



# Biodiversity of Mammals in Everglades National Park

## *An Updated Species List with Habitat Associations*

Natural Resource Report NPS/EVER/NRR—2015/1056





#### **ON THIS PAGE**

Photograph of two Common bottlenose dolphins (*Tursiops truncates*) swimming in Florida Bay at Everglades National Park.  
Photograph courtesy of the National Park Service.

#### **ON THE COVER**

Photograph of a Marsh rabbit (*Sylvilagus palustris*) at Everglades National Park.  
Photograph courtesy of R. Cammauf and the National Park Service.

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# **Biodiversity of Mammals in Everglades National Park**

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Tonya M. Howington<sup>1</sup>

<sup>1</sup>Everglades National Park  
950 North Krome Avenue  
3<sup>rd</sup> Floor  
Homestead, Florida 33030

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## **Contents**

	Page
Figures.....	iv
Tables.....	v
Photographs.....	vi
Abstract.....	vii
Acknowledgments.....	ix
Introduction.....	1
Methods.....	3
Results and Discussion .....	9
Conclusions.....	14
Literature Cited .....	16

## Figures

	Page
<b>Figure 1.</b> The map of EVER's 17 physiographic regions created as part of the NRCA.....	6
<b>Figure 2.</b> Graph of the total number of native mammal species predicted to be found in each physiographic region of EVER.....	10
<b>Figure 3.</b> Graph of the total number of T&E mammal species predicted to be found in each physiographic region of EVER.....	12
<b>Figure 4.</b> Graph of the total number of non-native mammal species predicted to be found in each physiographic region of EVER.....	13

## Tables

	Page
<b>Table 1.</b> The list of F-Gap vegetative communities used in this study and assessment codes. ....	3
<b>Table 2.</b> Assignments of F-Gap codes to EVER NRCA regions. ....	7
<b>Table 3.</b> List of the mammal species to add to the NPSpecies and CESI datasets.....	9
<b>Table 4.</b> Mammalian guilds in EVER (guilds with one asterisk [*] contain non-native species and those with two asterisks [**] only contain non-native species).....	10
<b>Table 5.</b> provides the list of most broadly and most narrowly distributed mammal species.....	11

## Photographs

	Page
<b>Photo 1.</b> River otter ( <i>Lutra Canadensis</i> ) resting in marl prairie in Everglades National Park. Photo courtesy of National Park Service.....	vii
<b>Photo 2.</b> Raccoon ( <i>Procyon lotor</i> ) in a tree at Royal Palm Visitor Center, Everglades National Park. .....	viii
<b>Photo 3.</b> Florida panther ( <i>Puma concolor coryi</i> ) photograph on wildlife monitoring camera in Pine Island area, Everglades National Park. Photo courtesy of National Park Service.....	x
<b>Photo 4.</b> Track of Florida black bear ( <i>Ursus americanus floridanus</i> ). Photo courtesy of G. Reed and National Park Service.....	15
<b>Photo 5.</b> Virginia opossum ( <i>Didelphis virginiana</i> ) in a tree. Photo courtesy of National Park Service. ....	20

## Abstract

Protecting biodiversity is important for Everglades National Park (EVER). EVER was the first park to have its biodiversity recognized in its enabling legislation enacted in 1934. Field monitoring in EVER is challenging, and consequently, elucidating details of the park's biodiversity is a slow and complicated effort. In order to progress more rapidly, EVER updated the dataset of species and habitat associations developed under a project funded by the Critical

Ecosystems Studies Initiative (CESI) using a comprehensive literature review that included citizen science databases. EVER is recommending that the South Florida and Caribbean Inventory and Monitoring Network (SFCN) use the CESI dataset to update the internet accessible species lists on <https://irma.nps.gov/NPSpecies/> (NPSpecies). The SFCN provided a quality assurance and quality control (QAQC) analysis of the updated CESI species lists. Predictions were made of the spatial distribution of species by comparing their preferred habitats to vegetative communities found within EVER's physiographic regions.

This report addresses the mammal species found within EVER. This analysis refined our understanding of how native, threatened and endangered, and non-native species may affect overall biodiversity. Recommendations are included regarding next steps for refining the list of mammal species and potential initiation of long-term monitoring of mammal biodiversity in EVER. Other reports will address birds, fish, reptiles and amphibians. Separate reports will address other taxonomic groups as the information is collected and vetted as appropriate.



**Photo 1.** River otter (*Lutra Canadensis*) resting in marl prairie in Everglades National Park. Photo courtesy of National Park Service.



**Photo 2.** Raccoon (*Procyon lotor*) in a tree at Royal Palm Visitor Center, Everglades National Park. Photo courtesy of National Park Service.

## **Acknowledgments**

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**Photo 3.** Florida panther (*Puma concolor coryi*) captured on wildlife monitoring camera in Long Pine Key area, Everglades National Park. Photo courtesy of M. Parry, National Park Service.

## Introduction

Calculating the native biodiversity of mammals in Everglades National Park (EVER) is a critical component of understanding, protecting, and enjoying the park's natural resources. Biodiversity is generally associated with the health of an ecosystem, and therefore it is an important indicator for park management to track. This is particularly true for areas that are expected to have few impacts of human development, such as large tracts of designated wilderness. The diversity of native species should be managed to remain stable over time and contribute to the resilience of the park's ecosystems (Ceausu, 2015; Hobbs et al., 2009; Walker, 2002). With 87% of EVER designated as the Marjory Stoneman Douglas Wilderness, actual resilience will be dependent on internal and external impacts to the large habitat buffers provided by the managed wilderness area. As scientific knowledge of the Everglades grows, we can continue to explore questions such as "How is biodiversity distributed across the Everglades landscape?"

Studying the species richness (defined as the number of different native species of each taxonomic category) of mammals is critical to understanding and predicting habitat community structure and disturbance (Feldhamer, 2007; Fox and Fox, 2000; Medellin and Equihua, 1998). Tracking species richness is especially important in EVER where the habitats available for mammals include a uniquely diverse combination of water, land, and tropic and sub-tropic vegetation. The inventory of mammal populations provides important information needed for their protection and persistence (Pifer et al., 2011). Evaluating biodiversity of mammals is part of an overall biodiversity assessment for the park, but is probably not predictive of biodiversity of other groups. Evaluating the biodiversity of mammals alone is not sufficient for identifying areas of high biodiversity overall and adding other taxa to the measured group can be more effective such as considering the biodiversity of mammals along with the biodiversity of birds, which is a more common measure (Larsen et al., 2012).

Mammals that are part of the Everglades ecosystem include native residents which sometimes roam in and out of park boundaries looking for food or temporary refuge. There is also a growing population of non-native mammal species. Non-native mammals are considered to be those that were introduced by human activity either deliberately or by accident. Although little is known about the ecological impacts of some of the non-native mammals in the Everglades, the negative impacts of others are well known (NWF, 2014). Species such as the Roof rat (*Rattus rattus*) have well documented effects in other locations on birds. Feral pigs have well documented impacts on vegetation (Global Invasive Species Database, 2005). Domestic cats and dogs have generally been found to impact birds and other species near urban interfaces (Marks and Duncan, 2009). Those that cause the greatest impact would be most likely to be targeted for management action.

Park-wide information on species diversity is found on the National Park Service website National Park Service website for their Integrated Resource Management Application <https://irma.nps.gov/NPSpecies/> (NPSpecies). NPSpecies is an online database created to track the occurrence of species in park units across the nation (NPS, 2014). NPSpecies is used by land managers that need to have a general picture of species diversity within national park units. It is also

available for public use. The NPSpecies dataset for EVER is managed by the South Florida Caribbean Inventory and Monitoring Network (SFCN). Creation of the current list of mammals in NPSpecies for EVER has relied on the limited primary sources of information available, which are primarily park species lists and individual observations. The majority of the mammal species in NPSpecies were last updated in 2006 (NPS, 2014; Robertson and Kusland, 2006). Small mammal inventories are of importance, such as Pifer (2011), because they often find species not previously documented or validated in NPSpecies.

Keeping NPSpecies up-to-date is a time-consuming process EVER can provide information intended to update NPSpecies by reviewing the references used for the existing information, adding information from relevant literature previously not applied, and then maintaining the dataset using new information from recent field studies that may include citizen science databases.

The usefulness of the information provided by NPSpecies is reliant upon the application of consistent quality assurance (QA) and quality control (QC) methods prior to the data from inventories, including data entered from all-taxa inventories and bio-blitzes (Budde and Kingston, 2014). By applying a QAQC process, data managers who maintain NPSpecies as a source of information for the species that can be found in EVER can then also be prepared in the event of large-scale updates such as a bioblitz or other small scale field inventories intended to verify the current species lists.

Keeping NPSpecies current may also include more reliance on the use of on-line citizen science databases in the future with appropriate QAQC checks (NPS, 2013b). By implementing as much as possible a QAQC process and peer reviewed Natural Resource Reports of species lists prior to the data from any source being entered into NPSpecies, the accuracy of the information available in NPSpecies for EVER can be improved. For example, each species should be validated by associating it to a voucher specimen, photograph, report or paper.

This first objective of this project was to create a single current park mammal species list using the information available from a study funded by the Critical Ecosystems Studies Initiative (CESI) and the NPSpecies with the assistance of the SFCN, EDDmaps.org (EDDmaps (2014) and other sources. The second objective was to provide habitat associations for each species, and to examine the distribution of mammal species across broad physiographic regions in EVER. This work was done in cooperation with the SFCN. It should be noted that for this study neither species richness nor its spatial distribution is considered as a surrogate for the abundance of species.

## Methods

This first step in this study was an update of the CESI dataset. The CESI dataset was created during 2001-2003 (Howington, 2008), initially using the Robertson and Kushlan (1995) EVER mammal species check list for visitors. Initially, the preferred habitat of mammals on the mammal species check list was determined by reviewing various literature references that describe observations of mammals within EVER and south Florida that included USFWS (1999), Myers and Ewel (1990), Schemnitz (1972), Jennings (1958), Schwartz (1952), Opsahl (1951), Blair (1935), and Bangs (1898). Updates to the preferred habitats were made using descriptions of where 15 native small and medium-sized mammals were found during an inventory conducted in 2011 by Pifer et al. (2011). All of these animals were already a part of the CESI and NPSpecies datasets.

The dataset was originally created in Excel in a format required to facilitate a GIS application that would visually display the potential occurrence of vegetation and animal species under the hydrologic conditions of a given simulation model run over a selected year; however, the dataset can be used independently of the GIS application. The final list of species, which has breeding, seasonal occurrence, and a general description of the preferred habitats, is provided in Howington (2015).

Habitat associations were made separately for each individual mammal species by comparing the species' preferred habitat in Florida using USFWS (1999), Myers and Ewel (1990), and personal knowledge and experience of the principle investigator, to the habitats within EVER as identified by the Florida GAP program (F-Gap) (Pearlstine et al., 2002). The hydroperiod associated with the habitat was also taken into account as developed by Wetzel (2001). Qualitative abundance and occurrence information that is reported in NPSpecies was not included in the CESI dataset. Table 1 provides the list of F-Gap vegetative communities used in this study. Qualitative abundance and occurrence information that is reported in NPSpecies was not included in the CESI dataset.

**Table 1.** The list of F-Gap vegetative communities used in this study and assessment codes.

F-Gap Vegetative Community Types	F-Gap Code
Open Saltwater/Seagrass/Sandy Bottom	1
Tropical Hardwood Hammock Formation	2
Semi-Deciduous Ecological Complex Tropical/Subtropical Swamp Forest	3
Xeric-Mesic Live Oak Ecological Complex	4
Mesic-Hydric Live Oak, Sabal Palm Ecological Complex	5
Bay/Gum/Cypress Ecological Complex	6
Lobolly Bay Forest	7
Cajeput Forest	8
Mixed Mangrove Forest Formation	9
Black Mangrove Forest	10
Red Mangrove Forest	11
Casuarina Compositional Complex	12
South Florida Slash Pine Forest	13
Mesic-Hydric Pine Forest	16

**Table 1. (continued).**

F-Gap Vegetative Community Types	F-Gap Code
Swamp Forest Ecological Complex	17
Cypress Forest	18
Buttonwood Woodland	20
Mixed Mangrove Woodland	21
Black Mangrove Woodland	22
Red Mangrove Woodland	23
South Florida Slash Pine Woodland	25
Dry Prairie Ecological Complex	29
Gallberry/Saw Palmetto	30
Brazilian Pepper Shrubland	31
Dwarf Mangrove Ecological Complex	32
Coastal Strand	33
Groundsel-tree/Marsh Elder Tidal Shrubland	34
Saturated-Flooded Cold Ecological Complex Shrubland	37
Saltwort/Glasswort Ecological Complex	38
Graminoid Emergent Marsh	42
Sawgrass Marsh	43
Spikerush Marsh	44
Muhly Grass Marsh	45
Cattail Marsh	46
Salt Marsh Ecological Complex	47
Sand Cordgrass Grassland	48
Black Needle Rush Marsh	49
Saltmarsh Cordgrass Marsh	50
Saltmeadow Cordgrass/Salt Grass Marsh	51
Sparsely Wooded Wet Prairie	52
Dwarf Cypress Prairie	53
Temperate Wet Prairie	54
Maidencane Marsh	55
Forb Emergent Marsh	56
Water Lily or Floating Leaved Vegetation	57
Periphyton	58
Sand, Beach	59

This comprehensive mammal-habitat dataset was first reviewed to identify species that are listed by the federal and/or state government as threatened or endangered (T&E) following the guidelines in the Endangered Species Act of 1973 with amendments (Title 16 of the United States Code). Updates were obtained from information available on the US Fish and Wildlife Service website (USFWS, 2014) and the Florida Fish and Wildlife Conservation Commission website (FFWCC, 2014).

Listings of species vulnerability were added for migratory species (USFWS, 2014) and those species considered as potentially in need of greater management protection by the Florida Natural Areas Inventory (FNAI) website (FNAI, 2014). Species considered as vulnerable and not threatened or endangered were not included as part of the T&E category in this study.

The list of non-native species in the dataset was updated using the Early Detection and Distribution Mapping System (EDDmaps) on-line citizen science database (EDDmaps, 2014). A total of five non-native mammal species Coyote (*Canis latrans*), Domestic Cat (*Felix domesticus*), Domestic Dog

(*Canis familiaris*), Southern short-tailed shrew (*Blarina carolinensis*), and Red Fox (*Vulpes vulpes*) were found during the small and medium-sized mammal inventory in 2011 (Pifer et al., 2011) that were already a part of the CESI, but not in the NPSpecies dataset.

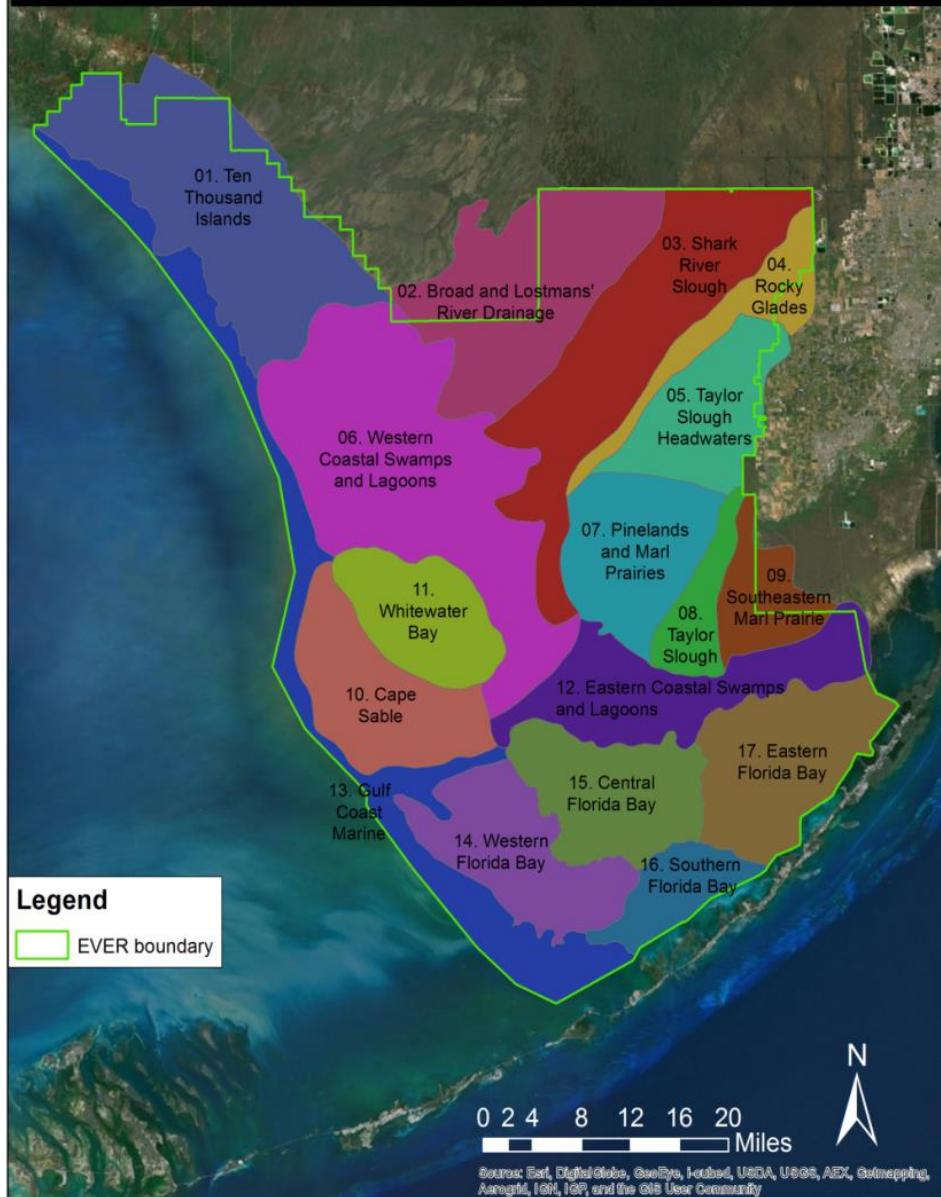
For the purpose of examining patterns of mammal diversity, and to facilitate the presentation of species lists, much of this analysis uses these three categories of mammals species within EVER. 1) native, non, T&E species (no special status), 2) T&E species (special status species), and 3) non-native species. Howington (2015), which contains the data and graphics associated with this report, is organized accordingly.

The second step of this study was to determine distribution of the species among EVER physiographic regions. As part of the Natural Resource Condition Assessment (NRCA) for EVER, the SFCN analyzed available vegetation and landscape information and created a map of 17 physiographic regions based on dominant physical and biological features of the landscape (NPS, *in press*). Figure 1 shows the map resulting from the analysis. This map was overlaid on the map of the F-Gap vegetative communities so that the mammal species in the CESI dataset could be associated with the physiographic regions.

A full description of each physiographic region can be found in the EVER NRCA (NPS, *in press*). The distribution of F-Gap vegetative communities within the physiographic regions is provided in Table 2. The detailed results of this step and metadata are provided in the dataset associated with this report (Howington, 2015).

## Everglades National Park Physiographic Regions

National Park Service  
U.S. Department of the Interior



**Figure 1.** The map of EVER's 17 physiographic regions created as part of the NRCA.

**Table 2.** Assignments of F-Gap codes to EVER NRCA regions.

<b>Physiographic Regions</b>	<b>F-Gap codes of vegetative communities found within physiographic regions</b>
Region 1 - Ten Thousand Islands	1, 9, 10, 11, 21, 22, 23, 33
Region 2 - Broad and Lostmans River Drainage	2, 3, 5, 21, 22, 23, 30, 43, 44, 46, 55, 56, 57, 58, 59
Region 3 - Shark River Slough	3, 5, 17, 43, 44, 55, 56, 57
Region 4 - Rocky Glades	5, 8, 12, 43, 44, 45, 46, 55, 56, 58
Region 5 - Taylor Slough Headwaters	2, 3, 4, 5, 8, 25, 30, 43, 44, 45, 46, 52, 55, 56, 58
Region 6 - Western Coastal Swamps and Lagoons	9, 10, 11, 17, 18, 21, 22, 23, 33, 59
Region 7 - Pineland and Southwestern Marl Prairies	2, 3, 4, 5, 6, 7, 13, 16, 18, 25, 29, 30, 31, 32, 42, 45, 46, 52, 53, 55, 56, 58
Region 8 - Taylor Slough	6, 32, 42, 43, 44, 45, 53, 54, 55, 56, 57, 58
Region 9 - Southeastern Marl Prairies	3, 8, 6, 17, 18, 42, 43, 44, 45, 46, 54, 55, 56, 58
Region 10 - Cape Sable	1, 9, 10, 11, 21, 22, 23, 34, 38, 42, 47, 48, 49, 50, 51, 59
Region 11 - Whitewater Bay	1, 9, 10, 11, 21, 22, 23
Region 12 - Eastern Coastal Swamps and Lagoons	9, 10, 6, 11, 20, 21, 22, 23, 32, 33, 34, 37, 38, 47, 48, 49, 50, 51, 59
Region 13 - Gulf Coast Marine	1
Region 14 - Western Florida Bay	1, 11, 17, 20, 23, 59
Region 15 - Central Florida Bay	1, 9, 11, 23, 33, 50, 51, 59
Region 16 - Southern Florida Bay	1, 11, 23
Region 17 - Eastern Florida Bay	1, 9, 11, 20, 21, 23, 33, 50, 51, 59

The third step of this study was performed by the SFCN. They provided an independent QAQC of the final species list of mammals in the CESI dataset when compared to the species list provided in NPSpecies. This QAQC was intended to facilitate the process of transferring the CESI dataset to the SFCN to use as their first step toward updating NPSpecies, which was the first objective of this study. The QAQC considered the various attributes describing the species and their populations that are documented in NPSpecies and include nativeness, qualitative abundance, general occurrence or frequency of presence in the park, and threatened and endangered status as listed by the federal and state governments. The QAQC reviewer's recommendations as to which species should not be considered to be in the park and which might be added to the NPSpecies list were incorporated as an update to the CESI dataset. The QAQC also included whether species in NPSpecies and the CESI dataset were equally identified in terms of the common and scientific names being used.

As a fourth step to this study, a final review was conducted of the SFCN QAQC recommendations, the EVER bird list in NPSpecies, and the most recent park mammals list. Decisions were made as to what would remain and what might be changed in the updated CESI species list based on the following criteria:

- If SFCN recommended the species not be considered in the park, it was removed from the dataset.
- If SFCN recommended that the species should be considered at species level only and not variety, the dataset was updated to reflect only species level identification.
- Some species listed in NPSpecies but not in most recent park check list were not added to the CESI dataset. The species in this category are all considered vagrants, occur not more than occasionally, and have only 1 or no observation references listed in the dataset in the NPSpecies dataset. The rationale is to ensure that all species occurring in the final list are the result of more than one documented observation. This should help to eliminate errors of inclusion, and is conservative when estimating biodiversity.
- EDDMaps was used as the current authority for the occurrence of non-native species in the park. This eliminated some species that are currently in NPSpecies. Use of the EDDmaps.org website is recommended in the future to determine the status of a species as “native” or “non-native”. Species that are native but not residents in EVER are identified as “vagrants” under the NPSpecies field called “NPS Tags” that includes a description of the seasonality of the species occurrence.
- Species listed as having unknown nativeness in NPSpecies are listed as non-native in the CESI dataset if the species appears in EDDmaps.org as non-native. Otherwise, the species is listed as native in the CESI dataset.

## Results and Discussion

The EVER NPSpecies dataset includes 36 mammal species (NPS, 2014). This list includes 22 native mammal species, 5 non-native mammal species, and 9 species of mammals documented as having “unknown” nativeness. The list of native species includes 4 species of mammals listed as T&E.

The NPSpecies dataset includes 9 of the 36 species of mammals considered “probably present” in the park on EVER grey literature or observations of the species in the Miami, Florida area. The presence of all species of mammals listed in NPSpecies is based on the most recent park list (Robertson and Kushlan, 2006).

After the QAQC provided by the SFCN, the final CESI species list includes a total of 43 mammal species (Howington, 2015). The dataset includes 33 native mammal species and 10 non-native mammal species. The final CESI dataset includes 7 native mammal species that are listed as T&E.

The QAQC provided by the SFCN recommended that the CESI dataset maintain the Key Largo Woodrat (*Neotoma floridana smalli*) as a potential addition to the NPSpecies dataset. The QAQC also recommended the removal of Southeastern beach mouse (Old field mouse) (*Peromyscus polionotus niveiventris*) from the CESI dataset that was determined not likely to be found within park boundaries.

As a result of a second review of the two datasets by this study it was decided that 4 additional native species, including one state listed as threatened, and 4 non-native mammals found in EDDmaps should be added to the NPSpecies. These non-native mammal species were found during the small and medium-sized mammal inventory in 2011 (Pifer et al., 2011) and were already a part of the CESI, but not the NPSpecies dataset. The species to be added to the CESI dataset and added to the NPSpecies dataset are provided in Table 3.

**Table 3.** List of the mammal species to be added to the NPSpecies and CESI datasets.

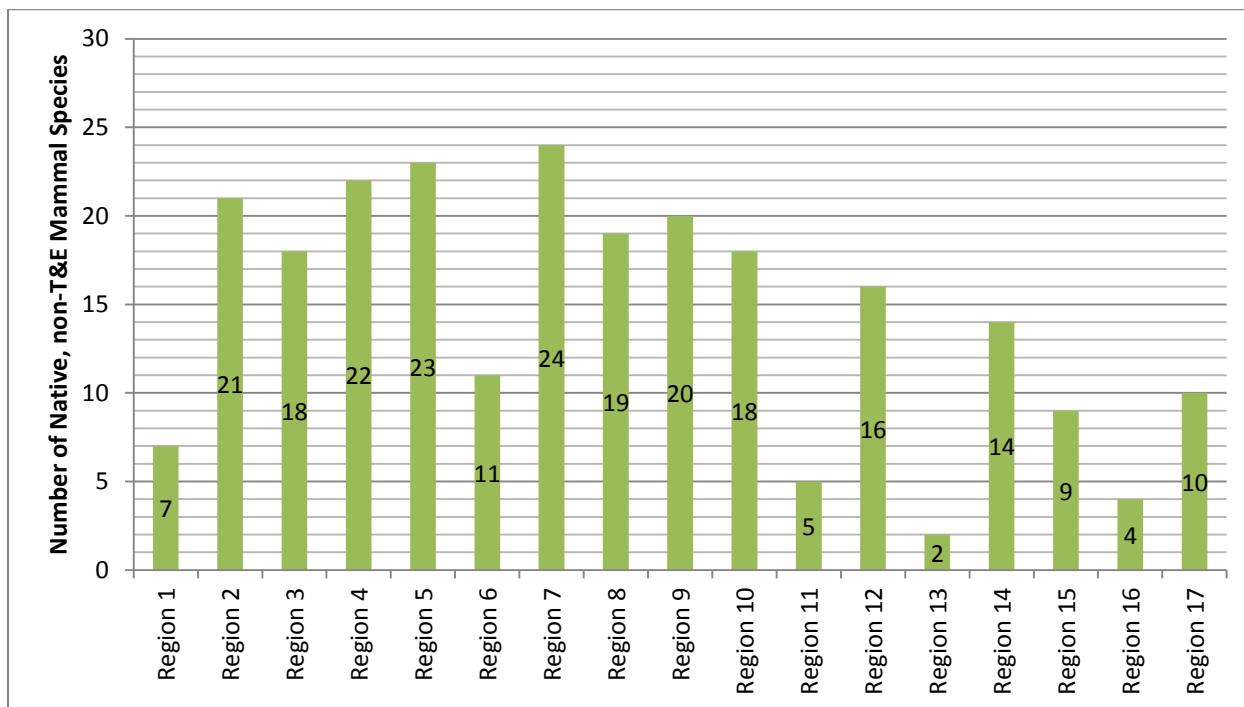
<b>Native mammal species to be added to CESI dataset and NPSpecies</b>
Southern short-tailed shrew ( <i>Blarina carolinensis</i> )
LeConte's free-tailed bat ( <i>Tadarida brasiliensis</i> )
Eastern Pipistreele ( <i>Pipistrellus subflavus</i> )
Big Cypress fox squirrel ( <i>Sciurus niger</i> ) (ST)
Non native mammal species to add to NPSpecies
Coyote ( <i>Canis latrans</i> )
Domestic Cat ( <i>Felis domesticus</i> )
Domestic Dog ( <i>Canis familiaris</i> )
Southern short-tailed shrew ( <i>Blarina carolinensis</i> )

The species list in the CESI dataset identifies 18 different mammalian guilds in EVER. Guilds are defined in this report as a grouping of species having similar traits of behavior, such as feeding strategy, or habitat preferences (see Table 4).

**Table 4.** Mammalian guilds in EVER (guilds with one asterisk [\*] contain non-native species and those with two asterisks [\*\*] only contain non-native species).

Armadillo**	Deer	Marsupials	Shrews Moles
Bats	Dogs**	Pigs**	Skunks, Mink, Otters
Bears	Dolphins and Whales	Rabbits	Squirrels
Big Cats	Fox*	Raccoons	
Cats**	Manatee	Rats and Mice*	

An average of 14 native mammal species is predicted to be found in any one of EVER's physiographic regions (see Figure 2). Five physiographic regions include more than 20 species mammal species found in EVER.



**Figure 2.** Graph of the total number of native mammal species predicted to be found in each physiographic region of EVER.

One explanation for why these regions have the highest number of native mammal species relates back to the complexity of the habitats within these regions. Individual species of mammals often prefer many different types of habitats, and these regions of higher than average species richness contain the highest number of different F-Gap community types. Moreover, regions that contain uplands of forests of pine, oak and sable palm have high numbers of mammals in EVER.

The location of these regions relative to each other may also account for the high number of species. These regions essentially comprise floodplains of Shark River Slough and Taylor Slough. Floodplains are well known as areas of high biological productivity. High productivity in EVER has been commonly attributed to the alternating pulse of surface water flowing downstream following the wet and dry seasons of South Florida's climate. Many studies have attributed high species richness

to climate and high productivity at large scales (Field et al. 2008). It is, however, not well understood how the biodiversity of mammal communities responds to changes in floodplains that are irregularly forested with tree islands and large expanses of flooded grasses such as that of Shark River Slough.

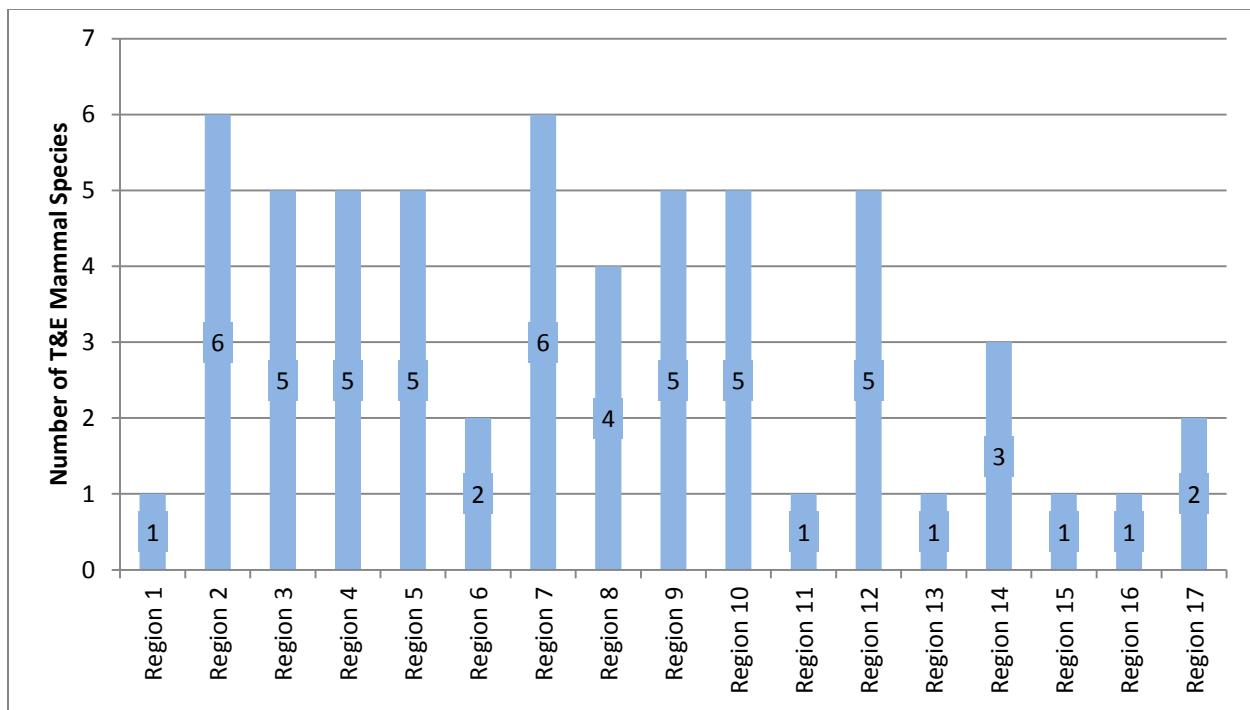
To better understand general patterns of mammal species distributions in EVER, the number of physiographic regions associated with a particular species was analyzed, starting with the subset of native, non-T&E species. There are 5 native, non-T&E mammal species that can be considered to have the most broad distribution. Mammals with a narrow distribution were defined as those occurring in 3 or fewer physiographic regions, and two mammal species fit this description. The species with the broadest and most narrow distribution are listed below in Table 5.

**Table 5.** provides the list of most broadly and most narrowly distributed mammal species.

Native, non-T&E species with the most broad distributions	Native, non-T&E species with the most narrow distributions
White-tailed deer ( <i>Odocoileus virginianus</i> )	Brazilian freetail bat (Mexican freetail bat) ( <i>Tadarida brasiliensis</i> )
Least shrew ( <i>Cryptotis parva</i> )	Eastern spotted skunk ( <i>Spilogale putorius</i> )
Eastern mole ( <i>Scalopus aquaticus</i> )	
Round-tailed muskrat ( <i>Neofiber alleni</i> )	
Eastern spotted skunk ( <i>Spilogale putorius</i> )	

Eight of EVER's physiographic regions have with the highest number of the T&E mammal species each have 5 to 6 species out of the 7 T&E mammal species found in EVER (see Figure 3). This group includes the same physiographic regions that have the highest number of native, non-T&E mammal species with the addition of Region 12 – Eastern Coastal Swamps and Lagoons.

There are not any T&E mammal species that are distributed in more than 11 physiographic regions. There is an average of 3 to 4 T&E species in any one of EVER's physiographic regions. There are 3 T&E species that are may be found in 11 physiographic regions include the Florida panther (*Puma concolor coryi*), Florida manatee (*Trichechus manatus latirostris*), Key Largo cotton mouse (*Peromyscus gossypinus*). The T&E species with the narrowest distribution is the Florida Mastiff Bat (*Eumops glaucinus floridanus*), also known as Wagner's Bonneted bat, which is known only to be found in Region 7 – Pinelands and Southwestern Marl Prairies.

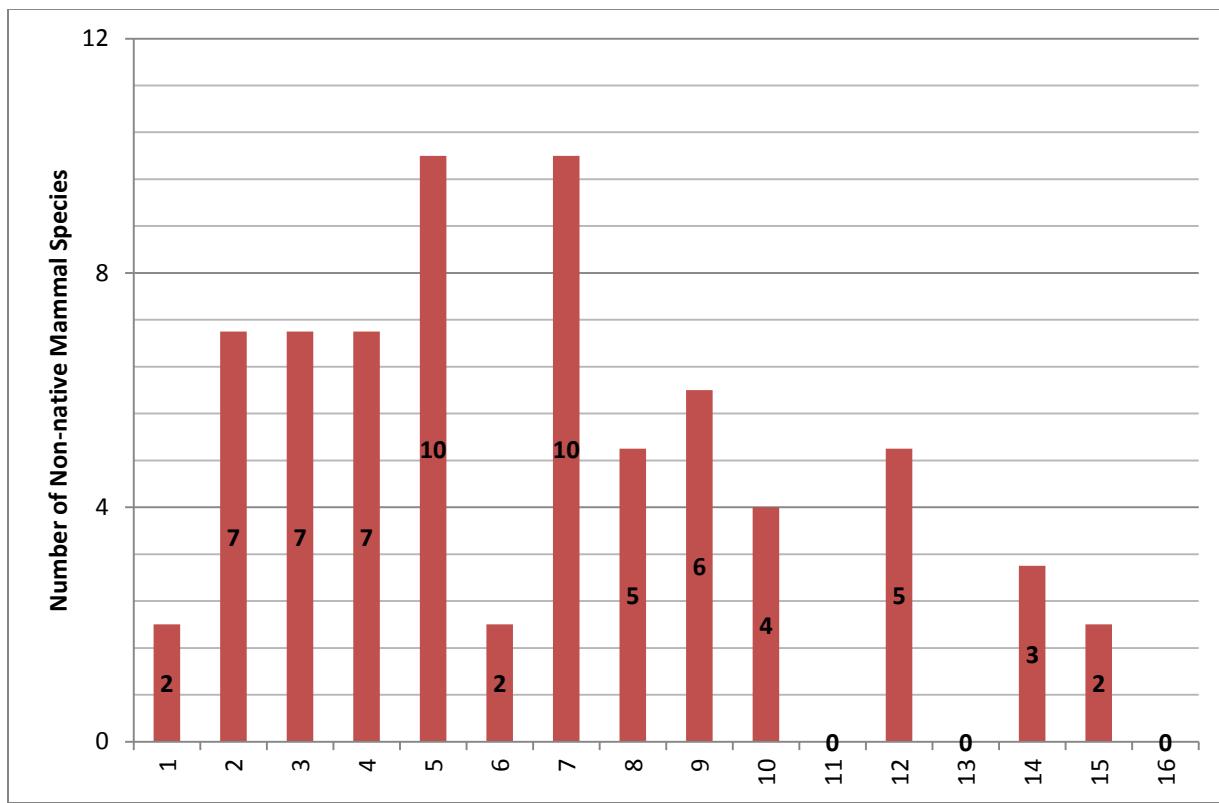


**Figure 3.** Graph of the total number of T&E mammal species predicted to be found in each physiographic region of EVER.

Non-native mammal species can be found in all of EVER's physiographic regions except 11 – Whitewater Bay, Region 13 - Gulf Coast Marine, and Region 16 – Southern Florida Bay (see Figure 4). Two regions have 10 non-native mammals: Regions 5 – Broad and Lostmans River Drainage and Region 7 – Pineland and Southwestern Marl Prairies. The regions with the least number of non-native species are those farthest away from the upland and freshwater areas. Three regions have 2 non-native mammals and include Regions 1 – Ten Thousand Islands, 10- Cape Sable, and 15 – Central Florida Bay.

The non-native mammal species with the most broad distribution may be found in 13, of EVER's physiographic regions. These non-native species include the House mouse (*Mus musculus*) and Roof rat (Black rat) (*Rattus rattus*).

The non-native mammal species with the narrowest distribution is the Red fox (*Vulpes vulpes*). It may be found in 2 of EVER's physiographic regions, Region 7 – Pinelands and Southwestern Marl Prairies and Region 5 – Taylor Slough Headwaters.



**Figure 4.** Graph of the total number of non-native mammal species predicted to be found in each physiographic region of EVER.

The majority of non-native mammals in EVER originated from the urbanized areas in South Florida. The non-native mammals in EVER are mostly either formerly domesticated, such as dogs, cats, and pigs, or are part of populations that have gradually expanded across the United States as wild areas have developed, such as the Nine-banded armadillo (*Dasypus novemcinctus*), Red fox (*Vulpes vulpes*), Roof rat (*Rattus rattus*), and House mouse (*Mus musculus*) (FFWCC, 2014b; FFWCC, 2014c; Loughry et al., 2013; Statham et al. 2012).

## **Conclusions**

The CESI dataset provided here is currently the most updated park-wide species list of mammals found in EVER. It is useful as a source of fully-referenced information about native, T&E, and non-native species found in EVER, and associates these species with habitats in EVER as well as with the broader physiographic regions defined in the EVER NRCA.

The CESI dataset is provided for the purposes of creating an updated EVER mammal list for NPSpecies. It is recommended that the information on preferred habitats and seasonal occurrence of species be incorporated into NPSpecies as additional data fields. Inclusion of species-habitat associations in NPSpecies can provide a wealth of information for further analysis, from comparison of different taxonomic groups in park habitats, to examination of long-term changes that can occur throughout park landscapes with time.

Additional studies of interest in the future include tracking biodiversity over time in EVER and looking at the ecosystem-wide effects of climate change and regional ecosystem restoration. As the data in NPSpecies is updated using new information such as the data included in this report, these comparative studies become more feasible, providing pertinent information to resource managers about the status of biodiversity in the park.



**Photo 4.** Track of Florida black bear (*Ursus americanus floridanus*). Photo courtesy of G. Reed and National Park Service.

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**Photo 5.** Virginia opossum (*Didelphis virginiana*) in a tree. Photo courtesy of National Park Service.

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