BIOLOGICAL OPINION
For
Final General Management Plan - Addition

Submitted to:

Big Cypress National Preserve

Prepared by:

Jane Tutton and Chris Belden

U.S. Fish and Wildlife Service
South Florida Ecological Services Office
Vero Beach, Florida

November 17, 2010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMES

BE	Biological Evaluation
BICY	Big Cypress National Preserve
CERP	Comprehensive Everglades Restoration Plan
CFA	Core Forging Area
Corps	U.S. Army Corps of Engineers
CR	County Road
DEP	Florida Department of Environmental Protection
District	South Florida Water Management District
EIS	Environmental Impact Statement
ENP	Everglades National Park
FDACS	Florida Department of Agriculture and Consumer Services
FDOF	Florida Division of Forestry
FLUCCS	Florida Land Use Cover and forms Classification System
FPNWR	Florida Panther National Wildlife Refuge
FSPSP	Fakahatchee Strand Preserve State Park
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information Systems
GMP	General Management Plan
GPS	Global Positioning System
I-75	Interstate 75
IPCC	Intergovernmental Panel on Climate Change
NEPA	National Environmental Protection Agency
NGGE	Northern Golden Gate Estates
NPS	National Park Service
NWI	National Wetlands Inventory
ORV	Off-Road Vehicle
PA	Preferred Alternative
PSSF	Picayune Strand State Forest
Service	U.S. Fish and Wildlife Service
SGGE	Southern Golden Gate Estates
Slopes	Standard Local Operating Procedures for Endangered Species
SR	State Road
US 41	U.S. Highway 41
WMA	Wildlife Management Area

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

November 18, 2010

Memorandum

To: Pedro Ramos, Superintendent, Big Cypress National Preserve

From: Paul Souza, Field Supervisor, South Florida Ecological Services Office

Subject: Final General Management Plan - Addition Biological Opinion, Service Consultation Code: 41420-2006-F-0095

The U.S. Fish and Wildlife Service (Service) has received the National Park Service's (NPS) Draft Final General Management Plan for the Big Cypress National Preserve – Addition (GMP). Your memorandum and GMP, dated September 28, 2009, provided determinations of effect for seven federally-listed threatened or endangered species. The following memorandum represents the Service's biological opinion for the development and implementation of the NPS's Preferred Alternative (PA). The Service has also recently received a memorandum and an amended *Interagency Section 7 Biological Evaluation* form from the NPS for the Addition Lands GMP project.

CONSULTATION HISTORY

The Service's involvement in this GMP has been extensive. Many meetings and site visits have been conducted to identify and discuss issues pertinent to the development of the PA. Although including every meeting, email, and teleconference would be onerous and not provide substantive information, the highlights of the consultation history are included in this section.

On December 13, 2005, Service staff attended a public meeting hosted by NPS scoping proposed alternatives for the Addition Lands GMP to the public for comment.

On January 9, 2006, the Service sent a memorandum providing comments on the initial range of alternatives for the GMP.

On June 13, 2007, the Service sent a memorandum commenting on NPS' Newsletter 5 regarding the proposed alternatives to be considered for inclusion in the National Environmental Policy Act (NEPA) analysis for the draft GMP.

On May 22, 2009, a teleconference was held with NPS and to discuss wildlife concerns to be addressed by the GMP.

On August 12, 2009, the Service attended another public meeting hosted by NPS and designed to keep the public informed on the status of the GMP and allow the public to provide comments on the suite of alternatives being considered.

On October 9, 2009, the Service sent a memorandum providing comments, in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*) and NEPA on the draft GMP dated July 20, 2009. The memorandum included recommendations related to trail selection and criteria, as well as recommendations to improve the document and conserve the listed species found on the Addition Lands.

On November 12, 2009, a meeting was held between NPS, Florida Fish and Wildlife Conservation Commission (FWC), and Service to discuss the preferred alternative being considered and its potential effects on the Florida panther (*Felis concolor coryi*).

On January 12, 2010, the Service provided NPS with a current list of threatened or endangered species to be considered for inclusion as issues in the GMP.

Since that time the Service has continued to consult with the NPS on the development of their final GMP/EIS, which is expected to be released to the public in the fall of 2010.

BIOLOGICAL OPINION

PROJECT DESCRIPTION AND BACKGROUND

The development of the GMP for the Addition Lands is a NPS requirement. The GMP for Big Cypress National Preserve (BICY) that was approved in 1991 (NPS 1991) did not, by its own terms, include the Addition Lands (approximately 147,000 acres); therefore, a separate GMP must be developed for them. This GMP includes four alternatives, including the no-action alternative and the preferred alternative which is the proposed action for this consultation. Each of the alternatives uses the concept of zoning for levels of activity except the no-action alternative. The four zones described are:

1. Developed – This zone includes Interstate 75 (I-75) access points, orientation and interpretation facilities, comfort stations, boardwalks and trails, administrative facilities, and commercial facilities.

2. Frontcountry – This zone includes recreational access or trailhead parking, picnic areas, orientation facilities, campgrounds, comfort stations, boardwalks and trails, and commercial activities.

3. Backcountry Recreation – This zone includes hiking, backpacking, hunting, fishing, horseback riding, camping, boating, bicycling, and vehicle use. Vehicle use is restricted to designated trails. Information/interpretation, ranger stations, fire cache, outfitter/guide activities, and resource protection and monitoring activities are also included.

4. Primitive Backcountry – This zone includes hiking, backpacking, hunting, fishing, horseback riding, camping, and non-motorized boating. Trails for non-motorized use could be designated in this zone. Outfitter/guide activities would be permitted and resource monitoring and protection activities would occur.

Two of the alternatives, including the PA, include the designation of primary trails. NPS defines primary trails as trails that would be maintained at an appropriate width and at grade so that they would not inhibit surface water flow. Trails that require stabilization are typically designed and maintained to be approximately 12 feet wide. Secondary trails are not identified in each alternative but are defined as branching off primary trails and receiving less use. They may be established to provide access to private property or specific destinations. Secondary trails would extend for a short distance from primary trails only. Secondary trails established to access private property would be limited in use to that landowner if no other destination existed along that route. The extent of secondary trails has not been identified in the GMP, therefore, this consultation will assess the potential effects of implementing the proposed primary system in the Addition Lands.

The PA would include off-road vehicle (ORV) access, provide a moderate amount of wilderness, provide non-motorized trail opportunities and new camping opportunities, and develop a partnership approach to visitor orientation. New visitor and operations facilities along the I-75 corridor would also be provided. This alternative also includes designation of approximately 130 miles of primary ORV trails and issuance of a maximum of 650 permits. Approximately 47,067 acres (ac) of the Addition Lands would be designated as wilderness under this alternative. Three new access points for motorized and non-motorized users would be provided under the PA. Two of these would be on I-75 and one at Bear Island Grade on State Road (SR) 29. A new hiking trailhead would be created at Miles City. A day use area would be created at Deep Lake, and facilities to support commercial services or partnerships would be created at Carnestown. A graphical representation of this information is located in Map 5 of the GMP and is included in Figure 1.

Details on the number of parking spaces and configuration of the access points are not available at this time. These access points will be developed as implementation of the PA is phased. These activities will also be subject to section 7 consultation in accordance with 50 CFR § 402. We assume that the amount of access enabled by the access points will be consistent with the number of permits allowed by the PA, depending on the phase of implementation. Should management unit quotas be established, the facilities at each access point would be designed with those limits in mind.

ACTION AREA

The Action Area for this consultation is defined differently than the action area for the development and implementation of the 2000 ORV Management Plan (NPS 2001). Since that consultation was written, additional science and models have indicated that a change in the calculation of action area was necessary. The Service now views the action area as the project location, or the central point of the project, plus a 25-mile buffer surrounding this location. For

the purposes of this consultation, we placed the 25-mile buffer around the northeast Addition Lands boundaries rather than at the center point of the Addition Lands (Figure 2). Since this project is not a development project that would result in direct loss of panther habitat, we believe this is a conservative approach. Designation of this large Action Area for the consultation is also consistent with recent biological opinions for the panther and necessarily reflects the wide ranging movements of juveniles and the large home territories of adults.

The Action Area is a subset of the current geographic range of the panther and includes those lands that the Service believes may experience direct and indirect effects from the proposed action. The 25-mile buffer around Addition Lands is based on an "average effective dispersal distance" of 37.3 kilometers (km) (23.2 miles) for subadult males (Maehr et al. 2002a) or a subadult male "mean dispersal distance" of 40 km (24.9 miles) from the natal range of subadult males (Comiskey et al. 2002). An area delineated based on this distance encompasses females as well because male panther dispersal distances exceed those reported for female panthers.

STATUS OF THE SPECIES/CRITICAL HABITAT

Seven federally threatened or endangered species were included in the analysis topics of the GMP. These included the endangered Florida panther, endangered West Indian manatee (*Trichechus manatus*), endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*), endangered red-cockaded woodpecker (*Picoides borealis*), endangered wood stork (*Mycteria americana*), endangered American crocodile (*Crocodylus acutus*), and the threatened eastern indigo snake (*Drymarchon corais couperi*).

Analysis of the species/critical habitat likely to be affected

Critical habitat has been designated for the West Indian manatee, Everglade snail kite, and American crocodile, although the Action Area contains critical habitat only for the manatee and the kite. The proposed project is not likely to affect hydrology or fresh water flows to designated manatee critical habitat. It is also not likely to increase or decrease recreational or commercial boating activity within designated critical habitat, therefore, manatee critical habitat is not likely to be adversely affected by implementation of the PA described in the GMP. The proposed action is also not likely to alter the status of designated critical habitat for either the Everglade snail kite or the American crocodile. These designated critical habitats will not be further discussed in this consultation.

The NPS provided determinations of effect for these species in the table in section VIII of the Biological Evaluation (BE) for the GMP, dated September 28, 2010. The BE provides information on the nature of the effects the PA may have on listed species and identifies actions the NPS will undertake to ensure the effects of implementation of the PA are minimized to the maximum extent practicable.

The GMP states that new paddling routes would be designated under the PA and that the new routes could affect behaviors of West Indian manatees to a minor degree. Non-motorized vessels

may increase human presence in areas used by manatees, but they do not create a likelihood of injury or death. It would be difficult to measure the effects of the new paddling routes on manatees due to a lack of baseline information and other uncontrollable variables. Manatees may exhibit some response to paddlers, however, it is unlikely that the effect of that displacement would rise to a measurable level or result in a reduction in reproductive success or alterations in breeding or foraging patterns. The NPS has determined the development and implementation of the GMP is not likely to adversely affect the West Indian manatee. Based on the information provided in the GMP and summarized above, the Service concurs.

The Everglade snail kite does not currently nest in the Addition Lands. However, there may be areas of the Addition Lands that provide suitable foraging or loafing opportunities. While some areas of the Addition Lands may have a hydroperiod conducive to apple snail (*Pomacea paludosa*) populations, these areas are more dispersed than they are in areas like the Water Conservation Areas. Implementation of the PA of the GMP will increase human use of the Addition Lands. Most of this human use will be confined to designated trails, hiking trails, or destination locations. The majority of these areas do not have suitable Everglade snail kite habitat. Areas that will receive increased non-motorized boat usage are not suitable habitat for snail kites (those areas on the SR 29 corridor). The NPS has committed to continuing management of exotic plants and animals. Hydrologic restoration projects will also be continued. These management actions should improve habitat for apple snails and Everglade snail kites. Designated critical habitat for the Everglade snail kite is present in the action area. Activities associated with the implementation of the PA are not likely to affect the hydrology of the designated critical habitat as the Addition Lands are hydrologically disconnected from designated critical habitat in the Water Conservation Areas by the L-28. The NPS determined the development and implementation of the PA in the GMP is not likely to adversely affect the Everglade snail kite. Based on the information provided in the GMP and summarized above, the Service concurs.

The Core Foraging Area (CFA) of 46 wood stork colonies intersects the Action Area (Figure 3). Although wood stork nesting in BICY is a rare occurrence, in 1996, 45 wood stork colonies were reported in the past (Jansen and Brooks 1996). Some of these colonies may have only been used once as they are not in our GIS database. Six known locations of wood stork rookeries in the Addition Lands are depicted in Map 14 of the GMP. Three of these known rookeries are south of I-75. As in other parts of south Florida, nesting locations vary sometimes from year to year depending upon conditions. Many colony sites are used every year, while some are used intermittently. Aside from nesting, wood storks use much of the Addition Lands for foraging and roosting. Much of the Addition Lands, particularly the northeast Addition south of I-75, contain wetlands with hydropatterns conducive to wood stork foraging. NPS staff will continue to survey former nest sites to determine if they are re-occupied. Management actions, including removal of exotic vegetation and hydrologic restoration, undertaken during implementation of the PA should create more natural and beneficial conditions for wood stork foraging. Based on this information, the NPS has determined the development and implementation of the GMP is not likely to adversely affect the wood stork. The Service concurs.

Red-cockaded woodpeckers use the original BICY as established in 1974. Although there are 70 to 80 active colonies on the original BICY, no known colonies have been located in the Addition Lands. Red-cockaded woodpeckers have had active colonies in the Addition Lands in the past and management actions undertaken near the southern boundary of the northeast Addition may have improved the potential habitat in this area. Management actions beneficial to this species will continue under the PA. A subsample of the colonies located within the original BICY is sampled each year during the breeding season. Should colonies form in the Addition Lands, these colonies will be included in the sampling efforts. This information will provide an index on the status of the species throughout BICY. In the original BICY, tree loss from soil compaction near ORV trails has not occurred and ORV trails located near active colonies are closed for colony protection. Based on this information, the NPS has determined that implementation of the PA of the GMP is not likely to adversely affect the red-cockaded woodpecker. The Service concurs.

Eastern indigo snakes have been seen in the Addition Lands. There are sufficient uplands and wetlands to provide habitat for prey species and the climate in this part of Florida is humid enough that eastern indigo snakes need not rely on gopher tortoise (*Gopherus polyphemus*) burrows to prevent desiccation. Prey for eastern indigo snakes includes small mammals, lizards, other snakes, and birds. The Addition Lands have a mosaic of habitat types that would support a wide variety of prey items for eastern indigo snakes. The activities included in the PA with the potential to affect this species are construction of new access points or recreational facilities and the use of ORV trails. NPS has incorporated an education program to inform users of the Addition Lands of the presence of, description of, and protections afforded this species. When access points or camping facilities, other than primitive camping facilities, are constructed, it is likely that U.S. Army Corps of Engineers' (Corps) permits will have to be secured. Additional consultation on the construction of the access points or other facilities will occur during that process. The PA is not a development project. During implementation, some eastern indigo snake habitat may become less suitable through trail hardening. However, trails were proposed on existing roadways or historic trails and hardening is not intended to change an existing trail from disturbed, native plant communities to paved roadway. NPS states that primary trails will typically be approximately 12 feet in width. The effect of this change in habitat condition would be difficult to measure. In biological terms, it is not likely that the change in territory size or configuration would result in measurable changes in feeding, breeding, or sheltering behaviors of the eastern indigo snake. The NPS determined the development and implementation of the GMP is not likely to adversely affect the eastern indigo snake. Based on the information provided in the GMP and summarized above, the Service concurs.

American crocodiles are occasionally sighted in BICY. In addition, they occur in southwestern Collier County and designated critical habitat is present in Everglades National Park (ENP). For those reasons, NPS retained the species as an issue to be addressed when developing the PA of the GMP. Current levels of boating activity and human use as well as any increase in those levels could alter the breeding, feeding, and sheltering behaviors of crocodiles in the area. Crocodile use of the Addition Lands is intermittent at present. Should American crocodiles begin to regularly use the Addition Lands, NPS would contact the Service for guidance on actions to implement to minimize risk to this species. Actions could include temporary closures

of boating areas as well as education of recreational users. Based on this information, NPS has determined that the implementation of the PA of the GMP is not likely to adversely affect the American crocodile. The Service concurs.

NPS has included criteria for measuring the effects of implementation of the PA of the GMP on these listed species. In addition, the Service will maintain channels of communication and remain an active participant in the implementation of the PA. These commitments provide an additional level of assurance that the implementation of the PA in the GMP is not likely to adversely affect the species considered above. These species will not be further discussed in this Biological Opinion. However, the reinitiation clause at the end of the Biological Opinion also applies to these species.

In developing the GMP and PA for the Addition Lands, particular consideration was given to the Florida panther. Although much science is available on this species, the cause of certain behaviors, such as movements away from ORV trails during hunting season, is not well known and cannot be controlled when studying the panther *in situ*. As a result of this lack of certainty, the NPS agreed that a conservative approach to addressing the potential effects of the development of the GMP and implementation of the PA would be to assume that the changes in human use of the Addition Lands could create stressors that would elicit a response in panthers. Based on that approach, the NPS has determined that the development of the GMP and implementation of the PA may affect, and is likely to adversely affect the Florida panther. The Service concurs and offers the following biological opinion.

Florida Panther

The Florida panther is the last subspecies of *Puma* (also known as mountain lion, cougar, puma, painter, or catamount) still surviving in the eastern United States. Historically occurring throughout the southeastern United States (Young and Goldman 1946), today the panther is restricted to less than 5 percent of its historic range in one breeding population of approximately 100 animals, located in south Florida.

When Europeans first came to this country, pumas roamed most all of North, Central, and South America. Early settlers attempted to eradicate pumas by every means possible. By 1899 it was believed Florida panthers had been restricted to peninsular Florida (Bangs 1899). By the late 1920s to mid 1930s it was thought by many that the Florida panther had been completely extirpated (Tinsley 1970). In 1935, Dave Newell, a Florida sportsman, hired Vince and Ernest Lee, Arizona houndsmen, to hunt for panthers in Florida. They killed eight in the Big Cypress Swamp (Newell 1935). Every survey conducted since then has confirmed that a breeding panther population occurs in southern Florida south of the Caloosahatchee River, and no survey since then has been able to confirm a panther population outside of southern Florida.

Attempts to eradicate panthers and a decline in panther prey (primarily white-tailed deer [*Odocoileus virginianus*]) resulted in a panther population threatened with extinction. Prior to 1949, panthers could be killed in Florida at any time of the year. In 1950, the Florida Game and Freshwater Fish Commission (now FWC) designated the panther a regulated game species due to

concerns over declining numbers. The FWC removed panthers from the game animal list in 1958 and gave them complete legal protection. On March 11, 1967, the Service listed the Florida panther as endangered (32 Federal Register 4001) throughout its historic range, and these animals received Federal protection under the passage of the Act in 1973. Also, the Florida Panther Act (State Statute 372.671), a 1978 Florida State law, made killing a panther a felony. The Florida panther is listed as endangered by the States of Florida, Georgia, Louisiana, and Mississippi.

Since the panther was designated as an endangered species prior to enactment of the Act, there was no formal listing package identifying threats to the species as required now by section 4(a)(1) of the Act. However, the Florida Panther Recovery Plan, third revision, addressed the five factor threats analysis (Service 2006b, 2008).

Species/critical habitat description

An adult Florida panther is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. There has never been a melanistic (black) puma documented in North America (Tinsley 1970, 1987). Florida panther kittens are gray with dark brown or blackish spots and five bands around the tail. The spots gradually fade as the kittens grow older and are almost unnoticeable by the time they are 6 months old. At this age, their bright blue eyes slowly turn to the light-brown straw color of the adult (Belden 1988).

A plan for genetic restoration and management of the Florida panther was developed in September 1994 (Seal 1994) and eight non-pregnant adult female Texas cougars (*Puma concolor stanleyana*) were released in five areas of south Florida from March to July 1995. Since this introgression, rates of genetic defects, including crooked tails and cowlicks, have dramatically decreased (Mansfield and Land 2002; Land et al. 2004; Onorato et al. 2010; Johnson et al. 2010). The last of these females was removed in 2003.

No critical habitat has been designated for the Florida panther.

Distribution and trends

The Florida panther once ranged throughout the southeastern United States from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee (Young and Goldman 1946). Historically, the panther intergraded to the north with *P. c. cougar*, to the west with *P. c. stanleyana*, and to the northwest with *P. c. hippolestes* (Young and Goldman 1946).

Although generally considered unreliable, sightings of panthers regularly occur throughout the southeast. However, no reproducing populations of panthers have been found outside of south Florida for at least 30 years, despite intensive searches to document them (Belden et al. 1991; McBride et al. 1993; Clark et al. 2002). Field surveys and more than 90,000 locations of radio-collared panthers recorded between 1981 and 2010 clearly define the panther's current breeding range. Reproduction is known only in the Big Cypress Swamp and Everglades

physiographic region in Collier, Lee, Hendry, Miami-Dade, and Monroe Counties, south of the Caloosahatchee River (Belden et al. 1991). Although the breeding segment of the panther population occurs only in south Florida, panthers have been documented north of the Caloosahatchee River over 125 times since February 1972. This has been confirmed through field signs (*e.g.*, tracks, urine markers, scats), camera-trap photographs, seven highway mortalities, four radio-collared animals, two captured animals (one of which was radio collared), and one skeleton. From 1972 through 2004, panthers had been confirmed in 11 counties (Flagler, Glades, Highlands, Hillsborough, Indian River, Okeechobee, Orange, Osceola, Polk, Sarasota, Charlotte, and Volusia) north of the river (Belden et al. 1991; Belden and McBride 2005). However, no evidence of a female or reproduction has been documented north of the Caloosahatchee River since 1973 (Nowak and McBride 1974; Belden et al. 1991; Land and Taylor 1998; Land et al. 1999; Shindle et al. 2000; McBride 2002; Belden and McBride 2005).

Puma are wide ranging, secretive, and occur at low densities. However, their tracks, urine markers, and scats are readily found by trained observers, and resident populations are easily located. Van Dyke et al. (1986a) determined that all resident puma, 78 percent of transient puma, and 57 percent of kittens could be detected by track searches in Utah. During 2 month-long investigations – one late in 1972 and early 1973 and another in 1974 – funded by the World Wildlife Fund to determine if panthers still existed in Florida, McBride searched for signs of panthers in portions of south Florida. In 1972, McBride authenticated a road-killed male panther in Glades County and a female captured and released from a bobcat trap in Collier County (McBride 2005). In 1973, McBride captured one female in Glades County (Nowak and McBride 1974). Based on this preliminary evidence, Nowak and McBride (1974) estimated the "population from the Lake Okeechobee area southward to be about 20 or 30 individuals." In 1974, McBride found evidence of only two additional panthers in the Fakahatchee Strand and suggested that "there could be as few as 10 individual panthers in the area around Lake Okeechobee and southward in the State" (Nowak and McBride 1975). This initial survey, while brief in nature, proved that panthers still existed in Florida and delineated areas where a more exhaustive search was warranted. After this initial investigation, more comprehensive surveys on both public and private lands were completed (Reeves 1978; Belden and McBride 1983; Belden et al. 1991).

More recently, McBride et al. (2008) and McBride (2010) reported minimum population counts (*i.e.*, number known alive) based on physical evidence (*e.g.*, tracks, urine markers, panther treed with hounds, trail-camera photos). They counted adult and subadult panthers but not kittens at the den. Three rules were used to distinguish individuals: (1) gender was determined by track size or stride length; (2) time (freshness) was determined by known events within the past 24 hours, such as wind or rain; and (3) distance between individual track sets. These rules were used as an exclusionary tool to avoid over-counting (McBride et al. 2008). The number of panthers detected and verified by physical evidence from 1981 to 1994 fluctuated between a high of 30 and a low of 19 adult and juvenile panthers, with the lowest point occurring in 1991 following the removal of 7 juveniles and 3 kittens to initiate a captive breeding program (McBride et al. 2008). In 1995, eight female pumas from Texas were released to address suspected deleterious effects of inbreeding. From 1996 to 2003, the panther population was increasing at a rate of 14 percent per year with 26.6 kittens being produced annually

(Johnson et al. 2010). The effective population size (N_e) rose from 9.6 to 32.1, and N_e /N was 0.314 (Johnson et al. 2010). The population has tripled since 1995 (McBride et al. 2008; Johnson et al. 2010), reaching a high of 117 by 2007 (mortalities not subtracted) (McBride et al. 2008). The count for 2009 (mortalities not subtracted) was 113 (McBride 2010). The deterministic annual growth rate (λ) for pre-1995 panthers was 0.952 ± 0.026 (SE), suggestive of a shrinking population (Hostetler et al. 2009). The λ for the overall population now is 1.052 ± 0.023 suggestive of a growing population (Hostetler et al. 2009).

Maehr et al. (1991) provides an estimate of population density of 1 panther/27,520 acres [11,137 hectares (ha)] based on 17 concurrently radio-collared and 4 uncollared panthers. They extrapolated this density to the area occupied (1,245,435 acres [504,012 ha]) by radio-collared panthers during the period 1985 to 1990 to achieve a population estimate of 46 adult panthers for southwest Florida (excluding ENP, eastern BICY, and Glades and Highlands Counties). Beier et al. (2003), however, argued that this estimate of density, although "reasonably rigorous," could not be extrapolated to other areas because it was not known whether densities were comparable in those areas. Kautz et al. (2006) provided a density estimate of 1 panther/31,923 acres (12,919 ha) by dividing the panther count at that time (67) by the area within the Primary Zone. However, panther densities are variable across the landscape. Using an average of the 2007 to 2009 panther counts in the eight survey units of McBride et al. (2008) and Kautz et al. (2006) Primary Zone land within these survey units, density estimates range from a low of 1 panther/81,479 acres (32,974 ha) to a high of 1 panther/7,850 acres (3,177 ha).

Life history

Reproduction: Male Florida panthers are polygynous, maintaining large, overlapping home ranges containing several adult females and their dependent offspring. The first sexual encounters for males normally occur at about 3 years based on 26 radio-collared panthers of both sexes (Maehr et al. 1991). Based on genetics work, some males may become breeders as early as 17 months. Breeding activity peaks from December to March (Shindle et al. 2003). Litters (n = 82) are produced throughout the year, with 56-60 percent of births occurring between March and June (Jansen et al. 2005; Lotz et al. 2005). The greatest number of births occurs in May and June (Jansen et al. 2005; Lotz et al. 2005). Female panthers have bred as young as 18 months (Maehr et al. 1989) and successful reproduction has occurred up to 11 years old. The mean age of denning females is 4.6 ± 2.1 (standard deviation [sd]) years (Lotz et al. 2005). Age at first reproduction for 19 known-aged female panthers averaged 2.2 ± 0.246 (sd) years and ranged from 1.8-3.2 years. Average litter size is 2.4 ± 0.91 (sd) kittens. Seventy percent of litters are comprised of either two or three kittens. Mean birth intervals (elapsed time between successive litters) are 19.8 ± 9.0 (sd) months for female panthers (n = 56) (range 4.1-36.5 months) (Lotz et al. 2005). Females that lose their litters generally produce another more quickly; five of seven females whose kittens were brought into captivity successfully produced another litter an average of 10.4 months after the removal of the initial litter (Land 1994).

Panther dens are usually located closer to upland hardwoods, pinelands, and mixed wet forests and farther from freshwater marsh-wet prairie (Benson et al. 2008). Most den sites are located in dense saw palmetto (*Serenoa repens*), shrubs, or vines (Maehr 1990; Shindle et al. 2003,

Benson et al. 2008). Den sites are used for 6 to 8 weeks by female panthers and their litters from birth to weaning (Benson et al. 2008). Independence and dispersal of young typically occurs at 18 months, but may occur as early as one year (Maehr 1992).

Survivorship and Causes of Mortality: Benson et al. (2009) analyzed survival and cause-specific mortality of subadult and adult Florida panthers. They found that sex and age influenced panther survival, as females survived better than males, and older adults (≥10 years) survived poorly compared with younger adults. Genetic ancestry strongly influenced annual survival of subadults and adults after introgression, as F_1 generation admixed panthers survived longer than pre-introgression panthers and non-F_1 admixed individuals (Benson et al. 2009).

Mortality records for uncollared panthers have been kept since February 13, 1972, and for radio-collared panthers since February 10, 1981. Through June 24, 2010, 280 mortalities have been documented (FWC 2010). Of the 280 total mortalities, 127 were radio-collared panthers that have died since 1981 (FWC 2010). Intraspecific aggression was the leading cause of mortality for radio-collared panthers, and was more common for males than females (Benson et al. 2009). Older-adult males had significantly higher and sub-adult males had marginally higher mortality due to intraspecific aggression than prime-adult males (Benson et al. 2009). Most intraspecific aggression occurs between male panthers; but, aggressive encounters between males and females have occurred, resulting in the death of the female. Defense of kittens and\or a kill is suspected in half (5 of 10) of the known instances through 2003 (Shindle et al. 2003).

Following intraspecific aggression, the greatest causes of mortality for radio-collared Florida panthers was from unknown causes, vehicles, and other (Benson et al. 2009). From February 13, 1972, through June 30, 2010, 152 radio-collared and uncollared Florida panthers were hit by vehicles (FWC 2010). Eight of the collisions were not fatal. The number of panther/vehicle collisions per year tracks very closely the annual panther count (McBride et al. 2008).

Female panthers are considered adult residents if they are older than 18 months, have established home ranges and bred (Maehr et al. 1991). Land et al. (2004) reported that 23 of 24 female panthers first captured as kittens survived to become residents and 18 (78.3 percent) produced litters; 1 female was too young to determine residency. Male panthers are considered adult residents if they are older than 3 years and have established a home range that overlaps with females. Thirty-one male panthers were captured as kittens and 12 (38.7 percent) of these cats survived to become residents (Jansen et al. 2005; FWC 2005). "Successful male recruitment appears to depend on the death or home range shift of a resident adult male" (Maehr et al. 1991). Turnover in the breeding population is low with documented mortality in radio-collared panthers being greatest in subadult and non-resident males (Maehr et al. 1991; Shindle et al. 2003).

Den sites of female panthers have been visited since 1992 and the kittens tagged with passive integrated transponder chips. Annual survival of these kittens has been determined to be 0.328 ± 0.072 (SE) (Hostetler et al. 2009). There was no evidence that survival rate differed between male and female kittens or was influenced by litter size. (Hostetler et al. 2009) found that kitten survival generally increased with degree of admixture with introduced Texas pumas

and decreased with panther abundance. Kitten survival is lowest during the first 3 months of their lives (Hostetler et al. 2009).

Dispersal: Panther dispersal begins after a juvenile becomes independent from its mother and continues until it establishes a home range. Dispersal distances are greater for males (n = 18) than females (n = 9) (42.5 miles [68.4 km] verses 12.6 miles [20.3 km], respectively) and the maximum dispersal distance recorded for a young male was 139.2 miles (224.1 km) over a 7-month period followed by a secondary dispersal of 145 miles (233 km) (Maehr et al. 2002a). Males disperse an average distance of 25 miles (40 km); females typically remain in or disperse short distances from their natal ranges (Comiskey et al. 2002). Female dispersers are considered philopatric because they usually establish home ranges less than one average home range width from their natal range (Maehr et al. 2002a). Maehr et al. (2002a) reported that all female dispersers (n = 9) were successful at establishing a home range whereas only 63 percent of males (n = 18) were successful. Young panthers become independent at 14 months on average for both sexes, but male dispersals are longer in duration than female dispersals (9.6 months and 7.0 months, respectively) (Maehr et al. 2002a). Dispersing males usually go through a period as transient (non-resident) subadults, moving through the fringes of the resident population and often occupying suboptimal habitat until an established range becomes vacant (Maehr 1997).

Most panther dispersal occurs south of the Caloosahatchee River with only four radio-collared panthers crossing the river and continuing north since 1981 (Land and Taylor 1998; Land et al. 1999; Shindle et al. 2000; Maehr et al. 2002a; Belden and McBride 2005). Western subspecies of *Puma* have been documented crossing wide, swift-flowing rivers up to a mile in width (Seidensticker et al. 1973; Anderson 1983). The Caloosahatchee River, a narrow (295-328 feet (ft) [90-100 meters]), channelized river, probably is not a significant barrier to panther movements, but the combination of the river, State Road (SR) 80, and land uses along the river seems to have restricted panther dispersal northward (Maehr et al. 2002a). Documented physical evidence of at least 15 other uncollared male panthers have been confirmed north of the river since 1972, but no female panthers nor reproduction have been documented in this area since 1973 (Belden and McBride 2005).

Home Range Dynamics and Movements: Panthers require large areas to meet their needs. Numerous factors influence panther home range size, including: habitat quality, prey density, and landscape configuration (Belden 1988; Comiskey et al. 2002). Home range sizes of six radio-collared panthers monitored between 1985 and 1990 averaged 128,000 acres (51,800 ha) for resident adult males and 48,000 acres (19,425 ha) for resident adult females; transient males had a home range of 153,599 acres (62,160 ha) (Maehr et al. 1991). Comiskey et al. (2002) examined the home range size for 50 adult panthers (residents greater than 1.5 years old) monitored in south Florida from 1981-2000 and found resident males had a mean home range of 160,639 acres (65,009 ha) and females had a mean home range of 97,920 acres (39,627 ha). Beier et al. (2003) found home range size estimates for panthers reported by Maehr et al. (1991) and Comiskey et al. (2002) to be reliable.

Annual minimum convex polygon home range sizes of 52 adult radio-collared panthers monitored between 1998 and 2002 ranged from 15,360 – 293,759 acres (6,216 – 118,880 ha),

averaging 89,600 acres (36,260 ha) for 20 resident adult males and 44,160 acres (17,871 ha) for 32 resident adult females (Land et al. 1999; Shindle et al. 2000, 2001; Land et al. 2002). The most current estimate of home-range sizes (minimum convex polygon method) for established, non-dispersing, adult, radio-collared panthers averaged 29,056 acres (11,759 ha) for females (n = 11) and 62,528 acres (25,304 ha) for males (n = 11) (Lotz et al. 2005). The average home range was 35,089 acres (14,200 ha) for resident females (n = 6) and 137,143 acres (55,500 ha) (n = 5) for males located at BICY (Jansen et al. 2005). Home ranges of resident adults tend to be stable unless influenced by the death of other residents; however, several males have shown significant home range shifts that may be related to aging. Home range overlap is extensive among resident females and limited among resident males (Maehr et al. 1991).

Activity levels for Florida panthers are greatest at night with peaks around sunrise and after sunset (Maehr et al. 1990a). The lowest activity levels occur during the middle of the day. Female panthers at natal dens follow a similar pattern with less difference between high and low activity periods.

Telemetry data indicate panthers typically do not return to the same resting site day after day, with the exception of females with dens or panthers remaining near kill sites for several days. The presence of physical evidence such as tracks, scats, and urine markers confirm that panthers move extensively within home ranges, visiting all parts of the range regularly in the course of hunting, breeding, and other activities (Maehr 1997; Comiskey et al. 2002). Males travel widely throughout their home ranges to maintain exclusive breeding rights to females. Females without kittens also move extensively within their ranges (Maehr 1997). Panthers are capable of moving large distances in short periods of time. Nightly panther movements of 12 miles (20 km) are not uncommon (Maehr et al. 1990a).

Intraspecific Interactions: Interactions between panthers occur indirectly through urine markers or directly through contact. Urine markers are made by piling ground litter using a backwards-pushing motion with the hind feet. This pile is then scent-marked with urine and occasionally feces. Both sexes make urine markers. Apparently, males use them as a way to mark their territory and announce presence while females advertise their reproductive condition.

Adult females and their kittens interact more frequently than any other group of panthers. Interactions between adult male and female panthers last from one to seven days and usually result in pregnancy (Maehr et al. 1991). Aggressive interactions between males often result in serious injury or death. Independent subadult males have been known to associate with each other for several days and these interactions do not appear to be aggressive in nature. Aggression between males is the most common cause of male mortality and an important determinant of male spatial and recruitment patterns based on radio-collared panthers (Maehr et al. 1991; Shindle et al. 2003). Aggressive encounters between radio-collared males and females also have been documented (Shindle et al. 2003; Jansen et al. 2005).

Food Habits: Primary panther prey species are white-tailed deer and feral hog (*Sus scrofa*) (Maehr et al. 1990b; Dalrymple and Bass 1996). Generally, feral hogs constitute the greatest biomass consumed by panthers north of the Alligator Alley section of Interstate 75 (I-75),

while white-tailed deer are the greatest biomass consumed to the south (Maehr et al. 1990b). Secondary prey species includes raccoons (*Procyon lotor*), nine-banded armadillos (*Dasypus novemcinctus*), marsh rabbits (*Sylvilagus palustris*) (Maehr et al. 1990b) and American alligators (*Alligator mississippiensis*) (Dalrymple and Bass 1996). No seasonal variation in diet has been detected. Maehr et al. (1990b) rarely observed domestic livestock in scats or kills of the Florida panther, although cattle were readily available in the study area.

Little information on the feeding frequency of the Florida panther is available. However, the feeding frequency of the Puma is likely similar to the feeding frequency of the Florida panther. Ackerman et al. (1986) reported that a resident adult male puma generally consumes one deer-sized prey every 8 to 11 days. Moreover, a female puma will consume one deer-sized prey item every 14 to 17 days for a resident female and one deer-sized prey item every 3.3 days for a female with three 13-month-old kittens.

Infectious Diseases, Parasites, and Environmental Contaminants:

Viral Diseases - Feline leukemia virus (FeLV) is common in domestic cats (*Felis catus*), but is quite rare in non-domestic felids. Routine testing for FeLV antigen (indicating active infection) in captured and necropsied panthers was negative since testing began in 1978. However, between November 2002 and February 2003, two panthers tested FeLV antigen positive (Cunningham 2005; Cunningham et al. 2008). The following year, three more cases were diagnosed (Brown et al. 2008). All infected panthers had overlapping home ranges in the Okaloacoochee Slough ecosystem. Three of the panthers died due to suspected FeLV-related diseases (opportunistic bacterial infections and anemia) and the two others died from intraspecific aggression. Testing of serum samples collected from 1990 to 2005 for antibodies (indicating exposure) to FeLV indicated increasing exposure to FeLV beginning in the late 1990s and concentrated north of I-75. There was apparently minimal exposure to FeLV during this period south of I-75. Positive antibody titers in different areas at different times may indicate that multiple introductions of the virus into the panther population may have occurred. These smaller epizootics were apparently self-limiting and did not result in any known mortalities. Positive antibody titers, in the absence of an active infection (antigen positive), indicate panthers can be exposed and overcome the infection (Cunningham 2005). Genetic analysis of the panther FeLV determined that the source of this outbreak was a cross-species transmission from a domestic cat (Brown et al. 2008). Management of the disease includes vaccination (Cunningham et al. 2008) as well as removal of infected panthers to captivity for quarantine and supportive care. As of June 1, 2005, about one-third of the population had received at least one vaccination against FeLV (Cunningham et al. 2008). No new positive cases have been diagnosed since July 2004; however, the potential for reintroduction of the virus remains (Cunningham et al. 2008).

Pseudorabies virus (PRV) (Aujeszky's disease) causes respiratory and reproductive disorders in adult hogs and mortality in neonates, but is a rapidly fatal neurologic disease in carnivores. At least one panther died from PRV infection presumably through consumption of an infected feral hog (Glass et al. 1994). At least one panther has also died of rabies (Taylor et al. 2002). This panther was radio-collared but not vaccinated against the disease.

Feline immunodeficiency virus (FIV) is a retrovirus of felids that is endemic in the panther population. About 28 percent of Florida panthers were positive for antibodies to the puma lentivirus strain of FIV (Olmstead et al. 1992); however, the prevalence may be increasing. Between November 2004 and April 2005, 13 of 17 (76 percent) panthers tested were positive (M.Cunningham, FWC, unpublished data). The cause of this increase is unknown but warrants continued monitoring and investigation. There is also evidence of exposure to Feline panleukopenia virus (PLV) in adult panthers (Roelke et al. 1993) although no PLV-related mortalities are known to have occurred.

Serological evidence of other viral diseases in the panther population includes feline calicivirus, feline herpes virus, and West Nile virus. However, these diseases are not believed to cause significant morbidity or mortality in the population. All panthers found dead due to unknown causes are tested for alphaviruses, flaviviruses (including West Nile virus), and canine distemper virus. These viruses have not been detected in panthers by viral culture or polymerase chain reaction (FWC, unpublished data).

Other Infectious Diseases - Bacteria have played a role in free-ranging panther morbidity and mortality as opportunistic pathogens, taking advantage of pre-existing trauma or FeLV infections (FWC, unpublished data). Dermatophytosis (ringworm infection) has been diagnosed in several panthers and resulted in severe generalized infection in at least one (Rotstein et al. 1999). Severe infections may reflect an underlying immunocompromise, possibly resulting from inbreeding depression or immunosuppressive viral infections.

Parasites - The hookworm, *Ancylostoma pluridentatum,* is found in a high prevalence in the panther population. Other parasites identified from live-captured or necropsied panthers include: eight arthropod species, eight nematode species, three cestode species, two trematode species, and three protozoa species (Forrester et al. 1985; Forrester 1992; Wehinger et al. 1995; Rotstein et al. 1999; Land et al. 2002; Foster et al. 2006). Of these, only an arthropod, *Notoedres felis*, caused significant morbidity in at least one panther (Maehr et al. 1995).

Environmental Contaminants - Overall, mercury in south Florida biota has decreased over the last several years (Frederick et al. 2002). However, high mercury concentrations are still found in some panthers. At least one panther is thought to have died of mercury toxicosis and mercury has been implicated in the death of two other panthers in ENP (Roelke 1991). One individual panther had mercury concentrations of 150 parts per million (ppm) in its hair (Land et al. 2004). Elevated levels of p, p'– DDE were also detected in fat from that panther. The role of mercury and/or p, p'– DDE in this panther's death is unknown and no cause of death was determined despite extensive diagnostic testing. Elevated mercury concentrations have also been found in panthers from Florida Panther National Wildlife Refuge (FPNWR). Two sibling neonatal kittens from this area had hair mercury concentrations of 35 and 40 ppm. Although other factors were believed to have been responsible, these kittens did not survive to leave their natal den and neonates may be more susceptible to the toxic effects of mercury (Berglund and Berlin 1969). Consistently high hair mercury values in ENP and FPNWR and the finding of elevated values in some portions of BICY warrant continued monitoring (Land et al. 2004). Other environmental

contaminants found in panthers include polychlorinated biphenyls (Arochlor 1260) and organochlorines (p, p'–DDE) (Dunbar 1995; Land et al. 2004).

Reproduction: Male Florida panthers are polygynous, maintaining large, overlapping home ranges containing several adult females and their dependent offspring. The first sexual encounters for males normally occur at about 3 years based on 26 radio-collared panthers of both sexes (Maehr et al. 1991). Based on genetics work, some males may become breeders as early as 17 months (Johnson 2005).

The 6-month breeding probability (probability of producing a litter) for females was 0.232 ± 0.021 (standard error [SE]) (annual breeding probability 0.410 ± 0.032 SE), and average litter size was 2.596 ± 0.144 (Hostetler et al. 2009). Seventy percent of litters are comprised of two or three kittens. Litters are produced throughout the year, but the greatest numbers of births occur from March through July (Service 2010). Female panthers have bred as young as 18 months (Maehr et al. 1989) and successful reproduction has occurred up to 11 years old. However, older-adult females (age ≥ 10 years) are less likely to breed than younger females (Hostetler et al. 2009). The mean age of denning females is 4.6 ± 2.1 (standard deviation [sd]) years (FWC 2005). Age at first reproduction for 19 known-aged female panthers averaged 2.2 ± 0.246 (sd) years and ranged from 1.8 to 3.2 years. Mean birth intervals (elapsed time between successive litters) are 19.8 ± 9.0 (sd) months for female panthers (n = 56) (range 4.1 to 36.5 months) (FWC 2005). Females that lose their litters generally produce another more quickly; five of seven females whose kittens were brought into captivity successfully produced another litter an average of 10.4 months after the removal of the initial litter (Land 1994).

Panther dens are usually located closer to upland hardwood, pineland, and mixed wet forest and farther from freshwater marsh-wet prairie (Benson et al. 2008). Most den sites are located in dense saw palmetto (*Serenoa repens*), shrubs, or vines (Maehr 1990; Shindle et al. 2003, Benson et al. 2008). Den sites are used for 6 to 8 weeks by female panthers and their litters from birth to weaning (Benson et al. 2008).

Survivorship and Causes of Mortality: Benson et al. (2009) analyzed survival and cause-specific mortality of subadult and adult Florida panthers. They found that sex and age influenced panther survival, as females survived better than males, and older adults (≥10 years) survived poorly compared with younger adults. Genetic ancestry strongly influenced annual survival of subadults and adults after introgression, as F_1 generation admixed panthers survived longer than pre-introgression panthers and non-F_1 admixed individuals (Benson et al. 2009).

Mortality records for uncollared panthers have been kept since February 13, 1972, and for radio-collared panthers since February 10, 1981. Through June 24, 2010, 280 mortalities have been documented (FWC 2010). Of the 280 total mortalities, 127 were radio-collared panthers that died since 1981 (FWC 2010). Intraspecific aggression was the leading cause of mortality for radio-collared panthers, and was more common for males than females (Benson et al. 2009). Older-adult males had significantly higher and sub-adult males had marginally higher mortality due to intraspecific aggression than prime-adult males (Benson et al. 2009). Most intraspecific aggression occurs between male panthers; but, aggressive encounters between males and females

have occurred, resulting in the death of the female. Defense of kittens or a kill is suspected in half (5 of 10) of the known instances through 2003 (Shindle et al. 2003).

Following intraspecific aggression, the greatest causes of mortality for radio-collared Florida panthers was from unknown causes, vehicles, and other (Benson et al. 2009). From February 13, 1972 through June 30, 2010, 152 radio-collared and uncollared Florida panthers were hit by vehicles (FWC 2010). Eight of the collisions were not fatal. The number of panther/vehicle collisions per year tracks very closely the annual panther count (McBride et al. 2008).

Female panthers are considered adult residents if they are older than 18 months, have established home ranges and bred (Maehr et al. 1991). Land et al. (2004) reported that 23 of 24 female panthers first captured as kittens survived to become residents and 18 (78.3 percent) produced litters; 1 female was too young to determine residency. Male panthers are considered adult residents if they are older than 3 years and have established a home range that overlaps with females. Thirty-one male panthers were captured as kittens and 12 (38.7 percent) of these cats survived to become residents (Jansen et al. 2005; FWC 2005). "Successful male recruitment appears to depend on the death or home range shift of a resident adult male" (Maehr et al. 1991). Turnover in the breeding population is low with documented mortality in radio-collared panthers being greatest in subadult and non-resident males (Maehr et al. 1991; Shindle et al. 2003).

Den sites of female panthers have been visited since 1992 and the kittens tagged with passive integrated transponder (PIT) chips. Annual survival of these kittens has been determined to be 0.328 ± 0.072 (SE) (Hostetler et al. 2009). There was no evidence that survival rate differed between male and female kittens or was influenced by litter size. Hostetler et al. (2009) found that kitten survival generally increased with degree of admixture with introduced Texas pumas and decreased with panther abundance. Kitten survival is lowest during the first 3 months of their lives (Hostetler et al. 2009).

Dispersal: Panther dispersal begins after a juvenile becomes independent from its mother and continues until it establishes a home range. Dispersal distances are greater for males ($n = 18$) than females ($n = 9$) (42.5 mi [68.4 km] verses 12.6 mi [20.3 km], respectively) and the maximum dispersal distance recorded for a young male was 139.2 mi (224.1 km) over a 7-month period followed by a secondary dispersal of 145 mi (233 km) (Maehr et al. 2002a). Males disperse an average distance of 25 miles (40 km); females typically remain in or disperse short distances from their natal ranges (Comiskey et al. 2002). Female dispersers are considered philopatric because they usually establish home ranges less than 1 average home range width from their natal range (Maehr et al. 2002a). Maehr et al. (2002a) reported that all female dispersers ($n = 9$) were successful at establishing a home range whereas only 63 percent of males ($n = 18$) were successful. Young panthers become independent at 14 months on average for both sexes, but male dispersals are longer in duration than female dispersals (9.6 months and 7.0 months, respectively) (Maehr et al. 2002a). Dispersing males usually go through a period as transient (non-resident) subadults, moving through the fringes of the resident population and often occupying suboptimal habitat until an established home range becomes vacant (Maehr 1997).

Most panther dispersal occurs south of the Caloosahatchee River with only four radio-collared panthers crossing the river and continuing north since 1981 (Land and Taylor 1998; Land et al. 1999; Shindle et al. 2000; Maehr et al. 2002a; Belden and McBride 2005). Western subspecies of *Puma* have been documented crossing wide, swift-flowing rivers up to a mile in width (Seidensticker et al. 1973; Anderson 1983). The Caloosahatchee River, a narrow (295-328 ft [90-100 m]), channelized river, probably is not a significant barrier to panther movements, but the combination of the river, SR 80, and land uses along the river seems to have restricted panther dispersal northward (Maehr et al. 2002a). Documented physical evidence of at least 15 other uncollared male panthers have been confirmed north of the river since 1972, but no female panthers nor reproduction have been documented in this area since 1973 (Belden and McBride 2005).

Home Range Dynamics and Movements: Numerous factors influence panther home range size, including: habitat quality, prey density, and landscape configuration (Belden 1988; Comiskey et al. 2002). Home range sizes of six radio-collared panthers monitored between 1985 and 1990 averaged 128,000 acres (51,800 ha) for resident adult males and 48,000 acres (19,425 ha) for resident adult females; transient males had a home range of 153,599 acres (62,160 ha) (Maehr et al. 1991). Comiskey et al. (2002) examined the home range size for 50 adult panthers (residents greater than 1.5 years old) monitored in south Florida from 1981 to 2000 and found resident males had a mean home range of 160,639 acres (65,009 ha) and females had a mean home range of 97,920 acres (39,627 ha).

Annual minimum convex polygon home range sizes of 52 adult radio-collared panthers monitored between 1998 and 2002 ranged from 15,360 to 293,759 acres (6,216 to 118,880 ha), averaging 89,600 acres (36,260 ha) for 20 resident adult males and 44,160 acres (17,871 ha) for 32 resident adult females (Land et al. 1999; Shindle et al. 2000, 2001; Land et al. 2002). The most current estimate of home range sizes (minimum convex polygon method) for established, non-dispersing, adult, radio-collared panthers averaged 29,056 acres (11,759 ha) for females (n = 11) and 62,528 acres (25,304 ha) for males (n = 11) (FWC 2005). The average home range was 35,089 acres (14,200 ha) for resident females (n = 6) and 137,143 acres (55,500 ha) (n = 5) for males located at BICY (Jansen et al. 2005). Home ranges of resident adults tend to be stable unless influenced by the death of other residents; however, several males have shown significant home range shifts that may be related to aging (Jansen 2005). Home range overlap is extensive among resident females and limited among resident males (Maehr et al. 1991).

Activity levels for Florida panthers are greatest at night with peaks around sunrise and after sunset (Maehr et al. 1990a). The lowest activity levels occur during the middle of the day. Female panthers at natal dens follow a similar pattern with less difference between high and low activity periods.

Telemetry data indicate panthers typically do not return to the same resting site day after day, with the exception of females with dens or panthers remaining near kill sites for several days. The presence of physical evidence such as tracks, scats, and urine markers confirm that panthers move extensively within home ranges, visiting all parts of the range regularly in the course of

hunting, breeding, and other activities (Maehr 1997; Comiskey et al. 2002). Males travel widely throughout their home ranges to maintain exclusive breeding rights to females. Females without kittens also move extensively within their ranges (Maehr 1997). Panthers are capable of moving large distances in short periods of time. Nightly panther movements of 12 miles (20 km) are not uncommon (Maehr et al. 1990a).

Intraspecific Interactions: Interactions between panthers occur indirectly through urine markers or directly through contact. Urine markers are made by piling ground litter using a backwards-pushing motion with the hind feet. This pile is then scent-marked with urine and occasionally feces. Both sexes make urine markers. Apparently males use them as a way to mark their territory and announce presence while females advertise their reproductive condition.

Adult females and their kittens interact more frequently than any other group of panthers. Interactions between adult male and female panthers last from 1 to 7 days and usually result in pregnancy (Maehr et al. 1991). Aggressive interactions between males often result in serious injury or death. Independent subadult males have been known to associate with each other for several days and these interactions do not appear to be aggressive in nature. Aggression between males is the most common cause of male mortality and an important determinant of male spatial and recruitment patterns based on radio-collared panthers (Maehr et al. 1991; Shindle et al. 2003). Aggressive encounters between radio-collared males and females also have been documented (Shindle et al. 2003; Jansen et al. 2005).

Food Habits: Primary panther prey is white-tailed deer and feral hog (*Sus scrofa*) (Maehr et al. 1990b; Dalrymple and Bass 1996). Generally, feral hogs constitute the greatest biomass consumed by panthers north of the Alligator Alley section of I-75, while white-tailed deer are the greatest biomass consumed to the south (Maehr et al. 1990b). Secondary prey includes raccoons (*Procyon lotor*), nine-banded armadillos (*Dasypus novemcinctus*), marsh rabbits (*Sylvilagus palustris*) (Maehr et al. 1990b) and alligators (*Alligator mississippiensis*) (Dalrymple and Bass 1996). No seasonal variation in diet has been detected. A resident adult male puma generally consumes one deer-sized prey every 8 to 11 days; this frequency would be 14-17 days for a resident female; and 3.3 days for a female with three 13-month-old kittens (Ackerman et al. 1986). Maehr et al. (1990b) documented domestic livestock infrequently in scats or kills, although cattle were readily available on their study area.

Habitat Characteristics/Ecosystem: Noss and Cooperrider (1994) considered the landscape implications of maintaining viable panther populations. Assuming a male home range size of 137,599 acres (55,685 ha) (Maehr 1990), an adult sex ratio of 50:50 (Anderson 1983), and some margin of safety, they determined that a reserve network as large as 15,625 to 23,438 mi^2 (40,469 - 60,703 km^2) would be needed to support an effective population size of 50 individuals (equating to an actual adult population of 100 to 200 panthers [Ballou et al. 1989]). However, to provide for long-term persistence based on an effective population size of 500 individuals (equating to 1,000 to 2,000 adult panthers [Ballou et al. 1989]), could require as much as 156,251 to 234,376 mi^2 (404,687-607,031 km^2). This latter acreage corresponds to roughly 60 to 70 percent of the Florida panthers historical range. Although it is uncertain whether this much land is needed for panther recovery, it does provide some qualitative insight into the importance

of habitat conservation across large landscapes for achieving a viable panther population (Noss and Cooperrider 1994).

Between 1981 and 2010 more than 90,000 locations were collected from more than 180 radio-collared panthers. Belden et al. (1988), Maehr et al. (1991), Maehr and Cox (1995), Maehr (1997), Kerkoff et al. (2000), Comiskey et al. (2002), Cox et al. (2006), and Kautz et al. (2006) provide information on habitat use based on various subsets of these data. Since almost all locations from radio collars have been collected during daytime hours (generally 0700 to 1100) using very high frequency (VHF) aerial telemetry, and because panthers are most active during nocturnal and crepuscular periods (Maehr et al. 1990a), daytime telemetry data may be insufficient to describe habitat use patterns of nocturnal animals (Beyer and Haufler 1994; Comiskey et al. 2002; Beier et al. 2003; Dickson et al. 2005; Beier et al. 2006). However, Land et al. (2008), investigated habitat selection of 12 panthers in the northern portion of the breeding range using Global Positioning System (GPS) telemetry data collected during nocturnal and diurnal periods as well as VHF telemetry data collected only during diurnal periods and found that analysis of both types of telemetry data yielded similar results.

A landscape-level strategy for the conservation of the panther population in south Florida was developed using a Florida panther potential habitat model based on the following criteria: (1) forest patches greater than 4.95 acres (2 ha); (2) non-urban cover types within 656 ft (200 m) of forest patches; and (3) exclusion of lands within 984 ft (300 m) of urban areas (Kautz et al. 2006). In developing the model, data from radio-collared panthers collected from 1981 through 2000 were used to evaluate the relative importance of various land cover types as panther habitat, thus identifying landscape components important for panther habitat conservation. Those components were then combined with a least cost path analysis to delineate three panther habitat conservation zones for south Florida: (1) Primary Zone – lands important to the long-term viability and persistence of the panther in the wild; (2) Secondary Zone – lands which few panthers use contiguous with the Primary Zone, but given sufficient habitat restoration could accommodate expansion of the panther population south of the Caloosahatchee River; and (3) Dispersal Zone – the area which may facilitate future panther expansion north of the Caloosahatchee River (Kautz et al. 2006) (Figure 4). The Primary Zone is currently occupied and supports the breeding population of panthers. The Secondary Zone could support resident panthers with sufficient restoration. Although panthers move through the Dispersal Zone, it is not currently occupied by resident panthers.

These zones vary in size, ownership, and land cover composition. The Primary Zone is 2,270,711 acres (918,928 ha) in size, 73 percent of which is publicly owned (R. Kautz, Breedlove, Dennis, and Associates, personal communication 2005), and includes portions of the BICY, ENP, FSPSP, FPNWR, Okaloacoochee Slough State Forest, and PSSF. This zone's composition is 45 percent forest, 41 percent freshwater marsh, 7.6 percent agriculture lands, 2.6 percent prairie and shrub lands, and 0.52 percent urban lands (Kautz et al. 2006). The Secondary Zone is 812,157 acres (328,670 ha) in size, 38 percent of which is public land (Kautz 2005). This zone's composition is 43 percent freshwater marsh, 36 percent agriculture, 11 percent forest, 6.1 percent prairie and shrub lands, and 2.3 percent low-density residential areas and open urban lands (Kautz et al. 2006). The Dispersal Zone is 28,160 acres (11,396 ha)

in size, 12 percent of which is either publicly owned or in conservation easement. This zone's composition is 49 percent agriculture (primarily improved pasture and citrus groves), 29 percent forest (wetland and upland), 8.8 percent prairie and shrub land, 7.5 percent freshwater marsh, and 5.1 percent barren and urban lands (Kautz et al. 2006).

As part of their evaluation of occupied panther habitat, in addition to the average density estimate of one panther per 27,181 acres (11,000 ha) developed by Maehr et al. (1991) and Kautz et al. (2006) estimated the average density during the timeframe of their study, based on telemetry and other occurrence data, to average one panther per 31,923 acres (12,919 ha). In the following discussions of the number of panthers that a particular zone may support, the lower number is based on the 31,923 acres (12,919 ha) value (Kautz et al. 2006) and the higher number is based on the 27,181 acres (11,000 ha) value (Maehr et al. 1991).

Based on these average densities, the Primary Zone could support 71 to 84 panthers; the Secondary Zone could support 8 to 10 panthers without habitat restoration and 25 to 30 panthers with habitat restoration (existing high quality panther habitat currently present in the Secondary Zone is estimated at 32 percent of the available Secondary Zone lands); and the Dispersal Zone could support 0 panthers. Taken together, the three zones in their current condition have the capacity to support approximately 79 to 94 Florida panthers.

Even though some suitable panther habitat remains in south-central Florida, it is widely scattered and fragmented (Belden and McBride 2005). Thatcher et al. (2006, 2009) used a statistical model in combination with Geographic Information Systems (GIS) to develop a multivariate landscape-scale habitat model based on the Mahalanobis distance statistic (D^2) to evaluate habitats in south- central Florida for potential expansion of the Florida panther population. They identified four potential habitat patches: (1) the Avon Park Air Force Range area; (2) Babcock-Webb Wildlife Management Area (WMA); (3) eastern Fisheating Creek WMA; and (4) the Duette Park/Manatee County area. These habitat patches are smaller and more isolated compared with the current Florida panther range, and the landscape matrix where these habitat patches exist provides relatively poor habitat connectivity among the patches (Thatcher et al. 2006, 2009). Major highways and urban or agricultural development isolate these habitat patches, and they are rapidly being lost to the same development that threatens southern Florida (Belden and McBride 2005).

Panther Habitat Use: Radio-collar data and ground tracking indicate that panthers use the mosaic of habitats available to them as resting and denning sites, hunting grounds, and travel routes. The majority of panther telemetry locations (Belden 1986; Belden et al. 1988; Maehr 1990; Maehr et al. 1991; Maehr 1992; Smith and Bass 1994; Kerkhoff et al. 2000; Comiskey et al. 2002, Cox et al. 2006, Kautz et al. 2006, Land et al. 2008) and natal den sites (Benson et al. 2008) were within or close to forested cover types, particularly cypress swamp, pineland, hardwood swamp, and upland hardwood forest. GPS data has shown that panthers ($n = 12$) use all habitats contained within their home ranges by selecting for forested habitat types and using all others in proportion to availability (Land et al. 2008).

Kautz et al. (2006) found that the smallest class of forest patches (*i.e.*, 9 to 26 acres [3.6 to 10.4 ha]) were the highest ranked forest patch sizes within panther home ranges. The diverse woody flora of forest edges probably provides cover suitable for stalking and ambushing prey (Belden et al. 1988; Cox et al. 2006). Also, dense understory vegetation comprised of saw palmetto provides some of the most important resting and denning cover for panthers Maehr 1990; Benson et al. 2008). Shindle et al. (2003) estimated that 73 percent of panther dens were in saw palmetto thickets.

Panther habitat selection is related to prey availability (Janis 1999; Dees et al. 2001) and, consequently, prey habitat use. Adequate cover and the size, distribution, and abundance of available prey species are critical factors to the persistence of panthers in south Florida and often determine the extent of panther use of an area. Duever et al. (1986) calculated a deer population of 1,760 in BICY, based on Harlow (1959) deer density estimates of 1/210 acres (85 ha) in pine forest, 1/299 ac (121 ha) in swamps, 1/1,280 acres (518 ha) in prairie, 1/250 acres (101 ha) in marshes, and 1/111 ac (45 ha) in hammocks. Schortemeyer et al. (1991) estimated deer densities at 1/49-247 acres (20-100 ha) in three management units of BICY based on track counts and aerial surveys. Labisky et al. (1995) reported 1/49 ac (20 ha) in southeastern BICY. Using track counts alone, McCown (1994) estimated 1/183 to 225 ac (74 to 91 ha) on the FPNWR and 1/133 to 200 acres (54 to 81 ha) in the FSPSP.

Hardwood hammocks and other forest cover types are important habitat for white-tailed deer and other panther prey (Harlow and Jones 1965; Belden et al. 1988; Maehr 1990; Maehr et al. 1991; Maehr 1992; Comiskey et al. 1994; Dees et al. 2001). Periodic understory brushfires (Dees et al. 2001) as well as increased amounts of edge (Miller 1993) may enhance deer use of hardwood hammocks, pine, and other forest cover types. Other vegetation types (*e.g.*, marshes, rangeland, and low-intensity agricultural areas) may also support high deer densities. In the Everglades, for example, deer appear to be adapted to a mosaic of intergrading patches comprised of wet prairie, hardwood tree islands, and peripheral wetland habitat (Fleming et al. 1994; Labisky et al. 2003). High-nutrient deer forage, especially preferred by females, includes hydrophytic marsh plants, white waterlily (*Nymphaea odorata*), and swamp lily (*Crinum americana*) (Loveless 1959; Labisky et al. 2003). Wetland willow (*Salix spp.*) thickets also provide nutritious browse for deer (Loveless 1959; Labisky et al. 2003). However, the importance of these habitat types to panthers is dependent upon the availability of stalking and ambush cover.

In the absence of direct field observations/measurements, Harrison (1992) suggested that landscape corridors for wide-ranging predators should be half the width of an average home range size. Following Harrison's (1992) suggestion, corridor widths for Florida panthers would range 6.1 to 10.9 miles (9.8 to 17.6 km) depending on whether the target animal was an adult female or a transient male. Beier (1995) suggested that corridor widths for transient male puma in California could be as small as 30 percent of the average home range size of an adult. For Florida panthers, this would translate to a corridor width of 5.5 miles (8.8 km). Without supporting empirical evidence, Noss (1992) suggests that regional corridors connecting larger hubs of habitat should be at least 1.0 mile (1.6 km) wide. Beier (1995) makes specific recommendations for very narrow corridor widths based on short corridor lengths in a California setting of wild lands completely surrounded by urban areas; he recommended that corridors with

a length less than 0.5 mile (0.8 km) should be more than 328 ft (100 meters) wide, and corridors extending 0.6 to 4 miles (1 to 7 km) should be more than 1,312 ft (400 meters) wide. The Dispersal Zone encompasses 44 mi^2 (113 km^2) with a mean width of 3.4 miles (5.4 km). Although it is not adequate to support even one resident panther, the Dispersal Zone is strategically located and expected to function as a critical landscape linkage to south-central Florida (Kautz et al. 2006). Transient male panthers currently utilize this zone as they disperse northward into south-central Florida.

Panther management and conservation

Recovery: The recovery objectives identified in the final third revision of the Florida Panther Recovery Plan (Service 2008) are to: (1) maintain, restore, and expand the Florida panther population and its habitat in south Florida and, if feasible, expand the known occurrence of Florida panthers north of the Caloosahatchee River to maximize the probability of the long-term persistence of this metapopulation; (2) identify, secure, maintain, and restore habitat in potential reintroduction areas within the panther's historic range, and to establish viable populations of the panther outside south and south-central Florida; and (3) facilitate panther conservation and recovery through public awareness and education.

Habitat Conservation and Protection: Panthers, because of their wide-ranging movements and extensive spatial requirements, are particularly sensitive to habitat fragmentation (Harris 1984). Mac et al. (1998) defines habitat fragmentation as:

> "The breaking up of a habitat into unconnected patches interspersed with other habitat which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines."

The reference to "unconnected patches" is a central underpinning of the definition. For panther conservation, this definition underscores the need to maintain contiguous habitat and protected habitat corridors in key locations in south Florida and throughout the panther's historic range. Habitat fragmentation can result from road construction, urban development, and agricultural land conversions.

Habitat protection has been identified as being one of the most important elements to achieving panther recovery. While efforts have been made to secure habitat (Table 1), continued action is needed to obtain additions to and inholdings for public lands, assure linkages are maintained, restore degraded and fragmented habitat, and obtain the support of private landowners for maintaining property in a manner that is compatible with panther use. Conservation lands used by panthers are held and managed by a variety of entities including Service, NPS, Seminole Tribes of Florida, Miccosukee Tribe of Indians of Florida, FWC, Florida Department of Environmental Protection, Florida Division of Forestry (FDOF), Water Management Districts, non-governmental organizations, counties, and private landowners. Conservation lands in south Florida that benefit the panther are listed below and shown in Figure 5:

1. In 1944, Collier County donated 5,475 acres to the State of Florida for what would eventually become the 7,271-acre Collier Seminole State Park, which straddles U.S. Highway41 (US 41). Approximately 1,097 acres of the park are located north of US 41, and the majority of the area south of US 41 is mangroves (5,000 acres).

2. In 1947, ENP was established with 1,507,834 acres (610,199 ha) and in 1989 was expanded with the addition of 104,320 acres (42,217 ha).

3. In 1954, the National Audubon Society established the nearly 10,880-acre (4,403-ha) Corkscrew Swamp Sanctuary.

4. In 1974, Congress approved the purchase and formation of BICY, protecting 570,238 acres (230,767 ha); they later added 145,919 acres (59,051 ha).

5. In 1974, the State of Florida began acquiring land for the FSPSP, which encompasses over 80,000 acres (32,375 ha). Efforts are underway to acquire an additional 16,640 acres (6,734 ha).

6. In 1985, acquisition of PSSF began with the complex Southern Golden Gate Estates (SGGE) subdivision buyout that now comprises over 76,160 acres (30,821 ha). The SGGE buyout through State and Federal funds is complete. The south Belle Meade portion of Picayune Strand is about 90 percent purchased. Mitigation for roadways and other development in Collier County has resulted in the purchase and management of some inholdings in this area and Collier County's Transfer of Development Rights program may secure additional inholdings.

7. In 1989, FPNWR was established and now protects 26,240 acres (10,619 ha).

8. In 1989, the CREW Land and Water Trust, a public and private partnership, was established and to date has coordinated the purchase of approximately 42,037 acres (17,012 ha).

9. In 1996, the South Florida Water Management District (District) purchased the 32,000-acre (12,950-ha) Okaloacoochee Slough State Forest.

10. In 2002, Spirit of the Wild WMA, consisting of over 7,040 acres (2,849 ha), was taken into public ownership by the State of Florida and is managed by FDOF.

11. In 2003, Dinner Island Ranch WMA, consisting of 21,760 acres (8,806 ha) in southern Hendry County, was taken into public ownership by the State of Florida and is managed by FDOF.

12. In 2006, the State of Florida in cooperation with Lee and Charlotte Counties and with coordination with the Babcock Ranch family, the Babcock Florida Company, interested environmental advocacy groups, and concerned citizens; acquired 73,476 acres of the

91,362-acre Babcock Ranch. The 73,476-acre acquisition is referred to as the Babcock Ranch Preserve. The remaining 18,206 acres were purchased by the Babcock Ranch Community, an affiliate Babcock Ranch family company. The purchase agreement for the Babcock Ranch Preserve expressly reserved the ability to utilize portions of the property acquired by the State for mitigation of impacts from the Babcock Ranch Community's proposed residential development. These reserved lands are referred to as the Babcock Ranch Mitigation Park and encompass about 16,925 acres.

13. Lands of the Seminole Tribes of Florida and Miccosukee Tribe of Indians of Florida encompass over 350,079 ac (141,673 ha) in south Florida. Of these, 115,840 ac (46,879 ha) are used by panthers, and comprise 5 percent of the Primary Zone (Kautz 2005). In general, these lands are not specifically managed for the panther and are largely in cultivation. However, in 2007, the Seminole Tribes of Florida reserved about 4,144 acres within the Big Cypress Seminole Indian Reservation Native Area, an area encompassing about 14,724 acres, specifically for the benefit of the Florida panther. The remaining native area, about 10,580 acres, although not specifically managed for the Florida panther, provides high quality value habitat for the Florida panther and panther prey species.

Habitat and Prey Management: Land management agencies in south Florida are implementing fire programs that mimic a natural fire regime through the suppression of human-caused wildfires and the application of prescribed natural fires. No studies have been conducted to determine the effects of invasive plant management on panthers. However invasive vegetation may reduce the panther's prey base by disrupting natural processes, such as water flow and fire, and by reducing available forage for prey (Fleming et al. 1994). All public lands in south Florida have active invasive plant treatment programs. Management for panther prey consists of a variety of approaches such as habitat management and regulation of hunting and OHV use.

Response to Management Activities: Few studies have examined the response of panthers to various land and habitat management activities. Dees et al. (2001) investigated panther habitat use in response to prescribed fire and found that panther use of pine habitats was greatest for the first year after the area had been burned and declined thereafter. Prescribed burning is believed to be important to panthers because prey species (*e.g.*, deer and hogs) are attracted to burned habitats to take advantage of changes in vegetation structure and composition, including exploiting hard mast that is exposed and increased quality or quantity of forage (Dees et al. 2001). However, depending upon the frequency and effects upon upland habitat communities, prescribed fire may alter the vegetation structure and composition that are necessary for panther den sites (Maehr and Larkin 2004). Responses of puma to logging activities (Van Dyke et al. 1986b) indicate that they generally avoid areas within their home range with intensification of disturbance.

There is the potential for disturbance to panthers from recreational uses on public lands. Maehr (1990) reported that indirect human disturbance of panthers may include activities associated with hunting and that panther use of Bear Island (part of BICY) was significantly less during the hunting season. Schortemeyer et al. (1991) examined the effects of deer hunting on panthers at BICY between 1983 and 1990. They concluded that, based on telemetry data, panthers may be

altering their use patterns as a result of hunting. Janis and Clark (2002) compared the behavior of panthers before, during, and after the recreational deer and hog hunting season (October through December) on areas open (BICY) and closed (FPNWR, FSPSP) to hunting. Variables examined were: (1) activity rates; (2) movement rates; (3) predation success; (4) home range size; (5) home range shifts; (6) proximity to ORV trails; (7) use of areas with concentrated human activity; and (8) habitat selection. Responses to hunting for variables most directly related to panther energy intake or expenditure (*i.e.*, activity rates, movement rates, predation success of females) were not detected (Janis and Clark 2002). However, panthers reduced their use of Bear Island, an area of concentrated human activity, and were found farther from ORV trails during the hunting season. Most recently, Fletcher and McCarthy (personal communication 2010) were tasked with examining panther response to hunting and recreational ORV use. Their investigation took Janis and Clark (2002) further in that over 20 years of hunter check-in data were used in concert with panther telemetry and other data to attempt to replicate and refine the Janis and Clark study. Overall, they found similar relationships between panther movements and use and the presence of recreational ORV use.

Transportation: Construction of highways in wildlife habitat typically results in loss and fragmentation of habitat, traffic-related mortality, and avoidance of associated human development. Female panthers are less likely to cross roads than males (Maehr 1990).

There are presently 28 wildlife crossings with associated fencing suitable for panther use along I-75 (Figure 6). Six wildlife crossings with associated fencing have also been constructed on SR 29 (Figure 6). Panther crossings A and B, completed in 2007, were constructed in an area of 10 documented panther collisions with vehicles from 1980 to 2004. Crossings C and D, north of I-75, were installed in 1995. There were two recorded collisions in the vicinity of crossing D from 1979 to 1990, but none at either C or D since crossing installation. Crossing E was installed in 1997. There has been one collision approximately 1 mile to the north of this crossing in 2002. Crossing F was installed in 1999. There was one documented collision in the immediate vicinity in 1981, two collisions approximately 1.5 miles to the north since crossing installation, and one collision approximately 0.5 mile to the south in December 2005. Along SR 29, two panther-vehicle collisions have been recorded in the immediate vicinity of wildlife crossings, one in December 2005 and one in June 2007. There have been no collisions on east-west I-75 in the vicinity of crossings since installation in 1991. Prior to 1991, there were five recorded deaths from collisions in this location.

PVA Summaries and Population Guidelines: Root's (2004) moderate model runs, which have a carrying capacity 53 females (106 individuals), show final populations of 42.3 females (84 total) and 31.2 females (62 total) with extinction rates of 5 percent and 6 percent, respectively, for the basic and 1 percent habitat loss scenarios. The predicted final populations in Root (2004) are 84 and 62 panthers for no loss of habitat and 1 percent loss of habitat, respectively, over a 100-year period.

Kautz et al.'s (2006) population guidelines, when applied to the populations predicted by Root's (2004) moderate models, describe the "with habitat loss" population (62 panthers) as barely

viable and expected to decline by 25 percent over a 100-year period. The "without habitat loss" population (84 panthers) is likely stable but would still be subject to genetic problems.

Model Violations: The actual likelihood of population declines and extinctions may be different than the guidelines and models suggest, depending upon the number of and severity of assumptions violated. The Service realizes that habitat loss is occurring at an estimated 0.8 percent loss of habitat per year (Kautz 2003). The Service has accounted for some habitat loss and changes in habitat quality within its regulatory program, specifically through its habitat assessment methodology. For example, we have increased the base ratio used within our compensation methodology that is used for development projects to account for unexpected increases in habitat loss. Similarly, we consider changes in habitat quality and encourage habitat restoration wherever possible.

With regard to the assumption of no catastrophes, the Service has considered the recent outbreak of feline leukemia in the panther population at Okaloacoochee Slough as a potential catastrophe. The FWC is carefully monitoring the situation and it appears to be under control at this time due to a successful vaccination program. However, if the outbreak spreads into the population, the Service will consider this as a catastrophe and factor this into our decisions.

We acknowledge that uncertainties exist, assumptions can be violated, and catastrophes can occur. The Service and the FWC, along with our partners, will continue to monitor the panther population and the south Florida landscape and incorporate any new information and changes into our decision-making process.

South Florida Panther Population Goal:

The Service's goal for Florida panther conservation in south Florida is to locate, preserve, and restore sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of a population of 80 to 100 individuals (adults and subadults) south of the Caloosahatchee River. The Service proposes to achieve this goal through land management partnerships with private landowners, through coordination with private landowners during review of development proposals, and through land management and acquisition programs with Federal, State, local, private, and Tribal partners. Based on an average density of 31,923 acres (12,919 ha) per panther as determined by Kautz et al. (2006), the acreages of lands necessary to achieve this goal are 2,553,840 acres (1,033,520 ha) for 80 panthers and 3,192,300 acres (1,291,900 ha) for 100 panthers.

The principal regulatory mechanism that allows the Service to work directly with private land owners during review of development and land alteration projects is section 10 of the Act. The Service coordinates with Federal agencies pursuant to section 7 of the Act. In August 2000, the Service, to assist the Corps in assessing project effects to the Florida panther, developed the Florida panther final interim Standard Local Operating Procedures (SLOPES) for Endangered Species (Service 2000). The Florida panther SLOPES provide guidance to the Corps for assessing project effects to the Florida panther and recommends actions to minimize these

effects. The Florida panther SLOPES also included a consultation area map that identified an action area where the Service believed land alteration projects may affect the Florida panther.

In the original SLOPES, the consultation area map (the Map) was generated by the Service by overlaying existing and historical panther telemetry data on a profile of Florida and providing a connecting boundary surrounding most of these points. Since the development of the Map, we have received more accurate and up-to-date information on Florida panther habitat usage. Specifically, we have received two documents that the Service believes reflect the most likely panther habitat usage profiles, although documentation clearly shows panther use of areas outside these locations. These documents are the publications by Kautz et al. (2006) and Thatcher et al. (2006). Based on the information in these documents, we have clarified the boundaries of the Map to better reflect areas where Florida panthers predominate (Figure 7) and refer to these areas cumulatively as the Florida Panther Focus Area.

The Panther Focus Area was determined from the results of recent panther habitat models south of the Caloosahatchee River (Kautz et al. 2006) and north of the Caloosahatchee River (Thatcher et al. 2006, 2009). The Kautz et al. (2006) model of landscape components important to Florida panther habitat conservation was based on an analysis of panther habitat use and forest patch size. This model was used in combination with radio-telemetry records, home range overlaps, land use/land cover data, and satellite imagery to delineate primary and secondary areas that would be most important and comprise a landscape mosaic of cover types important to help support the current panther breeding population south of the Caloosahatchee River.

Thatcher et al. (2006, 2009) developed a habitat model using Florida panther home ranges in south Florida to identify landscape conditions (land-cover types, habitat patch size and configuration, road density and other human development activities, and other similar metrics) north of the Caloosahatchee River that were similar to those associated with the current panther breeding population.

The Panther Focus Area Map south of the Caloosahatchee River is divided into Primary, Secondary, and Dispersal Zones, and north of the Caloosahatchee River into the Primary Dispersal/Expansion Area.

Primary Zone is currently occupied and supports the only known breeding population of Florida panthers in the world. These lands are important to the long-term viability and persistence of the panther in the wild.

Secondary Zone lands are contiguous with the Primary Zone and although these lands are used to a lesser extent by panthers, they are important to the long-term viability and persistence of the panther in the wild. Panthers use these lands at lower levels than in the Primary Zone.

Dispersal Zone is a known corridor between the Panther Focus Area south of the Caloosahatchee River and the Panther Focus Area north of the Caloosahatchee River. This zone is necessary to facilitate the dispersal of panthers and future panther population expansion to areas north of the Caloosahatchee River. Marked panthers have been known to use this zone.

Primary Dispersal and Expansion Area is the Fisheating Creek and Babcock-Webb WMA region. These are lands identified by Thatcher et al. (2006) as potential panther habitat with the shortest habitat connection to the Panther Focus Area in south Florida. Several collared and uncollared male panthers have been documented in this area since 1973, and the last female documented north of the Caloosahatchee River was found in this area.

ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions, which occur simultaneously with the consultation in progress.

Climate change

According to the Intergovernmental Panel on Climate Change Report (IPCC 2007), warming of the earth's climate is "unequivocal," as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level. The IPCC Report (2007) describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals and migratory birds. The potential for rapid climate change poses a significant challenge for fish and wildlife conservation. Species' abundance and distribution is dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing climate. Based on these findings and other similar studies, the Department of the Interior requires agencies under its direction to consider potential climate change effects as part of their long-range planning activities (Service 2007a).

Climate change at the global level drives changes in weather at the regional level, although weather is also strongly affected by season and by local effects (*e.g.*, elevation, topography, latitude, proximity to the ocean. Temperatures are predicted to rise from 2°C to 5°C for North America by the end of this century (IPCC 2007). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing and distribution), storms (frequency and intensity), and sea level rise. However, the exact magnitude, direction and distribution of these changes at the regional level are not well understood or easy to predict. Seasonal change and local geography make prediction of the effects of climate change at any location variable. Current predictive models offer a wide range of predicted changes.

Prior to the 2007 IPCC Report, Titus and Narayanan (1995) modeled the probability of sea level rise based on global warming. They estimated that the increase in global temperatures could likely raise sea level 6 inches by 2050 and 13 inches by 2100. While these estimates are lower than the estimates described in the IPCC Report (2007), Titus and Narayanan's (1995) modeling

efforts developed probability-based projections that can be added to local tide-gauge trends to estimate future sea level at specific locations.

Whittle et al. (unpublished data 2008) applied several prominent climate change models to panther habitat in southwest Florida. Their review indicated a climate change-induced sea level rise of 1 meter (3 feet) will reduce southwest Florida panther habitat by 29 percent, at 3 meters (9.8 feet) by 62 percent, and at 5 meters (16.4 feet) by 90 percent. The consequences would be particularly dire for the panther which has no other populations outside of low-lying south Florida. Their cost surface analyses identified likely migration routes that would link the south Florida panther population to suitable habitat to the north. However, without rapid conservation actions that establish a population to the north, they predict that the Florida panther may go extinct in the wild due to climate change effects.

Climatic changes in south Florida could exacerbate current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management (Pearlstine 2008). Global warming will be a particular challenge for endangered, threatened, and other "at risk" species. It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006a).

It should be noted that Titus and Narayanan's (1995) worst-case scenario was premised on a 1 percent chance that global warming would raise sea level that high. However, most climate change researchers agree with the findings in the IPCC Report (2007) which estimates a 90 percent probability of 7 to 23 inches of sea level rise by 2100. Scientific evidence that has emerged since the publication of the IPCC Report (2007) indicates an increase in the speed and scale of the changes affecting the global climate. Important aspects of climate change seem to have been underestimated and the resulting impacts are being felt sooner. For example, early signs of change suggest that the less than 1.0°C (1.8°F) of global warming that the world has experienced to date may have already triggered the first tipping point of the Earth's climate system – the disappearance of summer Arctic sea ice. This process could open the gates to rapid and abrupt climate change, rather than the gradual changes that have been currently forecasted.

Status of the species within the action area

As stated previously, for the purposes of this consultation, the Action Area includes the Addition Land boundaries plus a 25-mile buffer surrounding those boundaries (Figure 2). The proposed action may have direct and indirect effects on the ability of panthers to breed, feed, and shelter, and to disperse within the population.

The Service used current and historical radio-telemetry data, information on habitat quality, prey base, and evidence of uncollared panthers to evaluate panther use in the Action Area. Panther telemetry data are collected 3 days per-week from fixed-wing aircraft, usually in early to midmorning. Research has shown panthers to be most active between dusk and dawn, (Maehr

et al. 1990a; Beier 1995) and are typically at rest in dense ground cover during daytime monitoring flights (Land 1994). This potential bias was not detected in a recent analysis by Land et al. (2008) using GPS location data collected throughout a 24 hour day. This study revealed that panther habitat selection patterns are similar when using either aerial telemetry data or GPS location data and that upland and wetland forests were the habitats most selected by panthers. There was an indication that grassland-dry prairie habitats were used more at night than during daytime hours.

Not all panthers have been radio-collared; however, telemetry locations from the subset of marked panthers telemetry locations are a good indicator, due to the extensive data set, of the approximate boundaries of home ranges, panther travel corridors, and the range of Florida panthers south of the Caloosahatchee River. The FWC also uses observational data collected during telemetry flights to assess the yearly breeding activity of radio-collared panthers. Female panthers accompanied by kittens or male panthers within proximity of an adult female were assumed to have engaged in breeding activity during that year.

As of August 2010, at least 29 known radio-collared panthers have home ranges that intersect with, or are contained within the Action Area (Figure 8, Table 2). These panthers are known to be living as of August 2010. Uncollared panthers are presumed to occur in the Addition Lands because there is documented use of the area by collared panthers. It would be difficult to determine whether any physical evidence located in the Addition Lands came from collared panthers or uncollared panthers. Rancher's Supply (2009) performed an annual count of both radio-collared and uncollared panthers. The Action Area for this consultation includes most of survey areas 2 through 6 in that report. Rancher's Supply found a total of 80 individual Florida panthers in these survey areas. Fifty of those 80 panthers were found within the original BICY and the Addition Lands. Four of those radio-collared animals are now confirmed to be dead.

Past and ongoing Federal and State actions that could affect panther habitat in the Action Area include the issuance of Corps permits and State of Florida Environmental Resource Permits authorizing the filling of wetlands for development projects and other purposes. Since 1982, the Corps and the State have had a joint wetland permit application process, where all permit applications submitted to the State are copied to the Corps and vice versa. Upon review of our records, the Service finds that we have consulted on 17 non-Comprehensive Everglades Restoration Plan (CERP) projects, affecting approximately 8,676 ac of panther habitat, in the Action Area other than the current PA described in this Biological Opinion (Table 3). These projects also provided 12,295 ac of habitat proposed for restoration or preservation. Six CERP projects also intersect or fall within the Action Area (Figure 9). CERP projects are restoration projects that will still provide for equal to or better wildlife habitat than the baseline condition of the site. Therefore, their acreages are not included in the acres of affected habitat for the Florida panther.

From July 2000 through September 2006, the Service engaged in informal consultation with the Corps for approximately 757 projects, all under 5 acres each, that affected about 561.3 ac in Collier County (primarily NGG), which averages about 94 ac per year over the reported time frame (database entries for informal consultations prior to 2000 are incomplete). Almost all of

these projects involved the construction of single-family residences in partially developed areas, in most cases involving less than an acre of direct impact per project. Panthers have been known to cross these areas to other parts of their range and prey base and denning use of these areas has likely been affected by the level of development. For these actions, the Service concurred with the Corps' determination of "may affect, but is not likely to adversely affect" for these individual projects. Assuming that these projects are representative of the number of informal consultations for projects less than 5 acres each reviewed by the Corps for the Action Area, we can expect that about 93.5 ac of potential panther habitat could be developed each year. This annual level of loss has been anticipated as a component of our landscape scale assessment multiplier of 2.5, which provides for an increase above base of 0.05 and is estimated at 2,590 acres per year.

There have been 96 documented panther-vehicle collisions within the Action Area (see Table 4 and Figure 10). One collision was recorded on I-75 at the eastern boundary of the northeast Addition Lands. Approximately 17 of the 96 mortalities were recorded on SR29 along the western Addition Lands (Figure 10, Table 4).

Since 1986, a total of 132 panther dens have been located within the Action Area (Figure 11). Two of those were located in the western Addition Lands north of I-75. Twenty were located in the northeast Addition Lands with a single den identified south of I-75. Nine Florida panther dens were located in Bear Island between 1986 and 2005. Six of the dens in Bear Island were located adjacent to ORV trails. Eight of the dens in the northeast Addition Lands have been located adjacent to proposed trails.

Other activities within the action area have benefited panthers. The installation of wildlife crossings on I-75 and SR29 are used by panthers and have, undoubtedly reduced the number of fatal vehicle/panther interactions in the Action Area. The land acquisition programs of Federal, State, and County resource agencies have preserved high quality panther habitat. Table 1 provides a summary of the State and County acquisitions within the last 5 years. Moreover, the management of public lands, including prescribed fire and eradication of exotic vegetation in the Okaloacoochee Slough Strand State Forest, Dinner Island WMA, and other conservation areas, is intended to improve habitat for panther prey species, which benefits panthers within these areas. Current land management activities within the original BICY boundaries also benefit panthers through removal of exotic vegetation and improvements to prey habitat.

Factors affecting species environment within the action area

Factors that affect the species environment (positively and negatively) within the action area include, but are not limited to, the presence and construction of highways and urban development, agriculture, resource extraction, public lands management (prescribed fire, public use, exotic eradication, etc.), hydrological restoration projects, public and private land protection efforts, effects of genetic inbreeding, and genetic restoration. Development activities may result in avoidance or limited use of remaining suitable habitat by panthers as well as habitat loss, habitat fragmentation, habitat degradation, and also an increase in risk of vehicular collision (*e.g.*, injury or death). Public and private land management practices can have a positive, neutral, or negative effect, depending on the management goals. Land protection efforts will

help to stabilize the extant population. Hunting of the panther is no longer sanctioned, although there still may be instances of intentional or unintentional shooting of individuals for various reasons.

Federal actions implemented since the listing of the panther under the Act are included in the baseline for Florida panthers in south Florida. The Service has completed formal or informal consultation on approximately 125 Federal actions (excluding CERP) since 1984 affecting panthers in south Florida (Table 5), where the Service, through coordination with applicants, has recommended and received habitat offsets for minimization of direct habitat losses from proposed actions. All formal consultations were initiated because of the likelihood of adverse effects to Florida panthers. Each formal consultation concluded the proposed action under review was not likely to jeopardize the continued existence of the panther. Compensation (preservation) lands included 22,311 acres in the Primary Zone, 2 acres in the Secondary Zone, 652 acres in the Dispersal Zone, and 1,646 acres in the Other Zone.

The impacted lands generally were: (1) on the western fringe of occupied panther habitat; (2) vegetated with dense stands of exotic species, which likely reduce the density of the panther prey base; or (3) included agricultural enterprises, *i.e.*, row crops, citrus, etc., which provide some, but lower quality habitat for the Florida panther. The preserved and off-site compensation lands for these impacts are generally proximate to larger tracts of Federal, State, and other preserves therefore providing enhanced habitat quality for the Florida panther.

In summary, by 2008, the Service had consulted in the loss or degradation (negative effects) of 96,416 acres of panther habitat in south Florida since 1983. However, there was also on-site preservation and off-site compensation of 41,641 acres of panther habitat in south Florida (Table 5).

State of Florida Environmental Resource Permits have preserved 30,325 acres of higher quality panther habitat to offset permitted impacts to 40,584 acres of lower quality panther habitat (1992 to present). Installation of wildlife crossings under SR 29 and I-75 within the action area has also benefited the panther by protecting habitat connectivity and reducing panther-vehicle collisions. Additional benefits have resulted from the acquisition of high quality habitat through acquisition programs by Federal, State, and County resource agencies. Table 1 provides a summary of the State and county acquisitions within the Panther Focus Area. Moreover, the management of public lands, including prescribed fire and eradication of exotic vegetation in the PSSF, FSPSP, FPNWR, BICY, ENP, and other conservation areas is intended to improve habitat for panther prey species, which benefits Florida panthers within these areas.

ORV use is present in the Action Area. The original BICY permits up to 2,000 ORVs per year. ORV types include street-legal vehicles, swamp buggies, all-terrain vehicles, and airboats. Non-motorized users also have access to the Action Area through trailheads in the original BICY. Non-motorized uses also occur in the Addition Lands.

EFFECTS OF THE ACTION

This section analyzes the direct and indirect effects of the proposed action and interrelated and independent actions on the Florida panther and Florida panther habitat. The direct effects of adoption of a plan are usually not measureable, it is the effects of implementation of that plan that may result in effects to the Florida panther. Many of the components of the PA will require additional coordination through the Corps permitting process or other Federal mechanism that will result in additional consultation. Direct and indirect effects of implementation of the PA are so closely related that we will analyze them together in this document.

Factors to be considered

Residential, commercial, and industrial development projects may have a number of direct and indirect effects on the Florida panther and panther habitat. Direct impacts, which are primarily habitat based, may include: (1) the permanent loss and fragmentation of panther habitat; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) the loss of available habitat for feeding, breeding, and dispersing panthers; (4) a reduction in the geographic distribution of habitat for the species; (5) harassment of panthers due to construction activities; and (6) enhancement, restoration and preservation of panther habitat resulting from habitat compensation. Indirect effects may include: (1) an increased risk of roadway mortality to Florida panthers traversing the area due to the increase in vehicular traffic; (2) increased disturbance to panthers and panther prey in the vicinity due to human activities (human/panther interactions); (3) the reduction in value of panther habitat adjacent to the Addition Lands due to habitat fragmentation; and (4) a potential increase in intraspecific aggression between panthers due to reduction in the spatial extent of panther habitat.

The Addition Lands contain panther habitat and are located within the geographic range of the Florida panther. The timing of implementation of activities contained in the GMP, relative to sensitive periods of the panther's lifecycle, is unknown. Panthers may be found on and adjacent to the Addition Lands year-round. The activities included in the PA of the GMP will be implemented over the course of 20 years after the Record of Decision is signed. Some activities included in the PA of the GMP will involve trail hardening or construction of recreational facilities. The timing of this construction and the duration are unknown at this time. Therefore, the Service assumes that construction activities could take place at any time of year, although trail hardening would most likely occur only during the drier months.

The disturbance intensity associated with these activities should be lower than other types of construction activities. Trail hardening will involve use of heavy equipment, but the number of vehicles used at any given time will be limited by equipment/personnel availability, trail width, and access points. Disturbance intensity during construction of recreational facilities will be localized to the site of the recreational facility.

The geographic location for a particular disturbance such as trail hardening will not be known until locations that require hardening are identified. It is likely that a Corps' permit will be necessary to perform these activities. The Service will comment on, or potentially consult on,

those activities through the Department of the Army permitting process. Notwithstanding this future consultation, we did assume that all trails identified in the PA would be used during the life of the GMP. Accordingly, we buffered those trails by the 180 meters noted by Janis and Clark (2002) and assumed that panther use of those areas would be reduced during portions of the year. The spatial extent of that analysis is included below.

The disturbance frequency associated with implementation of the PA would be year-round with the exception of the 60-day rest period (normally early June through early August each year) that is currently implemented within the original BICY boundaries, as well as nightly, safety, resource protection, and hydrologic closures as described in the GMP. These closures will also be implemented in the Addition Lands.

Analysis for effects of the action

Panthers, because of their wide-ranging movements and extensive spatial requirements, are particularly sensitive to habitat fragmentation (Harris 1984). Mac et al. (1998) defines habitat fragmentation as: "The breaking up of a habitat into unconnected patches interspersed with other habitat, which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines." The reference to "unconnected patches" is a key component of the definition. For panther conservation, this definition underscores the need to maintain contiguous habitat and protected habitat corridors in key locations in south Florida. Habitat fragmentation can result from road construction, urban development, mines, and agricultural land conversions within the habitat of panther prey species and affect the ability of panthers to move freely throughout their home ranges. Construction of highways in wildlife habitat typically results in loss of habitat, traffic-related injury or mortality, and panther avoidance of associated human development. Female panthers appear to be less likely to cross roads than males, which may increase the effects of habitat fragmentation (Maehr 1990).

Disturbance from Human Activities: The implementation of the PA will increase human use of the Addition Lands. Current use of the Addition Lands is limited but does occur. While some of this use, other than NPS administrative and foot traffic, is not regulated or authorized, we considered it to be a part of the baseline for this proposal. The level of both motorized (ORV) and non-motorized use that occurs is unknown. Manpower to enforce closure is limited at present. The NPS has included additional enforcement in the PA, therefore, the level of unregulated use should diminish. Trails opened in the Addition Lands will be clearly marked, which may diminish any off-trail habitat degradation in these areas.

As trails are hardened, ORV use in the Addition Lands will increase vehicular traffic and noise in areas that are currently less accessible. Noise in proximity to I-75 is not likely to increase in any meaningful manner as the highway use is, likely, more impactive than ORV engines will be in low numbers and small groups.

Non-motorized use also currently occurs in the Addition Lands. Non-motorized use may increase as access points are constructed and opened. These activities and disturbances may cause panthers and or their prey to temporarily avoid the areas in proximity to trails, although there are no definitive data to support this assumption. Non-motorized use is restricted to daytime use except where users obtain an overnight camping permit. Implementation of the PA will allow the NPS to determine the level of non-motorized use in the Addition Lands. These data may be used to further assess the effects of motorized and non-motorized use on the Florida panther.

Habitat use and Movements: Janis and Clark (2002) analyzed hunter use data and panther telemetry data to detect if that use had a measurable effect on Florida panthers. In their discussion of their analysis, they noted that panthers moved an average of 180 m from designated trails during hunting season in the Bear Island management unit. The level of use of Bear Island did decrease, and the panthers moved back to their normal patterns after hunting season concluded. The cause of this shift in use was unknown. The authors surmise that prey species could be directing that movement as they move away from trails during hunting season. They also surmise that hydropatterns could be affecting use and movements as the transition from wet season to dry season progresses. Given that, though, the use of Bear Island should have increased at the same rate as the use of FPNWR, a trend not seen by the authors. Although statistically significant, the authors could not correlate the movement away from trails with any biological consequences and concluded that the effects were, likely, biologically insignificant or "minor."

The results of the Janis and Clark study prompted NPS and the Service to collaborate on a study that would go further in an analysis of the relationship between human use, particularly by ORVs, and panther movements in Bear Island. Various study designs were explored and the Service and NPS finally agreed that the best way to attempt to identify trends in panther behavior as they relate to ORV use was to digitize the existing FWC check-in sheets and use those data on hunter use in concert with panther data to create a more complete picture of the relationship of ORV and hunter use and panther use and movements. The NPS had that task completed and Dr. Robert Fletcher, Department of Wildlife Ecology and Conservation, University of Florida, was contracted to analyze those data and the panther telemetry data to attempt to replicate what Janis and Clark had done and expand upon that investigation.

Fletcher and McCarthy (personal communication, 2010) reviewed the Janis and Clark study and took it further. The hunter check data for the 20 years provided a much more detailed view of human use patterns for Bear Island than was available to Janis and Clark. Janis and Clark primarily used parking area and trail head vehicle counts to extrapolate levels of use. Fletcher and McCarthy also had another 10 years of Florida panther telemetry data available for their use. These factors may contribute to the differences in results in the two studies.

To compare the two studies, Janis and Clark also found that female movement rates increased during the hunting season. These movement rates returned to pre-hunting season levels in FPNWR but remained higher in Bear Island. They concluded that there was a "marginally significant" relationship effect of hunting on movements, but stated that the interaction effect

they detected (285 meters) was small relative to daily movement patterns (2 to 2.5 km) of female panthers. The results they found for male movements had insufficient power to support any conclusions.

Fletcher and McCarthy (personal communication 2010) also found an increase in panther distance from trails from pre-hunting season to during hunting season. Unlike Janis and Clark, however, they did not see the distance to trails return to pre-hunting levels but saw an increase through the post-hunting season (Figure 12, Table 6). Fletcher and McCarthy also applied this analysis to the proposed trail system for the Addition Lands. They saw the same trend noted for Bear Island in the Addition Lands, which have been closed to ORV hunting since 1996.

The pattern of the movements and increased distance to trails appears to be seasonal and could be correlated with habitat changes as distance from trails increased. The change in use could also be attributed to changes in hydrology as the wet season advances. Both Janis and Clark (2002), and Fletcher and McCarthy (2010) mention hydrology as a potential cause of the movement patterns noted.

Fletcher and McCarthy (2010) also analyzed the habitat composition of areas as distance from trails increased. Many of the vegetative communities they looked at changed in similar manners as distance to a trail increased. This is consistent with NPS' policy of locating trails in vegetative communities that are more resilient and have substrate that is easier to maintain. These conditions are predominantly pine flatwoods and other mesic or xeric communities.

Janis and Clark (2002) also found differences in the use patterns of public and private lands by Florida panthers related to season. Florida panthers tended to move onto FPNWR as water receded toward the end of the wet season. This was not noted for Bear Island. In fact, Janis and Clark noted a decline in the use of Bear Island during and after the hunting season. The cause of this difference is unknown. It is not likely that the difference is due to prey movements as Land (1991) found no evidence that radio-collared white-tailed deer left Bear Island during hunting season. Likewise, Wood and Brenneman 1980, Ilse and Hellgren 1995 noted that average annual home range sizes for feral hog were 50 to 90 percent smaller than those noted for Bear Island, indicating movement of feral hog from Bear Island during hunting season was unlikely. Differences in vegetative community type could influence this change in use as NPS property (excluding the Addition Lands) had 61 percent open habitat types (wet prairie and disturbed) compared with 31 percent of FPNWR (Janis and Clark 2002).

It is interesting to note that Fletcher and McCarthy (personal communication 2010) did not see the same results as Janis and Clark. The report on this study is expected to be finalized in December 2010, however, Dr. Fletcher provided a preliminary draft of the report for our use. FPNWR was chosen as a control location by Janis and Clark, and serves as a surrogate for the Addition Lands when comparing areas open to human use and areas closed to human use. The preliminary analysis found that the overall use of Bear Island and FPNWR increased from pre-hunting season during hunting season with a slight dip in the post-hunting season use (Figure 12). Only when an 86 day time frame for pre-, during-, and post-hunting seasons was used for the Bear Island data was there a decrease in use of Bear Island below the pre-hunting season use.

Janis and Clark (2002) found no differences between the movements of females for the three time periods examined. They did, however, note an overall treatment effect that female Florida panthers moved less before hunting season than during hunting season.

Habitat Damage and Degradation:

ORV use and its effects on the ecosystem has been a contentious subject for many years. ORV rutting can cause changes in sheet flow that may cause additional effects to habitat composition, etc. (Duever et al. 1986). Opening the Addition Lands to ORV use will enable ORVs to access areas they have no legal access to currently. Prior to acquisition of the Addition Lands between 1989 and 1996, ORVs and street-legal vehicles were able to access the Addition Lands north of I-75 and portions of the Addition Lands south of I-75 on both improved and unimproved trails. To enable recreational use of the Addition Lands again without degrading or damaging the plant communities therein is key to successful implementation of the PA of the GMP.

In analyzing the potential effects of the PA, we placed a 180 m buffer around the proposed trail system. Following Janis and Clark (2002), it is likely that panthers will move this distance away from the proposed trails during hunting season. Since the PA proposes a maximum of 130 miles of trails and a maximum of 650 permits, we considered this to be the mark to use for our analysis as it represents the maximum implementation of the PA. Much of the 180m buffer around these trails was high quality habitat according to Thatcher et al. (2006). Our analysis indicated that 16,808 ac of suitable panther habitat would be affected seasonally by full implementation of the PA. The 16,808 ac represents approximately 11 percent of the Addition Lands.

Intraspecific Aggression:

In assessing the potential effect of implementation of the PA on panthers, we also looked at the potential for increases in intraspecific aggression. One might argue that movements away from ORV trails during the hunting season could cause shifts in home ranges and result in an increase in the likelihood of intraspecific aggression. Figure 10 shows locations of panther mortalities from intraspecific aggression. While there are areas that appear to have more of these incidents recorded, the distribution is scattered over the landscape. There are two locations in Bear Island, which is currently open to ORV use and six locations in the northern Addition Lands, which is not open to ORV use. Another six locations are found in FPNWR which is closed to all ORV traffic except research and Service operations. The locations of these points would appear to discount the assumption that ORV use in a management unit increases the likelihood of intraspecific aggression. The ephemeral loss of a 180 meters trail buffer for a portion of the year represents an insignificant loss with respect to home range dynamics (Land 2010). It should be noted, however, that these locations are mainly for radio-instrumented Florida panthers and that some victims of intraspecific aggression may not be located if they do not wear radio collars, in fact, only two panthers in the database were listed as UC (uncollared).

Road Mortalities:

Another factor to consider when assessing the potential effects of the proposed action on the Florida panther is the effect on panther/vehicle interactions. Opening the Addition Lands to recreational use is likely to increase vehicle trips per day in the area. The location of the Addition Lands north and south of I-75 and the western Addition Lands east of SR29 dictate that the majority of the traffic increase is likely to use I-75 and SR29. Both these thoroughfares have wildlife crossings installed and panther mortalities have diminished as a result. The number of additional trips per day or year that the additional 650 ORV permit holders and other recreational users of the Addition Lands would add to the existing traffic is unknown, but not likely to create a measurable effect on panther/vehicle interactions. NPS will educate permit holders and other recreationists on the importance of obeying speed limits and watching for wildlife when driving these roads and any roadways that enable higher speeds in the Addition Lands. We must assume, however, that permitees and other users of the Addition Lands will abide by lawful speed limits when travelling to recreational access points within BICY.

Reproductive Success:

Panther dens in Bear Island, which is open to recreational ORV use, have been located adjacent to ORV trails. Panther dens in the northeast Addition, which is not open to recreational ORV use, have been located adjacent to proposed and formerly-used ORV trails. Panthers den mainly between March and July. As the wet season progresses, Fletcher and McCarthy (personal communication, 2010) noted that hunter use dropped off to almost nothing. It is likely that this trend would be similar in the Addition Lands, should they be opened under the PA. NPS has included in the PA measures to avoid disturbing denning panthers, should one be located near an ORV trail. These measures should reduce the likelihood of adverse effects of implementation of the PA.

Interrelated and interdependent actions

The effects of the proposed action are analyzed together with the effects of other activities that are interrelated to, or interdependent with, the proposed action. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart fromt the action under consultation. We believe the NPS has included all actions that would be considered interrelated in the GMP. These interrelated actions include proposed ORV and paddling trails, new trailheads, fire operations centers, vehicle permits, monitoring programs, law enforcement, and visitor orientation and education facilities and other components of the PA identified in the GMP.

Interdependent actions are more difficult to isolate. The Florida Department of Transportation (FDOT) is proposing additional rest areas and access points off I-75. These access points will be reviewed separately but are interdependent to an extent. Foot traffic is currently allowed in the northeast Addition Lands. Visitors on foot could use new access areas for parking prior to

entering the Addition Lands. In that scenario, the additional access points would not be considered interdependent.

The Big Cypress National Preserve Addition Act of 1988 (16 U.S.C. § 698f) states that *"the Secretary and other involved Federal agencies shall cooperate with the State of Florida to establish recreational access points and roads, rest and recreation areas, wildlife protection ... in conjunction with the creation of the Addition and in the construction of Interstate Highway 75."* This statement would seem to identify the access points as interdependent activities, however, the FDOT is the lead agency responsible for the design and construction of the access points. Therefore, while we acknowledge that these access points will be designed and proposed for construction, we also need to clarify that additional consultation in accordance with 50 CFR § 402 will occur with the FDOT through the Federal Highway Administration on the potential effects the construction and operation of the access points may have on federally listed threatened and endangered species.

Species response to the proposed action

Panther and Prey Disturbance (Panther/Human Interactions): Potential increases in disturbance to the Florida panther and panther prey were evaluated. As implementation of the PA proceeds, an increase in the potential for panther/human interactions and prey disturbance may occur as recreational activity patterns increase in the Addition Lands.

Panthers and their prey may avoid trails during hunting season as they are hardened and opened, but are not expected to leave the area entirely and are expected to resume normal behaviors during the post-hunting period. Janis and Clark (2002) found that panthers moved away from designated trails during the hunting season but returned to those areas within 4 months after the hunting season ended. Since Fletcher and McCarthy (personal communication, 2010) found that panthers in the Addition Lands moved away from the proposed trail system while the area was closed, it is likely that the cause of the movement is something other than hunting season ORV traffic. They surmise this pattern may be related to habitat composition or hydrology. Janis and Clark (2002) also suspected a relationship between use patterns and hydrology. Regardless of the cause, it is likely that this cycle would continue after trails are opened. It is unlikely that opening trails would remove whatever stimulus causes panthers to move away from the trails in this area, however, ORV use could serve as a catalyst to increase the level of movement away from trails. Janis and Clark (2002) could find no biological consequences resulting from these movements away from trails. Long-term monitoring in the Addition may yield additional information regarding the cause of this movement pattern.

Habitat Use and Movements: Janis and Clark (2002) and Fletcher and McCarthy (personal communication, 2010) both noted that panthers moved away from trails during the hunting season. The cause for this movement is unknown and occurred in areas that were open to recreational ORV use and those that were not open to recreational ORV use. Based on these analyses, it is likely that panthers will continue to move away from trails during the hunting season. Janis and Clark (2002) noted that the increased distance from trails probably had "minor biological consequences." They also noted that panthers used Bear Island less and moved off to

private property as hunting season progressed. Fletcher and McCarthy did not see this pattern. As in the movements away from trails, the cause of the change in use patterns is unknown but both groups of investigators surmised this might be a product of hydropatterns and prey species movements (Janis and Clark 2002, Fletcher and McCarthy personal communication, 2010). Regardless of the cause of the change in use patterns, it is likely that these patterns would continue during implementation of the PA. The biological consequences of these changes in habitat use and movements are unknown but could not be measured in either investigation.

Intraspecific Aggression: Potential increases in intraspecific aggression were analyzed as they relate to increases in human disturbance and potential alterations of panther use patterns in the Addition Lands. The past level of intraspecific aggression mortalities in the Addition Lands is similar to that found in Bear Island. Since Bear Island is open to human use, and the Addition Lands are not, it is unlikely that we will be able to measure any change in the level of intraspecific aggression in the Addition Lands.

Reproductive Success:

Most denning activity occurs during the summer months between March and July. ORV use tends to be lower during these months since preliminary data from Fletcher and McCarthy indicate that hunter use begins to drop in late March and April and is almost non-existent until the beginning of September for the hunter data that they analyzed from 1989 to 2009. This information and the fact that panthers have denned adjacent to ORV trails in Bear Island and the Addition Lands would appear to indicate that reproductive success is not likely to be affected by opening trails in the Addition Lands. NPS has included conservation measures that may include trail closure should a panther den in proximity to an open trail.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions reasonably certain to occur in the Action Area considered in this Biological Opinion. Cumulative effects associated with increased development in the Action Area may affect the need and demand for recreational opportunities proposed for the Addition Lands. Cumulative effects associated with increases in vehicular traffic and potential increases in human/panther interactions may also affect the Addition Lands. Although future Federal actions located within the Action Area affecting panthers are technically not linked to this project and will be considered in separate section 7 consultations, the Service notes that several projects affecting panther habitat and providing increases in vehicular traffic have been subject to section 7 consultations resulting in biological opinions and have been included in the environmental baseline.

To identify future private actions that would affect panthers and that may reasonably be certain to occur in the Action Area, the Service first identified the types of land alteration actions that could occur in the lands surrounding the Addition Lands. We then developed a mechanism to distinguish between those that will require future Federal review and those that are not likely to be future Federal actions, thus meet the cumulative effects definition. Within the Action Area, past and ongoing state and county actions (non-Federal) affecting panther habitat include:

(1) State of Florida DRI Orders; (2) Collier County Comprehensive Plan Amendments; (3) Collier County Zoning Amendments; (4) Collier County's PUDs; and (5) District's Environmental Resource Permits.

To estimate future non-Federal actions, the Service chose to identify and tabulate these recent past non-Federal actions and project this level of development as representative of future non-Federal actions. However, because the Addition Lands are in southern Collier County and bordered by protected lands, limited land use changes (residential development) are likely to occur in proximity to the Addition Lands at least in the foreseeable future. The most likely source of development is associated with residential developments fringing the rural/urban boundary in western Collier County. To assess this level of development, the Service evaluated data from cumulative effects assessments associated with residential developments proposed in Collier County's rural/urban boundary. We evaluated data from the Service's June 29, 2005, Biological Opinion for Ave Maria University, which is north of the Addition Lands and covers a review period between 2001 through 2005. We also evaluated data from the Service's 2010 pending Biological Opinion for Hacienda Lakes Development, which is west of the Addition Lands and covers a review period between 2006 and 2009.

To evaluate these effects, the Service incorporated Florida Land Use Cover and forms Classification System (FLUCCS) mapping to determine properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps. To determine which of these projects would likely be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps, we identified the percentage of the project site that was classified as wetland habitat, based on the FLUCCS mapping units. The mapping units relied on by the Service included the 600 series (wetland classifications) and the 411 and 419 pine flatwood classifications (hydric pine systems).

For listing purposes, properties with less than 5 percent wetlands were considered by the Service to be generally exempt from regulatory review as these quantities of wetlands could be avoided by project design. Based on FLUCCS mapping, our review of the Ave Maria University Biological Opinion data noted 38 projects affecting 2,627 ac and our review of the Hacienda Lakes pending Biological Opinion data noted 25 projects, affecting 913.2 ac. The summed value of these two reviews is 3,540.2 ac and could be expected to be subject to development without Federal permit involvement through the Clean Water Act section 404. This level of development represents 12.2 percent of a female panther's average home range (29,059 ac) and 5.7 percent of a male panther's average home range (62,542 ac).

State and county land alteration permits in southwest Florida not part of those actions listed above generally included single-family residential developments within NGGE. Vacant lands within the area of NGGE (north of I-75), also within the action area, totaled about 34,028 acres as of September 2004. To evaluate these effects, the Service overlaid the plat boundaries on 2004 aerials, queried the parcel data from Collier County's Property Appraisers Office, noted lots with developments, compared those to 2003 aerials, and noted the changes. Vacant lands within the area of NGGE (north of I-75) totaled about 35,768 ac as of August 2003. The breakdown of acres for August 2003 is: (1) wetlands, about 17,568 ac; (2) uplands, about

17,990 ac; and (3) water, about 210 ac. These changes were overlaid on the National Wetlands Inventory (NWI) maps for presence of wetlands. This evaluation was used to estimate the acreage of properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps. A comparison of the 2003 and 2004 data for NGGE indicates about 1,740 ac of land were converted from vacant to developed with the breakdown as: (1) wetlands, about 696 ac; (2) uplands, about 1,044 ac; and (3) water, 0 ac.

The evaluation process provided an estimate of 417 lots totaling 1,740 acres for s. Therefore, using NWI mapping for the s, a total of about 1,044 acres could be expected to be subject to development in a year in these areas without Federal permit involvement. Based on historical records for wetland permits issued by the Corps for these areas, most of these projects will involve the construction of single-family residences in partially developed areas and will involve less than an acre of impact. This level of development represents 3.59 percent of a female panther's average home range (29,059 ac) and 1.67 percent of a male panther's average home range (62,542 ac).

In conclusion, the Service's cumulative effects analysis has identified approximately 6,162 ac (2,627 + 913 + 3,540 + 1,044) within the action area that could be developed without Federal wetland permit involvement. This level of development, which the Service believes is representative of future non-Federal actions, is reasonably certain to occur and, therefore, meets the definition of a cumulative effect. This level of projected future development represents 15.8 percent of a female panther's average home range (29,059 acres) and 7.3 percent of a male panther's average home range (62,542 acres). These lands represent 0.23 percent of the non-urban private lands at risk in the Service's panther core area (1,962,294 acres). Based on the above analysis, we believe the loss of the habitat associated with these lands, though insignificant in the short term, may adversely impact the panther as development continues to occur in the future in the action area. The Service has accounted for some habitat loss and changes in habitat quality through its habitat assessment methodology and is encouraging state and county environmental staff to pursue the section 10 (Habitat Conservation Plan) process to account for and compensate for adverse effects to the Florida panther.

CONCLUSION

Implementation of the PA of the GMP will result in increased human use of the Addition Lands. Investigations of the interaction of recreational ORV use and hunting with panther behavior have noted alterations in behavior that trend with hunting season and human use. However, these alterations in behavior have not been correlated with any change in reproductive success or survival in Florida panthers. The movements may, in fact, be more related to hydropatterns and prey movements as the wet season transitions to the dry season in south Florida. Therefore, after reviewing the current status of the Florida panther, the environmental baseline for the action area, the effects of the proposed implementation of the PA in the GMP, and the cumulative effects, it is the Service's biological opinion that implementation of the PA for the Addition Lands, as proposed, is not likely to jeopardize the continued existence of the Florida panther. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking, that is incidental to and not intended as part of the agency action, is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary and must be undertaken by the NPS so that they become binding conditions of any grant, permit, or Record of Decision, as appropriate, for the exemption in section 7(o)(2) to apply. The NPS has a continuing duty to regulate the activity covered by this incidental take statement. If the NPS (1) fails to assume and implement the terms and conditions or (2) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the grant, agreement, or permit document, the protection coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the NPS must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates that panthers associated with the Addition Lands and within the 25-mile buffer Action Area could be incidentally taken as a result of this proposed action. The primary methods of determining the presence of panthers on a given area is through radio telemetry and by detecting physical evidence. The use of radio telemetry is limited (less than a third of the panther population is radio collared at any one time), and, due to their large home ranges (resident males have a mean home range of 160,639 acres [65,009 ha] and females 97,920 acres [39,627 ha]) and the fact that they occur at low densities (1 to 8 per 100 mi^2), counting the exact number of panthers responsible for creating physical evidence can be problematic. The annual population count reflects the total number of panthers confirmed by physical evidence during one calendar year (McBride et al. 2008). This count serves as an indication of the population trend rather than an actual count since in any one 12-month period some of the panthers recorded will die, kittens previously documented at the den may become dependent-aged juveniles, and un-collared subadults, particularly males, may disperse into other areas.

Research has noted that panthers move an average distance of 180 m from trails during the hunting season. We buffered the trails system proposed in the PA of the GMP with the 180m

buffer and determined that Florida panthers using the Addition Lands would avoid using a maximum of 16,808 ac associated with the 180 m buffer of the proposed trail system. This equates to approximately 11.4 percent of the Addition Lands. The GMP did not provide an estimate of the number of miles of secondary trails that may be opened during implementation of the PA. Since we cannot currently quantify the extent of secondary trails, this Incidental Take Statement refers only to the primary trails described in the PA of the GMP. We understand that this means the NPS may have to reinitiate consultation to address the establishment of secondary trails in the future. The incidental take is expected to be in the form of harassment.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined this level of anticipated incidental take is not likely to jeopardize the continued existence of the Florida panther.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the NPS must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline reporting and monitoring requirements. These terms and conditions are non-discretionary.

1. Minimize human disturbance and habitat degradation.

    a. NPS will provide educational materials to ORV permitees and recreational users of the Addition Lands that stresses the importance of obeying speed limits and watching for Florida panthers on roadways in the vicinity of BICY.
    b. NPS will coordinate with the Service to identify and define appropriate photo monitoring sites and plans for the Addition Lands.
    c. NPS will coordinate with the Service to identify an optimal trail marking procedure to ensure ORV users stay on designated trails.
    d. Trails will not be opened until after photo points, if necessary, are established and trail marking efforts are completed.

2. Minimize take through a better understanding of the interactions of the Florida panther and its environment in the Addition Lands.

    a. The NPS will continue to acquire and analyze data and facilitate monitoring (*e.g.*, hunter use data analysis, camera traps, etc.) on panther use of the Addition Lands.
    b. Annual status reports and meetings between NPS and the Service will continue to occur and will cover both Bear Island and the Addition Lands.
    c. Reports shall be submitted to the Service at 1339 20th Street, Vero Beach, Florida 32960-3559 by November 30 every year until the NPS and the Service agree that reporting is no longer necessary. The report contents and level of detail will vary depending on the progress of implementation of the PA. Report will be as detailed as

necessary to summarize the actions and observations, including the following information:

i. The current status of the implementation of the PA as well as any milestones that have been completed.
ii. Any mapping of PA components in the Addition Lands.

3. Upon locating a dead, injured, or sick threatened or endangered species, initial notification must be made to the nearest Service Law Enforcement Office; U.S. Fish and Wildlife Service (10426 NW 31st Terrace, Miami, Florida 33172; 305-526-2610). Additional notification must be made to the FWC at 1-888-404-FWCC (3922). Secondary notification should be made to the FWC; South Region, 8535 Northlake Boulevard, West Palm Beach, Florida 33412, and FWC, Darrell Land, Panther Team Leader, FWC, 566 Commercial Boulevard, Naples, Florida 34104; 239-643-4220.

Care should be taken in handling sick or injured specimens to ensure effective treatment and care in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured panthers or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service requests notification of the implementation of any conservation recommendations so that we are kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats.

We recommend the following:

NPS should develop additional species monitoring plans for the red-cockaded woodpecker, wood stork, and eastern indigo snake.

REINITATION NOTICE

This concludes formal consultation on the actions outlined in the PSRP. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an

effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for the opportunity to consult on the GMP for the Addition Lands. If you have any questions, please contact Jane Tutton at 772-562-3909, extension 235.

cc: electronic copy only
FWC, Naples, Florida (Darrell Land)
FWC, Tallahassee, Florida (Nick Wiley)
NPS, Big Cypress National Preserve, Ochopee, Florida (Ron Clark)
NPS, Denver Service Center, Denver, Colorado (Patrick Malone)

LITERATURE CITED

Ackerman, B. B., F. G. Lindzey, and T. P. Hemker. 1986. Predictive energetics model for cougars. Pages 333-352 in S. D. Miller and D. D. Everett (eds). Cats of the world: biology, conservation, and management. National Wildlife Federation and Caesar Kleberg Wildlife Research Institute, Washington, D. C. and Kingsville, Texas.

Anderson, A. E. 1983. A critical review of literature on puma (*Felis concolor*). Special Report No. 54. Colorado Division of Wildlife, Fort Collins, CO.

Ballou, J.D., T.J. Foose, R.C. Lacy, and U.S. Seal. 1989. Florida panther (*Felis concolor coryi*) population viability analysis and recommendations. Captive Breeding Specialist Group, Species Survival Commission, IUCN, Apple Valley, *Minnesota*.

Bangs, O. 1899. The Florida puma. Proceedings of the Biological Society of Washington 13:15-17.

Beier, P. 1995. Dispersal of juvenile cougars in fragmented habitat. Journal of Wildlife Management 59:228-237.

Beier P., M.R. Vaughan, M.J. Conroy, and H. Quigley. 2003. An analysis of scientific literature related to the Florida panther. Final report, Project NG01-105, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Beier P., M. R. Vaughan, M. J. Conroy, and H. Quigley. 2006. Evaluating scientific inferences about the Florida panther. Journal of Wildlife Management.

Belden, R.C. 1986. Florida panther recovery plan implementation - a 1983 progress report. Pages 159-172 in S.D. Miller and D.D. Everett (eds). Cats of the world: biology, conservation, and management. National Wildlife Federation and Caesar Kleberg Wildlife Research Institute, Washington, D.C. and Kingsville, Texas.

Belden, R.C. 1988. The Florida panther. Pages 515-532 in Audubon Wildlife Report 1988/1989. National Audubon Society; New York, New York.

Belden, R.C. and R.T. McBride. 1983. Florida panther surveys - Big Cypress National Preserve. Final report to Hughes and Hughes Oil and Gas Company.

Belden, R.C. and R.T. McBride. 2005. Florida panther peripheral areas survey final report 1998-2004. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Belden, R.C., W.B. Frankenberger, R.T. McBride, and S.T. Schwikert. 1988. Panther habitat use in southern Florida. Journal of Wildlife Management 52:660-663.

Belden, R.C., W.B. Frankenberger, and J.C. Roof. 1991. Florida panther distribution. Final Report 7501, E-1 II-E-1. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Benson, J.F., M.A. Lotz, and D. Jansen. 2008. Natal den selection by Florida panthers. Journal of Wildlife Management 72:405-410.

Benson, J.F., J.A. Hostetler, D.P. Onorato, W. E. Johnson, M. E. Roelke, S. J. O'Brien, D. Jansen, and M.K. Oki. 2009. Chapter 2: Survival and cause-specific mortality of sub-adult and adult Florida panthers. Pp. 10 – 61 *in* J. A. Hostetler, D.P. Onorato, and M.K. Oli, (eds). Population ecology of the Florida panther. Final report submitted to Florida Fish and Wildlife Conservation Commission and U. S. Fish and Wildlife Service.

Berglund, F. and M. Berlin. 1969. Risk of methylmercury cumulation in man and mammals and the relation between body burden of methylmercury and toxic effects. *In* M.W. Miller and G. G. Berg (eds). Chemical fallout. Charles C. Thomas, Springfield, Illinois.

Beyer, D.E., Jr. and J.B. Haufler. 1994. Diurnal versus 24-hour sampling of habitat use. Journal of Wildlife Management 58:178-180.

Brown, M.A., M.W. Cunningham, A.L. Roca, J.L. Troyer, W.E. Johnson, and S.J. O'Brien. 2008. Genetic characterization of Feline Leukemia Virus from Florida panthers. Emerging Infectious Diseases 14:252-259.

Clark J. D., D. Huber, and C. Servheen. 2002. Bear reintroductions: lessons and challenges. Ursus 13:335-345.

Comiskey, E.J., O.L. Bass, Jr., L.J. Gross, R.T. McBride, and R. Salinas. 2002. Panthers and forests in south Florida: an ecological perspective. Conservation Ecology 6:18.

Cox, J.J., D.S. Maehr, and J.L. Larkin. 2006. Florida panther habitat use: New approach to an old problem. Journal of Wildlife Management 70:1778-1785.

Cunningham, M.W. 2005. Epizootiology of feline leukemia virus in the Florida panther. M.S. Thesis. University of Florida; Gainesville, Florida.

Cunningham, M.W., M. A. Brown, D.B. Shindle, S.P. Terrell, K.A. Hayes, B.C. Ferree, R.T. McBride, E.L. Blankenship, D. Jansen, S.B. Citino, M.E. Roelke, R.A. Kiltie, J.L. Troyer, and S.J. O'Brien. 2008. Journal of Wildlife Diseases 44:537-552.

Dalrymple, G.H. and O.L. Bass. 1996. The diet of the Florida panther in Everglades National Park, Florida. Bulletin of the Florida Museum of Natural History 39:173-193.

Dees, C.S., J.D. Clark, and F.T. Van Manen. 2001. Florida panther habitat use in response to prescribed fire. Journal of Wildlife Management 65:141-147.

Dickson, B.G., J.S. Jenness, and P. Beier. 2005. Influence of vegetation, topography, and roads on cougar movement in Southern California. Journal of Wildlife Management 69:264-276.

Duever, M. J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.L. Myers, and D.P. Spangler. 1986. The Big Cypress National Preserve. Research Report 8. National Audubon Society, New York, New York.

Dunbar, M. R. 1995. Florida panther biomedical investigations. Annual performance report. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission. 2005. Florida Panther Annual Report 2004-05. Land, E.D., M. Cunningham, and B. Ferree. Fish and Wildlife Research Institute & Division of Habitat and Species Conservation, Naples, Florida.

Florida Fish and Wildlife Conservation Commission. 2010. Unpublished Florida panther master mortality table. Naples, Florida.

Fleming, M., J. Schortemeyer, and J. Ault. 1994. Distribution, abundance, and demography of white-tailed deer in the Everglades. Pages 247-274 in D. Jordan (ed). Proceedings of the Florida Panther Conference. U.S. Fish and Wildlife Service; Gainesville, Florida.

Fletcher, R. and McCarthy R. and McCarthy, K., (personal communication, 2010). Professor and Post Doc, University of Florida. Email with U.S. Fish and Wildife in September 2010.

Forrester, D.J. 1992. Parasites and diseases of wild mammals in Florida. University Press of Florida, Gainesville, Florida.

Forrester, D.J., J.A. Conti, and R.C. Belden. 1985. Parasites of the Florida panther (*Felis concolor coryi).* Proceedings of the Helminthological Society of Washington 52:95-97.

Foster, G.W., M.W. Cunningham, J.M. Kinsella, G. McLaughlin, and D. J. Forrester. 2006. Gastrointestinal helminthes of free-ranging Florida panthers (*Puma concolor coryi*) and the efficacy of the current anthelminic treatment protocol. Journal of Wildlife Diseases 42:402-406.

Frederick, P.C., M.G. Spalding, and R. Dusek. 2002. Wading birds as bioindicators of mercury contamination in Florida, USA; annual and geographic variation. Environmental Toxicology and Chemistry 21:163-167.

Harlow, R. F. 1959. An evaluation of white tailed deer habitat in Florida. Florida Game and Fresh Water Fish Commission Technical Bulletin 5, Tallahassee, Florida.

Harlow, R.F. and F.K. Jones. 1965. The white-tailed deer in Florida. Florida Game and Fresh Water Fish Commission Technical Bulletin 9, Tallahassee, Florida.

Harris, L.D. 1984. The fragmented forest: island biogeography theory and the preservation of biotic diversity. University of Chicago Press, Chicago, Illinois.

Hollister, N. 1911. The Louisiana puma. Proceedings of the Biological Society of Washington 24:175-178.

Hostetler, J.A., D.P. Onorato, and M.K. Oli (eds). 2009. Population ecology of the Florida panther. Final report submitted to Florida Fish and Wildlife Conservation Commission and U. S. Fish and Wildlife Service.

Ilse, L. M., and E. C. Hellgren. 1995. Resource partitioning in sympatric populations of collared peccaries and feral hogs in southern Texas. Journal of Mammalogy 76:784–789.

Intergovernmental Panel on Climate Change Fourth Assessment Report. 2007. Climate Change 2007: Synthesis Report. Summary for Policy Makers. Draft.

Janis, M.W. and J.D. Clark. 1999. The effects of recreational deer and hog hunting on the behavior of Florida panthers. Final report to Big Cypress National Preserve, National Park Service; Ochopee, Florida.

Janis, M.W. and J.D. Clark. 2002. Responses of Florida panthers to recreational deer and hog hunting. Journal of Wildlife Management 66:839-848.

Jansen, D.K., S.R. Schulze, and A.T. Johnson. 2005. Florida panther (*Puma concolor coryi*) research and monitoring in Big Cypress National Preserve. Annual report 2004-2005. National Park Service, Ochopee, Florida.

Johnson, W.E., D.P. Onorato, M.E. Roelke, E.D. Land, M. Cunningham, R.C. Belden, R. McBride, D. Jansen, M. Lotz, D. Shindle, J. Howard, D.E. Wildt, L.M. Penfold, J.A. Hostetler, M.K. Oli, and S.J. O'Brien. 2010. Genetic restoration of the Florida panther. SCIENCE 329:1641-1645.

Kautz, R.S. and J.A. Cox. 2001. Strategic habitats for biodiversity conservation in Florida. Conservation Biology 15:55-77.

Kautz, R., R. Kawula, T. Hoctor, J. Comiskey, D. Jansen, D. Jennings, J. Kasbohm, F. Mazzotti, R. McBride, L. Richardson, and K. Root. 2006. How much is enough? Landscape-scale conservation for the Florida panther. Biological Conservation.

Kerkhoff, A.J., B.T. Milne, and D.S. Maehr. 2000. Toward a panther-centered view of the forests of south Florida. Conservation Ecology 4:1.

Labisky, R.F., M.C. Boulay, K.E. Miller, R.A. Sargent, Jr., and J. M. Zultowskil. 1995. Population ecology of white-tailed deer in Big Cypress National Preserve and Everglades National Park. Final report to National Park Service, Ochopee, Florida.

Labisky, R.F., C.C. Hurd, M.K. Oli, and R.S. Barwick. 2003. Foods of white-tailed deer in the Florida Everglades: the significance of Crinum. Southeastern Naturalist 2:261-270.

Land, E.D. 1994. Response of the wild Florida panther population to removals for captive breeding. Final Report 7571. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Land, D. and S.K. Taylor. 1998. Florida panther genetic restoration and management annual report 1997-98. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Land, D., B. Shindle, D. Singler, and S. K. Taylor. 1999. Florida panther genetic restoration annual report 1998-99. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Land, D., M. Cunningham, R. McBride, D. Shindle, and M. Lotz. 2002. Florida panther genetic restoration and management annual report 2001-02. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Land, D., D. Shindle, M. Cunningham, M. Lotz, and B. Ferree. 2004. Florida panther genetic restoration and management annual report 2003-04. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Land, E.D., D.B. Shindle, R.J. Kawula, J.F. Benson, M. A. Lotz, and D.P. Onorato. 2008. Florida panther habitat selection analysis of Concurrent GPS and VHF telemetry data. Journal of Wildlife Management 72:633-639.

Logan, T.J., A.C. Eller, Jr., R. Morrell, D. Ruffner, and J. Sewell. 1993. Florida panther habitat preservation plan - south Florida population. Prepared for the Florida Panther Interagency Committee.

Lotz, M., D. Land, M. Cunningham, and B. Ferree. 2005. Florida panther annual report 2004-05. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Loveless, C.M. 1959. The Everglades deer herd life history and management. Florida Game and Fresh Water Fish Commission Technical Bulletin 6, Tallahassee, Florida.

Mac, M.J., P.A. Opler, C.E. Puckett Haecker, and P.D. Doran. 1998. Status and trends of the nation's biological resources. 2 vols. U.S. Department of the Interior, U.S. Geological Survey, Reston, Virginia.

Maehr, D.S. 1990. Florida panther movements, social organization, and habitat utilization. Final Performance Report 7502. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1992. Florida panther. Pages 176 189 in S.R. Humphrey (ed). Rare and endangered biota of Florida. Volume I: mammals. University Press of Florida; Gainesville, Florida.

Maehr, D.S. 1997. The comparative ecology of bobcat, black bear, and Florida panther in south Florida. Bulletin of the Florida Museum of Natural History 40:1-176.

Maehr, D.S., and J.A. Cox. 1995. Landscape features and panthers in Florida. Conservation Biology 9:1008-1019.

Maehr, D. S., J. C. Roof, E. D. Land, and J. W. McCown. 1989. First reproduction of a panther (*Felis concolor coryi*) in southwestern Florida, U.S.A. Mammalia 53: 129-131.

Maehr, D.S., R.C. Belden, E.D. Land, and L. Wilkins. 1990a. Food habits of panthers in southwest Florida. Journal of Wildlife Management 54:420-423.

Maehr, D.S., E.D. Land, J.C. Roof, and J. W. McCown. 1990b. Day beds, natal dens, and activity of Florida panthers. Proceedings of Annual Conference of Southeastern Fish and Wildlife Agencies 44:310-318.

Maehr, D.S., E.D. Land, and J.C. Roof. 1991. Social ecology of Florida panthers. National Geographic Research & Exploration 7:414-431.

Maehr, D.S., E.C. Greiner, J.E. Lanier, and D. Murphy. 1995. Notoedric mange in the Florida panther (*Felis concolor coryi*). Journal of Wildlife Diseases 31:251-254.

Mansfield, K.G., and E.D. Land. 2002. Chryptorchidism in Florida panthers: prevalence, features, and influence of genetic restoration. Journal of Wildlife Diseases 38:693-698.

Maehr, D.S., E.D. Land, D.B. Shindle, O.L. Bass, and T.S. Hoctor. 2002a. Florida panther dispersal and conservation. Biological Conservation 106:187-197.

McBride, R.T. 2002. Current panther distribution and conservation implications -- highlights of field work: fall 2001 - winter 2002. Report to Florida Panther Subteam of MERIT, U.S. Fish and Wildlife Service, Vero Beach, Florida.

McBride, R.T. 2010. 2009 Florida panther annual count. Report to U. S. Fish and Wildlife Service, South Florida Ecological Services Office, Vero Beach, Florida.

McBride, R.T., R.M. McBride, and C.E. McBride. 2008. Counting pumas by categorizing physical evidence. Southeastern Naturalist 7:381-400.

McCown, J.W. 1994. Big Cypress deer/panther relationships: deer herd health and reproduction. Pages 197-217 in D. B. Jordan (ed). Proceedings of the Florida Panther Conference. U.S. Fish and Wildlife Service; Gainesville, Florida.

Miller, K.E. 1993. Habitat use by white-tailed deer in the Everglades: tree islands in a seasonally flooded landscape. M.S. Thesis. University of Florida, Gainesville, Florida.

National Park Service. 1991. General Management Plan and Final Environmental Impact Statement: Big Cypress National Preserve, Florida. Volume 1. Ochopee, Florida: Big Cypress National Preserve.

Newell, D. 1935. Panther. The Saturday Evening Post. July 13:10-11, 70-72.

Noss, R.F. 1992. The wildlands project land conservation strategy. Wild Earth (Special Issue):10-25.

Noss, R.F. and A.Y. Cooperrider. 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Island Press; Washington, D.C.

Nowak, R.M. and R. T.McBride. 1974. Status survey of the Florida panther. Project 973. World Wildlife Fund Yearbook 1973-74:237-242.

Nowak, R. M. and R. T. McBride. 1975. Status of the Florida panther. Project 973. World Wildlife Fund Yearbook 1974-75:245-46.

Olmstead, R.A., R. Langley, M.E. Roelke, R.M. Goeken, D. Adger-Johnson, J.P. Goff, J.P. Albert, C. Packer, M.K. Laurenson, T.M. Caro, L. Scheepers, D.E. Wildt, M. Bush, J.S. Martenson, and S.J. O'Brien. 1992. Worldwide prevalence of lentivirus infection in wild feline species: epidemiologic and phylogenetic aspects. Journal of Virology 66:6008-6018.

Onorato, D., C. Belden, M. Cunningham, D. Land, R. McBride, and M. Roelke. 2010. Long-term research on the Florida panther (*Puma concolor coryi*): historical findings and future obstacles to population persistence. Pp. 453-469 *in* D. Macdonald and A. Loveridge (eds.). Biology and conservation of wild felids. Oxford University Press, Oxford, UK.

Pearlstine, L.G. 2008. Ecological consequences of climate change for the Florida Everglades: An initial summary. Technical memorandum, South Florida Natural Resources Center, Everglades National Park. Homestead, Florida.

Reeves, K.A. 1978. Preliminary investigation of the Florida panther in Big Cypress Swamp. Unpublished report. Everglades National Park, Homestead, Florida.

Roelke, M.E. 1991. Florida panther biomedical investigation. Annual performance report, Study No. 7506. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Roelke, M.E., D.J. Forrester, E.R. Jacobsen, G.V. Kollias, F.W. Scott, M.C. Barr, J.F. Evermann, and E.C. Pirtle. 1993. Seroprevalence of infectious disease agents in free-ranging Florida panthers (*Felis concolor coryi*). Journal of Wildlife Diseases 29:36-49.

Root, K. 2004. Florida panther (*Puma concolor coryi*): Using models to guide recovery efforts. Pages 491-504 in H.R. Akcakaya, M. Burgman, O. Kindvall, C.C. Wood, P. Sjogren-Gulve, J. Hatfield, and M. McCarthy (eds). Species Conservation and Management, Case Studies. Oxford University Press; New York, New York.

Rotstein, D.S., R. Thomas, K. Helmick, S.B. Citino, S.K. Taylor, and M.R. Dunbar. 1999. Dermatophyte infections in free-ranging Florida panthers (*Felis concolor coryi*). Journal of Zoo and Wildlife Medicine 30:281-284.

Schortemeyer, J.L., D.S. Maehr, J.W. McCown, E.D. Land, and P.D. Manor. 1991. Prey management for the Florida panther: a unique role for wildlife managers. Transactions of the North American Wildlife and Natural Resources Conference 56:512-526.

Seal, U.S. (ed). 1994. A plan for genetic restoration and management of the Florida panther (*Felis concolor coryi*). Report to the Florida Game and Fresh Water Fish Commission, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN, Apple Valley, Minnesota.

Seal, U.S. and R. C. Lacy (eds). 1989. Florida panther (*Felis concolor coryi*) viability analysis and species survival plan. Report to the U. S. Fish and Wildlife Service, by the Captive Breeding Specialist Group, Species Survival Commission, IUCN, Apple Valley, Minnesota.

Seidensticker, J.C., IV, M.G. Hornocker, W.V. Wiles, and J.P. Messick. 1973. Mountain lion social organization in the Idaho primitive area. Wildlife Monographs 35:1-60.

Shindle, D., D. Land, K. Charlton, and R. McBride. 2000. Florida panther genetic restoration and management. Annual Report 7500. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Shindle, D., D. Land, M. Cunningham, and M. Lotz. 2001. Florida panther genetic restoration and management. Annual Report 7500. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Shindle D., M. Cunningham, D. Land, R. McBride, M. Lotz, and B. Ferree. 2003. Florida panther genetic restoration and management. Annual Report 93112503002. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Smith, T.R. and O.L. Bass, Jr. 1994. Landscape, white-tailed deer, and the distribution of Florida panthers in the Everglades. Pages 693-708 in S.M. Davis and J.C. Ogden (eds). Everglades: the ecosystem and its restoration. Delray Beach, Florida.

Taylor, S. K., C. D. Buergelt, M. E. Roelke-Parker, B. L. Homer, and D. S. Rotstein. 2002. Causes of mortality of free-ranging Florida panthers. Journal of Wildlife Diseases 38:107-114.

Thatcher, C., F.T. van Manen, and J.D. Clark. 2006. Identifying suitable sites for Florida panther reintroduction. Journal of Wildlife Management.

Tinsley, J.B. 1970. The Florida panther. Great Outdoors Publishing Company, St. Petersburg, Florida.

Tinsley, J.B. 1987. The puma: legendary lion of the Americas. Texas Western Press, University of Texas, El Paso, Texas.

Titus, J.G. and V.K. Narayanan. 1995. The probability of sea level rise. EPA 230-R95-008, U.S. Environmental Protection Agency. Washington, DC. 186 pages.

U.S. Fish and Wildlife Service. 2000. Florida panther final interim standard local operating procedures (SLOPES) for endangered species. U.S. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Fish and Wildlife Service. 2006. Strategic Habitat Conservation. Final Report of the National Ecological Assessment Team to the U.S. Fish and Wildlife Service and U.S. Geologic Survey. 48 pages.

U.S. Fish and Wildlife Service. 2007. Draft communications plan on the U.S. Fish and Wildlife Service's Role in Climate Change.

U.S. Fish and Wildlife Service. 2008. Florida panther recovery plan (*Puma concolor coryi*). Third Revision. U.S. Fish and Wildlife Service, Southeast Region; Atlanta, Georgia.

Van Dyke, F.G., R.H. Brocke, and H.G. Shaw. 1986a. Use of road track counts as indices of mountain lion presence. Journal Wildlife Management 50:102-109.

Van Dyke, F.G., R.H. Brocke, H.G. Shaw, B.B. Ackerman, T.P. Hemker, and F.G. Lindzey. 1986b. Reactions of mountain lions to logging and human activity. Journal of Wildlife

Wehinger, K.A., M.E. Roelke, and E.C. Greiner. 1995. Ixodid ticks from Florida panthers and bobcats in Florida. Journal of Wildlife Diseases 31:480-485.

Whittle, A.J., D.S. Maehr, S. Fei, and J.J. Cox. 2008. Global Climate Change and Its Effects on Large Carnivore Habitat in Florida. Poster presented at the Florida's Wildlife: On the Frontline of Climate Change Conference on October 1-3, 2008, in Orlando, Florida.

Wood, G.W. and R.E. Brenneman. 1980. Feral hog movements and habitat use in coastal South Carolina. Journal of Wildlife Management. 44(2):420-427.

Young, S.P. and E.A. Goldman. 1946. The Puma - Mysterious American Cat. Dover Publications, Incorporated; New York, New York.

Table 1. Targeted and Acquired Acreage Totals of Conservation Lands in South Florida directly affecting the Panther within the Panther Focus Area (Brief of Amicus 2003). The lands shown as acquired in this table may include some private in-holdings and may include lands currently under sales negotiations or condemnation actions.

Name	Targeted[1] Acreage	Acquired Acreage	Indian Reservation
Federal Conservation Lands			
Everglades National Park	1,508,537	1,508,537	--
Big Cypress National Preserve	720,000	720,000	--
Florida Panther National Wildlife Refuge	26,400	26,400	--
Subtotal	**2,254,937**	**2,254,937**	--
State of Florida: Florida Forever Program			
Belle Meade	28,505	19,107	--
Corkscrew Regional Ecosystem Watershed	69,500	24,028	--
Twelvemile Slough	15,653	7,530	--
Panther Glades	57,604	22,536	--
Devil's Garden	82,508	0	--
Caloosahatchee Ecoscape	18,497	2,994	--
Babcock Ranch	91,361	0	--
Fisheating Creek	176,760	59,910	--
Subtotal	**540,388**	**136,105**	--
State of Florida: Other State Acquisitions			
Water Conservation Area Number 3	491,506	491,506	--
Holey Land Wildlife Management Area	33,350	33,350	--
Rotenberger Wildlife Management Area	25,019	20,659	--
Fakahatchee Strand State Preserve	74,374	58,373	--
Picayune Strand State Forest	55,200	55,200	--
Okaloacoochee Slough State Forest and WMA	34,962	34,962	--
Babcock-Webb Wildlife Management Area	79,013	79,013	--
Subtotal	**793,424**	**773,063**	--
Indian Reservations[2]			
Miccosukee Indian Reservation	--	--	81,874
Big Cypress Seminole Indian Reservation	--	--	68,205
Brighton Seminole Indian Reservation	--	--	37,447
Subtotal	**--**	**--**	**187,526**
GRAND TOTALS	**3,588,749**	**3,164,105**	**187,526**

[1] Targeted acres not available for all lands. In Such cases, targeted equals acquired acreage.

[2] Indian lands are included due to their mention in the Multi Species Recovery Plane. Acreages taken from GIS data

.

Table 2. Living Florida panthers with home ranges in the Action Area.

CAT	NUMBER OF TELEMETRY POINTS	STATUS	MOST RECENT YEAR
FP65	1209	Alive	2009
FP93	692	Alive	2007
FP102	930	Alive	2009
FP110	538	Alive	2008
FP113	831	Alive	2009
FP119	691	Alive	2009
FP124	504	Alive	2008
FP133	568	Alive	2009
FP137	276	Alive	2009
FP141	483	Alive	2009
FP143	209	Alive	2007
FP145	194	Alive	2007
FP146	217	Alive	2008
FP147	86	Alive	2006
FP149	57	Alive	2007
FP150	52	Alive	2007
FP151	50	Alive	2007
FP153	196	Alive	2009
FP154	157	Alive	2008
FP156	166	Alive	2008
FP159	1	Alive	2008
FP160	24	Alive	2008
FP161	147	Alive	2009
FP162	149	Alive	2009
FP163	1	Alive	2009
FP165	40	Alive	2009
FP167	43	Alive	2009
FP170	50	Alive	2009
FP171	54	Alive	2009

Table 3. CERP and non-CERP projects in the Action Area.

Action	Date	Latest Date	Service Log Number	Project Number	Applicant (project description)
BO	04/08/05	04/08/05	4-1-04-F-8176	2004-5312 (AEK)	Big Cypress Rock Mine
BO Revised 1 Revised 2	02/25/05, 03/16/05, 06/29/05, 04/04/06	04/04/06	4-1-04-F-6866	200309416 (NW-MAE)	Ava Maria University
BO	01/04/06	01/04/06	4-1-04-F-8388	2004554	Immokalee Regional Airport - Phase I
BO	11/29/05	11/29/05	4-1-04-F-8847	20048995	Seminole Tribe of FL Administrative Complex
BO	09/12/06	09/12/06	41420-2006-F-0554	20057414	Miccosukee Government Complex
NLAA	10/27/06	10/27/06	41420-2006-I-0607	20064878	Seminole Reservation Access Road
TA	11/15/06	11/15/06	41420-2006-TA-0727	N/A	Liberty Landing
TA	04/13/07	04/13/07	41420-2007-TA-0618	NA	Collier County School Site J - Everglades Blvd.
NLAA	05/01/07	05/01/07	41420-2006-FA-0756 41420-2006-I-0992	SAJ-2004-5223-AEK	Seminole Motocross
NLAA	07/17/07	07/17/07	41420-2007-I-0330	2006-6377	Faith Landing
TA	11/16/06	11/16/06	41420-2006-TA-0060	N/A	Collier County Elementary School K
NLAA	09/22/06	09/22/06	41420-2006-I-0355	20040047	Immokalee Seminole Reservation Road Improvements
BO	10/31/07	10/31/07	41420-2007-F-1035	2004-3931	Big Cypress Regional General Permit - 83
BO	06/26/08	06/26/08	41420-2007-FA-1150 41420-2007-F-1144	2007-2175	Immokalee Master Plan
BO	07/02/08	07/02/08	41420-2007-FA-0592 41420-2007-F-0491	2005-7439	Kaicasa
BO	02/26/09	02/26/09	41420-2006-FA-0548 41420-2006-F-1011	2006-7018	Oil Well Road Widening
NLAA	04/28/08	04/28/08	41420-2008-FA-0442 41420-2008-I-0313	2007-6414	LCEC, Immokalee Rd Substn

Table 4. Florida panthers vehicle incidents and outcomes in the Action Area.

CAT NUMBER	DATE	TYPE	DEATHCAUSE	SEX	AGE	LOCATION	YEAR
UCFP04-(G80-4)	12/23/1979	DEATH	Vehicle	F	1.5-2.5	SR 29 JUST N SR 84	1979
UCFP05-(G80-15)	2/7/1980	DEATH	Vehicle	M	1.5-2.5	SR 29 NEAR SUNNILAND	1980
UCFP06-(G81-19)	4/19/1981	DEATH	Vehicle	F	2-3	SR 29 NEAR COPELAND	1981
FP01	12/14/1983	DEATH	Vehicle	M	12-14	SR 84 18 MM	1983
BIG GUY	11/2/1984	INJURY	Vehicle - Injured	M	unknown	US 41 1	1984
UCFP12-(G84-26)	11/12/1984	DEATH	Vehicle	F	8-10	SR 84 16 MM	1984
UCFP13-(G85-BNZ)	1/8/1985	DEATH	Vehicle	F	1.5-2	SR 84 MM16	1985
FP04	4/18/1985	DEATH	Vehicle	M	12+	SR 84 17 MM	1985
FP07	10/26/1985	DEATH	Vehicle	M	10	SR 29 4 MI S SR 84	1985
UCFP15	11/15/1986	DEATH	Vehicle	F	4-5	SR 84 16.5 MM	1986
FP20	6/17/1987	INJURY	Vehicle - Injured	M	3-4	CR 858 .8 M E SR 29	1987
FP13	12/14/1987	DEATH	Vehicle	M	6-8	SR 29 SUNNILAND	1987
UCFP19-(RK-846)	6/18/1990	DEATH	Vehicle	M	10 mos.	CR 835 (846) 1 M E CR 833	1990
FP37	11/26/1990	DEATH	Vehicle	M	4-5	SR 29 .5 M N I-75	1990
UCFP20-(FP11'S)	2/4/1991	DEATH	Vehicle	F	9 mos.	SR 29 PISTOL POND BRIDGE	1991
UCFP21-(FP19'S)	11/9/1992	DEATH	Vehicle	F	7 mos.	SR 29 SUNNILAND	1992
FP50	12/6/1993	DEATH	Vehicle	M	2.5	CR 846 5 M E OF IMMOKALEE	1993
UCFP23-(FP52'S)	2/28/1994	DEATH	Vehicle	M	8 mos.	3 M N ON COUNTY LINE ROAD	1994
FP31	3/3/1994	DEATH	Vehicle	F	12-14	SR 29 SUNNILAND	1994
FP52	1/14/1995	DEATH	Vehicle	F	3.3	CR 846 NEAR DUPREE ROAD	1995
TX102	9/21/1995	DEATH	Vehicle	F	4	CR 833 JUST N CR 835 (846)	1995
UCFP30	5/2/1996	DEATH	Vehicle	F	1	US 41 @ TURNER RIVER	1996
UCFP31	7/13/1997	DEATH	Vehicle	U	unknown	CR 846 1.5 M W CR 858	1997
UCFP25	6/13/1998	DEATH	Vehicle	F	2	CR 846 3 M E CR 858	1998

Table 4 (continued)

CAT NUMBER	DATE	TYPE	DEATHCAUSE	SEX	AGE	LOCATION	YEAR
FP51	7/17/1998	DEATH	Vehicle	M	9	SR 29 @ BEAR ISLAND GRADE	1998
UCFP26	9/17/1998	DEATH	Vehicle	M	3-5	US 41 3	1998
UCFP27	7/8/1999	DEATH	Vehicle	F	2	FARM ROAD E HENDRY PRISON	1999
UCFP33	10/29/1999	DEATH	Vehicle	M	11 mos.	CR 833 2 MI N BCSIR	1999
FP63	1/15/2000	DEATH	Vehicle	M	5	6 mi N of Pistol Pond, E. side of SR29 in Canal	2000
FP80	2/10/2000	DEATH	Vehicle	F	4-5	200 FT. W SWAMP SAFARI, BCSIR	2000
K76-(FP66)	2/28/2000	DEATH	Vehicle	M	3 mos.	1 MI W SR 29, ON CR 858	2000
UCFP34	3/23/2000	DEATH	Vehicle	M	1.5-2	CR846 2 MILES E COUNTY LINE	2000
UCFP35	6/23/2000	DEATH	Vehicle	M	1.5-2	CR846 2 MILES E IMMOKALEE	2000
UCFP36	8/13/2000	DEATH	Vehicle	F	1.7	CR 846 E IMMOK. NEAR POWERLINE	2000
UCFP37	12/29/2000	DEATH	Vehicle	F	5	4.5 MI E SR29 ON CR846	2000
UCFP38	4/14/2001	DEATH	Vehicle	F	2	CR 833 1 MI N BCSIR, HENDRY CO	2001
FP90	4/26/2001	DEATH	Vehicle	M	1.9	US 27 2.5 MI N OF TERRYTOWN	2001
UCFP39	5/7/2001	DEATH	Vehicle	F	10 mos.	SR 29 1/2 MI N OF JEROME	2001
UCFP40	5/7/2001	DEATH	Vehicle	M	10 mos.	SR 29 1/2 MI N OF JEROME	2001
UCFP41	5/22/2001	DEATH	Vehicle	M	2-3	SR 29 SUNNILAND, NEAR MINE RD	2001
UCFP42	6/14/2001	DEATH	Vehicle	F	3-4	CR846, 1 MILE EAST POWERLINE	2001
UCFP43	8/17/2001	DEATH	Vehicle	M	2-3	CR846 1 MILE EAST OF POWERLINE	2001
UCFP46	4/10/2002	DEATH	Vehicle	M	6 mos.	1/2 MI N OF DEEP LAKE, COLLIER	2002
FP98	7/1/2002	DEATH	Vehicle	M	4-5	1 KM N PISTOL POND, SR 29	2002
UCFP48	11/10/2002	DEATH	Vehicle	F	8-9 mos.	CR846 5-6 MI E IMMOKALEE	2002
UCFP49 (K98)	11/25/2002	DEATH	Vehicle	F	19 mos.	CR846 3-4 MI E IMMOKALEE	2002
FP99	11/28/2002	DEATH	Vehicle	M	33 mos.	CR846 1/4 MI N COLLIER FAIRGRN	2002
UCFP50 (K33)	1/26/2003	DEATH	Vehicle	M	3-4	CR846 3.4 MI E EVERGLADES BLVD	2003
FP106	2/20/2003	DEATH	Vehicle	F	3	SR29 AT SUNNILAND MINE ENTRANCE	2003

Table 4 (continued)

CAT NUMBER	DATE	TYPE	DEATHCAUSE	SEX	AGE	LOCATION	YEAR
UCFP52	3/20/2003	DEATH	Vehicle	M	2-3	CR833, 2MI S CR832, HENDRY CO.	2003
UCFP53	5/25/2003	DEATH	Vehicle	F	2-3	SR29, 1.4 MI N CR858, COLLIER	2003
UCFP54	6/3/2003	DEATH	Vehicle	M	8-10 mos.	SR29, 1.7 MI N CR858, COLLIER	2003
UCFP58	6/30/2003	DEATH	Vehicle	F	1	CR846 3/4 MILES E OF EVERGLADS B.	2003
UCFP59	11/2/2003	DEATH	Vehicle	F	3-4 mos.	CR 858, 1.2 miles west of SR 29	2003
UCFP61	12/25/2003	DEATH	Vehicle	F	2-3	CR833, 1.7 MI N CR846 INTERSECTION	2003
UCFP62	1/11/2004	DEATH	Vehicle	F	7-8 mos.	US41 NEAR 40 MILE BEND	2004
UCFP65	4/6/2004	DEATH	Vehicle	M	2	SR29, 200 YD N BEAR ISLAND GRADE	2004
UCFP66	6/27/2004	DEATH	Vehicle	M	3	I-75, MM93 0.5 MI W EVERGLADES BLVD	2004
FP120	7/11/2004	INJURY	Vehicle - Injured	F	4	US41, ~750 m W OF TURNER RIVER RD	2004
K156	8/2/2004	DEATH	Vehicle	M	6 mos.	US41 @ TURNER RIVER	2004
UCFP69	10/25/2004	DEATH	Vehicle	F	2	SR 29 2.5 miles N of CR 858	2004
UCFP70	12/1/2004	DEATH	Vehicle	F	1	SR 29 at Owl Hammock Curve	2004
UCFP71	2/4/2005	DEATH	Vehicle	M	2-3	US 41 just east of 11 Mile Road	2005
UCFP72	2/25/2005	DEATH	Vehicle	M	2	SR 29 near Jerome	2005
FP120	5/7/2005	DEATH	Vehicle	F	5	US41 near Turner River	2005
UCFP75	6/19/2005	DEATH	Vehicle	M	2	SR 29 at Owl Hammock Curve	2005
K49	12/2/2005	DEATH	Vehicle	F	7 yrs. 10 mos.	SR 29 1 mi N Wagon Wheel Road	2005
FP70	1/14/2006	DEATH	Vehicle	F	8 yrs. 7 mos.	US 41 near Turner River	2006
UCFP78	1/25/2006	DEATH	Vehicle	M	9 mos.	CR846 1 mi W of CR858	2006
UCFP85	6/5/2006	DEATH	Vehicle	M	3-4	CR 832 3 mi east of OK Slough SF	2006
UCFP89	12/12/2006	DEATH	Vehicle	M	3-5	County Line Road, Collier/Hendry	2006
UCFP92	3/29/2007	DEATH	Vehicle	M	1.5	US 41 1.2 mi W of SR 29	2007
UCFP98	6/11/2007	DEATH	Vehicle	M	20-24 mos.	SR29 at Jerome wildlife crossing	2007
UCFP100	6/23/2007	DEATH	Vehicle	M	2-3	SR 29 3 mi S of Immokalee	2007

Table 4 (continued)

CAT NUMBER	DATE	TYPE	DEATHCAUSE	SEX	AGE	LOCATION	YEAR
UCFP102	9/12/2007	DEATH	Vehicle	M	2	I-75, 1.5 miles east of SR29	2007
UCFP104	4/12/2008	DEATH	Vehicle	F	1-2	SR29, 2.6 km north of US 41	2008
UCFP108	7/28/2008	DEATH	Vehicle	F	3-4	Imokolee Road 1.7 Miles E of Oil Grade Road	2008
UCFP111	10/24/2008	DEATH	Vehicle	F	6-8 mos.	SR29 approx. 2.4 km N of Oil Well Rd.	2008
UCFP114	11/29/2008	DEATH	Vehicle	F	4	CR858 (Oil Well Rd), Collier County; 1 mile east of Camp Keais Rd	2008
UCFP115	1/11/2009	DEATH	Vehicle	M	4	CR832, E of the Okaloacoochee Slough State Forest	2009
K253	1/17/2009	DEATH	Vehicle	M	1.5-2.5	Eastbound exit ramp, I-75/SR29	2009
UCFP116	1/20/2009	DEATH	Vehicle	F	4-5	SR29 3mi S of Immokalee	2009
UCFP119	4/9/2009	DEATH	Vehicle	F	2-3	US41 near Turner River in Collier County	2009
UCFP121	5/14/2009	DEATH	Vehicle	M	2	SR29 approx. 4 miles South of -I75	2009
UCFP122	5/25/2009	DEATH	Vehicle	M	1.5	Along Immokalee Road (n. side of road) near Camp Keasi Road	2009
UCFP124	8/5/2009	DEATH	Vehicle	F		I-75 at MM 90	2009
UCFP129	10/19/2009	DEATH	Vehicle	M	3-4 mos.	CR 846 2 miles E of Immokalee	2009
UCFP130	10/21/2009	DEATH	Vehicle	F	3-4	CR 846 2 miles E of Immokalee	2009
UCFP131	11/1/2009	DEATH	Vehicle	F	3-4 ,mos.	CR 833 N boundary of BCSIR	2009
UCFP133	12/17/2009	DEATH	Vehicle	M	3-4	I-75 1/2 mi W Snake Road	2009
UCFP135	12/29/2009	DEATH	Vehicle	F	4	2 miles N of Jerome on SR29	2009
FP174	3/16/2010	DEATH	Vehicle	M	4-5	I-75 eastbound, MM95	2010
FP169	5/21/2010	DEATH	Vehicle	M	5-6	Hwy 41 .4km west of SR94 (Monroe Station), East of Kirby Storter wayside	2010
UCFP144	5/31/2010	DEATH	Vehicle	M	12-14 mos.	CR833, .4 mi north of CR832 itersection	2010
UCFP145	6/24/2010	DEATH	Vehicle	M	16-18 MOS	SR29, 3.7km south of Farm Workers Village	2010
UCFP146	8/3/2010	DEATH	Vehicle	F	3-4	SR 29, 1 mi S of Owl Hammock, Collier Co.	2010

Table 5. List of development projects affecting Florida panther habitat consulted on the by the Service from March 1984 through October 2010 and acres of habitat impacted and preserved.

Date	Service Log No.	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
03/29/84	4-1-83-195	83M-1317	CMC Development Corporation (Ford Test Track)	Collier	530	0	0	0
02/21/85	4-1-85-018	FAP #?	USDOT, FHA (conversion of Hwy 84 to I-75)	Broward, Collier	1,517	0	0	0
10/17/86	4-1-87-016/4-1-87-017	unknown	NPS, BICY (Exxon Master Plan Modification)	Collier	9	0	0	0
01/07/87	4-1-86-303	86IPM-20130	Collier Enterprises (citrus grove)	Collier	11,178	0	0	0
01/11/88	4-1-88-029	unknown	NPS, BICY (NERCO - Clements Energy, Inc.)	Collier	3	0	0	0
02/23/88	4-1-88-055	unknown	NPS, BICY (Shell Western E&P, Inc.)	Collier Miami-Dade Monroe	0	0	0	0
02/10/89	4-1-89-001	FAP IR-75-4(88)81	USDOT, FHA (SR 29/I-75 Interchange)	Collier	350	0	0	0
08/15/90	4-1-90-289	unknown	NPS, BICY [I-75 Rec. Access Plan (MM 31, 38, 49)]	Collier	150	0	0	0
09/24/90	4-1-90-212	89IPD-20207	U.S. Sugar Corp (46 mi2 ag conversion)	Hendry	28,740	700	0	700
03/12/91	4-1-91-229	90IPO-02507	Lourdes Cereceda (commercial rock mine)	Dade	97	0	0	0
01/14/92	4-1-91-325	199101279 (IP-HH)	Dooner Gulf Coast Citrus (32 acre citrus grove)	Collier	40	40	0	40
09/25/92	4-1-92-340	unknown	BIA, STOF, BCSIR (1,995 acre citrus grove)	Hendry	1,995	0	0	0
06/18/93	4-1-93-217	199200393 (IP-SL)	Lee County DOT (Corkscrew Road)	Lee	107	0	0	0
02/25/94	4-1-94-209	199301131 (IP-KC)	Lee County DOT (Daniels Road extension)	Lee	65	0	0	0
05/09/94	4-1-93-251	199202019 (IP-KA)	Corkscrew Enterprises (The Habitat)	Lee	900	100	100	200
10/27/94	4-1-94-430	199302371 (IP-BB) 199400807 (IP-BB) 199400808 (IP-BB)	Timberland and Tiburon Florida Gulf Coast University Treeline Boulevard	Lee	1,088	526	0	526
05/24/95	4-1-95-230	199302130 (IP-TB)	FDOT, I-75 (Turner River access @ MM 70)	Collier	1,936	0	0	0
08/07/95	4-1-95-274	199405501 (IP-AW)	Bonita Bay Properties, Inc. (golf course)	Collier	509	491	0	491
08/15/95	4-1-94-214	199301495 (IP-MN)	SWFIA, Northeast Access Road	Lee	14	0	0	0
09/19/96	4-1-95-F-230	199302052 (IP-TB) 199301404 (IP-TB)	FDOT, I-75 (Central and West Broward access) FDOT, I-75 (Miami Canal Access)	Broward	116	0	0	0
03/10/98	4-1-98-F-3	L30(BICY)	NPS, BICY (Calumet Florida, Inc. seismic testing)	Collier Miami-Dade Broward	0	0	0	0
03/27/98	4-1-97-F-635	199604158 (IP-SB)	Bonness, Joseph D., Jr. Trustee (Willow Run Quarry)	Collier	359	190	0	190
06/11/99	4-1-98-F-398	199800622 (IP-SS)	STOF, BCSIR (water conservation plan)	Hendry	1,091	0	0	0
09/27/99	4-1-98-F-310	199130802 (IP-SB)	Lee County DOT (Daniels Parkway extension)	Lee	2,093	0	94	94

Table 5 (continued)

Date	Service Log No.	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
12/08/99	4-1-98-F-517	199607574 (IP-MN)	Kaufmann Holdings, Inc. (Cypress Creek Farms)	Collier	239	0	24	24
04/17/00	4-1-98-F-428	199507483 (IP-AM)	Miromar Development, Inc. (Miromar Lakes)	Lee	1,323	0	194	194
06/09/00	4-1-99-F-553	199900619 (IP-SB)	Vineyards Development Corp. (Naples Reserve GC)	Collier	833	0	320	320
02/21/01	4-1-00-F-135	199803037 (IP-SR)	Wortzel & Landl, Co-Trustees (Corkscrew Ranch)	Lee	106	0	0	0
04/17/01	4-1-00-F-584	200001436 (IP-MN)	WCI Communities, Inc. (Sun City - Ft. Myers)	Lee	1,183	0	408	408
07/30/01	4-1-94-357	199003460 (IP-TB)	Naples Golf Estates	Collier	439	175	0	175
08/31/01	4-1-00-F-183	199900411 (IP-SR)	Worthington Communities, Inc. (Colonial G&CC)	Lee	1,083	0	640	640
12/14/01	4-1-00-F-585	199301156 (IP-MN)	SWFIA, Mid-field Terminal Expansion	Lee	8,058	0	6,986	6,986
01/30/02	4-1-98-F-372	199402492 (IP-ML)	Florida Rock Industries, Inc. (Fort Myers Mine #2)	Lee	2,913	1,959	0	1,959
03/07/02	4-1-00-F-178	199901251 (IP-MH)	Benton, Charles (Southern Marsh GC)	Collier	121	75	80	155
04/24/02	4-1-01-F-148	199901378 (IP-SR)	Schulman, Robert, Trustee (Hawk's Haven)	Lee	1,531	267	0	267
09/24/02	4-1-01-F-135	200001574 (IP-DY)	State Road 80, LLC (Verandah)	Lee	1,456	0	320	320
10/08/02	4-1-02-F-014	199602945 (IP-DY)	Barron Collier Company (Winding Cypress)	Collier	1,088	840	1,030	1,870
05/19/03	4-1-02-I-1741	200200970 (IP-DEY)	Apex Center	Lee	95	10	18	28
06/10/03	4-1-01-F-1955	200003795 (IP-DY)	Walnut Lakes	Collier	157	21	145	166
06/18/03	4-1-01-F-136	199701947 (IP-SR)	Twin Eagles Phase II	Collier	593	57	98	155
06/23/03	4-1-01-F-143	199905571 (IP-SR)	Airport Technology Center	Lee	116	55	175	230
07/02/03	4-1-98-F-428	199507483 (IP-MN)	Addition to Miromar Lakes	Lee	342	158	340	498
09/04/03	4-1-02-F-1486	200206725 (IP-MN)	State Road 80 Widening	Lee	33	2	12	14
10/06/03	4-1-02-F-0027	200102043 (IP-MN)	Bonita Beach Road Development	Lee	1,117	145	640	785
12/29/03	4-1-02-F-1743	200202926 (IP-MGH)	The Forum - Saratoga Investments	Lee	650	0	310	310
01/18/05	4-1-04-F-4259	199702228 (TWM)	Bonita Springs Utilities	Lee	79	0	108	108
03/31/05	4-1-04-F-5656	200306759 (NW-MAE)	Gateway Shoppes II	Collier	82	0	122	122
04/08/05	4-1-04-F-8176	2004-5312 (AEK)	Big Cypress Rock Mine	Broward	110	0	220	220
04/29/05	4-1-04-F-5780 4-1-04-F-5982	2003-5331 (IP-TWM) 2003-6965 (IP-TWM)	Worthington Holdings - Arborwood Worthington Holdings - Treeline Avenue Extension	Lee	2,330	0	1,700	1,700
06/06/05	4-1-03-F-7855	2003-11156 (IP-RMT)	Collier Regional Medical Center	Collier	44	0	64	64
02/25/05 03/16/05 06/29/05 04/04/06	4-1-04-F-6866	200309416 (NW-MAE)	Ava Maria University	Collier	5,027	0	6,114	6,114
06/29/05	4-1-03-F-3915	199806220 (IP-MAE)	Wenthworth Estates - V.K. Development	Collier	917	0	458	458
07/15/05	4-1-04-F-5786	199405829 (IP-CDC)	Land's End Preserve	Collier	231	0	61	61
09/26/05 10/26/05	4-1-04-F-9348	2004-1122 (IP-RMT)	Super Target/Brentwood Land Partners	Collier	34	0	20	20
11/23/05	4-1-04-F-6043	20039414	Waterways Join Venture IV	Collier	108	0	61	61

Table 5 (continued)

Date	Service Log No.	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
11/29/05	4-1-04-F-8847	20048995	Seminole Tribe of FL Administrative Complex	Collier	6	0	8	8
12/06/05	4-1-03-F-3483	200302409	Southwest Florida Investment Property, LLC	Lee	207	0	305	305
12/6/05	4-1-04-F-6691	200310689	Rattlesnake Hammock Road	Collier	47	0	23	23
01/04/06	4-1-04-F-8388	2004554	Immokalee Regional Airport - Phase I	Collier	163	0	43	43
01/04/06	4-1-04-F-9777	20048577	Logan Boulevard Extension	Collier	40	0	10	10
01/13/06	4-1-04-F-6707	20042404	Journey's End	Collier	66	0	34	34
01/26/06	4-1-04-F-8940	20047053	The Orchard	Lee	93	0	81	81
02/09/06	4-1-05-11724	2005384	Firano at Naples	Collier	24	0	19	19
02/22/06	4-1-04-F-6505	200101122	Corkscrew Road	Lee	63	0	47	47
02/23/06	4-1-04-F-5244	200312276	Summit Church	Lee	10	0	13	13
03/31/06	4-1-05-PL-11343	20051909	Coral Keys Homes	Dade	31	0	61	61
05/05/06	41420-2006-I-0274	2005-6176	Santa Barbara , Davis to Radio Road, Widening	Collier	6	0	3	3
05/09/06	41420-2006-I-0263	2005-6298	Santa Barbara and Radio Road Widening	Collier	29	0	20	20
05/09/06	41420-2006-F-0089	200403248	Collier Boulevard, Immokalee Rd. to Goldengate Blvd.	Collier	14	0	16	16
05/16/06	4-1-05-F-10309	19971924	Sabal Bay	Collier	1,017	1,313	223	1,536
06/05/06	4-1-05-PL-8486	20041688	Seacrest School	Collier	31	0	16	16
06/09/06	4-1-05-PL-10965	200303733	HHJ Development	Dade	3	0	4	4
06/14/06	4-1-05-F-11855	200411010	Keysgate School Site	Dade	39	0	62	62
06/15/06	41420-2006-I-0362	20056176	Collier County Wellfield	Collier	29	0	36	36
07/12/06	41420-2006-F-0282	200311150	Cypress Shadows	Lee	244	0	160	160
07/28/06	4-1-05-F-12330	20047920	Hamilton Place	Dade	10	0	50	50
07/28/06	4-1-04-F-7279	20041695	Raffia Preserve	Collier	131	0	119	119
08/15/06	41420-2006-I-0151	20031963	Naples Custom Homes	Collier	10	0	9	9
08/21/06	41420-2006-I-0540	20041813	ASGM Business Park	Dade	41	0	25	25
08/21/06	4-1-03-F-3127	19956797	Atlantic Civil Ag Permit Extension	Collier	981	0	1,553	1,553
09/12/06	41420-2006-F-0554	20057414	Miccosukee Government Complex	Dade	17	0	37	37
09/22/06	41420-2006-I-0355	20040047	Immokalee Seminole Reservation Road Improvements	Collier	17	0	35	35
10/05/06	41420-2006-I-0616	20065295	New Curve on Corkscrew Road	Lee	12	0	18	18
10/16/06	41420-2006-F-0667	199507483	Miromar Addition	Lee	366	0	390	390
10/18/06	41420-2007-F-0026	2004777	Treeline Preserve	Lee	97	0	95	95
10/25/06	41420-2006-F-0442	20047046	Koreshan Boulevard Extension	Lee	14	0	31	31
10/26/06	41420-2006-F-0787	200306755	Jetway Tradeport	Collier	38	0	52	52
10/26/06	41420-2006-I-0849	20055702	Marina Del Lago	Lee	49	0	36	36
10/27/06	41420-2006-I-0203	20057180	Living Word Family Church	Collier	18	0	35	35
10/27/06	41420-2006-I-0607	20064878	Seminole Reservation Access Road	Hendry	2	0	5	5
11/15/06	41420-2006-TA-0727	N/A	Liberty Landing	Collier	27	0	19	19

Table 5 (continued)

Date	Service Log No.	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
11/15/06	41420-2007-FA-0222	200412415	Barry Goldmeier 5th Avenue Estates	Dade	15	0	18	18
11/16/06	41420-2006-TA-0060	N/A	Collier County Elementary School K	Collier	26	0	17	17
12/05/06	41420-2006-FA-1179	20057179	The Roberts Group CPD	Lee	58	0	29	29
12/07/06	41420-2006-FA-0781	20041689	Cypress Landing	Collier	46	0	18	18
01/19/07	41420-2006-I-0871	20061359	Brighton Veterans Center	Glades	9	0	8	8
03/09/07	4-1-04-F-6112	20021683	Alico Airpark (Haul Ventures)	Collier	241	75	315	390
03/09/07	41420-2006-F-0850	200312445	Airport Interstate Commerce Park	Lee	323	0	371	371
04/13/07	41420-2007-TA-0618	NA	Collier County School Site J - Everglades Blvd.	Collier	39	0	56	56
02/21/03 03/9/05 03/02/07 05/03/07	4-1-01-F-607	200001926 (IP-SB)	Mirasol	Collier	773	940	182	1,122
03/09/07	41420-2007-TA-0623	NA	Abercia North	Collier	25	0	31	31
03/09/07	41420-2007-I-0581	1999-4313	Savanna Lakes	Lee	124	0	140	140
05/01/07	41420-2006-I-0992	20045223	Seminole Motocross	Hendry	58	5	19	23
06/19/07	41420-2007-I-0997	2006-2583	Caloosa Reserve	Collier	111	0	139	139
07/03/07	41420-2007-TA-0818	NA	Woodcrest Development	Collier	11	0	15	15
07/17/07	41420-2007-I-0330	2006-6377	Faith Landing	Collier	35	0	18	18
07/30/07	41420-2007-I-0866	2006-7022	Collier county School Site L	Collier	32	0	21	21
09/05/07	41420-2006-I-0051	2005-4186	Gulf Coast Landfill Expansion	Lee	123	0	65	65
06/14/04 03/21/05 08/24/07	4-1-04-F-5744	199603501 (IP-TWM)	Terafina	Collier	437	210	261	471
10/31/07	41420-2007-F-1035	2004-3931	Big Cypress Regional General Permit - 83	Hendry Broward	2,357	4,144	0	4,144
11/13/07	41420-2006-FA-1430	2005-782	Summit Lakes	Collier	139	0	134	134
9/8/2005 02/15/08	4-1-04-F-5260 41420-2008-F-0112	200106580	Parklands Collier	Collier	487	157	434	591
02/7/2008	41420-2007-FA-1120 41420-2007-I-0862	1993-0862	Poinciana Parkway	Polk	187	0	236	236
01/30/2008	41420-2008-FA-0009 41420-2008-I-003	2007-4884	I-75 from Corkscrew Road to Daniels Parkway	Lee	7	0	12	12
01/22/2008	41420-2008-FA-0021 41420-2008-I-005	2007-4503	I-75 from Collier County Line to South of Corkscrew Rd	Lee	7	0	44	44
7/02/2008	41420-2007-FA-0592 41420-2007-F-0491	2005-7439	Kaicasa	Collier	72	0	183	183
07/14/2008	41420-2008-I-0508	2005-6488	Amerimed Medical Center	Collier	19	0	14	14

Table 5 (continued)

Date	Service Log No.	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
04/28/2008	41420-2008-I-0313	2007-6414	Immokalee Rd Substation	Collier	1	0	1	1
07/14/2008	41420-2008-I-0509	2007-4314	Gridley Medical Building	Collier	4	0	2	2
07/23/2008	41420-2006-FA-0165 41420-2006-F-0846	2004-182	Premier Airport Park	Lee	180	0	211	211
09/04/2008	41420-2008-FA-0415 41420-2008-I-0211	1984-4913	Colonial Boulevard Widening	Lee	35	0	39	39
09/25/08	41420-2008-FA-0702 41420-2008-I-0806	1988-1061	Alligator Alley Commercial Center	Collier	41	0	18	18
12/17/2008	41420-2006-FA-0023 41420-2008-F -0018	1999-4926	Sembler Partnership McMullen Parcel	Collier	40	0	49	49
01/13/09	41420-2007-FA-1111 41420-2007-I-1083	2007-1264	Big Corkscrew Island Fire Control & Rescue	Collier	5	2	5	7
01/30/02 02/12/09	4-1-98-F-372 41420-2006-F-0267	199402492 (IP-ML)	Florida Rock Industries, Inc. (Fort Myers Mine #2)	Lee	2,913	1,959	0	1,960
02/24/2009	41420-2006-FA-0548 41420-2006-F-1011	2006-7018	Oil Well Road Widening	Collier	329	0	356	356
06/10/2009	41420-2008-FA-0804 41420-2008-I-0253	Not applicable	Greenfrog Electrical Substation	Miami-Dade	3	0	12	12
10/08/2010	41420-2010-CPA-0388 41420-2010-F-0164	Not known at time of issuance	Tamiami Trail Modifications: Next Steps Project	Miami-Dade	101	0	143	143
				Total:	96,151	12,583	29,373	41,955

Table 6. Percent use of Bear Island and FPNWR before, during, and after hunting season by Florida panthers following various classification schemes to determine specific treatment for each panther.[1]

			Hunting					
			Before		During		After	
Period	**Kernel rule**	**Treatment**	**n**	**%**	**n**	**%**	**n**	**%**
80 days	yes	Bear Isl.	709	36.95	826	38.26	782	39.39
80 days	no	Bear Isl.	641	38.07	760	40.39	714	41.60
86 days	yes	Bear Isl.	770	37.40	908	37.44	867	37.02
86 days	no	Bear Isl.	697	38.74	838	39.50	793	38.97
80 days	yes	FPNWR	1137	40.11	1214	44.56	1162	42.51
80 days	no	FPNWR	1205	40.00	1280	44.22	1230	42.03
86 days	yes	FPNWR	1247	39.29	1329	43.34	1266	42.58
86 days	no	FPNWR	1320	39.09	1399	43.17	1340	42.16

[1] From Fletcher and McCarthy personal communication, draft report, 2010.

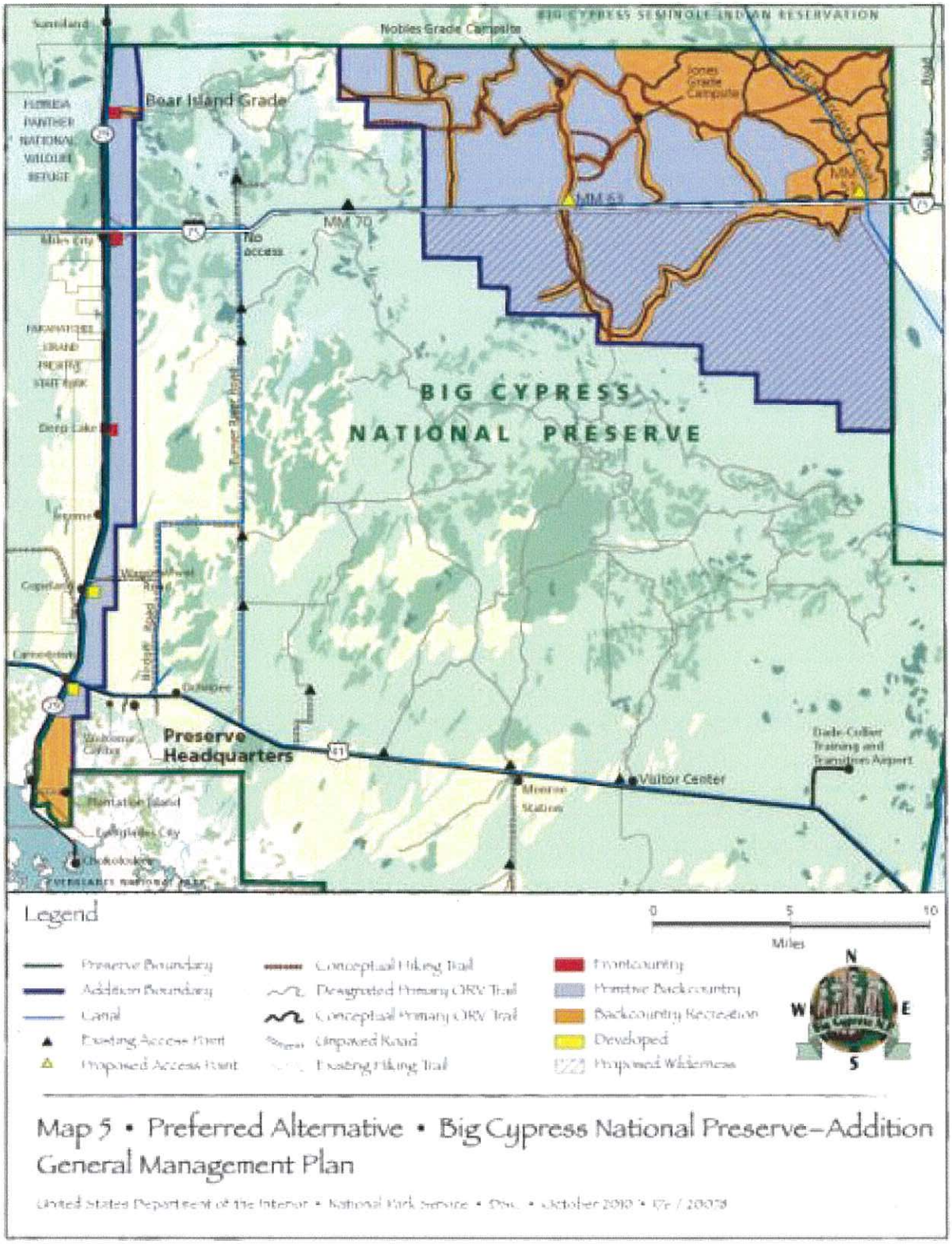

Figure 1. Preferred Alternative map from BICY – Addition Final GMP/ Wilderness Study/ORV Management Plan/ Environmental Impact statement.

Figure 2. Location of the Action Area including BICY and the Addition Lands.

Figure 3. Wood stork colonies and CFA within the Action Area.

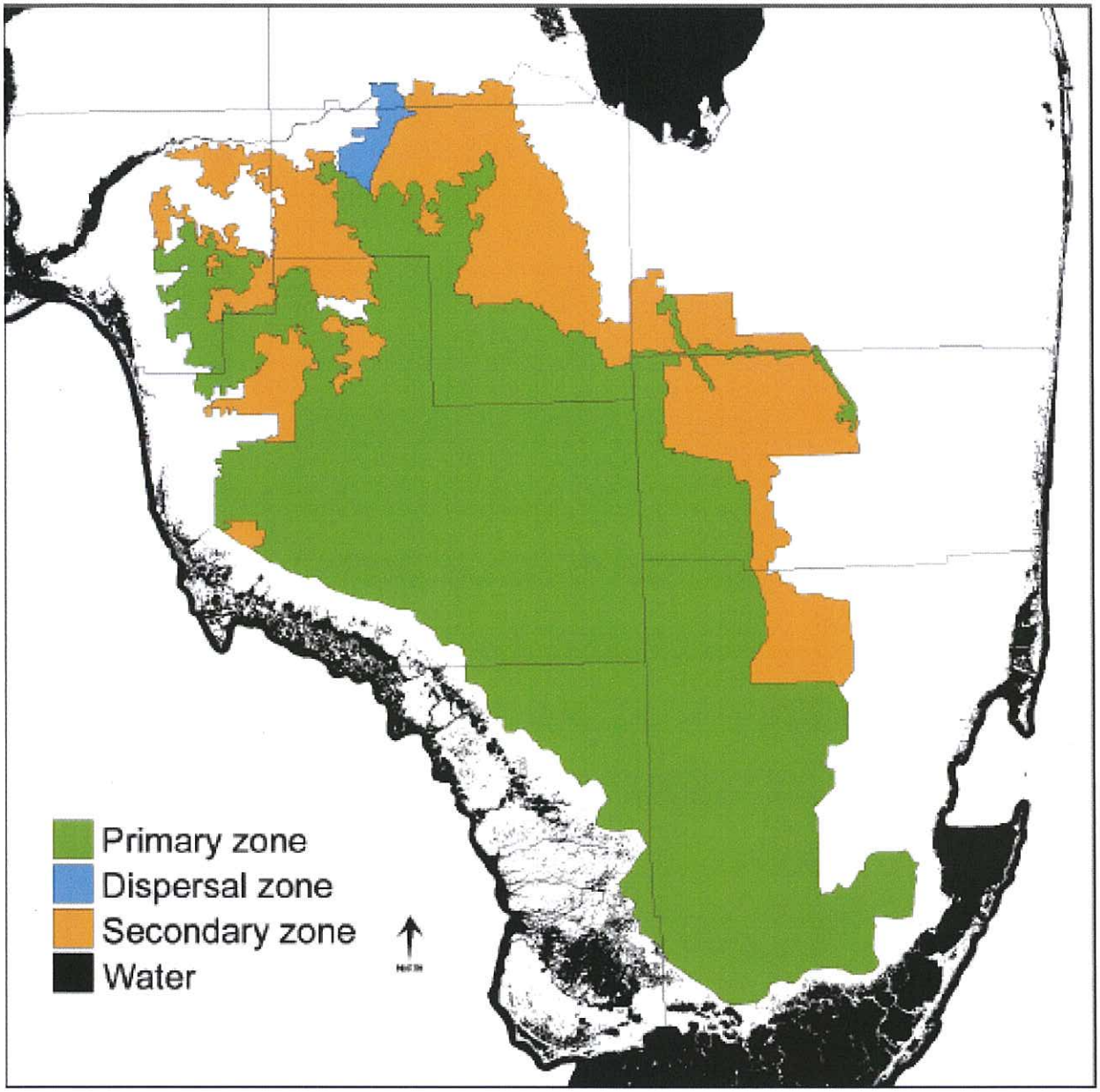

Figure 4. Primary, Secondary, and Dispersal Zones Kautz et al. (2006).

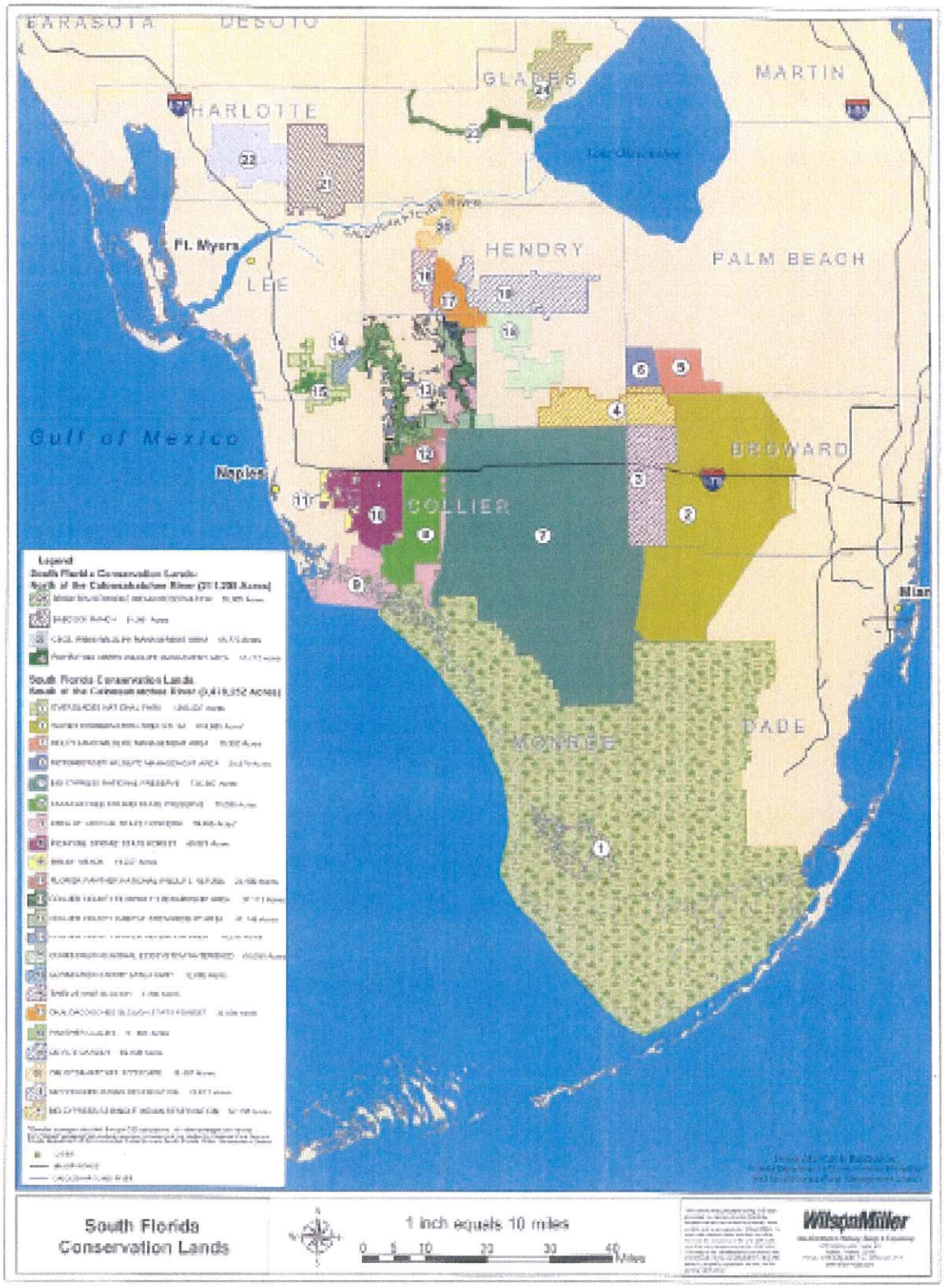

Figure 5. Conservation Lands in south Florida.

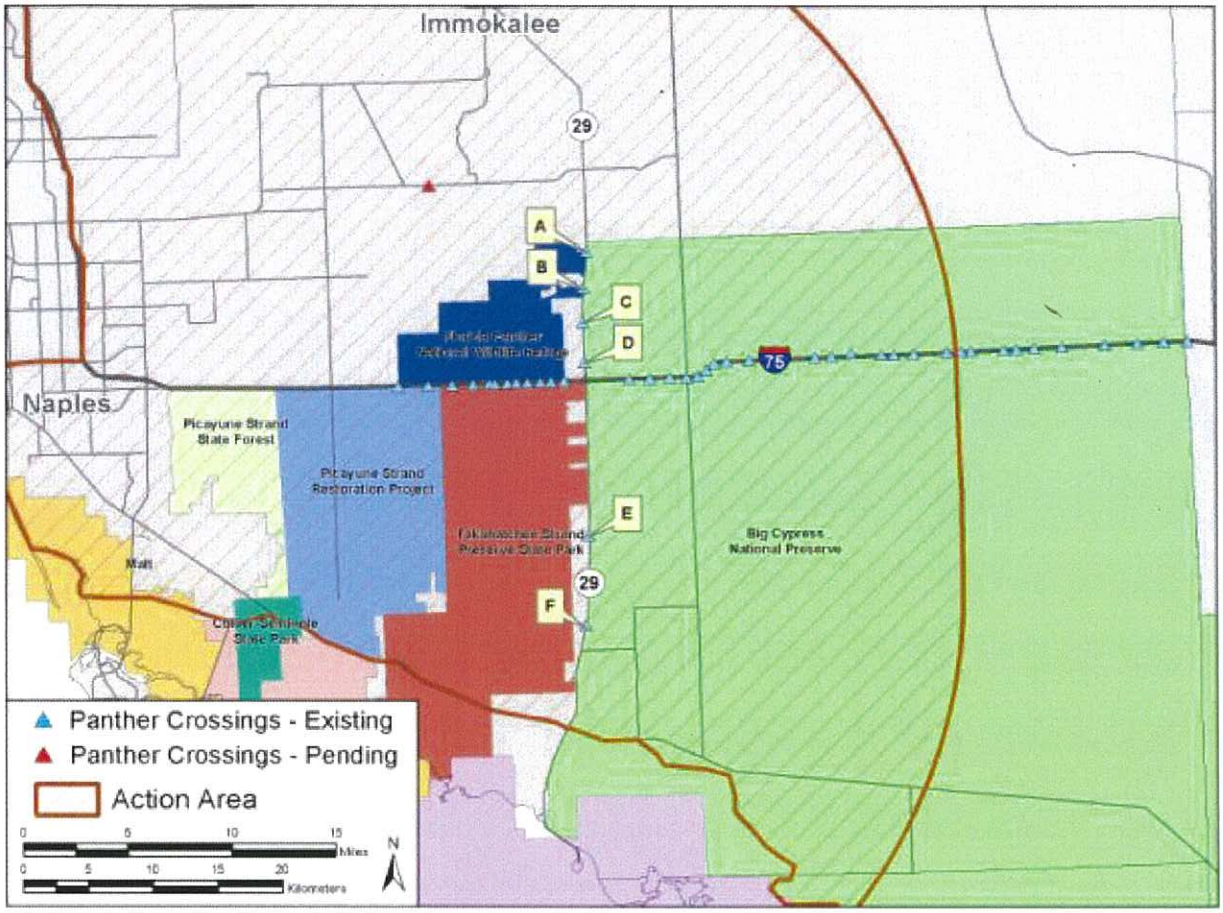

Figure 6. Wildlife crossing locations in south Florida.

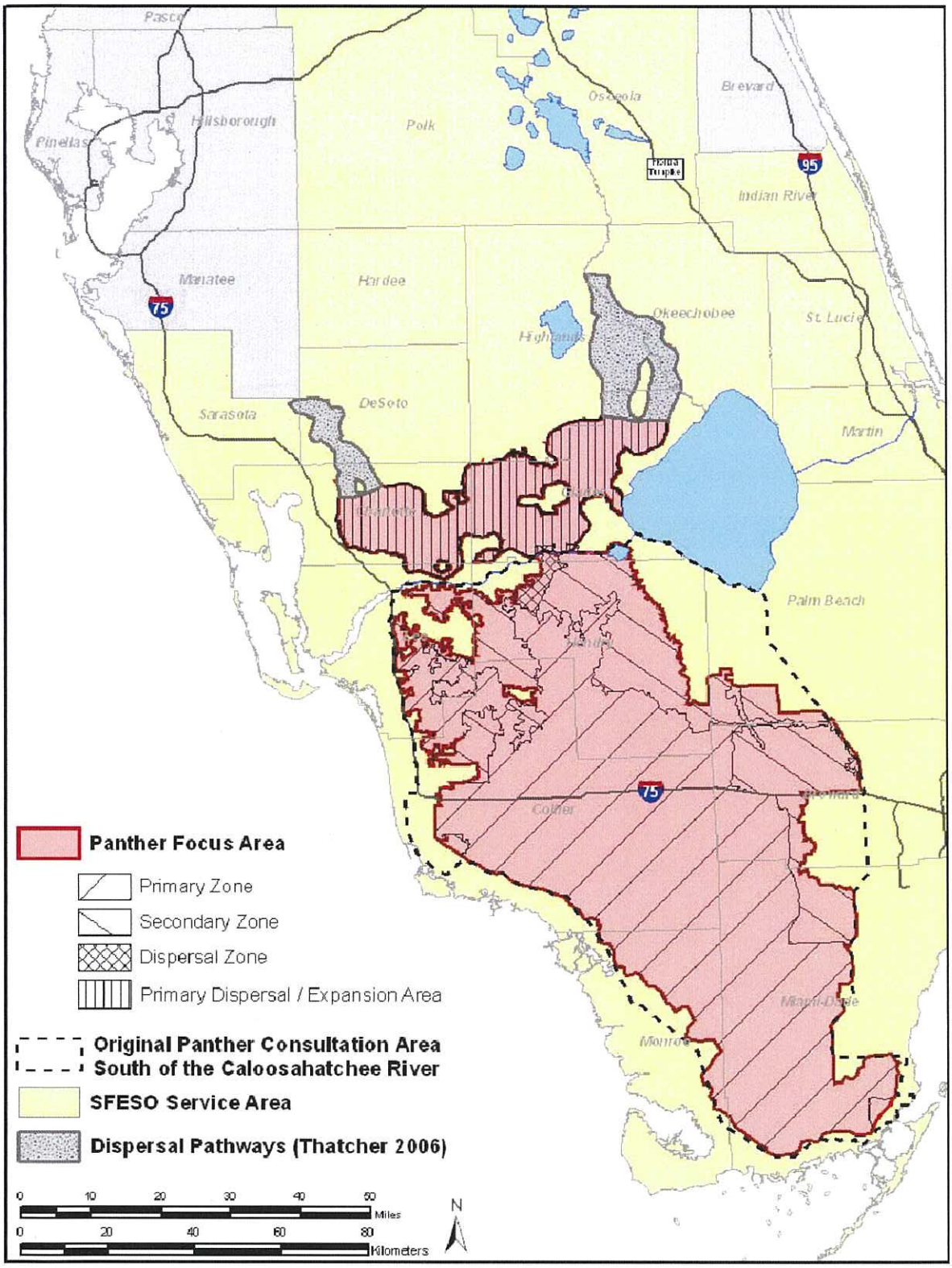

Figure 7. Florida panther focus area.

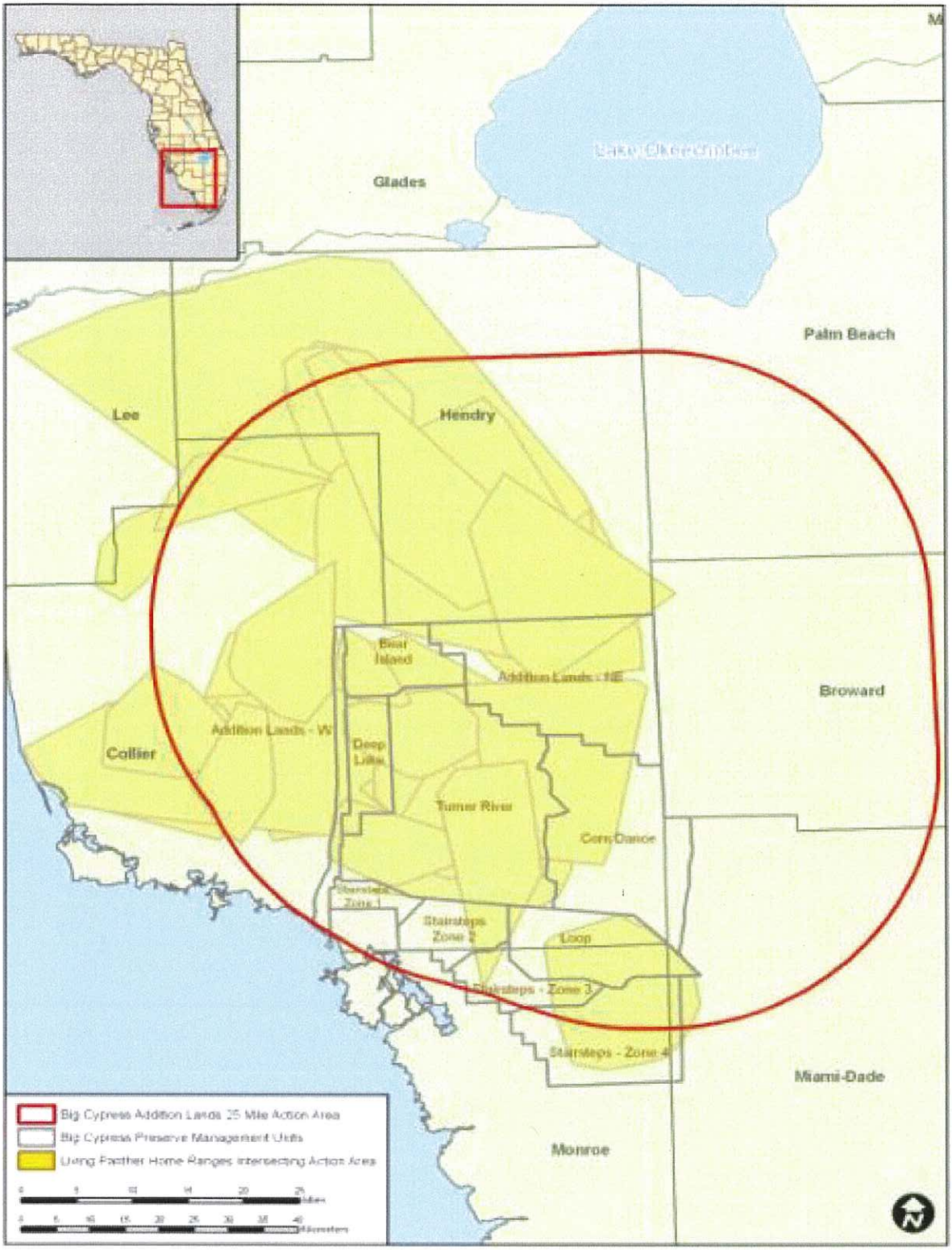

Figure 8. Florida panther home ranges intersecting the Action Area.

Figure 9. CERP projects and non-CERP projects in the Action Area.

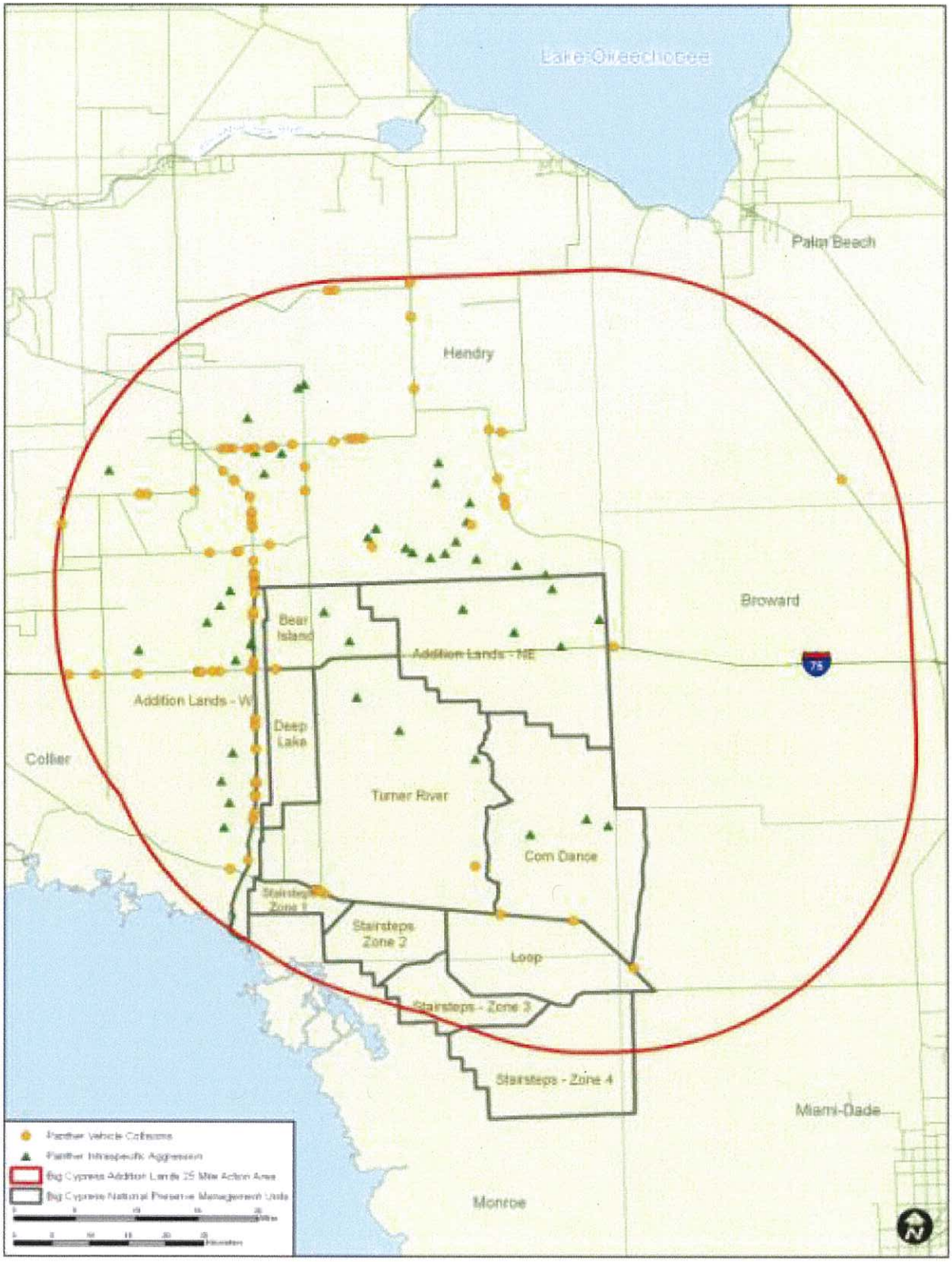

Figure 10. Panther vehicle collisions and intraspecific mortality locations in the Action Area.

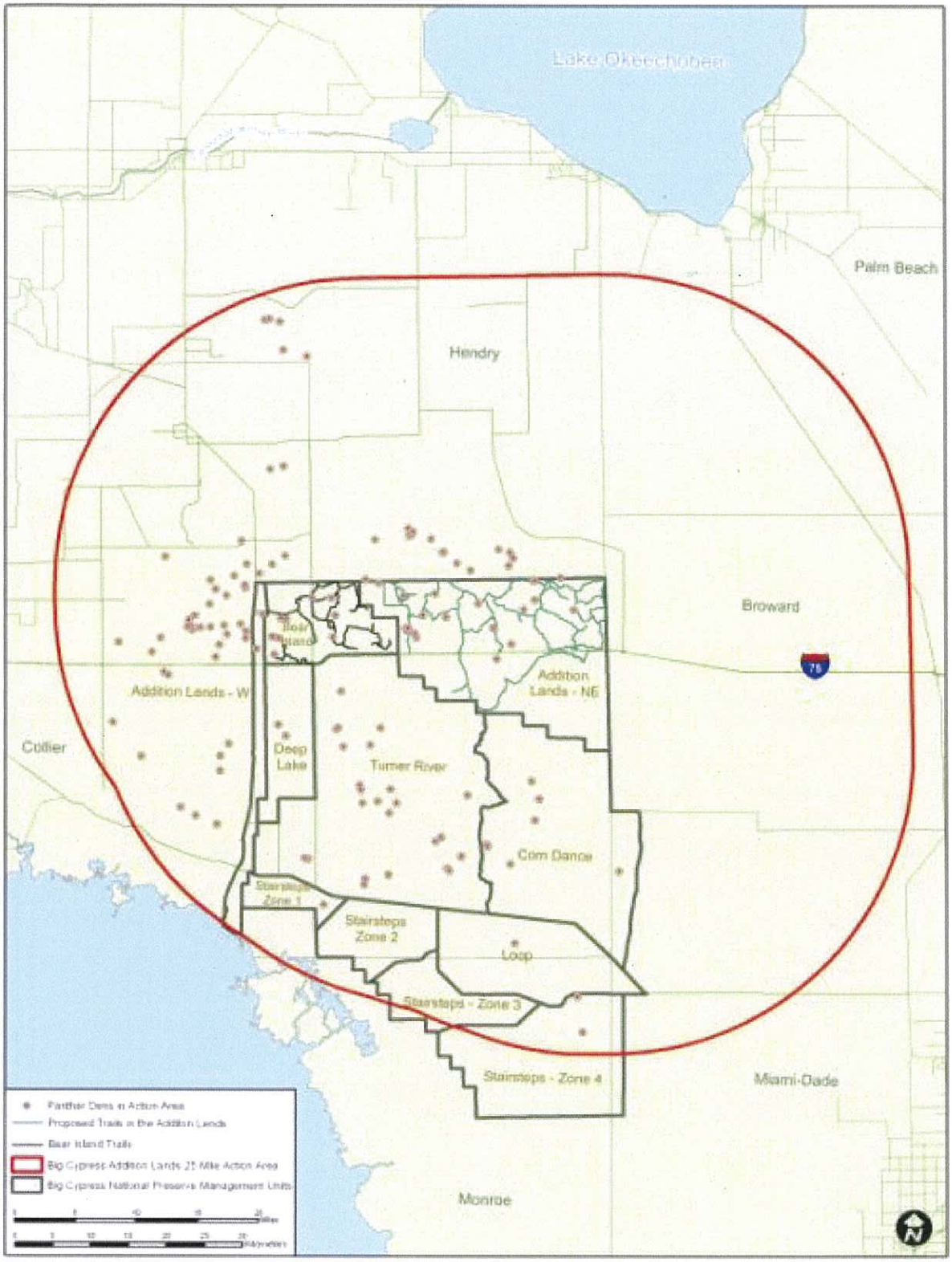

Figure 11. Known panther den locations and existing and proposed ORV trails in BICY.

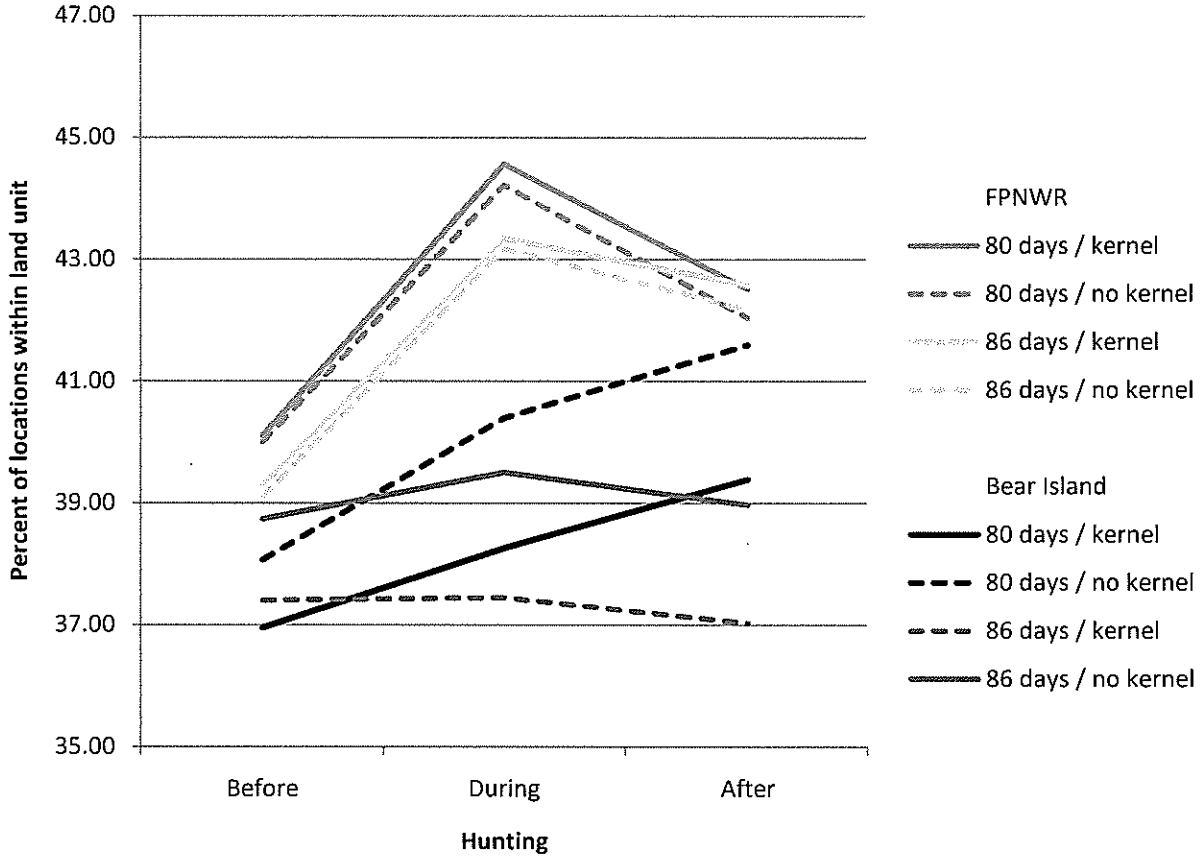

Figure 12. Percent use of Bear Island and FPNWR before, during, and after hunting season by Florida panthers following various classification schemes adapted from Janis and Clark (2002).[2]

[2] From Fletcher and McCarthy 2010 draft report.