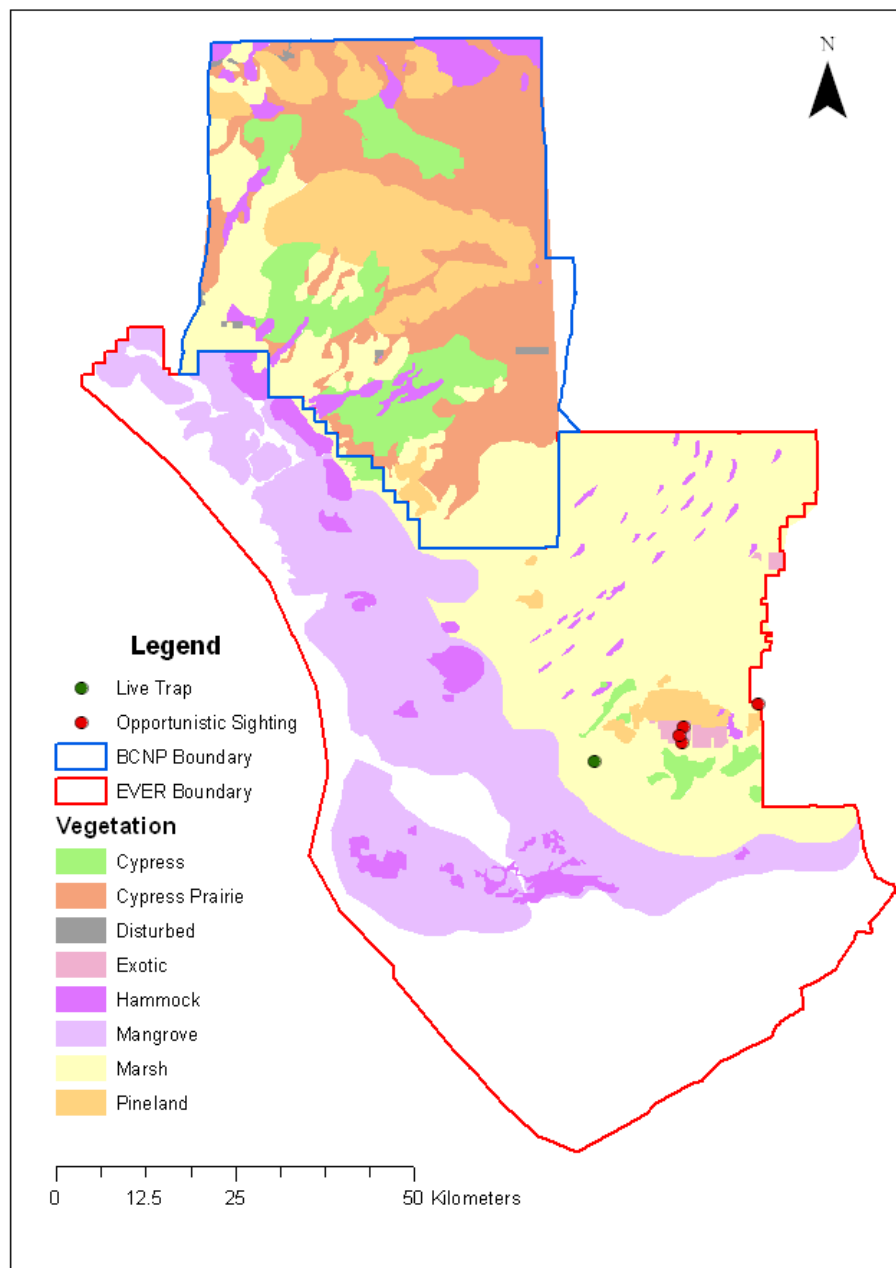


Figure 35. Locations of detected least shrews (*Cryptotis parva*) during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

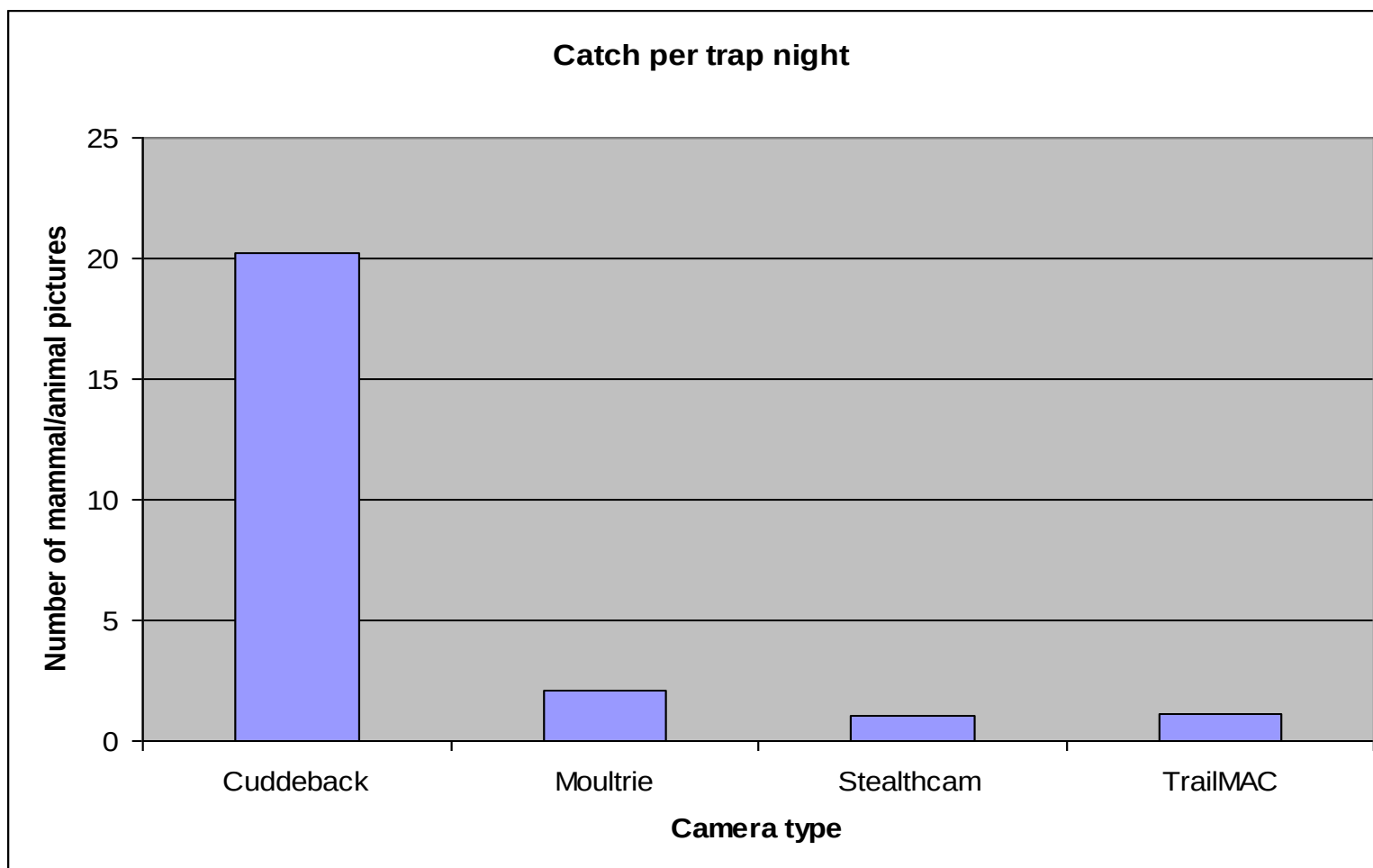


Figure 36. Catch per trap night for the Moultrie, Cuddeback, TrailMAC, and Stealthcam cameras for one camera session.

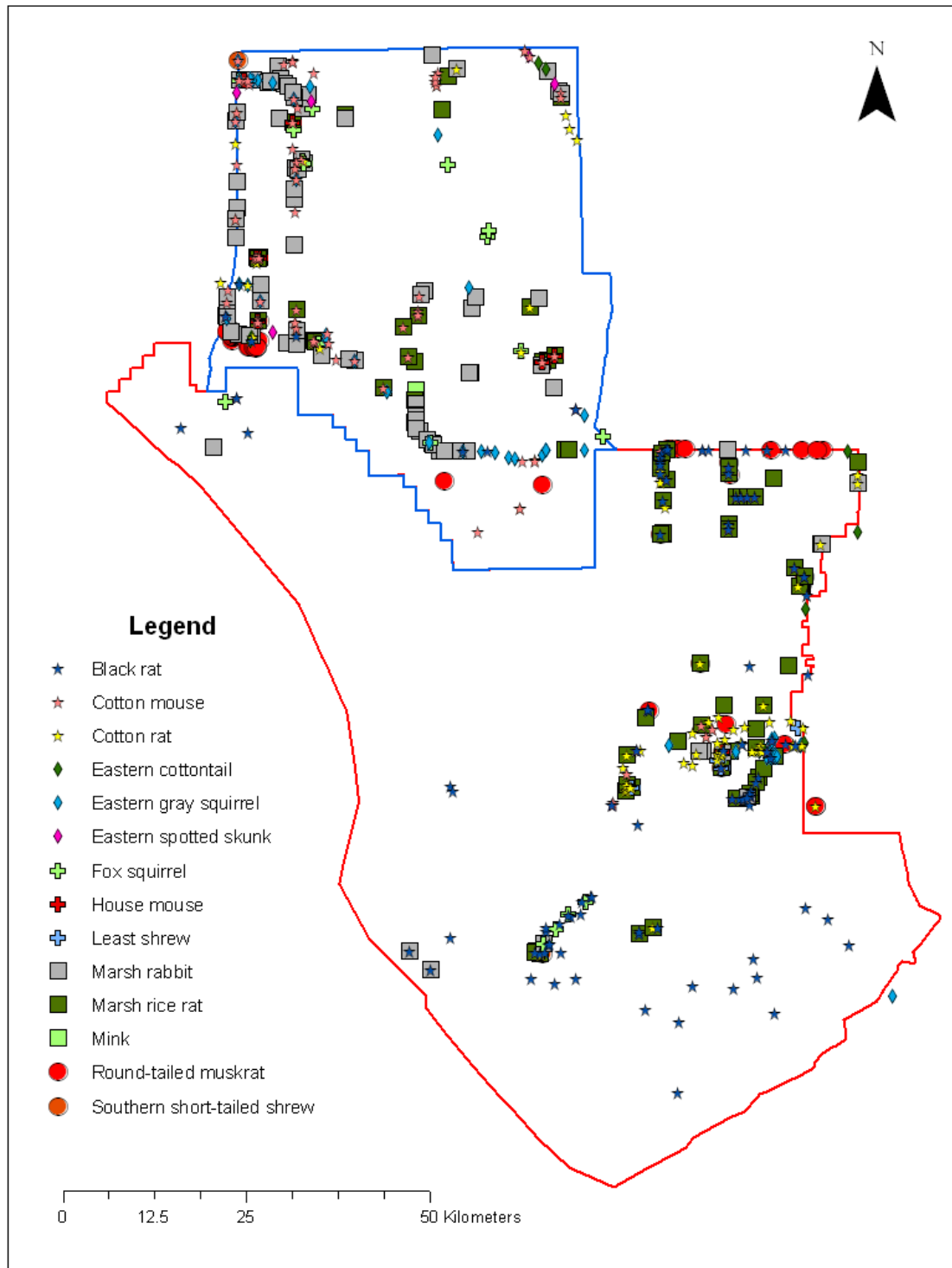


Figure 37. Locations of all small mammal species detected during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009. Although it appears that two Marsh rabbit observations were from the islands of Florida Bay, this is just an artifact of the map.

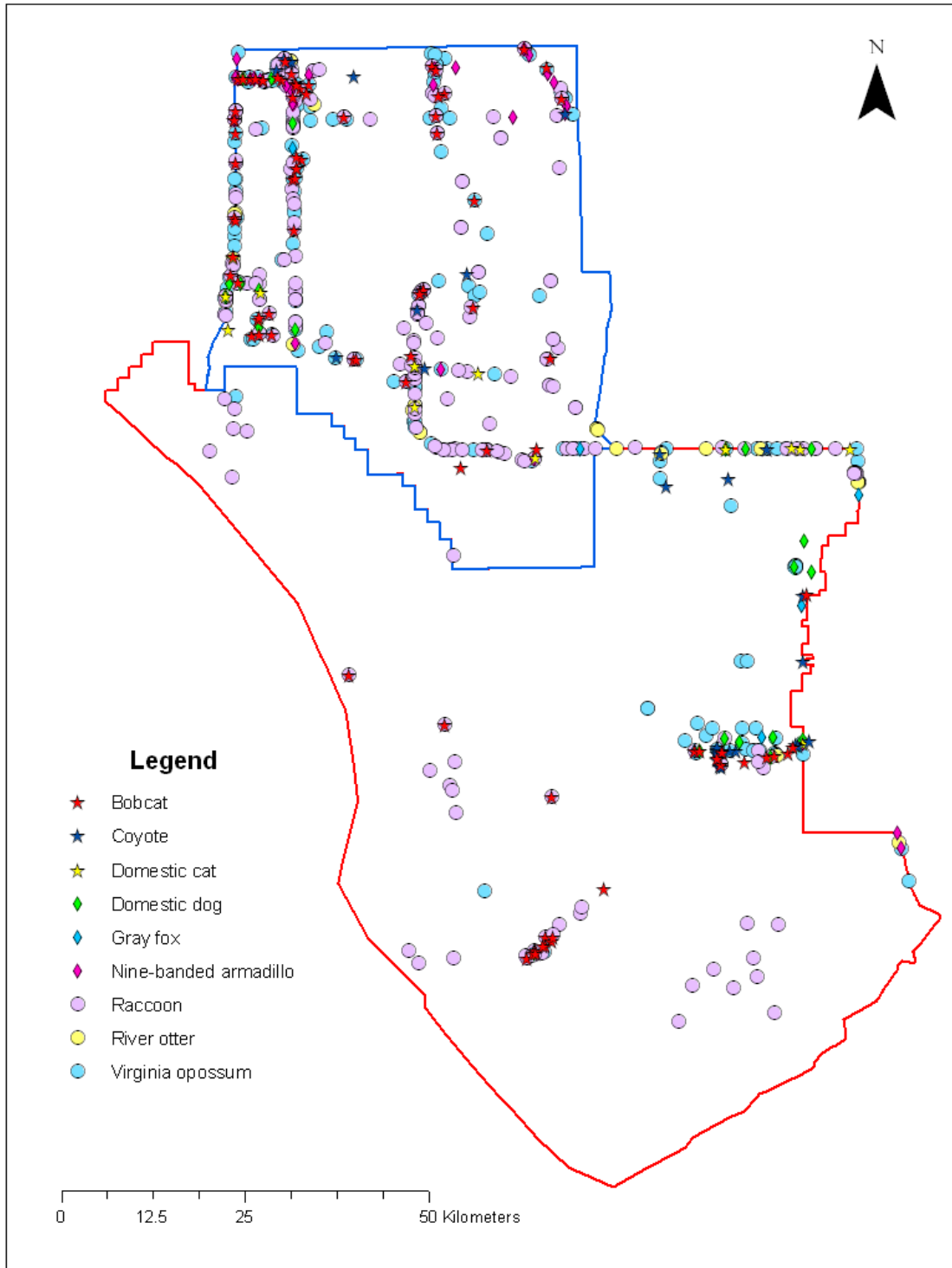
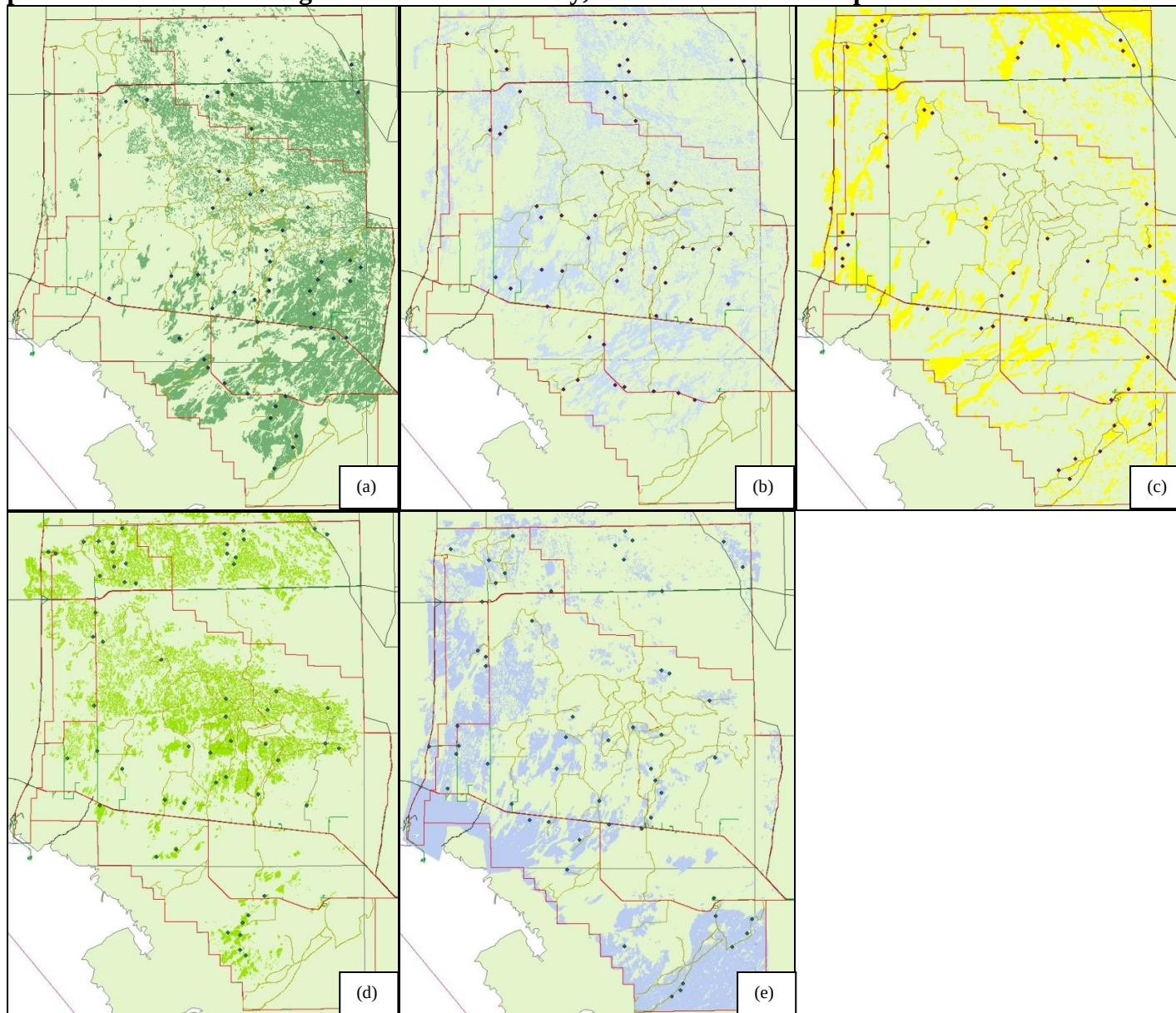


Figure 38. Locations of all medium-sized mammals detected during a small and medium mammal inventory of Big Cypress National Preserve and Everglades National Park from 2007-2009.

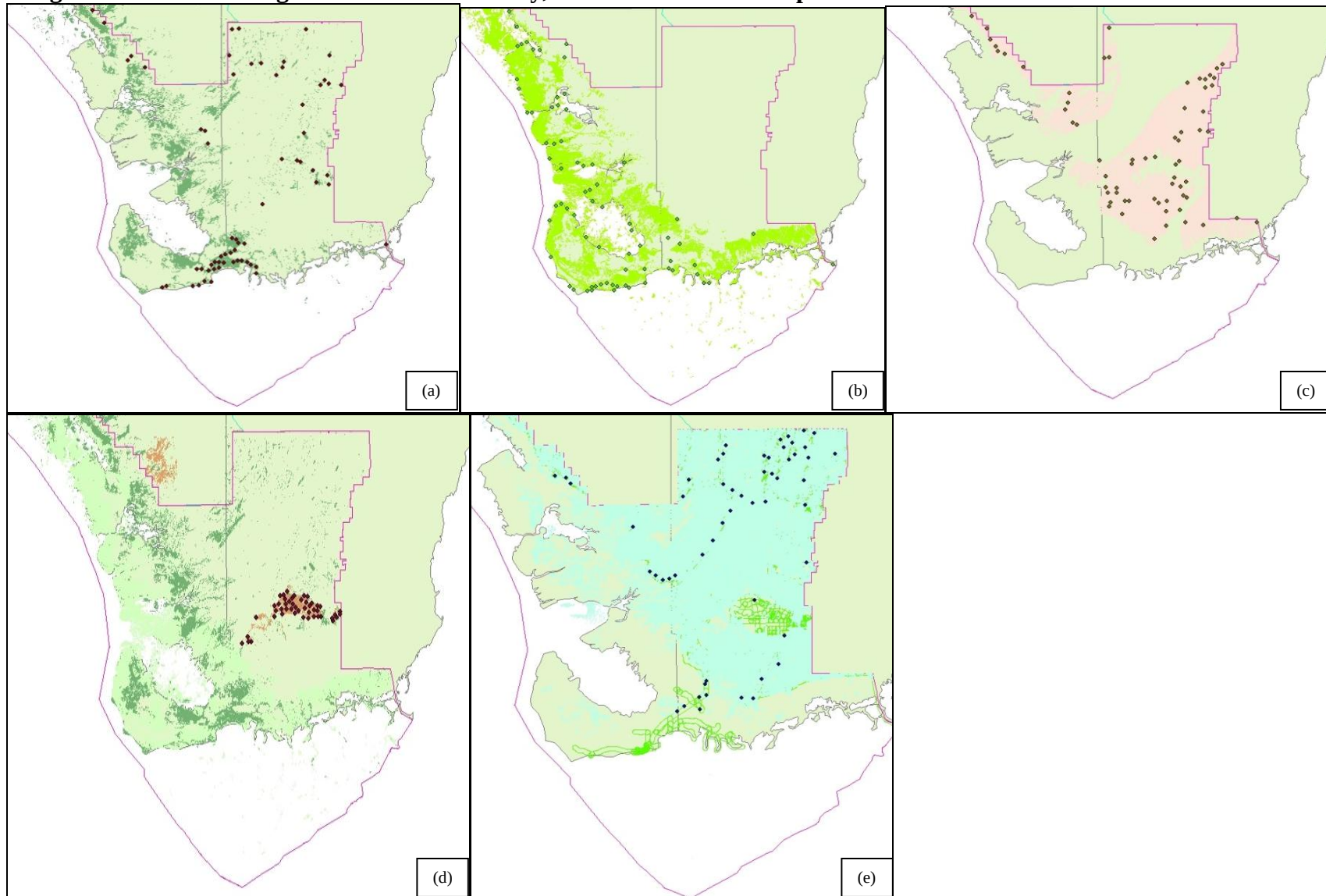
Appendix 1. Description of the database

Our database consists of all pictures from BICY and EVER in ThumbsPlus. Each picture is labeled with the species identification, plot identification, date, and time. We also have a Microsoft Access database. Within this database, there are two userfields tables which show the ThumbsPlus database as an Access database. However, the numbers in the final report do not necessarily match up with the numbers in these tables due to multiple animals in photos, thus it may be necessary to utilize the Thumbs database as well. The Access database also contains livetrapp, opportunistic, and passive tables. The livetrapp table contains all data collected during livetrapping events including the trap site identification, the species name, and the exact Universal Transverse Mercator coordinates (UTMs) of the location where the species was trapped. The opportunistic table contains all of our opportunistic sighting data including the species observed, habitat in which it was observed, and the exact UTM coordinates of the location where it was observed. The passive table contains all of our plot identification names (all camera traps and livetrapp sites), the habitats in which they were located as well as the exact UTM coordinates of their location. The veg table contains all of our plot identification names (all camera traps and livetrapp sites), the habitats in which they were located, and a more thorough habitat description of each site, including average canopy height, grass density, and a description of the dominant low, shrub, and tree species at that particular site. Also included in the Access database are two look-up tables, one that is a vegetation identification table and one that is a species identification table. There are also two Plot ID Crosswalk tables that connect both the veg and passive tables for BICY and EVER. All of the tables within Access can be viewed in design view to get further definitions for the columns in each of the tables.

Appendix 2. Maps showing original potential sampling sites in BICY in (a) cypress prairie, (b) cypress, (c) cypress, (d) pine, and (e) prairie habitats. Due to logistics and inaccessibility, we were unable to sample at all of these sites.



Appendix 3. Maps showing original potential sampling sites in EVER in (a) hammock, (b) mangrove, (c) marl prairie, (d) pine, and (e) slough habitats. Due to logistics and inaccessibility, we were unable to sample at all of these sites.



Appendix 4. List of lures used throughout this project, along with main ingredients of the lure and a list of which species each lure is made to attract.

Lure Name	Species Attracted	Ingredients
Hawbaker's Mink Lure #1	Mink	Gland with odors compelling to mink
Hawbaker's Mink Lure #2	Mink	Multiple musks
Hawbaker's Weasel Lure	Weasel	Natural weasel-calling ingredients
Murray's Mink Lure	Mink	Mink gland Food attractive to mink
Caven's Mink Master	Mink	Mink gland
Hawbaker's Muskrat Lure No. 1	Muskrat	Catnip oil Sweet flag oil Carrot oil Rat musk Beaver castor
Hawbaker's Muskrat Lure No. 2	Muskrat Rats	Includes new ingredient that calls rats
Hawbaker's Muskrat Lure No. 5	Muskrat	Muskrat musk Foreign musks Castors
Caven's Gusto	Red fox Gray fox Coyote Bobcats	Castor Muskrat musk "Special agents" Skunk scent
Caven's Quality Otter Lure	Otter	Seven ingredients
Carman's Canine Call Lure	Red fox Gray fox Coyote Bobcats	(no description)
Carman's Three Rivers Mink Lure	Mink	Musk
Cottontail scent	Cottontail	Urine
Sardines in oil	Mink	Herring Soybean oil Salt
Cat food	All carnivores	Meat by-products Water sufficient for processing Chicken Poultry by-products Tuna Fish A variety of vitamins, minerals and preservatives

Kishel's Squirrel Bait	Squirrels	Select food extracts and fragrances attractive to squirrels
Kishel's Grub Essence (for attracting skunks)	Skunks	Skunk food Grubs
Mark June's Brown Sugar All Season Mink Lure	Mink Otter	High grade mink glands Food sources minks prey on every day Brown sugar
Fish oil	Mink	Fish oil
Mark June's Salmon Oil	Mink	Salmon oil
Murray's Red Fox Gland Lure	Red fox	Clean, aged glands
Murray's Red Fox Urine	Red fox	Urine
Murray's Mink Urine	Mink	Urine
Lenon's Weasel Super All Call Lure	Weasel	Fresh blood Weasel musk Genuine old-time secret weasel calling ingredients
Hawbaker's Big 3 Lure	Mink Muskrat Raccoon	Native and high-priced imported musk Two high-priced essential oils which are attractive to mink, muskrat and raccoon Other secretions A special base for retention of odor and far- reaching calling power
Rosebud Skunk Paste Bait	Skunks	Skunk attractant which inspires Pungent, odor carrying side tone
Rabbit #1 - Meadow Mist	Rabbits	Three of the most deadly rabbit calling agents known A non-freeze base

Appendix 5. Protocol for constructing track plates.

Constructing track plates:

We used unenclosed acetate track plates in March 2007 and sand track plates in June 2008 to capture mammal prints.

To construct the acetate plates, we used 0.46 m × 0.15 m acetate sheets. We spread a thin layer of 15% graphite, 80% alcohol, and 2.5% mineral oil over the acetate using a paintbrush (Connors et al. 2005). Once the plates were dry, we attached them to aluminum flashing with paperclips and tape to prevent them from being blown around or trampled into the ground. All supplies were purchased at Home Depot or Fisher Scientific. Sand plate construction is described below.

Field site preparation:

We cleared and raked an area of about one square meter in which to set out the acetate track plates. We placed two plates side by side in the cleared location and set the bait (oats, fatty acid scent disks, and skunk lure) between them. We then placed TrailMAC Olympus D-435 digital cameras roughly 0.61 m -0.91 m away, facing the track plates, to capture images of all animals crossing over the plate.

To set out the sand track plates, we first raked the area and removed large items such as sticks and leaves. We placed sand in a 1 m × 3 m rectangle with a depth of 2.54 cm. We used a rake to spread, flatten, and smooth the sand. We also dug a small hole (about one inch in diameter) in the middle of the rectangle and placed a piece of vegetation scented with skunk lure inside the hole. At roughly one third of the stations we also placed apple slices as additional bait in the middle of the sand.

We checked the sand track plates early every morning and identified and recorded any tracks. If there were tracks, or if the site was disturbed by rain, we smoothed the area with the rake again. We then re-baited the plates. Acetate track plates were checked and removed every 14 days, and the pictures and prints were compared. All results were entered into an Excel database.

Appendix 6. Areas surveyed during hiking and night surveys

BICY

- Alligator Alley
- Various roads/trails throughout Bear Island
- State route 29
- Wagonwheel Road
- Birdon Road
- Tamiami Trail
- Turner River Road
- Burns Road
- Loop Road
- Dade Collier Airport road
- 11-mile Road
- Parts of the Florida National Scenic Trail
- Monument Lake Campground
- Fire Prairie Trail
- Levee 28

EVER

- L-67 levee road
- N-31 levee road
- Shark Valley Tram
- Main Park Road
- Pa-hay-okee
- Mahogany Hammock
- Long Pine Key
- Old Ingram
- Various roads through Chekika
- Tamiami Trail
- Old Tamiami Trail
- Old Tamiami canal
- Gumbo Limbo Trail
- Anhinga Trail
- Sissal Pond
- Ficus Pond
- Snake Bite
- Mrazek Pond

Disclaimer: Use of trade, product, or firm names does not imply endorsement by the U.S. Government.

Appendix 7. Protocol for collecting and examining scat and owl pellets.

After collecting owl pellets and all types of mammal scat on hiking surveys, we placed each specimen in a plastic Ziploc bag. We labeled each bag with the date, time, and location (including UTM coordinates) of collection.

Wearing latex gloves for protection, we examined specimens one at a time. We placed the specimen to be examined on a paper towel. Using tweezers and a probe, we pulled the specimen apart, separating bones and hair. The specimens were easy to pull apart, and therefore we did not need water or a dissolving agent. We identified bones and teeth by comparing them to a collection of reference skulls and skeletons and/or by consulting literature mentioned in the report (Driver 1949, Ernst 1975, Burt and Grossenheider 1976). Hair specimens were examined by placing two - five hairs on a clean microscope slide and covering them with a microscope slide cover. We purchased the slides and slide covers from Carolina Biological Supply Company and Fisher Scientific. Dorsal hair is preferable for creating microscope slides, but any type of hair will work. We examined the slides under a Meiji dissecting microscope, and keyed out the hair samples (Snow et al. 2007).

In an Excel spreadsheet, we recorded each scat/owl pellet specimen as one sample and assigned it a number (1, 2, 3 etc.). For each sample in the spreadsheet, we listed the following: the type of remains (i.e., hair, bones) found in the scat/owl pellet; the species from which the remains came; and the date, time and location (including UTM coordinates) at which the specimen was collected. If we found remains from multiple species in the same sample, we listed them using the number assigned to the sample followed by a letter for each species (1a, 1b, 1c, etc.).

After identifying and recording the remains present in each sample, we disposed of the paper towel and sample. If the osteological remains were in good condition, we cleaned them and added them to our collection of reference skulls and skeletons rather than disposing of them. All hair specimen slides were thrown away because we already possessed hair reference slides.

Appendix 8. List of biologists consulted during this project as well as for which species/topic they were consulted.

• Steve Humphrey	Mink/weasel
• Melissa Foster, Humphrey's grad student	Mink/otter track plates
• Phil Frank (Archibold Biological Station)	Weasels
• C. DuToit	Weasels
• Lynn Lefevbre	Muskrats
• Roy McBride	Gray Foxes
• Mark Lotz	Gray Foxes
• James Fine	Gray Foxes
• Dr. Susan Loeb	Southern Flying Squirrel
• Gary Slater	Southern Flying Squirrel
• Bart Harmsen	Camera trapping
• Sonny Bass	Mink, Muskrat, Flying Squirrel
• Skip Snow	Muskrat
• Deb Jansen	Owl pellets, various topics related to BICY

Appendix 9. Protocol for constructing floating mink rafts.

We built a mink raft based on the Game Conservancy Trust's Mink Raft and altered it to fit our purpose in Everglades National Park and Big Cypress National Preserve. Alterations included adding a camera basket, camouflage covering, and in some cases a tunnel (described below).

We purchased 2.44 m × 1.22 m, 0.4 cm plywood and cut each piece into 1.22 m × 0.61 m sections. We then treated all the wood with clear polyurethane before assembling the rafts. We purchased 5.1 cm thick polystyrene sheets which we cut with utility knives to the same dimensions as the plywood. We placed the polystyrene in between two pieces of plywood and lined up the edges. We used G clamps to hold the boards together, drilled holes with a handheld drill, and fastened them on each corner using two 80 mm M6 eyebolts and two 80 mm M6 roofing bolts with nuts. We found that this process was easier if the boards were set on a high, flat surface off the ground, such as a sawhorse, to enable better access to the bottom of the raft. We attached the eyebolts on one side of the raft and removed the G clamps.

Because mink like dark, enclosed places to explore, we attached a simple tunnel to the top of roughly 50% of the rafts. We only included tunnels on about half of the rafts because we placed the others in places that were already dark and secluded. The tunnel was made of 2.54 cm × 20.3 cm board cut into a 3-sided box with dimensions of roughly 0.30 m × 0.15 m × 0.15 m. The box was attached, using L brackets and screws, on the back end of the raft with the opening facing the end of the raft.

We stretched 1.3 cm wire mesh over the ends of the raft to help the animals climb onto the raft from the water. We cut the mesh using wire snips, fit it along the edges of the raft so that 10.2 cm folded onto the top and bottom of the raft.

We built a wire mesh basket based on our own design to hold a camera to the raft. The basket was made of the same type of wire mesh as that used on the raft edges. We folded the wire into a box shape, roughly 20.3 cm × 12.7 cm, and secured the edges together with zip ties. The bottom was cut and folded out so it could later be stapled to the front of the raft and hold up the rest of the basket. To allow a clear camera view, we cut a hole in the front of the basket for the camera lens. We secured Moultrie Cameras inside the baskets with additional zip ties.

We also attached camouflage coverings to some of the rafts that were placed in high boat traffic areas. We did this to prevent damage to the rafts and to reduce the number of camera thefts by park visitors. We cut the camouflage material with scissors and spread it over the entire raft, including the tunnel, leaving the openings free, and attached it to the raft using a staple gun.

Our final step before placing each raft in the water was to tie on a one m piece of 1.3 cm rope. We secured the rope to the raft by threading it through both eyebolts and then tying it. The other end was tied to a tree so that the raft did not drift away as water levels rose and fell.

Appendix 10. Protocol for constructing squirrel platform feeders.

The squirrel feeder platforms consisted of three parts: the back, the platform, and the sides. The back and the platform were made of 15.2 cm × 2.54 cm trim board. Using a miter saw, we cut the back of the feeder to a length of 30.5 cm and width of 8.9 cm, and the platform to a length of 15.2 cm and width of 8.9 cm. We also cut 17.8 cm × 5.1 cm sides for the platform out of 0.4 cm plywood. We secured the platform to the back of the feeder, about 10.2 cm from the bottom, with L brackets and screws. We then used screws to attach the sides to the platform so that food would not easily fall off the feeder. We coated the entire platform feeder with two - three coats of clear polyurethane to protect the wood from the elements. All materials were purchased at Home Depot.

The purpose of the feeders was to hold food bait, usually birdseed, to attract southern flying squirrels. Using bungee cords, we attached each platform to a tree at about eye level. We placed a camera (TrailMAC or Moultrie) in a tree facing the platform.

Appendix 11. List of models used in Program PRESENCE for proportion area occupied analyses and underlying biological hypotheses. We list models used for every species and then species specific models.

Models for All Species

Model	Reason Used
psi(.)p(.)	Constant
psi(habitat)p(.)	Species may prefer certain habitats over others for foraging, reproduction, etc.
psi(habitat)p(time)	Species may prefer certain habitats over others for foraging, reproduction, etc. and detection may change over time
psi(forested/nonforested)p(.)	Species may simply prefer forested or unforested habitats for foraging, reproduction, etc.
psi(forested/nonforested)p(time)	Forest/nonforest could affect occupancy with detection changing over time
psi(.)p(water presence)*	Water presence could affect detection
psi(habitat)p(water presence)*	Habitat may affect occupancy, while water presence may affect detection
psi(.)p(wet/dry season)*	Wet/dry season may affect detection
psi(.)p(season)*	Season (spring, summer, fall, winter) may affect detection
psi(habitat)p(wet/dry season)*	Habitat may affect occupancy, while wet/dry season may affect detection
psi(habitat)p(season)*	Habitat may affect occupancy, while season may affect detection
psi(forested/nonforested)p(wet/dry season)*	Forest/nonforest may affect occupancy, while wet/dry season may affect detection
psi(forested/nonforested)p(season)*	Forest/nonforest may affect occupancy, while season may affect detection
psi(.)p(total obstruction)	Total obstruction (grass and stem density) could affect detection
psi(habitat)p(total obstruction)	Total obstruction (grass and stem density) could affect detection within the different habitat types
psi(habitat, forested/nonforested)p(season, wet/dry season, total obstruction, water presence)*	Habitat and forest/nonforest may affect occupancy, while season, wet/dry season, water presence, and total obstruction may affect detection

*temporary cameras only

Opossum Models

Model	Reason Used
psi(avg. canopy height)p(.)	Canopy height may determine occupancy

Swamp rabbit Models

Model	Reason Used
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species
psi(.)p(bait type)	Bait type may affect detection
psi(habitat type)p(bait type)	Bait type may affect detection
psi(.)p(grass density)	Grass density may affect detection

Cotton rat Models

Model	Reason Used
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species
psi(.)p(grass density)	Grass density may affect detection of smaller species

Rice rat Models

Model	Reason Used
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species
psi(.)p(grass density)	Grass density may affect detection of smaller species

Black rat Models

Model	Reason Used
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species
psi(.)p(grass density)	Grass density may affect detection of smaller species

Raccoon Models

Model	Reason Used
psi(avg. canopy height)p(.)	Canopy height may determine whether or not PrLo uses that habitat
psi(.)p(breeding season)	Breeding season may affect detection

Bobcat Models

Model	Reason Used
psi(.)p(breeding season)	Breeding season may affect detection

Fox squirrel Models

Model	Reason Used
psi(avg. canopy height)p(.)	Canopy height may determine occupancy

Cotton mouse Models

Model	Reason Used
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species

psi(.)p(grass density)	Grass density may affect detection of smaller species
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Gray squirrel Models

Model	Reason Used
psi(.)p(breeding season)	Breeding season may affect detection
psi(avg. canopy height)p(.)	Canopy height may determine occupancy

House mouse Models

Model	Reason Used
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species
psi(.)p(grass density)	Grass density may affect detection of smaller species

Armadillo Models

Model	Reason Used
psi(.)p(breeding season)	Breeding season may affect detection
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species
psi(.)p(grass density)	Grass density may affect detection of smaller species

River otter Models

Model	Reason Used
psi(water present)p(.)*	Water presence could affect occupancy
psi(water present, forest)p(.)*	Water presence and forested/nonforested habitat may affect occupancy
psi(water present)p(water present)*	Water presence could affect occupancy and detection
psi(.)p(breeding season)	Breeding season may affect detection

*temporary cameras only

Cottontail Models

Model	Reason Used
psi(.)p(bait type)	Bait type may affect detection
psi(habitat type)p(bait type)	Bait type may affect detection
psi(habitat type)p(grass density)	Grass density may affect detection of smaller species
psi(.)p(grass density)	Grass density may affect detection of smaller species

Spotted skunk Models

Model	Reason Used
psi(.)p(breeding season)	Breeding season may affect detection
psi(.)p(bait type)	Bait type may affect detection

$\psi(\text{habitat type})p(\text{bait type})$	Bait type may affect detection
$\psi(\text{habitat type})p(\text{grass density})$	Grass density may affect detection of smaller species
$\psi(.)p(\text{grass density})$	Grass density may affect detection of smaller species

Coyote Models

Model	Reason Used
$\psi(.)p(\text{breeding season})$	Breeding season may affect detection

Appendix 12. The following two tables detail the effort spent working on this project.

Year 1 Effort				
People	Tasks	Access	Hours	Budgeted Hours
Mark Peyton	Field work, data management	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	2400	2080
Shona Wilson	Project manager – scheduling and conducting field work, data proofing/organization, submitting technical reports, budgeting	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	2720	2080
Jeff Beauchamp	Field work, data mgmt, cameras, road-cruising	Helicopter, truck, airboat, hiking	1300	1040
Clayton McKee	Field work, data mgmt, cameras, road-cruising	Helicopter, truck, airboat, hiking	1200	1040
Matt Brien	Operate boats, cameras	Powerboat, hiking	60	0
Jemeema Carrigan	Operate boats, cameras	Powerboat, hiking	60	0
Mike Cherkiss	Operate boats, cameras	Powerboat, hiking	60	0
Alex Wolf	Checked cameras, live-trapping, road-cruising	Powerboat, truck, hiking	60	0
Brian Greeves	Checked cameras, live-trapping, road-cruising, boats	Powerboat, truck, hiking	60	0
Brian Banks-FIU	Checked cameras, live-trapping, road-cruising	Truck, hiking	50	0
Robbert Veens-NPS intern	Checked cameras, live-trapping, road-cruising	Truck, hiking	50	0
Brian Jeffery	Operate boats, checked cameras	Powerboat, airboat, hiking	40	0
Mike Rochford	Processing python gut-contents, road-cruising	Truck	200	0
Wellington Guzman	Operate boats, checked cameras, road-cruising	Airboat, truck	80	0
Ryan Lynch	Road-cruising	Truck	20	0
Billy Meyer-Volunteer	Camping, checked cameras, live trapping	Canoe/kayak, johnboat, hiking	80	0
Tyler Ward-Volunteer	Camping, checked cameras, live trapping	Canoe/kayak, johnboat, hiking	80	0
Nate Sikes-Volunteer	Camping, checked cameras, live trapping	Canoe/kayak, johnboat, hiking	80	0
Brian Eller-Volunteer	Camping, checked cameras, live trapping	Canoe/kayak, johnboat, hiking	80	0
Joy Vinci	Live trapping	Truck, hiking	20	0
Jeff Cline-NPS	Operate airboats	Airboat	20	0
Total			8720	6240

Year 2 Effort				
People	Tasks	Access	Hours Worked	Budgeted Hours
Jen Eells	EVER field technician	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	2397	2080
Jeff Beauchamp	BICY technician	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	480	520
Danielle Payne	BICY technician	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	800	520
Jean Olbert	BICY technician	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	480	520
Amanda Breon	BICY technician	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	960	520
Emily Pifer	Project manager – scheduling and conducting field work, data proofing/organization, submitting technical reports, budgeting	Helicopter, truck, airboat, powerboat, canoe/kayak, johnboat, hiking	2600	2080
Alex Wolf	Checked cameras, road cruising	Truck, ATV	90	0
Mike Rochford	Python guts, road cruising, boats	Truck	200	0
Zac Fratto- NPS	Boats, surveys, helicopter flights	Truck, johnboat, helicopter	40	0
Karen Balentine- USGS	Made maps, helped out with hiking surveys, camera setup, checking cameras, reporting sitings	Truck, hiking, powerboat, canoe/kayaking, airboat	80	0
Brian Jeffrey	Boats, checked cameras	Airboat, truck, powerboat	60	0
James Catlin- Intern	Thumbs, errands, research, data entry	N/A	90	0
David Cockerill - Intern	Checked cameras, data entry	Truck	32	0
Mike Cherkiss	Boats	Truck, airboat	20	0
Gail Morris- volunteer	Helped me check live traps	Truck	16	0
Debbie Ward- volunteer	Helped me check camera traps	Truck, canoe/kayak	8	0
Christy Harry- Intern	Thumbs, data entry, checked cameras	Truck, canoe/kayak	320	160

Brian Greeves	Hiking surveys, checking cameras, camera setup, advice, road cruising, data entry	Truck, hiking	150	0
Theresa Walters	Road cruising	Truck	16	0
Matt Eygenraam-volunteer	Helped check cameras	Truck, canoe/kayak	8	0
Hillary Burgess	Help with plant id	Truck, hiking	8	0
Mat Denton	Drove airboats, checked cameras, helicopter flights	Truck, helicopter, airboat	40	0
Ed Larrivee	Checked cams	Truck	16	0
Rafael Crespo	Drove airboat, helped in muskrat search	Truck, airboat	16	0
Kevin Wirth – volunteer	Checked cameras, made squirrel platform feeders	Truck	40	0
Total			8967	6400

Appendix 13. List of equipment used for this project and from where it was purchased.

Item	Where Purchased /Property
GPS (Garmin 72 and 60CSx)	• Bass Pro Shops
Head Lamps	• Amazon (www.amazon.com)
Leatherman	• Bass Pro Shops • Amazon (www.amazon.com)
Raingear	• Bass Pro Shops • Amazon (www.amazon.com)
Field notebooks	• Ben Meadows
Palm pilots	• Office Depot • Amazon (www.amazon.com) • Palm Store
M-Audio Microtrack II recorder	• Stith Recording (www.stithrecording.com)
Audio-Technica AT8015 shotgun microphone	• Audio-Technica
FoxPro AR4 Game Caller	• FoxPro
Moultrie Gamespy I40	• Bass Pro Shops • Wal-Mart
Cuddeback Capture IR	• Bass Pro Shops
TrailMAC Olympus D-435	• Trail Sense Engineering, LLC
Stealth Cam STC-V450	• Abe's of Miami
Wood for various building projects	• Wal-Mart • Home Depot
Sqrl feeder materials (wood, clear coat, screws, L-brackets)	• Wal-Mart • Home Depot
Bait- bird seed and corn, apples, sunflower seeds	• Wal-Mart • Home Depot
Lures	• F&T Fur Havesters Trading Post (http://www.fntpost.com) • Mark June's Lures (www.markjuneslures.com) • Kishels (www.kishelscents.com)
Oil and Graphite	• Fisher Scientific
Sherman traps	• Property of UF*, previously purchased from HB Sherman Traps
Thermometers	• UF Property
Refractometer	• Ben Meadows
Rulers	• Wal-Mart
Clorox wipes	• Wal-Mart
Perm markers	• Wal-Mart
Bug jackets	• The Original Bug Shirt Company (http://www.bugshirt.com)

Flying squirrel call	• Jerboa Sounds (www.soundboard.com/sb/Jerboa_Sounds_music.aspx)
Recordable CDs	• Wal-Mart • Office Depot • Office Max
Batteries- AAA, AA, C, D	• Wal-Mart • Home Depot • Office Depot • Target
Sardines	• Publix • Wal-Mart • Target
Cat food (Special Kitty and Friskies)	• Wal-Mart • Target
35 mm Film	• CVS • Target
Tarp	• Home Depot
Duct tape	• Home Depot
SD cards	• Amazon (www.amazon.com) • Wal-Mart • Target • Office Max
Bungee cords	• Wal-Mart
Scales	• UF Property
Binoculars	• Oceanside
Optio waterproof camera	• Amazon (www.amazon.com)
Field guides	• UF Property • Amazon (www.amazon.com) • EVER Property
Ziploc bags	• Wal-Mart
Probes	• Carolina Biological supply- these were part of Skip Snow's collection at the Beard Center
Strainer	• Carolina Biological supply- these were part of Skip Snow's collection at the Beard Center
Tweezers	• Carolina Biological supply- these were part of Skip Snow's collection at the Beard Center
Spotlights	• Brinkman.net (www.brinkman.net)
Rope/twine	• Wal-Mart • Home Depot
Spray paint	• Wal-Mart
Bugspray	• Wal-Mart • Target
Technu	• Technu.com

Sunblock	• Wal-Mart
Buckets	• Wal-Mart
Supply/trapping bags	• REI Direct
Dry bag	• Amazon (www.amazon.com) • Bass Pro Shops
Bleach	• Wal-Mart
PVC poles	• UF Property
Rebar	• Home Depot
Airpump	• K-Mart
Kayak	• UF property
Canoe	• UF property
Paddles	• UF property
Life jackets	• Bass Pro Shops
Metal folder and clips	• Office Depot
Sand	• Home Depot
Antibacterial wipes	• K-Mart
Tent pegs	• Home Depot
Safety hasps for padlocks/locks for cams	• Home Depot
Nuts, bolts, screws for various building projects	• Wal-Mart • Home Depot • Tru-Value
Polystyrene for milk rafts	• Foam Factory • Marine World
Paper towels	• part of Skip Snow's lab collection
Jeep Liberty, other trucks	• UF property
Tahoe/Suburban	• USGS property
Supplies for track plates-acetylene torch, paper, metal plates	• Home Depot
Rake	• Home Depot
Compass	• Wal-Mart
ATV	• USGS property
Motorboat	• UF property
Airboat	• UF property • USGS property
Calipers	• Bel-Art Products- part of Skip Snow's collection
Swamp Buggy	• USGS property